9. Soil Cement Test

Soil Cement Test (Foundation Ground)

Project Title	THE STUDY FOR ASSESSMENT OF ECOSYSTEM, COASTAL EROSION AND PROTECTION/REHABILITATION OF DAMAGED AREA IN TUVALU	Date	November 5, 2010
		The Person in Charge of Arrangement	Kazunari Yoda

	Sample Number (Depth)			DS-4 BB 30kg/m³ Cure in Air	DS-4 BB 60kg/m³ Cure in Air	DS-4 BB 90kg/m³ Cure in Air	DS-4 BB 30kg/m³ Cure in Water	DS-4 BB 60kg/m³ Cure in Water	DS-4 BB 90kg/m3 Cure in Water
The General	Wet Density	ρ_t	g /cm³	1.595	1.646	1.723	1.763	1.775	1.801
	Dry Density	ρ_d	g /cm³						
	Density of Soil Particle	ρ_s	g /cm³						
	Natural Water Content	w_n	%						
	Void Ratio	e							
	Degree of Saturation	S_r	%						
Particle	Stone Fraction	(more than 75mm)	%						
	Gravel Fraction[1)]	(2～75mm)	%						
	Sand Fraction[1)]	(0.075～2mm)	%						
	Silt Fraction[1)]	(0.005～0.075mm)	%						
	Clay Fraction[1)]	(less than 0.005mm)	%						
	Maximum Particle Size		mm						
	Uniformity Coefficient	U_C							
Properties of Consistency	Liquid Limit	w_L	%						
	Plastic Limit	w_P	%						
	Plastic Index	I_P							
Classification	Class Name of Ground Materials								
	Class Symbol								
Consolidation	Test Method								
	Compression Index	C_C							
	Compressive Yield Stress	P_C	kN/m²						
Unconfined Compression	Unconfined Compression Strength	q_u	kN/m²	234.2	313.1	1073.5	195.8	379.3	1050.4
Shear	Test Condition								
	Total Stress	c	kN/m²						
		φ	°						
	Effective Stress	c '	kN/m²						
		φ'	°						

Special Instruction

1) A percentage by the soil materials which are less than 75mm except stone fraction is indicated.

[$1kN/m^2 \fallingdotseq 0.0102kgf/cm^2$]

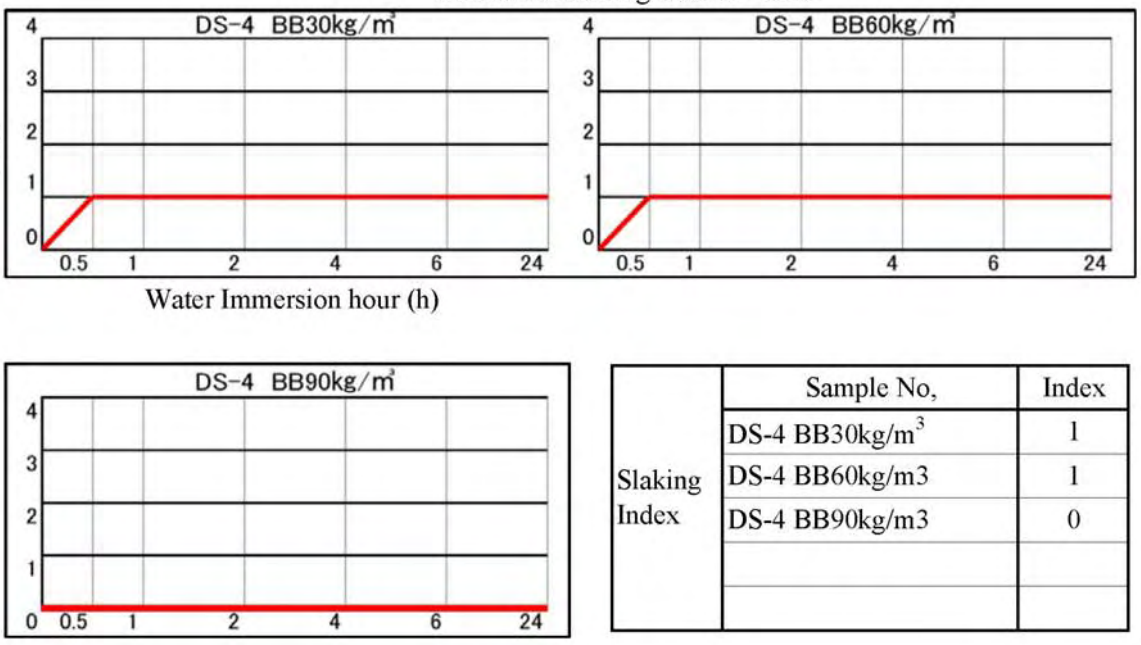
9-1 Slaking Test of Soil Cement

Slaking Test of Soil Cement

Project Title	THE STUDY FOR ASSESSMENT OF ECOSYSTEM, COASTAL EROSION AND PROTECTION/REHABILITATION OF DAMAGED AREA IN TUVALU	Date	October 29, 2010
		Trier	Hideaki Tsuge
Kind of Water	Sea Water		

	Sample No,		DS-4 BB30kg/m^3	DS-4 BB60kg/m^3	DS-4 BB90kg/m^3
Mass of Test Piece	Mass before Water Immersion m1	(g)	387.29	397.04	403.01
	Mass after Water Immersion in 24 hours m2	(g)	413.64	416.07	420.40
	Mass after Fire Pit Dry m3	(g)	321.97	326.52	329.21
	Container Mass m4	(g)	68.80	68.59	68.97
Water Content	Initial Water Content ω1	(%)	26.0	27.8	29.2
	Water Content before Water Immersion ω2	(%)	25.8	27.3	28.4
	Water Content after Water Immersion in 24 hours ω3	(%)	36.2	34.7	35.0

Relation of Slaking Section - time



Slaking Index	Sample No,	Index
	DS-4 BB30kg/m^3	1
	DS-4 BB60kg/m3	1
	DS-4 BB90kg/m3	0

Remarks

- A sample of four days' cure in air after a test piece was made is considered as dry.
- Water content of target sample when a test piece was made is considered as initial water content.

9-2 Underwater Segregation Test of Soil Cement

THE STUDY FOR ASSESSMENT OF ECOSYSTEM, COASTAL EROSION AND PROTECTION/REHABILITATION OF DAMAGED AREA IN TUVALU

November 5, 2010

Hideaki Tsuge

The comment concerning collapse condition of test pieces which were shaken in the seawater after the unconfined compression test was inspected.

①Test pieces used for this test were made from the same sample (DS-4) with three different amounts of Portland blast furnace cement B of slurry condition (water : cement = 1 : 1) . Furthermore,

1, Cure in air of seven days × 3 test pieces.

2, After cure in air of four days, cure in the seawater of three days × 3 test pieces.

As above, they were divided into 6 test pieces.

They respectively inspected by the unconfined compression test were used.

Details are as is follows.

- Sample A : DS-4 BB30 kg/m^3 (cure in air of four days and cure in the seawater of three days)
- Sample B : DS-4 BB60 kg/m^3 (cure in air of four days and cure in the seawater of three days)
- Sample C : DS-4 BB90 kg/m^3 (cure in air of four days and cure in the seawater of three days)

- Sample D : DS-4 BB30 kg/m^3 (cure in air of seven days)
- Sample E : DS-4 BB60 kg/m^3 (cure in air of seven days)
- Sample F : DS-4 BB90 kg/m^3 (cure in air of seven days)

②After test pieces were divided between sample A~C (Group G) and sample D~F (Group H), a half of the seawater in the measuring cylinders which could contain a liter was quietly poured into plastic test cases with test pieces.

As any test pieces were hardly crushed in this step, remarkable destruction was not shown except a little lack of crack extent brought about by the unconfined compression test.

③3 test pieces of group G were at the same time shook up and down and shaken by humans.

The number of shaking is 5, 30, 50, 15 times which were shaken 100 times in total.

After shaken 5 times, sample A showed slaking section 2, sample B showed 1 and sample C showed 0 which enabled us to distinguish the original shape of 3 test pieces.

④After 3 test pieces were almost continually shaken 30, 50, 15 times, at this point they were shaken 100 times, both sample A and B were almost become sand condition and they showed slaking section 4. Sample C which was almost become sand condition with particles of some masses showed slaking section 3.

Additionally, regarding sample C after it was shaken over 50 times, when the cylinder was gone up and down, it was confirmed to keep the original shape of the test piece.

⑤The seawater which settling measuring cylinders contained was observed the time to become almost transparent. By the difference of sedimentation velocity of very fine particles, the time until particles were almost completely settled out was within 1 minute about sample C which contained a lot of amount of cement, on the other hand, over 10 minutes about sample A and B.

After most of particles were settled out, they were measured the layer thickness of the test pieces in measuring cylinders.

Sample A showed approximate 13 cm.

Sample B showed approximate 12 cm.

Sample C showed approximate 10 cm.

Approximate particle size distribution by visual contact is as follows.

Group G	Coarse particle which was more than 2mm	Coarse particle which was under 2mm	Fine particle which was less than 1mm
Sample A	0cm	6cm	7cm
Sample B	3cm	3cm	6cm
Sample C	6cm	2cm	2cm

⑥3 test pieces of group H were shaken 100 times in total with the same way of group G.

At this point shaken 5 times, they were dominantly shown to be crushed more than group G. Both sample D and E showed slaking section 2 and sample F showed 1.

⑦When remaining times to shake were conducted, compared with group G, the difference of advance rate of collapse became conspicuous. At this point they were shaken 30 times, both sample D and E almost became sand condition.

At this point they were shaken 100 times, both D and E showed slaking section 4, on the other hand, sample F which almost became sand condition with some visible masses of gravel condition showed slaking section 3.

Ditto with sample C, sample F was confirmed to keep the original shape of the test piece when it was shaken.

⑧When the seawater which settling measuring cylinders contained was observed the time to become almost transparent, ditto with group G, the time until particles were almost completely settled out was within 1 minute about sample F which contained a lot of amount of cement, on the other hand, over 10 minutes about sample D and E.

Ditto with group G, after most of particles were settled out, they were measured the layer thickness of the test pieces in measuring cylinders which is as is follows.

Sample D showed approximate 14 cm.

Sample E showed approximate 14 cm.

Sample F showed approximate 10 cm.

Approximate particle size distribution by visual contact is as follows.

Group H	Coarse particle which was more than 2mm	Coarse particle which was under 2mm	Fine particle which was less than 1mm
Sample D	0cm	6cm	8cm
Sample E	2cm	4cm	8cm
Sample F	4cm	3cm	3cm

Regarding sample F, as the large mass which was not crushed was settled out at a slant, line of the layer was in great turmoil in mid-course.

⑨After both group G and H were remained in 24 hours, they were measured the layer thickness of the test pieces in measuring cylinders again which is as is follows.

Sample A : approximate 11 cm.

Sample B : approximate 11 cm.

Sample C : approximate 10 cm.

Sample D : approximate 11 cm.

Sample E : approximate 11 cm.

Sample F : approximate 10 cm.

(If the projection which was not crushed was included, sample F was measured approximate 11 cm)

Conclusive particle size distribution by visual contact is as follows.

Group G	Coarse particle which was more than 2mm	Coarse particle which was under 2mm	Fine particle which was less than 1mm
Sample A	0cm	6cm	5cm
Sample B	3cm	3cm	5cm
Sample C	6cm	2cm	2cm

Group H	Coarse particle which was more than 2mm	Coarse particle which was under 2mm	Fine particle which was less than 1mm
Sample D	0cm	6cm	5cm
Sample E	3cm	3cm	5cm
Sample F	5cm	2cm	3cm

⑩Each sample was moved from the cylinder to the try and they were confirmed collapse condition in detail by visual contact.

Group G

Sample A

As sample A was finely crushed, there were particles which were mainly under 2 mm in the large one, there were many very fine particles and impurity of the seawater was quite thick.

Two round masses of gravel condition which were approximately measured 4 cm and 2.5 cm in the diameter were remained.

Sample B

A percentage of particles to correspond with coarse particles which were more than 2 mm was high to compared with A. Impurity of the seawater was a little thin to compared with sample A.

Two round masses of gravel condition which were approximately measured 4 cm in the diameter were remained.

Sample C

Compared with A and B, as very fine particles were considerably decreased, particle sizes from 2 mm to 4.5 mm were remarkable.

Impurity of the seawater was quite thin and soon after sample C was moved to the try, a degree of transparency became high.

Two round masses of gravel condition which were approximately measured 5 cm and 2 cm in diameter and the 6-cm-long test piece which kept the original shape were remained.

Group H

Sample D

Ditto with sample A, as sample D was finely crushed, very fine particles were remarkable, there were particles which were mainly under 2 mm in the large one and impurity of the seawater was quite thick.

Two round masses of gravel condition which were approximately measured 3 cm and 2 cm in the diameter were remained.

Sample E

Although particles which were more than 2mm were remarkable, the difference between sample D and E was less than that between sample A and B.

Impurity of the seawater was quite thick.

Two round masses of gravel condition which were approximately measured 4 cm in the diameter were remained.

Sample F

Compared with D and E, very fine particles were considerably decreased and particle sizes from 2 mm to 4.5 mm were remarkable.

Impurity of the seawater was quite thin and soon after sample F was moved to the try, a degree of transparency became high.

A round mass of gravel condition which was approximately measured 4 cm in the diameter and the 7-cm-long test piece, confirmed when it was in the cylinder, which kept the original shape of the test piece were remained.

General overview

This time the inspected test pieces were previously inspected by the unconfined compression test. Therefore, at the point they were settled out in the cylinders at first, there were some small cracks and breach which is noted again.

For reference, the unconfined compression strength of each sample is as is follows.

Sample A : 195 kN/m^2

Sample B : 378 kN/m^2

Sample C : 1050 kN/m^2

Sample D : 234 kN/m^2

Sample E : 312 kN/m^2

Sample F : 1072 kN/m^2

At the point each sample was crushed, Group H (cure in air) was felt to be crushed comparatively faster than group G (cure in the seawater), on the other hand, the large difference between group G and H was not confirmed by the measurement of the layer thickness of test pieces which was crushed and the particle size confirmation by visual contact.

Checked the difference of the additive amount of cement, 4 samples that sample A, B, D, E which were made from composition of BB30 kN/m^3 or BB60 kN/m^3 were shown some difference of particle size distribution around 2 mm. But as long as the amount of very fine particles and largeness of masses which were not crushed were compared, there was little difference.

Meanwhile, as sample C and F which were made from composition of BB90 kN/m^3 were remained to keep the original shape, there was the obvious difference from the other 4 samples.

By the above-mentioned result,

1, As long as the way of cure was compared, there was not the obvious difference of the breakage rate by shaking in the seawater.

2, Regarding comparison of the amount of cement, to compared with BB30 kN/m^3 and BB60 kN/m^3, the breakage rate of BB90 kN/m^3 by shaking in the seawater was considerably decreased.

This result showed the commeasurable result with the result of the unconfined compression strength.

9-3 Photographs

Soak and Underwater Shaking Test for Soil Cemented Dredging Sand

Photo-1 : Soaking Test of Soil Cemented Dredged Sand（At the Beginning of Soaking）

From right 30kg, 60kg, 90kg cement mixed samples per 1m3 have been casted.
From the right, the test piece that adds the cement for each dredging soil 1m3 of 30kg, 60kg, and 90kg is made.
The test piece was visually inspected and the segregation underwater was confirmed.

