

Earthquake & Tsunami Emergency Support Project

ETESP

Interpretation of Laboratory Data for ETESP Irrigation Component

Laboratory Data Summary

ETESP Banda Aceh

Kabupaten: **Aceh Besar**

Chemical Characteristics of - **Deposits**

Scheme: **Blang Luas**

(Refer below for Original & Mixed Soil Data)

Tsunami Deposit														Exchangeables						Saturations			
Site	Text	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	S ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %
							H	Al						Ca	Mg	K	Na	CEC	TEB				
BL A2	LS	0 - 40	36.00	8.00	8.00	0.00	0.23	0.18	6.80	128.50	1.44	0.13	11	9.66	1.43	0.34	2.20	14.61	13.63	10	2	1	93
		Rating	Ext Sal	Mod Alk	ND		Low	V Low	Mod / OK	Mod	Mod	Low	Good	Mod	Low	Mod	V High	Low	Mod	V Low	V Low	V Low	V High
BLA 8	S	0 - 20	34.50	8.00	6.70	1.30	0.19	0.20	14.60	234.10	0.42	0.11	4	6.23	0.72	0.13	0.97	10.18	8.05	7	1	2	79
		Rating	Ext Sal	Mod Alk	ND	ND	V Low	Low	Mod / OK	Mod	V Low	Low	V Poor	Mod	Low	Low	High	Low	Mod	V Low	V Low	V Low	High
BLE 7	LS	0 - 9	200.00	8.00	6.30	1.70	0.41	0.17	5.20	309.00	0.91	0.15	6	7.78	0.35	0.50	1.02	10.39	9.65	3	5	2	93
		Rating	Ult Sal	Mod Alk	ND	ND	Low	V Low	Mod / OK	Mod	Low	Low	Mod	Mod	V Low	Mod	High	Low	Mod	V Low	V Low	V Low	V High
BLD 0	S		47.0	7.8	6.9	0.90	0.23	0.16	4.7	239.3	0.26	0.08	3	8.49	1.26	0.19	1.19	12.72	11.13	10	1	1	88
		Rating	Ext Sal	Sl Alk	ND	ND	Low	V Low	Mod / OK	Mod	V Low	V Low	V Poor	Mod	Low	Low	High	Low	Mod	V Low	V Low	V Low	V High

To use this worksheet immediately rename it to your survey area, using the "Save As" menu routine

On the DATA + RATINGS sheet add your data to the white boxes

Shaded boxes will automatically fill with RATINGS and RATIOS

There are areas for:

Sediments laid down by the tsunami inundation

The original soil under the sediment, and

An automatic assessment of the properties if the sediment is mixed in with an equal depth of the original soil

Lime requirements and pH versus ASP will automatically show on the relevant pages

Up to 8 sites can be entered per worksheet

A limited summary of the overall, average data for the area is calculated for some parameters - for other parameters the operator should compile a summary

Some summary items / comments are, to some extent, experimental and based on experiences and considered opinion of more than one experienced soil scientist, but they should not be taken as guaranteed

(February 2006 – update of March 2006)

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Interpretation of Laboratory data for ETESP Irrigation Component

1. INTRODUCTION

The ETESP Soil Salinisation and Improvement Specialist was requested to “cast his eye” over the laboratory data being supplied to the Irrigation and Drainage component of ETESP. The data were sourced from the Northern Sumatra Irrigated Agriculture Sector project, which closed down in December 2005, with the laboratory analyses being carried out by C. Lotti and Associati, Consulting Engineers, Rome Italy.

ETESP Agriculture component was supplied a copy of the raw or semi processed soil data in mid December 2005 and the first rapid assessment was completed by late December when the Soil Salinisation and Improvement Specialist went on overseas leave. The manipulated dataset at that time was passed to the Irrigation and Drainage component by the ETESP Agriculture component team leader.

The study of the data and further manipulation recommenced in early February 2006.

The original dataset, in Microsoft Excel format, comprised the basic laboratory values for the standard soil analyses as shown in Table 1.

Table 1 Original Dataset Composition

Item	PSC			Salinity	Reaction / Acidity				Risk factors		Fertility			Exchangeables			
	S	Si	C	EC	pH	pH	H ⁺	Al ³⁺	Fe	S	OC	N	CEC	Ca	Mg	K	Na
Unit	%	%	%	mmhos/cm	H ₂ O	KCl	me/100g	me/100g	ppm	ppm	%	%	Me/100g	Me/100g	Me/100g	Me/100g	Me/100g
									Ferrous	SO ₄		Total					

In total there were data items for 203 samples from 38 planned irrigation schemes which fell within 7 separate Kabupaten or Kota boundaries.

Table 2 Areas with Schemes and Sample numbers

ACEH BESAR	ACEH JAYA	ACEH TIMUR	ACEH UTARA	BIREUEN	PIDIE	SINGKIL
38 samples	117 samples	2 samples	13 samples	13 samples	8 samples	12 samples
4 schemes	19 schemes	1 scheme	3 schemes	5 schemes	2 schemes	4 schemes
<i>Names</i>	<i>Names</i>	<i>Names</i>	<i>Names</i>	<i>Names</i>	<i>Names</i>	<i>Names</i>
Blang Luas Geunteut Lamsujen Krueng Geupeu Krueng Kala	Alue Monmata Baba Awe Baba Ie Blang Alue Gajah Blang Jempeuk Bunbun Jabie Krueng Tunong Kr. Ateu Kuala Meurisi Kulam Asan Lambaro Lambesoi Meudheun Meulha Panghuleu Harakat Rawa Krueng Itam Seneubok Padang Trenng Lipeh	Julok Tunong	Krueng Tuan Pase Kanan Pase Kiri	Pandrah Pate Lhong Paya Nie Peudada Samalanga	Beuracan Cubo Trienggading	Parakan Sulampi Sidorejo Tana Bara Ujung Bawang

In early march 2006 the sites at Baba Ie, Krueng Tunong, Lambaro and Meudheun were all visited for inspection plus further data collection. The data in this current report has been used in the ETESP Site Visit Report, “Irrigation Sites, Lhamno, Aceh Jaya, March 2006”.

2. DATA MANIPULATION

2.1 Aim

The main aim was to manipulate the data and use that data to establish the fertility status and the risk factors presented by the chemical composition of the soils for each sample, site, scheme and kabupaten. The latter being included to try and establish if regional location had much or any obvious effect on the soil chemical composition.

2.2 Procedure

Firstly the data set was studied to ensure that the units being reported were the internationally accepted norm – all apart from the salinity values appeared to be as expected and the salinity figures were converted to the now accepted EC (Electrical Conductivity) format of dS/m.

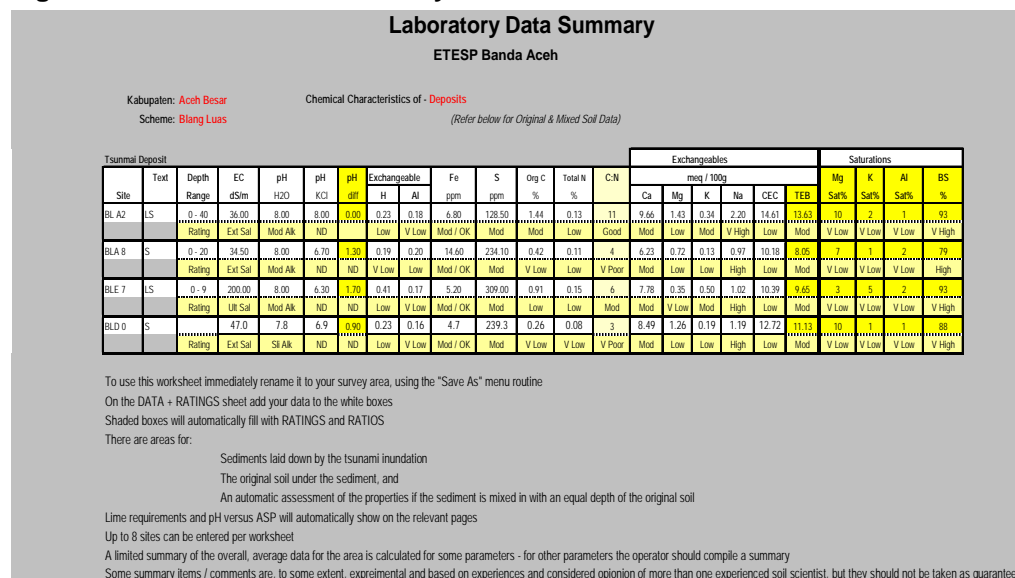
Next any obviously incorrect data items were either deleted or corrected, in some cases this was a matter of repositioning the decimal point which had been misplaced via a typographical error. Some values could not be corrected as they depended on other values and in such cases the “suspect” values were colour coded to ensure they were excluded once manipulation was undertaken.

The data were then added to the ETESP Agriculture component tool “ETESP Labdata Summary” sheet which is an MS Excel spreadsheet with inbuilt functions which calculate other parameters from the data and apply ratings to the various outputs. Each data subset was added to a separate form which carried the name of the scheme.

2.3 ETESP Labdata Summary

The format of this tool is that the data concerning sediments or topsoils was added to one table whilst the data for the subsoil (assumed to be the original soil) was added to another. The form then automatically adds a rating against every data item entered. At the same time the tool also combines the two above described table and adds a rating against the combined data – this was done since ETESP Agriculture component has determined that, unless the deposit is a deep sand, the sediment and the original soil should be mixed via ploughing.

Figure 1 ETESP Labdata Summary Tool



The tool finally calculates a “mean” value for the combined data and allocates a rating to it. This final step is done in order to try and establish average values and ratings for the whole scheme – this is on the assumption that the sampling was fully representative of the scheme.

This process gives an overall average or mean figure for the scheme which is the only meaningful way to use the data since actual locations for the sample points were not supplied.

Hardcopy of all the data are not presented in this report as there is just too much. However, the data can be studied and used directly on computer since the results have been copied to CD ROM and can be supplied on request.

Figure 2 Final Part of Output from Labdata Summary Tool

Kabupaten: Aceh Besar
Scheme: Blang Luas

Chemical Characteristics of - Soil Sediment Mixture
(Refer below for Mixed Soil Data)

Blang Luas Aceh Besar

IF YOU WISH TO CONTINUE and USE THE DATA ENTERED ABOVE THEN ADD THE SITE INDEX NUMBER (1 - 8) IN THE APPROPRIATE BOX (Use Index No) BELOW also CALCULATE or ESTIMATE TEXTURE OF MIXTURE

IF IN DOUBT ABOUT DATA OF ANY SAMPLE THEN OMIT FROM USE BY NOT ADDING THE INDEX NUMBER AND THAT DATA SET WILL NOT BE USED

Mixed: Deposit and Original Soil (Depth range based on theory that mixing is done to twice the depth of original sediment)										Exchangeables meq / 100g							Saturations				Cation Ratios		Cation Ratios						
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H2O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	Ca	Mg	K	Na	CEC	TEB	Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating	
								H	Al																				
1	1	SL		4.15	7.75	6.80	0.95	0.23	0.19	5.75	106.15	1.62	0.18	9.63	9.26	1.12	0.34	1.85	13.11	12.56	8.34	2.63	1.43	96.09	8.91	Mg deficient with P inhibition	3.28	OK	
		Rating		SI Sal	SI Alk	ND	ND	Low	V Low	Mod / OK	Mod	Low	Mod	Mod	Low	Mod	High	Low	Mod	V Low	V Low	V Low	V High						
2	2	SL		4.33	7.55	6.60	0.95	0.21	0.19	61.20	165.65	1.06	0.12	8.99	6.14	0.88	0.21	1.18	9.94	8.40	8.85	2.13	1.86	84.69	7.26	Mg deficient with P inhibition	4.55	OK	
		Rating		SI Sal	SI Alk	ND	ND	Low	V Low	High	Mod	Low	Mod	Mod	Low	Mod	High	Low	Mod	V Low	V Low	V Low	V High						
3	3	SL		17.70	7.40	5.95	1.45	0.23	0.17	6.65	229.20	1.11	0.15	7.40	7.31	0.77	0.44	1.24	10.73	9.75	7.06	4.12	1.54	90.93	13.98	Mg deficient with P inhibition	1.92	Mg deficient	
		Rating		High Sal	Neutral	ND	ND	Low	V Low	Mod / OK	Mod	Low	Mod	Mod	Low	Mod	High	Low	Mod	V Low	V Low	V Low	V High						
4	4	SL		3.35	7.35	6.30	1.05	0.13	0.17	40.20	126.65	1.38	0.16	6.81	8.61	1.48	1.03	12.94	11.26	11.41	1.13	1.31	87.03	5.94	Mg si deficient	11.82	K si deficient		
		Rating		Non Sal	Neutral	ND	ND	V Low	V Low	High	Mod	Low	Mod	Mod	Low	Low	High	Low	Mod	ND	V Low	V Low	V High						
5	5	SCI		5.00	7.40	6.55	0.85	0.13	0.20	11.65	157.90	2.70	0.28	8.45	7.75	2.32	0.19	1.83	14.30	12.08	16.13	1.30	1.40	84.50	3.40	OK	12.46	K deficient	
		Rating		SI Sal	Neutral	ND	ND	V Low	V Low	Mod / OK	Mod	Mod	Mod	Mod	Mod	High	Low	Mod	ND	V Low	V Low	V High							
6	6	SCI		1.68	7.35	6.50	0.85	0.03	0.17	11.80	3.80	0.55	0.09	6.44	6.93	1.32	0.11	0.74	10.20	9.09	12.82	1.07	1.67	88.99	5.35	Mg si deficient	12.01	K si deficient	
		Rating		Non Sal	Neutral	ND	ND	V Low	V Low	Mod / OK	ND	V Low	V Low	Mod	Mod	Low	Low	High	Low	Mod	ND	V Low	V Low	V High					
7																													
		Rating																											
8																													
		Rating																											
Mean for mixed soils				6.0	7.47	6.45	1.02	0.16	0.18	23	132	1.40	0.16	7.95	7.66	1.31	0.24	1.31	11.9	10.5	10.8	2.1	1.5	88.7	7.5	Mg deficient with P inhibition	7.67	OK	
Ratings for mixed soils				SI Sal	Neutral	ND	ND	V Low	V Low	Mod / OK	Mod	Mod	Low	Mod	Low	Low	High	Low	Mod	ND	V Low	V Low	V High						

A MANUAL SUMMARY FOR FERTILITY, DEFICIENCIES and REACTION SHOULD BE ATTEMPTED BASED ON THE ABOVE DATA AND ENTERED BELOW:

NB The recommended procedure is to mix sediments with the original, underlying soil - unless the sediment comprises deep sand when it should be physically removed or the land use changed

NB Accordingly the MANUAL SUMMARY should be done on the data presented above in the "Mixed: Deposit and Original Soil" table since this will be the situation when reclamation or development is done

NB Comments for Salinity, Iron precipitation, Iron toxicity and Acid Sulphate are generated automatically

Fertility: Inherent fertility is moderate to low with Organic Carbon, Total-N, C:N ratio and Total Exchangeable Bases (TEB) all rated as moderate. Application of organic manures (FYM and or compost suggested) plus mineral fertilisers

Potential: Fertility potential is rated as low with Cation Exchange Capacity (CEC) and the ability to retain added nutrients is rated as low with CEC ranging from 9.9 - 14.3me/100g. Application of organic manures will boost CEC and is suggested

Deficiencies: Magnesium (Mg) is considered deficient and potassium (K) is considered slightly deficient and appropriate fertilisers should be added.

