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# Singapore

May 1973

Military Geography

NATIONAL INTELLIGENCE SURVEY

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*This chapter was prepared for the NIS by the Defense Intelligence Agency. Research was substantially completed by December 1972.*

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# SINGAPORE

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*This General Survey supersedes the one dated July 1968, copies of which should be destroyed.*



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## FIGURES





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# Military Geography

## A. Location and description (U/OU)

Singapore comprises one main island and about 40 small islands and islets off the southern tip of the Malay Peninsula (Figure 13). The capital, Singapore, is within 200 nautical miles of Kuala Lumpur, 500 nautical miles of Djakarta, and 800 nautical miles of Saigon and Bangkok. Because of its focal position in Southeast Asia—on international sea and air routes—and because of its deepwater harbor, Singapore is one of the world's greatest commercial centers. The strategic and commercial importance of the country is out of proportion to its size, which is only about three times that of Washington, D.C. Singapore has a total area of 225 square miles and a population of some 2.1 million. The main island is diamond shaped, extending about 26 miles[1] east-west and about 14 miles north-south.

### 1. Topography

Singapore consists mainly of flat to rolling plains (Figures 1, 2, and 13). Rough, dissected plains occur in several places in the western half of the main island (Figure 3), and there is a small hilly area near the center (Figure 4), where the highest elevation in the country is 581 feet above sea level (Figure 5). Local relief (differences in elevation between tops and bottoms of adjacent topographic features) is less than 100 feet nearly everywhere, between 100 and 500 feet in the dissected areas, and more than 500 feet in the hilly area. A succession of low scarps and valleys in the west trend northwest-southeast; the steepest ridge backs the southwest coast.

The other topographic aspects, mainly the drainage characteristics, vegetation, and culture features, are closely interrelated. The streams, small and steep banked, radiate from the center of the island; many flow into wide tidal estuaries. There are no seasonal variations in streamflow, and flooding may occur in low areas after rains in any month. Mangrove swamps border much of the north and west coasts and extend inland along many stream mouths. The three artificial lakes in the interior are reservoirs formed by damming small streams. This catchment area has the only remaining forest—about 15 square miles of closely spaced broadleaf evergreen trees. About one-fifth of the island is under cultivation, largely in holdings less than 3 acres in size—market gardens producing vegetables, fruits, and spices, or small plots producing rubber or coconuts. Much of the remainder of the island is the densely built-up city of Singapore and its suburbs. New sections have mostly multistory concrete or masonry residential, commercial, or industrial buildings. Older sections of the city consist of less substantial buildings, and many parts present a contrast of structural types (Figures 6 and 7). In the outskirts of the city and in rural areas, buildings are one-story frame structures (Figure 8).

### 2. Climate

Singapore has a tropical monsoon climate, with considerable cloudiness and precipitation and persistently high temperatures and humidities (Figure 9). The climatic seasons are based on the two major wind systems, the northeast monsoon (November through March) and the southwest monsoon (mid-May through September). The northward advance in April and southward retreat in October of the intertropical convergence zone (ITCZ) across Singapore determine the change in the monsoons. In general, there is little variation in weather from monsoon to monsoon; rather, the greatest variations are the strong contrasts in rainfall and cloudiness from day to night.

The day often begins with early morning fog, which is quickly dissipated by the sun's heat, and with large sheets of stratified middle and high clouds. By noon, however, convective activity develops puffs of cumulus clouds which rapidly grow to great heights. The afternoon skies are almost completely covered by the towering clouds and heavy showers or thun-

[1]Distances are in statute miles unless nautical miles are specifically stated.