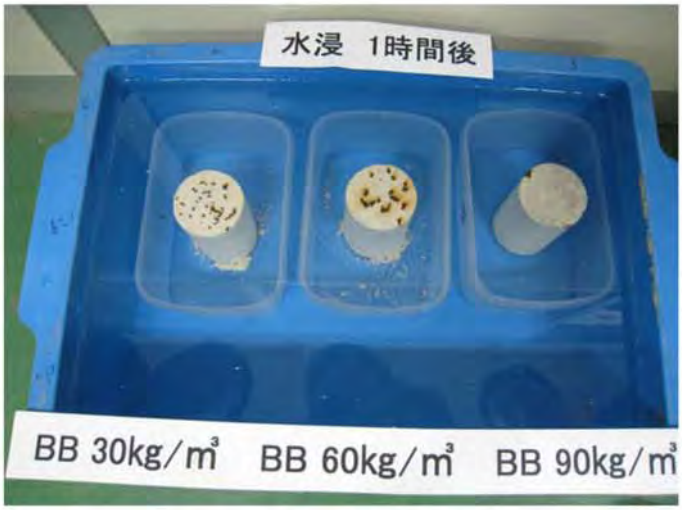


Photo-2 : After 1 hour

After soaking in the seawater, the small cracks was developed at the corner part in the test piece of 30kg/m3 and 60kg/m3. The change was not seen in 90kg/m3 at all.

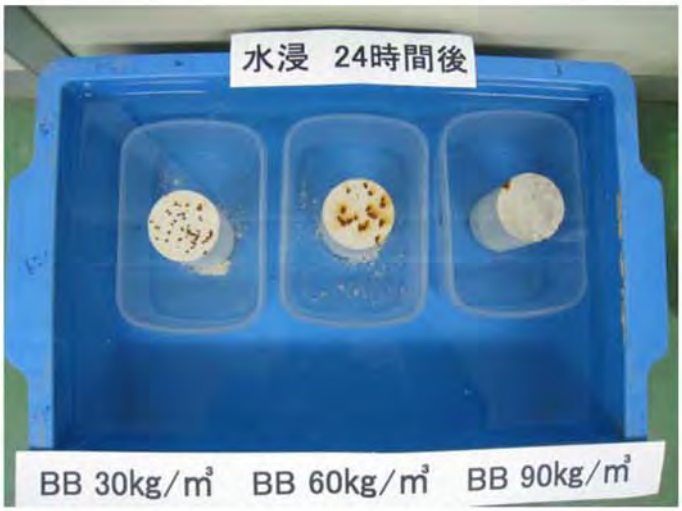


Photo-3 : After 24 hours

No big crack. has not developed. There is a difference of the lack extent of the corner part depending on the additive amount of cement.
There was no change in the test piece of 30kg/m3 and 60kg/m3 after 24 hours had passed only by small cracking and being developed of the corner part just after soaking started.
The change was not seen in the test piece that added the cement of 90kg/m3 at all.

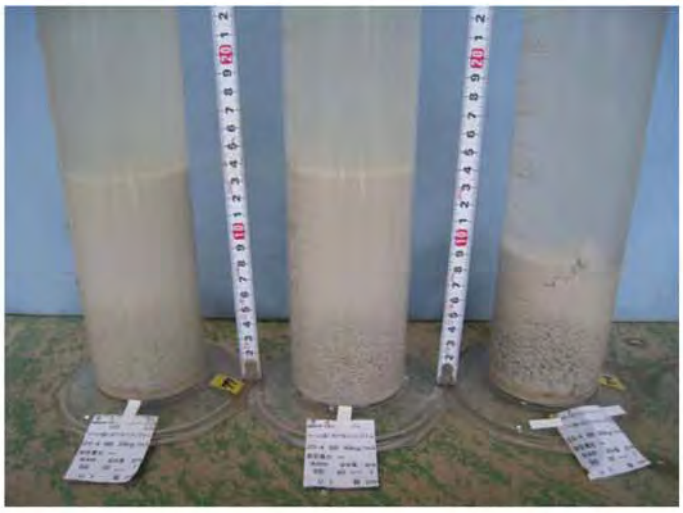
Soak and Underwater Shaking Test for Soil Cemented Dredging Sand

From right 30kg/m3, 60kg/m3, 90kg/m3 cemented mixed per 1 m3 of soil

Photo-4 : Before Shaking Test (After Soaking)

The fine-grained fraction elutes in the one with a little amount of the cement addition immediately after shaking five times, and the impurity of water is intense.
A little amount of the cement addition can be crushed in fine particles though large amount of the cement addition is a grainy of the grain diameter about 5mm in the lump size that was able to be broken.

Photo-5 : Shaken 5 times (From right 30kg/m3, 60kg/m3, 90kg/m3 cemented mixed per 1 m3 of soil)



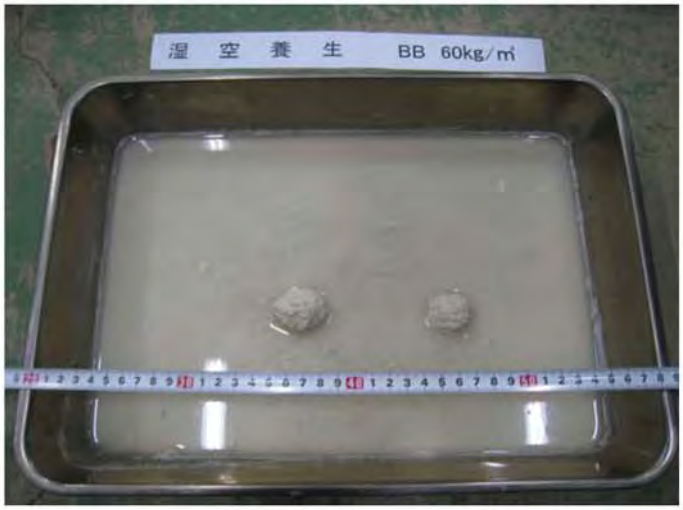
The test piece was broken by shaking 100 times.

Photo-6 : Shaken 100 times (From right 30kg/m3, 60kg/m3, 90kg/m3 cemented mixed per 1 m3 of soil)

Soak and Underwater Shaking Test for Soil Cemented Dredging Sand

Mostly crushed into fine-grained fraction.
The mass of about 2cm in the diameter is the maximum.

Photo-7 : Cement addition amount 30kg/m3 After shaking 100 times



Crushed into sand and fine-grained fraction.
The mass of about 3cm in the diameter is the maximum.

Photo-8 : Cement addition amount 60kg/m3 After shaking 100 times

There is a little amount of fine-grained fraction.
The test piece was crushed into coarse sand and the small gravel size.
The mass of about 4cm in the diameter remained and the mass of about 3cm in the diameter which was remained original shape of test piece of a cylindrical test piece remained.

Photo-9 : Cement addition amount 90kg/m3 After shaking 100 times

PART VII: FINANCIAL AND ECONOMIC ANALYSES

Section 2: Data Book

1. Questionnaire for Cost of Damage due to Flooding

1. Questionnaire for Cost of Damage due to Flooding

Please tell Us about your family, your house and yourself

Q1. You are a

☐Male ☐Female

Q2. What is your age ?

☐10-20 ☐21-30 ☐31-40☐ ☐41-50 ☐51-60 ☐61-70 ☐over71

Q3. How long have your family been living at your present address ?

☐Less than 5 years ☐5-10 years ☐over 10 years

Q4. How many persons are living within your house ?

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8

☐ 9 ☐ 10 ☐ more than 10

Q5. In your house, does someone suffering from long-term illness reside ?

☐No ☐1 person ☐2 persons ☐More than 2 persons

Q6. In your house, is someone aged 75 or more living?

☐No ☐1 person ☐2 persons ☐More than 2 persons

Q7. Do you or your family plant food crops or vegetable in your premises ?

☐No ☐Yes

Q8. If yes, Please answer the name and estimated weight of harvest a year.

Taro ( ) kg/year Pulaka ( )kg/year

Sweet Potatoes ( )kg/year, Pumpkin ( )kg/year

Tomato ( )kg/year, Cucumber ( )kg/year

Eggplant ( )kg/year, Sweet Corn( )kg/year

Chinese Cabbage ( )kg/year, Banana ( )kg/year,

Cauliflower ( )kg/year,

Others ( ) ( )kg/year, ( ) ( )kg/year,

Q9. How many square meters are your premises and your house?

Premises : ( ) sq.m

House : ( ) sq.m

Q10. What is your house's main structure (made of)

☐ Timber ☐ Brick ☐ Reinforced Concrete ☐ Steel

Q11. How old is your house ?

☐ Less than 1 year ☐ 1-2 years ☐ 2-3 years ☐ 3-5 years
☐ 5-10 years ☐ 10-15 years ☐ 15-20 years ☐ Older than 20 years

Q12. What kind of furniture do you have in your house ?

☐ Refrigerator ☐ Gas/Kerosene/Electric Stove ☐ Rice cooker
☐ Freezer ☐ Microwave Oven ☐ Washing machine
☐ Electric Fan ☐ Electric Mixer ☐ Sewing Machine
☐ Toaster ☐ Rice cooker ☐ Electric kettle ☐ Bed ( )
☐ Table ( ) ☐ Chair ( ) ☐ Arm chair ( )
☐ TV ☐Stereo ☐ DVD/CD Deck ☐ Radio
☐ Fixed Telephone
☐ Others, please specify ( )( )

Q13. For transportation, what do you keep in your premises ?

Bicylcle ☐ No ☐ 1 ☐ 2 ☐ 3 ☐ More than 3, specify ( )
Motor Bike ☐ No ☐ 1 ☐ 2 ☐ 3
Car ☐ No ☐ 1 ☐ 2 ☐ 3
Truck ☐ No ☐ 1 ☐ 2 ☐ 3
Van ☐ No ☐ 1 ☐ 2 ☐ 3

Q14. Are you or your family engaging business in your premises ?

☐ No ☐ Yes

Q15. If yes, what kind of business are you or your family engaging ?

☐ Store ☐ Fuel shop ☐ Restaurant ☐ Bike repair
☐ Trading
☐ Others, please specify ( )

Q16. How much is the total value of equipment, stocks and goods <u>in your premises</u> for your business ?

☐ Less than $100 ☐ $100-$200 ☐ $201-300 ☐ $301-400
☐ $401-500 ☐ $501-600 ☐ $601-700 ☐ $701-800
☐ $801-900 ☐ $901-1,000 ☐ $1,001-1,500 ☐ $1,501-2,000
☐ $2,001-2,500 ☐ $2,501-3,000 ☐ $3,001-3,500 ☐ $3,501-4,000
☐ $4,001-4,500 ☐ $4,501-5,000 ☐ $5,001-5,500 ☐ $5,501-6,000
☐ $6,001-6,500 ☐ $6,501-7,000 ☐ $7,001-7,500 ☐ $7,501-8,000
☐ $8,001-8,500 ☐ $8,501-9,000 ☐ $9,001-9,500 ☐ $9,501-10,000

☐ More than $10,001 (specify) ($)

Flooding

Q17. How many times have your house (or premises) flooding in the last 5 years ?

☐Never ☐1 ☐2 ☐3 ☐4 ☐5 ☐6
☐7 ☐8 ☐9 ☐10 ☐more than 11

If you have any, please answer the depths of those flooding.

Q18. How many flooding, the water level were below the floor or living room ?

☐Never ☐1 ☐2 ☐3 ☐4 ☐5 ☐6
☐7 ☐8 ☐9 ☐10 ☐more than 11

Q19. How many flooding, the water level were above the floor but below the level of seat of chair (Floor + approx. 50cm) ?

☐Never ☐1 ☐2 ☐3 ☐4 ☐5 ☐6
☐7 ☐8 ☐9 ☐10 ☐more than 11

Q20. How many flooding, the water level were above the seat of chair but below the level of table top (Floor +approx. 100cm) ?

☐Never ☐1 ☐2 ☐3 ☐4 ☐5 ☐6
☐7 ☐8 ☐9 ☐10 ☐more than 11

Q21. How many flooding, the water level were between above the table top but below the upper side of door (Floor +approx. 200cm) ?

☐Never ☐1 ☐2 ☐3 ☐4 ☐5 ☐6
☐7 ☐8 ☐9 ☐10 ☐more than 11

Q22. How many flooding, the water level were between above the upper side of door but below the ceiling (Floor +approx. 300cm) ?

☐Never ☐1 ☐2 ☐3 ☐4 ☐5 ☐6
☐7 ☐8 ☐9 ☐10 ☐more than 11

Q23. How many flooding, the water level were between above the ceiling (higher than Floor +approx. 300cm) ?

☐Never ☐1 ☐2 ☐3 ☐4 ☐5 ☐6
☐7 ☐8 ☐9 ☐10 ☐more than 11

Q24. How many days did it take for receding the flood water ?

☐1 ☐2 ☐3 ☐4 ☐5 ☐6

☐7 ☐8 ☐9 ☐10 ☐more than 11(specify) ( ) days)

Q.25. How much damage have you been suffered, in terms of money, by flooding every year ?

☐	$0	☐	$3	☐	$5	☐	$10	☐	$15	☐	$20	☐	$25	
☐	$30	☐	$35	☐	$40	☐	$45	☐	$50	☐	$55	☐	$60	
☐	$65	☐	$70	☐	$75	☐	$80	☐	$85	☐	$90	☐	$95	
☐	$100	☐	$105	☐	$110	☐	$115	☐	$120	☐	$125	☐	$130	
☐	$135	☐	$140	☐	$145	☐	$150	☐	$160	☐	$170	☐	$180	
☐	$190	☐	$200	☐	$225	☐	$250	☐	$275	☐	$300	☐	$325	
☐	$350	☐	$400	☐	$450	☐	$500	☐	$550	☐	$600	☐	$650	
☐	$700	☐	$750	☐	$800	☐	$850	☐	$900	☐	$950	☐	$1,000	
☐	$1,050	☐	$1,100	☐	$1,150	☐	$1,200	☐	>$1,200	☐	Other	☐	Don't know	
									(Specify)		($)			

Q26. Have your premises diminished due to erosion of the beach ?

☐No ☐Yes

Q27. If yes, please answer how much it became reduced in size.

( ) sq.m

or

( ) m back from the original shoreline

since ( ) years ago.

Counter measures to prevent coastal erosion and flooding.

J-PACE (Japan-Project Against Coastal Erosion) Team is planning to propose to the Government of Tuvalu counter measures, which are summarized attachment A, in order to prevent coastal erosion and flooding in Fongafale.

Q28. Should measures to prevent coastal erosion and flooding be done, are you willing to pay a part of the cost ?

☐ No ☐ Yes

Q29. If "No", what is(are) the reason(s) ?

☐ The Government should pay the cost.

☐ Kaupule should pay the cost.

☐ Those people benefit from it should pay the cost.

☐ No need to take measures to prevent coastal erosion and flooding.

☐ I cannot see the benefit as much as paying the cost.

☐ The Government should ask donors.
☐ I don't have money
☐ Don't Know

Q30. If "Yes", what is(are) the reason(s) ?

☐ Resident should bear a part of the cost.
☐ Beneficiaries from the counter measures should pay a part of the cost.
☐ We want to make starting the counter measures earlier.
☐ I can pay for it.
☐ Don't know

Q31. If "Yes", how much can you pay for it ?

