

**POINT AND REGIONAL SCALE  
MODELLING OF VADOSE ZONE  
WATER AND SALT FLUXES  
IN AN AREA OF  
INTENSIVE HORTICULTURE**

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# TABLE OF CONTENTS

<b>LIST OF FIGURES.....</b>	<b>IV</b>
<b>LIST OF TABLES.....</b>	<b>VIII</b>
<b>ABSTRACT .....</b>	<b>IX</b>
<b>DECLARATION OF ORIGINALITY .....</b>	<b>X</b>
<b>ACKNOWLEDGMENTS.....</b>	<b>XI</b>
<b>CHAPTER 1: INTRODUCTION .....</b>	<b>1</b>
1.1 WASTEWATER RE-USE, IRRIGATION DRAINAGE, AND IRRIGATION-INDUCED SOIL SALINITY ON THE NORTHERN ADELAIDE PLAINS .....	1
1.2 RESEARCH OBJECTIVES .....	5
1.3 RATIONALE FOR THE MODELLING APPROACH .....	5
1.4 WHY NOT SIMPLY MAKE DIRECT MEASUREMENTS OF SOIL WATER AND SALT FLUXES? .....	7
1.5 SOIL HYDROLOGY MODELLING .....	8
1.5.1 <i>Opportunities presented by numerical models of soil hydrology</i> .....	8
1.5.2 <i>Underlying principles of soil hydrology modelling</i> .....	11
1.5.3 <i>Laboratory methods for measuring soil hydraulic characteristics</i> .....	13
1.5.4 <i>Methods of measuring in-field soil hydrologic variables</i> .....	14
1.5.5 <i>Measurement or estimation of evapotranspiration</i> .....	15
1.6 EXTENDING MODELS TO REGIONAL STUDIES: DEALING WITH SPATIAL VARIABILITY .....	17
<b>CHAPTER 2: FIELD AND LABORATORY METHODS.....</b>	<b>20</b>
2.1 STUDY AREA .....	20
2.2 DATA REQUIREMENTS .....	21
2.3 FIELD DATA COLLECTION.....	23
2.3.1 <i>Selection of study sites</i> .....	23
2.3.2 <i>Monitoring period</i> .....	27
2.3.3 <i>Field methods</i> .....	27
2.4. LABORATORY METHODS.....	39
2.4.1 <i>Water retention curves and unsaturated hydraulic conductivity</i> .....	39
2.4.2 <i>Soil water and irrigation water chemistry</i> .....	41
<b>CHAPTER 3: RESULTS OF FIELD AND LABORATORY WORK .....</b>	<b>44</b>
3.1 RESULTS FROM FIELD MONITORING PROGRAM .....	44
3.1.1 <i>Port Gawler Road (PGR) study site</i> .....	45
3.1.2 <i>Huxtable Road (HX) study site</i> .....	53
3.1.3 <i>Thompson Road (TR) study site</i> .....	56
3.2 RESULTS FROM LABORATORY ANALYSES.....	59