Salinity Reclamation leaching required and drainage must be fully functional, but check for change after civil works complete to check condition

Reaction: Soil reaction is neutral, but this could be due to flooding

Iron pptn: Little or no risk of iron precipitation with root damage and drain clogging

Iron Toxicity: No perceived risk to rice from iron toxicity

Acid Sulphate: Little or no perceived risk of acid sulphate conditions existing

Instructions and guides for using this tool are given on the various pages of the spreadsheet.

3 RESULTS

3.1 Introduction

As stated above the full output of results is not presented here. However, a condensation is given below where the overall values and ratings for the various kabupaten have been manipulated further in the ETESP Labdata Summary tool and the verbal summary from each Kabupaten or area is give in Section 3.3 whilst the summary for each scheme is given in Appendix 1

3.2 Overall Data for NAD

The overall data and ratings generated for the 7 kabupaten / districts of NAD can be seen in Figure 2.

The data can be seen more clearly in Table 3 below where the ratings have been omitted but the average, maximum and minimum values for the various parameters are presented.

Table 3 Average, Maximum and Minimum Data Values

Site No	Avrg Text	PSC (%)			EC dS/m	pH H ₂ O	pH KCl	H ⁺ Diff	Al ³⁺	Fe ppm	S (ppm)	C (%)	N	C/N	Exchangeable me /100g					BS (%)		
		Sand	Silt	Clay											Ca	Mg	K	Na	CEC			
ACEH BESAR 38 samples 4 schemes	SCI	Average	63	15	22	0.99	7.43	6.56	0.87	0.13	0.19	36.32	162.87	1.47	0.18	8	7.78	1.39	0.35	1.38	12.55	86.86
		Maximum	97	48	71	4.90	8.00	8.00	1.90	0.46	0.39	228.40	1004.20	4.64	0.42	20	10.83	2.74	0.63	3.07	16.58	99.92
		Minimum	11	1	1	0.14	6.40	5.20	0.00	0.01	0.16	2.80	2.20	0.13	0.08	0	5.04	0.35	0.09	0.70	9.59	67.23
ACEH JAYA 117 samples 19 schemes	SCI	Average	57	21	22	1.64	6.75	6.07	0.69	0.45	0.25	83.12	380.78	2.71	0.24	12	7.79	1.35	0.52	1.46	13.89	82.76
		Maximum	95	74	73	8.40	8.30	8.30	1.90	6.22	0.93	780.10	7198.10	12.34	1.00	66	10.95	2.87	1.49	2.94	36.13	100.07
		Minimum	2	0	1	0.23	3.00	2.30	-0.20	0.01	0.07	2.10	3.10	0.21	0.08	1	0.35	0.29	0.11	0.19	8.75	14.39
ACEH TIMUR 2 samples 1 scheme	CL	Average	22	39	40	1.31	5.80	5.35	0.45	0.19	0.73	45.62	512.39	2.89	0.15	20	1.97	0.55	0.60	0.90	11.66	34.46
		Maximum	25	44	42	1.55	5.90	5.50	0.50	0.19	0.90	50.99	567.12	3.01	0.15	22	2.00	0.59	0.65	0.95	12.12	35.18
		Minimum	19	33	37	1.06	5.70	5.20	0.40	0.18	0.56	40.24	457.66	2.76	0.14	18	1.93	0.51	0.55	0.85	11.20	33.75
ACEH UTARA 13 samples 3 schemes	CL	Average	31	34	34	2.28	6.14	5.65	0.49	0.26	0.44	92.40	209.41	3.28	0.18	18	2.57	1.10	0.76	0.72	11.19	46.34
		Maximum	80	57	57	13.64	7.40	6.70	0.70	0.42	0.76	189.90	657.47	3.92	0.25	23	3.70	3.00	1.17	0.95	13.35	68.06
		Minimum	19	14	6	0.10	5.50	5.00	0.30	0.15	0.24	15.00	15.27	2.57	0.15	15	0.59	0.40	0.50	0.50	9.52	31.20
BIREUEN 13 samples 5 schemes	CL	Average	27	29	44	2.01	5.72	5.23	0.49	0.24	0.56	143.53	178.45	3.67	0.19	20	2.53	0.55	0.57	0.63	11.77	36.61
		Maximum	43	45	65	6.33	6.00	5.60	0.80	0.42	0.82	289.90	442.12	4.78	0.26	25	3.88	0.71	0.76	1.55	12.46	50.69
		Minimum	15	20	32	0.64	5.30	4.60	0.30	0.13	0.34	56.17	45.00	2.92	0.16	15	2.00	0.38	0.31	0.51	10.14	30.17
PIDIE 8 samples 2 schemes	C	Average	26	33	41	1.06	5.68	5.10	0.58	0.28	0.58	103.94	101.26	3.31	0.15	22	2.21	1.16	0.61	0.67	10.42	34.02
		Maximum	34	41	56	2.18	6.10	5.40	0.90	0.42	0.82	127.95	122.93	6.47	0.25	40	2.88	6.25	0.81	0.99	11.33	45.36
		Minimum	19	25	31	0.62	5.00	4.50	0.40	0.17	0.33	45.00	45.00	2.12	0.11	11	1.80	0.17	0.36	0.43	9.55	3.03
SINGKIL 12 samples 4 schemes	C	Average	27	31	42	0.82	4.82	4.38	0.45	0.27	2.59	159.44	209.68	5.16	0.18	32	2.17	0.55	0.67	0.48	21.54	22.07
		Maximum	50	42	56	1.05	5.90	5.30	0.60	0.42	4.22	320.45	367.89	10.01	0.19	56	2.88	0.59	0.89	0.62	42.76	46.45
		Minimum	17	21	29	0.56	4.00	3.40	0.30	0.16	0.90	67.80	89.00	3.12	0.16	18	1.65	0.48	0.44	0.34	10.29	12.89

Figure 3 Overall Averages and Ratings within Areas (Kabupaten)

NAD Kabupaten: Irrigation Schemes
Data Type: Overall Averages

Chemical Characteristics of - Soil Sediment Mixture

Overall Averages Irrigation Schemes

Mixed: Deposit and Original Soil (Depth range based on theory that mixing is done to twice the depth of original sediment)

Index No	Use Index No	Area	Avg Text	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	Exchangeables meq / 100g						Saturations				Cation Ratios		Cation Ratios		
								H	Al						Ca	Mg	K	Na	CEC	TEB	Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating	
																													meq / 100g
1		Aceh Besar	SCI	0.99	7.43	6.56	0.87	0.13	0.19	36.32	162.87	1.47	0.18	8.22	7.78	1.39	0.35	1.38	12.55	10.91	11.11	2.77	1.49	86.92	5.58	Mg sil deficient	4.01	OK	
				NON Sal	Neutral	ND	ND	V LOW	V LOW	MOD High	MOD	MOD	LOW	MOD	MOD	LOW	MOD	High	LOW	MOD	ND	V LOW	V LOW	V High					
2		Aceh Jaya	SCI	1.64	6.75	6.07	0.69	0.45	0.25	83.12	380.78	2.71	0.24	11.11	7.79	1.35	0.52	1.46	13.89	11.12	9.73	3.71	1.82	80.02	5.77	Mg sil deficient	2.62	Mg sil deficient	
				NON Sal	Neutral	ND	ND	LOW	LOW	High	MOD	MOD	MOD	GOOD	MOD	LOW	MOD	High	LOW	MOD	V LOW	V LOW	V LOW	V High					
3		Aceh Timur	CL	1.31	5.80	5.35	0.45	0.19	0.73	45.62	512.39	2.89	0.15	19.90	1.97	0.55	0.60	0.90	11.66	4.02	4.72	5.15	6.26	34.43	3.57	OK	0.92	Mg deficient	
				NON Sal	Sil Acid	ND	ND	V LOW	MOD	High	High	MOD	LOW	MOD	V LOW	LOW	High	High	LOW	LOW	V LOW	V LOW	LOW	V LOW					
4		Aceh Utara	CL	2.28	6.14	5.65	0.49	0.26	0.44	92.40	209.41	3.28	0.18	17.93	2.57	1.10	0.76	0.72	11.19	5.15	9.79	6.80	3.91	45.98	2.35	Ca sil deficient	1.44	Mg deficient	
				NON Sal	Sil Acid	ND	ND	LOW	LOW	High	MOD	High	MOD	MOD	LOW	LOW	High	High	MOD	LOW	V LOW	V LOW	V LOW	LOW					
5		Bireuen	CL	2.01	5.72	5.23	0.49	0.24	0.56	143.53	178.45	3.67	0.19	19.63	2.53	0.55	0.57	0.63	11.77	4.28	4.67	4.82	4.80	36.36	4.61	OK	0.97	Mg deficient	
				NON Sal	Sil Acid	ND	ND	LOW	MOD	V High	MOD	High	LOW	MOD	LOW	LOW	MOD	MOD	LOW	LOW	V LOW	V LOW	V LOW	LOW					
6		Pidie	C	1.06	5.68	5.10	0.58	0.28	0.58	103.94	101.26	3.31	0.15	21.52	2.21	1.16	0.61	0.67	10.42	4.64	11.14	5.80	5.56	44.56	1.90	Ca sil deficient	1.92	Mg deficient	
				NON Sal	Sil Acid	ND	ND	LOW	MOD	V High	MOD	High	LOW	POOR	LOW	LOW	High	MOD	LOW	LOW	ND	V LOW	LOW	LOW					
7		Singkil	C	0.82	4.82	4.38	0.44	0.27	2.59	159.44	209.68	5.16	0.18	29.28	2.17	0.55	0.67	0.48	21.54	3.87	2.57	3.12	12.04	17.98	3.92	OK	0.83	Mg deficient	
				NON Sal	V Acid	ND	ND	LOW	High	V High	MOD	V High	LOW	POOR	LOW	LOW	High	MOD	MOD	LOW	V LOW	V LOW	MOD	V LOW					
8																													
Mean for mixed soils				1.4	6.05	5.48	0.57	0.26	0.76	95	251	3.21	0.18	18.23	3.86	0.95	0.58	0.89	13.3	6.3	7.7	4.6	5.1	49.5	4.0	OK	1.81	Mg deficient	
Ratings for mixed soils				Non Sal	Sil Acid	ND	ND	Low	Mod	High	Mod	High	Low	Mod	Low	Low	Mod	High	Low	Low	V Low	V Low	Low	Low					

Summary for NAD

- Fertility:** Inherent fertility considered to be low with BS, TEB, Exch Ca and Mg rated low though Exch K and C:N ratios are moderate and OC rated as high
- Potential:** Fertility potential or ability to retain added fertilisers is rated as low with overall CEC of only 13.3me/100g
- Deficiencies:** Deficiencies: based on the Mg:K ration it appears as though magnesium (Mg) could be deficient. Use of dolomitic limestone or mineral fertilisers with Mg indicated
- Salinity** Reclamation leaching not required, but check salinity after civil works complete to check for change in condition
- Reaction:** Reaction at the time the samples were taken was slightly acid with pH of 6.05 and moderate level of Exch Al but overall the ASP is rated as low at 5.1%
- Iron pptn:** Some risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** No or only slight risk of iron toxicity to rice
- Acid Sulphate:** Moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H₂S and monitor for dropping pH values

NB: Above summary items in “blue” self generate in the tool. Manual summaries are in “black”

It may not be particularly accurate to present the data as done above in Table 3 since the results cannot be directly compared and contrasted between the various areas or kabupaten since some areas, such as Aceh Jaya, had over 100 samples analysed and included whilst others, Aceh Timur and Pidie for example, only had a few samples included. However, it might still be useful to have these “ballpark” figures since there might just be some differences based on location.

3.2.1 Salinity

It would appear as though the soils of Aceh Utara were more heavily salinised than the other areas with an overall average EC (Electrical Conductivity) value of almost 2.3dS/m whilst Singkil was the least effected with an average of just over 0.8dS/m. It might now be an interesting, if not useful, exercise to determine with what these salinity figures correlate – if anything. Possibilities are length of inundation (how long the sites were flooded), soil textures before the inundation, depth of sediments deposited and type (texture) of sediment deposited. However, the important thing is that the salinities are negligible and no or very little lasting effect on the land should ensue – assuming there is drainage and irrigation water to flush out or leach the salts.

However, before any plans are made to install reclamation programmes it needs to be established just when the samples were taken for measurement of salinity. Recent work by ETESP in Aceh Besar, Pidie and Bireuen has shown that the salinity status of many soils has changed in the year following the tsunami – some have become more saline whilst others have improved through natural leaching. In the individual summaries of the schemes it is stated that salinity needs to be re-measured after the civil engineering works to rehabilitate or build new irrigation and drainage systems. Any reclamation leaching would then be designed based on the most recent data available. The likelihood is that no programme of leaching will be required unless some areas have become more saline since the samples were taken by Lotti.

Table 4 Overall Salinity in the Areas Studied - decreasing sort order

ACEH UTARA	BIREUEN	ACEH JAYA	ACEH TIMUR	PIDIE	ACEH BESAR	SINGKIL
2.28dS/m	2.01dS/m	1.64dS/m	1.3.1dS/m	1.06dS/m	0.99dS/m	0.8.2dS/m
SC1 Very slightly saline	SC1 Very slightly saline	SC1 Non-saline	SC1 Non-saline	SC1 Non-saline	SC1 Non-saline	SC1 Non-saline

Note: SC – Salinity Class, refer ETESP Soil Salinity & Improvement Mobilisation Report, November 2005

3.2.2 Soil Reaction

Overall there is a relatively wide range of soil pH values ranging from pH7.43 in Aceh Besar to 4.82 in Singkil. One possible explanation, or correlation, could be the state of wetness or flooding of the soil at the time the samples were taken. It is known that there was long-lasting flooding in Aceh Besar and it is well established fact that in flooded soils the pH reverts to neutral or near neutral. Also, it has been recorded on previous studies in the NAD area that there is a soil acidity / aluminium problem that can develop as the soil dries. (ETESP Report “Soil Acidity and Liming, 2005).