☐	$0	☐	$3	☐	$5	☐	$10	☐	$15	☐	$20	☐	$25
☐	$30	☐	$35	☐	$40	☐	$45	☐	$50	☐	$55	☐	$60
☐	$65	☐	$70	☐	$75	☐	$80	☐	$85	☐	$90	☐	$95
☐	$100	☐	$105	☐	$110	☐	$115	☐	$120	☐	$125	☐	$130
☐	$135	☐	$140	☐	$145	☐	$150	☐	$160	☐	$170	☐	$180
☐	$190	☐	$200	☐	$225	☐	$250	☐	$275	☐	$300	☐	$325
☐	$350	☐	$400	☐	$450	☐	$500	☐	$550	☐	$600	☐	$650
☐	$700	☐	$750	☐	$800	☐	$850	☐	$900	☐	$950	☐	$1,000
☐	$1,050	☐	$1,100	☐	$1,150	☐	$1,200	☐	>$1,200	☐	Other	☐	Don't know
									(Specify)		($)		

Thank you very much for your cooperation.

2. Results of Economic Analysis

2. Results of Economic Analysis

2-1 Yearly change of the house assets and Yearly change of the loss of house assets by area (1)

	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year
House Assets in C Area	193,264	185,092	214,061	204,895	196,132	187,754	179,744	172,086	164,763	157,761
Loss of House Assets in C Area	26,091	24,987	28,898	27,661	26,478	25,347	24,265	23,232	22,243	21,298
House Assets in D-1Area	1,739,779	1,685,294	2,096,370	2,024,248	1,954,850	2,019,720	1,949,387	1,881,737	1,816,662	1,754,057
Loss of House Assets in D-1Area	234,870	227,515	283,010	273,273	263,905	272,662	263,167	254,035	245,249	236,798
House Assets in D-2 Area	805,200	805,200	805,200	805,200	805,200	805,200	805,200	805,200	805,200	805,200
Loss of House Assets in D-2 Area	0	0	0	0	0	0	0	0	0	0
House Assets in D-3 Area	304,312	292,781	605,073	579,587	555,216	564,145	540,374	517,644	495,906	475,118
Loss of House Assets in D-3 Area	41,082	39,525	81,685	78,244	74,954	76,160	72,951	69,882	66,947	64,141
Loss of House Assets in (D-1+D-3)	275,952	267,040	364,695	351,518	338,859	348,822	336,118	323,916	312,197	300,939
Total Loss of House Assets	302,043	292,028	393,593	379,179	365,337	374,169	360,383	347,148	334,440	322,236

	11th Year	12th Year	13th Year	14th Year	15th Year	16th Year	17th Year	18th Year	19th Year	20th Year
House Assets in C Area	208,214	199,183	190,552	182,305	174,422	246,088	235,245	224,888	220,233	210,641
Loss of House Assets in C Area	28,109	26,890	25,725	24,611	23,547	33,222	31,758	30,360	29,732	28,437
House Assets in D-1Area	1,988,992	1,917,449	1,848,712	1,782,661	1,719,187	1,794,537	1,729,625	1,667,269	1,911,743	1,845,116
Loss of House Assets in D-1Area	268,514	258,856	249,576	240,659	232,090	242,263	233,499	225,081	258,085	249,091
House Assets in D-2 Area	805,200	805,200	805,200	805,200	805,200	805,200	805,200	805,200	805,200	805,200
Loss of House Assets in D-2 Area	0	0	0	0	0	0	0	0	0	0
House Assets in D-3 Area	483,286	462,981	443,563	424,992	407,231	416,158	398,717	382,037	437,387	419,721
Loss of House Assets in D-3 Area	65,244	62,502	59,881	57,374	54,976	56,181	53,827	51,575	59,047	56,662
Loss of House Assets in (D-1+D-3)	333,758	321,358	309,457	298,033	287,066	298,444	287,326	276,656	317,133	305,753
Total Loss of House Assets	361,866	348,248	335,182	322,644	310,613	331,666	319,084	307,016	346,864	334,190

2-1 Yearly change of the house assets and Yearly change of the loss of house assets by area (2)

	21st Year	22nd Year	23rd Year	24th Year	25th Year	26th Year	27th Year	28th Year	29th Year	30th Year
House Assets in C Area	227,102	217,166	207,672	198,602	215,530	206,073	206,777	197,883	189,382	181,255
Loss of House Assets in C Area	30,659	29,317	28,036	26,811	29,097	27,820	27,915	26,714	25,567	24,469
House Assets in D-1Area	1,825,451	1,841,633	1,792,984	1,731,249	1,994,459	1,922,429	2,050,975	2,269,407	2,191,445	2,116,414
Loss of House Assets in D-1Area	246,436	248,620	242,053	233,719	269,252	259,528	276,882	306,370	295,845	285,716
House Assets in D-2 Area	805,200	805,200	805,200	805,200	805,200	805,200	805,200	805,200	805,200	805,200
Loss of House Assets in D-2 Area	0	0	0	0	0	0	0	0	0	0
House Assets in D-3 Area	402,806	416,699	399,898	383,810	593,390	568,286	549,052	582,902	558,969	536,067
Loss of House Assets in D-3 Area	54,379	56,254	53,986	51,814	80,108	76,719	74,122	78,692	75,461	72,369
Loss of House Assets in (D-1+D-3)	300,815	304,875	296,039	285,533	349,360	336,247	351,004	385,062	371,306	358,085
Total Loss of House Assets	331,474	334,192	324,075	312,344	378,456	364,066	378,919	411,776	396,872	382,554

	31st Year	32nd Year	33rd Year	34th Year	35th Year	36th Year	37th Year	38th Year	39th Year	40th Year
House Assets in C Area	235,807	225,635	215,913	206,621	223,332	213,664	204,424	195,594	0	0
Loss of House Assets in C Area	31,834	30,461	29,148	27,894	30,150	28,845	27,597	26,405	0	1,391,112
House Assets in D-1Area	2,102,675	2,128,475	2,322,066	2,241,694	2,196,564	2,268,255	2,224,695	2,283,111	2,216,652	2,142,066
Loss of House Assets in D-1Area	283,861	287,344	313,479	302,629	296,536	306,214	300,334	308,220	299,248	289,179
House Assets in D-2 Area	805,200	805,200	805,200	805,200	805,200	805,200	805,200	805,200	805,200	805,200
Loss of House Assets in D-2 Area	0	0	0	0	0	0	0	0	0	0
House Assets in D-3 Area	517,629	525,695	504,293	483,806	468,825	453,322	435,153	447,495	434,170	416,863
Loss of House Assets in D-3 Area	69,880	70,969	68,080	65,314	63,291	61,198	58,746	60,412	58,613	56,277
Loss of House Assets in (D-1+D-3)	353,741	358,313	381,558	367,943	359,828	367,413	359,079	368,632	357,861	345,455
Total Loss of House Assets	377,162	382,658	411,803	396,902	387,559	393,969	385,149	403,975	391,683	377,823

2-1 Yearly change of the house assets and Yearly change of the loss of house assets by area (3)

	41st Year	42nd Year	43rd Year	44th Year	45th Year	46th Year	47th Year	48th Year	49th Year	50th Year
House Assets in C Area	229,464	219,622	235,807	225,635	215,913	206,621	223,332	213,664	204,424	195,594
Loss of House Assets in C Area	30,978	29,649	31,834	30,461	29,148	27,894	30,150	28,845	27,597	26,405
House Assets in D-1Area	2,187,031	2,114,219	2,088,453	2,043,040	1,990,243	1,948,609	2,207,305	2,138,907	2,065,188	2,096,875
Loss of House Assets in D-1Area	295,249	285,420	281,941	275,810	268,683	263,062	297,986	288,752	278,800	283,078
House Assets in D-2 Area	805,200	805,200	805,200	805,200	805,200	805,200	805,200	805,200	805,200	805,200
Loss of House Assets in D-2 Area	0	0	0	0	0	0	0	0	0	0
House Assets in D-3 Area	428,756	411,649	395,265	408,026	425,804	408,664	620,565	597,752	572,686	573,837
Loss of House Assets in D-3 Area	57,882	55,573	53,361	55,084	57,484	55,170	83,776	80,697	77,313	77,468
Loss of House Assets in (D-1+D-3)	353,131	340,992	335,302	330,894	326,166	318,232	381,762	369,449	356,113	360,546
Total Loss of House Assets	384,109	370,641	367,136	361,355	355,315	346,126	411,912	398,294	383,710	386,951

2-2 Yearly change of the value of the household utensils and Yearly change of the loss of the household utensils by area (1)

	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year
Value of Household Utensils in C Area	29,682	24,755	20,645	17,218	14,360	11,976	29,682	24,755	20,645	17,218
Loss of Household Utensils in C Area	1,870	1,560	1,301	1,085	905	755	1,870	1,560	1,301	1,085
Value of Household Utensils in D-1Area	269,436	224,710	187,408	156,298	130,353	108,714	269,436	224,710	187,408	156,298
Loss of Household Utensils in D-1Area	16,974	14,157	11,807	9,847	8,212	6,849	16,974	14,157	11,807	9,847
Value of Household Utensils in D-2 Area	147,408	122,938	102,531	85,510	71,316	59,477	147,408	122,938	102,531	85,510
Loss of Household Utensils in D-2 Area	0	0	0	0	0	0	0	0	0	0
Value of Household Utensils in D-3 Area	69,258	57,761	48,173	40,176	33,507	27,945	69,258	57,761	48,173	40,176
Loss of Household Utensils in D-3Area	4,363	3,639	3,035	2,531	2,111	1,761	4,363	3,639	3,035	2,531
Loss of Household Utensils in (D1+D3) Areas	21,338	17,796	14,842	12,378	10,323	8,610	21,338	17,796	14,842	12,378
Total Loss of Household Utensils	23,208	19,355	16,142	13,463	11,228	9,364	23,208	19,355	16,142	13,463

	11th Year	12th Year	13th Year	14th Year	15th Year	16th Year	17th Year	18th Year	19th Year	20th Year
Value of Household Utensils in C Area	14,360	11,976	29,682	53,695	44,782	37,348	31,148	25,978	29,682	24,755
Loss of Household Utensils in C Area	905	755	1,870	3,383	2,821	2,353	1,962	1,637	1,870	1,560
Value of Household Utensils in D-1Area	130,353	108,714	269,436	53,695	44,782	37,348	31,148	25,978	269,436	224,710
Loss of Household Utensils in D-1Area	8,212	6,849	16,974	3,383	2,821	2,353	1,962	1,637	16,974	14,157
Value of Household Utensils in D-2 Area	71,316	59,477	147,408	122,938	102,531	85,510	71,316	59,477	147,408	122,938
Loss of Household Utensils in D-2 Area	0	0	0	0	0	0	0	0	0	0
Value of Household Utensils in D-3 Area	33,507	27,945	69,258	57,761	48,173	40,176	33,507	27,945	69,258	57,761
Loss of Household Utensils in D-3Area	2,111	1,761	4,363	3,639	3,035	2,531	2,111	1,761	4,363	3,639
Loss of Household Utensils in (D1+D3) Areas	10,323	8,610	21,338	7,022	5,856	4,884	4,073	3,397	21,338	17,796
Total Loss of Household Utensils	11,228	9,364	23,208	10,405	8,677	7,237	6,036	5,034	23,208	19,355

2-2 Yearly change of the value of the household utensils and Yearly change of the loss of the household utensils by area (2)

	21st Year	22nd Year	23rd Year	24th Year	25th Year	26th Year	27th Year	28th Year	29th Year	30th Year
Value of Household Utensils in C Area	20,645	17,218	14,360	11,976	29,682	24,755	20,645	17,218	14,360	11,976
Loss of Household Utensils in C Area	1,301	1,085	905	755	1,870	1,560	1,301	1,085	905	755
Value of Household Utensils in D-1Area	187,408	156,298	130,353	108,714	269,436	224,710	187,408	156,298	130,353	108,714
Loss of Household Utensils in D-1Area	11,807	9,847	8,212	6,849	16,974	14,157	11,807	9,847	8,212	6,849
Value of Household Utensils in D-2 Area	102,531	85,510	71,316	59,477	147,408	122,938	102,531	85,510	71,316	59,477
Loss of Household Utensils in D-2 Area	0	0	0	0	0	0	0	0	0	0
Value of Household Utensils in D-3 Area	48,173	40,176	33,507	27,945	69,258	57,761	48,173	40,176	33,507	27,945
Loss of Household Utensils in D-3Area	3,035	2,531	2,111	1,761	4,363	3,639	3,035	2,531	2,111	1,761
Loss of Household Utensils in (D1+D3) Areas	14,842	12,378	10,323	8,610	21,338	17,796	14,842	12,378	10,323	8,610
Total Loss of Household Utensils	16,142	13,463	11,228	9,364	23,208	19,355	16,142	13,463	11,228	9,364

	31st Year	32nd Year	33rd Year	34th Year	35th Year	36th Year	37th Year	38th Year	39th Year	40th Year
Value of Household Utensils in C Area	29,682	24,755	20,645	17,218	14,360	11,976	29,682	24,755	20,645	17,218
Loss of Household Utensils in C Area	1,870	1,560	1,301	1,085	905	755	1,870	1,560	1,301	1,085
Value of Household Utensils in D-1Area	269,436	224,710	187,408	156,298	130,353	108,714	269,436	224,710	187,408	156,298
Loss of Household Utensils in D-1Area	16,974	14,157	11,807	9,847	8,212	6,849	16,974	14,157	11,807	9,847
Value of Household Utensils in D-2 Area	147,408	122,938	102,531	85,510	71,316	59,477	147,408	122,938	102,531	85,510
Loss of Household Utensils in D-2 Area	0	0	0	0	0	0	0	0	0	0
Value of Household Utensils in D-3 Area	69,258	57,761	48,173	40,176	33,507	27,945	69,258	57,761	48,173	40,176
Loss of Household Utensils in D-3Area	4,363	3,639	3,035	2,531	2,111	1,761	4,363	3,639	3,035	2,531
Loss of Household Utensils in (D1+D3) Areas	21,338	17,796	14,842	12,378	10,323	8,610	21,338	17,796	14,842	12,378
Total Loss of Household Utensils	23,208	19,355	16,142	13,463	11,228	9,364	23,208	19,355	16,142	13,463

2-2 Yearly change of the value of the household utensils and Yearly change of the loss of the household utensils by area (3)

	41st Year	42nd Year	43rd Year	44th Year	45th Year	46th Year	47th Year	48th Year	49th Year	50th Year
Value of Household Utensils in C Area	14,360	11,976	29,682	24,755	20,645	17,218	14,360	11,976	29,682	24,755
Loss of Household Utensils in C Area	905	755	1,870	1,560	1,301	1,085	905	755	1,870	1,560
Value of Household Utensils in D−1Area	130,353	108,714	269,436	224,710	187,408	156,298	130,353	108,714	269,436	224,710
Loss of Household Utensils in D−1Area	8,212	6,849	16,974	14,157	11,807	9,847	8,212	6,849	16,974	14,157
Value of Household Utensils in D−2 Area	71,316	59,477	147,408	122,938	102,531	85,510	71,316	59,477	147,408	122,938
Loss of Household Utensils in D−2 Area	0	0	0	0	0	0	0	0	0	0
Value of Household Utensils in D−3 Area	33,507	27,945	69,258	57,761	48,173	40,176	33,507	27,945	69,258	57,761
Loss of Household Utensils in D−3Area	2,111	1,761	4,363	3,639	3,035	2,531	2,111	1,761	4,363	3,639
Loss of Household Utensils in (D1+D3) Areas	10,323	8,610	21,338	17,796	14,842	12,378	10,323	8,610	21,338	17,796
Total Loss of Household Utensils	11,228	9,364	23,208	19,355	16,142	13,463	11,228	9,364	23,208	19,355