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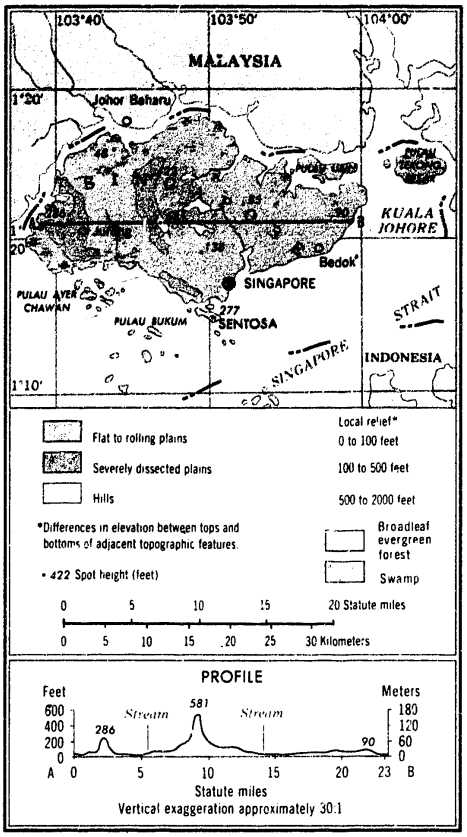


FIGURE 1. Military geographic region and terrain (U/OU)

FIGURE 2. Flat plains in the northern part of Singapore Island (C)

FIGURE 3. Rough, dissected plains in southwestern Singapore Island (C)

dershowers may fall for brief periods. During the evening convective activity declines and the clouds flatten into shapeless masses and stratify during the night; the threat of showers is least at this time. A result of this daily sequence is the small diurnal range of mean cloudiness—between 70% coverage near midnight and 90% in early afternoon. Average monthly rainfall also has a small range, mostly between 6 to 10 inches, with annual accumulations of 70 to 110 inches across the island. The afternoon showers are most frequent in November through January. Thundershowers, however, are most frequent near the intermonsoonal periods, April through May and October through November, when thunderstorms occur on 17 to 21 days per month.

The remaining climatic elements exhibit a monotonous distribution through the year. Average daily temperatures regularly rise to the upper 80's (°F.) in the afternoon and decrease to the middle 70's in the early morning, while average relative humidity alternates between morning maximums in the middle 90's (%) and afternoon minimums in the low 70's or upper 60's. This combination of high temperature and high humidity is probably the feature of the climate most oppressive to humans. Visibility is normally good except during showers and in morning fog, and winds are usually light except for strong gusts during thunderstorms.

## B. Military geography (C)

Singapore with its associated islands comprises one military geographic region (Figure 1). The region is fairly well suited for conventional ground operations. The rather dense road network facilitates movement

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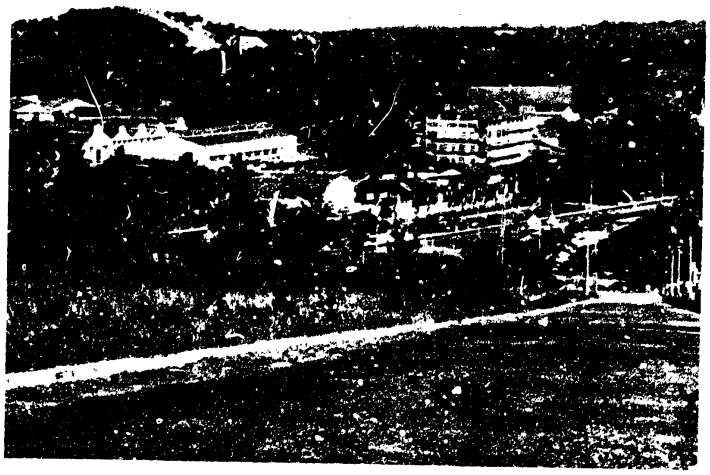

FIGURE 4. Hills in the central part of Singapore Island (U/OU)

on much of the island, but heavy rains at times cause flooding in low areas and interrupt use of the roads. Off-road dispersal and cross-country movement would be relatively easy in much of the island; they would be difficult in the rough, dissected or hilly areas, and precluded in the densely built-up metropolitan areas or in swamps. The well-drained parts of the plains are suited for the construction of roads with long, straight alignments; in the low and swampy areas, poor drainage and poor foundations create major construction problems; in the dissected and hilly areas, alignments would be restricted. Concealment from air and ground observation is afforded by buildings in the urban area and environs; cover from air observation is available from tree crops in the cultivated areas, and by a forest in the central part of the island. Cover from flat-trajectory fire is afforded by the masonry structures in the city and by surface irregularities in the dissected areas. The better drained parts of the plains are suited for the construction of bunker-type installations; excavation, however, would be difficult in the places where hard layers occur in the lateritic soils that cover most of the island.