<b>CHAPTER 4: MODELLING OF SOIL WATER AND SALT FLUXES .....</b>	<b>64</b>
4.1 OPTIMISATION OF MODELS .....	69
4.2 OPTIMISATION OF MODEL PARAMETERS FOR OTHER PRIMARY STUDY SITES. ....	75
4.3 SENSITIVITY OF MODEL PREDICTIONS TO SOIL HYDRAULIC PARAMETERS.....	79
4.4 MODEL OUTPUT: WATER FLUX ESTIMATES FOR MONITORED STUDY SITES.....	82
4.5 COMPARISON WITH DIRECT ESTIMATES OF FLUXES USING FIELD TENSIO METER READINGS	87
4.6 SENSITIVITY OF SIMULATED DRAINAGE FLUXES TO MODELLED SOIL PROFILE COMBINATIONS .....	92
4.7 SENSITIVITY OF MODEL PREDICTIONS TO LOCAL AND REGIONAL ETO DATA .....	94
4.8 SOIL SALINITY MODELLING.....	97
4.8.1 <i>Modelling soil salts as a single solute</i> .....	102
<b>CHAPTER 5: APPLICATION OF MODELS AT A POINT SCALE .....</b>	<b>105</b>
5.1 SOIL WATER DRAINAGE FLUXES AT NAP STUDY SITE PGR .....	105
5.2 EXTENSION OF POINT SCALE MODELS TO A LONGER TIME SERIES .....	110
5.2.1 <i>Inter-annual variability of water fluxes</i> .....	110
5.2.2 <i>Alternative irrigation scenarios</i> .....	115
5.3 SOIL SALINITY CHANGES OVER A 20 YEAR SIMULATION .....	118
5.4 CONCLUSIONS FROM APPLICATION OF MODELS AT THE POINT SCALE.....	133
<b>CHAPTER 6: APPLICATION OF MODELS AT CATCHMENT SCALE.....</b>	<b>135</b>
6.1 CONSIDERATIONS WHEN UP-SCALING MODELS .....	135
6.2 METHODOLOGY FOR APPLYING MODELS TO THE WHOLE STUDY AREA .....	139
6.3 CATCHMENT-SCALE ANNUAL WATER BALANCE DERIVED FROM A 20-YEAR SIMULATION DISTRIBUTED ACROSS THE NAP AGRICULTURAL AREA .....	143
6.3.1 <i>Whole area model output</i> .....	146
6.3.2 <i>Whole area water balance</i> .....	149
6.3.3 <i>Effects of water table depth change</i> .....	152
6.4 RECOMMENDATIONS FOR IRRIGATION MANAGEMENT.....	154
<b>CHAPTER 7: CONCLUSIONS.....</b>	<b>156</b>
7.1 ONE-DIMENSIONAL SOIL WATER AND SOLUTE FLUX MODELS .....	156
7.2 EXTENSION OF MODELS TO THE WHOLE NAP AREA .....	158

<b>APPENDIX 1 .....</b>	<b>163</b>
UNSATURATED HYDRAULIC CONDUCTIVITY MEASUREMENTS: SOIL MOISTURE OUTFLOW CURVES .....	163
<b>APPENDIX 2 .....</b>	<b>169</b>
MEASUREMENTS OF SOIL WATER RETENTION VARIABLES AND DERIVATION OF CAMPBELL'S EQUATION PARAMETERS FROM SOIL WATER RETENTION CURVES .....	169
1. STUDY SITE PGR.....	171
2. STUDY SITE HX .....	175
3. STUDY SITE SR .....	177
4. SITE TR .....	179
<b>REFERENCES .....</b>	<b>181</b>

