A GIS ASSESSMENT OF NONPOINT SOURCE POLLUTION
IN THE SAN ANTONIO-NUECES COASTAL BASIN

by

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ABSTRACT

An Arc/Info Geographic Information System (GIS) method has been developed for the assessment of nonpoint source pollution in a watershed. This method makes use of publicly available elevation, stream network, rainfall, discharge, and land use data sets and uses a digital discretization, or grid representation, of a watershed for the approximation of average annual pollutant loads and concentrations. The San Antonio-Nueces Coastal Basin in south Texas is identified as the test site for execution of the method.

A digital grid replica of the basin stream network is first created, employing a "burn-in" process to affix the USGS Digital Line Graph stream network to the Digital Elevation Model of the basin. Precipitation is then compared with historical discharge at five gauge locations in the basin and a mathematical relationship between rainfall and runoff is established, using a regression analysis. Literature-based Expected Mean Concentrations (EMC's) of pollutant constituents are associated with land uses in the watershed. The products of these spatially distributed EMC's and the runoff in each digital basin grid cell are calculated and then summed in the downstream direction to establish spatially distributed grids of average annual pollutant loads in the basin. Finally, grids of nonpoint source pollutant concentrations are created by dividing the average annual pollutant load grids by a grid of total annual cumulative runoff.

In an effort to refine the process, a method of simulating suspected nutrient point sources in the basin is investigated and an optimization routine is used with pollutant measurement data at four major sampling points to adjust the literature-based Expected Mean Concentration values for phosphorus.

The GIS nonpoint source pollution assessment method is performed for four pollutant constituents: phosphorus, nitrogen, cadmium, and Fecal Coliform. Predicted concentrations for phosphorus and nitrogen, when determined with the simulated point sources, match closely with average observed concentrations in the basin. Predicted Fecal Coliform concentrations did not match well with average observed values, but Expected Mean Concentration values for the pollutant were highly variable between land uses and should be investigated further. Insufficient heavy metal measurement data exist to make conclusive assessments of predicted cadmium concentrations.
# TABLE OF CONTENTS

Acknowledgements ............................................................................................................. ii  
Abstract ................................................................................................................................ iii  
Table Of Contents .............................................................................................................. iv  
List of Tables ..................................................................................................................... v  
List of Figures .................................................................................................................... vi  
1 INTRODUCTION ........................................................................................................ 1  
   1.1 Background ....................................................................................................... 1  
   1.2 Objectives ....................................................................................................... 3  
   1.3 Study Area ...................................................................................................... 4  
   1.4 Research Approach ....................................................................................... 7  
2 LITERATURE REVIEW ............................................................................................... 9  
   2.1 Nonpoint Source Pollution Models .................................................................. 9  
   2.2 GIS-Based Nonpoint Source Pollution Models ................................................. 17  
   2.3 Earlier Studies in the San Antonio-Nueces Coastal Basin .................................. 22  
3 DATA DESCRIPTION ................................................................................................. 29  
   3.1 Map Projection .............................................................................................. 29  
   3.2 Establishing a Digital Database ..................................................................... 30  
   3.3 Scales of Analysis ......................................................................................... 60  
4 METHODOLOGY ....................................................................................................... 62  
   4.1 Grid-Based Watershed Modeling Using Digital Elevation Data .......................... 62  
   4.2 Determination of a Rainfall/Runoff Relationship ............................................. 79  
   4.3 Linking Expected Mean Concentration of Pollutants to Land Use ..................... 91  
   4.4 Estimating Annual Loadings Throughout the Watershed ................................. 95  
   4.5 Predicting Downstream Pollutant Concentrations in Watershed Stream Networks ................................................................. 99  
   4.6 Considering and Simulating Point Sources ...................................................... 118  
   4.7 Using an Optimization Routine to Provide Estimates of EMC Values ................ 125  
5 RESULTS .................................................................................................................... 131  
   5.1 Nonpoint Source Pollution Assessment .......................................................... 131  
   5.2 Assessment of Basin Pollution Including Point Sources .................................... 144  
   5.3 Expected Mean Concentration Values from the Optimization Routine ............... 149  
6 CONCLUSIONS AND LIMITATIONS ..................................................................... 155  
Appendix A : Data Dictionary ....................................................................................... 159  
Appendix B : Programs/AMLs .................................................................................... 195  
Appendix C : List of Acronyms .................................................................................. 212  
References ....................................................................................................................... 215  
Vita .................................................................................................................................... 222
LIST OF TABLES