Conditions are unfavorable for large-scale amphibious landings because of restricted offshore approaches, encumbered nearshore approaches, flat nearshore bottoms, muddy shores, and difficult cross-country movement near the shores. Sea approaches to

FIGURE 5. This hill in central Singapore Island is 581 feet high, the highest elevation in the country (C)



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FIGURE 6. Redhill/Henderson redevelopment is contrasted with earlier development of the 1950's in the foreground (U/OU)

Singapore Island are restricted to Singapore and Johore Straits, and are partly obstructed by islets and scattered shoals, mudflats, reefs, fishing stakes, and rocks. The predominantly muddy shores fringing Singapore Island are mostly backed by an irregular, discontinuous belt of dense mangrove up to 2 miles wide, poor to unsuited for cross-country movement.

Singapore is poorly suited for airborne and airmobile operations even though air approaches are unrestricted and four modern airfields that can accommodate assault-type aircraft are accessible. Drop zones and sites for helicopter landings are available only in cultivated areas where the crops are less than 3 feet in height. The densely built-up urban area and environs, swamps, and dissected or forested areas are unsuited for either airdrops or helicopter operations. The better drained parts of the plains are suited for the construction of airfields with unrestricted orientations. Grading would be difficult where hard layers occur in the lateritic soils that cover most of the island.

Singapore's rural areas are poorly suited for irregular force operations. In the densely built-up urban area and environs, such operations would be precluded. Throughout the remainder of the island, movement, both on-road and cross-country, would be easy. Concealment from air observation, however, would be available only in the forested area and in tree crop plantations. Concealment from ground observation and cover from flat-trajectory fire would be afforded mainly by surface irregularities in the dissected and hilly areas, and by buildings. Food is plentiful in the cultivated areas. Among the hazards to operations are respiratory and enteric infections including typhoid fever and diseases caused by bacteria and parasites. Other hazards are poisonous snakes (including cobras), scorpions, ticks, leeches, centipedes, sandflies, and mosquitoes.

## C. Strategic importance (C)

The chief feature of the area is the large metropolis of Singapore (population 1,410,000) and its deepwater port (Figure 10), the main port in Southeast Asia and one of the major ports in the world. The city is a distribution center for the strategic raw materials from a large part of Southeast Asia. Singapore is gaining in industrial potential and now has a steel mill, rubber-producing plants, four petroleum refineries and a fifth under construction, as well as many other diversified industrial plants; additional port facilities are being constructed along the southwest coast at Jurong which has storage facilities for about 20 million barrels of refined and crude POL (petroleum fuels, oils, and lubricants). Singapore depends on reservoirs in Malaysia for most of its water supply. The many military installations include the naval base along the north-central part of the island, and two airfields. There are two civil airfields, including an international field northeast of the city.

FIGURE 7. Anson Road enters the city of Singapore from the southwest. This area is a typical mixture of older arcaded buildings and new multistory apartments. (U/OU)



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FIGURE 8. Rural settlement on Singapore Island (C)

## D. Internal route (C)

The internal route (Figure 10) crosses the 3,500-foot causeway over Johore Strait (Figure 11) southward to the city of Singapore. The route is mostly across rough, dissected plains; in the north it traverses low, poorly drained flat plains. The route contains both a road and a railroad. The road is a four-lane, bituminous-surfaced highway in good condition; the railroad is meter gage and single track. Flooding in low areas may disrupt traffic on both the road and the railroad for several days in any month. Off-road dispersal and cross-country movement would be easy in small flat cultivated areas most of the time, but flooding during and after heavy rains would preclude movement. In the mangrove areas near the coast and also in rough, steep, or disected areas off-road dispersal and cross-country movement would be precluded.

## E. Approaches

### 1. Land (C)

The only land approach to Singapore is by the highway or railroad to the causeway which crosses Johore Strait and links the island with West Malaysia. The highway is two lanes wide and has a bituminous surface. The railroad is meter gage and single track.