## LIST OF FIGURES

FIGURE 1.1 NORTHERN ADELAIDE PLAINS LAND USE AND STUDY SITE LOCATIONS.....	3
FIGURE 2.1 TIMETABLE OF CROPS MONITORED AT THE FOUR STUDY SITES.....	27
FIGURE 2.2 CAPILLARY WICK LYSIMETER .....	32
FIGURE 2.3 LYSIMETER COLLECTION PLATE INSTALLATION.....	32
FIGURE 2.4 INSTALLATION OF CAPILLARY WICK LYSIMETERS.....	32
FIGURE 2.5 SOIL MOISTURE PROBES AT STUDY SITE TR. ....	33
FIGURE 2.6 MONITORING POINT CONFIGURATION AT THREE STUDY SITES.....	34
FIGURE 2.7 AUTOMATIC WEATHER STATION AT STUDY SITE PGR.....	35
FIGURE 2.8 CROP COVER PHOTOGRAPHS TAKEN AT SITE PGR. ....	35
FIGURE 2.9 SITE LAYOUT AT STUDY SITE PGR .....	36
FIGURE 2.10 MONITORING STATION ARRANGEMENT AT BROADACRE VEGETABLE SITE PGR. ....	37
FIGURE 2.11 STUDY SITE LAYOUT FOR STUDY SITE SR.....	38
FIGURE 2.12 MONITORING STATION 2 AT THE SR STUDY SITE. ....	38
FIGURE 2.13 RACK OF SIX TEMPE CELLS WITH HANGING TUBES .....	40
FIGURE 3.1 FIELD STUDY DATA FROM PGR CROP 1 AND MATRIC POTENTIALS AT POINT PGR2.....	46
FIGURE 3.2 RESULTS FROM LYSIMETER AT POINT PGR1 DURING PGR CROP 1 .....	47
FIGURE 3.3 FIELD STUDY DATA FROM PGR CROP 2.....	49
FIGURE 3.4 SOIL MATRIC POTENTIALS MEASURED AT ADDITIONAL MONITORING POINTS .....	50
FIGURE 3.5 RESULTS FROM LYSIMETER AT POINT PGR1 DURING PGR CROP 2 .....	51
FIGURE 3.6 EC VALUES OF SOIL SOLUTION CAPTURED BY SUCTION CUP SOLUTION SAMPLERS AT PGR1 AND PGR2 DURING THE PERIOD OF PGR CROP 2.....	52
FIGURE 3.7 WATER TABLE DEPTH IN TWO PIEZOMETERS INSTALLED AT THE PGR STUDY SITE.....	53
FIGURE 3.8 FIELD STUDY DATA FROM STUDY SITE HX.....	53
FIGURE 3.9 SOIL MATRIC POTENTIALS MEASURED AT FOUR MONITORING POINTS AT STUDY SITE HX .....	54
FIGURE 3.10 EC VALUES OF SOIL SOLUTION CAPTURED BY SUCTION CUP SOLUTION SAMPLERS AT POINTS HX1 AND HX2.....	55
FIGURE 3.11 FIELD STUDY DATA FROM STUDY SITE TR.....	57
FIGURE 3.12 EC VALUES OF SOIL SOLUTION CAPTURED BY SUCTION CUP SOIL SOLUTION SAMPLERS AT POINTS TR1 AND TR2 .....	58
FIGURE 4.1 COMPARISONS OF SIMULATED MATRIC POTENTIAL AT 30, 75 AND 110 CM DEPTHS AT STUDY SITE PGR, USING MEASURED PARAMETERS VALUES WITH NO OPTIMISATION .....	70
FIGURE 4.2 COMPARISONS OF SIMULATED MATRIC POTENTIAL AT 30, 75 AND 110 CM DEPTHS AT STUDY SITE PGR, WITH PEST OPTIMISATION .....	73

