from boreholes, the more sustainable is groundwater development. Groundwater development potential of Honiara Groundwater Basin has been estimated as shown below.

Table B2.2-13 Groundwater Development Potential

Basin Area of Honiara groundwater basin	Groundwater Potential	
59.4 km^2	700 mm/year	113,900 m^3/day

Source : SIWA

It is proposed as one option in this Study that gravity system should be maintained in White River system, but high level pumping system should be replaced with groundwater sources (see Section B2.3 of this Report). In this case, amount of groundwater to be pumped up from Honiara Groundwater Basin will increase as shown below.

Table B2.2-14 Groundwater to be Developed

Groundwater potential		Current extraction of groundwater		Groundwater development potential
113,900 m3/day	−	14,663m^3/day • 10,283 m^3/day from bores • 4,380 m^3/day from Rove and Kombito Spring (See Table B1.5-1 and B1.5-2)	=	99,237 m^3/day

Source : JICA Study Team

Amount of groundwater to be developed in year of 2010 is 30,587m^3/day as maximum. It corresponds to 24% of groundwater potential of Honiara Groundwater Basin, and it seems to be sustainable in view point of water balance.

B2.2.3 Optimum Water Resources

(1) Selection of Water Resources

According to development potential of the surface water and groundwater, it is concluded that both surface water and groundwater have enough potential for maximum water demand in the year 2010 (in case of Option J-1). Potential of water resources is summarized in Table B2.2-15.

Table B2.2-15 Water Demand in 2010 and Water Resources Development Potential

Area	Water demand in year of 2010 (m^3/day)	Water to be developed *1 (m^3/day)	Water development potential			
			Type of water source	Remaining potential*1 (m^3/day)	Water quality	Land ownership
Honiara	30,587	12,717*1	Surface-water	• Mataniko River : 29,980 • The other rivers: 0	Purification plant is necessary	Customary land
			Ground-water	99,237	Chlorination only	Town area

Note 1. Water to be developed = Water demand in 2010 – Current water extraction from existing sources
2. Remaining potential＝Development Potential－Current water extraction

Source : SIWA

In this Study, groundwater is proposed for source of water supply to meet water demand of year 2010. Groundwater is more favorable than surface water as explained below.

Construction of reservoir and purification plant is needed for surface water development. Construction of reservoir in Mataniko River will cause environmental and social problems in case of submergence behind the reservoir. In addition to it, purification plant will cause technical problem in maintenance

and operation. To the contrary, development of groundwater resource can prevent problems above.

In case of water intake from Mataniko River, intake point will belong to customary land. Consequently, SIWA will be requested 25% of its total sales for payment to landowners, same as in case of Konglai spring. Additionally, trouble in water intake is likely to happen between SIWA and landowner. To the contrary, groundwater can be developed within town area, which will prevent payment and troubles for water right and water intake. It will make water supply more sustainable.

Based on viewpoints above, it is concluded that groundwater should be developed for the future water supply.

(2) Groundwater Development Plan

In formulation of groundwater development plan, items below should be taken into consideration.

- Groundwater is flowing from mountain area, where the groundwater is recharged, toward NNE direction to the sea. It is important to pump-up groundwater efficiently that flows toward the sea. For this purpose, new boreholes should not be concentrated on one place but be located scattering with perpendicular to direction of groundwater flow.
- Amount of groundwater flowing in aquifer is gradually increasing toward the sea. From this view point, groundwater potential may be higher in the coastal area than in the mountain area. However, boreholes that are located too near to the sea will cause sea water intrusion. Therefore, new boreholes should be located more than 500m far from the shoreline.
- New boreholes should be located within town area of Honiara City to prevent problem of water right in costmary land.
- New wells should be located near the current water supply system to reduce construction cost for connection pipe between new boreholes and the current water supply system.