Of course other possible correlations should be sought; such as if there are any mapped geological differences since different parent rock can give different soil pH. Similarly, it should be investigated if there is a correlation between the acidity and exchangeable aluminium in the soils – or is there any documented history of acid sulphate soils in the areas studied. The ETESP labdata summary does attempt to help identify any soils at risk in this manner.

Table 5 Overall Soil Reaction (pH) – decreasing sort order

ACEH BESAR	ACEH JAYA	ACEH UTARA	ACEH TIMUR	BIREUEN	PIDIE	SINGKIL
7.43	6.75	6.14	5.8	5.72	5.68	4.82
Neutral	Neutral	Slightly Acid	Moderately Acid	Moderately Acid	Moderately Acid	Ext Acid

3.2.3 Base Saturation (BS) - Inherent fertility

One of the main measures of inherent fertility is the sum of the various nutrient cations, the exchangeable bases. The main nutrient cations are calcium (Ca), magnesium (Mg) and potassium (K) and these are assessed individually in the actual spreadsheet. As can be seen below the soils of Aceh Besar and Aceh Jaya are apparently inherently quite fertile whilst the others have poor to very poor fertility. There are several possible reasons for differences in inherent fertility; differences in original parent material and over-exploitation without adequate fertilization are two distinctly possible causes.

Table 6 Overall Base Saturation – decreasing sort order

ACEH BESAR	ACEH JAYA	ACEH UTARA	BIREUEN	ACEH TIMUR	PIDIE	SINGKIL
86.9	82.8	46.3	36.6	34.5	34.0	22.1
Very High	Very High	Low	Low	Very Low	Very Low	Very low

The very low BS in Singkil (22.1%) is associated with the moderately high CEC (21.5me/100g) recorded. If there is an error in the reported CEC value then this would be the reason for the very low BS – it does seem odd that Singkil should have a CEC value far in excess of the other areas, the other areas all have low CEC. It should be established if the Singkil CEC is moderately high or if the sole reason for the low BS is due to the extremely acid condition reported in Table 5. If the soil is extremely acidic then most of the basic cations (Ca) will have been leached out.

3.2.4 Cation Exchange Capacity (CEC) – fertility potential

The ability of a soil to retain added nutrients is what is meant by fertility potential and the criteria used to measure this is the cation exchange capacity (CEC). The higher the CEC then the more nutrient cations the soil can hold on the exchange complex and these nutrients are then available for plant use. In a mineral soil the main reasons for difference in CEC is the texture of the soil; sands have very poor CEC whilst clays can have moderate to very high CEC – depending on clay type.

Organic matter also has high inherent ability to add to the CEC contents hence a soil with only medium texture may have good CEC if it contains high percentages of organic matter. It is not known if the organic matter in these soils was destroyed before the CEC was measured but indications are that is was since many of the soils have high OM but low CEC.

Table 7 Cation Exchange capacity (CEC) – decreasing sort order

SINGKIL	ACEH JAYA	ACEH BESAR	BIREUEN	ACEH TIMUR	ACEH UTARA	PIDIE
21.5	13.9	12.6	11.8	11.7	11.2	10.4
Moderate	Low	Low	Low	Low	Low	Low

3.3 Summaries by Area or Kabupaten

The summaries created from the average data for each Kabupaten are presented below whilst the summaries for each individual scheme are presented in Appendix 1. It should be noted that in Appendix there are 40 entries for the 38 schemes – when there was an obvious split in the dataset, such as sandy topsoil and non-sandy topsoil, a subset was created.

3.3.1 Aceh Besar

Fertility:	Inherent fertility considered to be moderate to low with Exch Ca and K, OC and C:N all rated as moderate but Exch Mg and Total N are rated as low. BS is high due to low CEC
Potential:	Fertility potential or ability to retain added fertilisers is rated as low with overall CEC of only 12.5me/100g
Deficiencies:	Overall, based on the Ca:Mg ration, it appears as though magnesium (Mg) could be deficient. Use of mineral fertilisers with Mg indicated
Salinity	Reclamation leaching not required, but check salinity after civil works complete to check for change in condition
Reaction:	Reaction at the time the samples were taken was neutral with overall pH of 7.43 whilst levels of Exch H and Al both rated as very low
Iron Precipitation:	Little or no risk of iron precipitation with root damage and drain clogging
Iron Toxicity:	No perceived risk to rice from iron toxicity
Acid Sulphate:	Little or no perceived risk of acid sulphate conditions existing

3.3.2 Aceh Jaya

Fertility:	Inherent fertility considered to be moderate with a good C:N ratio, Exch Ca and K, OC and Total N plus TEB all rated as moderate though Exch Mg is low. BS rated as high due to the low CEC.
Potential:	Fertility potential or ability to retain added fertilisers is rated as low with a CEC of only 13.9me/100g. Application of organic manures could boost both inherent and potential fertility
Deficiencies:	Overall, based on the Ca:Mg and Mg:K ratios, it appears as though magnesium (Mg) could be slightly deficient. Use of mineral fertilisers with Mg indicated
Salinity	Reclamation leaching probably not needed if good water management exists along with functioning drainage system, but check salinity after civil works complete to check condition
Reaction:	Reaction at the time the samples were taken was neutral with pH of 6.75 and both Exch H and Al rated as low.
Iron Precipitation:	Some risk of iron precipitation with root damage and drain clogging
Iron Toxicity:	No or only slight risk of iron toxicity to rice
Acid Sulphate:	Moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H ₂ S and monitor for dropping pH values

3.3.3 Aceh Timur

Fertility:	Inherent fertility considered to be low to very low with Exch Ca and BS both rated very low, Exch Mg, N and TEB rated low though OM is rated moderate and Exch K rated as high
Potential:	Fertility potential or ability to retain added fertilisers is rated as low with CEC of only 11.7 me/100g. Application of organic manures could boost both inherent and potential fertility
Deficiencies:	Overall, based on the Mg:K ratio, it appears as though magnesium (Mg) could be deficient. Use of dolomitic limestone or mineral fertilisers with Mg indicated
Salinity	Reclamation leaching not required, but check salinity after civil works complete to check for change in condition
Reaction:	Reaction at the time the samples were taken was slightly acid with pH of 5.8. Exch H is rated as very low but there is a moderate rating for Exch Al though the ASP is rated as low
Iron Precipitation:	Little or no risk of iron precipitation with root damage and drain clogging
Iron Toxicity:	Moderate to high risk of iron toxicity to rice
Acid Sulphate:	Moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H ₂ S and monitor for dropping pH values

3.3.4 Aceh Utara

Fertility:	Inherent fertility considered to be low with Exch Ca, & Mg, N, TEB and BS all rated low. OC is rated as high and the C:N ratio is moderate.
Potential:	Fertility potential or ability to retain added fertilisers is rated low with CEC of only 11.2me/100g. The application of organic manures would boost both inherent and potential fertility
Deficiencies:	Deficiencies: overall it appears as though magnesium (Mg) could be deficient. Use of dolomitic limestone or mineral fertilisers with Mg indicated
Salinity	Reclamation leaching probably not needed if good water management exists along with functioning drainage system, but check salinity after civil works complete to check condition
Reaction:	Reaction at the time the samples were taken was slightly acid with pH of 6.14 but both Exch H and Al both rated as low as is the ASP. However, if pH falls any further ASP could increase dramatically
Iron Precipitation:	Some risk of iron precipitation with root damage and drain clogging
Iron Toxicity:	No or only slight risk of iron toxicity to rice
Acid Sulphate:	Moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H ₂ S and monitor for dropping pH values

3.3.5 Bireuen

Fertility:	Inherent fertility considered to be low with Exch Ca and Mg, TEB, BS and N all rated as low whilst the C:N ratio is moderate and OC level rated as high.
Potential:	Fertility potential or ability to retain added fertilisers is rated as low with CEC of 11.8 me/100g. Application of organic manures would boost both inherent and potential fertility
Deficiencies:	Overall, based on the Mg:K ratio and low level of Exch Mg it appears as though magnesium (Mg) could be deficient. Use of dolomitic limestone or mineral fertilisers with Mg indicated
Salinity	Reclamation leaching probably not needed if good water management exists along with functioning drainage system, but check salinity after civil works complete to check condition
Reaction:	Reaction at the time the samples were taken was slightly acidic with pH of 5.72 and the level of Exch Al rated as moderate though the ASP is rated as low at 4.8%
Iron Precipitation:	Some risk of iron precipitation with root damage and drain clogging
Iron Toxicity:	Moderate to high risk of iron toxicity to rice
Acid Sulphate:	Moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H ₂ S and monitor for dropping pH values

3.3.6 Pidie

Fertility:	Inherent fertility considered to be low with Exch C and Mg, TEB, BS, N all rated low and the C:N ratio as poor .Potassium level is however rated as high as is the OC level
Potential:	Fertility potential or ability to retain added fertilisers is rated low with CEC of 10.4 me/100g. Application of organic fertilisers would boost both inherent and potential fertility levels
Deficiencies:	Overall, based on Ca:Mg and Mg:K ratios, it appears as though magnesium (Mg) could be deficient and Ca slightly deficient. Use of dolomitic limestone indicated
Salinity	Reclamation leaching not required, but check salinity after civil works complete to check for change in condition
Reaction:	Reaction at the time the samples were taken was slightly acid with pH of 5.68 and level of Exch Al rated as moderate though ASP rated low at 5.6%
Iron Precipitation:	Some risk of iron precipitation with root damage and drain clogging
Iron Toxicity:	Moderate to high risk of iron toxicity to rice
Acid Sulphate:	Moderate risk of acid sulphate conditions existing. As soils dry monitor for smell of H ₂ S and pH

3.3.7 Singkil

Fertility:	Inherent fertility considered to be low to very low due to acidity and Exch Ca and Mg, TEB and N rated low, BS rated very low and C:N ratio as poor at almost 30. OC is rated as very high
Potential:	Fertility potential or ability to retain added fertilisers is rated as moderate with a CEC of 21.5me/100g which would fit with the overall clay texture
Deficiencies:	Overall, based on Mg:K ratio and low level of Exch Mg, it appears as though magnesium (Mg) could be deficient. Use of dolomitic limestone or mineral fertilisers with Mg indicated to overcome deficiency plus acidity
Salinity	Reclamation leaching not required, but check salinity after civil works complete to check for change in condition
Reaction:	Reaction at the time the samples were taken was very acid with pH of 4.82 and Exch Al rated as high and the ASP moderate at 12%. Application of liming material could control both acidity and ASP whilst organic manure would reduce ASP
Iron Precipitation:	Some risk of iron precipitation with root damage and drain clogging
Iron Toxicity:	Moderate to high risk of iron toxicity to rice
Acid Sulphate:	Moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H ₂ S and monitor for dropping pH values

4. CONCLUSIONS

Overall the soils for which data are available would appear to be rather infertile, quite often have rather low fertility potential and may well be slightly saline or, in some cases, acidic in reaction.

A blanket cover of treatment is NOT the answer and each site must be treated based on the assessment of the available data. A standard package of fertilisers may well give some improvement in yield, assuming soil acidity and or salinity is first brought under control, but fertiliser applications need to be 'tuned' or adjusted for each individual area.

The data produced by this ETESP manipulation and analysis should act as a guide as to what should be done and what needs further investigation.

Caution needs to be applied in using the assessment of acid sulphate risk in these sites since the whole subject of acid sulphate soil development is extremely complicated and what has been produced in this present study is, to a large extent, experimental and may not always hold true. The main advice and guidance for determining possible acid sulphate soils is to monitor the soils as and when they start to dry out. If there is a significant increase in soil acidity (drop in pH value) associated with the smell of hydrogen sulphide (H₂S) there is every chance that acid sulphate soils are developing. A relatively simple laboratory test does exist to assess acid sulphate more accurately.

However, as the soils dry and there is a significant increase in soil acidity without any trace of hydrogen sulphide then the chances are that the soil is becoming acid through the processes associated with exchangeable aluminium (ETESP report Soil Acidity and Aluminium, 2005). The treatment of this problem can consist of returning the soil to flooded rice cultivation – when the flooded soil will return to neutral or, if dry land-crops are to be grown, the application of liming material or gypsum as a source of calcium, which displaces the Al on the soil exchange complex, plus add copious amounts of organic manures – the aluminium forms a complex with the organic material and is taken out of play.

APPENDIX 1 Summaries for Individual Schemes

A.1 Aceh Besar – Blang Luas

Mixed: Deposit and Original Soil														Exchangeables						Saturations				Cation Ratios		Cation Ratios			
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating	
								H	Al						Ca	Mg	K	Na	CEC	TEB									
Mean for mixed soils				0.7	7.47	6.45	1.02	0.16	0.18	23	132	1.40	0.16	7.95	7.66	1.31	0.24	1.31	11.9	10.5	10.8	2.1	1.5	88.7	7.5	Mg deficient with P inhibition	7.67	OK	
Ratings for mixed soils				Non Sal	Neutral	ND	ND	V Low	V Low	Mod / OK	Mod	Mod	Low	Mod	Mod	Low	Low	High	Low	Mod	ND	V Low	V Low	V High					

- Fertility:** Inherent fertility is moderate to low with Organic Carbon, Total-N, C:N ratio and Total Exchangeable Bases (TEB) all rated as moderate. Application of organic manures (FYM and/or compost suggested) plus mineral fertilisers
- Potential:** Fertility potential is rated as low with Cation Exchange Capacity (CEC) and the ability to retain added nutrients is rated as low with CEC ranging from 9.9 - 14.3me/100g. Application of organic manures will boost CEC and is suggested
- Deficiencies:** Magnesium (Mg) is considered deficient and potassium (K) is considered slightly deficient and appropriate fertilisers should be added.
- Salinity:** Reclamation leaching not required, but check Ece after civil works complete to check for change in condition
- Reaction:** Soil reaction is neutral, but this could be due to flooding
- Iron pptn:** Little or no risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** No perceived risk to rice from iron toxicity
- Acid Sulphate:** Little or no perceived risk of acid sulphate conditions existing

A.2 Aceh Besar – Geunteut

Mixed: Deposit and Original Soil														Exchangeables						Saturations				Cation Ratios		Cation Ratios			
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating	
								H	Al						Ca	Mg	K	Na	CEC	TEB									
Mean for mixed soils				1.0	7.58	6.76	0.82	0.09	0.21	46	142	1.47	0.18	8.30	7.57	2.05	0.51	1.62	12.5	11.7	63.9	8.7	3.3	157.6	5.6	Mg sli deficient	4.21	OK	
Ratings for mixed soils				Non Sal	Neutral	ND	ND	V Low	Low	High	Mod	Mod	Low	Mod	Mod	Mod	Mod	High	Low	Mod	ND	V Low	V Low	V High					