FIGURE 4.3 COMPARISONS OF SIMULATED MATRIC POTENTIAL AT 30, 75 AND 110 CM DEPTHS AT STUDY SITE PGR, VERIFYING OPTIMISED PARAMETER VALUES .....	74
FIGURE 4.4 COMPARISONS OF MEASURED AND SIMULATED MATRIC POTENTIAL AT MONITORED POINT HX1 .....	76
FIGURE 4.5 COMPARISONS OF MEASURED AND SIMULATED MATRIC POTENTIAL AT MONITORED POINT HX2.....	76
FIGURE 4.6 COMPARISONS OF MEASURED AND SIMULATED MATRIC POTENTIAL AT AT MONITORED POINT TR1. ....	77
FIGURE 4.7 COMPARISONS OF MEASURED AND SIMULATED MATRIC POTENTIAL AT MONITORED POINT TR2.....	77
FIGURE 4.8 ALTERNATIVE WATER RETENTION CURVES FOR SOIL LAYERS AT POINT PGR1.....	80
FIGURE 4.9 VARIATION OF TOTAL ANNUAL DRAINAGE WITH ALTERNATIVE WATER RETENTION CURVE PARAMETERS AND UNSATURATED CONDUCTIVITY PARAMETERS. ....	81
FIGURE 4.10 MODEL SIMULATIONS OF ETA AND DRAINAGE AT STUDY SITE PGR.....	83
FIGURE 4.11 MODEL SIMULATIONS OF ETA AND DRAINAGE AT MONITORED POINTS HX1 AND HX2. ....	85
FIGURE 4.12 MODEL SIMULATIONS OF ETA AND DRAINAGE AT MONITORED POINTS TR1 AND TR2. ....	86
FIGURE 4.13 DIRECT APPROXIMATIONS OF FLUXES AT MONITORING POINT PGR1, BASED ON MEASURED MATRIC POTENTIALS AND WATER POTENTIAL GRADIENTS.....	86
FIGURE 4.14 DIRECT APPROXIMATIONS OF FLUXES AT MONITORING POINT PGR1, BASED ON MEASURED MATRIC POTENTIALS AND WATER POTENTIAL GRADIENTS.....	89
FIGURE 4.15 DIRECT APPROXIMATIONS OF FLUXES AT MONITORING POINT PGR1, BASED ON MEASURED MATRIC POTENTIALS AND WATER POTENTIAL GRADIENTS.....	90
FIGURE 4.16 PREDICTED DRAINAGE FLUXES OVER A ONE-YEAR PERIOD WITH SOIL PROFILE DESCRIPTIONS FROM MODELS FOR ALL MONITORED SITES SUPERIMPOSED ON THE MODEL OF STUDY SITE PGR1.....	93
FIGURE 4.17 PREDICTED DRAINAGE FLUXES OVER A ONE-YEAR PERIOD AT THE PGR STUDY SITE WHEN THE ON-SITE ETO DATA ARE REPLACED BY ETO DATA DERIVED FROM WEATHER RECORDS FROM THE BOM EDINBURGH AIR FIELD WEATHER STATION.....	94
FIGURE 4.18 REGRESSION OF REFERENCE DAILY ETO VALUES DERIVED FROM PGR STUDY SITE WEATHER STATION DATA AND DAILY ETO VALUES DERIVED FROM RAAF EDINBURGH AIRFIELD BOM WEATHER STATION DATA.....	96
FIGURE 4.19 SIMULATED SOIL SOLUTION EC AT 70 CM DEPTH IN MONITORED STUDY SITE LOCATIONS PGR1 AND PGR2, COMPARED WITH MEASURED EC OF LEACHATE COLLECTED IN LYSIMETERS AND SUCTION CUP SAMPLERS. ....	100

