APENDICE B

Estudio Hidrológico e Hidráulico

Noviembre 2010

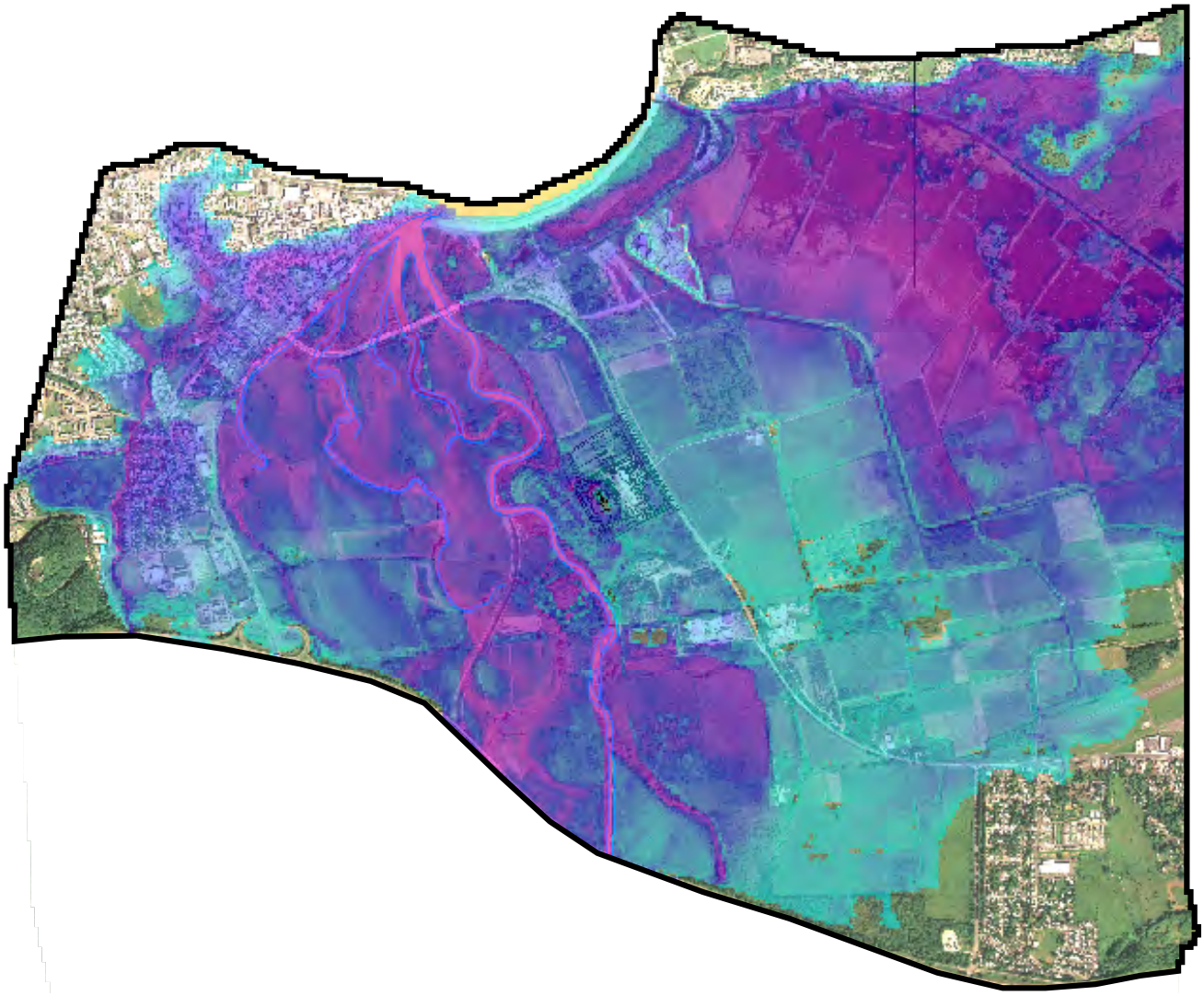
Declaración de Impacto Ambiental – Preliminar

Planta de Generación de Energía Renovable y Recuperación de Recursos

BARRIO CAMBALACHE DE ARECIBO

EnergyAnswers Arecibo

HYDROLOGIC-HYDRAULIC STUDY OF RÍO GRANDE DE ARECIBO, RENEWABLE POWER GENERATION AND RESOURCE RECOVERY FACILITY, ARECIBO, PUERTO RICO



October 5, 2010

Prepared for:

Energy Answers International
79 N Pearl Street
Albany NY, 12207

Prepared by:

Tanca St. # 250
P.O. BOX 9024157
San Juan, PR 00902
Tel. (787) 723-8005 Fax (787) 721-3196

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HYDROLOGIC-HYDRAULIC STUDY OF RÍO GRANDE DE ARECIBO, RENEWABLE POWER GENERATION AND RESOURCE RECOVERY FACILITY, ARECIBO, PUERTO RICO

1. INTRODUCTION

1.1. Project Description and Location

Energy Answers International proposes the construction of a renewable power generation and resource recovery facility located on state road PR-2, in the municipality of Arecibo. The site is located along the eastern bank of the river channel, downstream of the old Central Cambalache sugar cane mill, approximately 2 kilometers south of highway PR-22. Figure 1 and Figure 2 show the location of the proposed development on the USGS topographic quadrangle and on recent aerial photography, respectively.

1.2. Scope and Purpose of Study

This study has been undertaken to determine 10-, 50-, 100- and 500-year flood levels along Río Grande de Arecibo and revise encroachment limits at the location of the project site, based on recent topographic data and updated modeling. This study provides hydraulic modeling and documentation required to request a regulatory floodway amendment to the Puerto Rico Planning Board and Federal Emergency Management Agency.

1.3. Authorization

Roberto M. León Iglesias, of CSA Architects and Engineers LLP, has authorized preparation of this report through a written agreement with Gregory L. Morris Engineering, P.S.C.

1.4. Parties Involved with Project

The following parties were involved with the preparation of this report:

Owner:	Energy Answers International
Project Designer:	CSA Architects and Engineers, LLP
Report Preparers:	Gregory L. Morris, P.E., Ph.D.
	Luan M. Esteban, P.E., M.E.C.E.
	José D. Miranda, P.E.
	Juan Portalatin, P.E., M.S.C.E

2. STUDY AREA DESCRIPTION

2.1. Study Area Description

Río Grande de Arecibo generally runs south and its watershed begins at the Cordillera Central mountain range, specifically in the Guilarte State Forest, at elevations of approximately 1,200 m-msl. The river begins at the confluence of Río Las Vacas and Río Cidra, immediately upstream of state road PR-135, in the municipality of Adjuntas. Along its upper reaches, Río Grande de Arecibo runs though a narrow, canyon-like valley, in a region characterized by karst formations. The river is moderately entrenched with stable banks, has a riffle dominated channel with infrequently spaced pools, and a river valley that presents colluvial deposition.

The heavily sedimented Lago Adjuntas dam is located 2.3 kilometers downstream of Adjuntas. A smaller diversion dam is also located 7 kilometers downstream of Lago Adjuntas. Neither dam has appreciable storage, and the 100-year flood overflows the uncontrolled crests of both structures. Because of coarse sediment trapping by the Lago Adjuntas reservoir, bed degradation has occurred downstream the dam. Some portions of the riverbed completely lack granular material, exposing bedrock. These in-stream structures are located more than 30 kilometers upstream from the coastal floodplain. Several other in-stream reservoirs are located within the river's watershed (upstream to downstream): Lago Garzas, Lago Pellejas, Lago Caonillas, and Lago Dos Bocas.

Lago Garzas, located on the uppermost portion of the watershed, was built in 1943 and diverts runoff from approximately 6 mi^2 to the south coast of the Island for the production of hydroelectricity and for irrigation of the Lajas Valley. The two major reservoirs within the watershed are Lago Dos Bocas and Lago Caonillas, built in 1942 and 1948, respectively, for hydroelectric production. Even though neither reservoir was designed for flood control purposes, they do offer hydrograph attenuation during large events.

The river enters a wide alluvial floodplain downstream of the PR-22 highway bridge. This coastal floodplain is approximately 4 kilometers wide, and extends from the river mouth at the Atlantic Ocean to approximately 11 kilometers upstream. The primary developed area in the floodplain is the town of Arecibo, located along the western portion of the valley. Three bridges are currently located in the coastal floodplain: 1) the PR-22 highway bridge, 2) state road PR-2 bridge, and 3) PR-680, Victor Rojas Bridge.

Caño Tiburones is an extensive coastal lagoon and wetland system located between Río Grande de Manatí (to the east) and Río Grande de Arecibo (to the west). Caño Tiburones has been historically affected by floodwaters overflowing from Río Grande de Manatí and Río Grande de Arecibo, although inflow from Arecibo is now prevented by a system of dikes along the western portion of the Caño. High floodwaters, however, tend to overtop the dike system.

The project site is located between state road PR-2 and the river channel, along the eastern portion of the Río Grande de Arecibo floodplain, approximately 2 kilometers downstream (north) of highway PR-22. The property is located downstream from the old Central Cambalache sugar mill, approximately 2 kilometers west of Caño Tiburones. Figure 3 shows flow patterns at the floodplain below the highway PR-22 bridge. After flow exits the highway bridge, part runs north towards PR-2, while the other portion runs towards the east, perpendicular to road PR-2.

2.2. Prior Studies and Floodplain Mapping

Several studies have been performed previously for Río Grande de Arecibo.

2.2.1. Federal Emergency Management Agency (FEMA)

Río Grande de Arecibo has been previously studied by FEMA in its Flood Insurance Study (FIS) for the Lower Río Grande de Arecibo Basin published in 1980. The study determined peak discharge, base flood elevations and floodway limits for a reach that extends approximately 17 kilometers upstream from the river mouth. The one-dimensional, unsteady flow, HEC-6 step-backwater model developed by the US Army Corps of Engineers was used by FEMA to model the coastal floodplain. Copy of FEMA's effective model is not available at the FEMA Project Library.

The study limit along the eastern portion of the floodplain was determined by FEMA to be the dike that runs southward from the Caño Tiburones mouth, and parallels state road PR-2 for approximately 11 kilometers, as seen in FEMA Flood Insurance rate Map (FIRM) panel 230J, dated November 18, 2009 (see Figure 4). According to the FIRM panel, the project site is located at FEMA cross section "D", with base flood elevation of 5.2 m-msl. Table 1 presents a portion of FEMA's Floodway Data Table for Río Grande de Arecibo.

Table 1: FEMA Floodway Data Table for FIS of Río Grande de Arecibo

Cross Section	Distance from mouth (km)	Base Flood Elevation (m-msl)		
		without floodway	with floodway	difference
B	0.4	2.7	2.7	0.0
C	0.8	3.6	3.6	0.0
D (site)	2.1	5.2	5.2	0.0
E	2.9	6.6	6.6	0.0
F	3.4	7.1	7.4	0.3
G	4.2	7.8	8.1	0.3
H	5.1	9.1	9.4	0.3
I	6.5	11.5	11.8	0.3
J	6.9	12.8	13.1	0.3

FEMA determined peak discharge using rainfall-runoff modeling, and hydrographs were routed to and through the Dos Bocas Dam. The FIS reports peak discharge along Río Grande de Arecibo downstream of the Dos Bocas Dam, and at the confluence with Río Tanamá, as seen in Table 2. Partial reproduction of FEMA's FIS of Río Grande de Arecibo is included in Appendix A.

Table 2: FEMA FIS peak discharge at Río Grande de Arecibo

Location	Drainage Area (km^2)	Peak Discharge (m^3/s)			
		10-yr	50-yr	100-yr	500-yr
Confluence with Río Tanamá	487	2,890	4,550	5,680	8,640
Downstream Dos Bocas Dam	415	2,520	4,050	4,930	7,650

2.2.2. United States Geological Survey (USGS) Flood Atlas

The USGS prepared the Water-Resources Investigation Report 01-4247 "*Flood of September 22, 1998, in Arecibo and Utuado, Puerto Rico*" (Torres-Sierra, 2002) to document the flood event that occurred in the Río Grande de Arecibo basin due to the passing of Hurricane Georges. The study provides peak discharge and flood levels based on USGS stream gage data and observed flood marks, respectively. Figure 5 shows the Historical Flood Atlas published by the USGS.

Peak discharge was computed by USGS over the spillways at the Caonillas and Dos Bocas Dams using recorded flood stage data and the theoretical spillway discharge rating curve for each reservoir. The computed peak discharge for Río Grande de Arecibo at the Dos Bocas Dam was transferred downstream to station 50027750 Río Grande de Arecibo above Arecibo using the procedure described by López and others (1979). This method was also used to translate the observed peak discharge at station 50028000 Río Tanamá near Utuado to station 50028400 Río Tanamá at Charco Hondo.

The location of USGS stream gage stations is shown in Figure 6. Station 50027750, Río Grande de Arecibo above Arecibo, is located above the confluence with Río Tanamá. USGS station 50027750, and station 50028400, Río Tanamá at Charco Hondo, are both located upstream from the highway PR-22 bridge. Table 3 shows the peak discharge calculated by the USGS for the September 1998 event.

Table 3: Peak discharge calculated by USGS for Hurricane Georges (September 1998)

Location	Drainage Area (km^2)	Peak Discharge (m^3/s)
Río Grande de Arecibo at the Dos Bocas Dam	440	3,260
50027750 Río Grande de Arecibo above Arecibo [a]	451	3,330
50028000 Río Tanamá near Utuado	48	666
50028400 Río Tanamá at Charco Hondo	149	778

[a] does not include discharge from Río Tanamá

2.2.3. US Army Corps of Engineers (USACE)

The USACE prepared a hydrologic-hydraulic study of the lower Río Grande de Arecibo basin for the "*Río Grande de Arecibo Final Feasibility Report and Environmental Impact Statement*" in July 1993. The study analyzed the proposed flood control project for Río Grande de Arecibo and two of its tributaries. The project consists primarily of three major elements, as seen in Figure 7: 1) approximately 4,500 meters of levee and floodwalls around the eastern and southern boundaries of the town of Arecibo, 2) 2,900 meters of a trapezoidal earthen channel to divert flow from the upper Río Santiago basin into the Río Grande de Arecibo floodplain, downstream of highway PR-22, and 3) 1,200 meters of levee north of Río Tanamá, immediately upstream of state road PR-10. Construction of the Río Tanamá levee, the Río Santiago diversion channel and the southern portion of the Río Grande de Arecibo levee has been

completed. The levee along the eastern boundary of the town of Arecibo has not begun.

