

## STEP DRAWDOWN TEST

PROJECT NAME:		THE STUDY ON GROUNDWATER DEVELOPMENT FOR WATER SUPPLY SYSTEMS IN PAPUA NEW GUINEA					
CLIENT:		JICA					
CONSULTANT:		JAPAN TECHNO CO., LTD					
CONTRACTOR:		CENTRAL DRILLERS PTY LT					
Borehole No		: KKBH 2	Static water level (m)		: 3.66 m b.g.l		
Location		: Kwikila town – Central Province	Dynamic water level (m)		: 7.67 m b.g.l		
Test by		: S. Egara	Borehole depth (m)		: 31.0 m b.g.l		
Date		: 22/08/2000	Screen depth (m)		: 5 – 11.0m / 23 – 29.0m		
Time since pumping started t(min)	Depth to water level (m)	Drawdown (m)	Discharge rate (l/min)	Time since pumping started t(min)	Depth to water level (m)	Drawdown (m)	Discharge rate (l/min)
<b>STEP 1</b>				<b>STEP 2</b>			
0	3.66	0		0	4.84	0	
1	6.93	3.27		1	5.12	0.28	
1.5	6.92	3.26		1.5	5.13	0.29	
2	6.88	3.22	211.8	2	5.16	0.32	
2.5	6.31	2.65		2.5	5.17	0.33	
3	6.43	2.77		3	5.17	0.33	81
4	5.85	2.19		4	5.18	0.34	
5	5.52	1.86		5	5.19	0.35	
6	5.34	1.68		6	5.19	0.35	
8	5.17	1.51		8	5.36	0.52	
10	4.94	1.28		10	5.38	0.54	
12	4.92	1.26		12	5.38	0.54	94.2
14	4.92	1.26		14	5.40	0.56	
18	4.80	1.14	63.6	18	5.42	0.58	93.6
24	4.80	1.14	65.4	24	5.44	0.60	
30	4.81	1.15	66.6	30	5.46	0.62	
40	4.82	1.16	61.8	40	5.48	0.64	94.2
60	4.82	1.16		60	5.51	0.67	
80	4.83	1.17	61.8	80	5.52	0.68	91.8
100	4.83	1.17		100	5.54	0.70	
120	4.84	1.18	61.8	120	5.55	0.71	94.2

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Location		: Kwikila town – Central Province		Dynamic water level (m)		: 7.67 m b.g.l	
Test by		: S. Egara		Borehole depth (m)		: 31.0 m b.g.l	
Date		: 22/08/2000		Screen depth (m)		: 5 – 11.0m / 23 – 29.0m	
Time since pumping started t(min)	Depth to water level (m)	Drawdown (m)	Discharge rate (l/min)	Time since pumping started t(min)	Depth to water level (m)	Drawdown (m)	Discharge rate (l/min)
<b>STEP 3</b>				<b>STEP 4</b>			
0	5.55	0		0	6.21	0	
1	6.42	0.87		1	6.	0	
1.5	6.57	1.02		1.5	6.	0	
2	6.58	1.03		2	6.	0	
2.5	6.65	1.10		2.5	6.	0	
3	6.69	1.14		3	6.	0.02	
4	6.28	0.73		4	6.	0.30	
5	6.25	0.70		5	6.	0.35	
6	6.18	0.63		6	6.	0.56	
8	6.09	0.54		8	6.	0.64	155.4
10	6.08	0.53	120	10	6.	0.77	
12	6.08	0.53		12	7.	0.79	
14	6.09	0.54		14	7.	0.80	
18	6.10	0.55	120	18	7.	0.84	
24	6.12	0.57		24	7.	0.87	
30	6.13	0.58	120	30	7.	0.90	155.4
40	6.14	0.59	120	40	7.	0.94	
60	6.15	0.60		60	7.	0.97	151.8
80	6.18	0.63	120	80	7.	1.05	
100	6.20	0.65		100	7.	1.06	151.8
120	6.21	0.66	120	120	7.	1.06	151.8

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Location		: Kwikila town – Central Province		Dynamic water level (m)		: 7.67 m b.g.l	
Test by		: S. Egara		Borehole depth (m)		: 31.0 m b.g.l	
Date		: 22/08/2000		Screen depth (m)		: 5 – 11.0m / 23 – 29.0m	
Time since pumping started t(min)	Depth to water level (m)	Drawdown (m)	Discharge rate (l/min)	Time since pumping started t(min)	Depth to water level (m)	Drawdown (m)	Discharge rate (l/min)
<b>STEP 5</b>				<b>STEP 6</b>			
0	7.27	0		0			
1	7.35	0.08		1			
1.5	7.29	0.02		1.5			
2	7.29	0.02		2			
2.5	7.30	0.03		2.5			
3	7.30	0.03		3			
4	7.31	0.04		4			
5	7.32	0.05		5			
6	7.33	0.06		6			
8	7.34	0.07	187.2	8			
10	7.35	0.08		10			
12	7.36	0.09		12			
14	7.37	0.10	188.4	14			
18	7.40	0.13	180	18			
24	7.44	0.17		24			
30	7.48	0.21		30			
40	7.50	0.23	189	40			
60	7.56	0.29		60			
80	7.60	0.33	189	80			
100	7.63	0.36	189	100			
120	7.67	0.40		120			

## CONTINUOUS PUMPING TEST

<b>PROJECT NAME</b>	: THE STUDY ON GROUNDWATER DEVELOPMENT FOR WATER SUPPLY SYSTEMS IN PAPUA NEW GUINEA		
<b>CLIENT</b>	: JICA		
<b>CONSULTANT</b>	: JAPAN TECHNO CO., LTD		
<b>CONTRACTOR</b>	: CENTRAL DRILLERS PTY LTD		

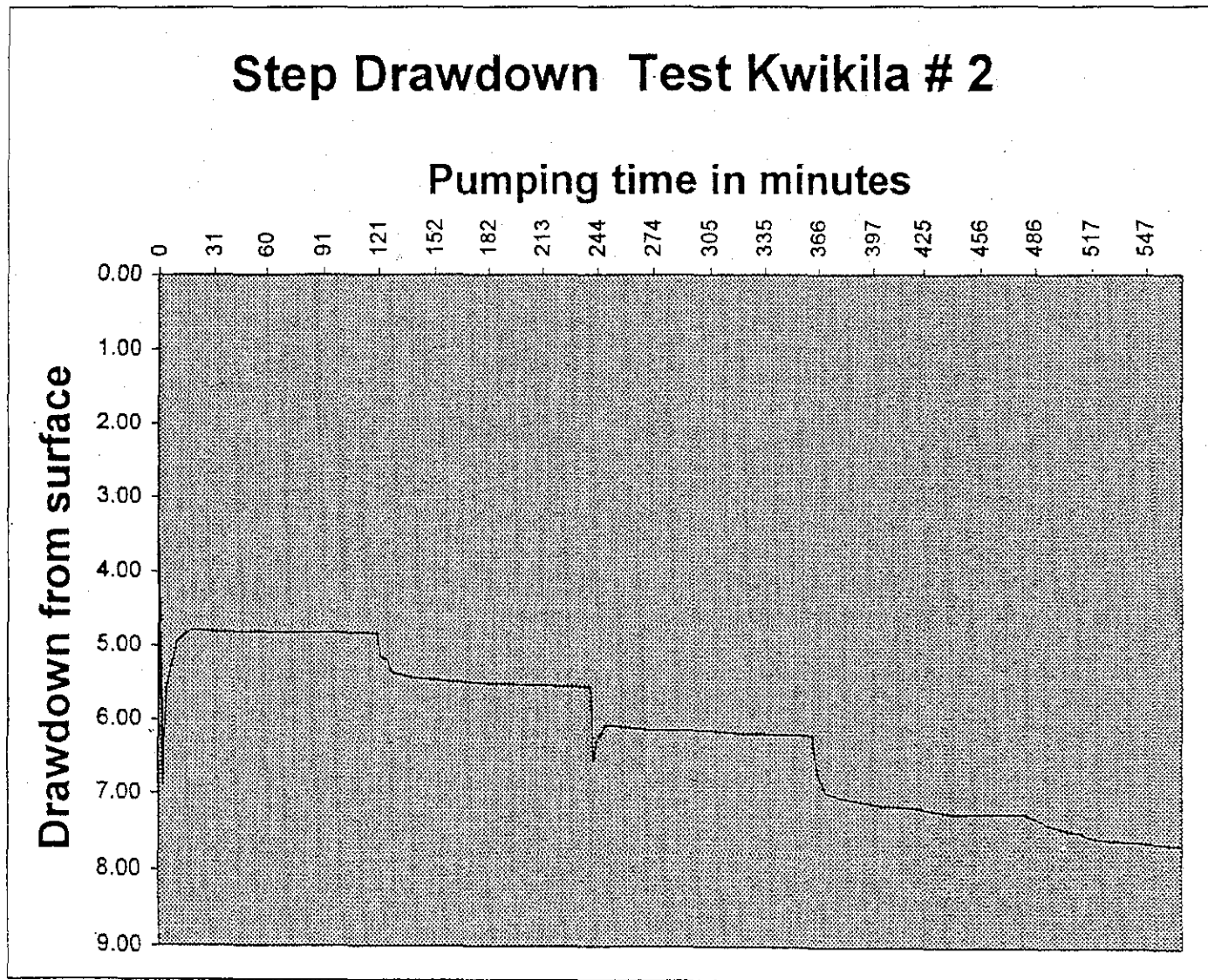
Borehole No	: KKBH 2	Static water level (m)	: 3.6m b.g.l
Location	: Kwikila town – Central Province	Dynamic water level (m)	: 7.67m b.g.l
Test by	: S.Egara / Y. Yamauchi	Borehole depth (m)	: 31.0m
Date	: 22/08/2000	Screen depth (m)	: 5-11.0m / 23-29.0m

Time since pumping started t(min)	Depth to water level (m)	Drawdown (m)	Discharge rate (l/min)	Time since pumping started t(min)	Depth to water level (m)	Drawdown (m)	Discharge rate (l/min)
0	3.67	0	210.6	210	8.67	5.00	
1	6.50	2.83		240	8.30	4.63	150
1.5	6.84	3.17		300	8.05	4.38	
2	7.02	3.35		360	8.05	4.38	
2.5	7.15	3.48		420	8.04	4.37	150
3	7.15	3.48		480	8.07	4.40	
4	7.36	3.69		540	8.09	4.42	
5	7.46	3.79		600	8.11	4.44	150
6	7.54	3.87		660	8.13	4.46	
7	7.60	3.93		720	8.14	4.47	150
8	7.66	3.99	211.8	780	8.15	4.48	150
10	7.76	4.09		840	8.15	4.48	150
12	7.86	4.19		900	8.16	4.49	
14	7.93	4.26		960	8.19	4.52	
18	8.05	4.38		1020	8.20	4.53	150
24	8.20	4.53		1080	8.21	4.54	
30	8.31	4.64	211.8	1140	8.23	4.56	
40	8.46	4.79		1200	8.26	4.59	150
60	8.66	4.99		1260	8.28	4.61	
80	8.82	5.15		1320	8.29	4.62	
100	9.01	5.34	211.2	1380	8.29	4.62	150
120	9.26	5.59		1440	8.29	4.62	150
150	9.64	5.97	211.8				
180	9.85	7.18					
197	14.59	10.92	168				

