

TABLE OF CONTENTS

	Page
PREFACE.....	i
PREFACE BY INDONESIAN DIRECTOR.....	ii
RESEARCH TEAM IN INDONESIA.....	iii
TABLE OF CONTENTS.....	iv
LIST OF TABLES.....	vii
LIST OF FIGURES.....	ix
LIST OF PHOTOS.....	x
ABBREVIATION.....	xi
PART ONE - INTRODUCTION.....	1
1.1. General Framework.....	2
1.2. Aim.....	3
1.3. Scope.....	3
1.4. Research Design.....	3
1.5. Research Methodology.....	4
1.6. Seminar and Workshops.....	4
PART TWO - FACT FINDING.....	5
2.1. NORTH JAKARTA.....	6
2.1.1. General Information.....	6
(1) Natural Condition.....	6
(2) Social Condition.....	9
2.1.2. Study Area Condition (Kecamatan Penjaringan in North Jakarta).....	12
(1) Physical characteristics.....	12
(2) Socio Economic Profile.....	13
2.1.3 The Effect of the Inundated Area on Building and Inhabitant's Live.....	14
(1) Building Deterioration.....	14
(2) Socio Economic.....	16
(3) Adaptation.....	17
2.2. SEMARANG.....	20
2.2.1. General Condition.....	20
(1) Urban Scope.....	20
(2) Inundated Area.....	21
(3) Study Area.....	22
2.2.2. The Effect of the Inundations on the Buildings and the Inhabitant's Lives.....	25
(1) Buildings Deterioration.....	25
(2) The Daily Activities.....	28
(3) Adaptation.....	29
2.3. SURABAYA.....	33
2.3.1. General condition.....	33
(1) Urban Scope.....	33
(2) Inundated Area.....	38
(3) Study Area.....	39
2.3.2. The Effect of the Inundation on the Buildings and the Inhabitants' Lives.....	43
(1) Building Deterioration.....	43
(2) The Daily Activities.....	45
(3) Adaptation.....	46



2.4. DENPASAR.....	47
2.4.1. General	47
(1) Urban Condition.....	47
(2) Inundated Area	48
(3) Study Area Condition	49
2.4.2. The Effect of the Inundation on the Buildings and the Inhabitant's Lives	50
(1) Building Deterioration.....	50
(2) The Daily Activities	51
(3) Adaptation.....	52
2.5. MATARAM.....	54
2.5.1. General	54
(1) Urban Condition.....	54
(2) Inundated Area	57
(3) Study Area Condition	59
2.5.2. The Effect of the Inundation on the Buildings and the Inhabitants' Lives	61
(1) Building Deterioration.....	61
(2) The Daily Activities	64
(3) Adaptation.....	65
2.6. BANJARMASIN	67
2.6.1. General Condition.....	67
(1) Urban Condition	67
(2) Inundated Area	69
(3) Study Area Condition	69
2.6.2. The Effect of the Inundated Area on Buildings and the Inhabitant's Live	71
(1) Building Deterioration.....	71
(2) The Daily Activities	72
(3) Adaptation.....	73
2.7. MAKASSAR.....	74
2.7.1. General Condition.....	74
(1) Urban Scope	74
(2) Inundated Area	78
(3) Study Area Condition	79
2.7.2. The Effect of the Inundation on Buildings and the Inhabitants' Lives	84
(1) Building Deterioration.....	84
(2) The Daily Activities	89
(3) Adaptation.....	89
PART THREE - LOSS MEASUREMENT	92
3.1. Loss of Building Analysis	93
3.2. Loss of Productive Hours	103
3.2.1. The percentages of respondents disrupted by inundation matters	104
3.2.2. Time Spent During Inundation Periods	105
3.3. Loss of Residential Areas in Term of Damaged Houses	106
PART FOUR - MACRO ANALYSIS ON GIS	117
4.1. Methoand Data Available	118
4.2. Identification of Current Areal Zone on GIS	119
4.2.1. Landuse Identification through Satellite Image.....	119
4.2.2. contour zone identification from geological map data	123
4.3. Identification of Damaged Area After SLR	125