The USACE study determined peak discharge along Río Grande de Arecibo based on a Log-Pearson III flood frequency analysis, verified through rainfall-runoff modeling performed with HEC-1 and through USGS regional regression equations. The Log-Pearson analysis was performed with data from the abandoned USGS station 50029000 at Central Cambalache, combined with peak data from station 50027750 Río Grande de Arecibo above Arecibo (which does not include discharge from Río Tanamá). Discharge for Río Tanamá was estimated with HEC-1 modeling. Table 4 presents the peak discharges calculated by USACE.

Table 4: USACE Peak Discharge at Río Grande de Arecibo and Río Tanamá

Location	Area (km^2)	100-year Peak Discharge (m^3/s)		
		Log-Pearson III	HEC-1	USGS equations
50028400 Río Tanamá at Charco Hondo	149	N/A	660	N/A
50027750 Río Grande de Arecibo above Arecibo	451	N/A	4,427	N/A
50029000 Río Grande de Arecibo at Central Cambalache	518	4,000	4,870	7,000

2.3. Summary of Peak Discharges

Table 5 and Table 6 compare peak discharge as calculated by previous studies along Río Grande de Arecibo and Río Tanamá, respectively. The FEMA FIS presents the highest, most conservative, peak discharge for Río Grande de Arecibo.

Table 5: Comparison of Río Grande de Arecibo peak discharge from previous studies

Study/Location	Drainage Area (km^2)	Peak Discharge (m^3/s)	Yield (m^3/s / km^2)
USGS Flood Atlas (Torres-Sierra, 2002)			
at Dos Bocas Dam	440	3,260	7.4
USGS 50027750	451	3,330	7.4
USACE (100-YEAR, HEC-1)			
USGS 50027750	451	4,427	9.8
USGS 50029000	518	4,870	9.4
FEMA FIS (100-YEAR)			
Downstream Dos Bocas Dam	415	4,930	11.9
at Confluence with Tanamá	487	5,680	11.7

Table 6: Comparison of Río Tanamá peak discharge from previous studies

Study/Location	Drainage Area (km^2)	Peak Discharge (m^3/s)	Notes
USGS Flood Atlas (Torres-Sierra, 2002)			
USGS 50028000	48	666	Hurricane Georges
USGS 50028400	149	778	Hurricane Georges
USACE			
USGS 50028400	149	660	100-year, HEC-1
100-year event (Ramos-Ginés, 1999)			
USGS 50028400	149	626	Bulletin 17B weighted

2.4. Field Observations

The site was visited on several occasions on February and April 2010. The following observations were made based on these field observations.

- The site is located approximately 200 meters east of the active river channel. Overbanks are heavily vegetated with brush, tress and some bamboo. Bed material consists predominately of sand.
- The project site is located along the eastern bank of Río Grande de Arecibo, in the Global Fibers Paper Mill facilities. Various abandoned structures from the old mill operations can still be found inside the site
- A concrete barrier (Jersey barrier), approximately 1-meter tall, runs along the state road PR-2 median beginning at the intersection of roads PR-681 and PR-2. This barrier is occasionally interrupted along road intersections.

2.5. Field Survey Data

Surveyor Pedro J. Dávila Colón provided river and bridge cross sections of the Río Grande de Arecibo study reach referenced vertically to mean sea level and/or Puerto Rico Vertical Datum of 2002, (MSL, PRVD02) and horizontally referenced to the State Plane Coordinates System for Puerto Rico and the North American Datum of 1983, (SPC, NAD83). The river cross-sections were surveyed during February 2010.

Floodplain elevations and topographic contours are also referenced vertically and horizontally to MSL, PRVD02 and SPC, NAD83, respectively. Elevations were obtained from the Digital Elevation Models for San Juan and Mayagüez, Puerto Rico, prepared for the NOAA Pacific Marine Environmental Laboratory (PMEL), Center for Tsunami Inundation Mapping Efforts (TIME) by the NOAA National Geophysical Data Center (NGDC) on May 5, 2006.

Topographic datasets used in the elevation grids consist of LIDAR collected at 3 meter postings by the USACE, and obtained from the USDA, National Resources Conservation Service for the main island. Topographic LIDAR data were collected by 3001, Inc. for the USACE in 2004 as part of an effort to develop digital orthophoto imagery for administration of the US Department of Agriculture GIS Orthophotography update program. The data cover nearly the entire island of Puerto Rico at 3 meter postings. The grids have an estimated vertical accuracy of 0.1 to 1 meters for topographic areas, and 0.1 meters to 5% of water depth for bathymetric areas. Topographic values are largely derived from USACE LIDAR surveys, which have an estimated vertical accuracy of 0.1 to 0.15 meters.

Three topographic digital elevation grids were built for the Pacific Marine Environmental Laboratory (PMEL), NOAA Center for Tsunami Inundation Mapping Efforts (TIME), a 3 arc-second grid covering the whole island of Puerto Rico and two 1/3 arc-second grids centered around Mayagüez and San Juan, Puerto Rico. The best available data from US federal and state agencies and the University of Puerto Rico were obtained for grid compilation. The data were quality checked, processed and gridded using ESRI ArcGIS, FME, GMT and MBSystem software.

The published elevation grids were originally tied to the mean high water, (MHW) vertical Datum but were transformed to MSL, PRVD02 by applying the correction provided NOAA.

3. STUDY APPROACH AND METHODOLOGY

3.1. Hydrologic Analysis

The hydrologic analysis has been performed using the US Army Corps of Engineers' HEC-HMS model based on the Unit Hydrograph Methodology developed by the Natural Resources Conservation Services (NRCS). Runoff hydrographs generated by this method are based on rainfall depths and durations, soil type and area, land use, lag times, and Antecedent Moisture Conditions.

Río Grande de Arecibo and its tributaries are partially located on the Puerto Rico karstic area, which is characterized by irregular limestone formations with sinkholes, underground streams, and caverns. In many places, surface runoff seeps underground through the hundreds of sinkholes throughout the watershed and travels an indeterminate length through underground fissures. This indeterminate hydrologic response of the watershed cannot be determined by use of any direct methodology or calculation.

For this reason, the hydrologic model was calibrated using a historical event (Hurricane Georges, September 22, 1998) for which the watershed's rainfall and peak discharge were known. This calibration served to incorporate into the model the uncertainties in the flow pattern caused by the complex surface and subsurface drainage mechanism existing within the watershed.

Discharge along the watershed is also influenced by several in-stream reservoirs, mainly Lago Dos Bocas and Lago Caonillas. These reservoirs were included in the hydrologic model and spillway discharge was calibrated by adjusting weir flow coefficients.

3.2. Hydraulic Analysis

Because of the flat and unconfined topography of the floodplain, the hydraulic analysis was performed using the FLO-2D two-dimensional model; a numerical model nationally-approved by FEMA. FLO-2D is a dynamic flood routing model that simulates channel flow by a one-dimensional model, floodplain flow by a 2-D grid, and by coupling the 1D to every adjacent 2-D element to calculate water exchange between the two. It simulates a flood over complex topography and roughness using the full dynamic wave momentum equation and a central finite difference routing scheme with eight potential flow directions to predict the progression of a flood hydrograph over a system of square grid elements.

Unconfined overland flow is simulated in eight directions (4 compass directions and 4 diagonal directions). One-dimensional channel flow is simulated with rectangular, trapezoidal or natural shaped cross section. When the discharge exceeds the channel capacity, an interactive routine in FLO-2D will compute the overbank discharge onto the floodplain or the return flow to the channel on a grid element basis.

The hydrologic-hydraulic model prepared consists of a flow surface topography represented by a square grid system. The grid system was created from a Digital Elevation Model (DEM) created by precision LIDAR mapping. Inflow hydrographs are used as hydrologic inputs to the model. Channel elements representing the principal stream within the simulation boundary were included as one-dimensional flow paths using irregular channel geometry defined by field survey.

4. HYDROLOGIC ANALYSIS

4.1. Watershed Limits

The Río Grande de Arecibo coastal floodplain drains a total area of approximately 541 squared kilometers. The watershed tributary to the study reach was divided into 9 sub-basins; delimited using the USGS topographic quadrangle, as seen in Figure 8. Although the watersheds were initially delimited using the topographic quadrangle, the drainage area within the karst area that actually contributes surface runoff is indeterminate, and was adjusted during the calibration process. The highest concentration of limestone formations is located between Lago Dos Bocas and the coastal floodplain. The upper watersheds are mainly undeveloped or forested areas with steep terrain. The watershed's coastal floodplain is relatively flat and there is significant ponding of water in some overbank areas near the river.

4.2. Soil Types, Curve Number and Time of Concentration

The Curve Number represents the runoff potential within a watershed and is estimated based on soil type (hydrologic soil group), land use and Antecedent Moisture Condition (AMC). In this study an AMC-II was used. The soil types within the watershed were obtained from Soil Survey Geographic data base (SSURGO), which contains the most detailed level of soil mapping performed by the NRCS. A runoff curve number was assigned to each soil type and land use combination, and a weighted average curve number was then calculated. Figure 9 illustrates the hydrologic soil groups found within the studied watersheds.

The time of concentration is the time required for rainfall in the most distant part of the watershed to influence the discharge from the basin outlet. Time of Concentration was initially calculated with the Soil Conservation Service TR-55 method, but due to the uncertainties associated with subsurface drainage and in-stream reservoirs within the watersheds, the time of concentration for each sub-basin was adjusted through calibration. Table 7 presents the calculated hydrologic parameters of the analyzed sub-basins, prior to calibration. Appendix B shows Time of Concentration calculations. Curve Number Calculations are included in the accompanying DVD.

Table 7: Calculated hydrologic parameters of analyzed sub-basins

Sub-basin	Area (km^2)	CN	TC (min)
Lago Caonillas	125	76	173
Río Viví	43	68	172
Río Grande de Arecibo at Utuado	125	72	135
Río Limón	98	80	167
Río Caonillas	22	72	56
Río Grande de Arecibo at Dos Bocas	40	72	100
Río Tanamá at Esperanza	127	74	204
Río Grande de Arecibo above Arecibo	36	70	143
Río Tanamá at Charco Hondo	15	74	37
Río Grande de Arecibo at Cambalache	12	76	140
Río Santiago	11	76	74

4.3. Model Calibration

The calibration process was undertaken to determine uncertain hydrological characteristics of the watershed such as time of concentration, travel lag times, and drainage area using an historical event where rainfall and peak discharges were known to produce a simulated hydrograph with characteristics similar to the observed one for the same rainfall. The calibration was performed using the rainfall event associated with the passing of Hurricane Georges during September 21-22, 1998. Calibration focused on matching the peak discharge and flow volumes, while producing a hydrograph shape as similar to the observed hydrograph as possible.

4.3.1. Rainfall Depths

The 15-minute rainfall data used for calibration was obtained from the National Climatic Data Center, Summary of the Day, for three stations within the Río Grande de Arecibo watershed: 1) Cerro Maravilla, 2) Adjuntas Substation, and 3) Dos Bocas. These are the only stations in the area with 15-minute records for the Hurricane Georges event. Other stations in the area provide only daily rainfall data.

Figure 10 shows the location of the three rainfall stations with 15-minute records for the Hurricane Georges event, and Figure 11 presents the cumulative rainfall for the three stations. As seen on the figure, each station had different rainfall distributions. Table 8 lists which rainfall station data (and rainfall distribution) was used at each of the analyzed sub-basins based on proximity to the station.

Table 8: Rainfall station data used at each analyzed sub-basin

Sub-basin	Rainfall Station/Rainfall Distribution
Lago Caonillas	Cerro Maravilla
Río Viví	Cerro Maravilla
Río Grande de Arecibo at Utuado	Adjuntas Substation
Río Limón	Cerro Maravilla
Río Caonillas	Dos Bocas
Río Grande de Arecibo at Dos Bocas	Dos Bocas
Río Tanamá at Esperanza	Adjuntas Substation
Río Grande de Arecibo above Arecibo	Dos Bocas
Río Tanamá at Charco Hondo	Dos Bocas
Río Grande de Arecibo at Cambalache	Dos Bocas
Río Santiago	Dos Bocas

Hyetographs were constructed using rainfall depths obtained from the rainfall stations listed in Table 8, for different durations, as seen in Table 9. The 24-hour rainfall depth seen in Table 9 corresponds to the most intense 24-hour period during the event that occurred between September 21 and 22, 1998, the 12-hour depths corresponds to the most intense 12-hour period, and so on. NCDC rainfall data obtained for the Hurricane George event, as well as Hurricane Georges rainfall distribution calculations, are included in Appendix C.

Table 9: Hurricane Georges Rainfall Depths (September 21 and 22, 1998) used for rainfall distribution calculations

Duration (hr)	Rainfall Depth (in)		
	Adjuntas Substation	Cerro Maravilla	Dos Bocas
0.25	1.2	1.0	0.6
0.5	2.3	1.7	1.1
1	4.3	2.8	1.9
2	7.0	4.8	3.2
3	8.9	6.6	4.1
6	12.8	10.7	5.7
12	16.5	15.8	8.1
24	18.1	18.8	9.6

Since rainfall depths varied greatly from watershed to watershed, an isohyetal map was constructed using 24-hour rainfall depth for a total of 17 stations in the area to estimate the 24-hour rainfall depth at each individual sub-basin during the Hurricane Georges event. The data used to generate the isohyetal map corresponds to the three stations that have 15-minute data (Cerro Maravilla, Adjuntas Substation, and Dos Bocas), plus daily data from 14 other stations.

Figure 12 presents the isohyetal map generated from Hurricane Georges precipitation data and the location of the rainfall stations used to generate the map. The 24-hour rainfall depth at each sub-basin (shown in Table 10) was applied to their corresponding hyetograph.

Table 10: 24-hour Rainfall Depths at each sub-basin during Hurricane George

Sub-basin	24-hour Rainfall Depth	
	inches	millimeters
Lago Caonillas	21.1	536
Río Viví	18.5	470
Río Grande de Arecibo at Utuado	18.5	470
Río Limón	14.0	356
Río Caonillas	11.8	300
Río Grande de Arecibo at Dos Bocas	12.0	305
Río Tanamá at Esperanza	12.3	312
Río Grande de Arecibo above Arecibo	7.1	180
Río Tanamá at Charco Hondo	6.6	168
Río Grande de Arecibo at Cambalache	5.8	147
Río Santiago	5.8	147

4.3.2. Calibration Results

Hydrologic parameters, particularly within the karst area, were calibrated to match observed and calculated peak discharges. Table 11 shows calibrated hydrologic parameters for the analyzed sub-basins.