**Note:** Gate valve adjusted to 168 l/min at 197 min



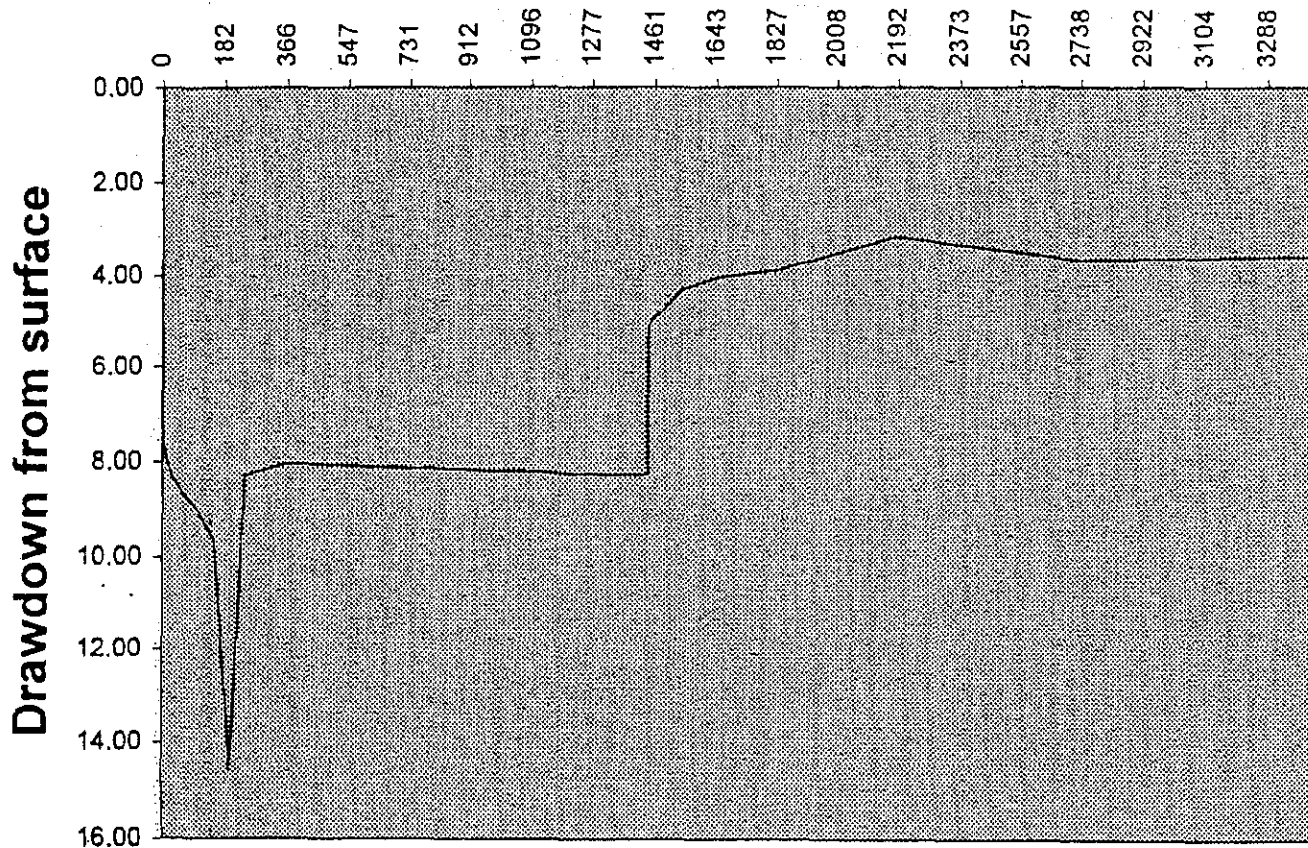
Time	Drawdown	Flow Rate
		l/second
0	3.66	
2	6.88	3.53
4	5.59	
6	5.34	
8	5.17	
10	4.94	
18	4.80	1.06
24	4.80	1.09
30	4.81	1.11
40	4.82	
60	4.82	
80	4.83	1.03
100	4.83	
120	4.84	1.03
122	5.16	
124	5.18	
126	5.19	1.35
128	5.36	
130	5.38	
136	5.42	
144	5.44	1.56
150	5.46	
160	5.48	
180	5.51	
200	5.52	1.53
220	5.54	
240	5.55	1.57
242	6.58	
244	6.28	
246	6.18	
248	6.09	
250	6.08	2
256	6.10	
264	6.12	
270	6.13	
280	6.14	2
300	6.15	
320	6.18	2
340	6.20	
360	6.21	2
362	6.21	
364	6.51	
366	6.77	
368	6.85	
370	6.98	2.59
378	7.05	
384	7.08	
390	7.11	2.59
400	7.15	
420	7.18	2.53
440	7.26	
460	7.27	
480	7.27	2.53
482	7.29	
484	7.31	
486	7.33	
488	7.34	3.12
490	7.35	
492	7.40	3
498	7.44	
504	7.48	
510	7.50	
516	7.56	
526	7.60	3.15
546	7.63	
566	7.67	3.15



Time	Drawdown	Flow Rate
0	3.67	3.5
2	7.02	
4	7.36	
8	7.87	
8	7.86	
10	7.76	
18	8.05	
30	8.31	
60	8.66	
100	9.01	
150	9.84	3.53
197	14.59	2.8
240	8.30	
360	8.05	2.5
480	6.07	
800	8.11	
720	8.14	
840	8.15	2.5
960	8.19	
1080	8.21	
1200	8.26	
1320	8.29	
1440	8.29	2.5
1441	5.45	pump stopped
1443	5.18	
1447	5.01	
1455	4.91	
1465	4.88	
1479	4.80	
1503	4.62	
1543	4.30	
1643	4.05	
1823	3.91	
2163	3.16	
2723	3.68	
3443	3.60	

# Continous Drawdown Test KKBH#2

Pumping time in minutes



KUPIANO  
KUBH #1

CENTRAL DRILLERS PTY LTD

Borehole Lithology		Depth (m)	Borehole Construction Design	Design Description	Borehole Geophysical Log	Remarks
Descriptive Log	Graphic Log					
GL	GL	0		GL	GL	GL
Yellowish brown Mudstone with occasional siltstone interbeds		0-15	<ul style="list-style-type: none"> <li>7m Cement grout</li> <li>250mm Steel surface casing</li> <li>150mm PVC blank casing</li> <li>150mm x 4mm factory slotted PVC screen</li> </ul>			GWL at 4.20m depth
As above but colour change at 150m depth		15-27	<ul style="list-style-type: none"> <li>14mm rounded river gravel</li> <li>Undisturbed formation</li> </ul>			Uniform Lithology
Blueish grey Siltstone with occasional Mudstone interbeds		27-54	<ul style="list-style-type: none"> <li>150mm blank PVC sump</li> <li>Caved in drill cuttings</li> </ul>			
Bluish Mudstone with Siltstone		54-60				
		63	EOH at 62.0m			



THE MILLERS  
P.O. BOX 6579  
BOROKO - NCD  
PH: 3259534 - FAX: 3259687

1 of 2

**BOREHOLE LITHOLOGICAL LOG**

PROJECT NO:.....

PROJECT: GW study - PNG BOREHOLE NO: KUBH #1 B.H. DIA: 250 mm  
CLIENT: Japan Techno Co. SURFACE CASING DIA: 300 mm from 0 m to 5.30 m bgl  
LOCATION: KUPIANO TOWN - CP CASING TYPE: 150 mm PVC  
RIG TYPE: Mobil/Fox B4 THD DRILLED DEPTH: 62.0 m  
DRILLING METHOD: Rotary (air) DATE START: 31/10/2000 COMPLETED: 01/11/2000  
REFERENCE LEVEL: GL WATER LEVEL: 4.2 m bgl

Depth (m)	Graphic Log	Description of strata	Remarks
0	GL	GL	GL
3.0		Yellowish brown Mudstone with occasional siltstone interbeds.	GW intercepted at 4.2 m bgl.
6.0			
9.0			
12.0			
15.0			
18.0		Same as above but colour turning to blue grey below 16.0m depth.	Mudstone with occasional siltstone
21.0			
24.0			
27.0			
30.0			
33.0		Bluish grey Siltstone with interbeds of mudstone	Becoming more silty.
36.0			
39.0			
42.0			
45.0			
48.0		Bluish Mudstone with siltstone interbeds.	More Mst. than Siltstone
51.0			
54.0			
57.0			
60.0			
63.0	E.O.H	E.O.H at 62.0m	E.O.H

**BORE HOLE DIARY**

PROJECT NAME	: THE STUDY ON GROUNDWATER DEVELOPMENT FOR WATER SUPPLY SYSTEMS IN PAPUA NEW GUINEA	
CLIENT	: JICA	
CONSULTANT	: JAPAN TECHNO CO., LTD	
CONTRACTOR	: CENTRAL DRILLERS LTD	
Borehole No	: KUBH # 1	Operator: A. Tonia/S. Brown
Location	: Kupiano Town - CP	Others : A. Aisa
Type of Rig	: Mobil Fox B40 Modified THD Rotary	
Date	Time	Description
30/10/2000	<b>ALL DAY</b>	Mobilisation to Kupiano from Port Moresby.
30/10/2000	7.30 am – 11.00 am	Arrive on site. Clear up drilling site and set up drill rig to commence drilling.
	11.00 am – 12.00 pm	<b>LUNCH BREAK</b>
	12.00 pm – 3.00 pm	Commence drilling using 12" (300 mm) flight bit to 5.3 m depth. Insert 250 mm diameter steel surface casing and grout with cement.
	4.00 pm – 6.00 pm	Resume drilling using 6½" blade bit with air to 36.0 m before shutting down drill rig.
	6.15 pm	<b>END OF DAY</b>
01/11/2000	7.38 am	Arrive on site.
	7.38 am – 12.00 pm	Resume drilling and completed drilling down to 62.0 m depth.
	12.00 pm – 1.00 pm	<b>LUNCH BREAK</b>
	1.30 pm – 3.30 pm	Downhole geophysical logging done. Only resistivity log done using IBM 3000 terrameter to 60.0 m depth.
	3.30 pm – 5.49 pm	Recommence reaming out borehole using 9⅝" (250 mm) diameter blade bit using air to 48.2 m depth before encountering cave-in problem. Hole caved into 36.0 m depth.
02/11/2000	7.30 am – 12.00 pm	Arrive on site. Resume cleaning out hole to 48.20 m depth using air, then install screen and casing to 35.0 m.
	12.00 pm – 5.00 pm	Await gravel from Port Moresby.
03/11/2000	AM	Await arrival of gravel from Port Moresby.
	2.00 pm – 5.30 pm	Commence gravel packing then start developing borehole using air lift method till 5.30 pm.
04/11/2000	8.00 am – 12.30 pm	Resume developing borehole till sand free state reached around 12.30 pm.
	1.00 pm – 5.00 pm	Install pump and await arrival of generator from Port Moresby.
05/11/2000	7.30 am – 12.00 pm	Set up generator and test pump. Whilst attempting testing of pump generator encountered difficulties (technical).
06/11/2000	ALL DAY AM till 2.30 pm	Await arrival of new pump and generator. Pull out other bigger pump and install new smaller pump. Install new pump and test OK. Quick drawdown test at about 18.0 m in

		** con't next page **
	7.00 pm	30 minutes. End of suction inlet at 18.50 m. A 4x2 hrs step drawdown test commenced at 0.15 l/s and completed after 8 hrs at 0.60 l/s at 9.00 am on 07/11/2000.
07/11/2000 to	} 9.30 am – 9.30 pm	A 24 hrs constant drawdown test done followed by 12 hrs Recovery at 0.5 l/s flow rate.
08/11/2000	} 9.30 am – 9.30 pm	