### 2. Sea (C)

The coastline of Singapore, including the smaller islands and islets, totals 120 miles. Singapore claims territorial jurisdiction for 3 nautical miles offshore. The 72-mile coastline of Singapore Island is along Johore

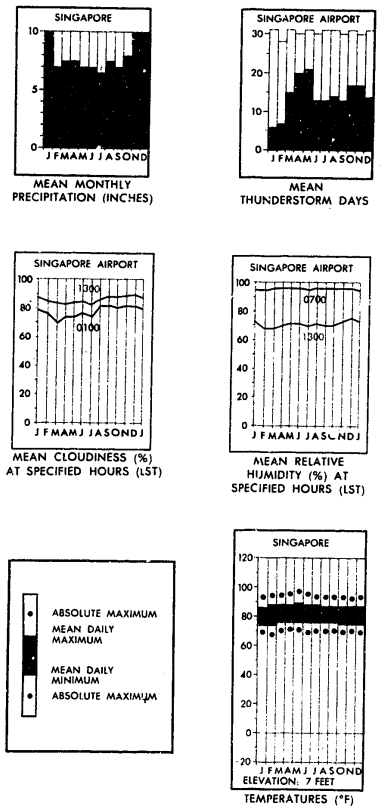


FIGURE 9. Precipitation, thunderstorm days, cloudiness, relative humidity, and temperatures for city of Singapore and Singapore Airport (U/OU)

Strait in the north and west and Singapore Strait in the south and east. Offshore approaches to the southwest coast are channelized by numerous islets, reefs, and shoals extending to 8 nautical miles offshore. Offshore approaches to the southeastern shores of the island are relatively clear except for shoals in places. The nearshore approaches are partly obstructed by shoals, reefs, and islands. These obstructions restrict passage of large vessels entering the eastern arm of Johore Strait to a channel. Johore Strait is divided into two arms by the causeway connecting Singapore Island and the mainland. The eastern arm is about 15 nautical miles long and is generally clear. The channel is navigable for oceangoing vessels to the causeway.

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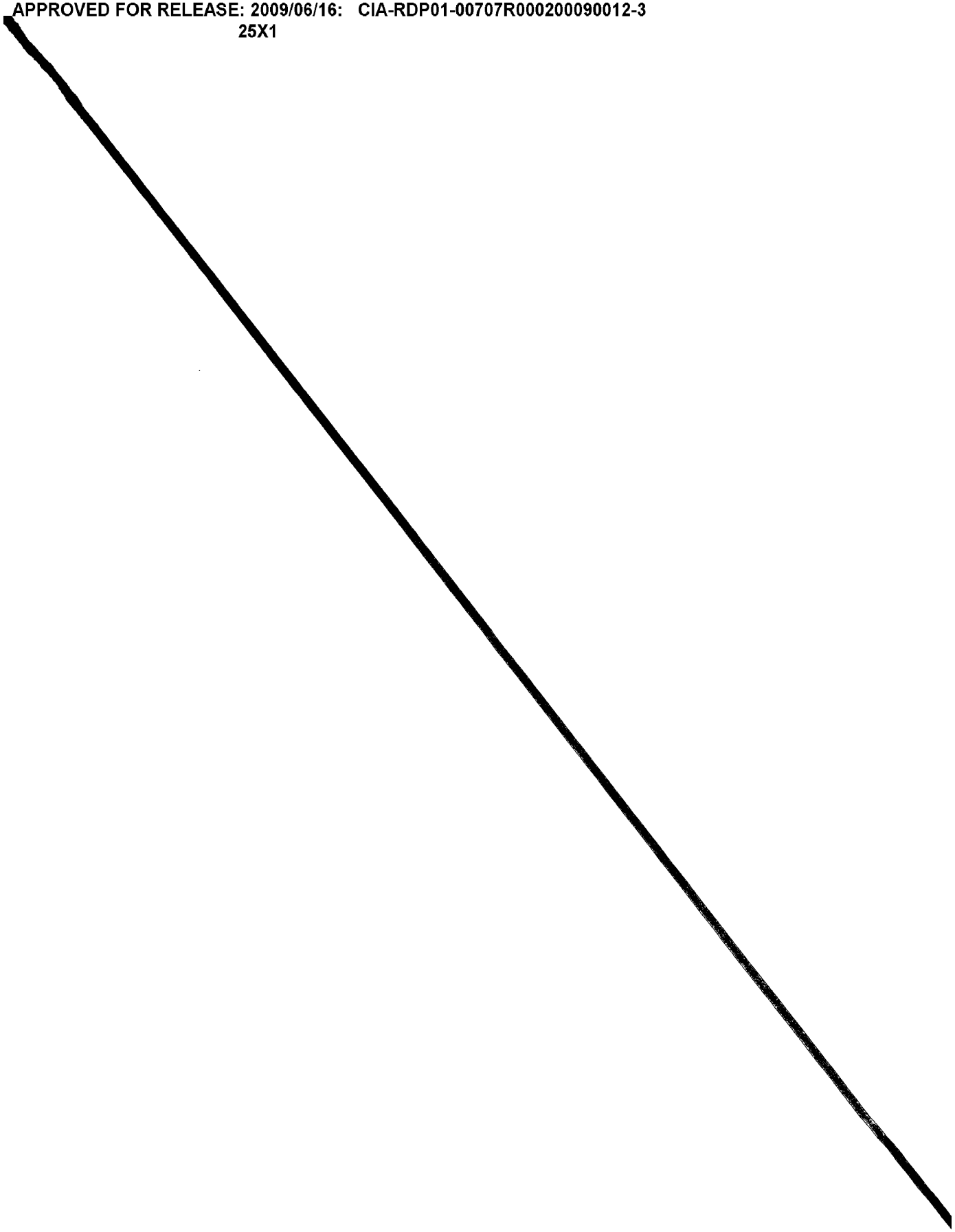