Table 11: Calibrated hydrologic parameters of analyzed sub-basins

Sub-basin	Area (km^2)	CN	TC (min)
Lago Caonillas	125	76	125
Río Viví	43	63	100
Río Grande de Arecibo at Utuado	125	65	250
Río Limón	90	72	83
Río Caonillas	18	66	67
Río Grande de Arecibo at Dos Bocas	35	66	100
Río Tanamá at Esperanza	80	72	242

Sub-basin	Area (km²)	CN	TC (min)
Río Grande de Arecibo above Arecibo	26	73	100
Río Tanamá at Charco Hondo	11	74	67
Río Grande de Arecibo at Cambalache	12	76	140
Río Santiago	11	76	74

Lago Dos Bocas and Lago Caonillas were both included in the hydrologic model as storage nodes. Stage volume relationships and spillway lengths from the Dos Bocas and Caonillas Dams were obtained from the USGS Scientific Investigations Report 2007-5053 "*Sedimentation History of Lago Dos Bocas, Puerto Rico, 1942-2005*" (Soler-López, 2007), and Water Resources Investigation Report 01-4043 "*Sedimentation Survey of Lago Caonillas, Puerto Rico, February 2000"* (Soler-López, 2007), respectively.

The 15-minute runoff hydrograph observed at USGS stream gage station number 50024950, Río Grande de Arecibo below Utuado, was obtained from the US Geological Survey (see data in Appendix D). The gage is located 6 kilometers above Lago Dos Bocas, as seen in Figure 6, and has a drainage area of approximately 170 km². Hydrologic parameters were calibrated to produce a simulated hydrograph at the location of station 50024950 with characteristics similar to the observed hydrograph, for the same rainfall event. This station was chosen for hydrograph comparison because it is the only station with available storm runoff hydrograph for Hurricane Georges. Peak discharge, as computed by USGS, was compared at all other points along the watershed.

Comparison of the observed and simulated hydrographs at USGS gage 50024950 is presented in Figure 13. The peak discharges and runoff volume for each of the two hydrographs are compared in Table 12.

Table 12: Runoff Hydrograph Calibration to USGS gage 50024950 for Hurricane Georges, September 21-22 1998

Parameter	Hydrograph at USGS gage 50024950		Difference
	Observed	Calculated	
Peak Discharge (m³/s)	2,160	2,110	-2.3 %
Runoff Volume (Mm³)	48.6	57.2	15%

The USGS study "*Flood of September 22, 1998, in Arecibo and Utuado, Puerto Rico. USGS Water Resources Investigations Report 01-4247*" provides peak discharge at various locations along the watershed that include: 1) Lago Dos Bocas spillway, 2) Lago Caonillas spillway, 3) at USGS gage station 50027750 on Río Grande de Arecibo above Arecibo, and 4) at USGS gage station 50028400 on Río Tanamá at Charco Hondo. Table 13 compares the peak discharges calculated by USGS and those obtained with our calibrated hydrologic model.

Table 13: Comparison of Peak Discharges as published in "*Flood of September 22, 1998, in Arecibo and Utuado, Puerto Rico. USGS Water Resources Investigations Report 01-4247:*"

Location	Peak discharge (m^3/s)		Difference
	USGS	HEC-HMS	
Río Grande de Arecibo above Arecibo	3,330	3,312	0.5 %
Río Tanamá at Charco Hondo	778	811	4.2 %
Lago Caonillas spillway	1,330	1,343	1.0 %
Lago Dos Bocas spillway	3,260	3,280	0.6 %

4.4. Discharge Hydrographs for Design Storms

Design hyetographs were constructed for each sub-basin using the 100-year rainfall depths reported in National Oceanic and Atmospheric Administration (NOAA) Atlas 14 published October 26, 2006. Table 14 presents the rainfall depth, for different durations, used to generate the design storm rainfall distribution for each sub-basin. NOAA rainfall data and rainfall distribution calculations are included in Appendix E.

Table 14: 100-year NOAA Atlas 14 Rainfall Depths (inches) for each sub-basin

Sub-basin	Duration (hr)							
	0.25	0.5	1	2	3	6	12	24
Lago Caonillas	1.78	2.84	4.22	6.14	7.16	9.67	13.55	18.92
Río Viví	1.69	2.71	4.02	5.95	6.86	9.43	13.13	17.38
RGA at Utuado	1.92	3.07	4.55	6.87	7.99	11.06	15.45	20.49
Río Limón	1.72	2.75	4.08	5.61	6.44	8.79	12.17	16.54
Río Caonillas	1.54	2.46	3.65	4.92	5.57	7.30	10.07	14.04
RGA at Dos Bocas	1.57	2.51	3.73	4.97	5.61	7.30	10.09	14.32
Río Tanamá at Esperanza	1.68	2.68	3.98	5.45	6.29	8.39	11.62	15.95
RGA above Arecibo	1.38	2.21	3.28	4.45	5.09	6.73	9.32	12.61
RGA at Cambalache	1.10	1.76	2.61	3.55	4.01	5.26	7.33	9.83
Río Santiago	1.10	1.76	2.61	3.55	4.01	5.26	7.33	9.83

The 10-, 50-, 100-, and 500-year 24-hour rainfall depths were applied to dimensionless hyetograph generated for each sub-basin. Rainfall depths used in the hydrologic analysis are presented in Table 15.

Table 15: 24-hour NOAA Atlas 14 Rainfall Depths for each sub-basin

Sub-basin	24-hour Rainfall depth (in)			
	10-yr	50-yr	100-yr	500-yr
Lago Caonillas	9.42	15.61	18.92	28.40
Río Viví	8.98	14.48	17.38	25.60
RGA at Utuado	10.09	16.85	20.49	31.00
Río Limón	8.72	13.86	16.54	24.07
Río Caonillas	7.92	10.13	14.04	19.63
RGA at Dos Bocas	7.98	12.19	14.32	20.18
Río Tanamá at Esperanza	8.67	13.47	15.95	22.90
RGA above Arecibo	7.39	10.90	12.61	17.15
RGA at Cambalache	6.32	8.75	9.83	12.45
Río Santiago	6.32	8.75	9.83	12.45

4.5. Hydrologic Effects of Río Santiago Diversion

As seen in Figure 7, the upper Río Santiago watershed has been diverted as part of the USACE Río Grande de Arecibo Flood Control Project. Prior to the flood control project, the river flowed north across the town of Arecibo before discharging into Río Grande de Arecibo approximately 400 meters upstream from the river mouth. The river has now been redirected under the highway bridge opening, and it now discharges into Río Grande de Arecibo approximately 2 kilometers downstream of the highway bridge.

We have generated flood hydrographs along Río Grande de Arecibo under two conditions to assess the effects of the Río Santiago diversion: 1) with Río Santiago's original discharge point upstream of the river mouth, and 2) with the current diversion under highway PR-22, and discharge point 2 kilometers downstream of the highway.

The diverted Río Santiago upper watershed represents less than 2% of the total drainage area tributary to the Arecibo coastal floodplain. This river drains into the valley before discharge along the Río Grande de Arecibo reaches the floodplain, having little-to-no effects on the flood hydrograph. Figure 14 compares flood hydrographs along Río Grande de Arecibo with and without the Río Santiago diversion. As seen graphically on Figure 14, the impacts of the Río Santiago

diversion are negligible. The flood hydrograph used in the hydraulic analysis corresponds to current conditions; with the diversion of Río Santiago.

4.6. Results of Hydrologic Analysis

The initial pool level at the Dos Bocas and Caonillas Dams was obtained from the average water level from 19 years of daily data at the dam sites. Even though the reservoirs were not designed for flood control, Lago Dos Bocas attenuates peak discharge approximately 19%, while Lago Caonillas reduces discharge approximately 45%, as seen graphically in Figure 15.

Table 16 compares the peak discharges obtained with the UH methodology with the FEMA discharge downstream of the confluence of Río Tanamá. Peak discharges calculated are similar, but lower, than those obtained by FEMA, with the exception of the 500-year discharge which is higher. Input data and results of all hydrologic models are included in Appendix F.

Table 16: Peak Discharge at Río Grande de Arecibo, at confluence with Río Tanamá

Study	Peak Discharge (m^3/s)			
	10-yr	50-yr	100-yr	500-yr
GME	1,615	4,014	5,469	9,797
FEMA	2,890	4,550	5,680	8,640

4.7. Verification of Hydrology

Peak discharges were verified by applying a Log Pearson Type III statistical distribution to the annual peak discharge series at USGS gage 50027750, Río Grande de Arecibo above Arecibo. Peak discharge data were available for the water years of 1982-2002. The frequency analysis data and results are given in Appendix G. Table 17 compares the Log Pearson peak discharges against those computed with the HEC-HMS model. This discharge corresponds to Río Grande de Arecibo upstream of the confluence with Río Tanamá. The 100-year discharge obtained with hydrologic modeling is higher, more conservative, than those obtained with Log Pearson. Our hydraulic analysis will use the higher peak discharge that better matches the regulatory FEMA discharge.

Table 17: Comparison of peak discharges at USGS gage station 50027750, Río Grande de Arecibo above Arecibo

Return Interval (years)	Peak discharge (m^3/s)	
	Log-Pearson III	GME
10	861	1,615
50	2,657	4,014
100	4,051	5,469

5. HYDRAULIC ANALYSIS

5.1. Hydraulic Model Configuration

As mentioned earlier, the hydraulic analysis was performed using the FEMA-approved FLO-2D two-dimensional hydraulic model. The model grid extends upstream from the Atlantic Ocean to a distance of approximately 10 kilometers. The flow system was represented by more than 100,000 square grid elements, 20 X 20 meters. Ground elevation of the grid elements were obtained from LIDAR topographic data. A small grid size was required to analyze the complex hydraulic system in the study area with the desired level of accuracy.

The hydraulic system used the following boundary conditions:

- **River Grid Elements.** River grid elements simulate flow in channels as one-dimensional. Average flow velocity and depth define the discharge between adjacent channel grid elements. Secondary currents, dispersion and super elevation in channel bends are not modeled with the 1-D channel component. The average flow path length between two channel elements is on the order of the length of the grid element and this precludes the simulation of hydraulic jumps over a short distance. The flow transition between subcritical and supercritical flow is based on the average conditions between two channel elements. The flow along each grid element is routed using the dynamic wave approximation to the momentum equation.

  The surveyed river sections were interpolated to represent each river grid element. The CHAN.DAT input file included for each model in accompanying DVD presents the river grid elements as well as the cross section geometry that defines the thalweg and bank elevations, average cross section roughness, and the length of channel within the grid element. Channel slope is computed as the difference between the channel element thalweg elevation divided by the half the sum of the channel lengths within the channel elements.

- **Inflow Elements.** Channel inflow hydrographs were used to represent the flood discharges from Río Tanamá and Río Grande de Arecibo that enter the model. The INFLOW.DAT input file included in the accompanying DVD presents the inflow elements used in the model.

- **Outflow Elements.** Both floodplain and channel outflow grid elements were used to remove water from the system. The discharge from outflow elements is equal to the sum of the inflows, and a flow depth is then assigned to the

outflow element based on a weighted average of the upstream flow depths. In this manner flow is approximated at each outflow element. The outflow discharge is completely removed from the system, and is accounted as outflow volume. These outflow elements correspond to the elements that are located at the downstream of the model, and along the eastern limit of the study, which represents flow that enters Caño Tiburones.

5.2. Effective FEMA Tie-in/ Length of Study Reach

Effective FEMA tie-in is required at both the downstream and upstream ends of the submitted models. Base flood elevations must "tie-in" within 0.5 feet to current FEMA flood elevations at both downstream and upstream ends of the revised river reach.

The downstream tie-in will be located at FEMA cross section "C" (PR-2 road), 800 meters upstream from the river mouth, and the upstream tie-in will be located at FEMA cross section "E", 2.9 kilometers upstream of the river mouth. The study reach to be revised has a length of 2.1 kilometers.

5.3. Models Prepared

The combination of large peak discharge and small grid size (20 X 20 m) produce an extremely slow computational time steps, requiring a model running time of more than 24 hours. To reduce the computational time, the hydraulic model was divided into two areas separated by PR-22 highway, as seen in Figure 16.

The area upstream of PR-22 was analyzed to perform hydraulic routing of the calculated discharge hydrograph along a distance of 7 kilometers upstream from the PR-22 highway bridge. The area downstream of PR-22, which corresponds to our revision area, was calibrated to match FEMA's flood profile and perform the floodway encroachment analysis.

The following FLOD-2D two-dimensional models were prepared:

1. Hydrograph Routing Model (HR). This model was prepared to perform hydraulic routing of the calculated discharge hydrograph along a distance of 7 kilometers upstream from highway PR-22 (FEMA cross section "G"). The model includes two types of boundaries, inflow hydrograph and free outflow nodes. Discharge at each outflow node in the Hydrograph Routing Model was used as hydrologic input at the upstream end of the Existing Condition and Floodway Encroachment Models. The location of the boundary nodes, as well as the extents of the HR Model, is presented in Figure 17. Input data and

results of the Hydrograph Routing Model are included in the accompanying DVD.

2. Duplicate Effective/Existing Condition Model (DE/EC). Since FEMA's Effective Model used to prepare the FIS of Río Grande de Arecibo is not available, this model was constructed within the FLO-2D environment to simulate the FEMA 100-year flow and match the FEMA effective flood profile. The model covers the revision distance of 2.1 kilometers, extending from FEMA cross section "C" to FEMA cross section "E". The model was run for the 10-, 50-, 100-, and 500-year events.

   The discharge hydrographs calculated at the outflow elements in the HR model were used as inflow boundary nodes in the DE/EC Model. The extents and location of boundary nodes for the DE/EC Model are presented in Figure 18. The model includes levee grid elements to represent the concrete barrier that runs along the PR-2 median (Jersey barrier).

   This model also includes the Río Santiago diversion channel that was dug out of the valley floor for the COE flood control project. The model was run with the flood hydrograph generated at the floodplain with the Río Santiago diversion, as seen in Figure 14. Input data and results of the Duplicate Effective/Existing Condition Model are included in the accompanying DVD.