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CONSULTANT:		JAPAN TECHNO CO., LTD					
CONTRACTOR:		CENTRAL DRILLERS PTY LT					
Borehole No		: KUBH 1		Static water level (m)		: 1.431 m from top of casing	
Location		: Kupiano station -- Central Prov.		Dynamic water level (m)		:	
Test by		: S. Egara / A. Aisa		Borehole depth (m)		: 62.0 m b.g.l	
Date		: 05/11/2000		Screen depth (m)		: 21 - 33.0m	
Time since pumping started t(min)	Depth to water level (m)	Drawdown (m)	Discharge rate (l/min)	Time since pumping started t(min)	Depth to water level (m)	Drawdown (m)	Discharge rate (l/min)
STEP 1				STEP 2			
0	1.431	0		0	2.752		
1	1.487			1	2.756		
1.5	1.550			1.5	2.759		
2	1.598			2	2.763		
2.5	1.632			2.5	2.779		
3	1.784			3	2.703		
4	1.992			4	2.708		
5	2.067			5	2.713		
6	2.117		9.6	6	2.742		
8	2.268			8	2.749		
10	2.292			10	2.760		
12	2.310		9.0	12	2.782		
14	2.332			14	2.791		
18	2.368			18	2.811		18.6
24	2.394			24	2.827		
30	2.442		9.0	30	2.832		
40	2.571			40	2.850		18.6
60	2.623			60	2.872		
80	2.691			80	2.891		18
100	2.708			100	2.826		18
120	2.752		9.0	120	2.989		

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CONSULTANT:		JAPAN TECHNO CO., LTD					
CONTRACTOR:		CENTRAL DRILLERS PTY LTD					
Borehole No		: KUBH 1		Static water level (m)		: 1.431 m from top of casing	
Location		: Kupiano station – Central Prov.		Dynamic water level (m)		:	
Test by		: S. Egara / A.Aisa		Borehole depth (m)		: 62.0 m b.g.l	
Date		: 05/11/2000		Screen depth (m)		: 21 – 33.0m	
Time since pumping started t(min)	Depth to water level (m)	Drawdown (m)	Discharge rate (l/min)	Time since pumping started t(min)	Depth to water level (m)	Drawdown (m)	Discharge rate (l/min)
<b>STEP 3</b>				<b>STEP 4</b>			
0	2.989			0	4.910		
1	3.142			1	5.325		
1.5	3.166			1.5	5.378		
2	3.182			2	5.421		
2.5	3.214			2.5	5.476		
3	3.256			3	5.521		
4	3.297			4	5.580		
5	3.323			5	5.600		
6	3.368			6	5.643		
8	3.426			8	5.699		
10	3.513			10	5.737		
12	3.618		28.2	12	5.784		35.4
14	3.706			14	5.846		
18	3.810			18	5.921		
24	4.006		27.6	24	5.969		36.6
30	4.132			30	6.992		36.6
40	4.364		27.6	40	6.207		
60	4.482			60	7.572		
80	4.635			80	7.778		36.6
100	4.847			100	7.963		36.6
120	4.910		27.6	120	8.305		

## CONTINUOUS PUMPING TEST

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<b>CONSULTANT</b>		: JAPAN TECHNO CO., LTD					
<b>CONTRACTOR</b>		: CENTRAL DRILLERS PTY LTD					
<b>Borehole No</b>		: KUBH 1		<b>Static water level (m)</b>		: 0.682 m b.g.l	
<b>Location</b>		: Kupiano station – Central Province		<b>Dynamic water level (m)</b>		:	
<b>Test by</b>		: S.Egara / A. Aisa		<b>Borehole depth (m)</b>		: 62.0m	
<b>Date</b>		: 06/11/2000		<b>Screen depth (m)</b>		: 21 –33.0m	
Time since pumping started t(min)	Depth to water level (m)	Drawdown (m)	Discharge rate (l/min)	Time since pumping started t(min)	Depth to water level (m)	Drawdown (m)	Discharge rate (l/min)
0	1.45	0		210	5.87	4.14	
1	3.59	2.14		240	5.92	4.47	
1.5	4.37	2.92		300	5.99	4.54	
2	4.83	3.38		360	6.05	4.60	
2.5	5.17	3.72		420	6.11	4.66	
3	5.20	3.97		480	6.17	4.72	
4	5.98	4.52		540	6.30	4.85	
5	6.40	4.95		600	6.37	4.92	
6	6.74	5.29		660	6.40	4.95	
7	7.03	5.58		720	6.47	5.02	
8	7.29	5.83		780	6.51	5.06	
10	7.04	5.59		840	6.55	5.10	
12	6.35	4.90		900	6.61	5.16	
14	5.97	4.52		960	6.65	5.19	
18	5.63	4.18		1020	6.71	5.25	
24	5.47	4.01		1080	6.73	5.28	
30	5.44	3.99		1140	6.76	5.31	
40	5.46	4.01		1200	6.81	5.35	
60	5.54	4.09		1260	6.81	5.36	
80	5.63	4.17		1320	6.83	5.38	
100	5.67	4.22		1380	6.88	5.43	
120	5.71	4.26		1440	6.91	5.46	
150	5.78	4.32					
180	5.82	4.37					

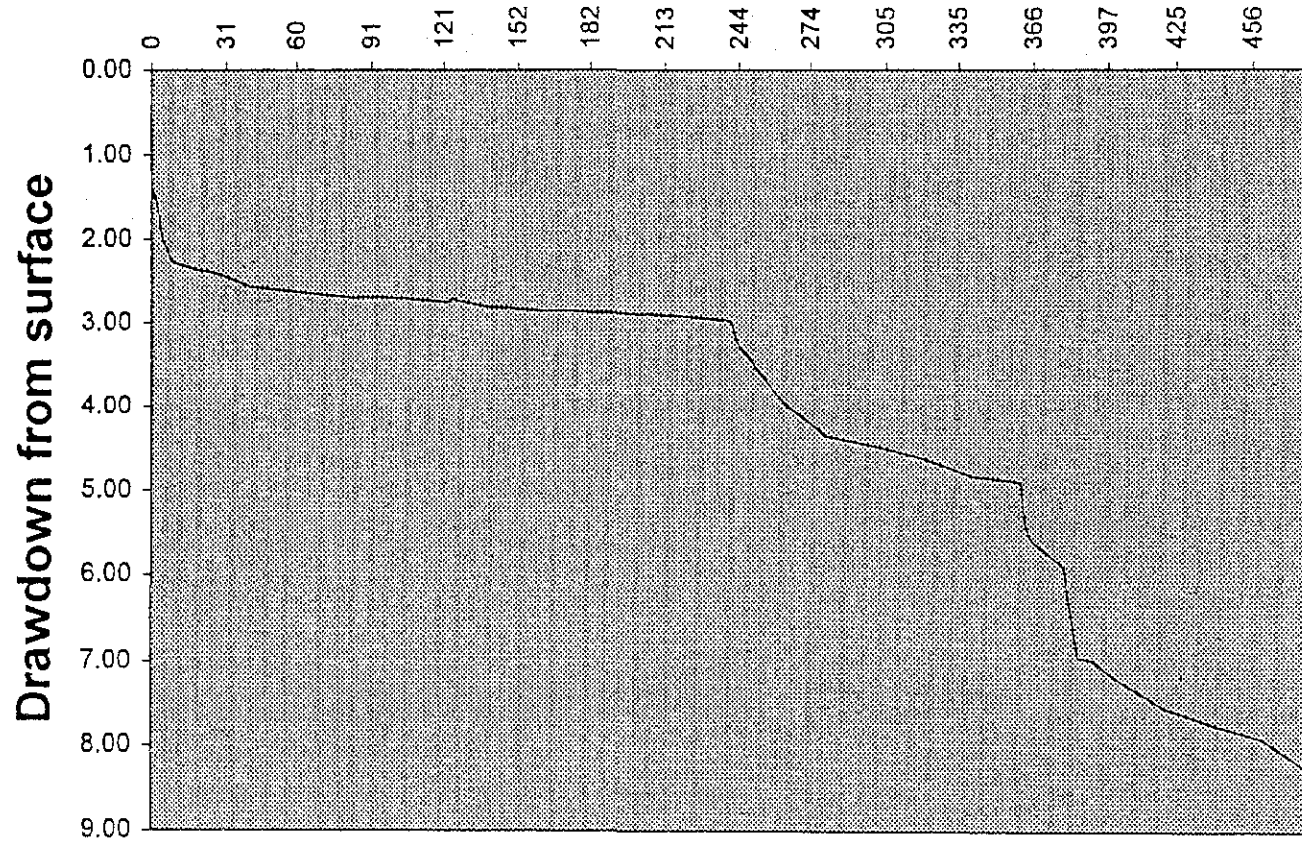
## RECOVERY TEST

PROJECT NAME:		THE STUDY ON GROUNDWATER DEVELOPMENT FOR WATER SUPPLY SYSTEMS IN PAPUA NEW GUINEA			
CLIENT:		JICA			
CONSULTANT:		JAPAN TECHNO CO., LTD			
CONTRACTOR:		CENTRAL DRILLERS PTY LTD			
Borehole No	: KUBH 1	Static water level (m)	: 0.682 m b.g.l		
Location	: Kupiano station	Dynamic water level (m)	: 5.461 m b.g.l		
Test by	: S.Egara / A. Owen	Borehole depth (m)	: 62.0 m		
Date	: 7 - 8/11/2000	Screen depth (m)	: 12 - 15m / 21 - 33m		
Time since pumping started t(min)	Time since pumping stopped t(min)	T/t	Depth to water level (m)	Residual drawdown (m)	Discharge rate (l/min)
	1		4.903		
	1.5		4.503		
	2		4.152		
	2.5		3.805		
	3		3.580		
	4		3.150		
	5		2.840		
	6		2.610		
	8		2.302		
	10		2.132		
	12		2.035		
	14		1.970		
	18		1.884		
	24		1.815		
	30		1.766		
	40		1.710		
	60		1.624		
	80		1.572		
	100		1.525		
	120		1.486		
	150		1.437		
	180		1.396		
	210		1.360		
	240		1.328		
	300		1.298		
	360		1.230		
	420		1.195		
	480		1.164		
	540		1.120		
	600		1.108		
	660		1.084		
	720		1.058		

Time	Drawdown	Flow Rate
		l/second
0	1.43	
2	1.59	
4	1.99	
6	2.11	
8	2.26	
10	2.29	0.15
18	2.36	
24	2.39	
30	2.44	0.15
40	2.57	
60	2.63	
80	2.69	
100	2.70	
120	2.75	0.15
122	2.76	
124	2.70	
126	2.74	
128	2.74	
130	2.76	
138	2.81	
144	2.82	0.3
150	2.83	
160	2.85	
180	2.87	
200	2.89	0.3
220	2.92	
240	2.98	
242	3.18	0.3
244	3.29	
246	3.36	
248	3.42	
250	3.51	
258	3.81	
264	4.00	0.46
270	4.13	
280	4.36	0.46
300	4.48	
320	4.63	0.46
340	4.84	
360	4.91	0.46
362	5.42	
364	5.58	
366	5.64	
368	5.68	
370	5.73	0.59
378	5.92	
384	6.96	0.61
390	6.99	
400	7.20	
420	7.57	0.61
440	7.77	
460	7.93	
480	8.30	0.61