2-3 Yearly change of the loss of infrastructure (1)

C Area	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year
Loss of House	26,091	24,987	28,898	27,661	26,478	25,347	24,265	23,232	22,243	21,298
Loss of House Utensils	1,870	1,560	1,301	1,085	905	755	1,870	1,560	1,301	1,085
Loss of Crops	469	469	469	469	469	469	469	469	469	469
Loss of Business Assets	1,900	1,900	1,900	1,900	1,900	1,900	1,900	1,900	1,900	1,900
Sub-Total	30,330	28,917	32,569	31,115	29,752	28,471	28,505	27,161	25,913	24,752
Loss of Roads	18,683	17,813	20,062	19,167	18,327	17,538	17,559	16,731	15,963	15,247
Loss of Utility	2,608	2,487	2,801	2,676	2,559	2,448	2,451	2,336	2,229	2,129
Loss of Infrastructure	21,292	20,299	22,863	21,843	20,886	19,987	20,011	19,067	18,191	17,376

D1 Area	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year
Loss of House	234,870	227,515	283,010	273,273	263,905	272,662	263,167	254,035	245,249	236,798
Loss of House Utensils	16,974	14,157	11,807	9,847	8,212	6,849	16,974	14,157	11,807	9,847
Loss of Crops	2,870	2,870	2,870	2,870	2,870	2,870	2,870	2,870	2,870	2,870
Loss of Business Assets	26,606	26,606	26,606	26,606	26,606	26,606	26,606	26,606	26,606	26,606
Sub-Total	281,321	271,148	324,293	312,596	301,593	308,987	309,618	297,667	286,532	276,121
Loss of Roads	173,294	167,027	199,764	192,559	185,781	190,336	190,725	183,363	176,504	170,090
Loss of Utility	24,194	23,319	27,889	26,883	25,937	26,573	26,627	25,599	24,642	23,746
Loss of Infrastructure	197,487	190,346	227,654	219,443	211,718	216,909	217,352	208,963	201,146	193,837

2-3 Yearly change of the loss of infrastructure (2)

D3 Areas	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year
Loss of House	41,082	39,525	81,685	78,244	74,954	76,160	72,951	69,882	66,947	64,141
Loss of House Utensils	4,363	3,639	3,035	2,531	2,111	1,761	4,363	3,639	3,035	2,531
Loss of Crops	174	174	174	174	174	174	174	174	174	174
Loss of Business Assets	9,502	9,502	9,502	9,502	9,502	9,502	9,502	9,502	9,502	9,502
Sub-Total	55,122	52,841	94,396	90,452	86,742	87,597	86,990	83,197	79,659	76,349
Loss of Roads	33,955	32,550	58,148	55,718	53,433	53,960	53,586	51,250	49,070	47,031
Loss of Utility	4,740	4,544	8,118	7,779	7,460	7,533	7,481	7,155	6,851	6,566
Loss of Infrastructure	38,696	37,094	66,266	63,497	60,893	61,493	61,067	58,405	55,920	53,597

All Areas	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year
Loss of House	302,043	292,028	393,593	379,179	365,337	374,169	360,383	347,148	334,440	322,236
Loss of House Utensils	23,208	19,355	16,142	13,463	11,228	9,364	23,208	19,355	16,142	13,463
Loss of Crops	3,514	3,514	3,514	3,514	3,514	3,514	3,514	3,514	3,514	3,514
Loss of Business Assets	38,008	38,008	38,008	38,008	38,008	38,008	38,008	38,008	38,008	38,008
Sub-Total	366,773	352,905	451,258	434,163	418,087	425,055	425,113	408,026	392,104	377,221
Loss of Roads	225,932	217,390	277,975	267,445	257,542	261,834	261,870	251,344	241,536	232,368
Loss of Utility	31,542	30,350	38,808	37,338	35,955	36,555	36,560	35,090	33,721	32,441
Loss of Infrastructure	257,475	247,739	316,783	304,783	293,497	298,389	298,429	286,434	275,257	264,809

2-3 Yearly change of the loss of infrastructure (3)

C Area	11th Year	12th Year	13th Year	14th Year	15th Year	16th Year	17th Year	18th Year	19th Year	20th Year
Loss of House	28,109	26,890	25,725	24,611	23,547	33,222	31,758	30,360	29,732	28,437
Loss of House Utensils	905	755	1,870	3,383	2,821	2,353	1,962	1,637	1,870	1,560
Loss of Crops	469	469	469	469	469	469	469	469	469	469
Loss of Business Assets	1,900	1,900	1,900	1,900	1,900	1,900	1,900	1,900	1,900	1,900
Sub-Total	31,383	30,014	29,964	30,364	28,738	37,944	36,090	34,366	33,971	32,366
Loss of Roads	19,332	18,489	18,458	18,704	17,703	23,374	22,231	21,169	20,926	19,937
Loss of Utility	2,699	2,581	2,577	2,611	2,471	3,263	3,104	2,955	2,922	2,783
Loss of Infrastructure	22,031	21,070	21,035	21,315	20,174	26,637	25,335	24,125	23,848	22,721

D1 Area	11th Year	12th Year	13th Year	14th Year	15th Year	16th Year	17th Year	18th Year	19th Year	20th Year
Loss of House	268,514	258,856	249,576	240,659	232,090	242,263	233,499	225,081	258,085	249,091
Loss of House Utensils	8,212	6,849	16,974	3,383	2,821	2,353	1,962	1,637	16,974	14,157
Loss of Crops	2,870	2,870	2,870	2,870	2,870	2,870	2,870	2,870	2,870	2,870
Loss of Business Assets	26,606	26,606	26,606	26,606	26,606	26,606	26,606	26,606	26,606	26,606
Sub-Total	306,202	295,181	296,027	273,518	264,388	274,092	264,938	256,194	304,536	292,724
Loss of Roads	188,621	181,831	182,352	168,487	162,863	168,840	163,202	157,816	187,594	180,318
Loss of Utility	26,333	25,386	25,458	23,523	22,737	23,572	22,785	22,033	26,190	25,174
Loss of Infrastructure	214,954	207,217	207,811	192,010	185,600	192,412	185,986	179,848	213,784	205,492

2-3 Yearly change of the loss of infrastructure (4)

D3 Areas	11th Year	12th Year	13th Year	14th Year	15th Year	16th Year	17th Year	18th Year	19th Year	20th Year
Loss of House	65,244	62,502	59,881	57,374	54,976	56,181	53,827	51,575	59,047	56,662
Loss of House Utensils	2,111	1,761	4,363	3,639	3,035	2,531	2,111	1,761	4,363	3,639
Loss of Crops	174	174	174	174	174	174	174	174	174	174
Loss of Business Assets	9,502	9,502	9,502	9,502	9,502	9,502	9,502	9,502	9,502	9,502
Sub-Total	77,031	73,939	73,921	70,689	67,688	68,389	65,614	63,012	73,087	69,978
Loss of Roads	47,451	45,547	45,535	43,545	41,696	42,128	40,418	38,815	45,022	43,106
Loss of Utility	6,625	6,359	6,357	6,079	5,821	5,881	5,643	5,419	6,285	6,018
Loss of Infrastructure	54,076	51,905	51,892	49,624	47,517	48,009	46,061	44,234	51,307	49,124

All Areas	11th Year	12th Year	13th Year	14th Year	15th Year	16th Year	17th Year	18th Year	19th Year	20th Year
Loss of House	361,866	348,248	335,182	322,644	310,613	331,666	319,084	307,016	346,864	334,190
Loss of House Utensils	11,228	9,364	23,208	10,405	8,677	7,237	6,036	5,034	23,208	19,355
Loss of Crops	3,514	3,514	3,514	3,514	3,514	3,514	3,514	3,514	3,514	3,514
Loss of Business Assets	38,008	38,008	38,008	38,008	38,008	38,008	38,008	38,008	38,008	38,008
Sub-Total	414,617	399,134	399,912	374,571	360,813	380,425	366,642	353,572	411,594	395,067
Loss of Roads	255,404	245,867	246,346	230,736	222,261	234,342	225,852	217,800	253,542	243,361
Loss of Utility	35,657	34,326	34,392	32,213	31,030	32,717	31,531	30,407	35,397	33,976
Loss of Infrastructure	291,061	280,192	280,738	262,949	253,291	267,058	257,383	248,208	288,939	277,337

2-3 Yearly change of the loss of infrastructure (5)

C Area	21st Year	22nd Year	23rd Year	24th Year	25th Year	26th Year	27th Year	28th Year	29th Year	30th Year
Loss of House	30,659	29,317	28,036	26,811	29,097	27,820	27,915	26,714	25,567	24,469
Loss of House Utensils	1,301	1,085	905	755	1,870	1,560	1,301	1,085	905	755
Loss of Crops	469	469	469	469	469	469	469	469	469	469
Loss of Business Assets	1,900	1,900	1,900	1,900	1,900	1,900	1,900	1,900	1,900	1,900
Sub-Total	34,329	32,772	31,310	29,935	33,336	31,749	31,585	30,169	28,841	27,594
Loss of Roads	21,147	20,187	19,287	18,440	20,535	19,557	19,456	18,584	17,766	16,998
Loss of Utility	2,952	2,818	2,693	2,574	2,867	2,730	2,716	2,595	2,480	2,373
Loss of Infrastructure	24,099	23,006	21,980	21,015	23,402	22,288	22,173	21,178	20,246	19,371

D1 Area	21st Year	22nd Year	23rd Year	24th Year	25th Year	26th Year	27th Year	28th Year	29th Year	30th Year
Loss of House	246,436	248,620	242,053	233,719	269,252	259,528	276,882	306,370	295,845	285,716
Loss of House Utensils	11,807	9,847	8,212	6,849	16,974	14,157	11,807	9,847	8,212	6,849
Loss of Crops	2,870	2,870	2,870	2,870	2,870	2,870	2,870	2,870	2,870	2,870
Loss of Business Assets	26,606	26,606	26,606	26,606	26,606	26,606	26,606	26,606	26,606	26,606
Sub-Total	287,719	287,943	279,741	270,044	315,703	303,161	318,165	345,693	333,534	322,041
Loss of Roads	177,235	177,373	172,321	166,347	194,473	186,747	195,989	212,947	205,457	198,377
Loss of Utility	24,744	24,763	24,058	23,224	27,150	26,072	27,362	29,730	28,684	27,696
Loss of Infrastructure	201,979	202,136	196,378	189,571	221,623	212,819	223,352	242,676	234,141	226,073

2-3 Yearly change of the loss of infrastructure (6)

D3 Areas	21st Year	22nd Year	23rd Year	24th Year	25th Year	26th Year	27th Year	28th Year	29th Year	30th Year
Loss of House	54,379	56,254	53,986	51,814	80,108	76,719	74,122	78,692	75,461	72,369
Loss of House Utensils	3,035	2,531	2,111	1,761	4,363	3,639	3,035	2,531	2,111	1,761
Loss of Crops	174	174	174	174	174	174	174	174	174	174
Loss of Business Assets	9,502	9,502	9,502	9,502	9,502	9,502	9,502	9,502	9,502	9,502
Sub-Total	67,090	68,462	65,774	63,251	94,147	90,034	86,833	90,899	87,248	83,806
Loss of Roads	41,328	42,173	40,517	38,963	57,995	55,461	53,489	55,994	53,745	51,624
Loss of Utility	5,770	5,888	5,657	5,440	8,097	7,743	7,468	7,817	7,503	7,207
Loss of Infrastructure	47,097	48,060	46,173	44,402	66,091	63,204	60,957	63,811	61,248	58,832

All Areas	21st Year	22nd Year	23rd Year	24th Year	25th Year	26th Year	27th Year	28th Year	29th Year	30th Year
Loss of House	331,474	334,192	324,075	312,344	378,456	364,066	378,919	411,776	396,872	382,554
Loss of House Utensils	16,142	13,463	11,228	9,364	23,208	19,355	16,142	13,463	11,228	9,364
Loss of Crops	3,514	3,514	3,514	3,514	3,514	3,514	3,514	3,514	3,514	3,514
Loss of Business Assets	38,008	38,008	38,008	38,008	38,008	38,008	38,008	38,008	38,008	38,008
Sub-Total	389,138	389,177	376,825	363,231	443,186	424,944	436,583	466,761	449,623	433,441
Loss of Roads	239,709	239,733	232,124	223,750	273,003	261,765	268,935	287,525	276,967	266,999
Loss of Utility	33,466	33,469	32,407	31,238	38,114	36,545	37,546	40,141	38,668	37,276
Loss of Infrastructure	273,175	273,202	264,531	254,988	311,117	298,311	306,481	327,666	315,635	304,275

2-3 Yearly change of the loss of infrastructure (7)

C Area	31st Year	32nd Year	33rd Year	34th Year	35th Year	36th Year	37th Year	38th Year	39th Year	40th Year
Loss of House	23,421	24,345	30,245	28,960	27,731	26,556	26,069	35,343	33,822	32,368
Loss of House Utensils	1,870	1,560	1,301	1,085	905	755	1,870	1,560	1,301	1,085
Loss of Crops	469	469	469	469	469	469	469	469	469	469
Loss of Business Assets	1,900	1,900	1,900	1,900	1,900	1,900	1,900	1,900	1,900	1,900
Sub-Total	27,660	28,274	33,915	32,414	31,005	29,680	30,309	39,272	37,492	35,822
Loss of Roads	17,039	17,417	20,892	19,967	19,099	18,283	18,670	24,192	23,095	22,066
Loss of Utility	2,379	2,432	2,917	2,788	2,666	2,553	2,607	3,377	3,224	3,081
Loss of Infrastructure	19,417	19,848	23,808	22,755	21,766	20,836	21,277	27,569	26,319	25,147

D1 Area	31st Year	32nd Year	33rd Year	34th Year	35th Year	36th Year	37th Year	38th Year	39th Year	40th Year
Loss of House	283,861	287,344	313,479	302,629	296,536	306,214	300,334	308,220	299,248	289,179
Loss of House Utensils	16,974	14,157	11,807	9,847	8,212	6,849	16,974	14,157	11,807	9,847
Loss of Crops	2,870	2,870	2,870	2,870	2,870	2,870	2,870	2,870	2,870	2,870
Loss of Business Assets	26,606	26,606	26,606	26,606	26,606	26,606	26,606	26,606	26,606	26,606
Sub-Total	330,312	330,977	354,762	341,952	334,225	342,540	346,784	351,853	340,531	328,502
Loss of Roads	203,472	203,882	218,533	210,642	205,882	211,004	213,619	216,741	209,767	202,357
Loss of Utility	28,407	28,464	30,510	29,408	28,743	29,458	29,823	30,259	29,286	28,251
Loss of Infrastructure	231,879	232,346	249,043	240,050	234,626	240,463	243,443	247,001	239,053	230,608

2-3 Yearly change of the loss of infrastructure (8)