(a) Amount of Groundwater to be Developed and Number of Boreholes Necessary

Amount of groundwater to be developed in 2010 shall be determined taking into account the current available water sources and the water demand. It is examined in section B2.3 "Plan for Water Supply System".

Yield from one borehole is expected 800 (m^3/day). Therefore, number of boreholes required in 2010 is calculated by the following formula.

$$\text{Number of boreholes required in 2010} = \frac{\text{Amount of groundwater to be developed}}{800\ (m^3/\text{day})}$$

B2.2.4 Drilling plan

(1) Drilling points and land-ownership

Drilling points are shown in Figure B2.2-2, Figure B2.2-5 and Table B2.2-16. Every drilling point is located within Honiara town boundary. Land within Honiara belongs to the Government. Therefore, payment for water right is not necessary to the groundwater from boreholes within Honiara. However, people can lease lands from the Government for maximum 75 years. If drilling point is located within leased land, SIWA has to lease its space for borehole facilities (2m×2m) from the current lease-holder who has already leased this land from the Government.

Most drilling points shown in Table B2.2-16 are located along public road. There is space of 3m width between public road and leased area. This space belongs to the Government. Therefore, SIWA does not need to lease these areas for borehole construction. However, as shown in Table B2.2-16, drilling point Ko-2 belongs to the current lease-holder (a church). SIWA has to negotiate with the lease-holder. But it seems possible for SIWA to use this area. Facilities for borehole with fence need area of around 2m×2m=4m^2. Judging from the current cases, payment for lease might be around S$15,000 annually

for one site.

Table B2.2-16 Drilling Points and Landownership

Area	Borehole No.	Current land-ownership
Tasahe new borefield (Ngossi Area)	N-1	Public
	N-2	
	N-3	
	N-4	
Titinge new borefield (Mbokona Area)	M-1	Public
	M-2	
	M-3	
	M-4	
Skyline new borefield (Mbokonavera Area)	MB-1	Public
	MB-2	
	MB-3	
	MB-4	
Borderline new borefield (Kombuvatu Area)	Ko-1	Public
	Ko-2	Church
	Ko-3	Public
	Ko-4	