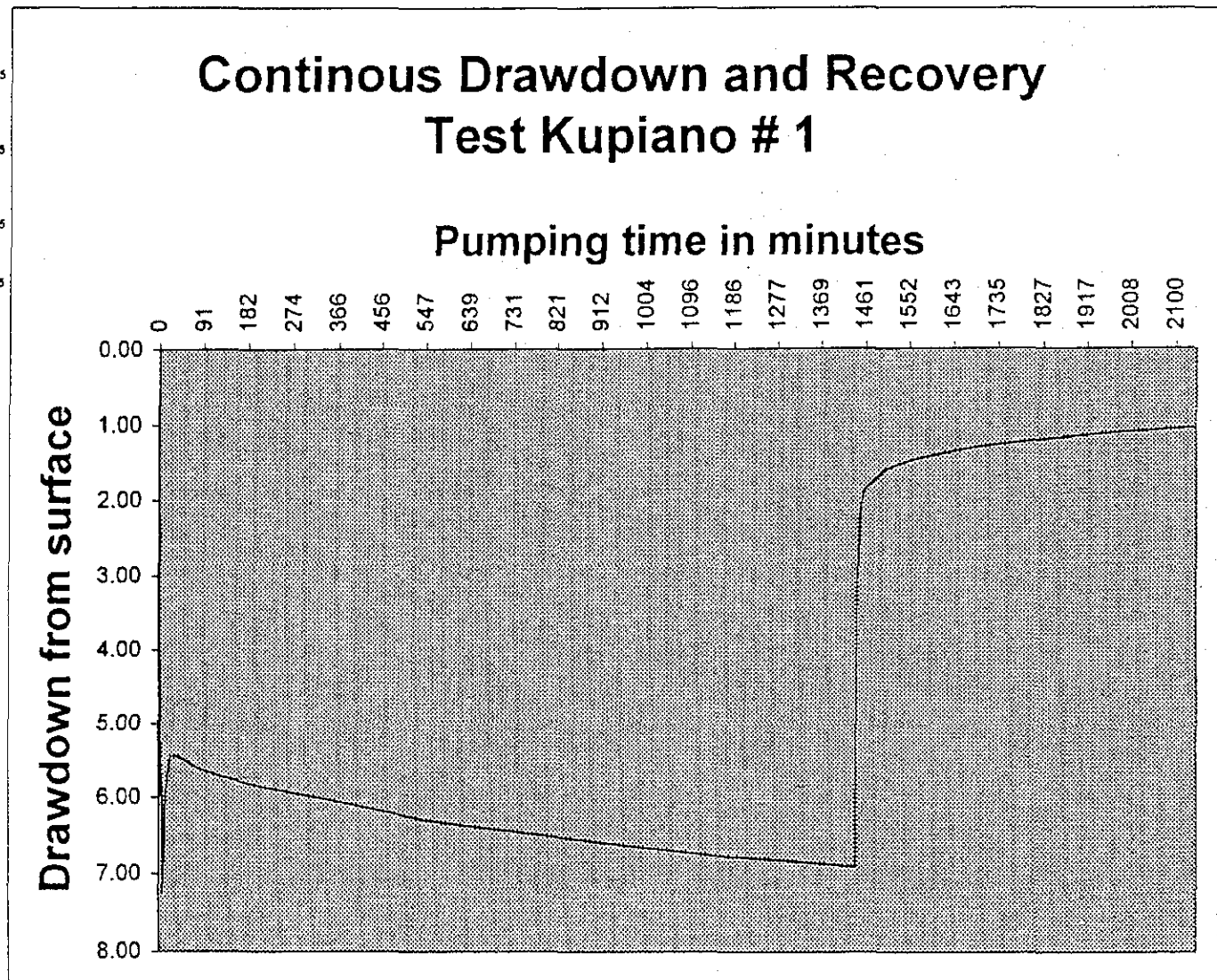
# Step Drawdown Test Kupiano # 1

Pumping time in minutes





Time	Drawdown	Flow Rate
0	1.45	
2	4.83	
4	5.97	
6	5.28	
8	7.28	
14	5.96	0.5
24	5.46	
40	5.46	
80	5.62	
120	5.71	0.5
180	5.82	
210	5.86	
360	6.05	
540	6.30	
660	6.40	0.5
840	6.54	
960	6.64	
1140	6.78	
1280	6.81	0.5
1440	6.91	0.5
1441	4.90	0.5
1444	3.15	0.5
1450	2.13	0.5
1458	1.88	0.5
1500	1.82	0.5
1560	1.48	0.5
1680	1.32	0.5
1860	1.19	0.5
1960	1.12	0.5
2140	1.05	0.5



SCOPE OF WORK  
FOR  
THE STUDY  
ON  
INVESTIGATION AND DEVELOPMENT  
OF  
UNDERGROUND WATER SOURCES  
FOR  
WATER SUPPLY SYSTEMS  
IN  
PAPUA NEW GUINEA

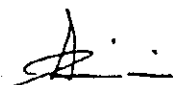
Agreed upon between

Papua New Guinea Waterboard

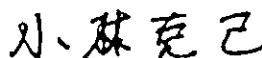
And

Japan International Cooperation Agency

Port Moresby, December 20, 1999



Patrick K. Amini  
Managing Director  
The Waterboard



Kobayashi Katsumi  
Leader, Preparatory Study Team,  
Japan International Cooperation  
Agency (JICA)



Joe Kenken Mok  
Acting Assistant First secretary  
Foreign Aid Management Division  
Department of Planning and Monitoring

## I INTRODUCTION

In response to the request of the Government of Papua New Guinea (hereinafter referred to as "the Government of PNG"), the Government of Japan decided to conduct the Study on Investigation and Development of Underground Water Sources for Water Supply Systems in Papua New Guinea (hereinafter referred to as "the Study") in accordance with the relevant laws and regulations in force in Japan.

Accordingly, Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, will undertake the Study in close cooperation with the authorities concerned of the Government of PNG.

The present document sets forth the Scope of Work with regard to the Study.

## II OBJECTIVES OF THE STUDY

The objectives of the Study are:

1. to formulate a water supply plan through the investigation of the surface and underground water potential,
2. to conduct the feasibility study on provincial towns,
3. to transfer technology to counterpart personnel in the course of the Study.

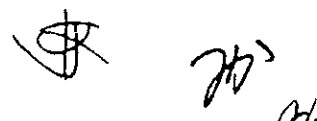
## III STUDY AREA

The Study will cover two (2) provincial towns and six (6) district towns shown in Appendix 1.

## IV SCOPE OF THE STUDY

### Phase I Basic Study

- 1) Review the existing studies and plans related to the Study
- 2) Analyse the existing data available for the study
- 3) Field reconnaissance
  - (1) Topographical, geological, and hydrological investigation
  - (2) Inventory of water resources and water supply systems
  - (3) Other relevant investigations



4) Study on actual condition of the target towns

- (1) Water usage and sanitation, hygiene
- (2) Awareness of portable water
- (3) Economic conditions
- (4) Sociological configuration
- (5) Gender issues

5) Underground water potential survey

- (1) Geophysical exploration
- (2) Test well construction and evaluation

6) Water demand forecast

7) Formulation of a water supply plan

- (1) Design of the water supply facilities
- (2) Management, operation and maintenance
- (3) Institutional and organizational
- (4) Financial and economical

8) Initial Environmental Evaluation (IEE)

Phase II Feasibility Study on the Projects for provincial towns

1) In-depth survey and supplemental data collection for the F/S

2) Formulation of the implementation plan

- (1) Design of facilities
- (2) Management, operation and maintenance plan
- (3) Cost estimation
- (4) Phased implementation plan

3) Environmental Impact Assessment (EIA)

1) Project evaluation

- (1) Social aspect
- (2) Economical aspect
- (3) Financial aspect

## V SCHEDULE OF THE STUDY

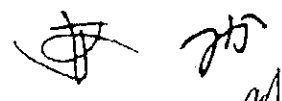
The Study will be carried out in accordance with the tentative schedule as Appendix 2. The schedule is tentative and subject to be modified during the course of the Study.

## VI REPORTS

JICA shall prepare and submit the following reports in English to the Government of PNG.

1. Inception Report

Fifteen (15) copies will be submitted at the commencement of the Study.



2. Interim Report

Fifteen (15) copies will be submitted at the beginning of Phase II.

3. Draft Final Report

Fifteen (15) copies will be submitted at the end of Phase II.

The Government of PNG shall submit its comments within one (1) month after its receipt of the Draft Final Report.

4. Final Report

Twenty (20) copies will be submitted after the receipt of the comments on the Draft Final Report.

## VII UNDERTAKING OF THE GOVERNMENT OF PNG


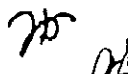
To facilitate the smooth conduct of the Study, the Government of PNG will take necessary measures as follows.

- (1) to secure the safety of the Japanese study team (hereinafter referred to as "the Team")
- (2) to permit the members of the Team to enter, leave and sojourn in Papua New Guinea for the duration of their assignment therein, and exempt them from foreign registration requirements and consular fees
- (3) to exempt the members of the Team from taxes, duties, fees and any other charges on equipment, vehicles, and other materials brought into Papua New Guinea for the conduct of the Study
- (4) to exempt the members of the Team from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to the members of the Team for their services in connection with the implementation of the Study
- (5) to provide necessary facilities to the Team for the remittances as well as the utilisation of the funds introduced into Papua New Guinea from Japan in connection with the implementation of the Study
- (6) to secure permission for the Team to enter into private properties or restricted areas for the implementation of the Study
- (7) to secure permission for the Team to take all data and documents including photographs and maps related to the Study out of Papua New Guinea to Japan, and
- (8) to provide medical services in case of necessity. Its expenses will be chargeable to the members of the Team.

2. The Government of PNG shall bear claims, if any arises, against the members of the Team resulting from, occurring in the course of, or otherwise connected with, the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or wilful misconduct on the part of the member of the Team.

3. The Waterboard shall act as a counterpart agency to the Team and also as a coordinating body in relation with other governmental and non-governmental organizations for the smooth implementation of the Study.

4. The Waterboard shall at its own expense, provide the Team with the followings, in cooperation with other organizations concerned:

- (1) available data and information related to the Study,
- (2) counterpart personnel,
- (3) suitable office space in Port Moresby,
- (4) credentials or identification cards when needed.


#### VII UNDERTAKING OF JICA

For the implementation of the Study, JICA shall take following measures:

1. to dispatch, at its own expense, the Team to PNG, and
2. to pursue technology transfer to counterpart personnel in the course of the Study.

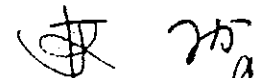
#### IX CONSULTATION

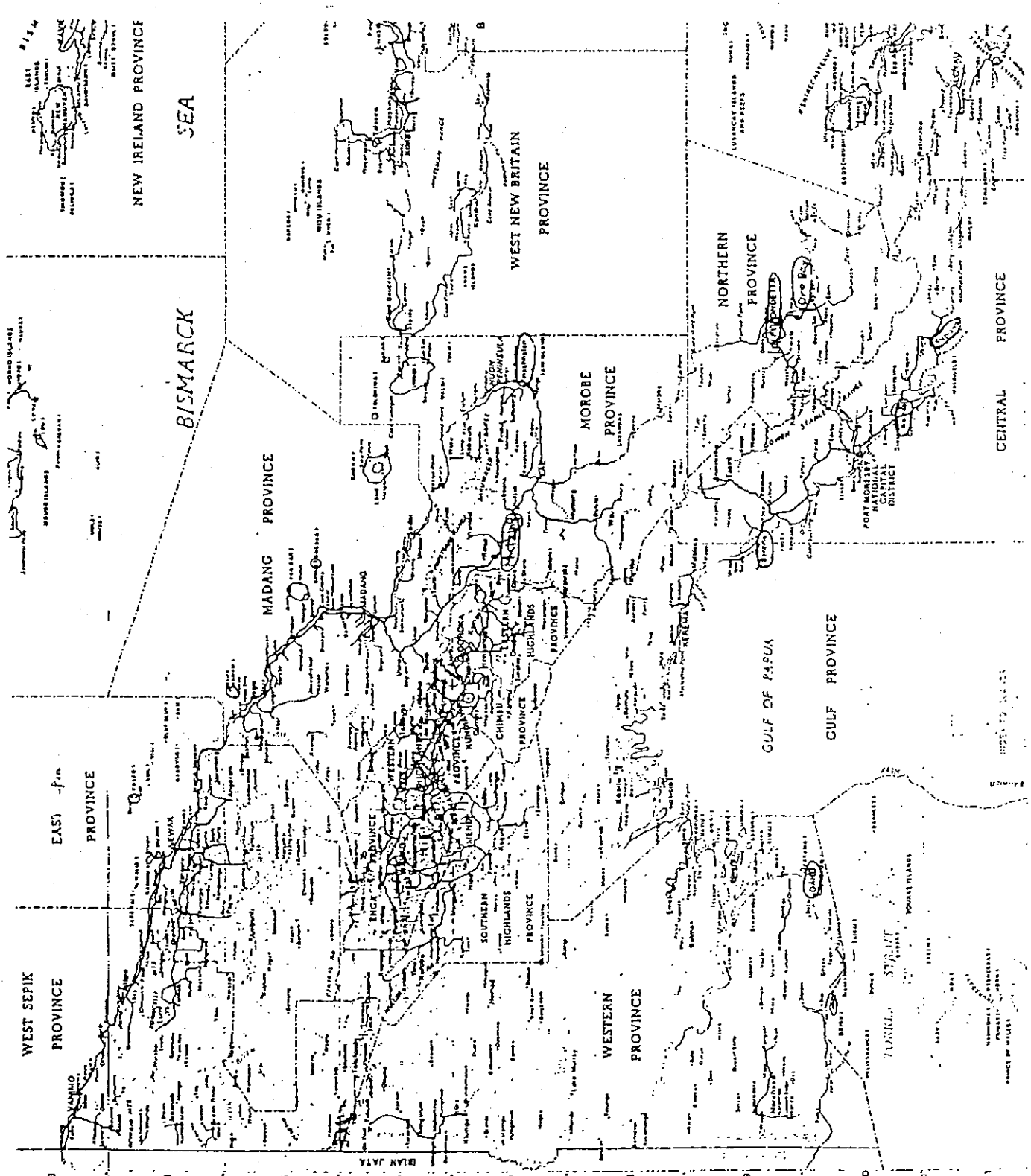
JICA and the Waterboard will consult with each other in respect of any matter that may arise from or in connection with the Study.