4.3.1. Future Coast Line.....	128
4.3.2. Future Innundated Area.....	129
4.4. Total Loss of Living Areas in Terms of Damaged Houses	130
4.5. Description and Evaluation of Possible Adaptation on GIS.....	130
PART FIVE - CONCLUSION AND RECOMMENDATION	134
5.1. Conclusion.....	135
5.1.1. Loss Measurement.....	135
5.1.2. Impact of Socio-economy.....	135
5.1.3. Influence of SLR in each area.....	136
5.2. Recommendation.....	137
5.2.1. Further development on loss measurement.....	137
5.2.2. Policies in view of socio-economic points.....	138
5.2.3. Suitable policies for each area	139
5.3. Application to other region/cities	139
5.3.1. Basic Units.....	139
5.3.2. Methods	139
5.3.3. Unit for Measurement.....	139
5.4. Setting up practical strategies adaptation	139
5.4.1. Financially best efficient solution.....	139
5.4.2. Socially feasible solution.....	140
5.5. Designing future images of cities	140
5.5.1. Viewpoint of emission.....	140
5.5.2. Longitudinal adaptation and future urban image	141
BIBLIOGRAPHY	142
APPENDIXES	145
Appendix 1: Questionnaire and Survey Guidance.....	145
Pengukuran Kerugian Bangunan Rumah Secara Fisik (Questionnaire, Measurement of fysical loss of residensial building)	146
Pengukuran Kerugian Rumah Secara Sosial dan Ekonomi (Questionnaire, Measurement of social and economical loss of households)	166
Penunjuk Pelaksanaan Survei Lapangan (Manual for field survey)	169
Appendix 2: Recapitulation of Cased House.....	176
Penjaringan sub-district, Jakarta.....	177
Loss measurement of houses in Penjaringan sub-district, Jakarta	182
1. One storey house	182
2. Two storey house	186
Tanjung Mas sub-district, Semarang.....	195
Loss measurement of houses in Tanjung Mas, Semarang.....	198
1. One storey house	198
Rungkut sub-district, Surabaya	204
Loss measurement of houses in Medokan Ayu & Kali Rungkut sub-district, Surabaya.....	208
1. One storey house	208
2. Two storey house	213
Serangan sub-district, Denpasar	220
Loss measurement of houses in Serangan sub-district, Denpasar	224
1. One storey house	224
Ampenan sub-district, Mataram	229
Loss measurement of Ampenan sub-district, Mataram	235
1. One storey house	235
North Kuin sub-district, Banjarmasin	240

Loss measurement of houses in Kuin Utara sub-district, Banjarmasin	246
1. One storey house	246
2. Two storey house	249
Cambaya sub-district, Makassar	254
Loss measurement of houses in Cambaya sub-district, Makassar	257
1. One storey house	257
2. Two storey house	260
Appendix 3: SATELLITE IMAGE ANALYSIS GUIDANCE.....	266
1. Preparation	267
2. Identification of land use zone, and polygon data entry	267
3. Altitude zone data entry, and overlay with land use zone	269
4. Measurement of area	270
5. Cross tabulation between altitude zone and land use zone	270
Annex	271
Appendix 4: OUTLINE OF SEMINARS AND WORKSHOPS	276
1. Seminar (19-20, Mar. 2001, Hotel Santika, Bandung)	277
2. Seminar (12-13, Mar. 2002, RIHS, Bandung)	281
3. Lokakarya (<i>Workshop</i>) (3-4, Feb. 2003, Hotel Lingga, Bandung)	285
LIST OF TABLES	
Table2.1.1. Water temperature in Jakarta bay and Seribu Archipelago	6
Table2.1.2. Average salinities (per mil) Jakarta Bay, 1996	8
Table2.1.3. Rise and fall of the tide in Jakarta bay, 1993	8
Table2.1.4. Households in Jakarta Utara	10
Table2.1.5. The total housing devided by its physical condition	11
Table2.1.6. Total Population of North Jakarta-2000	11
Table2.1.7. Building types in Penjaringan-Subdistrict	12
Table2.1.8. Land used in Penjaringan	13
Table2.1.9. The village and population in Penjaringan Kecamatan	13
Table2.1.10. The livelihood of the people in Penjaringan Kelurahan	13
Table2.1.11. The function and finance loss of building by Inundation	15
Table2.1.12. The effect of inundation to other daily activity	16
Table2.1.13. The effect of inundation to other daily activity	16
Table2.1.14. The effect of inundation to infrastructure	16
Table2.1.15. Action against flood	17
Table2.1.16. The effect of inundate to infrastructure	18
Table2.1.17. The effect of inundate to infrastructure	19
Table2.1.18. The effect of inundate to infrastructure	19
Table2.2.1. The Growth of Households and Dwelling Units Numbers	23
Table2.2.2. Occupation of Inhabitants	24
Table2.2.3. Education of Inhabitants	24
Table2.2.4. The total number of existing houses in Tanjung Mas village	25
Table2.2.5. The performance of constructed dwelling units (houses) in Tanjung Mas village	26
Table2.2.6. The Effects of the Inundation on The Inhabitant's Lives	28
Table2.2.7. The Growth of Urban Population	32
Table2.2.8. Adaptation of the inhabitants' lives	32
Table2.2.9. The reason of that inhabitants live	32
Table2.3.1. Kecamatan and Kelurahan in Surabaya	33
Table2.3.2. Inundation Height and Duration in RWs of Kecamatan Rungkut	39
Table2.3.3. Kelurahan in Kecamatan Rungkut	40
Table2.3.4. Occupations in Kecamatan Rungkut	40
Table2.3.5. Land use in Kecamatan Rungkut	41
Table2.3.6. Industries in Kecamatan Rungkut	41
Table2.3.7. Facilities in Kecamatan Rungkut	41
Table2.3.8. Building Types in Kecamatan Rungkut	42