Table 1.1: Populations of Major Cities within the San Antonio-Nueces Coastal Basin .............. 7
Table 3.1: Texas State Mapping System-Albers Projection Parameters .................................. 30
Table 3.2: Internet Addresses for Data Sources ..................................................................... 31
Table 3.3: Hydrologic Unit Codes Approximating the San Antonio-Nueces Coastal Basin ........................................................................................................... 34
Table 3.4: USGS Streamflow Gauge Information .................................................................... 47
Table 3.5: ASCII Header Formats for PRISM files in GRASS and Arc/Info .......................... 51
Table 3.6: Relationship Between Land Use and Expected Pollutant Concentrations .......... 55
Table 4.1: Comparison of Digitally Delineated and USGS Drainage Areas ......................... 72
Table 4.2: Comparison of Methods for Determining Average Annual Precipitation for each Gauged San Antonio-Nueces Drainage Area .............................................. 82
Table 4.3: Annual Volume (m$^3$) of Recorded Streamflow (1961-1990) for the Five USGS Gauges in the San Antonio-Nueces Coastal Basin ......................................................... 83
Table 4.4: Equivalent Depth (mm) of Recorded Streamflow (1961-1990) for the Five USGS Gauges in the San Antonio-Nueces Coastal Basin ......................................................... 84
Table 4.5: Projected 30-Year Average Annual Depth of Streamflow for the Five USGS Gauges in the San Antonio-Nueces Basin ........................................................... 87
Table 4.6: Summary Statistics for Total Phosphorus ................................................................. 105
Table 4.7: Expected Mean Concentration Values Calculated Using the Microsoft Excel Solver Optimization Routine .......................................................... 130
Table 5.1: Predicted Annual Pollutant Loads to Copano Bay .................................................. 133
LIST OF FIGURES