Source : SIWA

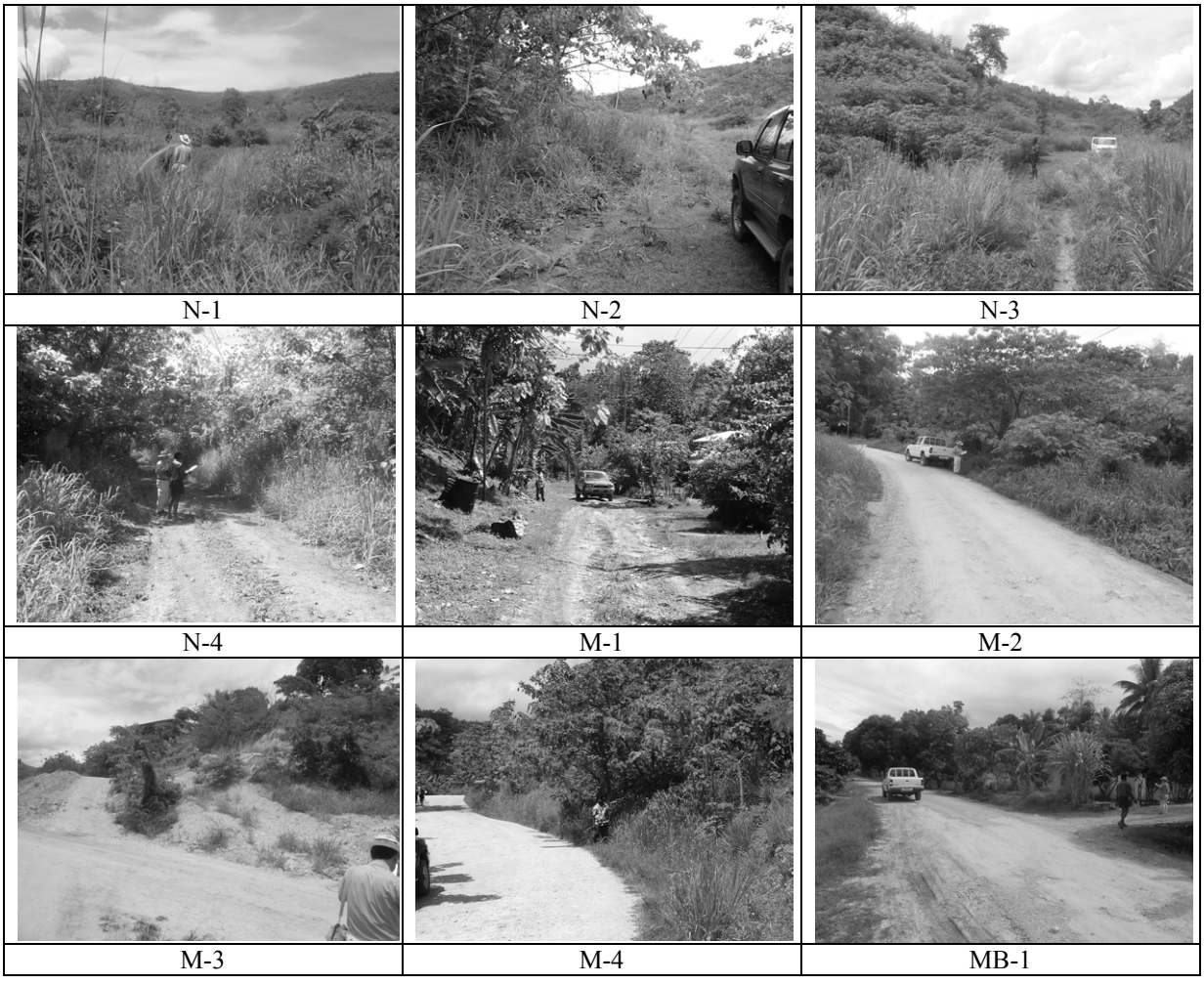
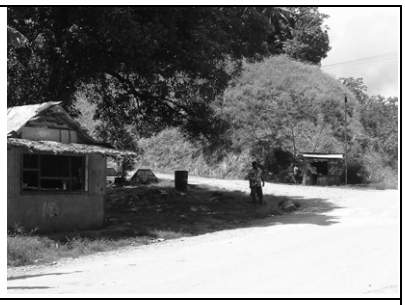


Figure B2.2-2 Current Situation of Drilling Points for Proposed Boreholes (1/2)


MB-2


MB-3


MB-4


Ko-1


Ko-2


Ko-3


Ko-4

Source : JICA Study Team

Figure B2.2-2 Current Situation of Drilling Points for Proposed Boreholes (2/2)

(2) Groundwater Development Plan

Hydrogeology and borehole specification is shown in Table B2.2-17.

Table B2.2-17 Hydrogeology and Borehole Specification

Area	Well No.	G.E.[1)]	Assumed G.W.L.[2)]	Depth	Φ[3)]	Aquifer	Depth of Aquifer (m) [4)]	Geological structure
Tasahe new borefield (Ngossi Area)	N-1	67m	64m	100m	8 inch	Honiara Bed	20-100	Fractured zone
	N-2	62m	59m					
	N-3	56m	53m					
	N-4	67m	64m					
Titinge new borefield (Mbokona Area)	M-1	63m	60m			Honiara Bed	40-100	Fractured zone
	M-2	51m	48m					
	M-3	54m	51m					
	M-4	54m	51m					
Skyline new borefield (Mbokonavera Area)	MB-1	58m	55m			Honiara Bed	30-100	Fault
	MB-2	52m	49m					
	MB-3	44m	41m					
	MB-4	40m	37m					
Borderline new borefield (Kombuvatu Area)	Ko-1	62m	59m			Honiara Bed	30-100	Fault
	Ko-2	54m	51m					
	Ko-3	56m	53m					
	Ko-4	56m	53m					