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FIGURE 11. Causeway across Johore Strait connects the Malay Peninsula with Singapore Island (at top) (C)

generally similar in all approaches. However, cloudiness is usually more extensive over land than over water, and the predominant cumulus-type clouds normally reach maximum development during the afternoon over land, and at night over water.

In all approaches the chief weather hazards to flight occur in tall convective clouds, in thunderstorms, and in tropical disturbances. Moderate to severe turbulence may be encountered within the towering cumulus and cumulonimbus clouds and moderate to severe aircraft icing is a danger all year above about 15,000 feet, the mean height of the freezing level. Cloudiness is abundant (65% to 90%) in all months over the Malay Peninsula. In the remaining approaches cloudiness is greatest in September or October through March or April, when monthly amounts average 60% to 85% before decreasing to lesser amounts during the rest of the year. Thunderstorms also are most frequent in the Malay Peninsula approaches, where 10 to 20 thunderstorm days per month are normally recorded in March or April through November. During the other months over the Malay Peninsula and in all months in the remaining approaches thunderstorms occur less frequently, generally on 2 to 7 days per month. Tropical disturbances are a threat to safety in the northernmost approaches in October through April; severe turbulence and aircraft icing are likely in these storms. Winds aloft in all approaches are light and variable below about 20,000 feet, above which easterly winds prevail to at least 55,000 feet. Maximum mean speeds in the easterlies are 40 to 50 knots near 50,000 feet in May through November.



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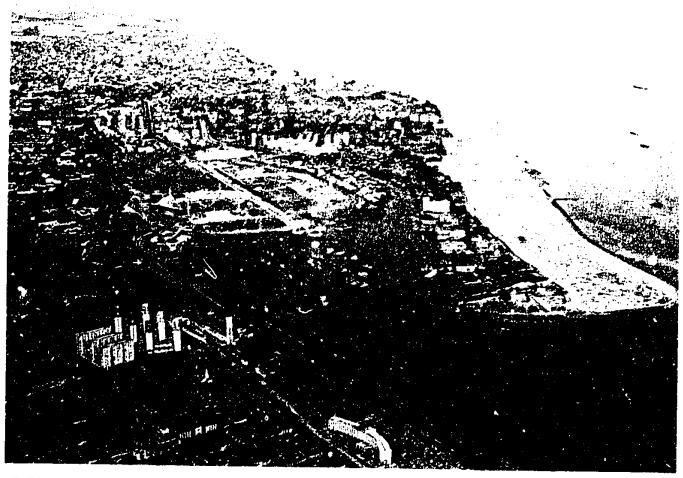