- Fertility:** Inherent fertility: considered to be moderate to low since exchangeable Ca and K and TEB plus organic-C are moderate and Total-N and Mg are low
- Potential:** Fertility potential: or ability to retain added fertilisers is rated low with overall CEC of 13.6me/100g. Application of organic manure and FYM would boost both inherent and fertility potential
- Deficiencies:** Deficiencies: overall it appears as though magnesium (Mg) could be deficient. Use of dolomitic limestone or mineral fertilisers with mg indicated
- Salinity:** Reclamation leaching not required, but check Ece after civil works complete to check for change in condition
- Reaction:** Reaction: at the time the samples were taken was neutral with over pH of 7.58 whilst exchangeable H and Al both low
- Iron pptn:** Little or no risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** No or only slight risk of iron toxicity to rice
- Acid Sulphate:** Little or no perceived risk of acid sulphate conditions existing

A.3 Aceh Besar – Kreung Geupeu

Mixed: Deposit and Original Soil														Exchangeables						Saturations				Cation Ratios		Cation Ratios			
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating	
								H	Al						Ca	Mg	K	Na	CEC	TEB									
Mean for mixed soils				1.9	7.28	6.51	0.76	0.21	0.17	28	263	1.64	0.23	8.13	7.35	1.54	0.37	1.34	12.5	10.6	12.4	3.0	1.4	84.6	5.7	Mg sli deficient	4.94	OK	
Ratings for mixed soils				Non Sal	Neutral	ND	ND	Low	V Low	Mod High	Mod	Mod	Mod	Mod	Mod	Mod	Mod	High	Low	Mod	ND	V Low	V Low	V High					

- Fertility:** Inherent Fertility: considered to be only moderate due to Organic-C, Total-N, C:N ratio and exchangeables plus TEB all rated moderate.
- Potential:** Fertility Potential: or ability to retain added fertilisers is low with CEC of 10.8 - 13.2me/100g. Application of large amounts of organic material would boost both inherent fertility and fertility potential
- Deficiencies:** Deficiencies: magnesium would appear to be slightly deficient to deficient, possibly with inhibition of phosphate. Calcium also possibly deficient in one site (KG 12A). Application of dolomitic limestone or Mg fertiliser would not be out of place
- Salinity:** Reclamation leaching not required, but check Ece after civil works complete to check for change in condition
- Reaction:** Reaction: is, overall, neutral - but this could be due to the fact that the site may have been flooded at the time of sampling. Exchangeable H and Al both low and risk of acid sulphates not considered high as OM content is moderate only. Fe and S are high
- Iron pptn:** Little or no risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** No perceived risk to rice from iron toxicity
- Acid Sulphate:** Little or no perceived risk of acid sulphate conditions existing

A.4 Aceh Besar – Kreung Kala

Mixed: Deposit and Original Soil														(Depth range based on theory that mixing is done to twice the depth of original sediment)										Exchangeables				Saturations				Cation Ratios		Cation Ratios	
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g				Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating									
								H	Al						Ca	Mg	K	Na									CEC	TEB							
Mean for mixed soils				0.6	7.43	6.47	0.97	0.06	0.17	55	134	1.39	0.15	8.89	6.97	1.23	0.40	1.16	12.4	9.8	9.9	3.3	1.4	79.2	5.7	Mg sli deficient	3.51	OK							
Ratings for mixed soils				Non Sal	Neutral	ND	ND	V Low	V Low	High	Mod	Mod	Low	Mod	Mod	Low	Mod	High	Low	Mod	V Low	V Low	V Low	High											

Fertility: Inherent fertility: considered to be moderate to low Organic-C, Exchangeable Ca and K and TEB all moderate whilst Total-N, and exchangeable Mg both low

Potential: Fertility potential: or ability to retain added fertilisers is rated low with CEC of 11.7 - 13.2me/100g. Application of large amount of organic materials (FYM and compost) would boost both inherent fertility and fertility potential

Deficiencies: Deficiencies: overall it appears as though magnesium (Mg) could be deficient. Use of dolomitic limestone or mineral fertilisers with mg indicated

Salinity Reclamation leaching not required, but check Ece after civil works complete to check for change in condition

Reaction: Reaction: at the time the samples were taken was neutral in all samples - however, this might have been due to the fact that the sites could have been flooded. Exchangeable H and Al both rated very low. No expectation of problems from acid sulphates as Fe

Iron pptn: Some risk of iron precipitation with root damage and drain clogging

Iron Toxicity: No or only slight risk of iron toxicity to rice

Acid Sulphate: Slight to moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H₂S and monitor for dropping pH values

A.5 Aceh Jaya – Alue Monmata

Mixed: Deposit and Original Soil														(Depth range based on theory that mixing is done to twice the depth of original sediment)										Exchangeables				Saturations				Cation Ratios		Cation Ratios	
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g				Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating									
								H	Al						Ca	Mg	K	Na									CEC	TEB							
Mean for mixed soils				1.4	6.85	5.98	0.87	0.26	0.19	80	250	2.46	0.24	11.27	8.59	1.19	0.89	1.40	13.6	12.1	8.6	6.5	1.4	88.5	7.5	Mg deficient with P inhibition	1.55	Mg deficient							
Ratings for mixed soils				Non Sal	Neutral	ND	ND	Low	V Low	High	Mod	Mod	Mod	Good	Mod	Low	High	High	Low	Mod	V Low	V Low	V Low	V High											

Fertility: Inherent fertility: considered to be moderate with Org-C, Total-N, Exch-Ca and TEB all moderate and C:N ratio good, Exch-K high and BS very high. Exch-Mg is low.

Potential: Fertility potential: or ability to retain added fertilisers is rated low with overall CEC of 13.6me/100g and CEC should be boosted by addition of organic manures - FYM and compost

Deficiencies: Deficiencies: overall it appears as though magnesium (Mg) is deficient, sometimes with inhibition of P. Use of mineral fertilisers with Mg indicated

Salinity Reclamation leaching not required, but check Ece after civil works complete to check for change in condition

Reaction: Reaction: at the time the samples were taken was slightly acid to neutral with pH range of 6.40 - 7.20 and average of 6.85. Exch-H is low and Exch-Al very low with Al-saturation very low.

Iron pptn: Some risk of iron precipitation with root damage and drain clogging

Iron Toxicity: No or only slight risk of iron toxicity to rice

Acid Sulphate: Moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H₂S and monitor for dropping pH values

A.6 Aceh Jaya – Baba Awe

Mixed: Deposit and Original Soil														(Depth range based on theory that mixing is done to twice the depth of original sediment)										Exchangeables				Saturations				Cation Ratios		Cation Ratios	
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g				Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating									
								H	Al						Ca	Mg	K	Na									CEC	TEB							
Mean for mixed soils				0.9	7.35	6.58	0.78	0.12	0.19	24	244	1.74	0.21	8.65	9.68	1.53	0.57	2.14	16.3	13.9	9.5	3.5	1.2	85.7	6.4	Mg sli deficient	3.84	OK							
Ratings for mixed soils				Non Sal	Neutral	ND	ND	V Low	V Low	Mod / OK	Mod	Mod	Mod	Mod	Mod	Mod	Mod	V High	Mod	Mod	V Low	V Low	V Low	V High											

Fertility: Inherent fertility: considered to be moderate with Org-C, Total-N, C:N ration, Exch-Ca, Mg and K plus TEB all moderate and BS very high

Potential: Fertility potential: or ability to retain added fertilisers is rated moderate with overall CEC of 16.3me/100g

Deficiencies: Deficiencies: overall it appears as though magnesium (Mg) could be slightly deficient. Use of dolomitic limestone or mineral fertilisers with Mg indicated

Salinity Reclamation leaching not required, but check Ece after civil works complete to check for change in condition

Reaction: Reaction: at the time the samples were taken was neutral with overall pH of 7.35 and Exch-h and Al both very low as is Al-saturation. Fe and S high and moderate respectively and Organic-C only moderate acid sulphates not expected.

Iron pptn: Little or no risk of iron precipitation with root damage and drain clogging

Iron Toxicity: No perceived risk to rice from iron toxicity

Acid Sulphate: Little or no perceived risk of acid sulphate conditions existing

A.7 Aceh Jaya – Baba le

Mixed: Deposit and Original Soil														Exchangeables						Saturations				Cation Ratios		Cation Ratios		
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating
								H	Al						Ca	Mg	K	Na	CEC	TEB								
Mean for mixed soils				2.2	7.25	6.60	0.65	1.06	2.10	45	99	6.52	0.14	54.40	7.22	1.63	0.76	2.19	14.7	11.8	11.0	5.1	14.0	80.6	5.2	Mg sli deficient	2.20	Mg sli deficient
Ratings for mixed soils				Non Sal	Neutral	ND	ND	Mod	High	High	Low	V High	Low	Poor	Mod	Mod	High	V High	Low	Mod	ND	V Low	Mod	V High				

- Fertility:** Inherent fertility: considered to be moderate to low with Org-C, Exch Ca and Exh K moderate whilst Total-N, Exch-Mg and TEB are all low. Organic manures and fertilisers indicated
- Potential:** Fertility potential: or ability to retain added fertilisers is rated low with CEC of 13.1 noted, though the figures are not really representative since there is no subsoil data for one site
- Deficiencies:** Deficiencies: overall it appears as though magnesium (Mg) could be deficient. Use of dolomitic limestone or mineral fertilisers with mg indicated
- Salinity** Reclamation leaching probably not needed if good water management exists along with functioning drainage system, but check for change after civil works complete to check condition
- Reaction:** Reaction: at the time the samples were taken was neutral. Exch H and Al both low
- Iron pptn:** Little or no risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** No or only slight risk of iron toxicity to rice
- Acid Sulphate:** Slight to moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H₂S and monitor for dropping pH values

A.8 Aceh Jaya – Blang Alue Gajah

Mixed: Deposit and Original Soil														Exchangeables						Saturations				Cation Ratios		Cation Ratios		
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating
								H	Al						Ca	Mg	K	Na	CEC	TEB								
Mean for mixed soils				1.3	7.16	6.44	0.73	0.26	0.25	69	272	1.89	0.23	8.58	9.14	1.28	0.41	1.31	13.6	12.1	9.5	3.0	1.9	89.6	8.3	Mg deficient with P inhibition	4.52	OK
Ratings for mixed soils				Non Sal	Neutral	ND	ND	Low	Low	High	Mod	Mod	Mod	Mod	Mod	Low	Mod	High	Low	Mod	V Low	V Low	V Low	V High				

- Fertility:** Inherent fertility: considered to be moderate with Org-C, Total-N, C:N ration, Exch-Ca, K and TEB all moderate whilst Exch-Mg is low and BS is very high
- Potential:** Fertility potential: or ability to retain added fertilisers is rated low with overall CEC of 13.6me/100g. Addition of organic manures (FYM and compost) would boost CEC and fertility
- Deficiencies:** Deficiencies: overall it appears as though magnesium (Mg) could be deficient and, possibly, be causing inhibition of P. Use of dolomitic limestone or mineral fertilisers with Mg and P indicated
- Salinity** Reclamation leaching not required, but check Ece after civil works complete to check for change in condition
- Reaction:** Reaction: at the time the samples were taken was neutral with over all pH of 7.16 and Exch-H and Al both low and Al-saturation very low.
- Iron pptn:** Some risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** No or only slight risk of iron toxicity to rice
- Acid Sulphate:** Slight to moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H₂S and monitor for dropping pH values

A.9 Aceh Jaya – Blang Jempeuk

Mixed: Deposit and Original Soil														Exchangeables						Saturations				Cation Ratios		Cation Ratios		
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating
								H	Al						Ca	Mg	K	Na	CEC	TEB								
Mean for mixed soils				0.8	6.57	5.61	0.95	0.27	0.20	98	288	2.37	0.27	9.30	8.32	1.15	0.35	1.53	13.6	11.3	8.3	2.7	1.6	83.6	7.7	Mg deficient with P inhibition	3.47	OK
Ratings for mixed soils				Non Sal	Sli Acid	ND	ND	Low	Low	High	Mod	Mod	Mod	Mod	Mod	Low	Mod	High	Low	Mod	V Low	V Low	V Low	V High				

- Fertility:** Inherent fertility: considered to be moderate with Org-C, Total-N, C:N ration, Exch-Ca, K and TEB all moderate whilst Exch-Mg is low and BS very high
- Potential:** Fertility potential: or ability to retain added fertilisers is rated low with CEC ranging from 10 - 17me/100g giving an average of 13.6 me/100g. Addition of organic fertilisers, FM and compost, would boost CEC and fertility
- Deficiencies:** Deficiencies: overall it appears as though magnesium (Mg) could be deficient, some times inhibiting P. Use of dolomitic limestone or mineral fertilisers with Mg indicated
- Salinity** Reclamation leaching not required, but check Ece after civil works complete to check for change in condition
- Reaction:** Reaction: at the time the samples were taken was neutral to slightly acid with pH ranging from 6.25 - 6.75 giving an average of 6.57. Exch-H and Al both low and Al-saturation very low.
- Iron pptn:** Some risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** No or only slight risk of iron toxicity to rice
- Acid Sulphate:** Moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H₂S and monitor for dropping pH values

A.10 Aceh Jaya – Bunbun

Mixed: Deposit and Original Soil														Exchangeables						Saturations				Cation Ratios		Cation Ratios		
Index No	Use Index No	Texture	Depth Range	EC dSm	pH H2O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating
								H	Al						Ca	Mg	K	Na	CEC	TEB								
Mean for mixed soils				0.6	5.25	4.45	0.80	0.53	0.18	38	512	2.22	0.32	6.90	6.58	1.35	0.36	1.61	11.1	9.9	11.5	3.2	1.6	89.1	7.5	Mg deficient with P inhibition	3.83	OK
Ratings for mixed soils				Non Sal	V Acid	ND	ND	Mod	V Low	Mod High	M High	Mod	Mod	Mod	Mod	Low	Mod	High	Low	Mod	ND	V Low	V Low	V High				

- Fertility:** Inherent fertility: considered to be moderate as Org-C, Total-N, C:N, Exch-Ca and K and TEB all moderate whilst BS is very high and Exch-Mg very low
- Potential:** Fertility potential: or ability to retain added fertilisers is rated low as CEC ranges from 10 to 12.03me/100g and this soil would benefit from additions of organic manures to boost CEC and improve fertility
- Deficiencies:** Deficiencies: overall it appears as though magnesium (Mg) could be deficient. Use of dolomitic limestone or mineral fertilisers with Mg indicated
- Salinity** Reclamation leaching not required, but check Ece after civil works complete to check for change in condition
- Reaction:** Reaction: at the time the samples were taken was very acid with pH values of 5.5 - 5.0 and Exchangeable-H was low to moderate, Exchangeable-Al was very low as was Al-saturation.
- Iron pptn:** Little or no risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** No or only slight risk of iron toxicity to rice
- Acid Sulphate:** Moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H2S and monitor for dropping pH values