3. Floodway Encroachment/Proposed Condition Model (FE/PC). This model was performed for the 100-year event to simulate regulatory limits, plus new floodway limits surrounding the project site, based on the Existing Condition Model. This model includes proposed river bank modifications between the project site and the channel to provide additional hydraulic conveyance capacity and compensate for the proposed encroachment around the site.

   Floodway encroachment limits were determined along Río Grande de Arecibo based on a maximum allowable increase in water surface elevation of 0.3 meters. Encroachment limits were determined using a similar procedure to the Type-1 method implemented in the CoE HEC-RAS model. The method consists on applying frictionless vertical walls along the flood boundaries to manually define encroachment limits, based on trial and error. Input data and results of the Floodway Encroachment/Proposed Condition Model are included in the accompanying DVD.

5.4. Hydraulic Modeling Coefficients

Manning's roughness coefficients are used to represent friction losses of the hydraulic system, and are a function of ground cover. The hydraulic roughness

coefficients (n-values) used in the 2-D model, and modified through calibration, are presented in Table 18.

Table 18: Manning's n-value used in Hydraulic Model

Location	Manning's N-value
Main Channel	0.03 - 0.04
Overbanks	0.05 - 0.06

5.5. Downstream Water Surface Elevation

Free outflow nodes are used as downstream boundary condition under the FLO-2D environment. As mentioned previously, water level at the outflow elements are determined by a weighted average of the upstream flow depths. Hydraulic coefficients were modified during the calibration process to match water levels at the model boundary with those presented in the FIS at FEMA cross section "C" (Table 19).

Table 19: FEMA Water Surface Elevation (m-msl) at Cross Section "C"

10-year	50-year	100-year	500-year
2.7	3.0	3.6	4.2

5.6. Results of Duplicate Effective/Existing Condition Model

A calibration process, which consisted of modifying hydraulic coefficients, was undertaken to match FEMA effective 100-yr water levels within the acceptable 0.15 meter (0.5 feet) difference. The DE/EC Model produces base flood elevations within the acceptable limits, as seen in Figure 19 and Table 20. Table 21 shows 10-, 50-, and 500-year flood levels for the Duplicate Effective/Existing Condition Model.

Table 20: Results of Duplicate Effective/Existing Condition Model

FEMA Cross Section	FLO-2D River Grid Element	Distance U/S River Mouth (km)	100-yr Water Surface Elevation (m-msl)		Diff (m)
			FEMA	DE/EC Model	
C	29,630	0.8	3.60	3.61	0.01
D (site)	34,346	2.1	5.20	5.29	0.09
E	43,355	2.9	6.60	6.61	0.01

Table 21: 10-, 50-, and 500-year flood levels for Duplicate Effective/Existing Condition Model

FEMA Cross Section	Distance U/S River Mouth (km)	Water Surface Elevation (m-msl)		
		10-year	50-year	500-year
C	0.8	2.63	3.31	4.68
D (site)	2.1	4.09	5.03	6.19
E	2.9	5.23	6.33	7.65

5.7. Results of Floodway Encroachment/Proposed Condition Model

This model, based on the calibrated DE/EC Model, incorporates existing regulatory floodway limits, plus the additional encroachment of the proposed site. The encroachment consists on applying frictionless vertical walls along the flood boundaries to manually define encroachment limits by trial and error.

To achieve the desired floodway limits around the project site, excavation of higher ground on the floodplain between the project site and the river channel was simulated to provide additional hydraulic conveyance capacity, and compensate for the proposed encroachment. Elevations within the area shown in Figure 20 will be lowered to a maximum of 3.5 m-msl, while areas that are already lower than 3.5 m will not be altered. Figure 21 shows a schematic design of the proposed bank modification area.

Figure 22 shows the proposed 100-year floodway limits for the study reach. Figure 23 shows maximum 100-yr water surface elevation increase attributable to encroachment. Since 100- and 500-yr flood levels have not been revised, floodplain limits will not altered. Table 22 compares 100-year Existing and Floodway Encroached water surface elevations. The increases presented on this table correspond to the average increase per model cell within the cross section.

Table 22: Comparison of 100-yr Existing and Encroached Water Surface Elevations

FEMA Cross Section	Water Surface Elevations (m-msl)		Difference (m)
	Existing	Encroachment	
C	3.61	3.65	0.04
D	5.29	5.35	0.06
E	6.61	6.61	0.00

5.8. Revised FIS Floodway Data Table

Table 23 presents the revised Río Grande de Arecibo Floodway Data Table. The proposed floodway limits do not increase base flood elevations more than 0.3 meters along any point throughout the floodplain, in compliance with federal and state regulations. Figure 24 shows the annotated FIRM panel 230 which includes the proposed floodway limits.

Table 23: Revised Río Grande de Arecibo Floodway Data Table

Cross Section	Distance from mouth (km)	Base Flood Elevation (m-msl)		
		without floodway	with floodway	difference
B	0.4	2.7	2.7	0.00
C	0.8	3.6	3.7	0.10
D (site)	2.1	5.3	5.4	0.10
E	2.9	6.6	6.6	0.00
F	3.4	7.1	7.4	0.30
G	4.2	7.8	8.1	0.30
H	5.1	9.1	9.4	0.30
I	6.5	11.5	11.8	0.30
J	6.9	12.8	13.1	0.30

6. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

1. Hydrology was based on model calibration to the Hurricane Georges event which occurred in September 22, 1998. Peak discharges were calibrated to values obtained and reported by USGS on its Water Resources Investigation 01-4247 "*Flood of September 22, 1998, in Arecibo and Utuado, Puerto Rico*" (Torres-Sierra, 2022).
2. FEMA's Effective Model is not available. A two-dimensional model was constructed within the FLO-2D environment to simulate FEMA's 100-year flow and match FEMA's effective flood profile. The revised study reach covers a distance of 2.9 kilometers, extending from FEMA cross section "C" to FEMA cross section "E".
3. The Floodway Encroachment/Proposed Condition Model was prepared for the 100-year event to simulate regulatory limits, plus new floodway limits surrounding the project site, based on the Duplicate Effective/Existing Condition Model. Floodway encroachment limits were determined along Río Grande de Arecibo based on a maximum allowable increase in water surface elevation of 0.3 meters.
4. This Floodway Encroachment/Proposed Condition Model includes the proposed excavation of higher ground on the floodplain between the project site and the river channel (see Figure 20) to provide additional hydraulic conveyance capacity, and compensate for the proposed encroachment around the site. Proposed river bank modifications consist of lowering field elevations to a maximum of 3.5 m-msl, as seen schematically in Figure 21. Proposed floodway limits are shown in Figure 22. The annotated flood map is shown in Figure 24.
5. The 100- and 500-year flood levels have not been altered, and therefore, floodplain limits have not been revised.

7. CERTIFICATION

I hereby certify that the document "Hydrologic and Hydraulic, Río Grande de Arecibo, Renewable Power Generation and Resource Recovery Facility, Arecibo, Puerto Rico" has been prepared in accordance with the best hydrologic and hydraulic practices as described in this document and that, based on the studies and field measurements provided by other parties, results are true and correct.

Certified today October 4, 2010

José D. Miranda, P.E.

8. REFERENCES

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Puerto Rico

HYDROLOGIC-HYDRAULIC STUDY
RÍO GRANDE DE ARECIBO,
RENEWABLE POWER GENERATION AND
RESOURCE RECOVERY FACILITY,
ARECIBO, PUERTO RICO

FIGURES

GLM MORRIS ENGINEERING

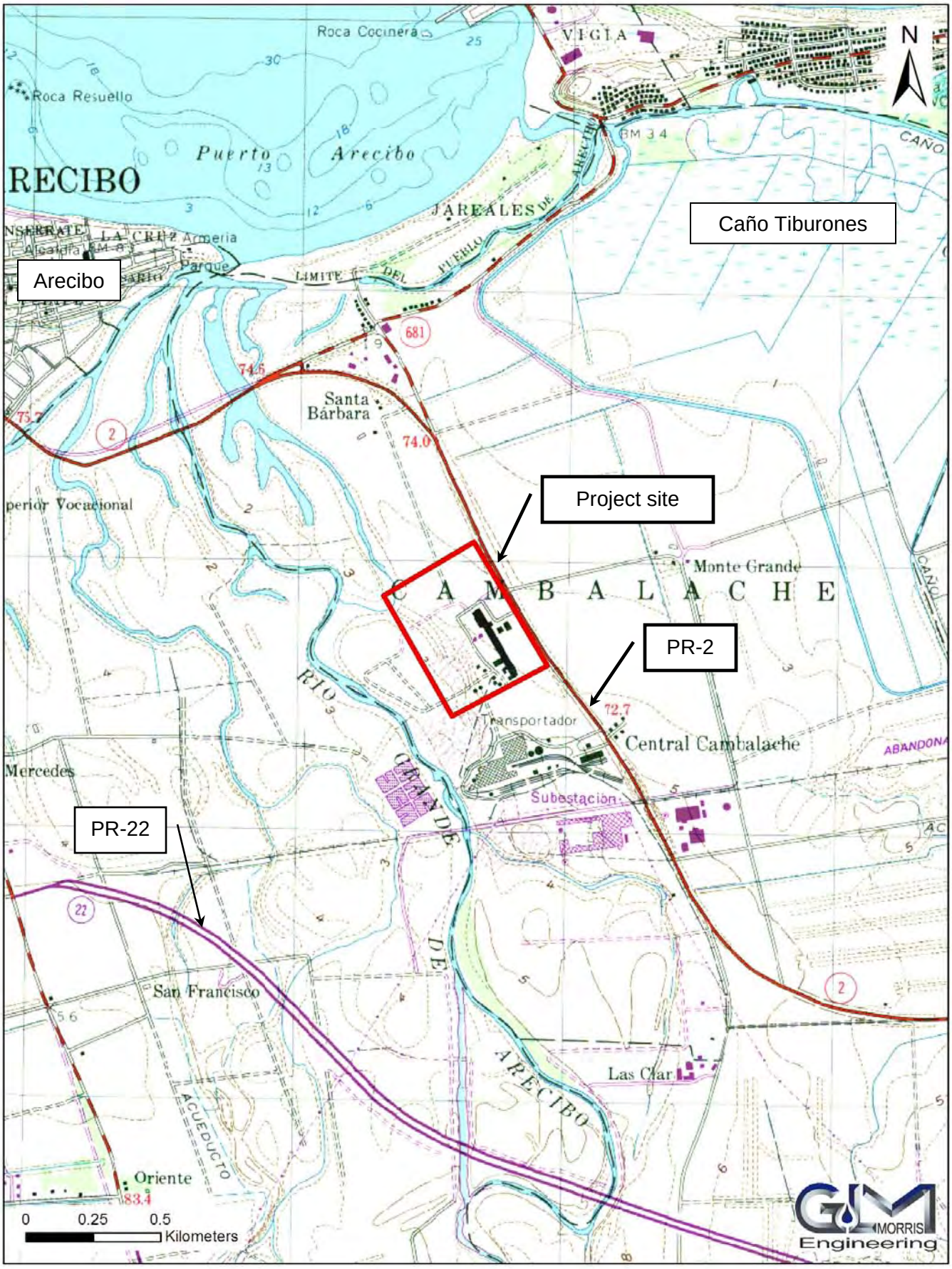


Figure 1: Project Site Location Map on USGS Topographic Quadrangle.

Figure 2: Project Site Location Map on Recent Aerial Photography.

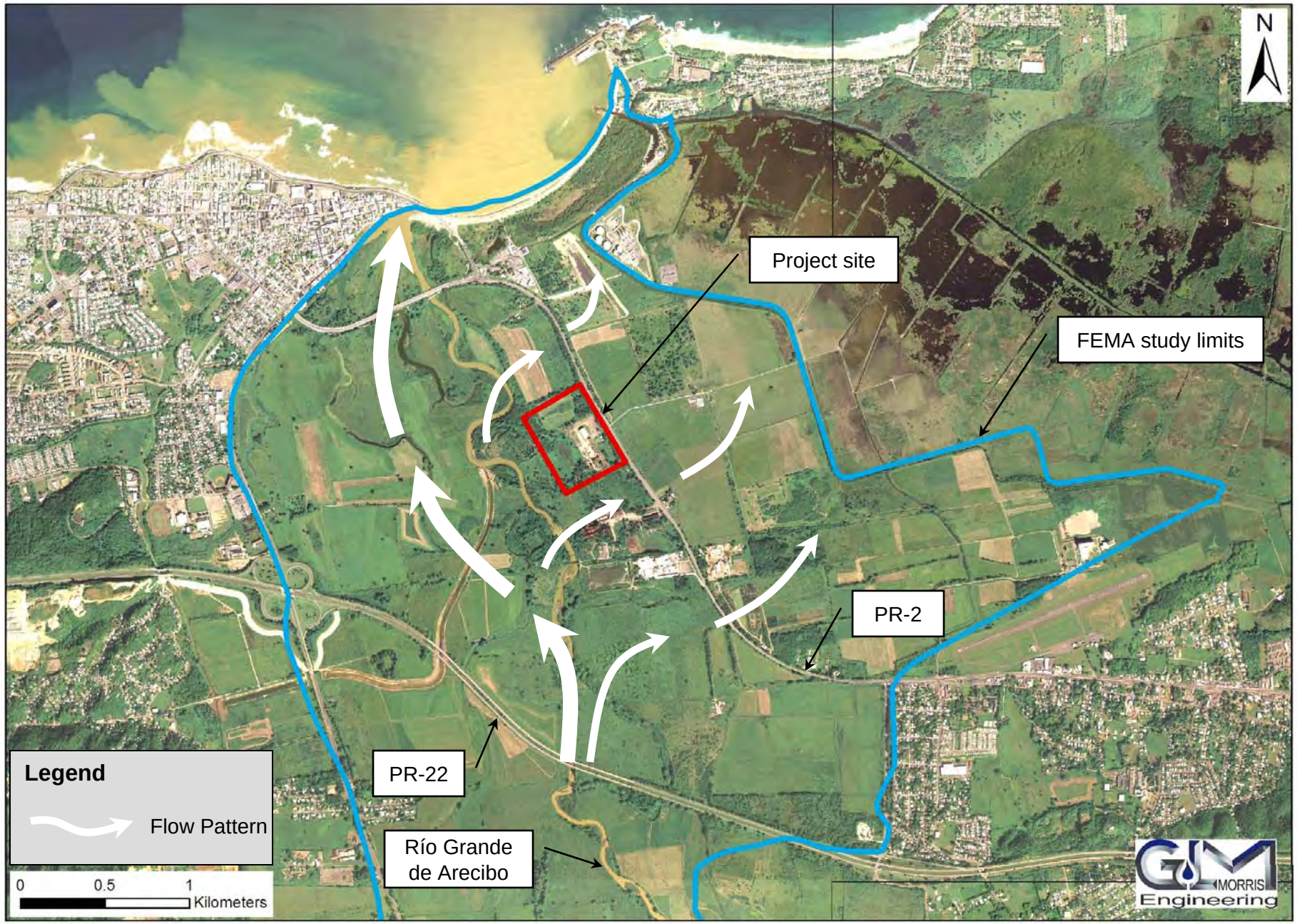


Figure 3: Flow Patterns below Highway PR-22 Bridge.