D3 Areas	31st Year	32nd Year	33rd Year	34th Year	35th Year	36th Year	37th Year	38th Year	39th Year	40th Year
Loss of House	69,880	70,969	68,080	65,314	63,291	61,198	58,746	60,412	58,613	56,277
Loss of House Utensils	4,363	3,639	3,035	2,531	2,111	1,761	4,363	3,639	3,035	2,531
Loss of Crops	174	174	174	174	174	174	174	174	174	174
Loss of Business Assets	9,502	9,502	9,502	9,502	9,502	9,502	9,502	9,502	9,502	9,502
Sub-Total	83,920	84,284	80,791	77,521	75,079	72,635	72,785	73,727	71,324	68,484
Loss of Roads	51,695	51,919	49,767	47,753	46,249	44,743	44,836	45,416	43,936	42,186
Loss of Utility	7,217	7,248	6,948	6,667	6,457	6,247	6,260	6,341	6,134	5,890
Loss of Infrastructure	58,912	59,168	56,715	54,420	52,705	50,990	51,095	51,757	50,070	48,076

All Areas	31st Year	32nd Year	33rd Year	34th Year	35th Year	36th Year	37th Year	38th Year	39th Year	40th Year
Loss of House	377,162	382,658	411,803	396,902	387,559	393,969	385,149	403,975	391,683	377,823
Loss of House Utensils	23,208	19,355	16,142	13,463	11,228	9,364	23,208	19,355	16,142	13,463
Loss of Crops	3,514	3,514	3,514	3,514	3,514	3,514	3,514	3,514	3,514	3,514
Loss of Business Assets	38,008	38,008	38,008	38,008	38,008	38,008	38,008	38,008	38,008	38,008
Sub-Total	441,892	443,535	469,468	451,887	440,309	444,856	449,879	464,852	449,347	432,808
Loss of Roads	272,205	273,218	289,192	278,363	271,230	274,031	277,125	286,349	276,798	266,610
Loss of Utility	38,003	38,144	40,374	38,862	37,867	38,258	38,690	39,977	38,644	37,221
Loss of Infrastructure	310,208	311,362	329,566	317,225	309,097	312,289	315,815	326,326	315,442	303,831

2-3 Yearly change of the loss of infrastructure (9)

C Area	41st Year	42nd Year	43rd Year	44th Year	45th Year	46th Year	47th Year	48th Year	49th Year	50th Year
Loss of House	30,978	29,649	31,834	30,461	29,148	27,894	30,150	28,845	27,597	26,405
Loss of House Utensils	905	755	1,870	1,560	1,301	1,085	905	755	1,870	1,560
Loss of Crops	469	469	469	469	469	469	469	469	469	469
Loss of Business Assets	1,900	1,900	1,900	1,900	1,900	1,900	1,900	1,900	1,900	1,900
Sub-Total	34,252	32,773	36,074	34,390	32,819	31,348	33,424	31,969	31,837	30,334
Loss of Roads	21,099	20,188	22,221	21,184	20,216	19,310	20,589	19,693	19,612	18,686
Loss of Utility	2,946	2,818	3,102	2,958	2,822	2,696	2,874	2,749	2,738	2,609
Loss of Infrastructure	24,045	23,007	25,324	24,142	23,039	22,006	23,464	22,442	22,350	21,295

D1 Area	41st Year	42nd Year	43rd Year	44th Year	45th Year	46th Year	47th Year	48th Year	49th Year	50th Year
Loss of House	295,249	285,420	281,941	275,810	268,683	263,062	297,986	288,752	278,800	283,078
Loss of House Utensils	8,212	6,849	16,974	14,157	11,807	9,847	8,212	6,849	16,974	14,157
Loss of Crops	2,870	2,870	2,870	2,870	2,870	2,870	2,870	2,870	2,870	2,870
Loss of Business Assets	26,606	26,606	26,606	26,606	26,606	26,606	26,606	26,606	26,606	26,606
Sub-Total	332,938	321,745	328,392	319,443	309,966	302,385	335,675	325,078	325,251	326,711
Loss of Roads	205,090	198,195	202,289	196,777	190,939	186,269	206,776	200,248	200,355	201,254
Loss of Utility	28,633	27,670	28,242	27,472	26,657	26,005	28,868	27,957	27,972	28,097
Loss of Infrastructure	233,722	225,865	230,531	224,249	217,596	212,274	235,644	228,204	228,326	229,351

2-3 Yearly change of the loss of infrastructure (10)

D3 Areas	41st Year	42nd Year	43rd Year	44th Year	45th Year	46th Year	47th Year	48th Year	49th Year	50th Year
Loss of House	57,882	55,573	53,361	55,084	57,484	55,170	83,776	80,697	77,313	77,468
Loss of House Utensils	2,111	1,761	4,363	3,639	3,035	2,531	2,111	1,761	4,363	3,639
Loss of Crops	174	174	174	174	174	174	174	174	174	174
Loss of Business Assets	9,502	9,502	9,502	9,502	9,502	9,502	9,502	9,502	9,502	9,502
Sub-Total	69,669	67,010	67,401	68,399	70,195	67,377	95,564	92,134	91,352	90,783
Loss of Roads	42,916	41,278	41,519	42,134	43,240	41,504	58,867	56,754	56,273	55,923
Loss of Utility	5,992	5,763	5,796	5,882	6,037	5,794	8,218	7,923	7,856	7,807
Loss of Infrastructure	48,908	47,041	47,315	48,016	49,277	47,299	67,086	64,678	64,129	63,730

All Areas	41st Year	42nd Year	43rd Year	44th Year	45th Year	46th Year	47th Year	48th Year	49th Year	50th Year
Loss of House	384,109	370,641	367,136	361,355	355,315	346,126	411,912	398,294	383,710	386,951
Loss of House Utensils	11,228	9,364	23,208	19,355	16,142	13,463	11,228	9,364	23,208	19,355
Loss of Crops	3,514	3,514	3,514	3,514	3,514	3,514	3,514	3,514	3,514	3,514
Loss of Business Assets	38,008	38,008	38,008	38,008	38,008	38,008	38,008	38,008	38,008	38,008
Sub-Total	436,859	421,528	431,866	422,232	412,979	401,111	464,662	449,180	448,440	447,829
Loss of Roads	269,105	259,661	266,029	260,095	254,395	247,084	286,232	276,695	276,239	275,863
Loss of Utility	37,570	36,251	37,140	36,312	35,516	34,496	39,961	38,629	38,566	38,513
Loss of Infrastructure	306,675	295,912	303,170	296,407	289,911	281,580	326,193	315,324	314,805	314,376

2-4 Annual benefits, costs and the cash flow (Plan-1)

	Construction Period	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year
Benefits for D1+D3		635,293	614,096	775,276	748,656	723,613	737,653	737,694	710,899	685,925	662,570
Cost	−7,121,241	−34,829	−34,829	0	0	0	0	0	0	0	0
Cash Flow	−7,121,241	600,464	579,267	775,276	748,656	723,613	737,653	737,694	710,899	685,925	662,570

	11th Year	12th Year	13th Year	14th Year	15th Year	16th Year	17th Year	18th Year	19th Year	20th Year
Benefits for D1+D3	714,931	690,910	692,318	648,509	627,859	645,569	625,267	605,956	705,382	679,985
Cost	0	0	0	0	0	0	0	0	0	0
Cash Flow	714,931	690,910	692,318	648,509	627,859	645,569	625,267	605,956	705,382	679,985

	21st Year	22nd Year	23rd Year	24th Year	25th Year	26th Year	27th Year	28th Year	29th Year	30th Year
Benefits for D1+D3	666,552	669,269	650,734	629,936	760,232	731,885	751,974	805,747	778,838	753,419
Cost	0	0	0	0	0	0	0	0	0	0
Cash Flow	666,552	669,269	650,734	629,936	760,232	731,885	751,974	805,747	778,838	753,419

	31st Year	32nd Year	33rd Year	34th Year	35th Year	36th Year	37th Year	38th Year	39th Year	40th Year
Benefits for D1+D3	767,689	769,442	803,978	776,611	759,302	769,296	776,775	787,005	763,645	738,337
Cost	0	0	0	0	0	0	0	0	0	0
Cash Flow	767,689	769,442	803,978	776,611	759,302	769,296	776,775	787,005	763,645	738,337

	41st Year	42nd Year	43rd Year	44th Year	45th Year	46th Year	47th Year	48th Year	49th Year	50th Year	Total
Benefits for D1+D3	747,905	724,327	736,306	722,775	709,701	692,003	796,635	772,761	771,726	773,243	36,026,411
Cost	0	0	0	0	0	0	0	0	0	0	−7,190,899
Cash Flow	747,905	724,327	736,306	722,775	709,701	692,003	796,635	772,761	771,726	773,243	28,835,512

2-4 Annual benefits, costs and the cash flow (Plan-2)

	Construction Period	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year
Total Benefits		690,011	666,408	833,804	804,710	777,347	789,207	789,306	760,223	733,125	707,794
Cost	−11,884,037	−34,829	−34,829	0	0	0	0	0	0	0	0
Cash Flow	−11,884,037	655,182	631,579	833,804	804,710	777,347	789,207	789,306	760,223	733,125	707,794

	11th Year	12th Year	13th Year	14th Year	15th Year	16th Year	17th Year	18th Year	19th Year	20th Year
Total Benefits	771,441	745,090	746,413	703,284	679,867	713,247	689,788	667,543	766,297	738,168
Cost	0	0	0	0	0	0	0	0	0	0
Cash Flow	771,441	745,090	746,413	703,284	679,867	713,247	689,788	667,543	766,297	738,168

	21st Year	22nd Year	23rd Year	24th Year	25th Year	26th Year	27th Year	28th Year	29th Year	30th Year
Total Benefits	728,077	728,143	707,120	683,982	820,066	789,018	808,828	860,190	831,021	803,479
Cost	0	0	0	0	0	0	0	0	0	0
Cash Flow	728,077	728,143	707,120	683,982	820,066	789,018	808,828	860,190	831,021	803,479

	31st Year	32nd Year	33rd Year	34th Year	35th Year	36th Year	37th Year	38th Year	39th Year	40th Year
Total Benefits	817,863	820,661	864,797	834,876	815,169	822,908	831,457	856,942	830,552	802,402
Cost	0	0	0	0	0	0	0	0	0	0
Cash Flow	817,863	820,661	864,797	834,876	815,169	822,908	831,457	856,942	830,552	802,402

	41st Year	42nd Year	43rd Year	44th Year	45th Year	46th Year	47th Year	48th Year	49th Year	50th Year	Total
Total Benefits	809,297	783,203	800,799	784,402	768,654	748,454	856,619	830,268	829,009	827,968	38,869,295
Cost	0	0	0	0	0	0	0	0	0	0	−11,953,695
Cash Flow	809,297	783,203	800,799	784,402	768,654	748,454	856,619	830,268	829,009	827,968	26,915,600

2-4 Annual benefits, costs and the cash flow (Plan-3)

	Construction Period	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year
Total Benefits		690,011	666,408	833,804	804,710	777,347	789,207	789,306	760,223	733,125	707,794
Cost	−12,806,773	−34,829	−34,829	0	0	0	0	0	0	0	0
Cash Flow	−12,806,773	655,182	631,579	833,804	804,710	777,347	789,207	789,306	760,223	733,125	707,794

	11th Year	12th Year	13th Year	14th Year	15th Year	16th Year	17th Year	18th Year	19th Year	20th Year	
Total Benefits	771,441	745,090	746,413	703,284	679,867	713,247	689,788	667,543	766,297	738,168	
Cost	0	0	0	0	0	0	0	0	0	0	
Cash Flow	771,441	745,090	746,413	703,284	679,867	713,247	689,788	667,543	766,297	738,168	

	21st Year	22nd Year	23rd Year	24th Year	25th Year	26th Year	27th Year	28th Year	29th Year	30th Year	
Total Benefits	728,077	728,143	707,120	683,982	820,066	789,018	808,828	860,190	831,021	803,479	
Cost	0	0	0	0	0	0	0	0	0	0	
Cash Flow	728,077	728,143	707,120	683,982	820,066	789,018	808,828	860,190	831,021	803,479	

	31st Year	32nd Year	33rd Year	34th Year	35th Year	36th Year	37th Year	38th Year	39th Year	40th Year	
Total Benefits	817,863	820,661	864,797	834,876	815,169	822,908	831,457	856,942	830,552	802,402	
Cost	0	0	0	0	0	0	0	0	0	0	
Cash Flow	817,863	820,661	864,797	834,876	815,169	822,908	831,457	856,942	830,552	802,402	

	41st Year	42nd Year	43rd Year	44th Year	45th Year	46th Year	47th Year	48th Year	49th Year	50th Year	Total
Total Benefits	809,297	783,203	800,799	784,402	768,654	748,454	856,619	830,268	829,009	827,968	38,869,295
Cost	0	0	0	0	0	0	0	0	0	0	−12,876,431
Cash Flow	809,297	783,203	800,799	784,402	768,654	748,454	856,619	830,268	829,009	827,968	25,992,864

2-4 Annual benefits, costs and the cash flow (Plan-4)

	Construction Period	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year
Total Benefits		690,011	666,408	833,804	804,710	777,347	789,207	789,306	760,223	733,125	707,794
Cost	−18,376,210	−34,829	−34,829	0	0	0	0	0	0	0	0
Cash Flow	−18,376,210	655,182	631,579	833,804	804,710	777,347	789,207	789,306	760,223	733,125	707,794

	11th Year	12th Year	13th Year	14th Year	15th Year	16th Year	17th Year	18th Year	19th Year	20th Year	
Total Benefits	771,441	745,090	746,413	703,284	679,867	713,247	689,788	667,543	766,297	738,168	
Cost	0	0	0	0	0	0	0	0	0	0	
Cash Flow	771,441	745,090	746,413	703,284	679,867	713,247	689,788	667,543	766,297	738,168	

	21st Year	22nd Year	23rd Year	24th Year	25th Year	26th Year	27th Year	28th Year	29th Year	30th Year	
Total Benefits	728,077	728,143	707,120	683,982	820,066	789,018	808,828	860,190	831,021	803,479	
Cost	0	0	0	0	0	0	0	0	0	0	
Cash Flow	728,077	728,143	707,120	683,982	820,066	789,018	808,828	860,190	831,021	803,479	

	31st Year	32nd Year	33rd Year	34th Year	35th Year	36th Year	37th Year	38th Year	39th Year	40th Year	
Total Benefits	817,863	820,661	864,797	834,876	815,169	822,908	831,457	856,942	830,552	802,402	
Cost	0	0	0	0	0	0	0	0	0	0	
Cash Flow	817,863	820,661	864,797	834,876	815,169	822,908	831,457	856,942	830,552	802,402	

	41st Year	42nd Year	43rd Year	44th Year	45th Year	46th Year	47th Year	48th Year	49th Year	50th Year	Total
Total Benefits	809,297	783,203	800,799	784,402	768,654	748,454	856,619	830,268	829,009	827,968	38,869,295
Cost	0	0	0	0	0	0	0	0	0	0	−18,445,868
Cash Flow	809,297	783,203	800,799	784,402	768,654	748,454	856,619	830,268	829,009	827,968	20,423,427

PART VIII: MINUTES OF MEETING

Section 1: Supporting Report

1. Inception Report (IC/R) Meeting

2. 1st PCC Meeting

3. 2nd PCC Meeting

4. 3rd PCC Meeting

5. Meeting on Draft Final Report

1. Inception Report (IC/R) Meeting

MINUTES OF MEETING
BETWEEN
THE JAPAN INTERNATIONAL COOPERATION AGENCY
AND
THE MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT
OF TUVALU
ON
THE INCEPTION REPORT OF THE JAPANESE TECHNICAL COOPERATION PROJECT
ON
THE STUDY FOR ASSESSMENT OF ECOSYSTEM, COASTAL EROSION AND PROTECTION/REHABILITATION OF DAMAGED AREA IN TUVALU

The Expert of the Japan International Cooperation Agency (henceforth "JICA") on the technical cooperation for "The Study for Assessment of Ecosystem, Coastal Erosion and Protection/Rehabilitation of Damaged Area in Tuvalu" (henceforth "the Study"), entrusted by JICA to conduct the Study, was sent to Tuvalu with the purpose of explaining and discussing the Inception Report (henceforth "IC/R").
The Expert explained IC/R and held a series of discussions with pertinent Tuvalu authorities for the successful implementation on the Study.
As a result of the discussions, JICA and Tuvalu authorities agreed to the matters mentioned in the attached document.