A.11 Aceh Jaya – Jabie

Mixed: Deposit and Original Soil														Exchangeables						Saturations				Cation Ratios		Cation Ratios		
Index No	Use Index No	Texture	Depth Range	EC dSm	pH H2O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating
								H	Al						Ca	Mg	K	Na	CEC	TEB								
Mean for mixed soils				0.6	7.29	6.63	0.66	0.14	0.23	50	175	2.38	0.30	8.07	10.22	1.37	0.77	1.65	14.8	14.0	9.2	5.2	1.6	94.6	7.6	Mg deficient with P inhibition	2.18	Mg sli deficient
Ratings for mixed soils				Non Sal	Neutral	ND	ND	V Low	Low	High	Mod	Mod	Mod	Mod	High	Low	High	High	Low	Mod	V Low	V Low	V Low	V High				

- Fertility:** Inherent fertility: considered to be moderate to high with Org-C, Total-N, C:N ratio and TEB all moderate but levels of Exch-Ca and K high and BS very high but Exch-Mg rated as low
- Potential:** Fertility potential: or ability to retain added fertilisers is rated low with overall CEC of 14.8me/100g. Addition of organic fertilisers, FYM and compost, would boost CEC and fertility
- Deficiencies:** Deficiencies: overall it appears as though magnesium (Mg) could be deficient and possibly even causing inhibition of P. Use of mineral fertilisers with Mg and P indicated
- Salinity** Reclamation leaching not required, but check Ece after civil works complete to check for change in condition
- Reaction:** Reaction: at the time the samples were taken was neutral with overall pH of 7.29 whilst Exch-H is very low, Exch-Al low and Al-saturation very low.
- Iron pptn:** Little or no risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** No or only slight risk of iron toxicity to rice
- Acid Sulphate:** Slight to moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H2S and monitor for dropping pH values

A.12 Aceh Jaya – Krueng Tunong

Mixed: Deposit and Original Soil														Exchangeables						Saturations				Cation Ratios		Cation Ratios		
Index No	Use Index No	Texture	Depth Range	EC dSm	pH H2O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating
								H	Al						Ca	Mg	K	Na	CEC	TEB								
Mean for mixed soils				1.0	7.28	6.45	0.83	0.20	0.19	42	146	2.30	0.19	12.07	7.49	1.42	0.68	1.99	16.1	11.6	9.4	4.4	1.3	77.7	6.7	Mg sli deficient	3.27	OK
Ratings for mixed soils				Non Sal	Neutral	ND	ND	Low	V Low	High	Mod	Mod	Low	Good	Mod	Low	High	High	Mod	Mod	V Low	V Low	V Low	High				

- Fertility:** Inherent fertility: considered to be moderate low with Org-C moderate as are Exch Ca and TEB whilst Total-N is low as is Mg but K is rated as high.
- Potential:** Fertility potential: or ability to retain added fertilisers is rated low with CEC ranging from 8.8 to 25.7 with an average of 14.7me/100g. Application of organic manures would boost CEC and overall fertility
- Deficiencies:** Deficiencies: overall it appears as though magnesium (Mg) could be deficient. Use of dolomitic limestone or mineral fertilisers with mg indicated
- Salinity** Reclamation leaching not required, but check Ece after civil works complete to check for change in condition
- Reaction:** Reaction: at the time the samples were taken was neutral with an overall pH of 7.12 whilst Exch-H and Al are both very low as is Al saturation
- Iron pptn:** Little or no risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** No or only slight risk of iron toxicity to rice
- Acid Sulphate:** Slight to moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H2S and monitor for dropping pH values

A.13 Aceh Jaya – Kreung Ateu (sandy tops)

Mixed: Deposit and Original Soil														Exchangeables						Saturations				Cation Ratios		Cation Ratios			
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating	
								H	Al						Ca	Mg	K	Na	CEC	TEB									
Mean for mixed soils				0.4	7.32	7.22	0.10	0.15	0.23	48	290	1.86	0.18	11.37	7.99	1.43	0.48	1.49	12.8	11.4	10.7	3.7	1.7	87.3	6.1	Mg sli deficient	2.92	Mg sli deficient	
Ratings for mixed soils				Non Sal	Neutral	ND	ND	V Low	Low	High	Mod	Mod	Low	Good	Mod	Low	Mod	High	Low	Mod	ND	V Low	V Low	V High					

- Fertility:** Inherent fertility: considered to be moderate to low with Org-C, Exch-Ca, Exch-K and TEB moderate whilst Total-N, and Exch-Mg are low, though C:N ratio is rated as good and BS is very high.
- Potential:** Fertility potential: or ability to retain added fertilisers is rated low with overall figure of 12.8 and a range of 11.2 - 14.5me/100g. Fertility potential could be improved by applying organic manures
- Deficiencies:** Deficiencies: overall it appears as though magnesium (Mg) could be deficient. Use of dolomitic limestone or mineral fertilisers with Mg indicated
- Salinity** Reclamation leaching not required, but check Ece after civil works complete to check for change in condition
- Reaction:** Reaction: at the time the samples were taken was, overall, rated as neutral at pH 7.32 but there are a few anomalies in the results and they should be treated with suspicion or even repeated as it is unusual to find pH water and pH KCl the same
- Iron pptn:** Little or no risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** No or only slight risk of iron toxicity to rice
- Acid Sulphate:** Little or no perceived risk of acid sulphate conditions existing

A.14 Aceh Jaya – Kreung Ateu (non-sandy tops)

Mixed: Deposit and Original Soil														Exchangeables						Saturations				Cation Ratios		Cation Ratios			
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating	
								H	Al						Ca	Mg	K	Na	CEC	TEB									
Mean for mixed soils				0.5	7.63	7.63	0.00	0.29	0.21	22	104	1.69	0.24	8.82	6.89	1.77	0.90	2.34	13.7	11.9	13.0	6.9	1.6	87.8	4.2	OK	3.45	OK	
Ratings for mixed soils				Non Sal	Sli Alk	ND	ND	Low	Low	Mod / OK	Mod	Mod	Mod	Mod	Mod	Mod	High	V High	Low	Mod	ND	V Low	V Low	V High					

- Fertility:** Inherent fertility: considered to be moderate to low with Org-C, Exch-Ca, Mg, K and TEB all moderate with Total-N low but C:N ratio good and BS very high
- Potential:** Fertility potential: or ability to retain added fertilisers is rated low with over all CEC 12.9me/100g and ranging from 10.7 - 14.8me/100g. Addition of organic manures would boost CEC and also fertility
- Deficiencies:** Deficiencies: overall it appears as though magnesium (Mg) could be slightly deficient. Use of dolomitic limestone or mineral fertilisers with Mg indicated
- Salinity** Reclamation leaching not required, but check Ece after civil works complete to check for change in condition
- Reaction:** Reaction: at the time the samples were taken was, overall, neutral at pH 7.40 but ranged from slightly acid (6.58) to slightly alkaline (7.85). Exchangeable H and Al both low to very low and Al-saturation very low.
- Iron pptn:** Little or no risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** No perceived risk to rice from iron toxicity
- Acid Sulphate:** Little or no perceived risk of acid sulphate conditions existing

A.15 Aceh Jaya – Kuala Meuris

Mixed: Deposit and Original Soil														Exchangeables						Saturations				Cation Ratios		Cation Ratios			
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating	
								H	Al						Ca	Mg	K	Na	CEC	TEB									
Mean for mixed soils				0.8	6.88	6.18	0.70	0.12	0.25	38	139	1.71	0.19	9.30	7.22	1.12	0.40	1.55	12.7	10.3	8.8	3.2	1.9	80.9	6.7	Mg sli deficient	3.00	OK	
Ratings for mixed soils				Non Sal	Neutral	ND	ND	V Low	Low	Mod High	Mod	Mod	Low	Mod	Mod	Low	Mod	High	Low	Mod	V Low	V Low	V Low	V High					

- Fertility:** Inherent fertility: considered to be moderate to low with Org-C, C:N ratio, Exch-Ca & K and TEB all moderate, Total-N and Exch-Mg both BS very high
- Potential:** Fertility potential: or ability to retain added fertilisers is rated low with CEC of 12.7me/100g and addition of organic manures indicated to boost CEC and fertility
- Deficiencies:** Deficiencies: overall it appears as though magnesium (Mg) could be slightly deficient to deficient. Use of mineral fertilisers with Mg indicated
- Salinity** Reclamation leaching not required, but check Ece after civil works complete to check for change in condition
- Reaction:** Reaction: at the time the samples were taken was slightly acid to neutral with pH values ranging from 6.5 to 7.4 with an overall value of 6.88.
- Iron pptn:** Little or no risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** No perceived risk to rice from iron toxicity
- Acid Sulphate:** Little or no perceived risk of acid sulphate conditions existing

A.16 Aceh Jaya – Kulam Asan

Mixed: Deposit and Original Soil				(Depth range based on theory that mixing is done to twice the depth of original sediment)										Exchangeables						Saturations				Cation Ratios		Cation Ratios			
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating	
								H	Al						Ca	Mg	K	Na	CEC	TEB									
1				1.19	7.55	6.85	0.70	0.45	0.20	136.10	193.55	2.16	0.18	11.78	9.31	1.73	0.59	1.64	14.44	13.26	11.94	4.05	1.38	91.84	5.46	Mg sli deficient	2.95	Mg sli deficient	
Mean for mixed soils				1.2	7.55	6.85	0.70	0.45	0.20	136	194	2.16	0.18	11.78	9.31	1.73	0.59	1.64	14.4	13.3	11.9	4.0	1.4	91.8	5.5	Mg sli deficient	2.95	Mg sli deficient	
Ratings for mixed soils				Non Sal	Neutral	ND	ND	Low	Low	V High	Mod	Mod	Low	Good	Mod	Mod	Mod	High	Low	Mod	ND	V Low	V Low	V High					

- Fertility:** Inherent fertility of LB 3: considered to be moderate with Org-C, Exch-Ca, Mg, K and TEB all moderate though Total-N is low. BS is very high.
- Potential:** Fertility potential: or ability to retain added fertilisers is rated as low with CEC of 14.4 and application of organic manures indicated to boost CEC
- Deficiencies:** Deficiencies: overall it appears as though magnesium (Mg) could be slightly deficient at LB 3. Use of mineral fertilisers with Mg indicated
- Salinity** Reclamation leaching not required, but check Ece after civil works complete to check for change in condition
- Reaction:** Reaction at LB 3: at the time the samples were taken was neutral with pH of 7.55 whilst Exch-H and Al both low and Al-saturation very low.
- Iron pptn:** Some risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** No or only slight risk of iron toxicity to rice
- Acid Sulphate:** Moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H₂S and monitor for dropping pH values

A.17 Aceh Jaya – Lambaro

Mixed: Deposit and Original Soil				(Depth range based on theory that mixing is done to twice the depth of original sediment)										Exchangeables						Saturations				Cation Ratios		Cation Ratios			
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating	
								H	Al						Ca	Mg	K	Na	CEC	TEB									
Mean for mixed soils				2.9	6.90	6.25	0.65	0.17	0.24	45	255	1.71	0.37	8.33	7.65	1.18	1.02	1.41	12.0	11.2	9.8	8.5	2.1	93.3	6.5	Mg sli deficient	1.15	Mg deficient	
Ratings for mixed soils				Non Sal	Neutral	ND	ND	V Low	Low	High	Mod	Mod	Mod	Mod	Mod	Low	High	High	Low	Mod	V Low	V Low	V Low	V High					

- Fertility:** Inherent fertility: considered to be moderate as Org-C, Total-N, C:N ratio, Exch-Ca and TEB all moderate, though Mg is low and K high
- Potential:** Fertility potential: or ability to retain added fertilisers is rated low as CEC is only 12me/100g. Addition of organic manure or compost would boost CEC and fertility
- Deficiencies:** Deficiencies: overall it appears as though magnesium (Mg) could be deficient. Use of dolomitic limestone or mineral fertilisers with Mg indicated
- Salinity** Reclamation leaching probably not needed if good water management exists along with functioning drainage system, but check for change after civil works complete to check condition
- Reaction:** Reaction: at the time the samples were taken was neutral with overall pH 6.9 whilst Exch-H and AL both very low. Risk of iron precipitating and harming rice roots or clogging drians considered minimal
- Iron pptn:** Little or no risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** No or only slight risk of iron toxicity to rice
- Acid Sulphate:** Little or no perceived risk of acid sulphate conditions existing

A.18 Aceh Jaya – Lamesoi

Mixed: Deposit and Original Soil				(Depth range based on theory that mixing is done to twice the depth of original sediment)										Exchangeables						Saturations				Cation Ratios		Cation Ratios			
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating	
								H	Al						Ca	Mg	K	Na	CEC	TEB									
Mean for mixed soils				2.3	7.45	6.80	0.65	0.31	0.25	86	482	2.36	0.20	11.13	8.69	1.69	0.51	1.77	14.7	12.7	11.2	3.5	1.7	85.4	5.7	Mg sli deficient	3.62	OK	
Ratings for mixed soils				Non Sal	Neutral	ND	ND	Low	Low	High	Mod	Mod	Mod	Good	Mod	Mod	Mod	High	Low	Mod	ND	V Low	V Low	V High					

- Fertility:** Inherent fertility: considered to be moderate with Org-C, Total-N, Exch-Ca, Mg, K and TEB all moderate, whilst C:N ratio is good and BS is very high
- Potential:** Fertility potential: or ability to retain added fertilisers is rated as low with CEC of 14.7 but addition of organic manures, compost and / or FYM would boost CEC and improve fertility
- Deficiencies:** Deficiencies: overall it appears as though magnesium (Mg) could be deficient. Use of dolomitic limestone or mineral fertilisers with Mg indicated
- Salinity** Reclamation leaching probably not needed if good water management exists along with functioning drainage system, but check for change after civil works complete to check condition
- Reaction:** Reaction: at the time the samples were taken was neutral and Exch-H and Al were both low whilst Al-saturation was very low.
- Iron pptn:** Some risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** No or only slight risk of iron toxicity to rice
- Acid Sulphate:** Moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H₂S and monitor for dropping pH values

A.19 Aceh Jaya - Meudheun

Mixed: Deposit and Original Soil <small>(Depth range based on theory that mixing is done to twice the depth of original sediment)</small>														Exchangeables						Saturations				Cation Ratios		Cation Ratios		
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating
								H	Al						Ca	Mg	K	Na	CEC	TEB								
Mean for mixed soils				2.2	7.10	6.55	0.55	0.24	0.29	43	233	2.15	0.26	8.18	7.59	1.57	0.53	1.42	12.1	11.1	12.9	4.1	2.3	91.5	4.9	OK	3.31	OK
Ratings for mixed soils				Non Sal	Neutral	ND	ND	Low	Low	High	Mod	Mod	Mod	Mod	Mod	Mod	Mod	High	Low	Mod	ND	V Low	V Low	V High				