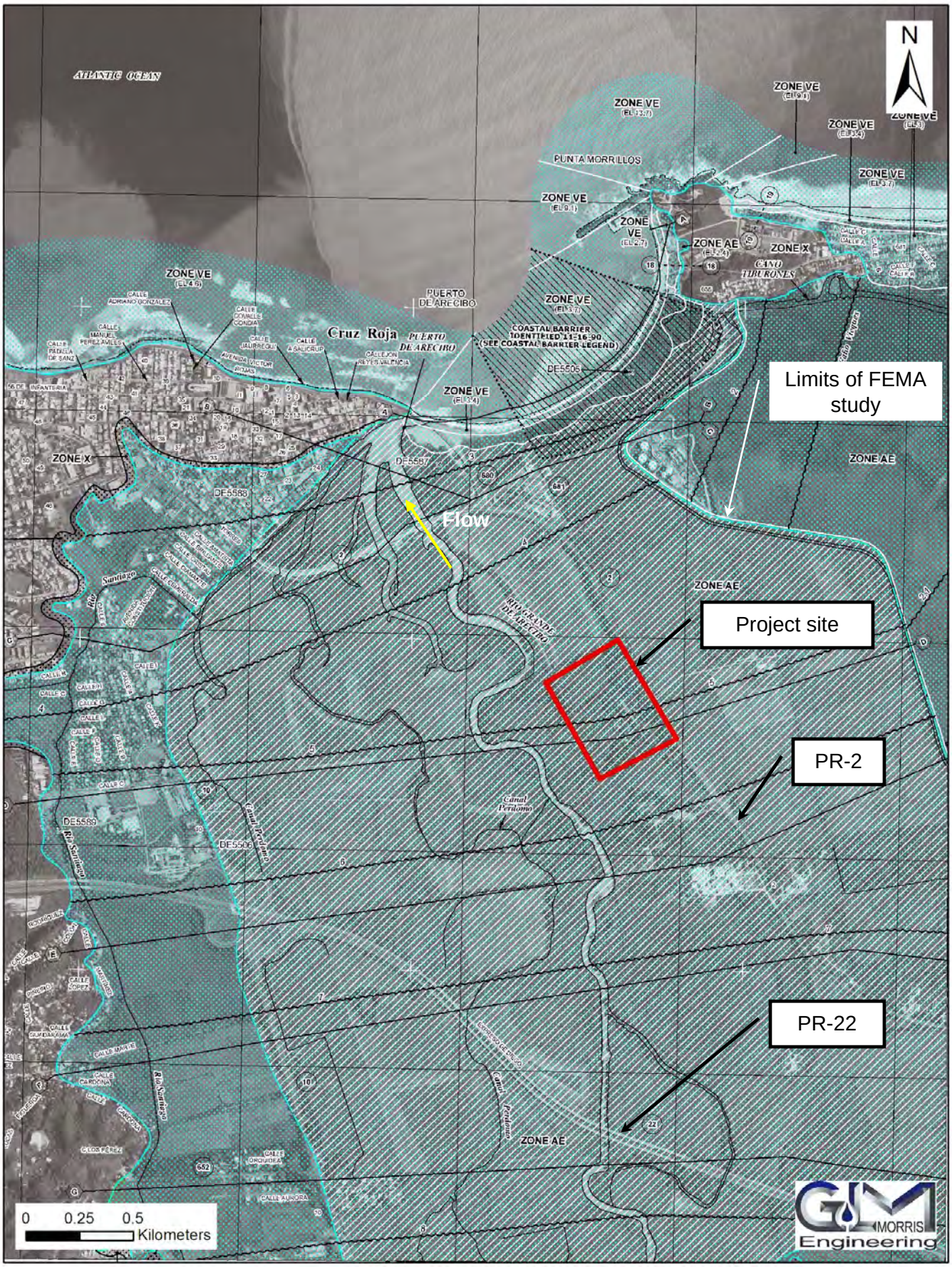


Figure 4: FEMA FIRM Panel 230J, Dated November 18, 2009

USGS
science for a changing world

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

WATER-RESOURCES INVESTIGATIONS REPORT 01-4247
Flood of September 22, 1998, in Arecibo, Puerto Rico. PLATE 1
Torres-Sierra, Heriberto, 2002

Flood of September 22, 1998, in Arecibo and Utuado, Puerto Rico

66°45′00″ 66°42′30″ 66°40′ 18°30′00″ 18°27′30″ 18°25′00″

EXPLANATION

- Area flooded during September 22, 1998
- 3.0 — Water-surface elevation contour for the flood, in meters above mean sea level. Contour interval variable
- 1 — Baseline and distance from mouth of river, in kilometers
- Boundary of flood
- RM-2 (2.49) ▲ — Survey reference marks and identification number. Number in parenthesis is elevation in meters above mean sea level
- 4.64 ● — High-water mark elevation, in meters above mean sea level

ATLANTIC OCEAN

ARECIBO

HATO ABAJO

HATO ARRIBA

CAMBALACHE

DOMINGUITO

ESPERANZA

SANTANA

Punta Caracoles

Punta Morrillos

Jareálito

Puerto Arecibo

Río Grande de Arecibo

New Highway 10

Highway 22 bridge

RM-1 (3.54)

RM-2 (2.49)

RM-3 (12.06)

RM-4 (9.69)

RM-5 (3.80)

RM-6 (13.76)

RM-7 (11.13)

RM-8 (14.49)

RM-9 (17.60)

RM-10 (18.51)

RM-11 (23.85)

RM-12 (20.41)

Flood boundaries not delineated beyond this point

Flood boundaries not delineated beyond this point

Base image from Digital Raster Graphic Quadrangle (DRG), U.S. Geological Survey, 1:20,000 Arecibo 1953
Polyconic projection. Puerto Rico datum, 1927 adjustment.
2000-meter grid ticks based on Puerto Rico coordinate system.

FLOOD OF SEPTEMBER 22, 1998, IN ARECIBO AND UTUADO, PUERTO RICO
By Heriberto Torres-Sierra
2002

0 1 Kilometer
0 1 Mile

Figure 5: USGS Historical Flood Atlas, Investigation Report 01-4247.