Table2.3.9. Deterioration of Building Components	44
Table2.3.10. Daily Activities Disturbed by Inundation	45
Table2.3.11. Life Line Disturbed by Inundation	45
Table2.3.12. Schools not Disturbed by Inundation	45
Table2.3.13. Adaptation by Inhabitants	45
Table2.4.1. Geological Condition of the Denpasar Land Unit	42
Table2.4.2. Type, length and function of coastal area	48
Table2.4.3. Livelihood of people in Serang	50
Table2.4.4. Outdoor Activities	51
Table2.4.5. Indoor activities	52
Table2.4.6. The activity after inundation	53
Table2.4.7. People who clean the house after inundation	53
Table2.4.8. The number of people who clean the house	53
Table2.4.9. The number of respondent who spend their money to clean the house	53
Table2.5.1. District and sub-district of Mataram	54
Table2.5.2. Location of Inundated Area in Mataram in 1992	55
Table2.5.3. Composition of Residents Job	61
Table2.5.4. describes types and number of infrastructure existing in the area	61
Table2.5.5. Outdoor activities	64
Table2.5.6. Indoor activities	65
Table2.5.7. Infrastructure	65
Table2.5.8. Disturbance	66
Table2.5.9. Effort to prevent water entering the house	66
Table2.5.10. Effort on house cleaning	66
Table2.5.11. Person cleaning house	66
Table2.6.1. Building Type	68
Table2.6.2. Data of others daily activities	67
Table2.6.3. Data of social economic activities	73
Table2.6.4. Data of infrastructure	73
Table2.7.1. Coverage Area and Population of each District	75
Table2.7.2. Data of Makassar marine geology elements – 1999	77
Table2.7.3. Flood/Inundated Area in Makassar	78
Table2.7.4. Population of Sub district Cambaya	80
Table2.7.5. Education Facilities	80
Table2.7.6. Number of Houses based on Type of Building Material	82
Table2.7.7. Types and specification of existing houses	82
Table2.7.8. Housing Condition	84
Table2.7.9. Daily Activities disturbed by Inundation	89
Table2.7.10. Social and Economic Activities disturbed by Inundation	89
Table2.7.11. Interference to People's Comfort	90
Table2.7.12. Kinds of Action against Flood	90
Table2.7.13. Kinds of Action after Inundation	90
Table3.1.1. Score Functional of Aspect Components	95
Table3.1.2. Cost Percentage of Detached House	96
Table3.1.3. Damaged Score	96
Table3.1.4. Score of Building Aspect	96
Table3.1.5. Intensity the Inundation	97
Table3.1.6. Average Percentage of Function Loss	100
Table3.1.7. Averaged Investment Loss and Averaged Function Loss in 7 cities	100
Table3.1.8. The Comparasion of Total Loss in Platformed House and Landed House	103
Table3.2.1. The Percentages of answers on respondent activities disrupted by inundation	104
Table3.2.2. Time Spent During Inundation Periods	105
Table3.3.1. Description of Loss in Penjaringan Sub-district	106
Table3.3.2. Estimated total loss of Building Materials in Penjaringan Sub-district	107
Table3.3.3. Description of Loss in Tanjung Mas Sub-district	108
Table3.3.4. Estimated Total Loss of Building Materials in Tanjung Mas Sub-District	108