- Fertility:** Inherent fertility: considered to be moderate as Org-C, total-N, C:N ratio, Exch Ca,Mg and K plus TEB are all rated moderate.
- Potential:** Fertility potential: or ability to retain added fertilisers is rated low with CEC of 12me/100g. Application of organic manures - FYM and / or compost - would boost fertility and fertility potential
- Deficiencies:** Deficiencies: overall it appears as though magnesium (Mg) might be slightly deficient. Use of dolomitic limestone or mineral fertilisers with Mg indicated
- Salinity** Reclamation leaching probably not needed if good water management exists along with functioning drainage system, but check for change after civil works complete to check condition
- Reaction:** Reaction: at the time the samples were taken was neutral and both Exch H and Al rated as low whilst Al saturation is very low. No problems from precipitation of iron, which is rated as high, would be expected
- Iron pptn:** Little or no risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** No or only slight risk of iron toxicity to rice
- Acid Sulphate:** Slight to moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H₂S and monitor for dropping pH values

A.20 Aceh Jaya - Meulha

Mixed: Deposit and Original Soil <small>(Depth range based on theory that mixing is done to twice the depth of original sediment)</small>														Exchangeables						Saturations				Cation Ratios		Cation Ratios		
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating
								H	Al						Ca	Mg	K	Na	CEC	TEB								
1	1	SCI	Rating	47.00	6.55	6.55	0.00	0.16	0.23	192.75	195.80	2.49	0.32	7.90	8.24	1.19	0.65	1.39	12.34	11.47	9.76	5.51	1.95	92.97	6.82	Mg sli deficient	1.81	Mg deficient
Mean for mixed soils				47.0	6.55	6.55	0.00	0.16	0.23	193	196	2.49	0.32	7.90	8.24	1.19	0.65	1.39	12.3	11.5	9.8	5.5	2.0	93.0	6.8	Mg sli deficient	1.81	Mg deficient
Ratings for mixed soils				Ext Sal	Sli Acid	ND	ND	V Low	Low	V High	Mod	Mod	Mod	Mod	Mod	Low	High	High	Low	Mod	V Low	V Low	V Low	V High				

- Fertility:** Inherent fertility: considered to be moderate with Org-C, total-N, C:N ratio, Exch-Ca and TEB moderate, Exch-K is high whilst Exch-Mg is low and BS is very high
- Potential:** Fertility potential: or ability to retain added fertilisers is rated as low with CEC of 12.3me/100g. Addition of organic manures, FYM and / or compost would boost CEC and improve fertility
- Deficiencies:** Deficiencies: overall it appears as though magnesium (Mg) could be deficient. Use of dolomitic limestone or mineral fertilisers with Mg indicated
- Salinity** Reclamation leaching cost could be too high in respect to water use so economic costs must be carefully considered
- Reaction:** Reaction: at the time the samples were taken was slightly acid with overall, mixed pH of 6.55 but Exch-H and Al are very low to low and Al-saturation very low at 2%. There should be no danger from iron precipitating and damaging rice roots or clogging drains
- Iron pptn:** Some risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** No or only slight risk of iron toxicity to rice
- Acid Sulphate:** Moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H₂S and monitor for dropping pH values

A.21 Aceh Jaya – Panghuleu Harakat

Mixed: Deposit and Original Soil <small>(Depth range based on theory that mixing is done to twice the depth of original sediment)</small>														Exchangeables						Saturations				Cation Ratios		Cation Ratios		
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating
								H	Al						Ca	Mg	K	Na	CEC	TEB								
Mean for mixed soils				0.9	6.55	5.75	0.80	0.36	0.26	54	1027	2.65	0.28	10.15	8.49	1.13	0.44	1.07	12.5	11.1	8.9	3.6	2.0	88.5	8.1	Mg deficient with P inhibition	3.10	OK
Ratings for mixed soils				Non Sal	Sli Acid	ND	ND	Low	Low	High	High	Mod	Mod	Good	Mod	Low	Mod	High	Low	Mod	V Low	V Low	V Low	V High				

- Fertility:** Inherent fertility: considered to be moderate with Org-C, Total-N, Exch-Ca, K and TEB all moderate and C:N ratio good and BS very high but Exch-Mg is low
- Potential:** Fertility potential: or ability to retain added fertilisers is rated low with overall CEC of 12.5me/100g. Addition of organic manures indicated to boost CEC and fertility
- Deficiencies:** Deficiencies: overall it appears as though magnesium (Mg) could be deficient. Use of dolomitic limestone or mineral fertilisers with Mg indicated
- Salinity** Reclamation leaching not required, but check Ece after civil works complete to check for change in condition
- Reaction:** Reaction: at the time the samples were taken was slightly acid at pH 6.55 but Exch-H and Al both low and Al-saturation very low.
- Iron pptn:** Some risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** No or only slight risk of iron toxicity to rice
- Acid Sulphate:** High risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H₂S and monitor for dropping pH values

A.22 Aceh Jaya – Rawa Krueng Itam

Mixed: Deposit and Original Soil <i>(Depth range based on theory that mixing is done to twice the depth of original sediment)</i>														Exchangeables						Saturations				Cation Ratios		Cation Ratios		
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating
								H	Al						Ca	Mg	K	Na	CEC	TEB								
Mean for mixed soils				0.8	4.27	3.70	0.57	2.18	0.66	481	1322	9.98	0.47	32.73	5.17	0.86	0.48	0.95	22.4	7.5	4.1	2.1	3.4	37.2	5.8	Mg sli deficient	2.11	Mg sli deficient
Ratings for mixed soils				Non Sal	Ext Acid	ND	ND	High	Mod	Toxic	High	V High	Mod	Poor	Mod	Low	Mod	High	Mod	Low	V Low	V Low	V Low	Low				

- Fertility:** Inherent fertility: considered to be extremely low with soil reaction extremely acid with pH of 2.13 and Exch-Ca, Mg and K low to very low as is TEB and BS is low.
- Potential:** Fertility potential: or ability to retain added fertilisers is rated low as even with high levels of Org-C the CEC is only 11.21me/100g.
- Deficiencies:** Deficiencies: overall it appears as though magnesium (Mg) could be deficient. Use of dolomitic limestone is indicated as this could combat the acidity and add the required Mg
- Salinity** Reclamation leaching not required, but check Ece after civil works complete to check for change in condition
- Reaction:** Reaction: at the time the samples were taken was extremely acid throughout with overall pH of 2.13, Exchangeable-H ranging from low to high in the fabric material but Exch-Al and Al-saturation are both low
- Iron pptn:** Some risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** Moderate to high risk of iron toxicity to rice
- Acid Sulphate:** High risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H₂S and monitor for dropping pH values

A.23 Aceh Jaya – Seneubok Padang

Mixed: Deposit and Original Soil <i>(Depth range based on theory that mixing is done to twice the depth of original sediment)</i>														Exchangeables						Saturations				Cation Ratios		Cation Ratios		
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating
								H	Al						Ca	Mg	K	Na	CEC	TEB								
Mean for mixed soils				1.3	3.86	3.16	0.70	2.66	0.51	277	1988	8.63	0.45	25.82	4.35	1.69	0.48	1.02	16.4	7.6	12.7	3.0	3.8	55.1	2.8	Ca sli deficient	4.91	OK
Ratings for mixed soils				Non Sal	Ext Acid	ND	ND	High	Mod	Ext High	High	V High	Mod	Poor	Low	Mod	Mod	High	Mod	Mod	ND	V Low	V Low	Mod				

- Fertility:** Inherent fertility: considered to be extremely low due to extremely acid conditions with pH of 3 - 4.1 averaging at 3.86. Exch-H is high and Exch-Al is moderate and Al-saturation is very low indicating the acidity is not from Aluminium.
- Potential:** Fertility potential: or ability to retain added fertilisers is rated as moderate due to the CEC of the organic materials, but this potential could not be realised until soil acidity is greatly reduced
- Deficiencies:** Deficiencies: overall it appears that calcium (Ca) is deficient (low Exch-Ca and from Ca:Mg ratio) and that magnesium is slightly deficient as K may be. Use of dolomitic limestone would be indicated if this site was to be improved
- Salinity** Reclamation leaching not required, but check Ece after civil works complete to check for change in condition
- Reaction:** Reaction: at the time the samples were taken was extremely acid as detailed above
- Iron pptn:** Some risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** Moderate to high risk of iron toxicity to rice
- Acid Sulphate:** High risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H₂S and monitor for dropping pH values

A.24 Aceh Jaya – Treng Lipeh

Mixed: Deposit and Original Soil <i>(Depth range based on theory that mixing is done to twice the depth of original sediment)</i>														Exchangeables						Saturations				Cation Ratios		Cation Ratios		
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating
								H	Al						Ca	Mg	K	Na	CEC	TEB								
Mean for mixed soils				1.0	6.60	5.75	0.85	0.31	0.23	62	86	2.10	0.23	9.61	7.95	1.52	0.29	1.30	12.6	11.1	12.0	2.3	1.9	87.4	5.4	Mg sli deficient	6.67	OK
Ratings for mixed soils				Non Sal	Neutral	ND	ND	Low	Low	High	Low	Mod	Mod	Mod	Mod	Mod	Low	High	Low	Mod	ND	V Low	V Low	V High				

- Fertility:** Inherent fertility: considered to be moderate with Org-C, Total-N, C:N, Exch-Ca, Mg and TEB all moderate whilst Exch-K is low
- Potential:** Fertility potential: or ability to retain added fertilisers is rated as low with overall CEC of 12.6me/100g. Addition of organic manures (FYM / compost) would boost CEC and fertility
- Deficiencies:** Deficiencies: overall it appears as though magnesium (Mg) could be slightly deficient. Use of mineral fertilisers with Mg indicated
- Salinity** Reclamation leaching not required, but check Ece after civil works complete to check for change in condition
- Reaction:** Reaction at the time the samples were taken was ADD YOUR COMMENTS HERE, use F2 key and edit
- Iron pptn:** Some risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** No or only slight risk of iron toxicity to rice
- Acid Sulphate:** Moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H₂S and monitor for dropping pH values

A.25 Aceh Timur – Julok Tunong

Mixed: Deposit and Original Soil													<i>(Depth range based on theory that mixing is done to twice the depth of original sediment)</i>						Exchangeables					Saturations				Cation Ratios		Cation Ratios	
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g					Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating				
								H	Al						Ca	Mg	K	Na	CEC									TEB			
Mean for mixed soils				1.3	5.80	5.35	0.45	0.19	0.73	46	512	2.89	0.15	19.95	1.97	0.55	0.60	0.90	11.7	4.0	4.7	5.1	6.2	34.5	3.6	OK	0.92	Mg deficient			
Ratings for mixed soils				Non Sal	Sli Acid	ND	ND	V Low	Mod	High	M High	Mod	Low	Mod	V Low	Low	High	High	Low	Low	V Low	V Low	Low	V Low							

- Fertility:** Inherent fertility: considered to be low to very low with very low Exch-Ca, low Exch-Mg and TEB and very low BS. Total-N also low but Org-C moderate giving moderate C:N ratio
- Potential:** Fertility potential: or ability to retain added fertilisers is rated low with CEC of 11.7
- Deficiencies:** Deficiencies: overall it appears as though magnesium (Mg) could be deficient based on the Mg:K ratio. Use of dolomitic limestone or mineral fertilisers with Mg indicated
- Salinity** Reclamation leaching not required, but check Ece after civil works complete to check for change in condition
- Reaction:** Reaction: at the time the samples were taken was slightly acid, Exch-H very low and Exch-Al low as was Al-saturation.
- Iron pptn:** Little or no risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** Moderate to high risk of iron toxicity to rice
- Acid Sulphate:** Moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H₂S and monitor for dropping pH values

A.26 Aceh Utara – Kreung Tuan

Mixed: Deposit and Original Soil													<i>(Depth range based on theory that mixing is done to twice the depth of original sediment)</i>						Exchangeables					Saturations				Cation Ratios		Cation Ratios	
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g					Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating				
								H	Al						Ca	Mg	K	Na	CEC									TEB			
Mean for mixed soils				2.4	5.53	5.00	0.53	0.38	0.59	128	72	3.42	0.22	15.84	2.05	0.53	0.80	0.78	12.2	4.2	4.4	6.5	4.8	34.2	3.9	OK	0.68	Mg deficient			
Ratings for mixed soils				Non Sal	V Acid	ND	ND	Low	Mod	V High	Low	High	Mod	Mod	Low	Low	High	High	Low	Low	V Low	V Low	V Low	V Low							

A MANUAL SUMMARY FOR FERTILITY, DEFICIENCIES and REACTION SHOULD BE ATTEMPTED BASED ON THE ABOVE DATA AND ENTERED BELOW:

- Fertility:** Inherent fertility: considered to be low to very low with very acid soil (pH5.5) plus low Exch-Ca, Mg, TEB and very low BS. Org-C is high, total-N is moderate and C:N ratio also moderate
- Potential:** Fertility potential: or ability to retain added fertilisers is rated is low with CEC 12.2 despite there being high level of Org-C which often correlates with higher CEC
- Deficiencies:** Deficiencies: overall it appears as though magnesium (Mg) could be deficient. Use of dolomitic limestone indicated to help reduce acidity and supply Mg
- Salinity** Reclamation leaching probably not needed if good water management exists along with functioning drainage system, but check for change after civil works complete to check condition
- Reaction:** Reaction: at the time the samples were taken was very acid with pH of 5.5 but Exch-H and AL were only low and moderate respectively whilst Al-saturation was very low
- Iron pptn:** Some risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** Moderate to high risk of iron toxicity to rice
- Acid Sulphate:** Moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H₂S and monitor for dropping pH values

A.27 Aceh Utara – Pase Kanan

Mixed: Deposit and Original Soil													<i>(Depth range based on theory that mixing is done to twice the depth of original sediment)</i>						Exchangeables					Saturations				Cation Ratios		Cation Ratios	
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g					Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating				
								H	Al						Ca	Mg	K	Na	CEC									TEB			
Mean for mixed soils				1.7	5.93	5.53	0.40	0.25	0.53	82	119	3.15	0.18	17.93	2.05	1.99	0.57	0.62	10.8	5.2	18.0	5.3	5.0	48.2	2.9	Ca sli deficient	3.45	OK			
Ratings for mixed soils				Non Sal	Sli Acid	ND	ND	Low	Mod	High	Mod	High	Low	Mod	Low	Mod	Mod	Mod	Low	Low	ND	V Low	V Low	Low							

