DESIGN STORM RAINFALL DEPTHS

for the

STATE OF FLORIDA

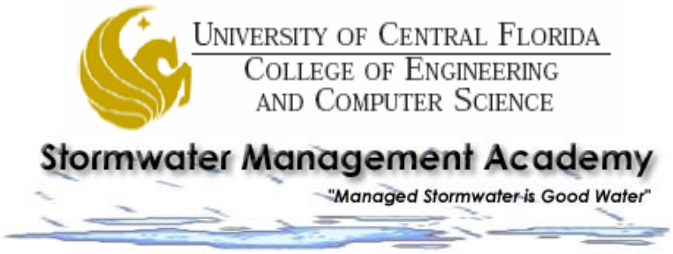
Project # M118

Proposal to the

Southwest Florida Water Management District

From

STORMWATER MANAGEMENT ACADEMY
UNIVERSITY OF CENTRAL FLORIDA



March 29, 2006

PROJECT TITLE (M118)

SCOPE OF WORK AND DELIVERABLES, COMPENSATION, AND EXPENSES SCHEDULE

I. INTRODUCTION

The five water management districts (WMDs) – Northwest Florida, St. Johns River, South Florida, Southwest Florida, and Suwannee River – have worked with the Federal Emergency Management Agency (FEMA) to improve and formalize their relationships with a federal agency that shares flood protection responsibilities. The WMDs have each executed a Cooperating Technical Partners (CTP) Memorandum of Agreement with FEMA. Staff from the five WMDs and other partners has started to coordinate on a regular basis to discuss the unique issues facing Florida in implementing FEMA's Flood Insurance Rate Map (FIRM) Modernization program. As CTPs, the WMDs see the necessity of a coordinated approach to implementing and managing Map Modernization and the advantages of dealing with issues as a united front. As a product of this coordination, staff identified the need to develop consistent rainfall depth criteria across the state for hydrologic analysis. The Southwest Florida Water Management District (hereinafter referred to as the "DISTRICT") entered into a cooperative agreement EMA-2005-CA-5244 with FEMA to receive funding to address this technical standards need that will facilitate the acceptance and adoption of the FIRMs.

Services and deliverables to be provided by Marty Wanielista, Ph. D., with the University of Central Florida (hereinafter referred to as the "UNIVERSITY") whose address is University of Central Florida, Department of Civil Engineering, 4000 Central Florida Boulevard, Orlando, Florida 32816-2993, hereinafter referred to as the "UNIVERSITY," as set forth below in Section III of this document. Compensation for these services and deliverables is described in Section IV.

The UNIVERSITY will perform as an Independent Contractor and not as an employee, representative, or agent of the DISTRICT, and will perform the services and comply with conditions described in Sections III and IV of this document.

II. BACKGROUND

Regionally specific hydrologic data have been developed by most of the WMDs to produce design criteria for the purpose of reviewing environmental resource permits (e.g., comparing post-development to pre-development runoff volumes). Four of the five WMDs (all but Northwest Florida) require the use of their respective design storm criteria for performing hydrologic and hydraulic studies within their jurisdiction. There is wide variation among the criteria used by the WMDs. Along the boundaries of these WMDs, the rainfall depths often do not match and may differ by several inches. In addition, the Isopluval maps generated by each WMD differ from the national standards: National Weather Service Technical Paper 40 (TP-40), published in 1961; National Weather Service Technical Paper (TP-49), published in 1964; and the National Oceanic and Atmospheric Administration Technical Memorandum NWS HYDRO-35, published in 1977. Suwannee River uses intensity-duration-frequency (IDF) curves that are based on data from TP-40, TP-49, and HYDRO-35. Differences in the maps are a result of using local data, different periods of record, different best-fit distributions, and different

approaches to filling in data gaps both spatially and temporally. The techniques used by each are proper and applicable for establishing "regional" design storm criteria.

Because the boundaries of the WMDs are based largely on watershed boundaries rather than political boundaries, many counties within the state are split between WMDs. One issue that has been raised during several Map Modernization projects is the difference among the WMDs in the total rainfall depth for a given duration. For split counties, determining which design storm criteria to apply for a countywide Map Modernization project must be determined. The WMDs have determined that developing Isopluval rainfall depth curves for the entire state is the best alternative to manage the design rainfall depth inconsistencies across the state. Developing updated, statewide Isopluval rainfall depth curves provides the WMDs a consistent approach based on defendable techniques, local data, and a longer period of record than existing maps.