Note-1) Ground Elevation, 2) Groundwater level is assumed from relation below: , Groundwater level of proposed borehole = Ground elevation – 10(m) , 3) Diameter of borehole , 4) Result of electric resistivity survey

Source : SIWA

Hydrogeology

As shown in Table B2.2-16, borefields are scattered in four areas. There areas are all located in the bottom of valleys: where four boreholes are located along the stream with 200m distance each other. This borehole arrangement follows principle that borehole should be scattered as widely as possible within Honiara Groundwater basin for effective extraction of the groundwater naturally flowing the aquifer. Distance between boreholes is kept 200m to avoid well interference that will cause over-drawdown of groundwater level in pumping.

In Mbokonavera and Kombuvatu area, faults is presumed running through valleys as shown in geological map of Honiara (1:50,000). Excellent aquifer with fractured zone is expected in these areas.

In Ngossi and Mbokona area, it is presumed that valley is originated from fractured zone where proposed boreholes are located along the bottom of the valley. Excellent aquifer is expected for above two areas.

Depth of aquifer

According to result of electric resistivity prospecting, formation showing electric resistivity more 100Ωm seems aquifer in Honiara Bed. From the result of electric resistivity survey, promising aquifer is distributed below 20m depth in some sites and below 40m depth in other sites.

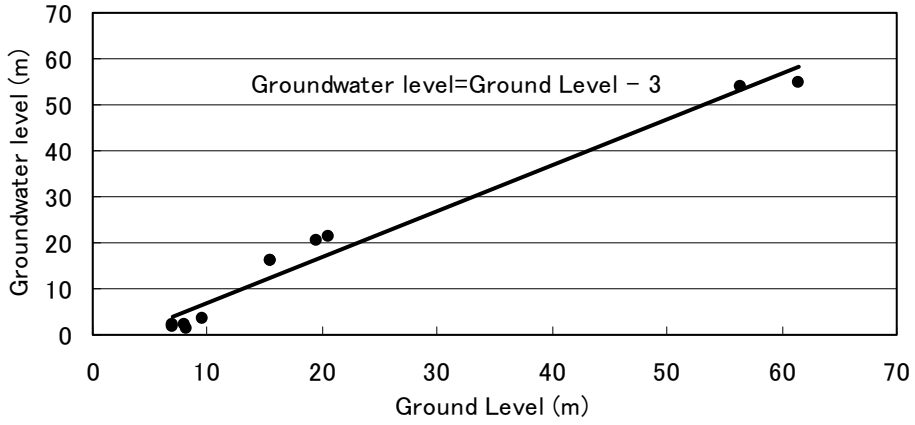
Influence to sea-water intrusion and to the existing SIWA boreholes

There is little probability of sea-water intrusion by pumping of proposed boreholes because the boreholes are located more than 900m from the shoreline. There are large distance between the proposed boreholes and the existing SIWA boreholes, which will prevent influence by new borehole to the existing boreholes in lowering of groundwater level and sea-water intrusion.

Groundwater level

Relation between groundwater level and ground elevation is shown in Figure B2.2-3, which is estimated from result of "The Project for Improvement of water Supply System in Honiara Solomon Islands (1998)". As shown in Figure B2.2-3, there is clear relationship between groundwater level and ground elevation. Based on this relationship, the groundwater level of the proposed borehole can be estimated as shown below.

Groundwater level of proposed borehole = Ground elevation – 10(m)



Source : JICA Study Team

Figure B2.2-3 Groundwater Level and Ground Level

Groundwater is confined in the Study Area, and it will be observed only inside borehole. Aquifer will be encountered below 20m - 40m depth in drilling. Confined groundwater will rise inside borehole up-to 10m below the ground surface

Planed Yield

Optimum yield of JICA boreholes in the previous grant aid project, "Project for Improvement of water

Supply System in Honiara Solomon Islands", seems 800m^3/day, though boreholes were tested by yield of more than 800m^3/day. Therefore, planed yield should be 800m^3/day for proposed boreholes.