FIGURE 12. Land reclamation of 1,125 acres from Bedok to Tanjong Rhu, east of the city, provides an amphibious landing area (U-OU)



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## Places and features referred to in this General Survey (U/OU)

| | COORDINATES | | | COORDINATES | |
|---|---|---|---|---|---|
| | ° 'N. | ° 'E. | | ° 'N. | ° 'E. |
| Alor Setar, Malaysia | 6 07 | 100 22 | Pulau Ayer Chawan (*isl*) | 1 16 | 103 42 |
| Bedok | 1 19 | 103 57 | Pulau Brani (*isl*) | 1 16 | 103 50 |
| Bukit Batok (*hill*) | 1 21 | 103 46 | Pulau Bukum (*isl*) | 1 14 | 103 46 |
| Bukit Gombak (*hill*) | 1 22 | 103 46 | Pulau Bukum Kechil (*isl*) | 1 14 | 103 46 |
| Bukit Timah (*hill*) | 1 21 | 103 47 | Queenstown | 1 18 | 103 48 |
| Bukit Timah Village | 1 20 | 103 47 | Sabah, Malaysia (*admin div*) | 5 30 | 117 00 |
| Caldecott Hill Estate | 1 20 | 103 50 | Sarawak, Malaysia (*admin div*) | 2 30 | 113 30 |
| Changi | 1 23 | 103 59 | Selat Sembilan (*strait*) | 1 18 | 103 42 |
| East Lagoon (*bay*) | 1 16 | 103 51 | Sembawang | 1 27 | 103 50 |
| Fort Canning (*fort*) | 1 18 | 103 51 | Senoko, Sungai (*strm*) | 1 28 | 103 49 |
| Gemas, Malaysia | 2 35 | 102 37 | Sentosa (*isl*), formerly Pulau Blakang Mati | 1 15 | 103 50 |
| Geylang | 1 19 | 103 53 | Serangoon | 1 22 | 103 54 |
| Geylang Serai | 1 19 | 103 54 | Singapore | 1 17 | 103 51 |
| Inner Roads (*roadstead*) | 1 17 | 103 51 | Singapore Island (*isl*) | 1 22 | 103 48 |
| Johor Baharu, Malaysia | 1 28 | 103 45 | Singapore Strait (*strait*) | 1 15 | 104 00 |
| Johore Strait (*strait*) | 1 28 | 103 48 | Tanglin (*rr station*) | 1 18 | 103 48 |
| Jurong | 1 19 | 103 43 | Tanjong Pagar (*point*) | 1 16 | 103 51 |
| Kalang | 1 20 | 103 52 | Tanjong Rhu (*point*) | 1 18 | 103 52 |
| Kalang River (*strm*) | 1 18 | 103 52 | Telok Blangah | 1 17 | 103 49 |
| Kampong Kembangan | 1 19 | 103 55 | Toa Payoh | 1 20 | 103 51 |
| Kampong Kranji | 1 26 | 103 45 | Tuas | 1 19 | 103 39 |
| Kampong Ubi | 1 19 | 103 54 | Woodlands | 1 27 | 103 46 |
| Keppel Harbour (*harbor*) | 1 16 | 103 50 | Yio Chu Kang | 1 23 | 103 51 |
| Kuala Sungai Johor, Malaysia (*strm mouth*) | 1 27 | 104 02 | | | |
| Malay Peninsula (*peninsula*) | 6 00 | 102 00 | **Selected airfields** | | |
| Mount Faber (*hill*) | 1 16 | 103 49 | | | |
| Outer Roads (*roadstead*) | 1 17 | 103 52 | Changi | 1 23 | 103 59 |
| Pasir Panjang Village | 1 18 | 103 46 | Seletar | 1 25 | 103 52 |
| Paya Lebar | 1 21 | 103 53 | Singapore | 1 21 | 103 55 |
| Pinang, Malaysia | 5 25 | 100 20 | Tengah | 1 23 | 103 43 |