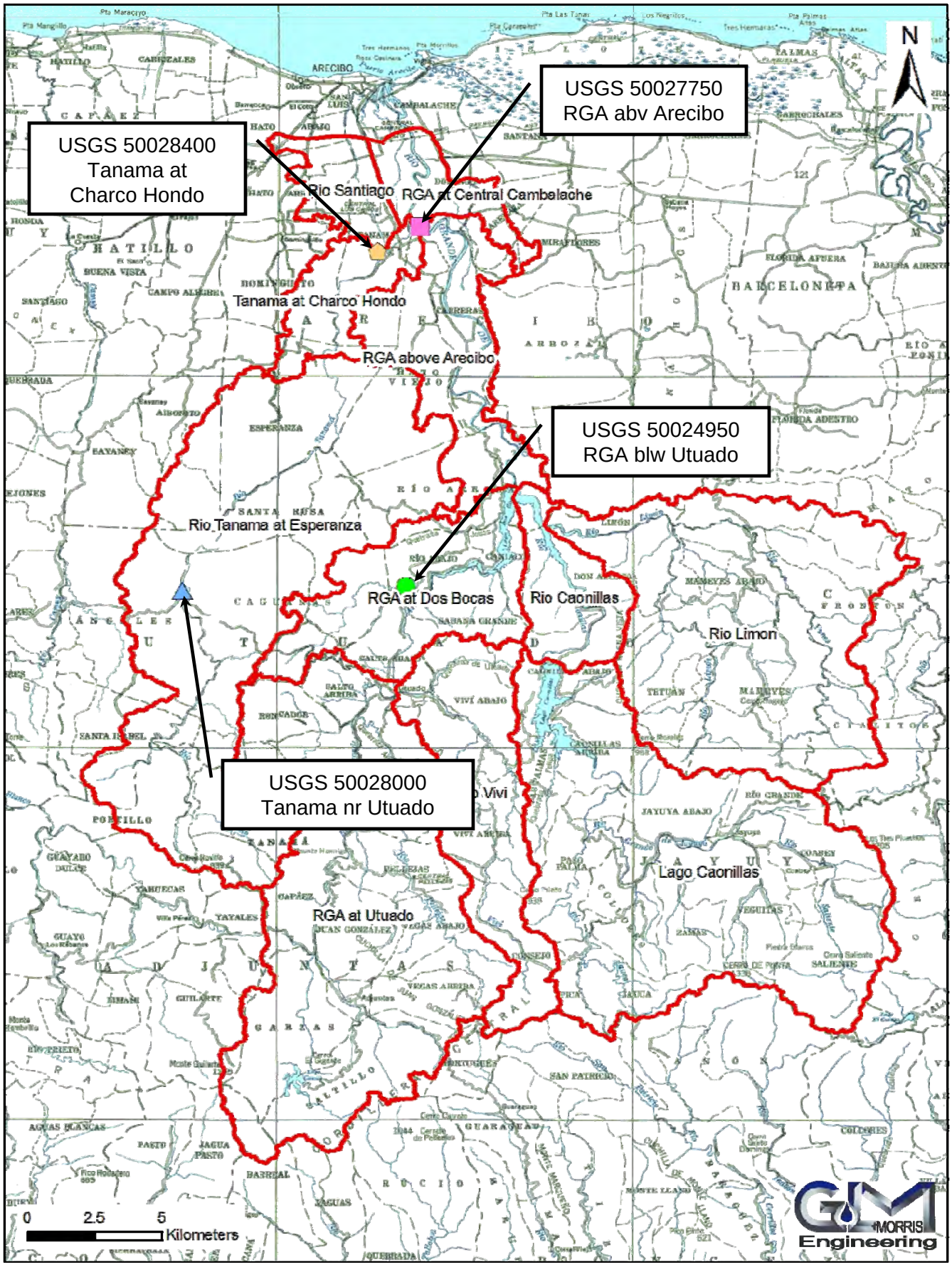


Figure 6: Location of USGS Streamgage Stations

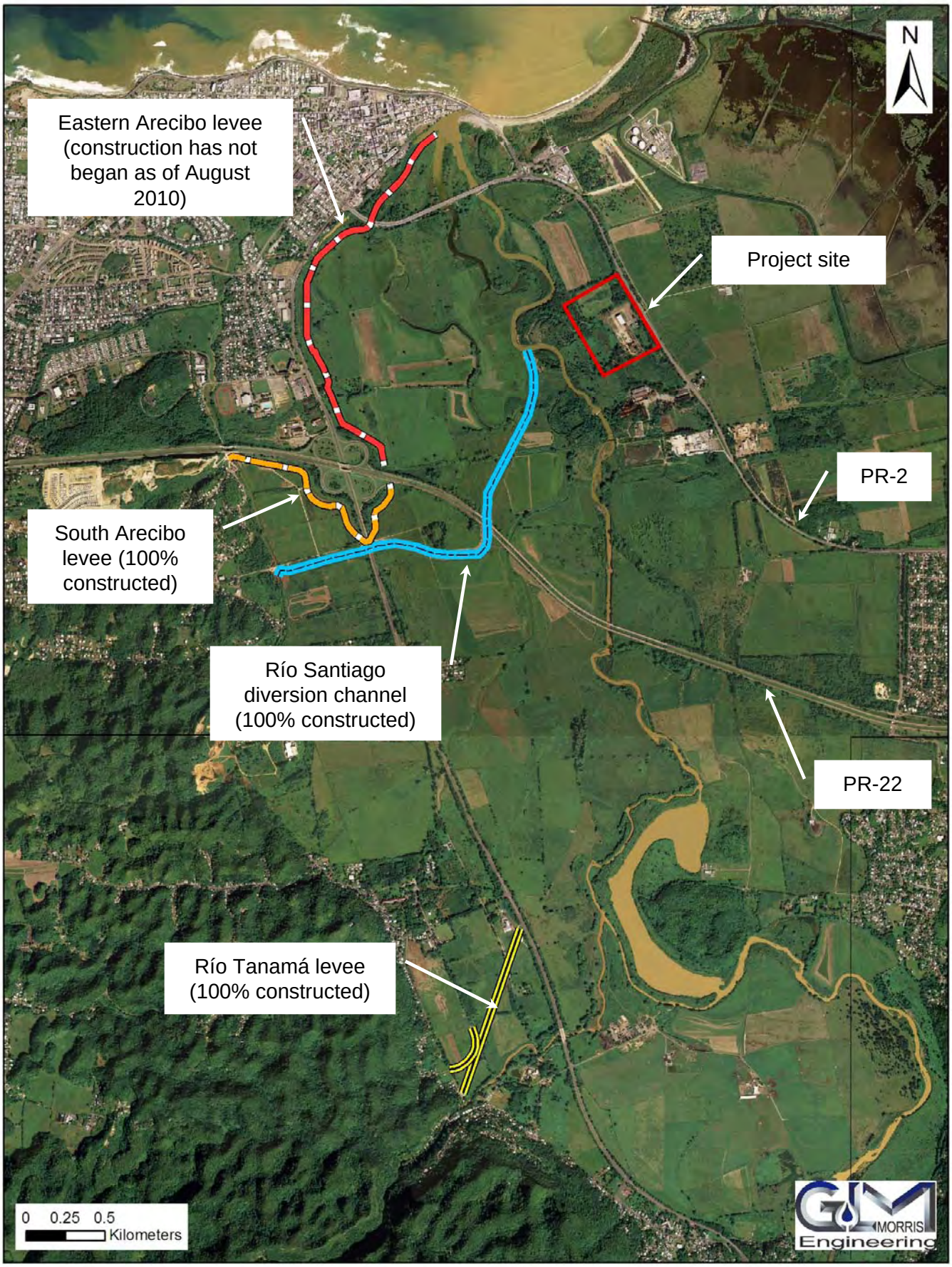


Figure 7: Army Corps of Engineers Río Grande de Arecibo Flood Control Project

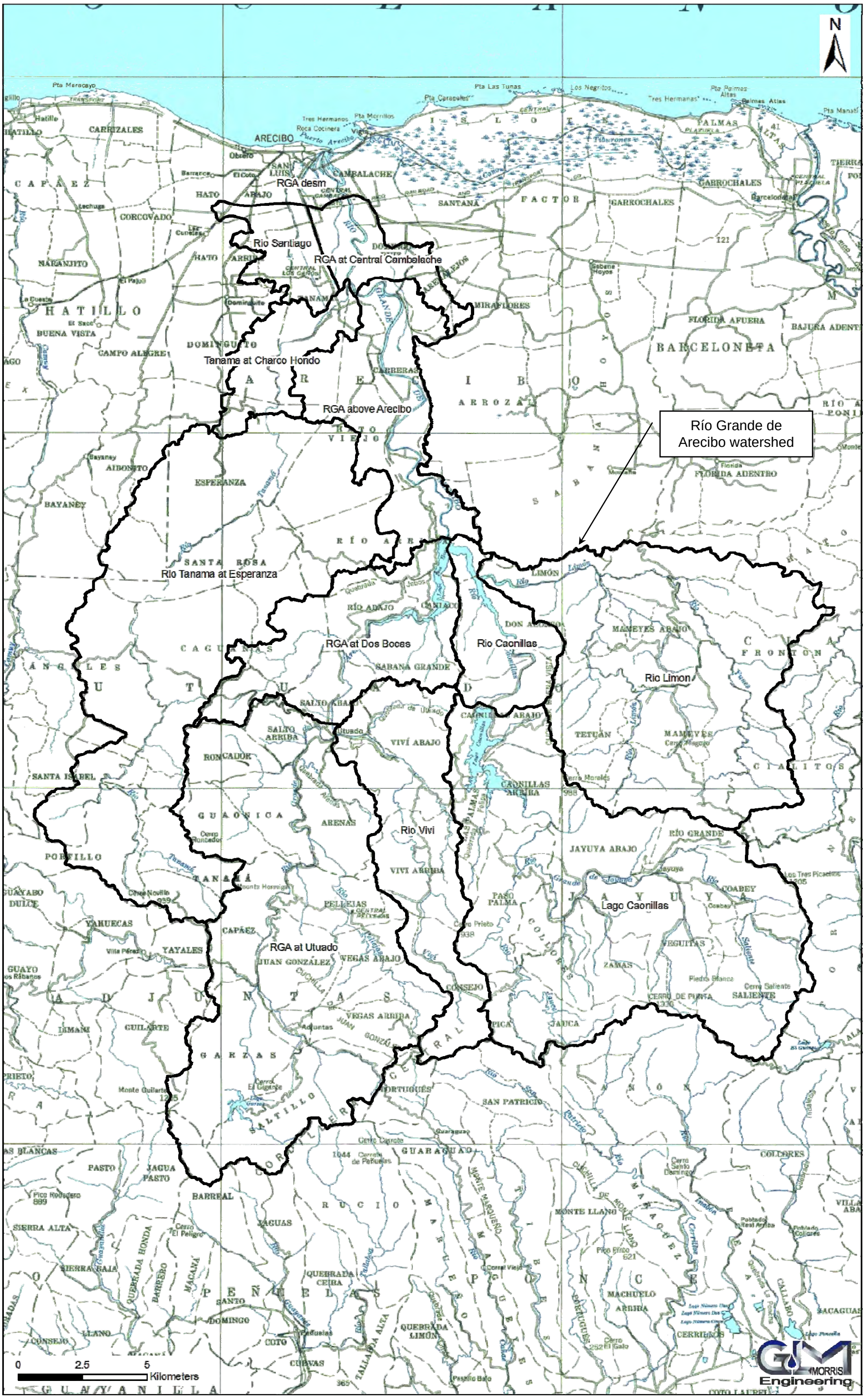


Figure 8: Analyzed Watershed Limits.

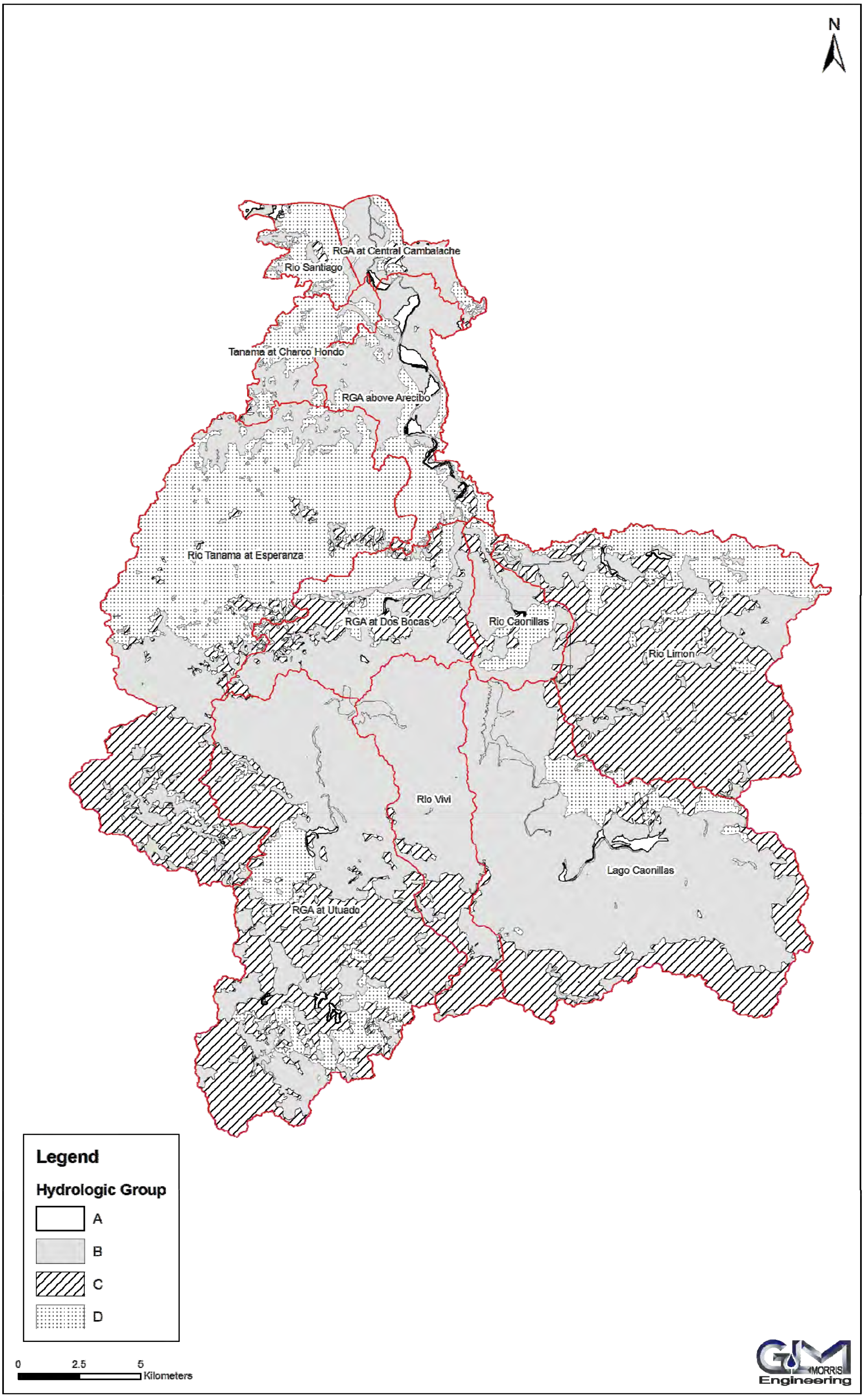


Figure 9: Hydrologic Soil Groups Found within Analyzed Watersheds.

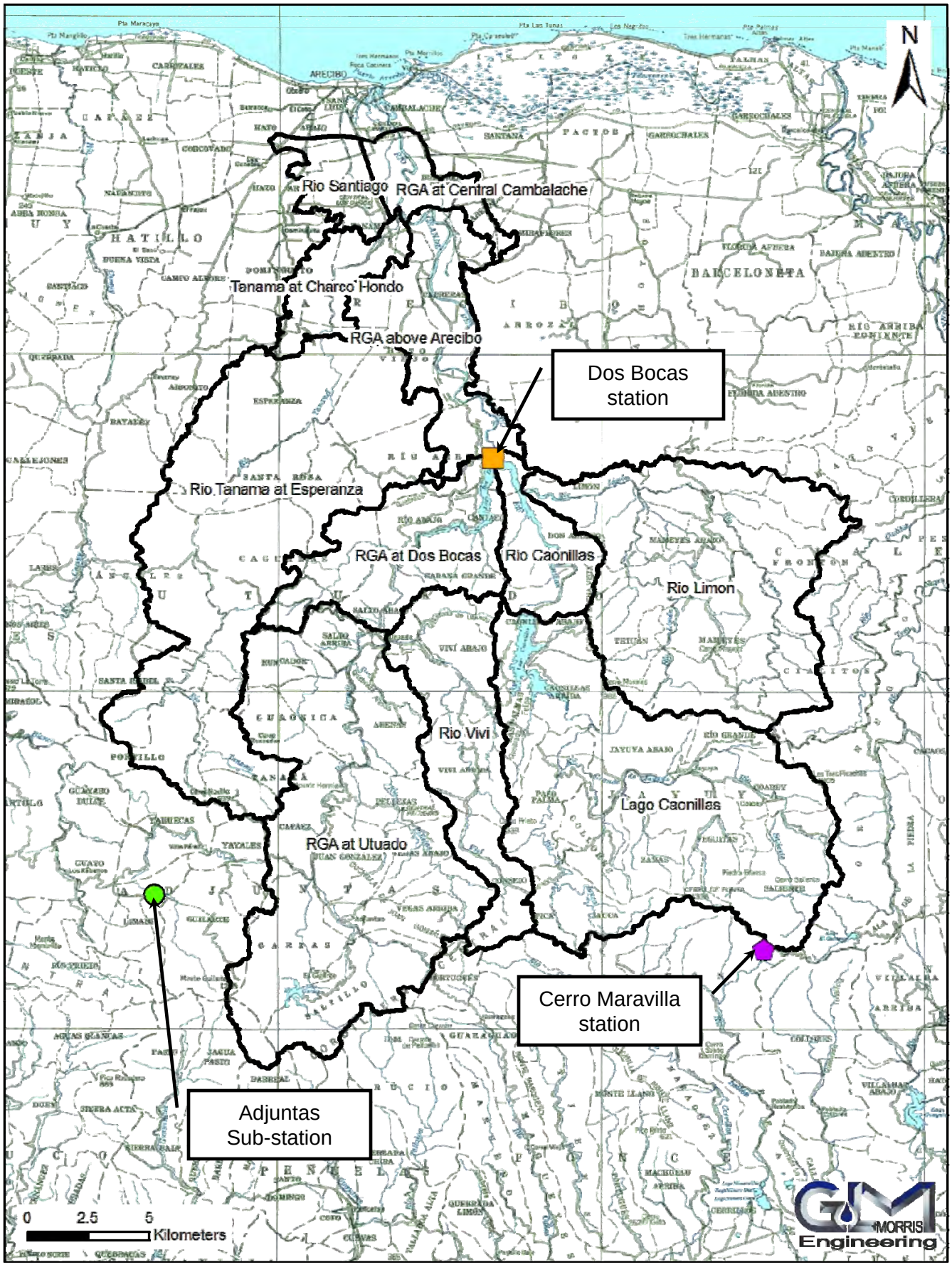


Figure 10: Location of the Three Stations with 15-minute Records for the Hurricane Georges Event.

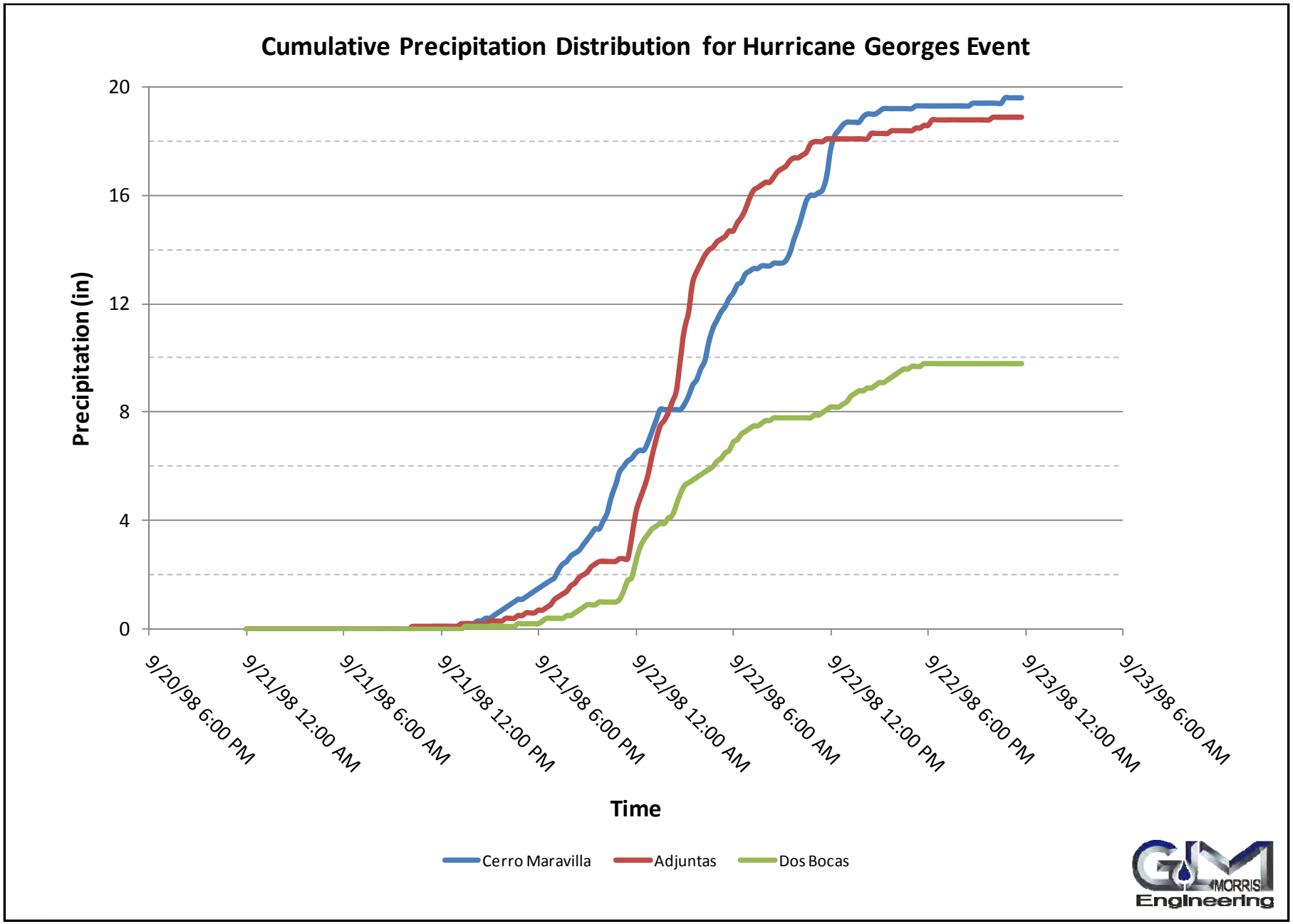


Figure 11: Cumulative Rainfall for the Three Stations with 15-minute Records for the Hurricane Georges Event