Funafuti, Tuvalu, September 2, 2009

Mr. Sam FINIKASO
Acting Secretary,
Ministry of Natural Resources and Environment,
Tuvalu

Dr. Takayoshi KURATA
The Team Leader,
JICA Study Team,
Japan International Cooperation Agency,
Japan

ATTACHED DOCUMENT TO MINUTES OF MEETING

1. Inception Report (IC/R) Meeting

Ministry of Natural Resources and Environment (henceforth MoNRE) basically accepted the IC/R with further clarification. Ministry of Natural Resources and Environment reached an agreement to support to implement the project. The leader of JICA study team also promised to make the most of the efforts to direct to success of the project through his explanation.

In this meeting, several valuable comments are provided in the following.

1) Public awareness is significant to avoid misleading the purpose of this project. This is because various groups and communities based on various cultural backgrounds exist here in Tuvalu. Therefore, additional discussions and seminars/meetings involving locals in respective generation will be needed as much as possible to lead our project successfully. In sum, communicating with locals is a robust factor to obtain a successful conclusion.

2) Hiring local person using local language is crucial to communicate with locals properly.

3) The outcome of the project should be considered to be linked to the next future plan as soon as possible after the completion of project even though the target year of the project is 2020.

4) This project particularly focuses on ecological aspect. Including the context of biological issue is significant to resolve the environmental problems such as coastal protection issues due to the consideration of sand production system on biological things. JICA study team recognized the above-mentioned matter.

5) The impact of human and livestock is crucial to be influential to the amount of nutrients in the seawater. JICA study team recognized the above-mentioned matter.

6) Finally, the Acting Secretary expects to feedback on this project and to achieve the successful conclusion.

ANNEX-1 List of the Members of the Attendance of Inception Report Meeting

R. K

ANNEX-1

List of the Members of the Attendance of Inception Report Meeting

		NAME	RESPONSIBILITY	INSTITUTION	E-mail
Tuvalu Side	1	Mr. Sam FINIKASO	Acting Secretary	Ministry of Natural Resources and Environment	sfinikaso@gov.tv
	2	Mr. Mataio TEKINENE	Director	Environment Dept. Ministry of Natural Resources and Environment	mtekinene@gov.tv
	3	Mr. Kilif T ・OBRIEN	EIA Officer	Environment Dept.	obrienkilifi@gmail.com
	4	Mr. Ian FRY	International Environmental Officer	Environment Dept.	Ianfry@envtuvalu.net
	5	Mr. Solonmona LOTOALA	Biodiversity Officer	Environment Dept.	smetia@gov.tv
	6	Mr. Tupulaga POULASI	Research Officer	Fisheries Dept.	tpoulasi@gov.tv
	7	Ms. Hellani TUMUA	Secretary	Funafuti Kauple	bkaitu@yahoo.com
Japan Side	1	Dr. Takayoshi KURATA	Team leader Coastal Protection and Rehabilitation Plan	JICA Study Team	Takayoshi_kurata@kkc.co.jp
	2	Mr. Kuniaki TAKAHASHI	Vice-team leader Management of Operation	JICA Study Team	takahashi@fishengn.co.jp
	3	Mr. Takeyasu KIKUTA	Analysis of Natural Environmental Conditions	JICA Study Team	
	4	Mr. Toshihiro INKI	Facility / Cost Estimation	JICA Study Team	inki@fishengn.co.jp
	5	Mr.Yoji ISHII	Project Coordinator	JICA Study Team	Yoji_ishii@kkc.co.jp
	6	Mr.Kazuyoshi OGAWA	Development Policy Advisor	Office of Prime Minister	tuvaluogawa@gmail.com
	7	Ms. Fumiko MATSUDATE	Project Coordinator	JST Project	fumikotuvalu@gmail.com

Attendance sheet

No,	Name	Organization	Responsibility	E-mail	Signature
1	Dr. Takayoshi KURATA	JICA Study Team	Leader, Coastal Protection and Rehabilitation	Takayoshi_kurata@kkc.co.jp	[illegible]
2	Mr. Kuniaki TAKAHASHI	JICA Study Team	Vice - Team leader Management of Operation	takahashi@fishengn.co.jp	高橋
3	Mr. Takeyasu KIKUTA	JICA Study Team	Analysis of Natural Environmental conditions		菊田
4	Mr. Toshihiro INKI	JICA Study Team	Facility / Cost Estimation	inki@fishengn.co.jp	[illegible]
5	Ms. Fumiko MATSUDATE	JICA PROJECT COORDINATOR	Coordinator	fumikotuvalu@gmail.com	[illegible]
6	Mr. Kilifi O'Brien	DEPARTMENT OF ENVIRONMENT	LOCAL COUNTERPART/EIA	eia@tuvalu.tv / obrienkilifi@gmail.com	[illegible]
7	Mr. Mataio Tekinene	✓	Project Manager	mataiotekinene@yahoo.com	[illegible]
8				or mtekinene@gov.tv	
9	Mr Ian Fry	Dept of Env	International policy	ianfry@envtuvalu.net	[illegible]
10	MR Kazuyoshi OGAWA	Office of the Prime Minister	Development Policy Adviser (JICA EXPERT)	tuvaluogawa@gmail.com	小川
11	Mr. Solomona Lotoala	Dept of Environment	PROJECT OFFICER/BIODIVERSITY ECOLOGICAL STUDY	smetia@gov.tv	[illegible]
12	Mr. Tupulaga Poulasi	FISHERIES DEPT	RESEARCH OFFICER	tpoulasi@gov.tv	[illegible]
13	Mr Sam Finikaso	Acting Secretary of Natural Resources & Environment		sfinikaso@gov.tv	[illegible]
14	Ms Hellani Tumua.	Secretary, Funafuti Kaupule	Secretary.	bkaitua@yahoo.com.au	[illegible]
15	Mr. Yoji ISHII.	JICA Study Team	Project Coordinator	yoji-ishii@kkc.co.jp	Yoji Ishii

2. 1st PCC Meeting

MINUTES OF MEETINGS
ON
JAPANESE TECHNICAL COOPERATION AND STUDY
FOR
THE PROJECTS ON COASTAL Preservation
IN
TUVALU

AGREED UPON AMONG
THE PROJECT TEAMS OF TECHNICAL COOPERATION AND STUDY,
JAPAN INTERNATIONAL COOPERATION AGENCY
AND
MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT

Funafuti, Tuvalu, September 24th, 2009

Mr. Seve Lausaveve
Permanent Secretary
Ministry of Natural Resources and Environment
Government Tuvalu

Dr. Hajime Kayanne
Team Leader
The Project Team
Japan International Cooperation Agency
JAPAN

Dr. Takayoshi Kurata
Team Leader
The Study Team
Japan International Cooperation Agency
JAPAN

Witnessed by

Mr. Nariaki Mikuni
Deputy Director
JICA Fiji office
Japan International Cooperation Agency
JAPAN

Based on the Record of Discussions (hereinafter referred to as "R/D") for the Project for Eco-Technological Management of Tuvalu against Sea Level Rise(hereinafter referred to as "the Foram Sand Project") agreed on 31 March 2009 between Ministry of Natural Resources and Environment (hereinafter referred to as "MNRE") and the Japan International Cooperation Agency (hereinafter referred to as "JICA"), and the Scope of Work (hereinafter referred to as "S/W") for the Study for Assessment of Ecosystem, Coastal Erosion and Protection/Rehabilitation of Damaged Area in Tuvalu(hereinafter referred to as "J-PACE") agreed on 22 January 2009 between MNRE and JICA, JICA dispatched the two teams, one is for the Foram Sand Project(hereinafter referred to as "the Project Team") headed by Dr. Hajime Kayanne and another is for J-PACE (hereinafter referred to as "the Study Team") headed by Dr. Takayoshi Kurata.

The 1st Program Coordination Committee Meetings(hereinafter referred to as "PCC") was held on 23rd September 2009 chaired by Mr.Mataio Tekinene, Director of Environment Department in attendance with representative from counterpart organizations, where MNRE explained the summary of the two projects and confirmed functions and member of PCC, the Project Team presented progress and next schedule of the Foram Sand Project and the Study team submitted Inception Report of the Study(hereinafter referred to as "IC/R") and explain the contents of IC/R and work items, approaches, methodology and schedule of the J-PACE.

As a result of the meeting, MNRE, the Project Team, the Study Team and JICA reached the agreements referred to in the document attached hereto.

ATTACHED DOCUMENT

I. Acceptance of the plans of the Foram Sand Project and the J-PACE

1. Tuvalu side confirmed the progress and accepted the next schedule of the Foram Sand Project
2. Tuvalu side accepted the IC/R of the J-PACE

II. The Functions of PCC

1. The functions of PCC are accepted among members of PCC. The functions are as follows.

(1) To supervise the Foram Sand Project and J-PACE annual work plan in line with the Plan of Operation within the frameworks of R/D and S/W, respectively.

(2) To monitor and review the overall progress of the Project and the Study carried out under the above-mentioned annual work plan.

(3) To detect appropriate ways and solutions to any issues arising from or in connection with the Foram Sand Project and J-PACE.

2. The members of PCC are listed in ANNEX I . From this meeting, TANGO was added to the members of PCC mentioned on R/D.
3. Schedule and contents of PCC are planned as follows.

(1)2nd PCC (March 2010)

a. Updating their activities from committee members

b. The Study Team Report shall contain the interim progress of the Study(Progress Report)

c. The Project Team Report shall maintain progress of the project (report of previous research and next schedule reflected by previous research)

(2)3rd PCC (August or September 2010)

a. Updating their activities from committee members

b. The Study Team Report shall contain basic policy of the coastal protection plan (Interim Report)

c. The Project Team Report shall contain progress of the project (report of previous research and next schedule reflected by previous research)

(3)4th PCC (November 2011)

a. The Study Team Report shall contain the preliminary design on the priority project(s) (Draft Final Report)

(4)5th PCC (March 2011)

a. Updating their activities from committee members

b. The Project Team Report shall contain progress of the project (report of previous research and next schedule reflected by previous research)

(5) Schedule of PCC after 6th meeting will be decided before 5th PCC

III. The main points discussed at 1st PCC are recorded in Annex II

IV. The Participants of 1st PCC are listed in AnnexIII

Annex I

List of Members of PCC

I .Chairperson

Secretary for Natural Resources and Environment

II .Tuvaluan side

1. Representative(s) of the Office of Prime Minister
2. Representative(s) of Funafuti Kaupule
3. Representative(s) of the Department of Environment
4. Representative(s) of the Department of Land and Survey
5. Representative(s) of the Department of Fisheries
6. Representative(s) of the Meteorological Office
7. Representative(s) of the Department of Public Works
8. Representative(s) of the Department of Rural Development
9. Representative(s) of the Department of Planning and Budget
10. Representative(s) of the Department of Foreign Affairs and Labour
11. Representative(s) of Tuvalu Association of Non-Government Organization(TANGO)

III. Japanese side

1. Team leaders of the Foram Sand Project and J-PACE
2. Other Japanese experts/researchers
3. Representative(s) of JICA Fiji Office
4. Representative(s) of Japan Science and Technology Agency(JST)
5. Member(s) of missions dispatched by JICA

Annex Ⅲ

Attendance of Program Coordination Committee				
No.	Name			
1	Mr.	Tavau. Teii	Minister	Ministry of Natural Resources & Environment
2	Mr.	Samasoni Finikaso	Director	Ministry of Natural Resources & Environment
3	Ms.	Teniku Talesi	Assistant Secretary	Ministry of Natural Resources & Environment
4	Mr.	Kelesoma Saloa	Acting Senior Assistant Secretary	Office of the Prime Minister
5	Mr.	Kazuyoshi Ogawa	Development Policy Advisor	Office of the Prime Minister
6	Mr.	Sumeo Silu	Disaster Coordinator	Office of the Prime Minister
7	Ms.	Hellani Tumua	Secretary	Funafuti Kaupule
8	Mr.	Apinelu TILI	Environmental & Marine Resource	Funafuti Kaupule
9	Ms.	Simalua Enele	Economic Advisor	Planning & Budget Dept
10	Mr.	Faatasi Malologa	Director	Department of Land and Survey
11	Mr.	Ampelosa Tehulu	Director	Public Work Department
12	Ms.	Hilia Vavae	Director	Meteorological Office
13	Mr.	Tupulaga Poulasi	Research officer	Fisheries Department
14	Ms.	Annie Homasi	Coordinator	Tuvalu Association of NGO
15	Mr	Semese Alefaio	Project Manager	Tuvalu Association of NGO
16	Mr.	Mataio Tekinene	Director	Environment Dept.
17	Mr.	Solonmona Lotoala	Biodiversity Officer	Department of Environment
18	Mr.	Nariaki Mikuni	Deputy RR	JICA Fiji Office
19	Mr.	Wataru Ono	Program Officer	JICA Head Quarter
20	Mr.	Taku Iwaki	Chief of RPSD	Japan Science and Technology Agency(JST)
21	Dr.	Hajime Kayanne	Foram Sand Project	
22	Dr.	Hiromune Yokoki	Foram Sand Project	
23	Dr.	Kazuhiko Fujita	Foram Sand Project	
24	Dr.	Arthur Webb	Coastal Processes Advisor	SOPAC
25	Dr.	Takayoshi Kurata	JPACE	
26	Mr.	Takeyasu Kikuta	JPACE	
27	Mr.	Toshihito Inki	JPACE	
28	Mr.	Masahiko Takahashi	JPACE	
29	Mr.	Yoji Ishii	JPACE	
30	Ms.	Fumiko Matsudate	Project Coordinator	
31	Ms.	Silafaga Lalua	Reporter	Tuvalu Media Department
32	Mr.	Nakala Nia	Liaison Officer	NAPA
33	Mr.	Roshni Chaad	Disaster Program Manager	FSPI
34	Mr.	Shozo Tsunashima	Coordinator	NPO Tuvalu Overview
35	Ms.	Haurna Kitazoe	Coordinator	NPO Tuvalu Overview

Annex II

Minutes of Discussion at 1st PCC
(Question and Answer, Comments)

Question1.
Have the pilot sites of the projects been already decided? (SOPAC)
Answer:
Not yet. The sites would be decided based on the result of survey.

Question2.
If sand would be provided to Fongafale islands from another islands in Funafuti Atoll as nourishment, are there any impacts to the area where is selected as source of sand. (Meteorological Office)
Answer:
The impacts are going to be studied in the survey and the results are included in the plan suggested.

Question3.
Sand should be provided from other near countries like Fiji. It's easy to get sand. (Office of the Prime Minister)
Answer:
We think it is very important to make sand in Tuvalu in the view point of sustainability.

Question4.
Can the projects actually provide sand and protect the islands against the speed of sea level rising? (Office of the Prime Minister)
Answer:
Theoretically, it would be possible.