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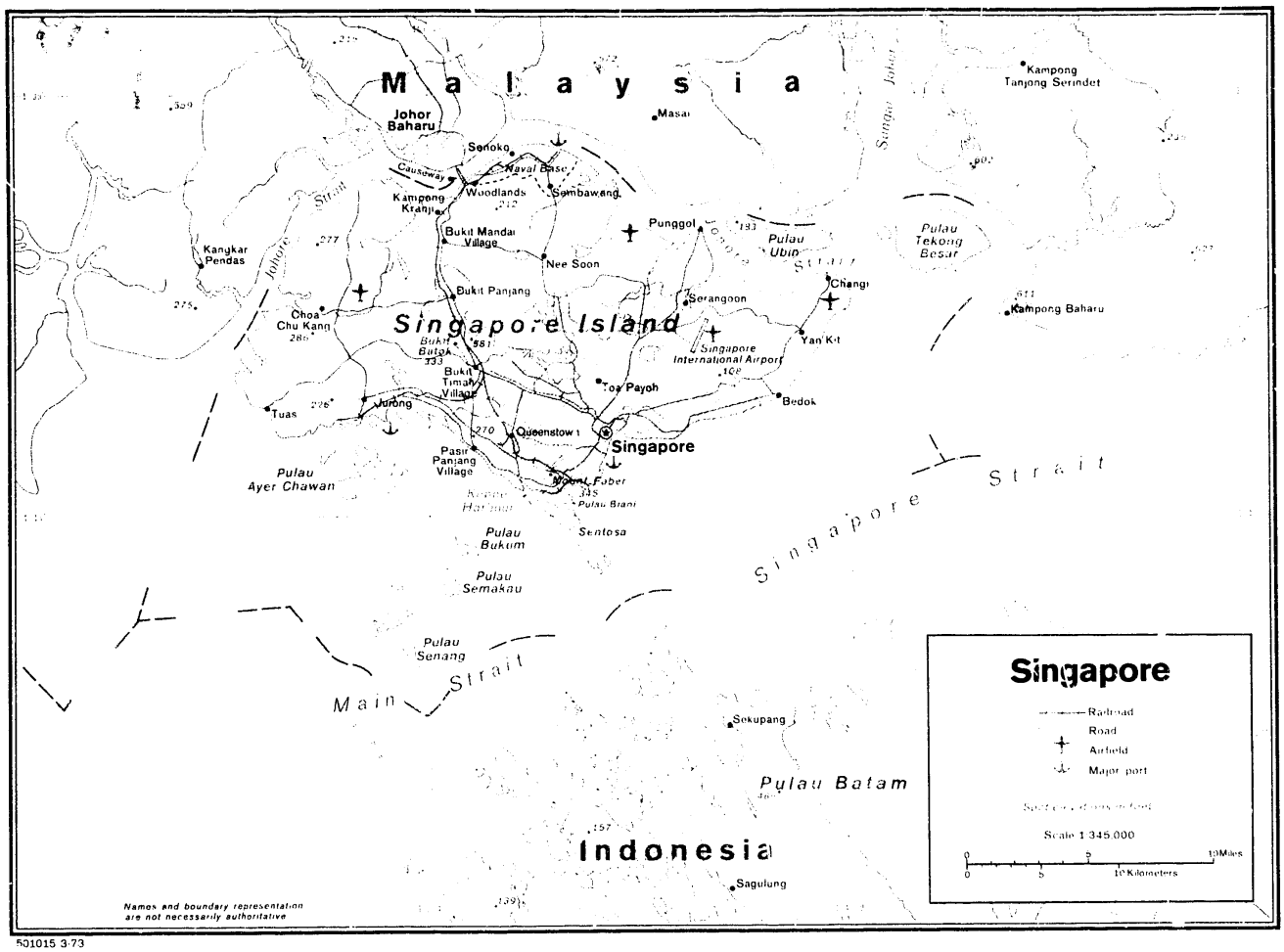


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**Terrain and Transportation Figure 13**

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