Depth of boreholes and diameter

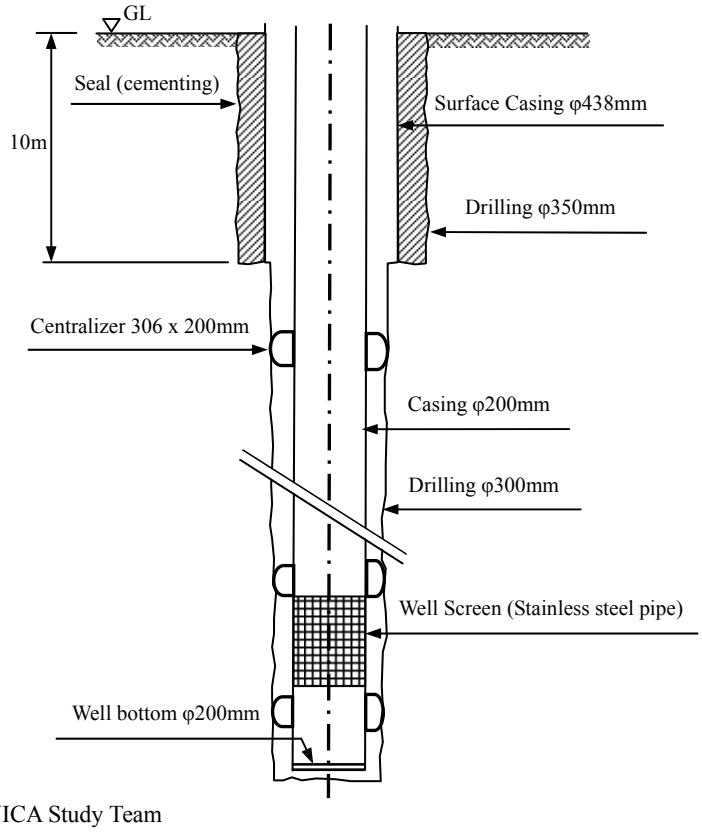
Based on result of the previous grant aid project and this study, depth of boreholes is proposed 100m. Taking into account of aquifer distribution, it is expected that borehole with 100 depth can provide enough groundwater necessary for future water supply. Diameter of proposed borehole should be 8 inch to install submersible pump necessary for planned yield.

Well success rate

In the previous grant aid projects, eleven boreholes were drilled, of which nine boreholes were successful with enough yield that exceeded yield of 800m3/day. Two boreholes have only 10% to 50% of planned yield. Judging from this result, it is concluded that success rate of boreholes in Honiara is 9÷11=0.8 (80%). However, it must be noticed that sites suitable for drilling borehole is more restricted than before. Drilling site with high success rate might be distributed in fault zone, where fractured rock has high infiltration capacity and easily eroded into deeply dissected valleys through long geological age. Mataniko River and White River are examples of such origin. However, these areas have been already developed, and additional groundwater development should be avoided. Proposed boreholes are located in valleys that were less dissected by erosion than Mataniko River and White River. Discharge of these valleys is negligible compared with Mataniko River and White River. Therefore, well success rate in the proposed area should be around 70%, which is lower than that adopted for borehole site (80%) in Mataniko River and White River.

Well structure

Well structure is shown in Figure B2.2-4.



Source : JICA Study Team

Figure B2.2-4 Well Structure

(3) Access of drilling machine

Every drilling point is located along public road, and there is no problem in access to the drilling points by drilling machines and supporting vehicles. There is enough space for drilling works at every point.