FIGURE 4.20 SIMULATED SOIL SOLUTION EC AT 70 CM DEPTH AT MONITORED POINTS HX1 AND HX2, COMPARED WITH MEASURED EC OF LEACHATE COLLECTED IN SUCTION CUP SAMPLERS. ....	101
FIGURE 4.21 SIMULATED SOIL SOLUTION EC AT 70 CM DEPTH AT MONITORED POINTS TR1 AND TR2, COMPARED WITH MEASURED EC OF LEACHATE COLLECTED IN SUCTION CUP SAMPLERS. ....	102
FIGURE 4.22 COMPARISON OF OUTPUTS FROM LEACHP AND LEACHC MODELS SIMULATING SOIL SOLUTION EC AT 70 CM DEPTH AT LOCATION PGR1.....	103
FIGURE 5.1 MODEL SIMULATIONS OF MATRIC POTENTIALS AT 30, 75 AND 110 CM RESULTING FROM (A) RAIN, IRRIGATION AND POTENTIAL ET CONDITIONS MEASURED ON-SITE, AND (B) RAIN AND ET DATA FROM LOCAL WEATHER STATION AND SIMULATED IRRIGATION. ....	108
FIGURE 5.2. SIMULATED ETA (A) AND DRAINAGE (B) RESULTING FROM APPLYING RAIN AND ET DATA FROM LOCAL WEATHER STATION AND SIMULATED TRIGGERED IRRIGATION .....	109
FIGURE 5.3 MODELLED ANNUAL DRAINAGE TOTALS AT MONITORED POINTS PGR1 AND PGR2 FOR A TWENTY YEAR SIMULATION FROM 1985 TO 2004, AND RECORDED RAINFALL FOR THOSE YEARS. ....	112
FIGURE 5.4 REGRESSION PLOTS OF ANNUAL DRAINAGE FLUX TOTALS VERSUS ANNUAL RAINFALL TOTALS FROM SIMULATIONS OF TWENTY YEARS OF IRRIGATED CROP GROWTH FROM 1985 TO 2004. ....	114
FIGURE 5.5 SIMULATIONS OF CUMULATIVE IRRIGATION WATER, EVAPORATION AND DRAINAGE OVER A 20-YEAR SIMULATION WITH SIMULATED TRIGGERED IRRIGATION. ....	117
FIGURE 5.6 SIMULATED SOIL SOLUTION EC AT 70 CM DEPTH FROM A ONE-YEAR SIMULATION OF STUDY SITE PGR1 AND EC MEASUREMENTS OF SOIL, SUCTION CUP SAMPLES AND LYSIMETER LEACHATE. ....	123
FIGURE 5.7 CHANGES IN SOIL SALINITY (EC <sub>1:5</sub> EQUIVALENT) OVER A 20-YEAR SIMULATION WITH AUTOMATED IRRIGATION TRIGGERED AT VARYING SOIL MATRIC POTENTIALS. ...	125
FIGURE 5.8 CHANGES IN SOIL SALINITY AT 70 CM DEPTH OVER A 20-YEAR SIMULATION WITH VARYING IRRIGATION TRIGGER POTENTIALS AND IRRIGATION WATER TDS. ....	130
FIGURE 5.9 CHANGES IN THE TOTAL SOLUTES IN THE SOIL PROFILE OVER A 20-YEAR SIMULATION WITH DIFFERING AUTOMATED IRRIGATION SCENARIOS. ....	132
FIGURE 6.1 COMBINATION OF LAND ATTRIBUTES USING GIS COVERAGES .....	132
FIGURE 6.2 FLOWCHART OF THE DISTRIBUTED MODELLING PROCESS USING LEACHPG. ....	142
FIGURE 6.3 AREAS OF THE 11 LAND USE CATEGORIES AND SOIL PROFILE TYPES INCORPORATED IN THE 20-YEAR SIMULATION. ....	145
FIGURE 6.4 DRAINAGE FLUXES (A) AND DRAINAGE VOLUMES (B) FOR THE EACH LAND USE / SOIL TYPE COMBINATION .....	147

FIGURE 6.5 DRAINAGE FLUXES (1) AND VOLUMES (2) FOR THE EACH LAND USE / SOIL TYPE  
COMBINATION WITH IRRIGATED CROP AREAS REPLACED BY AREAS OF NATURAL  
VEGETATION. .... 141

FIGURE 6.6 WATER TABLE DEPTHS IN SA STATE GOVERNMENT OBSERVATION WELLS IN THE  
VICINITY OF STUDY SITES HX AND TR. .... 153