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## STUDY AREA

<u>Site</u>	<u>Province</u>	<u>Provincial/District</u>
Popondetta	Oro	Provincial town
Daru	Western	Provincial town
Bereina	Central	District town
Kupiano	Central	District town
Kwikila	Central	District town
Finschafen	Morobe	District town
Mutzing	Morobe	District town
Oro Bay	Oro	District town





*Handwritten signature or initials.*



## TENTATIVE STUDY SCHEDULE

MONTH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
WORK IN PNG	[Solid black bar from month 1 to 8]										[Solid black bar from month 11 to 13]				[Small solid black square]		
WORK IN JAPAN	□								□					□			□
REPORT PRESENTATION	△ IC/R										△ IT/R				△ DF/R	△ F/R	

IC/R :                    Inception Report  
 IT/R :                    Interim Report  
 DF/R :                    Draft Final Report  
 F/R :                      Final Report

27/11  
 27/11

## **7. MINUTES OF MEETINGS**

MINUTES OF MEETINGS  
FOR  
THE STUDY  
ON  
INVESTIGATION AND DEVELOPMENT  
OF  
UNDERGROUND WATER SOURCES  
FOR  
WATER SUPPLY SYSTEMS  
IN  
PAPUA NEW GUINEA

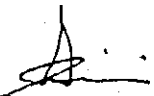
Agreed upon between

Papua New Guinea Waterboard

And

Japan International Cooperation Agency

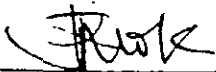
Port Moresby, December 20, 1999



Patrick K. Amini  
Managing Director  
The Waterboard



Kobayashi Katsumi  
Leader, Preparatory Study Team,  
Japan International Cooperation  
Agency (JICA)



Joe Kenken Mok  
Acting Assistant First secretary  
Foreign Aid Management Division  
Department of Planning and Monitoring

In response to the request of the Government of Papua New Guinea (hereinafter referred to as "the Government of PNG"), Japanese Preparatory Study Team (hereinafter referred to as "the Team ") was sent by Japan International Cooperation Agency (hereinafter referred to as "JICA") to discuss with The Waterboard, the Scope of Work (S/W) for the Study on Investigation and Development of Underground Water Sources for Water Supply Systems in Papua New Guinea (hereinafter referred to as "the Study").

The Team carried out the field survey on the study area and had a series of discussions with the officials of The Waterboard from 10 to 20 December. The following matters were mutually confirmed with regard to the S/W signed on 20 December 1999 in Port Moresby. The list of attendants of the meeting is shown in Appendix.

1. Study Title

Both sides agreed that the title of the Study would be "the Study on Investigation and Development of Underground Water Sources for Water Supply Project for District Towns in Papua New Guinea" as described in the S/W.

2. Target year

Target year shall be decided during the course of the study between main study team and The Waterboard.

3. Study areas for feasibility study

Study areas for feasibility study shall cover on Popondetta and Daru.

4. Steering Committee

The PNG side would organize the steering committee for smooth implementation of the study and effective use of the study results.

5. Counterpart personnel

The Waterboard would assign appropriate counterpart personnel.

6. Technology transfer

The Waterboard requested that JICA would hold seminars and workshops during the course of the study to transfer technology. The team assured to convey the request to JICA Headquarters.

7. Counterpart training in Japan

The Waterboard requested that JICA provide counterpart training in Japan. The team assured to convey the request to JICA Headquarters for further consideration. However, The Waterboard was informed that it would be difficult in fiscal year 2000.

8. Office space

The Waterboard expressed that it would be difficult to provide office space in Lae as the base station due to the budgetary constraints. The team assured to convey the request to JICA Headquarters for further consideration.

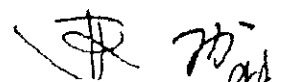
9. Vehicles

The Waterboard expressed that it would be difficult to provide vehicles and drivers due to

the budgetary constraints. The team assured to convey the request to JICA Headquarters for further consideration.

10. Reports

The Waterboard agreed to make Reports open to the public.

Handwritten signature and initials, possibly "R" and "ms".

List of Attendants

(Papua New Guinean Side)

The Waterboard

Mr. Patrick K. Amini  
Mr. Amo Mark

Mr. S. G. Nanayakkara

Mr. Sibona Vavia

Mr. Benny B. Bobola

Managing Director  
Engineering Manager,  
Engineering Division  
Principal Engineer,  
Engineering Division  
Principal Engineer, Planning  
Engineering Division  
Graduate Engineer,  
Engineering Division

Department of Planning and Monitoring  
Mr. Joe Kenken Mok

Acting First Secretary,  
Foreign Aid Management Division

(Japanese Side)

Embassy of Japan

Mr. EDAGAWA Mitsushi

Second Secretary

JICA Papua New Guinea Office

Mr. HOSHINO Akihiko

Assistant Resident Representative

The Preparatory Study Team

Mr. KOBAYASHI Katsumi  
Mr. YASUMOTO Takafumi

Leader  
Study Planning

AMENDMENTS  
OF  
SCOPE OF WORK  
FOR  
THE STUDY  
ON  
GROUNDWATER DEVELOPMENT  
FOR  
WATER SUPPLY SYSTEMS  
IN  
PAPUA NEW GUINEA

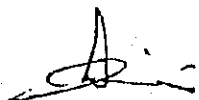
Agreed upon between

Papua New Guinea Waterboard

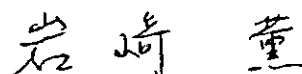
And

Japan International Cooperation Agency

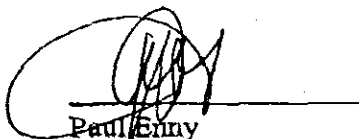
Port Moresby, 9<sup>TH</sup> November, 2000



Patrick K. Amini  
Managing Director  
Papua New Guinea Waterboard



Kaoru Iwasaki  
Resident Representative  
Japan International Cooperation Agency  
Papua New Guinea Office



Paul Enny  
Acting Assistant First Secretary  
Foreign Aid Management Division  
Department of Planning and Monitoring

## I INTRODUCTION

This Amendment of Scope of Work for the Study on Groundwater Development for Water Supply Systems in Papua New Guinea (hereinafter referred to as "the Study") signed on December 20, 1999 was made on the results of discussions on the Progress Report-1 submitted in September 2000. The Government of Papua New Guinea (hereinafter referred to as "the Government of PNG") requested the Government of Japan to amend the Scope of Work of the Study in accordance with the progress of the Study.

Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, agreed with the Government of PNG to amend the Scope of Work of the Study as follows.

The present document sets forth the amendments of the Scope of Work with regard to the Study.

Clauses not mentioned on this amendments remains unchanged from the original Scope of Work dated on December 20, 1999.

## II OBJECTIVES OF THE STUDY

The objectives of the Study are:

1. to formulate a water supply plan through the investigation of the surface and groundwater potential,
2. to conduct the pilot projects for improvement of water supply system in the selected areas,
3. to transfer technology to counterpart personnel in the course of the Study.

## III STUDY AREA

The Study will cover two (2) provincial towns and six (6) district towns, and pilot projects will cover one (1) provincial town and three (3) district towns shown in Appendix 1.

## IV SCOPE OF THE STUDY

### Phase I Basic Study

- 1) Review the existing studies and plans related to the Study
- 2) Analyse the existing data available for the study
- 3) Field reconnaissance
  - (1) Topographical, geological, and hydrological investigation
  - (2) Inventory of water resources and water supply systems
  - (3) Other relevant investigations
- 4) Study on actual condition of the target towns

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W



- (1) Water usage and sanitation, hygiene
- (2) Awareness of portable water
- (3) Economic conditions
- (4) Sociological configuration
- (5) Gender issues
- 5) Groundwater potential survey
  - (1) Geophysical exploration
  - (2) Test well construction and evaluation
- 6) Water demand forecast
- 7) Formulation of a water supply plan
  - (1) Design of the water supply facilities
  - (2) Management, operation and maintenance
  - (3) Institutional and organizational
  - (4) Financial and economical
- 8) Initial Environmental Examination (IEE)
- 9) Selection of the areas for pilot projects

**Phase II Pilot projects for improvement of water supply system**

- 1) Pilot projects
  - (1) Bereina, Kwikila, Mutzing  
Necessary installation and rehabilitation of water supply system
  - (2) Daru  
Necessary survey for improvement measures of water supply condition
- 2) Operation and maintenance
- 3) Evaluation

**V SCHEDULE OF THE STUDY**

The Study will be carried out in accordance with the tentative schedule as Appendix 2. The schedule is tentative and subject to be modified during the course of the Study.

**VI REPORTS**

JICA shall prepare and submit the following reports in English to the Government of PNG.

1. *Inception Report*  
Fifteen (15) copies will be submitted at the commencement of the Study.
2. *Progress Report (1)*  
Fifteen (15) copies will be submitted at the end of Phase I.
3. *Progress Report (2)*  
Fifteen (15) copies will be submitted after the implementation of the pilot projects.
4. *Draft Final Report*  
Fifteen (15) copies will be submitted at the beginning of the work in PNG (3).

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The Government of PNG shall submit its comments within one (1) month after its receipt of the Draft Final Report.

5. Final Report

Twenty (20) copies will be submitted after the receipt of the comments on the Draft Final Report.

