

# Table of Contents

Summary .....	ix
Samenvatting.....	xiii
Ringkasan.....	xviii
List of symbols and abbreviations .....	xxiii
1 Introduction.....	1
1.1 Background and problem definition .....	2
1.1.1 History of flood in Jakarta.....	2
1.1.2 Traditional flood management in Jakarta.....	3
1.1.3 Drivers of flood risk in Jakarta .....	4
1.1.4 Flood risk assessment.....	5
1.2 Objectives and research questions.....	6
1.3 General research strategy .....	7
1.4 Framework of the research project .....	9
1.5 Thesis outline .....	9
1.6 Publications related to this Thesis .....	10
2 Flood risk assessment for delta mega-cities: a case study of Jakarta .....	11
2.1 Introduction .....	13
2.2 Methods .....	15
2.2.1 Damagescanner .....	15
2.2.2 Input data .....	16
2.2.2.1 Hazard data.....	16
2.2.2.2 Exposure data.....	18
2.2.2.3 Vulnerability data.....	20
2.3 Results .....	22
2.3.1 Vulnerability curves and economic exposure values.....	23
2.3.1.1 Economic exposure values.....	23
2.3.1.2 Vulnerability curves.....	23
2.3.2 Economic damage and risk based on existing economic exposure values and	

	vulnerability curves .....	24
	2.3.3 Economic damage and risk based on new economic exposure values and all vulnerability curves .....	25
	2.3.4 Economic damage per land use class .....	26
	2.4 Discussion .....	27
	2.4.1 Comparison with reported damages and past modeling studies.....	27
	2.4.2 Sensitivity of flood risk assessment to the use of different vulnerability curves transferred from elsewhere.....	29
	2.4.3 Implications.....	30
	2.4.4 Limitations and future research.....	32
	2.5 Conclusions.....	33
3	River flood risk in Jakarta under scenarios of future change.....	36
	3.1 Introduction.....	38
	3.2 Method.....	39
	3.2.1 Hazard .....	39
	3.2.2 Exposure.....	42
	3.2.3 Vulnerability .....	46
	3.3 Results.....	46
	3.3.1 Flood risk under baseline conditions .....	46
	3.3.2 Potential impacts of climate change on extreme precipitation .....	50
	3.3.3 Impacts of future changes in individual risk drivers on flood risk.....	52
	3.3.3.1 Climate change.....	52
	3.3.3.2 Land use change .....	53
	3.3.3.3 Land subsidence .....	54
	3.3.4 Impacts of future changes in combined risk drivers on flood risk.....	55
	3.4 Discussion .....	57
	3.4.1 Uncertainty in projections of change in precipitation intensity .....	57
	3.4.2 Relative influence of different drivers on flood risk.....	58
	3.4.3 Implications for risk management.....	59

3.4.4	Limitations and future research developments .....	61
3.5	Concluding remarks .....	61
4	Flood Risk in Polder Systems in Present Jakarta and in the Future.....	63
4.1	Introduction .....	65
4.2	Methodology .....	66
4.2.1	Estimation of benefits .....	67
4.2.2	Estimation of costs .....	69
4.3	Results .....	69
4.3.1	Current situation: Kapuk Muara and Penjaringan Junction give the highest net benefits .....	71
4.3.2	Future situation: Kapuk Poglar and nine others give high net benefits.....	74
4.4	Discussion.....	78
4.4.1	Polders with very high net benefits are located away from the coastline .....	78
4.4.2	Policy implications of polder systems in Jakarta.....	79
4.4.3	Uncertainty and sensitivity test .....	79
4.4.4	Future research needs.....	80
4.5	Conclusions .....	81
5	Flood risk decrease resulting from Flood Early Warning System in Jakarta .....	82
5.1	Introduction .....	84
5.2	Method .....	85
5.2.1	Damagescanner-Jakarta.....	86
5.2.1.1	Hazard .....	86
5.2.1.2	Exposure .....	86
5.2.1.3	Vulnerability .....	87
5.2.2	Adapting depth-damage functions based on survey .....	87
5.2.2.1	Survey of households in Pesanggrahan.....	87
5.2.2.2	Using the survey to adjust the depth-damage functions .....	89
5.2.3	Estimating flood risk with and without FEWS.....	89
5.3	Results .....	89

5.3.1	Survey results on potential damage reduction .....	89
5.3.2	Adjusted depth-damage functions .....	90
5.3.3	Potential flood risk reduction in Jakarta through vulnerability reducing measures associated with SMS-based FEWS .....	91
5.4	Discussion .....	93
5.4.1	Comparison of results to previous studies .....	93
5.4.2	Implications and future research.....	93
5.5	Conclusion .....	94
6	Synthesis and Outlook .....	96
6.1	General overview .....	97
6.2	Main results per research questions .....	98
6.2.1	Can we develop a model to rapidly assess river flood risk in Jakarta, and how well does it simulate reported flood damage? .....	98
6.2.2	How sensitive is the flood risk model to the use of different curves for representing vulnerability? .....	98
6.2.3	What are the possible future changes in river flood risk in Jakarta as a result of climate change, and subsidence, and land use change? .....	99
6.2.4	How much could flood risk in Jakarta be reduced under current and future conditions by upgrading and installing polder systems, and what are the costs and benefits? .....	100
6.2.5	What is the potential reduction in flood risk that could be achieved in Jakarta through the implementation of an SMS-based Flood Early Warning System? .....	100
6.3	Usefulness of the results in practice.....	101
6.4	Future research and recommendations .....	103
Appendix A	.....	106
References	.....	113