- Fertility:** Inherent fertility: considered to be low with slightly acid reaction, low Exch-Ca, low TEB and BS and Total-N. Org-C is high and C:N ratio moderate
- Potential:** Fertility potential: or ability to retain added fertilisers is rated low at 10.8me/100g
- Deficiencies:** Deficiencies: overall it appears as though calcium is slightly deficient and magnesium (Mg) could be deficient. Use of dolomitic limestone or mineral fertilisers with Mg indicated
- Salinity** Reclamation leaching not required, but check Ece after civil works complete to check for change in condition
- Reaction:** Reaction: at the time the samples were taken was slightly acidic with pH of 5.93, low Exch-H and moderate Exch-Al but Al-saturation very low.
- Iron pptn:** Some risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** Moderate to high risk of iron toxicity to rice
- Acid Sulphate:** Moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H₂S and monitor for dropping pH values

A.28 Aceh Utara – Pase Kiri

Mixed: Deposit and Original Soil <small>(Depth range based on theory that mixing is done to twice the depth of original sediment)</small>														Exchangeables						Saturations				Cation Ratios		Cation Ratios			
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating	
								H	Al						Ca	Mg	K	Na	CEC	TEB									
Mean for mixed soils				2.0	7.20	6.65	0.55	0.17	0.25	53	481	3.25	0.16	20.10	3.22	1.26	1.03	0.86	11.1	6.4	11.4	9.3	2.2	57.5	3.5	OK	1.31	Mg deficient	
Ratings for mixed soils				Non Sal	Neutral	ND	ND	V Low	Low	High	Mod	High	Low	Poor	Low	Low	High	High	Low	Low	ND	V Low	V Low	Mod					

- Fertility:** Inherent fertility: considered to be moderate to low with low Exch-Ca and Mg, low TEB and low Total-N but high Org-C and moderate BS
- Potential:** Fertility potential: or ability to retain added fertilisers is rated low with CEC of 11.1me/100g
- Deficiencies:** Deficiencies: overall it appears as though magnesium (Mg) is deficient with some suggestion that Ca could be deficient also. Use of mineral fertilisers with Mg indicated
- Salinity** Reclamation leaching not required, but check Ece after civil works complete to check for change in condition
- Reaction:** Reaction: at the time the samples were taken was neutral with pH of 7.2 and very low Exch-H, low Exch-Al and very low Al-saturation.
- Iron pptn:** Some risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** No or only slight risk of iron toxicity to rice
- Acid Sulphate:** Moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H₂S and monitor for dropping pH values

A.29 Bireuen – Pandrah

Mixed: Deposit and Original Soil <small>(Depth range based on theory that mixing is done to twice the depth of original sediment)</small>														Exchangeables						Saturations				Cation Ratios		Cation Ratios			
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating	
								H	Al						Ca	Mg	K	Na	CEC	TEB									
Mean for mixed soils				1.6	5.60	5.20	0.40	0.30	0.56	157	133	4.78	0.22	21.73	3.88	0.59	0.31	0.62	12.3	5.4	4.8	2.5	4.5	43.8	6.6	Mg sli deficient	1.90	Mg deficient	
Ratings for mixed soils				Non Sal	Sli Acid	ND	ND	Low	Mod	V High	Mod	High	Mod	Poor	Low	Low	Mod	Mod	Low	Low	V Low	V Low	V Low	Low					

A MANUAL SUMMARY FOR FERTILITY, DEFICIENCIES and REACTION SHOULD BE ATTEMPTED BASED ON THE ABOVE DATA AND ENTERED BELOW:

- Fertility:** Inherent fertility: considered to be low with slightly acid reaction, low Exch-Ca, Mg, TEB and BS. However, Org-C is high and Total-N moderate but the C:N ratio is poor
- Potential:** Fertility potential: or ability to retain added fertilisers is rated low with CEC of 12.3me/100g despite there being a high level of Org-C in the soil
- Deficiencies:** Deficiencies: overall it appears as though magnesium (Mg) could be deficient. Use of dolomitic limestone, which would help lower the slight acidity and enable decomposition of the Org-matter plus add Mg, indicated
- Salinity** Reclamation leaching not required, but check Ece after civil works complete to check for change in condition
- Reaction:** Reaction: at the time the samples were taken was slightly acidic with pH of 5.6 but Exch-H was low though Exch-Al moderate, Al-saturation was very low.
- Iron pptn:** Some risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** Moderate to high risk of iron toxicity to rice
- Acid Sulphate:** Moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H₂S and monitor for dropping pH values

A.30 Bireuen – Pate Lhong

Mixed: Deposit and Original Soil <small>(Depth range based on theory that mixing is done to twice the depth of original sediment)</small>														Exchangeables						Saturations				Cation Ratios		Cation Ratios			
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating	
								H	Al						Ca	Mg	K	Na	CEC	TEB									
Mean for mixed soils				0.7	5.87	5.47	0.40	0.24	0.59	210	117	3.75	0.17	22.11	2.26	0.53	0.59	0.55	11.6	3.9	4.6	5.1	5.1	34.2	4.3	OK	0.93	Mg deficient	
Ratings for mixed soils				Non Sal	Sli Acid	ND	ND	Low	Mod	Ext High	Mod	High	Low	Poor	Low	Low	Mod	Mod	Low	Low	V Low	V Low	Low	V Low					

- Fertility:** Inherent fertility: considered to be low with Total-N low along with Exch-Ca, Mg, TEB whilst BS is very low
- Potential:** Fertility potential: or ability to retain added fertilisers is rated low with CEC of 11.6
- Deficiencies:** Deficiencies: overall it appears as though magnesium (Mg) is deficient or slightly deficient. Use of dolomitic limestone indicated as this would supply Mg whilst also possibly enabling breakdown of the Org-C materials
- Salinity** Reclamation leaching not required, but check Ece after civil works complete to check for change in condition
- Reaction:** Reaction: at the time the samples were taken was slightly acid with pH of 5.87 but Exch-H and Al were only low and moderate respectively and Al-saturation was low. At these pH levels precipitation of iron not expected
- Iron pptn:** Some risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** Moderate to high risk of iron toxicity to rice
- Acid Sulphate:** Moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H₂S and monitor for dropping pH values

A.31 Bireuen – Paya Nie

Mixed: Deposit and Original Soil <small>(Depth range based on theory that mixing is done to twice the depth of original sediment)</small>														Exchangeables						Saturations				Cation Ratios		Cation Ratios		
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating
								H	Al						Ca	Mg	K	Na	CEC	TEB								
Mean for mixed soils				1.4	5.48	4.93	0.55	0.25	0.53	106	154	3.54	0.17	20.83	2.52	0.55	0.54	0.53	12.2	4.1	4.5	4.5	4.3	33.8	4.6	OK	1.04	Mg deficient
Ratings for mixed soils				Non Sal	V Acid	ND	ND	Low	Mod	V High	Mod	High	Low	Poor	Low	Low	Mod	Mod	Low	Low	V Low	V Low	V Low	V Low				

- Fertility:** Inherent fertility: considered to be very low due to very acid soil reaction (pH5.5) and low Total-N as well as low Exch-Ca, Mg and TEB plus very low BS. Org-C level is high and the C:N ratio is poor.
- Potential:** Fertility potential: or ability to retain added fertilisers is rated low with CEC of 12.2me/100g despite there being high Org-C content
- Deficiencies:** Deficiencies: overall it appears as though magnesium (Mg) could well be deficient as indicated by cation ratios and Exch-Mg level. Use of dolomitic limestone is indicated
- Salinity** Reclamation leaching not required, but check Ece after civil works complete to check for change in condition
- Reaction:** Reaction: at the time the samples were taken was very acid with soil pH of 5.48 but Exch-H and Al were only low to moderate respectively whilst Al-saturation was very low. Precipitation of iron would not be a problem at these pH levels
- Iron pptn:** Some risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** Moderate to high risk of iron toxicity to rice
- Acid Sulphate:** Moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H₂S and monitor for dropping pH values

A.32 Bireuen - Pseudada

Mixed: Deposit and Original Soil <small>(Depth range based on theory that mixing is done to twice the depth of original sediment)</small>														Exchangeables						Saturations				Cation Ratios		Cation Ratios		
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating
								H	Al						Ca	Mg	K	Na	CEC	TEB								
Mean for mixed soils				1.5	5.65	5.00	0.65	0.32	0.72	159	132	4.24	0.23	19.12	2.50	0.55	0.61	0.58	12.4	4.2	4.5	5.0	5.8	34.3	4.5	OK	0.96	Mg deficient
Ratings for mixed soils				Non Sal	Sli Acid	ND	ND	Low	Mod	V High	Mod	High	Mod	Mod	Low	Low	High	Mod	Low	Low	V Low	V Low	Low	V Low				

- Fertility:** Inherent fertility: considered to be low to very low with Exch-C and Mg low, as is TEB but BS is very low. Org-C is high, Total-N is moderate and C:N ratio moderate
- Potential:** Fertility potential: or ability to retain added fertilisers is rated low with CEC of 12.4 despite there being high level of Org-C in the soil
- Deficiencies:** Deficiencies: overall it appears as though magnesium (Mg) is slightly deficient to deficient. Use of dolomitic limestone indicated as this would alter the soil reaction, add Mg and possibly enable better decomposition of the Org-C
- Salinity** Reclamation leaching not required, but check Ece after civil works complete to check for change in condition
- Reaction:** Reaction: at the time the samples were taken was slightly acid with pH of 5.65, Exch-H was low and Exch-Al moderate but Al-saturation was low. At these pH values precipitation of iron should not be a problem for rice roots or clogging drains
- Iron pptn:** Some risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** Moderate to high risk of iron toxicity to rice
- Acid Sulphate:** Moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H₂S and monitor for dropping pH values

A.33 Bireuen - Samalanga

Mixed: Deposit and Original Soil <small>(Depth range based on theory that mixing is done to twice the depth of original sediment)</small>														Exchangeables						Saturations				Cation Ratios		Cation Ratios		
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating
								H	Al						Ca	Mg	K	Na	CEC	TEB								
Mean for mixed soils				4.0	5.90	5.43	0.47	0.16	0.43	64	326	3.20	0.19	17.13	2.55	0.57	0.62	0.87	11.3	4.6	5.1	5.5	3.8	41.4	5.0	OK	0.98	Mg deficient
Ratings for mixed soils				Non Sal	Sli Acid	ND	ND	V Low	Low	High	Mod	High	Low	Mod	Low	Low	High	High	Low	Low	V Low	V Low	V Low	Low				

- Fertility:** Inherent fertility: considered to be low with Exch-Ca, Mg, TEB and BS all low as is Total-N. Org-C high and C:N ratio moderate
- Potential:** Fertility potential: or ability to retain added fertilisers is rated low with CEC 11.3me/100g despite the Org-C being high at 3.2%
- Deficiencies:** Deficiencies: overall it appears as though magnesium (Mg) could be deficient. Use of dolomitic limestone, as this would overcome the slight acidity plus add Mg - use or mineral fertilisers with Mg
- Salinity** Reclamation leaching probably not needed if good water management exists along with functioning drainage system, but check for change after civil works complete to check condition
- Reaction:** Reaction: at the time the samples were taken was slightly acid with soil pH of 5.9 but Exch-H was very low and Exch-Al low whilst Al-saturation also very low. If these pH values maintained precipitation of iron should not be a problem
- Iron pptn:** Some risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** Moderate to high risk of iron toxicity to rice
- Acid Sulphate:** Moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H₂S and monitor for dropping pH values

A.34 Pidie - Beuracan

Mixed: Deposit and Original Soil														Exchangeables						Saturations				Cation Ratios		Cation Ratios		
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating
								H	Al						Ca	Mg	K	Na	CEC	TEB								
Mean for mixed soils				1.9	5.66	5.09	0.58	0.22	0.62	94	95	3.43	0.15	23.52	2.25	1.13	0.55	0.61	10.3	4.6	10.5	5.3	6.1	43.8	6.9	Mg sli deficient	2.08	Mg sli deficient
Ratings for mixed soils				Non Sal	Sli Acid	ND	ND	Low	Mod	High	Low	High	Low	Poor	Low	Low	Mod	Mod	Low	Low	ND	V Low	Low	Low				

- Fertility:** Inherent fertility: considered to be poor to moderate due to variable soil acidities which range from 5.45 - 6.10, Exch-Al which is moderate and low levels of Excc-Ca, Mg, TEB, BS and Total-N
- Potential:** Fertility potential: or ability to retain added fertilisers is rated low with CEC of 10.3 despite high level of Org-C
- Deficiencies:** Deficiencies: overall it appears as though magnesium (Mg) could be deficient, sometimes with P-inhibition and possible calcium deficiency. Use of dolomitic limestone or mineral fertilisers with Mg indicated
- Salinity** Reclamation leaching not required, but check Ece after civil works complete to check for change in condition
- Reaction:** Reaction: at the time the samples were taken was slightly to very acid with pH ranging from 5.5 - 6.1 and moderate levels of Exch-Al
- Iron pptn:** Some risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** Moderate to high risk of iron toxicity to rice
- Acid Sulphate:** Moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H₂S and monitor for dropping pH values

A.35 Pidie – Cubo Trienggading

Mixed: Deposit and Original Soil														Exchangeables						Saturations				Cation Ratios		Cation Ratios		
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating
								H	Al						Ca	Mg	K	Na	CEC	TEB								
Mean for mixed soils				1.0	5.77	5.23	0.53	0.36	0.55	115	109	2.54	0.17	16.42	2.07	0.45	0.67	0.78	10.5	4.0	4.3	6.3	5.3	37.9	6.1	Mg sli deficient	0.68	Mg deficient
Ratings for mixed soils				Non Sal	Sli Acid	ND	ND	Low	Mod	V High	Mod	Mod	Low	Mod	Low	V Low	High	High	Low	Low	V Low	V Low	Low	Low				

- Fertility:** Inherent fertility: considered to be rather low with pH ranging from 5.4 - 6.0, low levels of Excc-Ca, Mg, TEB and BS plus low Total-N
- Potential:** Fertility potential: or ability to retain added fertilisers is rated as low with CEC of 10.5me/100g.
- Deficiencies:** Deficiencies: overall it appears as though magnesium (Mg) could be deficient. Use of dolomitic limestone or mineral fertilisers with Mg indicated
- Salinity** Reclamation leaching not required, but check Ece after civil works complete to check for change in condition
- Reaction:** Reaction: at the time the samples were taken ranged from 5.4 to 6.0, Exch-H was low but Exch-Al was moderately high but Al-saturation was low. Iron should not precipitate out at these pH levels so drain clogging and rice root damage should not be a problem
- Iron pptn:** Some risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** Moderate to high risk of iron toxicity to rice
- Acid Sulphate:** Moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H₂S and monitor for dropping pH values