Table3.3.5. Description of Loss in Medokan Ayu & Kali Rungkut Sub-district	109
Table3.3.6. Estimated Total Loss Of Building Materials In Kali Rungklut Sub-District	109
Table3.3.7. Description of Loss in Serangan Sub-district	111
Table3.3.8. Estimated Total Loss of Building Materials in Serangan Sub-District	111
Table3.3.9. Description of Loss in Ampenan Sub-district	112
Table3.3.10. Estimated Total Loss of Building Materials in Ampenan Sub-District	112
Table3.3.11. Description of Loss in Kuin Utara Sub-district, Banjarmasin	113
Table3.3.12. Estimated Total Loss of Building Materials in Kuin Utara Sub-District	113
Table3.3.13. Description of Loss in Cambaya Sub-district, Makassar	114
Table3.3.14. Estimated Total Loss of Building Materials in Cambaya Sub-District	114
Table3.3.15. The Comparison of Total Physical and Social Loss in the Seven Survey Areas	116
Table4.1. Secification of available satellite images	118
Table4.2. Analyzed cities and data utilized/obtained	118
Table4.3. Table of area (hectars) of each land use * contour zone (Semarang)	126
Table4.4. Table of area (hectars) of each land use * contour zone (Makassar)	126
Talbe4.5. Average features of sampled houses	127
Table4.6. Summary of Makassar	127
Table4.7. Tidal data	129
Table4.8. Partial loss caused by one time inundation	130

LIST OF FIGURES

Figure2.1.1. Administrative border North Jakarta District	20
Figure2.1.2. Map of North seashore Jakarta Reclamation Planning	22
Figure2.2.1. Existing Condition of Semarang Territory	20
Figure2.2.2. The Spread of Flood Areas and Land subsidence	22
Figure2.2.3. Existing Condition of Tanjung Mas Village Territory	23
Figure2.2.4. Deterioration of Building Elements	27
Figure2.2.5. Sketch of the Building Physical Adaptation Method	30
Figure2.2.6. Typical building Physical Adaptations	30
Figure2.2.7. Furniture Adaptation	31
Figure2.3.1. Territory of 28 Districts in Surabaya Municipality	28
Figure2.3.2. Coastal Areas in Surabaya City	29
Figure2.3.3. Mean Rainfall Height	30
Figure2.3.4. Inundated zone in coastal areas	31
Figure2.3.5. Overlapping of Contour Line and Inundated zone	31
Figure2.3.6. Flooded Area in Rungkut District	33
Figure2.3.7. Study area selection	40
Figure2.3.8. Land Use Planning in Rungkut District	42
Figure2.3.9. Planned Area for Housing in Rungkut District	43
Figure2.4.1. Land Unit of Denpasar City	47
Figure2.4.2. Settlements area spreading over Denpasar City	48
Figure2.4.3. The expansion of the Serangan Island	49
Figure2.4.4. The location of Serangan Sub-district	49
Figure2.4.5. House in Serangan Sub district (Owner: I Nyoman Tanda)	52
Figure2.5.1. Land Use Planning Map of Mataram - 2004	57
Figure2.5.2. Coastal Area of Ampenan District	57
Figure2.5.3. Elevation of Ampenan coastal area	58
Figure2.5.4. Study Area (Part of Ampenan Beach)	60
Figure2.6.1. The location of Kuin Utara Sub-district	69
Figure2.6.2. The location of cased houses (the black dotted are the cased houses)	70
Figure2.7.1. Location of Makassar	74
Figure2.7.2. Aerial photography of Makassar Municipality	75
Figure2.7.3. Inundated Area in Sub District of Cambaya	78
Figure2.7.4. Location of Cambaya Sub district	79
Figure3.1.1. General Scheme of Loss Measurement on Physical Building	94