Question5.
Will the projects provide any countermeasures for coastal erosion against strong waves? (Office of the Prime Minister)
Answer:
J-PACE is going to survey and suggest necessary and urgent countermeasures against such waves.

Question6.
It is important to record and share the information about the contents of each PCC, because the participants of the PCC member might be changed at each PCC. (Office of the Prime Minister)
Answer:
PCC would be utilized to share information for the PCC member.

Question7.

The tasks and roles of C/P in these projects should be clarified (Office of the Prime Minister)

Answer:

We also would like to clarify as soon as possible, so we will discuss with C/P in this visit of the project teams.

Question8.

What is the role of the project coordinator, Ms. Matusdate? (Office of the Prime Minister)

Answer:

Her tasks are to coordinate between the two projects, and make synergy effect with the collaboration of the people related two projects including Tuvalu side.

Comment1

Polluted water which effected sand supply is important issue, and if any countermeasures would be necessary, it needs other budget and project. (Office of the Prime Minister)

Comment2

There are seawalls around Fongafale islands which are remaining or already destroyed, however, all of them were constructed without ecological view point. I expect the projects would suggest sea walls which are not only permanently but also ecological friendly.(Department of Land and Survey)

3. 2nd PCC Meeting

MINUTES OF MEETING
BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY
AND
THE MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT
OF TUVALU
ON
THE JAPANESE TECHNICAL COOPERATION PROJECT
ON
THE PROJECT FOR ECO-TECHNOLOGICAL MANAGEMENT OF TUVALU AGAINST SEA LEVEL RISE
AND
THE STUDY FOR ASSESSMENT OF ECOSYSTEM, COASTAL EROSION AND PROTECTION/REHABILITATION OF DAMAGED AREA IN TUVALU

Funafuti, Tuvalu, March 31st, 2010

The 2nd Program Coordination Committee Meeting (hereinafter referred to as "PCC") was held on the 31st of March, 2010 chaired by Mr. Mataio Tekinene, Director of environmental department in attendance with representative from counterpart organizations. The project for eco-technological management of Tuvalu against sea level rise (hereinafter referred to as "The Foram Sand Project") team explained the progress of "The Foram Sand Project". The study for assessment of ecosystem coastal erosion and protection/rehabilitation of damaged area in Tuvalu (hereinafter referred to as "The JPACE Project") team explained the contents of progress of "The JPACE Project" during Phase I. A series of discussions was held with the members of PCC for boosting mutual understanding about both projects. As a result of the meeting, the members of PCC agreed to the matters mentioned in the attached document.

Mr. Seve Lausaveve
Permanent Secretary
Ministry of Natural Resources and Environment
Government TUVALU

Dr. Hajime Kayanne
The Foram Sand Project Team Leader
Japan International Cooperation Agency
JAPAN

Dr. Takayoshi Kurata
The JPACE Project Team Leader
Japan International Cooperation Agency
JAPAN

ATTACHED DOCUMENT TO MINUTES OF MEETING

As a result of 2nd PCC meeting, Ministry of Natural Resources and Environment (hereinafter referred to as "MNRE"), "The Foram Sand Project", "J-PACE Project" and JICA reached the agreements given as the followings.

(1) The Tuvaluan side understood that Phase 1 (Field Study) was completed, as results of field surveys were collected and summarized.

(2) The Tuvaluan side also comprehended the principals on prioritization of target areas for short-term coastal protection measures.

(3) It is agreed that measures to be taken by both Foram Sand Project and J-PACE Project would not conflict each other; but, they shall be designed to integrate for short and long term contribution for building resilience of Fongafale Islet against sea level rise.

ANNEX- I List of the Members of PCC

1 Chairperson
Secretary for Natural Resources and Environment

2 Tuvaluan side
(1) Representatives of the Office of Prime Minister
(2) Representatives of Funafuti Kaupule
(3) Representatives of the Department of Environment
(4) Representatives of the Department of Land and Survey
(5) Representatives of the Department of Fisheries
(6) Representatives of the Meteorological Office
(7) Representatives of the Department of Public Works
(8) Representatives of the Department of Rural Development
(9) Representatives of the Department of Planning and Budget
(10) Representatives of the Department of Foreign Affairs and Labor
(11) Representatives of Tuvalu Association of Non-governmental Organizations

3 Japanese side
(1) Team leader of the Foram Sand Project
(2) Team leader of the Study Team of J-PACE
(3) Other Japanese Experts / Researchers
(4) Representatives of JICA Fiji Office
(5) Representatives of Japan Science and technology Agency (JST)
(6) Members of missions dispatched by JICA

ANNEX- II Memorandum of 2nd PCC (Purport)

31 March, 2010
at Vaiaku Lagi Hotel
Conference Room

[On Foram Sand]

- What is the cause of sand loss? [Seve Paeniu: SPREP]

→ It is due to totally artificial causes [Kayanne: Foram Sand]

- How much volume do you expect by regeneration of foram sand? [Seve]

→ Expected volume of sand transportation from ocean to lagoon by cutting causeway is 1,000m^3/year, which will be enhanced by foram farming. We will monitor increase of sand volume four (4) years later. [Kayanne]

- The recovery time of foram sand may take much longer than the JICA project (JST) period according to the Dr. Kayanne's explanation, and it is not likely to budget maintaining this project by the Tuvaluan side after the period. It is important to balance the sand recovery time and budget to conduct effective coastal protection caused by climate change and sea level rise. (Mataio Tekinene: Environment Dept.)
- Can foram sand be an effective measure for sea level rising? We can't wait 50 years. [Nakara Nia: NAPA]
- What was a main rational of foram sand project? Communities and politicians are concerned about protecting foreshores from sea level rise and storm surges. You need to clarify your project enriches the coastal environment but is not solving our problem. [Seve]

→ As the island is formed by foram and coral sand, sand supply is the fundamental requirement to cope with sea level rise and coastal erosion, and that what Foram Sand Project is doing. Without sand, we must maintain the island only by artificial measures. [Kayanne]

[On J-PACE]

- There are suggestions such as planting mangroves along shoreline, building seawall with drain pipe and/or tri-pod, and sand nourishment for mitigation against over-topping of waves. [Seve, Tuburaga Poulasi: Fishery Dept., Faatasi Malologa: Land and Survey Dept.]
- What is the implementation plan of emergency project? [Loototasi Morikao: Planning & Budget Dept.]
- Please note the Tuvaluan side is longing for not only plans, but actual implementation of the project. [Kazuyoshi Ogawa: Office of the Prime Minister]

→ It is difficult to say anything tangible on implementation at this point as a JICA representative. [Takagi: JICA]

- If fishing boats will not be able to use the shore by the coastal protection measure, consideration of substitution facility will be appreciated. [Uliao Lauti: Kauple]

→ Fishing boat mooring points, jetty and navigation channel to Amatuku Islet might be disturbed. I'd like to know how the villagers feel about it. [Takahashi: J-Pace]

→ The Japanese members' basic understanding is that structures which would obstruct littoral drift are not preferable as the coastal protection measures. [Takagi]

[Common Issues for Both Parties]

- What is a financial cost for opening of the causeway?

→ JICA has not determined to cut off the causeway. Although JICA and Foram Sand are quite sure that the method will be effective, JICA has to wait for results of evaluation of the effectiveness. [Takagi].

→ Foram Sand will conduct the evaluation. The cost varies by the type of bridge and design of cutting-off the causeway.[Kayanne]

- How are you planning to transform the technology to the Tuvaluans for sustainable operation? Local involvement and public awareness are crucial for sustainability. Can JICA fund for the core-technical team on this project? [Seve]

→ The Japanese side can not directly pay any salary for the C/P. But I think it is possible to afford other means such as accepting the staff from your side as training. [Takagi]

→ Foram Sand is conducting not only capacity building through cooperative research with the counterparts but also awareness activities such as school visitation for sand foram classes. Foram Sand will do everything to transfer technology to our C/P, and would like to invite C/P for training in Japan.[Kayanne]

(End)

4. 3rd PCC Meeting

MINUTES OF MEETING
BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY
AND
THE MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT
OF TUVALU
ON
THE JAPANESE TECHNICAL COOPERATION PROJECT
ON
THE PROJECT FOR ECO-TECHNOLOGICAL MANAGEMENT OF TUVALU AGAINST SEA LEVEL RISE
AND
THE STUDY FOR ASSESSMENT OF ECOSYSTEM, COASTAL EROSION AND PROTECTION/REHABILITATION OF DAMAGED AREA IN TUVALU

Funafuti, Tuvalu, August 12, 2010

The 3rd Program Coordination Committee Meeting (hereinafter referred to as "PCC") was held on the 11th of August, 2010 chaired by Mr. Seve Lausaveve, Permanent Secretary of Ministry of Natural Resources & Environment in attendance with representative from counterpart organizations. The project for eco-technological management of Tuvalu against sea level rise (hereinafter referred to as " Foram Sand ") team explained the current state of Foram Sand. The study for assessment of ecosystem coastal erosion and protection/rehabilitation of damaged area in Tuvalu (hereinafter referred to as "J-PACE") team explained the context of progress of J-PACE during Phase2 (Formulation of Coastal Protection / Rehabilitation Plan). A series of discussions was held with the members of PCC for boosting mutual understanding about both projects. As a result of the meeting, the members of PCC agreed to the matters mentioned in the attached document.

Mr. Seve Lausaveve
Permanent Secretary
Ministry of Natural Resources and Environment
Government of TUVALU

Mr. Juichiro Sasaki
Resident Representative, Fiji Office
Japan International Cooperation Agency
JAPAN

Dr. Hajime Kayanne
Foram Sand Project Team Leader
Japan International Cooperation Agency
JAPAN

Dr. Takayoshi Kurata
J-PACE Project Team Leader
Japan International Cooperation Agency
JAPAN

ATTACHED DOCUMENT TO MINUTES OF MEETING

As a result of the 3rd PCC meeting, Ministry of Natural Resources and Environment (hereinafter referred to as "MNRE"), Foram Sand, J-PACE and Japan International Cooperation Agency (hereinafter referred to as "JICA") reached the agreements given as the followings.

(1) Coastal protection measures shall be actively developed in cooperation with Foram Sand and J-PACE.

(2) The Tuvaluan side understands the progress of Foram sand, which has been achieved through close cooperation between Tuvalu and Japan.

(3) The Tuvaluan side understands the scheme of Phase2 (Formulation of Coastal Protection / Rehabilitation Plan) and contents of interim report mentioned by J-PACE.

(4) The Tuvaluan side also comprehends that gravel nourishment in priority areas for short-term coastal protection measures.

(5) Tuvaluan side agrees that the newly created land with gravel nourishment shall be supervised under the responsibility of Tuvaluan side.

(6) Tuvaluan side recognizes that coastal protection measures shall be maintained and managed continuously by Tuvaluan side.

ANNEX- I List of the Members of PCC

1 Chairperson
Secretary for Natural Resources and Environment

2 Tuvaluan side
(1) Representatives of the Office of Prime Minister
(2) Representatives of Funafuti Kaupule
(3) Representatives of the Department of Environment
(4) Representatives of the Department of Land and Survey
(5) Representatives of the Department of Fisheries
(6) Representatives of the Meteorological Office
(7) Representatives of the Department of Public Works
(8) Representatives of the Department of Rural Development
(9) Representatives of the Department of Planning and Budget
(10) Representatives of the Department of Foreign Affairs and Labor
(11) Representatives of Tuvalu Association of Non-governmental Organizations

3 Japanese side
(1) Representatives of JICA Headquarter
(2) Representatives of JICA Fiji Office
(3) Team leader of Foram Sand
(4) Team leader of J-PACE
(5) Foram sand Researchers / J-PACE Experts

ANNEX-Ⅱ Minutes of Discussion at the 3rd PCC (Question and Answer, Comments)

[On Foram Sand]

- What is the cost / benefit in the case of open–cut the causeway ? (Uatea Salesi : PWD)

→ It depends on how many years we estimate for the benefit.
Benefit estimate for a long time scale is necessary. (Kayanne)

- Tell me how to access the northern areas if the causeway is cut off. (Seve Lausaveve : MNRE.)

→ New bridge will be constructed, beneath which sand and water can pass through. Another benefit to open-cut the causeway is that water quality would be improved in the lagoon side due to water exchange between the lagoon and ocean sides (Kayanne)

- Has funding be prepared for the open-cut causeway and the new construction by Japanese side ?(Lototasi Monkao : Planning & Budget Dept)

→ Cutting off causeway is still an idea at this moment. First of all, we must evaluate all the positive and negative effects from scientific approaches (Sasaki)

- How many years does it take to form sandy beach? (Uliao Lauti, Funafuti kaupule)

→ 10 years will be required for regeneration of the sand. The short-term protection measures will be proposed by J-PACE, and Foram Sand will propose rehabilitation of natural beach and island formation process with longer timescales. We must continue monitoring this sandy beach in the long run. (Kayanne)

- What is the driving force of the movement of sand ? The volume of sand increases or decreases.

→ Wave is the major driving force. The volume is almost the same. (Yokoki)

[On J-PACE]

- Is it enough to use materials from coral areas for refilling for the excavation areas? Also, we may need consultations before implementations. (Uatea Salesi : PWD)

→ Surely, we are going to discuss about this matter. (Inki)

- What are effects to three islands due to collect gravel? (Seve Lausaveve: MNRE)

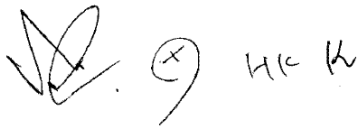
→ They are no-mans land and expanding / accumulating, hence, returning pre-status of the lands may be taken in a few years (Inki)

- Why is the sea sand filled directly into the borrow pit areas instead of excavating and refilling beside the runway? Anything happen? (Vinga Paelate :Civil Aviation Officer)

→ Because the sea sand will be easily lost away from the borrow pit, therefore, we currently consider using sand bags even when refilling with sea sand (Inki)

- I suggest that there is a need to consult with civil aviation bureau and Air Pacific when the side of runway is excavated (Vinga Paelate :Civil Aviation Officer)

→ I get the point and am going to make arrangements beforehand (Inki)



- Beach nourishment is not a countermeasure for sea level rise. Also, in the case of emergency included cyclone and high tides, they may be washed away. We experienced that some part of the seawall made with concrete blocks were washed away by high waves
  What are the main points to be related with sea level rise? (Nakala Nia : NAPA)

→ The seawall of concrete blocks collapsed may be too steep to stabilize against high waves. We should focus on not only sea level rise but also other effects due to climate change such as the increase in typhoon intensity. The gravel nourishment can prevent the hinterland from natural disasters concerning climate change. In Foram Sand project, the sand will be regenerated in long-term period. It may be expected that the sand generated may be used to strengthen the island. (Takagi and Kayanne).

- What is the relation between gravel nourishment proposed by J-PACE and sand beach regeneration proposed by Foram Sand? (Seve Lausaveve : MNRE)

→ Sand will firstly accumulate at the foot of gravel nourished beach, and in the long run we expect the gravel nourished beach will be all covered by sand.(Kayanne)

- Have you ever checked the environmental assessment in the coastal protection areas in this project ? (Observer)

→ According to SOPAC EIA research, it was concluded that they are stable and guarantees of safety in the case of collecting the sand. Also, we will consider the environments involving biological factors. (Inki)

- Tell me how to settle on the land owner problems after gravel nourishment? (Faatasi : Land & Survey Dept).