A.36 Singkil – Parakan Sulampi

Mixed: Deposit and Original Soil														Exchangeables						Saturations				Cation Ratios		Cation Ratios		
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating
								H	Al						Ca	Mg	K	Na	CEC	TEB								
Mean for mixed soils				0.7	5.00	4.60	0.40	0.16	1.90	77	135	3.12	0.17	18.35	2.47	0.48	0.61	0.50	12.1	4.1	4.0	5.0	15.7	33.5	5.1	Mg sli deficient	0.79	Mg deficient
Ratings for mixed soils				Non Sal	V Acid	ND	ND	V Low	Mod	High	Mod	High	Low	Mod	Low	V Low	High	Mod	Low	Low	V Low	V Low	Mod	V Low				

- Fertility:** Inherent fertility: considered to be low to very low due to the combination of very acid reaction, pH 5.0, low and very low levels of Exch-Ca, Mg, TEB, BS and Total-N, though Exch-K levels are high
- Potential:** Fertility potential: or ability to retain added fertilisers is rated low due to CEC of 12.1 despite Org-C being high at 3.12%.
- Deficiencies:** Deficiencies: overall it appears as though magnesium (Mg) could be deficient. Use of dolomitic limestone with or without mineral fertilisers with Mg indicated
- Salinity** Reclamation leaching not required, but check Ece after civil works complete to check for change in condition
- Reaction:** Reaction: at the time the samples were taken was very acidic with pH 5.0, Exch-Al moderate and Al-saturation also moderate causing the Liming Requirement and pH vs ASP sheets to respond
- Iron pptn:** Some risk of iron precipitation with root damage and drain clogging
- Iron Toxicity:** Moderate to high risk of iron toxicity to rice
- Acid Sulphate:** Moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H₂S and monitor for dropping pH values

A.37 Singkil - Sidorejo

Mixed: Deposit and Original Soil <small>(Depth range based on theory that mixing is done to twice the depth of original sediment)</small>														Exchangeables						Saturations				Cation Ratios		Cation Ratios		
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating
								H	Al						Ca	Mg	K	Na	CEC	TEB								
Mean for mixed soils				0.7	5.05	4.60	0.45	0.23	3.50	132	168	3.60	0.18	20.62	2.13	0.55	0.65	0.50	18.6	3.8	3.1	3.6	19.7	21.9	3.9	OK	0.87	Mg deficient
Ratings for mixed soils				Non Sal	V Acid	ND	ND	Low	High	V High	Mod	High	Low	Poor	Low	Low	High	Mod	Mod	Low	V Low	V Low	Mod	V Low				

Fertility: Inherent fertility: considered to be rather low due to very acidic reaction, pH 5.05, high Exch-Al and moderately high Al-saturation in conjunction with low Exc-Ca, Mg, TEB and Total-N and very low BS

Potential: Fertility potential: or ability to retain added fertilisers is rated moderate with CEC of 18.6 but this would be from the high level of Org-C. This potential could not be realised until the acidity was brought under control.

Deficiencies: Deficiencies: overall it appears as though calcium (Ca) and magnesium (Mg) could both be deficient. Use of dolomitic limestone or mineral fertilisers with Mg indicated

Salinity Reclamation leaching not required, but check Ece after civil works complete to check for change in condition

Reaction: Reaction: at the time the samples were taken was very acid with pH of 5.05, high Exch-Al and moderate Al-saturation. Both the Lime Requirement and pH vs ASP sheets responded to the levels of exch-Al

Iron pptn: Some risk of iron precipitation with root damage and drain clogging

Iron Toxicity: Moderate to high risk of iron toxicity to rice

Acid Sulphate: Moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H₂S and monitor for dropping pH values

A.38 Singkil – Tana Bara

Mixed: Deposit and Original Soil <small>(Depth range based on theory that mixing is done to twice the depth of original sediment)</small>														Exchangeables						Saturations				Cation Ratios		Cation Ratios		
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating
								H	Al						Ca	Mg	K	Na	CEC	TEB								
Mean for mixed soils				1.0	4.55	4.10	0.45	0.30	2.20	118	205	4.75	0.17	27.94	2.12	0.57	0.78	0.42	22.2	3.9	2.6	3.6	10.0	17.6	3.7	OK	0.75	Mg deficient
Ratings for mixed soils				Non Sal	Ext Acid	ND	ND	Low	High	V High	Mod	High	Low	Poor	Low	Low	High	Mod	Mod	Low	V Low	V Low	Low	V Low				

Fertility: Inherent fertility: considered to be rather poor due to the extreme acidic nature of the soil with pH 4.55, high Exch-Al though Exch-h is low. Al-saturation is, however, still classified as low. Exch-Ca, Mg and TEB are low but Org-C is high

Potential: Fertility potential: or ability to retain added fertilisers is rated as moderate with CEC of 22.2me/100g but this could only be realised if the acidity was controlled

Deficiencies: Deficiencies: overall it appears as though magnesium (Mg) could be deficient according to the Mg:K ratio plus the fact that Exch-Mg is rated as low. Use of dolomitic limestone or mineral fertilisers with Mg indicated

Salinity Reclamation leaching not required, but check Ece after civil works complete to check for change in condition

Reaction: Reaction: at the time the samples were taken was extremely acid with pH of 4.55, high Exch-Al but Exch-H and Al-saturation both low

Iron pptn: Some risk of iron precipitation with root damage and drain clogging

Iron Toxicity: Moderate to high risk of iron toxicity to rice

Acid Sulphate: Moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H₂S and monitor for dropping pH values

A.39 Singkil – Ujung Bawang (Organic Soil – Hemist)

Mixed: Deposit and Original Soil <small>(Depth range based on theory that mixing is done to twice the depth of original sediment)</small>														Exchangeables						Saturations				Cation Ratios		Cation Ratios		
Index No	Use Index No	Texture	Depth Range	EC dS/m	pH H ₂ O	pH KCl	pH diff	Exchangeable		Fe ppm	SO ₄ ppm	Org C %	Total N %	C:N	meq / 100g						Mg Sat%	K Sat%	Al Sat%	BS %	Ca/Mg	Rating	Mg/K	Rating
								H	Al						Ca	Mg	K	Na	CEC	TEB								
Mean for mixed soils				5.4	4.23	3.85	0.38	0.32	2.09	241	346	8.84	0.18	48.70	1.97	0.57	0.67	0.40	35.1	3.6	1.7	2.0	6.2	10.8	3.5	OK	0.85	Mg deficient
Ratings for mixed soils				Sli Sal	Ext Acid	ND	ND	Low	High	Ext High	Mod	V High	Low	Poor	V Low	Low	High	Mod	High	Low	V Low	V Low	Low	V Low				

Fertility: Inherent fertility of the peats: considered to be very poor due to extreme acidity (overall pH 4.23) and very low to low levels of Exch-Ca, Mg, TEB and Total-N plus BS very low

Potential: Fertility potential: or ability to retain added fertilisers is rated as high with the peat having overall CEC of 35.1 me/100g, but this potential could not be tapped until such time as the acidity was greatly reduced

Deficiencies: Deficiencies: overall it appears as though magnesium (Mg) could be deficient. Use of dolomitic limestone indicated as this would help alter soil pH and supply the missing Mg

Salinity Reclamation leaching probably required, especially if drainage system previously not fully functional

Reaction: Reaction: at the time the samples were taken was extremely acid as noted above with Exch-H being low and Exch-Al high, but Al-saturation still rated as low

Iron pptn: Some risk of iron precipitation with root damage and drain clogging

Iron Toxicity: Moderate to high risk of iron toxicity to rice

Acid Sulphate: Moderate risk of acid sulphate conditions existing, as / if soils dry monitor for smell of H₂S and monitor for dropping pH values

A.40 Singkil – Ujung Bawang (Mineral soil)

Kabupaten: **Singkil**

Chemical Characteristics of - **Mineral Soil**

Scheme: **Unjung Bawang**

Use	Texture	Depth	EC	pH	pH	pH	Exchangeable		Fe	S	Org C	Total N	C:N	meq / 100g				Mg	K	Al	BS						
Index No		Range	dS/m	H2O	KCl	diff	H	Al	ppm	ppm	%	%		Ca	Mg	K	Na	CEC	TEB	Sat%	Sat%	Sat%	%	Ca/Mg	Rating	Mg/K	Rating
	Mean for mixed soils		0.63	5.9	5.3	0.6	0.42	0.9	200.9	90.5	4	0.19	21	2.88	0.57	0.71	0.62	10.29	4.78	5.53936	6.8999	9	46	5.05	Mg sli deficient	0.80	Mg deficient
	Ratings for mixed soils		NonSal	Sli Acid	ND	ND	Low	Mod	Ext High	Low	High	Low	Poor	Low	Low	High	Mod	Low	Low	V Low	V Low	Low	Low				

Inherent fertility of the mineral soil is not too good in that pH is slightly acid, Exch-Ca, Mg, BS and TEB are all low and the C:N ratio is poor due to the low Total-N and high Org-C.

Fertility potential is rated as low due to CEC being only 10.3 me/100g despite the high Org-C content.

The various cation ratios indicate that magnesium (Mg) is slightly deficient to deficient, this is further back-up by Exch-Mg being rated low.

Soil reaction is slightly acid at pH 5.9 and Exch-H is low but Exch-Al is moderate though Al-saturation is still rated low despite being 9%.

Being slightly acidic it is unlikely that iron could precipitate out and cause problems on rice roots or by clogging up drainage channels.

There might be some risk of acid sulphate conditions due to the high level of Org-C, extremely high levels Fe though S is only rated as moderate

Reclamation leaching not required, but check Ece after civil works complete to check for change in condition

B.1 ETESP Soil Desalinisation and Improvement Reports

B.1.1 Technical Data Reports

ETESP Agricultural Component, Desalinisation & Soil Improvement, Mobilisation Report, OCTOBER 2005, Updated FEBRUARY 2006

ETESP, Banda Aceh Kota, Kuta Alam, Data Assessment and Soil Reclamation, NOVEMBER 2005

ETESP, Aceh Besar Kabupaten, *Lhoknga, Darussalam and Baitissalam*, Data Assessment and Soil Reclamation, DECEMBER 2005

ETESP, Pidie Kabupaten, *Meureudu, Triang Gadeng, Panteraja and Simpang Tiga*, Data Assessment and Soil Reclamation, DECEMBER 2005

ETESP, Bireuen Kabupaten, *Samalanga, Jeunieb, Jeumpa, Jangka and Ganda Pura*, Data Assessment and Soil Reclamation, DECEMBER 2005

ETESP, Executive Summary, Soil and Land Reclamation, DECEMBER 2005

ETESP, Soil and Land Reclamation Scenarios, DECEMBER 2005, Updated March 2006

ETESP, Interpretation of Laboratory Data for ETESP Irrigation Component, FEBRUARY 2006

B.1.2 Background Technical Papers

ETESP, Background Paper, Annual & Monthly Rainfall, OCTOBER 2005

ETESP, Background Paper, Soil Acidity and Aluminium, DECEMBER 2005

ETESP, Digital Maps, FEBRUARY 2006, Update MARCH 2006

ETESP, Sandy Sediments, FEBRUARY 2006, Updated March 2006

ETESP, Soil Conditions for Wetland Rice, MARCH 2006

B.1.3 Site Visit and Tour Reports

ETESP, Site Visit Report – BRR Area at Lhoong: Kemukiman Cot Jeumpa, DECEMBER 2005

ETESP, Site Visit report, BLANG KREUNG SITE, DECEMBER 2005

ETESP, Tour Report, Field Tour Report NAD Areas, Feb 20th – Feb 24th 2006, FEBRUARY 2006

ETESP, Site Visit Report, Visit to Oxfam Sites Calang, MARCH 2006

ETESP, Site Visit Report, Visit to Red Cross Site, Aceh Besar, MARCH 2006

ETESP, Site Visit Report, Lhamno Irrigation Sites, Aceh Jaya, MARCH 2006

B.2 ETESP Soil Desalinisation and Improvement Tools

File name and date	Purpose
ETESP ECe from EM38 data.XLS OCTOBER 2005	Calculate soil salinity (ECe) values from raw data collected by EM38 salinity device when no calibration information provided
ETESP Leaching Water Requirements.XLS NOVEMBER 2005	Calculate the depths and volumes of water that have to be applied and pass through a selected depth of soil to achieve desalinisation. Information required includes: <ul style="list-style-type: none"> • Textural class of soil • Initial salinity of the soil (dS/m) • Target salinity wished to be achieved (dS/m)

ETESP Irrigation Leaching Progress.XLS NOVEMBER 2005	Determine how many irrigation gifts have to be applied to achieve de-salinisation of various depths of variously textured soil. Information required includes: <ul style="list-style-type: none"> • Soil textural group, or • AWHC (Available Water Holding Capacity) • Estimate of water application efficiency, or use default values • Size of irrigation gift as mm of water
ETESP Survey Density.XLS DECEMBER 2005	1. Correlate the scale at which to map surveys of various types from reconnaissance to very detailed level 2. Determine observation density (Sites / hectare) 3. Calculate the total number of sites for surveys at various reliability levels Requirements: <ul style="list-style-type: none"> • Survey area extent in hectares (ha) Also presents various map and mapping information
ETESP Labdata summary.XLS Version 4 FEBRUARY 2006	Enter standard laboratory data and obtain ratings as to the level of all the various nutrients and chemical properties. Also calculate weighted mean vales for topsoil and subsoil plus obtain automatic simple summary of: <ul style="list-style-type: none"> • Inherent fertility • Fertility potential • Possible nutrient deficiencies • Salinity status, and • Reaction Also experimental estimate of possible perceived risks
ETESP Site Monitoring tool.XLS March 2006	Enter field data for specific sites or villages making note of : <ol style="list-style-type: none"> 1. <u>Locational information</u> <ul style="list-style-type: none"> • Kabupaten • Kecamatan • Desa • Farmer or Land-owner, and • Geographic coordinates 2. <u>Soil, land and crop features</u> <ul style="list-style-type: none"> • surface soil textural group • soil salinity • soil acidity • irrigation water quality (salinity) • status of drains, plus • estimate (%) of the actual pre-tsunami crop yield to monitor land reclamation progress and get information on further interventions possibly required
ETESP Soil Conditions Database tool.XLS March 2006	Enter field collected on the site form, or data collated and analysed from the data on the site form into a format that will be the first stages of a dbms / GIS compilation: <ul style="list-style-type: none"> • surface soil textural group • soil salinity • soil acidity • irrigation water quality (salinity) • status of drains, plus • estimate (%) of the actual pre-tsunami crop yield The data are stored against the official Dinas selected villages that qualify for ETESP inputs. This collation will allow monitoring land reclamation progress within kecamatan and kabupaten and get information on further interventions possibly required
ETESP Auger Description Form	Simple pro-forma for recording data collected during soil investigations to establish depths and distribution of sandy sediments