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## Study area

<u>Site</u>	<u>Province</u>	<u>Provincial/District</u>
Popondetta	Oro	Provincial town
Daru	Western	Provincial town
Bereina	Central	District town
Kupiano	Central	District town
Kwikila	Central	District town
Finschhafen	Morobe	District town
Mutzing	Morobe	District town
Oro Bay	Oro	District town

## Study area for the pilot project

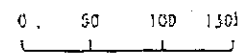
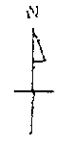
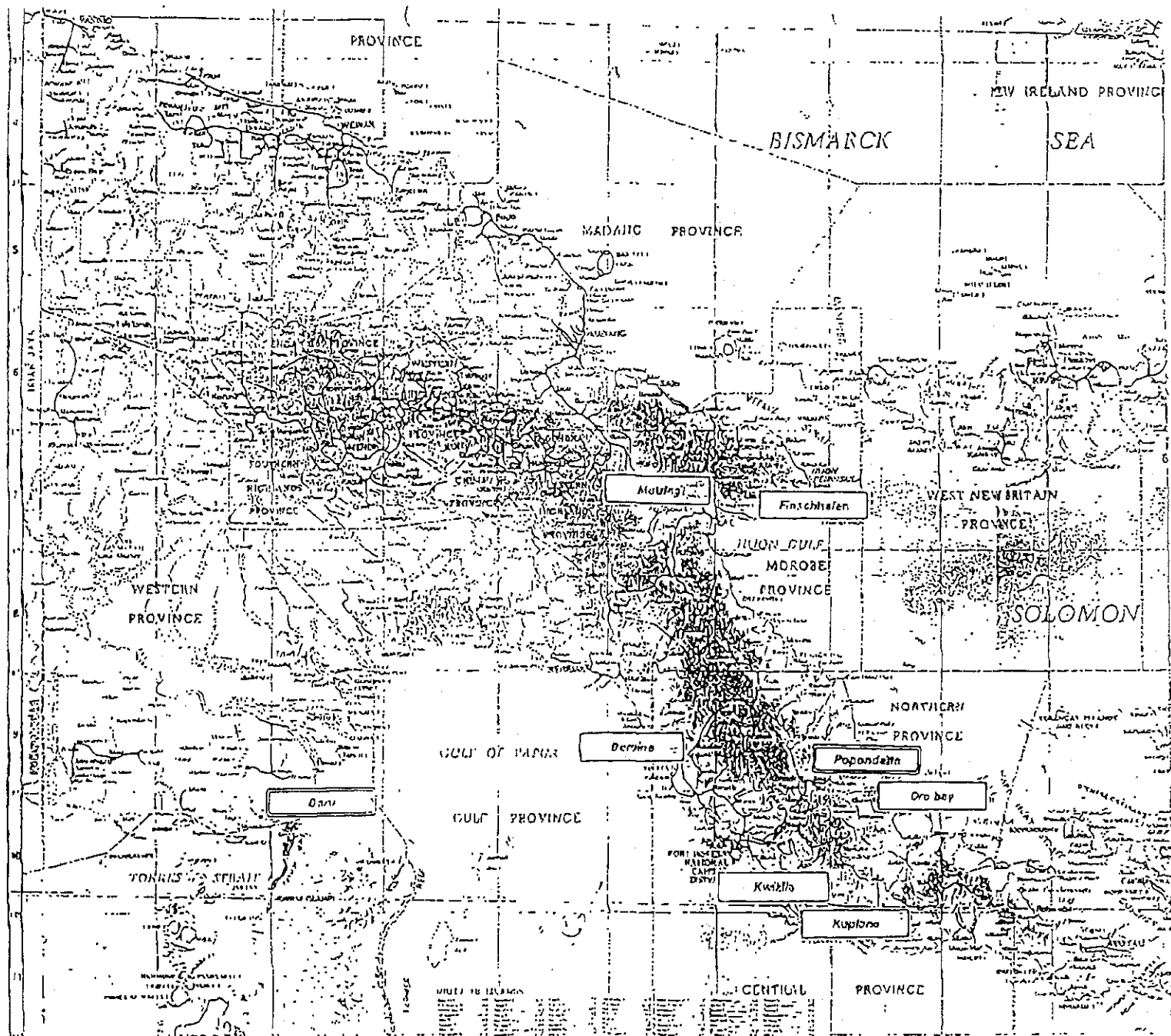
<u>Site</u>	<u>Province</u>	<u>Provincial/District</u>
Daru	Western	Provincial town
Bereina	Central	District town
Kwikila	Central	District town
Mutzing	Morobe	District town

17

PE

1

14



Provincial town

District town

PC

Appendix 1 (2)

### TENTATIVE STUDY SCHEDULE

MONTH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21				
WORK IN PNG																									
WORK IN JAPAN																									
REPORT PRESENTATI ON	△ IC/R						△ P/R(1)									△ P/R(2)		△ DF/R				△ F/R			

IC/R: Inception Report  
 P/R(1): Progress Report(1)  
 P/R(2): Progress Report(2)  
 DF/R: Draft Final Report  
 F/R: Final Report

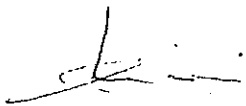
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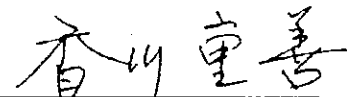
MINUTES OF DISCUSSIONS  
ON  
INCEPTION REPORT  
FOR  
THE STUDY  
ON  
GROUNDWATER DEVELOPMENT  
FOR  
WATER SUPPLY SYSTEMS  
IN  
PAPUA NEW GUINEA

AGREED UPON BETWEEN  
PAPUA NEW GUINEA WATERBOARD  
AND  
JAPAN INTERNATIONAL COOPERATION AGENCY

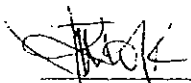
Port Moresby, May 4, 2000



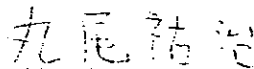
Mr. Patrick K. Amini, OBE  
Managing Director  
PNG Waterboard



Mr. Shigeyoshi KAGAWA  
Team Leader  
JICA Study Team



Mr. Joe Kenken Mok  
Assistant Secretary  
Bilateral Programs Branch  
Foreign Aid Management Division  
Department of Planning and Monitoring





Dr. Yuji MARUO  
JICA Advisory Committee  
Senior Advisor  
Japan International Cooperation Agency

Discussions were made on the Inception Report for the Study on Groundwater Development for Water Supply Systems in Papua New Guinea (hereinafter referred to as "the Study"), and the contents of the Inception Report were agreed upon, in principle. Additionally, the following points were mutually agreed upon.

1. Study Title: Both sides agreed that the title of the study would be "the Study on Groundwater Development for Water Supply Systems in Papua New Guinea" instead of "the Study on Investigation and Development of Underground Water Sources for Water Supply Systems in Papua New Guinea" which was agreed on the Scope of Work signed on December 20, 1999.
2. Target Year for Master Plan: Both sides agreed that the target year for the Master Plan in the Study would be 2015.
3. Groundwater Study: Both sides agreed that main aim of the Study would be to assess groundwater potential and to formulate groundwater development plan. While the study on the surface water is concerned, evaluation of the existing surface water sources will be carried out.
4. Test Drillings: Both side agreed that the test drilling which is to assess the groundwater potential would be carried out at the selected sites in the Study Areas. At least one test drilling would be done at the respective Study Area, and even in case that the yield of test drilling(s) is not sufficient enough as the water source for the water supply system, no further drilling shall be conducted. PNG Waterboard pointed out that although there are a few drilling contractors operating in PNG, only one contractor is qualified and recommendable in terms of previous working records. PNG Waterboard also pointed out that involvement of the foreign drilling contractor would be another possible alternative to complete the drilling work in accordance with the initial plan.
5. Counterpart Personnel: PNG Waterboard confirmed that the assignment of the appropriate number of counterpart personnel to the Study within its capacity. Both sides agreed that PNG Waterboard arranges to provide counterpart personnel from the relevant agencies such as local level governments for the technology transfer on operation, management and maintenance of the water supply systems and in the public awareness activities at the district centers.



6. Counterpart Training: PNG Waterboard requested that JICA provides counterpart training in Japan. JICA Headquarters confirmed that one counterpart personnel would be accepted for the training in Japan during the 2000 fiscal year.
7. Office Space: PNG Waterboard has provided a certain office space for the Team in the office of their Engineering Division in Port Moresby, including necessary arrangement and provision for the office such as telephone lines, desks, chairs and tables. However, provision of larger space in the same office is under consideration. PNG Waterboard agreed to prepare a desk at their offices in Daru and Popondetta for the Team during their work at the respective area.
8. Groundwater Assessment in Popondetta: PNG Waterboard explained that an emergency water supply project in Popondetta, which is to relocate the water treatment plant to avoid further damage by flood, funded by AusAid is under preparation. PNG Waterboard requested the Team that in order to reflect the result of groundwater potential evaluation to the above-mentioned project, the test drilling in Popondetta would be completed as soon as possible. The Team responded to make its utmost effort along with the request while considering effective progress of the entire study schedule.

  
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LIST OF ATTENDANTS

(Papua New Guinean Side)

The Waterboard

Mr. Patrick K. Amini. OBE

Mr. Amo Mark

Mr. S. G. Nanayakkara

Mr. Sibona Vavia

Mr. Benny B. Bobola

Managing Director

Engineering Manager,

Engineering Division

Principal Engineer,

Engineering Division

Principal Engineer, Planning

Engineering Division

Graduate Engineer,

Engineering Division

Department of Planning and Monitoring

Mr. Joe Kenken Mok

Assistant Secretary,

Bilateral Programs Branch

Foreign Aid Management Division

(Japanese Side)

JICA Papua New Guinea Office

Mr. Akihiko Hoshino

Assistant Resident Representative

Technical Advisory Committee

Dr. Yuji Maruo

Senior Advisor,

Japan International Cooperation Agency

The Study Team

Mr. Shigeyoshi Kagawa

Mr. Ichiro Takamatsu

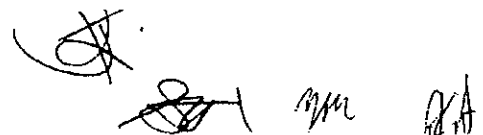
Mr. Masaru Fujita

Team Leader / Water Supply Planning

Economy, Finance, Institution and

Legal Framework

Geophysics Survey and Geology



MINUTES OF DISCUSSIONS  
ON  
PROGRESS REPORT  
FOR  
THE SYUDY  
ON  
GROUNDWATER DEVELOPMENT  
FOR  
WATER SUPPLY SYSTEMS  
IN  
PAPUA NEW GUINEA

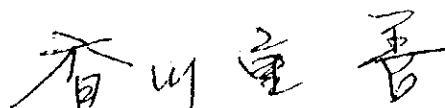
AGREED UPON BETWEEN  
PAPUA NEW GUINEA WATERBOARD  
AND  
JAPAN INTERNATIONAL COOPERATION AGENCY

Port Moresby, September 14, 2000



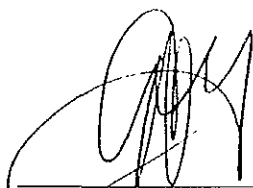
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Mr. Amo Mark  
Acting Managing Director  
PNG Waterboard



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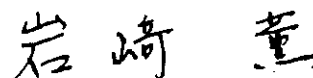
Mr. Shigeyoshi KAGAWA  
Team Leader  
JICA Study Team



---

Mr. Paul Enny  
Acting Assistant First Secretary  
Foreign Aid Management Division  
Department of National Planning and  
Monitoring

Witness:



---

Mr. Kaoru Iwasaki  
Resident Representative  
JICA Papua New Guinea Office

Discussions were made on the Progress Report for the Study on Groundwater Development for Water Supply Systems in Papua New Guinea (hereinafter referred to as "the Study"), and the contents of the Progress Report were agreed upon, in principle. Additionally, the following points were mutually agreed upon.

1. Pilot Study: Based on the results of the Work in PNG 1, the Pilot Project, which is aiming at examining applicability of the approach to construct and/or rehabilitate the water supply facilities and to set up the system for the sustainable operation, maintenance and management, was proposed. PNG Waterboard requested implementation of the Pilot Project during the Work in PNG 2. The Study Team assured that the request of PNG Waterboard would be conveyed to JICA Headquarters for the consideration. PNG Waterboard also requested the Study Team to prepare the detailed project implementation plan for the district centers which would not be taken up by the Pilot Project. The Study Team confirmed that the request would be conveyed for the consideration by JICA Headquarters.
2. PNG Waterboard assignment of the appropriate number of counterpart personnel to the Work in PNG 2 within its capacity. Both side agreed that the PNG Waterboard would arrange to provide counterpart personnel from the relevant agencies such as local level governments for the technology transfer on operation, maintenance and management of the water supply systems and in the public awareness activities at the district centers.
3. Operation and Maintenance: The PNG Waterboard confirmed to take a leadership for establishment of the framework of operation, maintenance and management and to provide technical assistance for sustainability of the water supply service in case the water supply facilities are constructed and/or rehabilitated by the Pilot Project.
4. Counterpart Training: The PNG Waterboard requested that JICA provides counterpart training in Japan. The team assured to convey the request to JICA Headquarters for further consideration.
5. Office Space: The PNG Waterboard agreed to provide the office space where the Team was working now in the office of their Engineering Division in Port Moresby, including necessary arrangement and provision for the office such as telephone lines, desks, chairs and tables. The PNG Waterboard agreed to prepare a desk at their offices in Daru, Lae and Popondetta for the Team during their work in Pilot Study at the respective area.