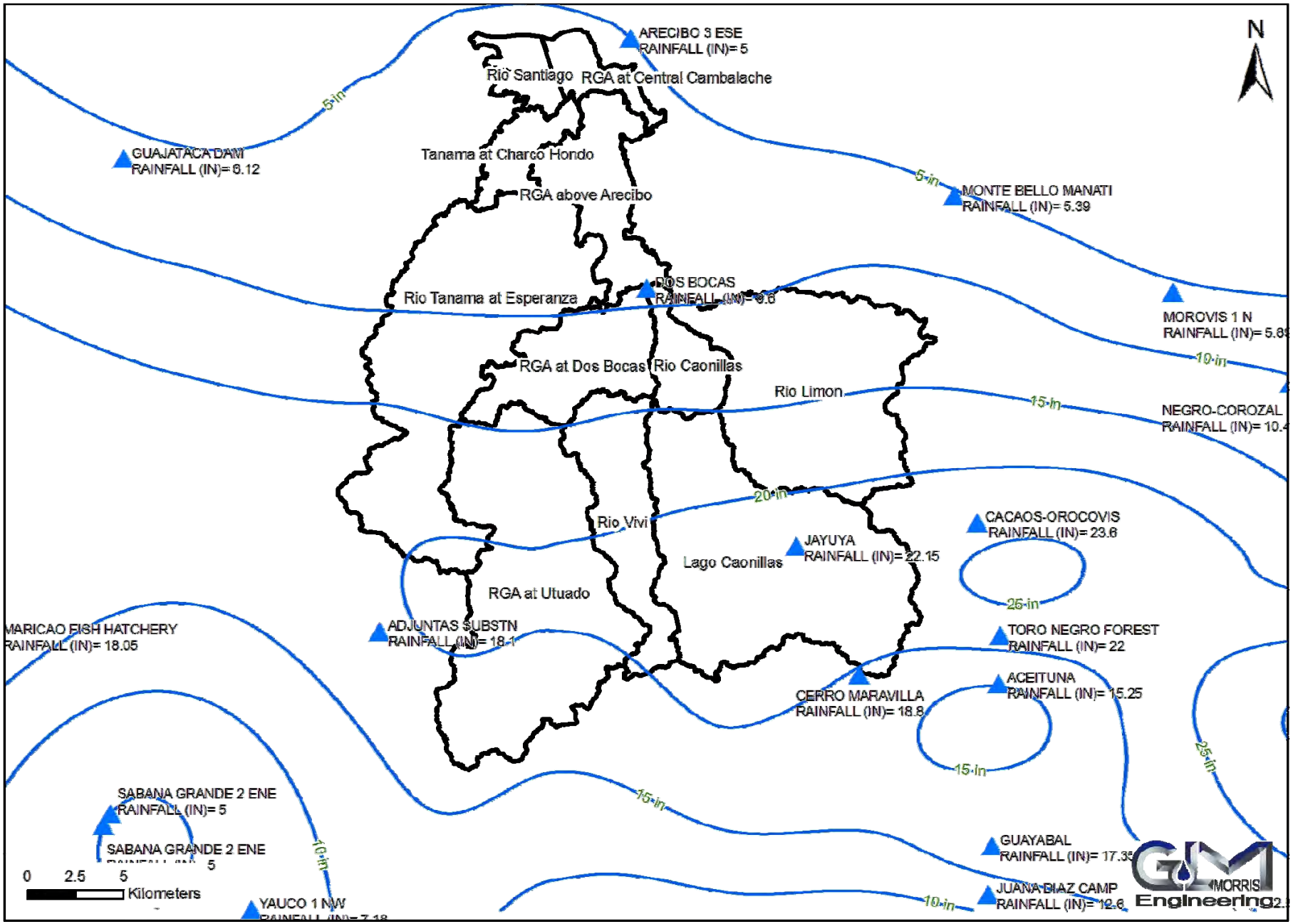


Figure 12: Hurricane Georges 24-hour Rainfall Isohyetal Map and Location of Rainfall Stations.

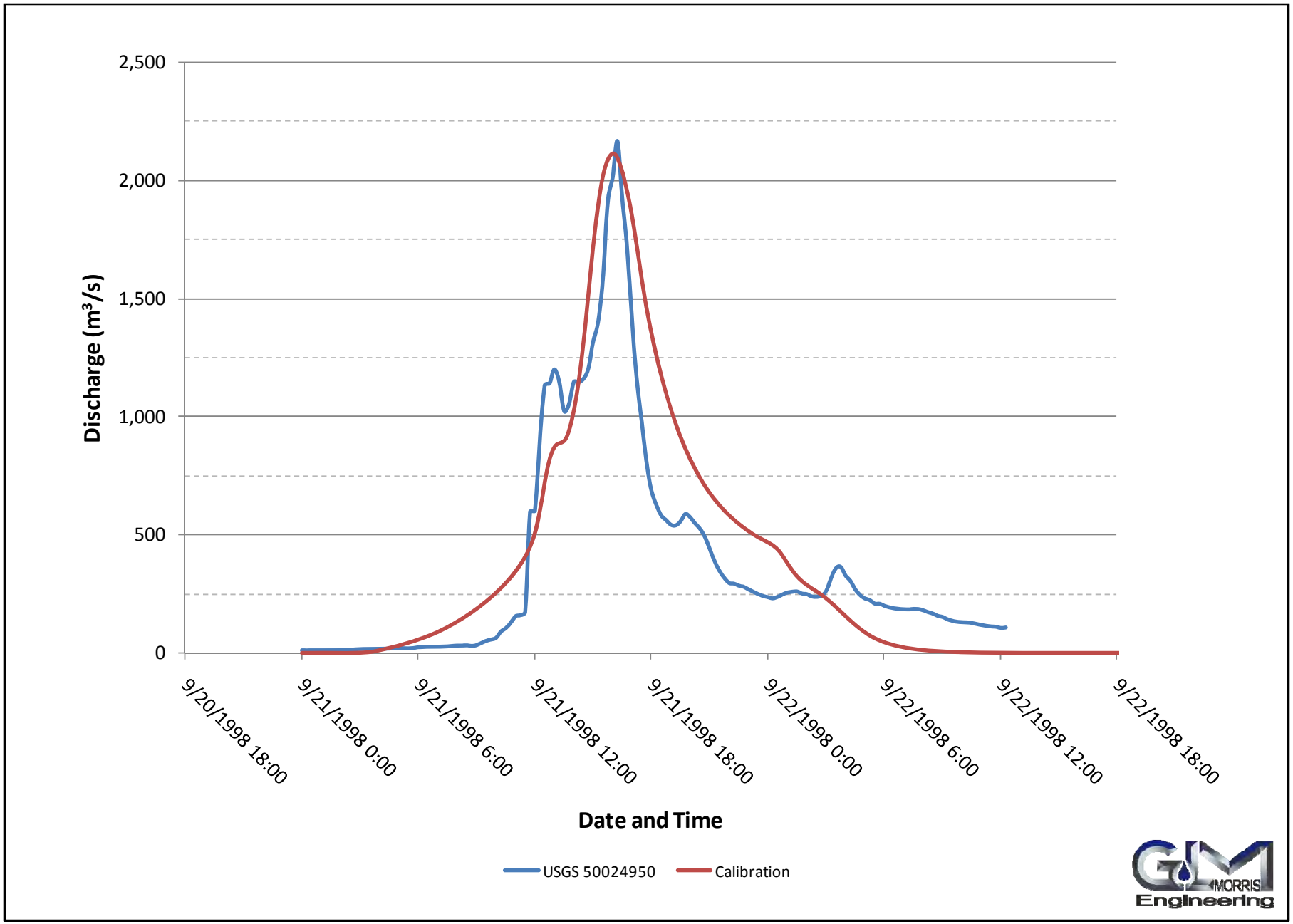


Figure 13: Comparison of Observed and Simulated Hydrographs at USGS Gage Sstation 50024950, Río Grande de Arecibo below Utuado

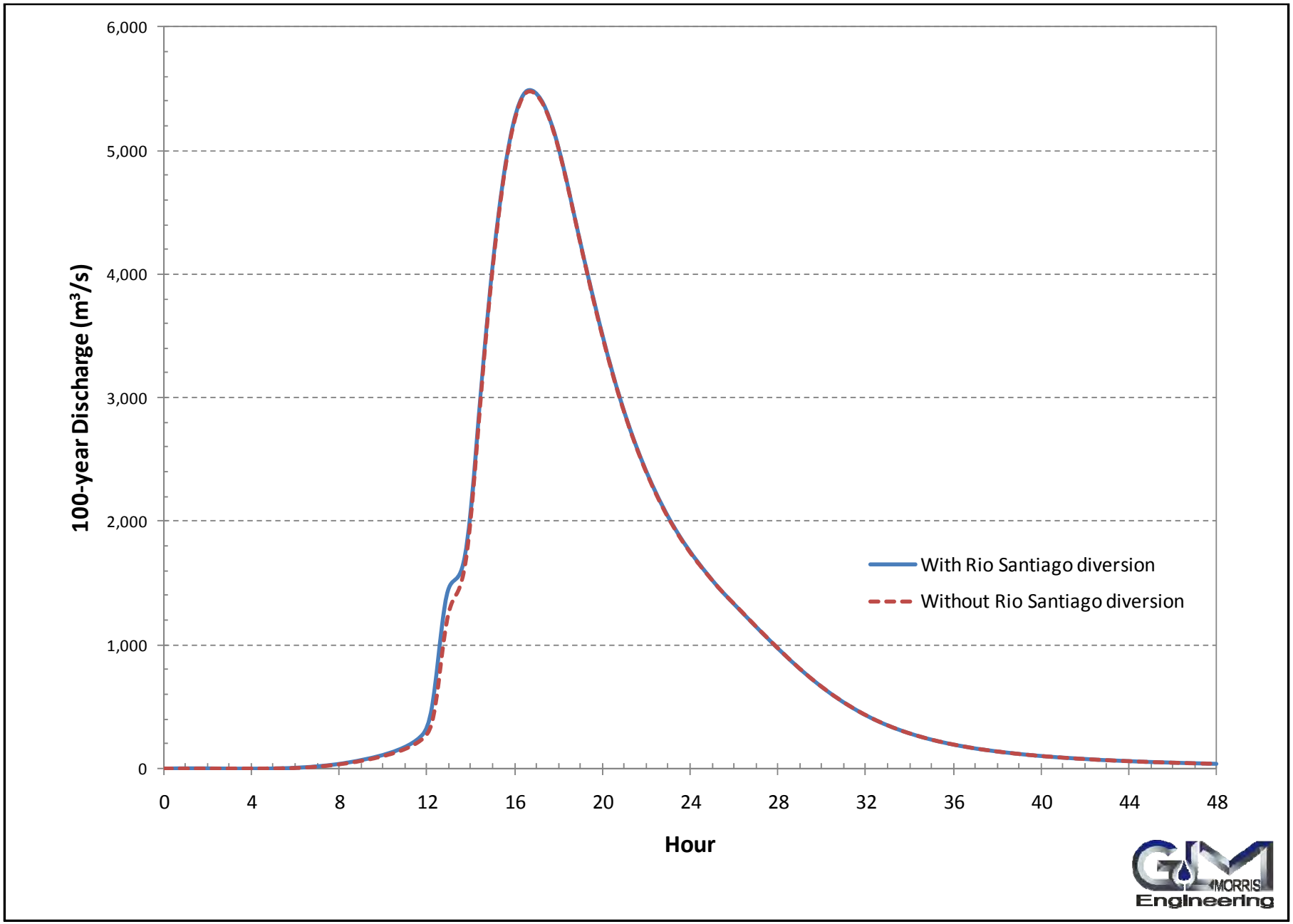


Figure 14: Flood Hydrographs at Río Grande de Arecibo before and after Río Santiago Diversion