→ The newly created land, which should be acknowledged as a public land by Tuvalu goverment, shall be supervised responsibly by Funafuti Kaupule (Uliao Lauti: Funafuti Kaupule).

General

- The final report of J-Pace will be submitted by the next January. After receiving the report, Tuvalu government should carefully consider the feasibility of the project and may issue the official request for the donors including Japan. Also both two projects should be recognized as those with high priority in the scheme of NAPA (Sasaki : JICA Fiji Office).

ANNEX-Ⅲ The Attendant Sheet of the 3rd PPC Meeting

Attendance of Program Coordination Committee				
No.	Name			
1	Mr.	Seve Lausaveve	Permanent Secretary	Ministry of Natural Resources & Environment
2	Hon.	Tien, Chung-Kwang	Ambassador	Embassy of the Republic of China
3	Mr.	Eric Su	The Third Secretary	Embassy of the Republic of China
4	Ms.	Siliaati・T・Filiake	Acting Senior Assistant Secretary	Office of the Prime Minister
5	Mr.	Andrew Ionatana	President	Funafuti Kaupule
6	Mr.	Uliao Lauti	Secretary	Funafuti Kaupule
7	Ms.	Lototasi Monkao	Senior Aid Advisor	Planning & Budget Dept
8	Ms.	Litia Mawi	UN Volunteer	Planning & Budget Dept
9	Mr.	Faatasi Malologa	Director	Department of Land and Survey
10	Mr.	Ane Talia	Assistant Surveyer	Department of Land and Survey
11	Mr.	Uatea Salesi	civil engeneer	Public Work Department
12	Ms.	Hilia Vavae	Director	Meteorological Office
13	Mr.	Taasi Pitoi	Director	Marine Department
14	Mr.	Uinga Pailate	Acting Director	Office of Civil Aviation
15	Mr.	Tupulaga Poulasi	Research officer	Fisheries Department
16	Mr.	Paeniu Lopati	Research officer	Fisheries Department
17	Mr.	Salemona tanielu	SNC officer	Department of Environment
18	Mr	Juichiro Sasaki	Regional Representative	JICA Fiji Office
19	Mr.	Hiroshi Takagi	Disaster Management Division	JICA Head Quarter
20	Mr.	Minoru Tamura	Project Fomulation Advisor(Environment)	JICA Fiji Office
21	Mr.	Hajime Kayanne	Project team leader	Foram Sand Project
22	Mr.	Hiromune Yokoki	Expert of Coastal Engineering	Foram Sand Project
23	Dr.	Daisaku Sato	Expert of Coastal Engineering	Foram Sand Project
24	Mr.	Takashi Hosono	Expert of Marine Ecology	Foram Sand Project
25	Dr.	Yuji Kuwahara	Expert of Coastal Engineering	Foram Sand Project
26	Dr.	Mashashi Fujita	Expert of Water Quarity	Foram Sand Project
27	Dr.	Koji Yamada	Expert of Coastal Engineering	Foram Sand Project
28	Dr.	Fumiko Matsudate	Coordinator	Foram Sand Project
29	Dr.	Takayoshi Kurata	Project team leader	J-PACE
30	Dr.	Kuniaki Takahashi	Project vice-team leader	J-PACE
31	Dr.	Takeyasu Kikuta	Expert of analysis of natural and environmental conditions	J-PACE
32	Ms.	Toshihito Inki	Expert of facility and cost estimation	J-PACE
33	Dr.	Yoji Ishii	Project coordinator	J-PACE
34	Mr.	Silafaga Laula	Journalist	Tuvalu Media Department
35	Mr.	Nakala Nia	Liaison Officer	NAPA
36	Ms.	Etita Morikao	Local Coordinator	UNDP
37	Ms.	Haruna Kitazoe	Coordinator	NPO Tuvalu Overview
38	Mr.	Kaoru Kaganoi	Volunteer Staff	NPO Tuvalu Overview
39	Ms.	Tota.Wa	Taiwaneese Voluntter	Solid Waste Manegement Office

5. Meeting on Draft Final Report

MINUTES OF MEETING
ON
THE DRAFT FINAL REPORT
FOR
THE STUDY FOR ASSESSMENT OF ECOSYSTEM, COASTAL EROSION AND PROTECTION/REHABILITATION OF DAMAGED AREA IN TUVALU

Based on the Scope of Work for the study for Assessment of Ecosystem, Coastal Erosion and Protection/Rehabilitation of damaged area in Tuvalu (hereinafter referred to as "the Study") signed on January 22, 2009, Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the study team for the Study (hereinafter referred to as "the Study Team") from August 25, 2009.

The Study Team held a series of meetings with the officials of the Ministry of Foreign Affairs, Environment, Trade, Labour and Tourism (hereinafter referred to as "the Ministry") and other authorities concerned with the Study, and conducted the site surveys.

In the course of discussions on the Draft Final Report (hereinafter referred to as "DF/R"), both sides confirmed the main items described on the attached sheets.

Funafuti, Tuvalu, January 12, 2011

Mr. Tapugao Falefou
Permanent Secretary
Ministry of Foreign Affairs,
Environment, Trade, Labour and
Tourism
TUVALU

Dr. Takayoshi Kurata
Team Leader
Study for Assessment of Coastal
Erosion and Protection/Rehabilitation of
Damaged Area in Tuvalu
Japan International Cooperation Agency
JAPAN

Witnessed by

Mr. Satoru Mimura
Senior Advisor to the Director General
Southwest Asia 1 and Pacific Department
Japan International Cooperation Agency
JAPAN

ATTACHED DOCUMENT TO MINUTES OF MEETING

The Study Team submitted 10 copies of the DF/R to the Ministry on January 10, 2011. The Tuvaluan side and the Study Team held a meeting in Funafuti on DF/R chaired by the Director of the Department of Environment of the Ministry on January 12, 2011. The Study Team explained the contents of DF/R of the Study to the meeting participants from the Government of Tuvalu, Kaupule and other related organizations listed in ANNEX-1.

As a result of the discussions, the Ministry and the Study Team confirm the following;

(1) The Study Team explained to the Tuvaluan side about the contents of DF/R. Comments raised at the meeting are shown in ANNEX-2. Further comments by the Government of Tuvalu will be submitted to the Japanese side in written form by the end of January, 2011.

(2) The Study Team explained to the Tuvaluan side that corrections and modifications on the DF/R will be incorporated into the Final Report (hereinafter referred to as "F/R"). F/R will be submitted to the Tuvaluan side by the end of February, 2011.

(3) The Japanese side explained rationale of appropriateness of gravel nourishment and inadequateness of a massive seawall for Fongafale Islet. The Tuvaluan side understood the countermeasures proposed in DF/R as a suitable way of protecting the area damaged due to coastal erosion.

(4) The Tuvaluan side will promote discussion between the Government and stakeholders towards the implementation of the plan on the condition that;
1. the plan shall be recognized as the governments' priority and mentioned in National Adaptation Programme of Action (hereinafter referred to as "NAPA"), and
2. the Tuvaluan side shall assume the responsibility on the official clarification that the ownership of the land reclaimed under the plan shall vest in the Crown.

(5) The Tuvaluan side understood the necessity of the pilot project for the purpose of;
1. confirmation of the gravel movement of the gravel nourishment,
2. selection of an appropriate construction method for filling up borrow-pits, and
3. tests in-situ for getting an official permission of gravel collection at safety zone along the runway.

(6) The Tuvaluan side takes responsibility of the maintenance works for the beach including;
1. collection and restoration of gravels washed up onto the land,
2. policing illegal mining from the newly created beach, and
3. planting for mitigating coastal hazards, stabilizing the newly created beach and improving the scenery along the beach.

The Tuvaluan side also takes responsibility of monitoring which is essential for securing the sustainability of the newly created beach.

(7) The Tuvaluan side shall explain the contents of the DF/R to development partners for further cooperation.

ANNEX- I List of the Members of the Committee

1 Chairperson
Permanent Secretary for Ministry of Foreign Affairs, Trade, Environment, Labour and Tourism

2 Tuvaluan side
(1) Representatives of the Office of Prime Minister
(2) Representatives of Funafuti Kaupule
(3) Representatives of the Department of Environment
(4) Representatives of the Department of Land and Survey
(5) Representatives of the Department of Fisheries
(6) Representatives of Marine, Harbour & Port Services Department
(7) Representatives of the Meteorological Services Department
(8) Representatives of the Department of Civil Aviation
(9) Representatives of the Public Works Department
(10)Representatives of the Department of Planning and Budget
(11)Representatives of the Department of Foreign Affairs

3 Japanese side
(1) Representatives of JICA Headquarter
(2) Team Leader and Experts of JICA Study Team

ANNEX- II Minutes of Discussion at the DF/R meeting (Comments and Questions)

Office of the Prime Minister
Q1-What is the life span of the mechanism of reproduction of foram sand?
A1-You can ask this question at the next PPC meeting for Foram Sand and gather the related information at that time.

Office of the Prime Minister
Q-2 What is the environmental impact in the case of the lagoon dredging?
A-2 SOPAC had already studied that. Sand is stable at a deeper than 15m water depth, on the other hand, sand of shallow water is quickly moving. Hence, in order to minimize the impact, dredging shall be conducted in deep sea-bed areas.

PWD
Q-3 The sand is fine at deep areas. Are any adverse effects in the conduct of dredging there?
A-3 We will enclose the dredging areas with silt fence to prevent the contamination.

Department of Environment
Q-4 What is the environmental impact in the case of carrying gravel from remote islets and shallow waters? Are there any impacts of the erosion at the remote islets?
A-4 Gravel is collected from three remote islets. The fragments of coral are accumulated and recovered by waves at sea shore of the islets. The impacts would be minimal.

PWD
Q-5 How is the pilot project implemented?
A-5 Our purpose is to recover the original form of island, which had been artificially deformed during WW II. Then it should be restored with considering of the minimization of the environmental impact. We have carried out simulation with computer, however some impacts which we had not expect might be occurred. That is why we are trying to recommend the Pilot Project.

Civil Aviation
Q-6 Why not make countermeasures at the ocean side of the Fongafale?
A-6 The problems at ocean side are mainly caused by human activity, artificial works, such as destruction of stormridge. Apart from the damages caused by artificial activities, most urgent issues are in the lagoon side, thus we are forcusing on the lagoon side.

Civil Aviation
Q-7 For securing the operation of the aviation, would it be better to get gravels from the outside of TUVALU instead of removing from the runway ?
A-7 There will be no problem for operation. The characteristic features of sand is fine, and suitable for back-filling in replacement. SOPAC also agrees to use sand in the lagoon to back-fill the land. This will be implemented on a trial basis through the pilot project.

Ministry of Foreign Affairs, Environment, Trade, Labor and Tourism
C-8 I understand that beach nourishment is the best way among the three possible options as J-PACE mentioned. I just wish this project would be implemented by the Government of Japan.

Ministry of Foreign Affairs, Environment, Trade, Labor and Tourism
Q-9 Can the project implement at off-island areas instead of at the existing coastal line ?
A-9 Going far from the coastal line, it is getting deeper in water depth. The area reclaimed is not for human habitat, but for preventing disasters. It is a buffer zone.

Ministry of Foreign Affairs, Environment, Trade, Labor and Tourism
Q-10 Is it possible to construct beach nourishment around island-wide areas?
A-10 It might not be an original island's form and also sand drift might be blocked with these structures.

PWD
Q-11 Are there any compensation for the people living at interface between newly created land and existing land ?
A-11 Major benefits of the project are preventing disasters.

Ministry of Foreign Affairs, Environment, Trade, Labor and Tourism
C-12 Land ownership is crucial to control gravel extraction at the newly created land.

NAPA
C-13 NAPA was planning to construct sea wall, however, I agree with the idea proposed by J-PACE. Funafuti Kaupule had the plan to construct seawall at Tepuka Islet, but they changed it to Fongafale Islet, so no seawall will be expected.

Department of Environment
C-14 We hope the project will be implemented in the near future.

Kaupule
C-15 It is an important project against coastal erosion. We are looking for successful outcome.

ANNEX-Ⅲ The Programe of the DF/R Meeting

AGENDA OF THE DRAFT FINAL REPORT MEETING

The Study for Assessment of Ecosystem, Coastal Erosion and Protection/Rehabilitation of Damaged area in Tuvalu

Date:12th January 2011
Time: 10:00 ~ 12:00
Place: Conference room at 1st floor of the Vaiaku Lagi Hotel

Schedule

10:00	Opening Prayer	
	Welcoming Remarks	Mr. Tapugao Falefou : Permanent Secretary of Ministry of Foreign Affairs, Environment, Trade and Labor
	Remarks	Mr. Satoru Mimura : Director of Pacific Division
	Briefing of the JICA projects	Dr. Hiroshi Takagi : Disaster Management Division
10:15	Explanation of Draft Final Report by JICA Study Team	Dr. Takayoshi Kurata : Project Leader Mr. Kuniaki Takahashi : Vice Project Leader Mr. Toshihito Inki : Expert of Facility and Cost Estimation
11:30	Feedback/Comments from the members	
11:55	Closing remarks	Mr. Apinelu Tili : Funafuti Kaupule

ANNEX-IV The Attendant Sheet of the Draft Final Report Meeting

No.	Prefix	Name	Duty Position	Affilitation
1	Mr.	Tapugao Falefou	Permanent Secretary	Ministory of Foreign Affairs, Environment, Trade, Labour and Tourism
2	Mr.	Isaia Taape	Senior Assistant Secretary	Office of the Prime Minister
3	Mr.	Larry R.L. Tseng	Ambassador	Embassy of the Republic of China
4	Mr.	Eric Su	The Third Secretary	Embassy of the Republic of China
5	Mr.	Nobuaki Matui	Policy Advisor	Office of the Prime Minister
6	Ms.	Lototasi Morikao	Senior Aid Advisor	Department of Planning and Budget
7	Ms.	Letasi Iulai	Director of Planning Budgets	Department of Planning and Budget
8	Mr.	Uatea Salesi	Civil Engeneer	Public Work Department
9	Mr.	Mataio Tekinene	Director	Department of Environment
10	Mr.	Satoru Mimura	Director	Pacific Division, JICA Head Quarter
11	Dr.	Hiroshi Takagi	Disaster Management Division	JICA Head Quarter
12	Dr.	Takayoshi Kurata	Project Team Leader	JICA Study Team
13	Mr.	Kuniaki Takahashi	Project Vice-Team Leader	JICA Study Team
14	Mr.	Takeyasu Kikuta	Expert of Natural Conditions	JICA Study Team
15	Ms.	Toshihito Inki	Expert of Facility and Cost	JICA Study Team
17	Mr.	Yoji Ishii	Project Coordinator	JICA Study Team
18	Ms.	Fumiko Matsudate	Project Coordinator	Foram Sand Project
19	Mr.	Silafaga Laula	Journalist	Tuvalu Media Department
20	Mr.	Nakala Nia	Liaison Officer	NAPA
21	Ms.	Toto Fu	Waste Volunteer	Volunteer of China
22	Mr.	Trent	Third Secretary	Embassy of the Republic of China
23	Mr.	Apinelu Tili	Kaupule	Funafuti Kaupule
24	Ms.	Pasuna Tuaga	Assistant Secretary	Ministory of Foreign Affairs
25	Mr.	Vitoli	Department of Civil Aviation	Department of Civil Aviation
26	Dr.	Nese Conway	Director of Health	Department of Health
27	Ms.	Etita Morikao	Local Coordinator	UNDP