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6. As a result of discussions on the present situation related to the study between PNG Waterboard and the Study Team, a necessity and a possibility of changes of contents and schedule of the study in the period of the Work in PNG 2 and onward were pointed out. Therefore, both parties confirmed to discuss further this issue.

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LIST OF ATTENDANTS

(Papua New Guinean Side)

The PNG Waterboard

Mr. Amo Mark	Acting Managing Director
Mr. Sibona Vavia	Project Manager (AusAID/JICA)/ a/Executive Manager, Technical Services
Mr. Giamsa Yagas	Principal Engineer Design, Technical Services Division
Mr. Henry Opu	Senior Systems Engineer, Customer Services Division
Mr. Benny B. Bobola	Graduate Engineer, Technical Services Division
Mr. Sebastian Tomausi	Graduate Engineer, Technical Service Division

Department of Planning and Monitoring

Mr. Paul M. Enny	Acting Assistant Secretary, Foreign Aid Management Division Dept. of National Planning and Monitoring
------------------	---

(Japanese Side)

JICA Papua New Guinea Office

Mr. Kaoru Iwasaki	Resident Representative
Mr. Akihiko Hoshino	Assistant Resident Representative Japan International Cooperation Agency

The Study Team

Mr. Shigeyoshi Kagawa	Team Leader / Water Supply Planning
Mr. Ichiro Takamatsu	Economy, Finance, Institution and Legal Framework
Mr. Nobuyuki Ishii	Facility Engineering & Water Supply
Mr. Chifumi Yamashita	Drilling Supervisor

KA

① SA

PE

MINUTES OF DISCUSSIONS  
ON  
PROGRESS REPORT (2)

FOR

THE STUDY  
ON  
GROUNDWATER DEVELOPMENT  
FOR  
WATER SUPPLY SYSTEMS  
IN  
PAPUA NEW GUINEA

AGREED UPON BETWEEN

PAPUA NEW GUINEA WATERBOARD

AND

JAPAN INTERNATIONAL COOPERATION AGENCY

Port Moresby, July 13, 2001



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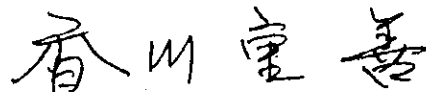
Mr. Patrick K. AMINI OBE  
Managing Director  
Papua New Guinea Waterboard

Witnessed, by:



---

Mr. Mosilayola KWAYAILA  
First Assistant Secretary  
Aid Coordination and Management  
Division  
Department of National Planning and  
Monitoring



---

Mr. Shigeyoshi KAGAWA  
Team Leader  
JICA Study Team



---

Mr. Kaoru IWASAKI  
Resident Representative  
Japan International Cooperation Agency  
(JICA)  
Papua New Guinea Office

Discussions were made on the Progress Report (2), Phase II, Pilot Project for the Study on Groundwater Development for Water Supply Systems in Papua New Guinea (hereinafter referred to as "the Study"), and the contents of the Progress Report (2) were agreed upon, in principle. Additionally, the following points were mutually agreed upon.

1. **Water Supply System:** Both sides agreed that the water supply systems at Bereina, Kwikila and Mutzing constructed under the Pilot Project were scheduled to be handed over from the Study Team to the PNG Waterboard in July and operation of these water supply systems would be started by the PNG Waterboard upon completion of the necessary preparation by the PNG Waterboard.
2. **Budgeting for Sustainable Water Supply at the District Towns:** The Papua New Guinean side agreed that the necessary fund for sustainable water supply at the above-mentioned District Towns; namely Bereina, Kwikila and Mutzing would be secured in the budget of the Provincial Governments and of the Local Level Governments as well as of the PNG Waterboard.
3. **Monitoring of Operation of the Water Supply Systems:** The Papua New Guinean side agreed that the operation of the water supply systems constructed under the Pilot Project including the water vending units in Daru Town would be monitored and the data and information would be provided whenever the Japanese side requested.
4. **Submission of the Draft Final Report:** The Study Team proposed that they would submit the Draft Final Report of the Study in the beginning of October, 2001, and the Papua New Guinean side agreed to that.
5. **Evaluation and Discussion on the Pilot Project:** Both sides agreed that in October, 2001, the Study Team would examine and evaluate the results of the Pilot Project in Bereina, Kwikila, Mutzing, Daru and Binaturi especially on operation, management and maintenance, and consequently discuss with the PNG Waterboard and other relevant governmental agencies.
6. **Schedule of the 1<sup>st</sup> Seminar for Technology Transfer:** The Study Team proposed the tentative schedule of the 1<sup>st</sup> Seminar for Technology Transfer which would be hold by the Study Team in October, 2001 as per the attached sheet. The seminar is aimed at facilitating technology transfer to the Papua New Guinean side concerning the respective technical fields covered in the Study. The Study area includes two provincial towns namely Popondetta and Daru, and six district towns namely

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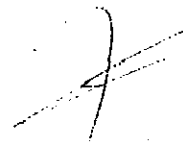
Bereina, Kupiano, Kwikila, Finschhafen, Mutzing and Oro Bay. Therefore, it is proposed to hold the seminar at three places considering location of the Study areas and convenience to the participants to attend the seminar from the respective Study area. The proposed places of the seminars are as follows:

Place of the seminar	Study area to be covered
Port Moresby	Bereina, Kwikila and Kupiano, Central Province Popondetta and Oro Bay , Oro Province.
Lae	Mutzing and Finshhafen, Morobe Province
Daru	Daru and Binaturi, Western Province

The Papua New Guinean side agreed to the proposed tentative schedule of the seminar.

7. Radio System: Both sides agreed that the radio system which was used during the Study be transferred to PNG Waterboard for the communication between Bereina, Kwikila and Port Moresby for operation, management and maintenance of the water supply systems.
8. Counterpart Training: A counterpart personnel is scheduled to participate to the JICA's counterpart training in Japan from beginning of August. This opportunity will be utilised to encourage the technology transfer related to this Study.

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LIST OF ATTENDANTS

(Papua New Guinean Side)

The Waterboard

Mr. Patrick K. Amini OBE

Managing Director

Mr. Amo Mark

Deputy Managing Director

Mr. Ukatha Otiwani

Executive Manager, Technical Services

Mr. N. Srinivasan

Executive Manager, Customer Services

Mr. Sibona Vavia

Executive Manager, Finance

Mr. Mannen Kulwah

Project Manager (JICA/AusAID)

Technical Services Division

Mr. Giamsa Yagas

Regional Manager, Northern Region

Customer Services Division

Mr. Sebastian Tomausi

Principal Engineer

Technical Services Division

Mr. Roslyn Boga

Project Engineer,

Technical Services Division

Project Engineer,

Technical Services Division

Department of National Planning and Monitoring

Mr. Mosilayola Kwayaila

First Assistant Secretary,

Aid Coordination and

Management Division

Mr. Noel Geti

Senior Advisor, Japan Desk

Bilateral Programs Branch

Mr. Ilivi Saneto

Senior Planner, Infrastructure

(Japanese Side)

JICA Papua New Guinea Office

Mr. Kaoru Iwasaki

Resident Representative

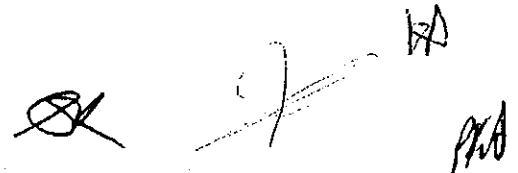
Mr. Akihiko Hoshino

Assistant Resident Representative

The Study Team

Mr. Shigeyoshi Kagawa

Team Leader / Water Supply Planning

Handwritten signatures and initials, including a large signature on the left, a signature in the middle, and initials 'KA' and 'PAB' on the right.

Mr. Ichiro Takamatsu

Mr. Nobuyuki Ishii

Mr. Masahiko Suginaga

Mr. Minoru Kimishima

Mr. Jun Yoshikawa

Economy, Finance, Institution and  
Legal Framework

Facilities Design & Water Supply

Social Environment

Facilities Design & Water Supply

Facilities Design & Water Supply

10

The Study on Groundwater development for Water Supply Systems  
in Papua New Guinea  
Tentative Schedule in October 2001

No	DATE			AM	PM	Stay
	1	Sep	30	SUN	Departure from Tokyo	
2	Oct	1	MON	Arrive in Port Moresby	Visit to EOJ/JICA	POM
3	Oct	2	TUS	Meeting with PNG WB	Meeting with PNG WB	POM
4	Oct	3	WED	< Move from POM to DARU >	Survey of Binaturi	DAR
5	Oct	4	THR	Meeting with Western Province	★ Seminar at DAR	DAR
6	Oct	5	FRI	< Move from DAR to POM >	< Move from POM to LAE >	LAE
7	Oct	6	SAT	Survey of MUTZING		LAE
8	Oct	7	SUN	Preparation of Seminar		LAE
9	Oct	8	MON	Meeting with Morobe Province	Preparation of Seminar	LAE
10	Oct	9	TUS	★ Seminar at LAE	< Move from LAE to POM >	POM
11	Oct	10	WED	Meeting with PNG WB		POM
12	Oct	11	THR	Meeting with PNG WB		POM
13	Oct	12	FRI	Preparation of Seminar		POM
14	Oct	13	SAT	Survey of KWIKILA		POM
15	Oct	14	SUN	Survey of BEREINA		POM
16	Oct	15	MON	Survey of KWIKILA/BEREINA	Preparation of Seminar	POM
17	Oct	16	TUS	★ Seminar at POM		POM
18	Oct	17	WED	Meeting with PNG WB		POM
19	Oct	18	THR	Preparation of Handing Over Ceremony		POM
20	Oct	19	FRI	★ Handing Over Ceremony at BEREINA		POM
21	Oct	20	SAT	Preparation of Report		POM
22	Oct	21	SUN	Preparation of Report		POM
23	Oct	22	MON	Meeting with PNG WB		POM
24	Oct	23	TUS	Meeting with PNG WB		POM
25	Oct	24	WED	★ Meeting of Minutes		POM
26	Oct	25	THR	★ Signing of Minutes		POM
27	Oct	26	FRI	Visit to EOJ/JICA		POM
28	Oct	27	SAT	Closing Office		POM
29	Oct	28	SUN	Leave Port Moresby		
30	Oct	29	Mon	Arrive in Tokyo		

**JICA Study Team**

Mr. Shigeyoshi Kagawa  
Mr. Ichiro Takamatsu  
Mr. Masahiko Suginaga  
Mr. Nobuyuki Ishii

Team Leader & Water Supply Planning  
Economy, Finance, Institution and Legal Framework  
Social Survey  
Facility Design & Water Supply

MINUTES OF DISCUSSIONS  
ON  
DRAFT FINAL REPORT EXPLANATION  
AND PROGRESS REPORT (3)

FOR

THE STUDY  
ON  
GROUNDWATER DEVELOPMENT  
FOR  
WATER SUPPLY SYSTEMS  
IN  
PAPUA NEW GUINEA

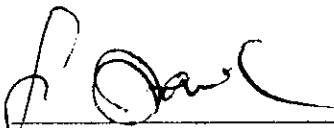
AGREED UPON BETWEEN

PAPUA NEW GUINEA WATERBOARD

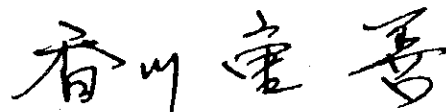
AND

JAPAN INTERNATIONAL COOPERATION AGENCY

Port Moresby, October 24, 2001



Mr. Patrick K. AMINI OBE  
Managing Director  
Papua New Guinea Waterboard

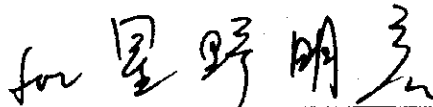


Mr. Shigeyoshi KAGAWA  
Team Leader  
JICA Study Team

Witnessed by:




Mr. Mosilayola KWAYAILA  
First Assistant Secretary  
Aid Coordination and Management  
Division  
Department of National Planning and  
Monitoring



Mr. Kaoru IWASAKI  
Resident Representative  
Japan International Cooperation Agency  
(JICA)  
Papua New Guinea Office

Discussions were made on the Draft Final Report and the Progress Report (3) for the Study on Groundwater Development for Water Supply Systems in Papua New Guinea (hereinafter referred to as "the Study"), as well as on the seminars for technology transfer and verification of the Pilot Project which had been carried out by the Study Team. The contents of the Draft Final Report and the Progress Report (3) were agreed upon, in principle. Additionally, the following points were mutually agreed.