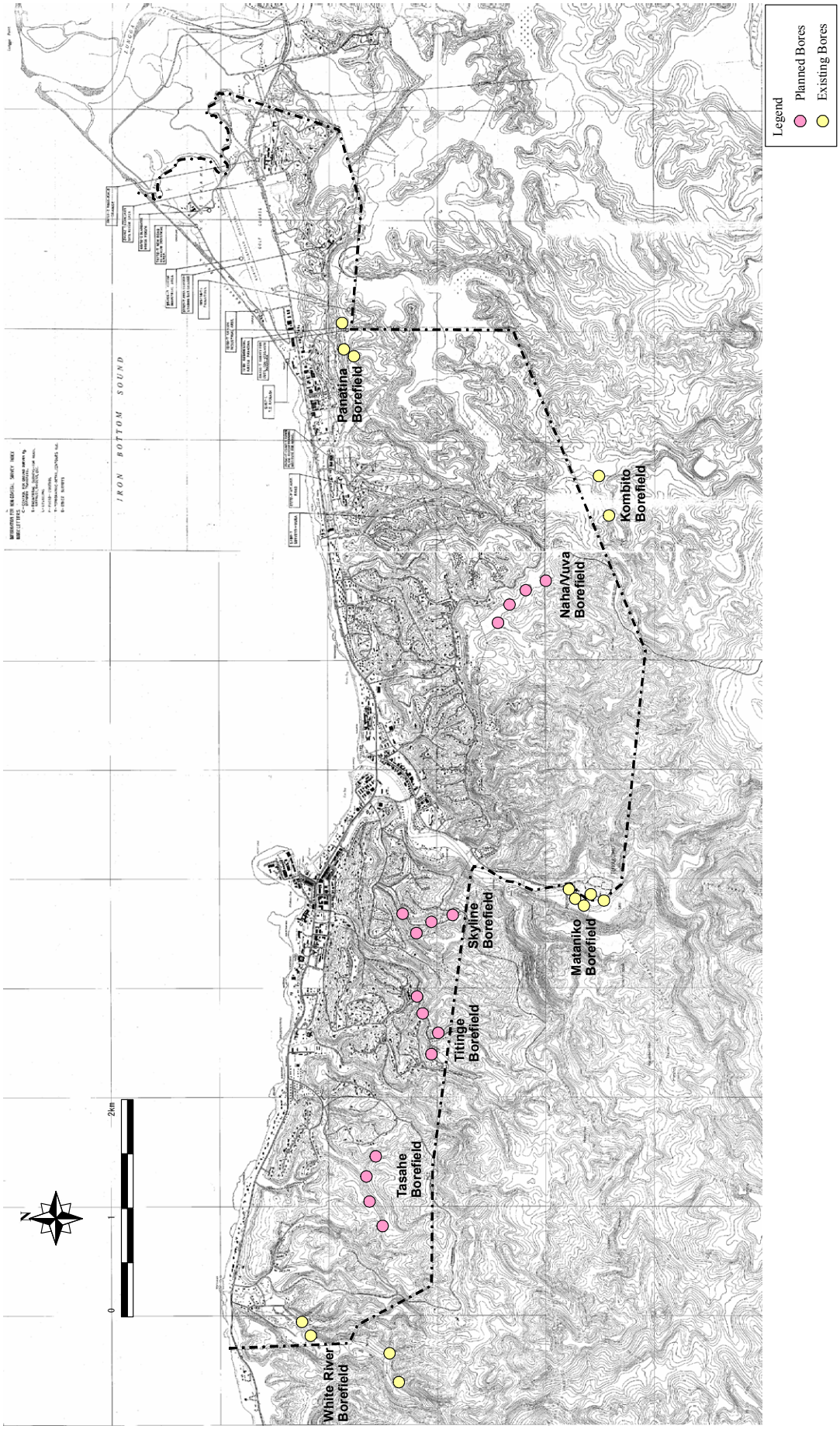


Figure B2.2-5 Proposed Location of Boreholes for Honiara City

Source : JICA Study Team