Figure 1.1 : San Antonio - Nueces Coastal Basin .............................................................................. 5
Figure 1.2 : Major Hydrologic Features of the San Antonio-Nueces Coastal Basin ......................... 6
Figure 2.1 : Levels of Integration of GIS and Simulation Models ......................................................... 18
Figure 2.2 : Conceptual Illustration of the Discretization of a Bay ...................................................... 23
Figure 2.3 : Nueces and Mission-Aransas Estuaries ........................................................................ 26
Figure 3.1 : Hydrologic Unit Codes of the San Antonio-Nueces Coastal Basin .................................. 33
Figure 3.2 : USGS 1:100,000-Scale Mapsheets Covering the San Antonio-Nueces Coastal Basin .......... 36
Figure 3.3 : 1:100,000-Scale Hydrography Digital Line Graphs in the San Antonio-Nueces Coastal Basin ............................................................................................................. 39
Figure 3.4 : Digital Elevation Model of the San Antonio-Nueces Coastal Basin ................................ 43
Figure 3.5 : Land Uses in the San Antonio-Nueces Coastal Basin ...................................................... 46
Figure 3.6 : Digital Coordinate Data File for San Antonio-Nueces Stream Gauges ............................. 47
Figure 3.7 : Gauge Number and Name Data File for San Antonio-Nueces Stream Gauges ................... 48
Figure 3.8 : USGS Stream Gauges in the San Antonio-Nueces Coastal Basin ..................................... 50
Figure 3.9 : Average Annual Precipitation in the San Antonio-Nueces Coastal Basin ..................... 54
Figure 3.10 : TNRCC Water Quality Measurement Locations in the San Antonio-Nueces Coastal Basin .............................................................................................................................. 57
Figure 3.11 : Linking Water Quality Measurement Data Files .............................................................. 59
Figure 3.12 : Scales of Analysis ........................................................................................................... 61
Figure 4.1 : Processing of Digital Elevation Data ................................................................................ 64
Figure 4.2 : Comparison of GRID-Delineated Streams with 1:100,000-Scale Hydrography Digital Line Graphs .......................................................... 66
Figure 4.3 : Final Edited Digital Line Graph Stream Coverage for the San Antonio-Nueces Coastal Basin .......................................................................................................................... 68
Figure 4.4 : Comparison of Burned-In Streams with 1:100,000-Scale Hydrography Digital Line Graphs .......................................................... 71
Figure 4.5 : Digital Drainage Areas Delineated from USGS Streamflow Gauges ................................. 73
Figure 4.6 : Drainage Area Delineated from the Copano Creek USGS Stream Gauge ........................... 74
Figure 4.7 : Digitally Delineated Subwatersheds of the San Antonio-Nueces Basin Compared with USGS Hydrologic Unit Codes .......................................................... 77
Figure 4.8 : Creating the Basin Boundary through use of ArcView Shapefiles ..................................... 78
Figure 4.9 : USGS Recorded Annual Streamflows for Five Gauges in the San Antonio-Nueces Basin .......................................................................................................................... 85
Figure 4.10 : Regression Tool Output for Best Linear Fit Relationship Between Average Annual Precipitation and Depth of Streamflow .................................................. 87
Figure 4.11 : Relationship Between Rainfall and Streamflow in the San Antonio-Nueces Coastal Basin (Linear) ................................................................................................................. 89
Figure 4.12 : Estimated Runoff in the San Antonio-Nueces Coastal Basin ........................................... 90
Figure 4.13: Conversion of Tabulated Expected Mean Concentration Values to an Arc/Info Data File .......................................................... 93
Figure 4.14: Expected mean concentrations for Total Phosphorus in the San Antonio-Nueces Coastal Basin....................................................... 94
Figure 4.15: Average Annual Total Phosphorus Loads in the San Antonio-Nueces Coastal Basin................................................................. 98
Figure 4.16: Average Annual Stream Flows in the San Antonio-Nueces Coastal Basin ........................................................................ 101
Figure 4.17: Estimated Total Phosphorus Concentrations in the San Antonio-Nueces Coastal Basin .............................................................. 103
Figure 4.18: Total Phosphorus Concentration Measurements at TNRCC SWQM Station # 12948 (Aransas River) ........................................ 107
Figure 4.19: Total Nitrogen Component Concentration Measurements at TNRCC SWQM Station # 12948 (Aransas River) .......................... 109
Figure 4.20: Total Nitrogen Component Concentration Measurements at TNRCC SWQM Station # 12944 (Mission River) ...................... 110
Figure 4.21: Percentile Distribution of Total Nitrogen Components Measured at Two Locations in the San Antonio-Nueces Basin .......... 111
Figure 4.22: Text-Delimited File of Water Quality Measurement Radii .......................................................... 114
Figure 4.23: Comparison of Estimated and Average Observed Total Phosphorus Concentrations in the San Antonio-Nueces Coastal Basin ... 116
Figure 4.24: Estimated vs. Observed Total Phosphorus Concentrations Just Downstream of Beeville, TX ......................................................... 117
Figure 4.25a: Predicted vs. Measured Total Phosphorus Concentrations (Beeville Point Source Included) Just Downstream of Beeville, TX .... 122
Figure 4.25b: Predicted vs. Measured Total Phosphorus Concentrations (Beeville Point Source Included) for Middle Aransas River .......... 123
Figure 4.25c: Predicted vs. Measured Total Phosphorus Concentrations (Beeville Point Source Included) for Lower Aransas River .............. 124
Figure 5.1: Total Nitrogen Estimated Mean Concentrations in the San Antonio-Nueces Coastal Basin ............................................................ 134
Figure 5.2: Average Annual Total Nitrogen Loads in the San Antonio-Nueces Coastal Basin ................................................................. 135
Figure 5.3: Comparison of Estimated and Average Observed Total Nitrogen Concentrations in the San Antonio-Nueces Coastal Basin .... 137
Figure 5.4: Total Cadmium Estimated Mean Concentrations in the San Antonio-Nueces Coastal Basin ............................................................. 138
Figure 5.5: Average Annual Total Cadmium Loads in the San Antonio-Nueces Coastal Basin ................................................................. 140
Figure 5.6: Comparison of Estimated and Average Observed Total Cadmium Concentrations in the San Antonio-Nueces Coastal Basin .... 141
Figure 5.7: Fecal Coliform Estimated Mean Concentrations in the San Antonio-Nueces Coastal Basin ............................................................. 143
Figure 5.8: Average Annual Fecal Coliform Loads in the San Antonio-Nueces Coastal Basin

Figure 5.9: Comparison of Estimated and Average Observed Fecal Coliform Concentrations in the San Antonio-Nueces Coastal Basin

Figure 5.10a: Predicted vs. Observed Total Nitrogen Concentrations (Beeville Point Source Included) Just Downstream of Beeville, TX

Figure 5.10b: Predicted vs. Observed Total Nitrogen Concentrations (Beeville Point Source Included) for Middle Aransas River

Figure 5.10c: Predicted vs. Observed Total Nitrogen Concentrations (Beeville Point Source Included) for Lower Aransas River