1. **Water Supply System:** The Study Team reported their observations during the field survey this time, i.e.: a) The water supply systems at Bereina, Kwikila and Mutzing constructed under the Pilot Project had been operated well by the PNG Waterboard though further arrangement for full operation by PNG Waterboard was still ongoing. b) The declaration of water districts in Bereina and Kwikila was made by the Minister on 16<sup>th</sup> October 2001 and eventually the one for Mutzing very soon. c) The Official Opening Ceremony was held on 19<sup>th</sup> October 2001 at Bereina with attendance of Japanese Ambassador, Governor of Central Province, Acting Chairman of PNG Waterboard, JICA Resident Representative and other concerned officials.
2. **Verification and Discussion on the Pilot Projects:** The Study Team reported to the Papua New Guinea (here in after "PNG") side that they had examined the results of the Pilot Projects in Bereina, Kwikila, Mutzing, Daru and Binaturi especially on operation, management and maintenance, during their field survey in October, 2001, and consequently had discussions with the PNG Waterboard and other relevant governmental agencies. It was verified by the Study Team that the water supply systems constructed under the Pilot Project including the water vending units in Daru Town had been operated in good conditions. It was agreed among them that the further preparation and sustainable management to be followed by the PNG Waterboard and other relevant agencies. The PNG side agreed that the further data and information including post-project evaluation reports would be provided whenever the Japanese side requested for monitoring purpose.
3. **Budgeting for Sustainable Water Supply at the District Towns:** The PNG side agreed that the necessary fund for sustainable water supply at the above-mentioned District Towns, namely Bereina, Kwikila and Mutzing would be secured in the budget of the Provincial Governments and of the Local Level Governments as well as of the PNG Waterboard.
4. **Submission of the Final Report:** Both side agreed the Final Report of the Study shall be prepared and delivered in December 2001, after necessary revision based on the



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comments on the Draft Final Report from the PNG side. PNG side will make comments by the end of November 2001 through JICA PNG office. The PNG side requested the Final Report in the form of data stored in CD-ROM as well as the number of copies of the Final Report. The Study Team confirmed that they would convey the request to JICA Headquarter.

5. Implementation of the Seminar for Technology Transfer: The Study Team carried out the Seminars for Technology Transfer at Daru, Lae and Port Moresby in October 2001. The seminar was aimed at introducing the results of the Study and facilitating technology transfer to the PNG side concerning the respective technical fields covered in the Study. Considering locations of the Study areas (two provincial towns of Popondetta and Daru, and six district towns namely Bereina, Kupiano, Kwikila, Finschhafen, Mutzing and Oro Bay) and convenience to the participants to attend the seminar from the respective Study areas, the seminars were held at the above three places.
6. Transfer of Study Equipment: The Study Team transferred the following listed study equipment based on the request from PNG Waterboard. It is expected that the equipment will contribute to enhance PNG Waterboard's capacity to carry out its functions as required under the National Water Supply and Sewerage Act.

I. Water Quality Analysis and Survey Kits

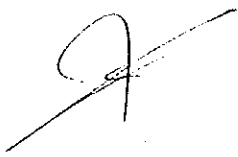
- |   |        |
|---|--------|
| 1) pH Meter :                                 | 3 sets |
| 2) Electric Conductivity Meter :              | 3 sets |
| 3) Water Level Measurement Set (100m and 50m) | 2 sets |
| 4) Current Meter :                            | 2 sets |
| 5) Water Sampler :                            | 2 sets |
| 6) Camera for Social Survey                   | 2 sets |
| 7) Survey Rope :                              | 1 set  |

II. Office Management Equipment

- |  |        |
|--|--------|
| 1) Fax Machine :                                     | 1 set  |
| 2) Copy Machine :                                    | 1 set  |
| 3) Desk Top Computer :                               | 1 set  |
| 4) Printer :   | 1 set  |
| 5) Radio Communication System (1 Station & 2 Mobile) | 3 sets |

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LIST OF ATTENDANTS

(Papua New Guinean Side)

The Waterboard

Mr. Amo Mark

Deputy Managing Director  
Executive Manager, Technical Services  
Regional Manager, Southern  
Project Engineer,  
Technical Services Division

Mr. Thomas Chee

Mr. Sebastian Tomausi

Department of National Planning and Monitoring

Mr. Mosilayola Kwayaila

First Assistant Secretary,  
Aid Coordination and  
Management Division  
Senior Advisor, Japan Desk  
Bilateral Programs Branch

Mr. Noel Geti

(Japanese Side)

JICA Papua New Guinea Office

Mr. Akihiko Hoshino

Assistant Resident Representative

The Study Team

Mr. Shigeyoshi Kagawa

Mr. Ichiro Takamatsu

Team Leader / Water Supply Planning  
Economy, Finance, Institution and  
Legal Framework  
Facilities Design & Water Supply  
Social Environment

Mr. Nobuyuki Ishii

Mr. Masahiko Suginaga

## **8. LIST OF CONCERNED PERSONS**



## List of Concerned Persons (Papua New Guinean Side)

### PNG Waterboard

#### Headquarters

Mr. Patric K. Amini OBE

Mr. Amo Mark

Mr. Ukata Otiwani

Mr. Narasmhachari Srinivasan

Mr. Api Leka

Mr. Kevin David

Mr. Paison Yabom

Mr. Ume Moses

Managing Director

Deputy Managing Director,

Executive Manager, Technical Services

Executive Manager, Customer Service

Executive manager, Financial Service

Executive manager, Administration & Human Resources

Technical Officer

Draftsman

Draftsman

#### Customer Service Division

Mr. Timothy Haiabona

Senior Technical Officer

#### Technical Service Division

Mr. Sibona Vavia

Mr. Giamsa Yagas

Mr. Benny Bobola

Mr. Sebastian Tomausi

Mr. Tau Momo

Project Manager (JICA / AusAID)

Principal Engineer, Design

Graduate Engineer

Graduate Engineer

Draftsman

#### Lae Water District Office

Mr. Thomas Chee

Mr. Graham Atkins

Mr. Joe A. Oaniu

Mr. Nelson Sali

District Manager

Deputy Chairman, PNGWB

Distribution Manager-PNG

Graduate Engineer

#### Daru Water District Office

Mr. Jerry Maira

Ms. Goretty Borre

Mr. Navary Teaku

District Manager

District Administration Officer

Senior Operator

## **Northern Regional Office**

Mr. Mannen Kuluwah

Regional Manager

## **Popondetta District Office**

Mr. Anton Emmanuel

District Manager

## **Department of National Planning and Monitoring**

### **Foreign Aid Management Division**

Mr. Mosilayaola Kwayaila

First Assistant Secretary

Aid Coordination and Management

Mr. Paul M. Enny

Assistant Secretary

Mr. Joe Kenken Mok

Assistant Secretary

Mr. Tomy Miva

Acting Assistant Secretary

Mr. John Kohl

Bilateral Programmes Branch

Mr. Noel Geli

Programme Officer, Japan Desk

Mr. Ilivi Saneto

Senior Advisor Japan ODA, Japan Desk

Senior Planner, Infrastructure

## **Department of Environment & Conservation**

Ms. Kay Kalim

Assistant Director, Water Resources Management

Ms. Katrina Solien

A/Assistant Director, Environmental Protection

Mr. Kelly Gawi

Secretary Environment Council

## **Department of Health**

Mr. Enoch Posanai

Director – Health Improvement Branch

Mr. William Muru

Principal Advisor, health Protection

## **Central Province**

Dr. Sibona Kopí

Provincial Administrator

Mr. Gevo Mabone

Director, Policy, Planning & Information

Mr. Tau Lakni

Project Officer, Policy, Planning & Information

Mr. Daleya Dibili

Coordinator, PPHS, Health Division

Mr. Timothy Mapor

A/Office in Charge, Water and Sanitation, Health Division

### **Kairuku District**

Mr. Koi One

District Administrator

Mr. Garamo Raga

A/District Administrator

### **Rigo District**

Mr. Gawaga Bowame

District Administrator

Mr. Daba Nigona

Deputy District Administrator

## **Morobe Province**

Mr. John Nicholas  
Mr. Peter Wartovo  
Mr. Api Gima  
Mr. Agnes Gapi

Deputy Provincial Administrator  
Land Advisor, Division of Land  
Division of Land  
LULLGC, Planning Division

## **Lae District**

Mr. Nithes Kondar  
Mr. Patlias Gamato

Acting District Administrator, Lae District Office  
Planning Division, Lae Urban LLG

## **Western Province**

Mr. David B. Iyasi  
Mr. John Iballi  
Mr. Bing Tengeng  
Mr. Samuel Gebia  
Mr. Walepa Kurokuro  
Mr. James Ase  
Mr. Gamama Mulaker  
Mr. Peter Boli  
Mr. Peter Vavine  
Mr. Bauba Hauoa Dao  
Mr. Wagera Buia

Provincial Administrator  
Acting Provincial Administrator  
Deputy Administrator  
Executive Officer  
Provincial Civil Engineer  
Planning Officer  
Provincial Works Coordinator  
Provincial Environmental Health Officer  
Provincial Physical Planner  
Department of Works  
District Administrator of South Fly

## **North Fly District**

Mr. Roland M. Dmonai  
Mr. Soy M. Soyaup  
Mr. Eric Mallen  
Mr. Menesha Kamborg  
Mr. Jim Ufaio  
Mr. Asiri Mabo  
Mr. John Lari  
Mr. Pancras Linus  
Mr. Yangtem Katie  
Mr. Karae Kawi

District Administrator  
District Manager Kiunga  
District Manager, Agriculture & Livestock  
District Manager  
Area Affairs manager – Lake Murry Sub District  
Education Officer  
Health Officer  
Project Officer  
Office of Community Development  
Division of commerce & Industry

## **Oro Province**

Mr. John Dagina  
Mr. Ken Noga

District Administrator  
Acting Provincial Administrator

Mr. Joseph Mokada

Mr. Francis Dira

Planning Office, Department of Oro

Media Office, Department of Oro

### **Other Organisation**

Mr. Jaru K. Bisa

Advisor, Environmental/Sustainable Development

### **(Japanese Side)**

#### **Embassy of Japan**

Mr. Tatsuo Tanaka

Mr. Masayuki Takashima

Mr. Ichiro Shimizu

Ambassador

Councillor

First Secretary

#### **JICA Papua New Guinea Office**

Mr. Kaoru Iwasaki

Mr. Akihiko Hoshino

Mr. Toshitaka Inao

Resident Representative

Assistant Resident Representative

Assistant Resident Representative

Dr. Keichi Kumagai

Mr. Hideo Kobayashi

JICA Expert

JICA Expert

JICA