## LIST OF TABLES

TABLE 3.1	SOIL HYDRAULIC CONDUCTIVITIES DERIVED FROM KLUTE OUTFLOW METHOD .....	60
TABLE 3.2	SOIL PHYSICAL PROPERTIES SUMMARY .....	61
TABLE 3.3	MEASURED MAJOR SOIL CHEMISTRY (CSIRO LABORATORY ANALYSIS RESULTS).....	62
TABLE 4.1	SOIL HYDROLOGIC PARAMETER VALUES FOR THE TWO MONITORED POINTS AT STUDY SITE PGR. ....	69
TABLE 4.2	OPTIMISATION OF SOIL HYDROLOGIC PARAMETER VALUES FOR SOIL PROFILES AT STUDY SITE PGR. ....	70
TABLE 4.3	MODEL PERFORMANCE FOR TWO MODEL SOIL PROFILES, OPTIMISED FOR BEST FIT BETWEEN OBSERVED AND MODELLED MATRIC POTENTIALS AT STUDY SITE PGR.....	72
TABLE 4.4	MEANS AND RANGES OF MATRIC POTENTIAL VALUES MEASURED AT PGR SITE AND USED IN CALIBRATION OF MODEL-SIMULATED MATRIC POTENTIALS. ....	72
TABLE 4.5	SOIL HYDROLOGIC PARAMETER VALUES – BEFORE AND AFTER OPTIMISATION FOR MONITORING POINT HX1 .....	78
TABLE 4.6	SOIL HYDROLOGIC PARAMETER VALUES – BEFORE AND AFTER OPTIMISATION FOR MONITORING POINT HX2 .....	78
TABLE 4.7	SOIL HYDROLOGIC PARAMETER VALUES – BEFORE AND AFTER OPTIMISATION FOR MONITORING POINT TR1 .....	78
TABLE 4.8	SOIL HYDROLOGIC PARAMETER VALUES – BEFORE AND AFTER OPTIMISATION FOR MONITORING POINT TR2.....	78
TABLE 4.9	COMPARISON OF TOTAL DRAINAGE PREDICTED BY 1-YEAR SIMULATION WITH VARYING MODEL SOIL PROFILE DESCRIPTIONS AND USING 1) REFERENCE ET DATA DERIVED FROM PGR STUDY SITE WEATHER STATION DATA AND 2) REFERENCE ET DATA DERIVED FROM BOM EDINBURGH AIRFIELD WEATHER STATION. ....	95
TABLE 5.1	AVERAGE ANNUAL FLUXES OF WATER AT STUDY SITE PGR1, ACCORDING TO 20- YEAR SIMULATIONS .....	116
TABLE 5.2	COMPOSITION OF IRRIGATION WATER AS USED IN MODELS.....	124
TABLE 5.3	WATER FLUX COMPONENTS WITH SCENARIOS TESTED TO DETERMINE SOIL ROOT ZONE SALINITY DEVELOPMENT.....	129
TABLE 6.1	SUMMARY OF OUTPUT FROM 20-YEAR WHOLE AREA SIMULATION .....	146
TABLE 6.2	SUMMARY OF OUTPUT FROM 20-YEAR WHOLE AREA SIMULATION WITH IRRIGATED CROP AREAS REPLACED BY AREAS OF NATURAL VEGETATION.....	150

## ABSTRACT

The introduction of a large volume of reclaimed effluent water for irrigation in the Northern Adelaide Plains (NAP) horticultural area has altered the regional water and salt balance, raising concerns regarding the effects of these on shallow water table elevation and root zone salinity in the highly valued and productive soils.

A methodology is described for constructing and calibrating numerical models of vertical fluxes of soil water and solutes to achieve simulations which match a number of monitored study sites. Extension of these simulations to a period of 20 years, and incorporation of measured soil chemistry variables, enables an examination of the influence of differing irrigation strategies and temporal variations in weather conditions on year-to-year variations in soil water fluxes and root zone salinity. Application of these models to the whole NAP horticultural area was achieved using a system of multiple one-dimensional simulations with variables altered according to their spatial distribution.

The results show large temporal variability in drainage fluxes beneath irrigated plots. Fluxes occur mainly in winter, with annual variations depending primarily on differences in rainfall distribution and evapotranspiration. Annual drainage flux totals were found to correlate poorly with annual rainfall totals.

Spatially, drainage fluxes varied both within and between study sites. Simulations of fluxes at observation points within monitored study sites varied owing to variations in soil hydrological properties. Results of the whole-area simulations suggest that over a larger scale, the majority of variation in drainage fluxes is due to differences in land use and irrigation practices, with a smaller but significant spatial variation due to differing soil types.

Additional simulations, representing the NAP prior to irrigated horticulture, indicates the introduction of irrigation has significantly increased drainage fluxes, but that the major change to the soil water budget in irrigated land areas has been to evaporation from the soil surface, with significant implications for soil salinity development.

## **DECLARATION OF ORIGINALITY**

I certify that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

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Graham Paul Green

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