Figure3.1.2. Function Loss and Investment Loss in Banjarmasin (12 houses)	98
Figure3.1.3. Function Loss and Investment Loss in Denpasar	98
Figure3.1.4. Function Loss and Investment Loss in Jakarta	98
Figure3.1.5. Function Loss and Investment Loss in Makassar	99
Figure3.1.6. Function Loss and Investment Loss in Mataram	99
Figure3.1.7. Function Loss and Investment Loss in Semarang	99
Figure3.1.8. Function Loss and Investment Loss in Surabaya	100
Figure3.1.9. Resume Analysis Result of seven Surveyed Cities	101
Figure3.1.10. Building Type In Surveyed Cities	102
Figure3.1.11. The Loss Due To Inundation In Platformed Houses	102
Figure3.1.12. The Loss Due To Inundation In Landed Houses	103
Figure4.1. Identification of border lines between different land use / building types on satellite image in GIS	119
Figure4.2. Zones of specific land-use/building types, on GIS	120
Figure4.3. Jakarta: Land use zone	121
Figure4.4a. Makassar LA-NDSAT7 image: urban area	121
Figure4.4b. Makassar LANDSAT7 image: surrounding area	122
Figure4.5. Makassar, special map for planning urban plant, 1:10,000	122
Figure4.6. Semarang, contour zone	123
Figure4.7. Makassar, contour zone	124
Figure4.8. Makassar, Land use * contour	125
Figure4.9. Makassar, Land use * contour zone, overlapped with satellite image	126
Figure4.10. Location of Seacoast line and 1m Contour line	129
Figure4.11. Advance of Seacoast line and with drawal of inundated area after SLR	130
Figure4.12. Provision of Bank & Pump	131
Figure4.13. Reclamation	131
Figure4.14. Relocation	131
Figure4.15. High-rise buildings	132

LIST OF PHOTOS

Photo2.1.1. Existing condition of north beach, North Jakarta	2
Photo2.5.1. Inundation around the houses	53
Photo2.5.2. Elevation A – B (Gatep village)	58
Photo2.5.3. Part C – D (Banjar village)	59
Photo2.5.4. Elevation E – F (Karang Mulya village)	59
Photo2.5.5-7. Types of Construction	62
Photo2.5.8-9. Deterioration of Foundation	62
Photo2.5.10-11. Deterioration of Floor	62
Photo2.5.12-14. Deterioration of Wall	63
Photo2.5.15-17. Deterioration of Ceiling	63
Photo2.5.18-20. Deterioration of Roof	63
Photo2.5.21. Deterioration of Door and Window	64
Photo2.5.22-23. Raised Floor	65
Photo2.5.24-26. Furniture and Electronic items	65
Photo2.6.1. River is the important transportation mode mainly for people living at houses along the river ..	70
Photo2.6.2. Wooden footpaths made of ulin timber	70
Photo2.6.3. Water sold in container (20 liter/container)	71
Photo2.6.4-5. Water supply from PDAM	71
Photo2.6.6-7. Bottom beam is decayed because of the quality of wood	72
Photo2.6.8. Pile foundation of the platform house without bracing beam	72
Photo2.6.9. Normal condition of the pile beam and mark of the height of water tide	72
Photo2.7.1. Access road to Cambaya from Eastern part	80
Photo2.7.2. One of Education Facilities in Cambaya	80
Photo2.7.3. Mosque in Cambaya	81

Photo2.7.4. Condition of Canal (Drainage), which is full of garbage	81
Photo2.7.5. Another main canal and seen that the water is overflow	81
Photo2.7.6. Garbage Container	81
Photo2.7.7. Condition of underneath of house which is full of garbage	81
Photo2.7.8. Elevated Floor	89
Photo2.7.9. Elevated Furniture	89
Photo2.7.10. Elevated Furniture	90
Photo2.7.11. Embankment in entrance	90
Photo4.1-3. Urban scale reclamation, undertaken by private sector	132
Photo4.4-5. Reclamation through disposal of garbage, waste soil	132
Photo4.6-7. Example of flat house, Bandarhardjo, north Semarang, completed in 1998.....	133

ABBREVIATION

BCR: Building Coverage Ratio
BRI (1) Building Research Institute (2) Bank Rakyat Indonesia: (3) Building Related Infection
FAR: Floor Area Ratio
MOC: Ministry of Construction
MOE: Ministry of Environment
MOLIT: Ministry of Land, Infrastructure and Transport
NILIM: National Institute for Land and Infrastructure Management
PDAM: Perusahaan Daerah Air Minum (Local Water Supply Corporation)
RIHS: Research Institute for Human Settlements
ROB: Inundation caused by sea level rise (Jawa language)
RT: Rukun Tetangga (neighbourhood community, chonaikai)
RW: Rukun Warga (union of RT)
SLR: Sea level rise
UTM: Universal Transverse Mercator