III. DESCRIPTION OF SERVICES

The objective of this research is to update the precipitation frequency estimates for the State of Florida. The last update using the then current rainfall data for Florida was completed in 1995. Since then there have been various other studies for specific areas that in some ways have resulting in discontinuous estimates of rainfall depths for different return periods at the boundaries of the Water Management Districts in the State of Florida.

The 1995 update preformed by the UCF research team resulting in the development of equal precipitation lines for the State of Florida and used rainfall data acquired from NOAA and the Water Management Districts in digital format. The data were obtained in both 15-minute and hourly recorded rainfall for stations in Florida, 5 stations in southern Georgia, and one file containing only 15-minute data from southeast Georgia. The information was then parsed into annual and partial series records containing the required durations for the study. An extensive visual quality control check of all data resulted in the acceptance of a total of 107 rainfall (76 hourly and 31 fifteen-minute) stations.

A sample of 25 stations was selected based on their spatial location and amount of data available for analysis. Distribution analysis of these 25 stations and comparison to results obtained in reviewed research resulted in the selection of the Log Pearson Type III distribution. The predicted rainfall volumes for the desired return periods of 2-, 3-, 5, 10-, 25-, 50-, 100-, 200-, and 500-years were generated and then converted to intensities. These intensities were then used to determine the best equation to fit the intensity versus duration data to the standard forms associated with IDF curves.

Since rainfall data collected and analyzed represented a single location, spatial analysis was used to estimate the values for unrecorded areas within the boundaries of the study. Kriging was used as the interpolation estimator for the special analysis to obtain the best possible local averages coinciding with actual obtained values of recorded rainfall stations. All 107 sites were used in the kriging analysis incorporating the

location of the stations and the predicted rainfall intensities at those stations. The estimates at 625 coordinate points in the Florida grid resulting from the kriging process provided the curve fit parameters for the selected best fit equation.

The proposed plan for updating the precipitation frequency estimates for the State of Florida will include all of the steps taken in the above described analysis and will be completed in five tasks.

1. The first task will be a review of the literature to determine the extent of work being completed for similar analyses. An annotated bibliography and summary report of available data are deliverables from this task.
2. In the second task, the national data used will be from the National Climatic Data Center (NCDC), a digital format of the available NOAA rainfall stations for the state of Florida, and additional quality controlled digital data from the Water Management Districts. To ensure the best possible accuracy of this project, additional visual QC checking will be performed on all data accepted. The rainfall stations used in southern Georgia and southeast Alabama will again be used in this study. This will ensure consistency across the north Florida borders. A DVD or other suitable storage device with all the rainfall data that had been deemed acceptable will be submitted along with a report statistically summarizing the data for each station. The proposed method for parsing the data, performing the frequency analysis, and the spatial interpolation will also be presented in this draft technical report. The report will be submitted to a committee from the WMD members for approval prior to task three implementation.
3. The third task will involve parsing of the data and frequency analysis. The revised data set will be submitted along with a draft report documenting the data used, methodology for parsing the data, the process for inspecting the accuracy of the data, the methodologies for determining the sample of stations for the frequency analysis, the range of functions used in the frequency analysis and the result thereof. Summary tables and figures will be included. Any abnormalities in the data shall be documented in a “problems” section with recommended solutions. This technical report will be presented to a committee of WMD members as a draft and revision made based upon the committee input.
4. Minutes and conversations with WMD staff related to this project will be submitted and incorporated into a project report. Thus there will be a technical and a project report.
5. The final report will be composed of a technical report and a project report. It will be delivered as two bound hardcopies and two CDs with a PDF copy.

In compliance with the Hydrometeorological Design Studies Center’s proposal for updating the precipitation frequency estimates, we are recommending for this work, durations from 1 through 5 days at average recurrence intervals from 1 to 1,000 years. This will be done for both the annual maximum and partial duration series estimates. The method of spatial interpolation will be selected from the current best methods available.