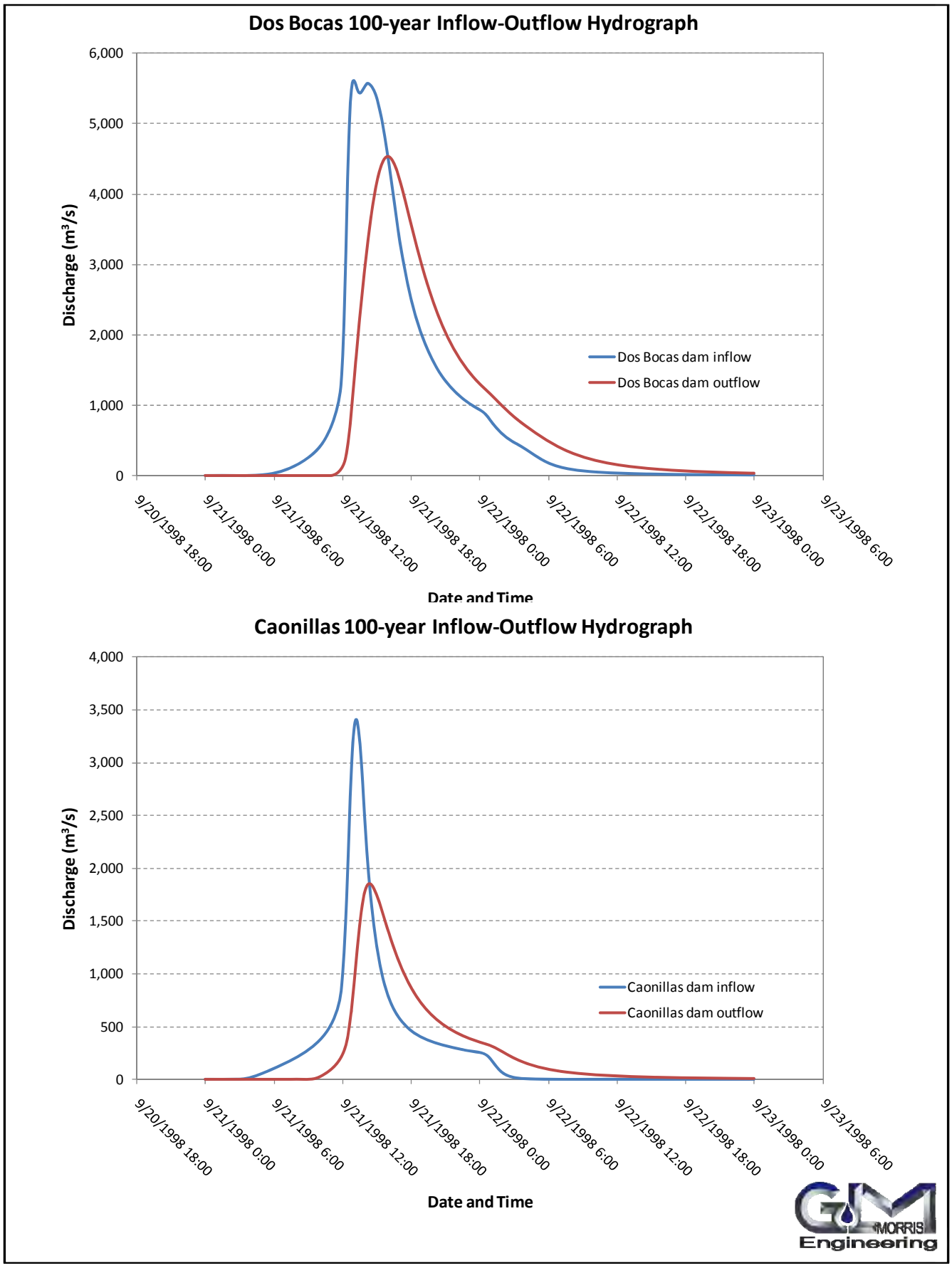


Figure 15: Hydrograph Attenuation at Lago Dos Bocas and Lago Caonillas for 100-year Event

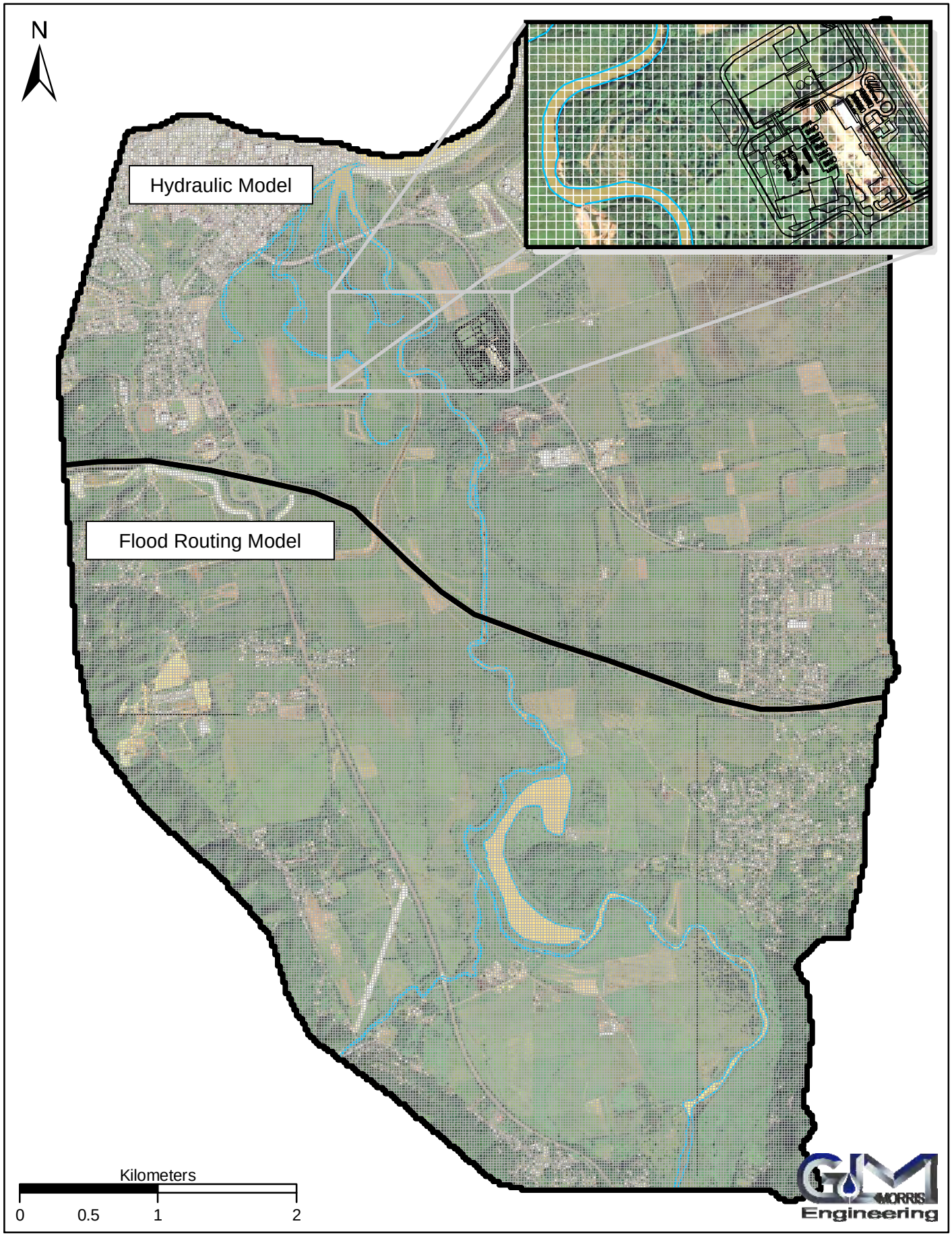


Figure 16: Layout and Extent of 2-D grid for Rio Grande de Arecibo.

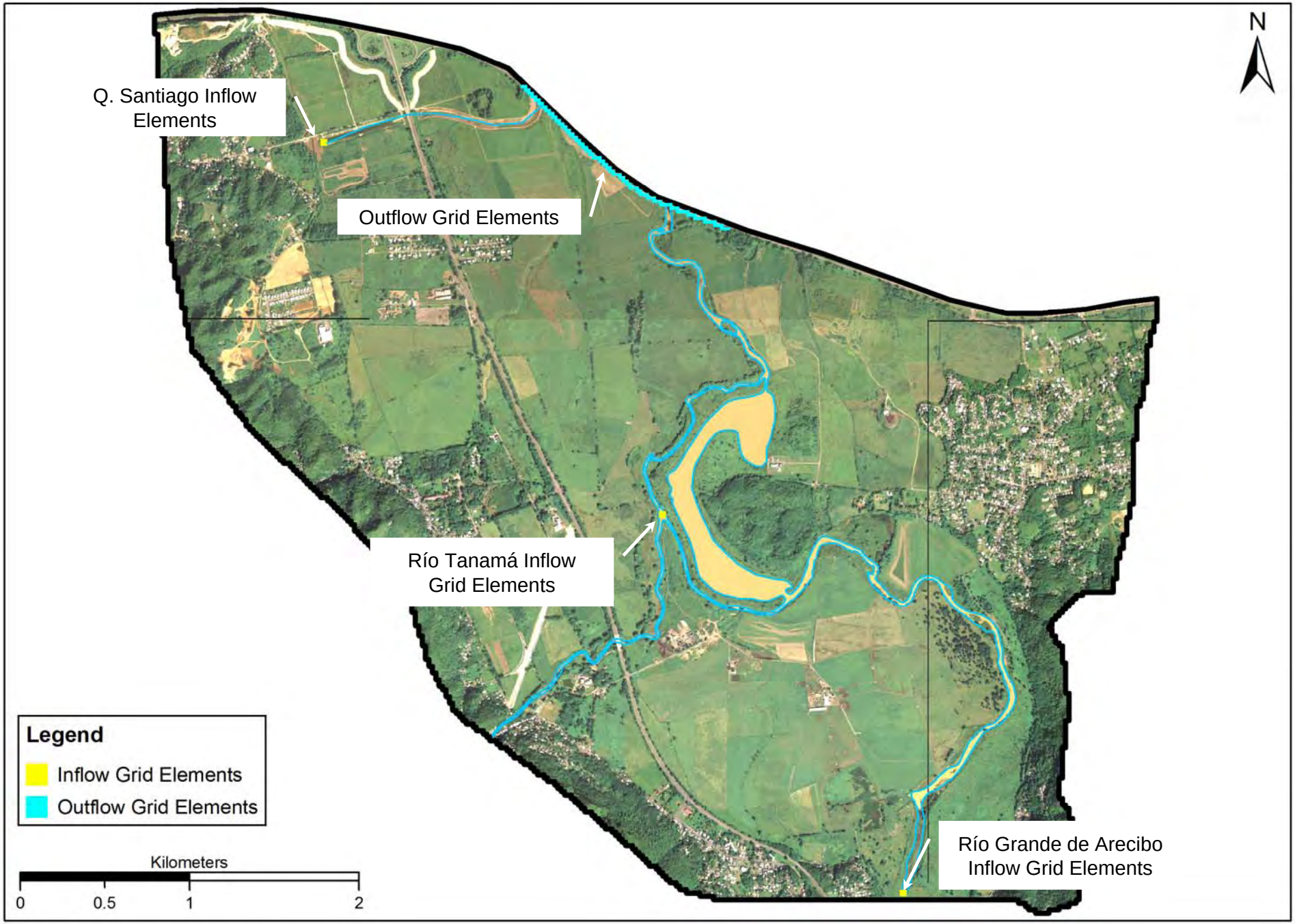


Figure 17: Layout and Extend of Hydrograph Routing Model

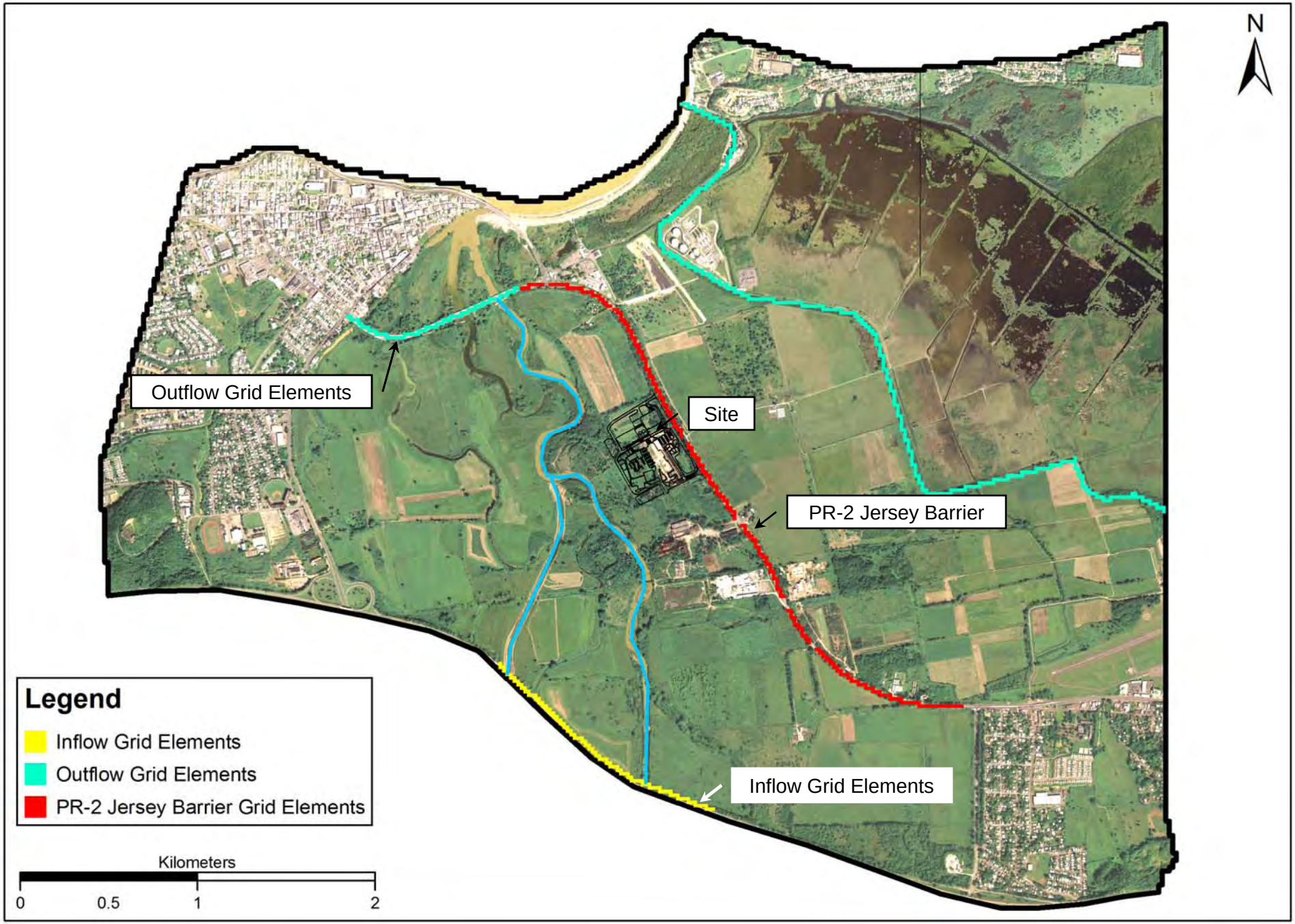


Figure 18: Layout and Extent of Duplicate Effective/Exisitng Condition Model.

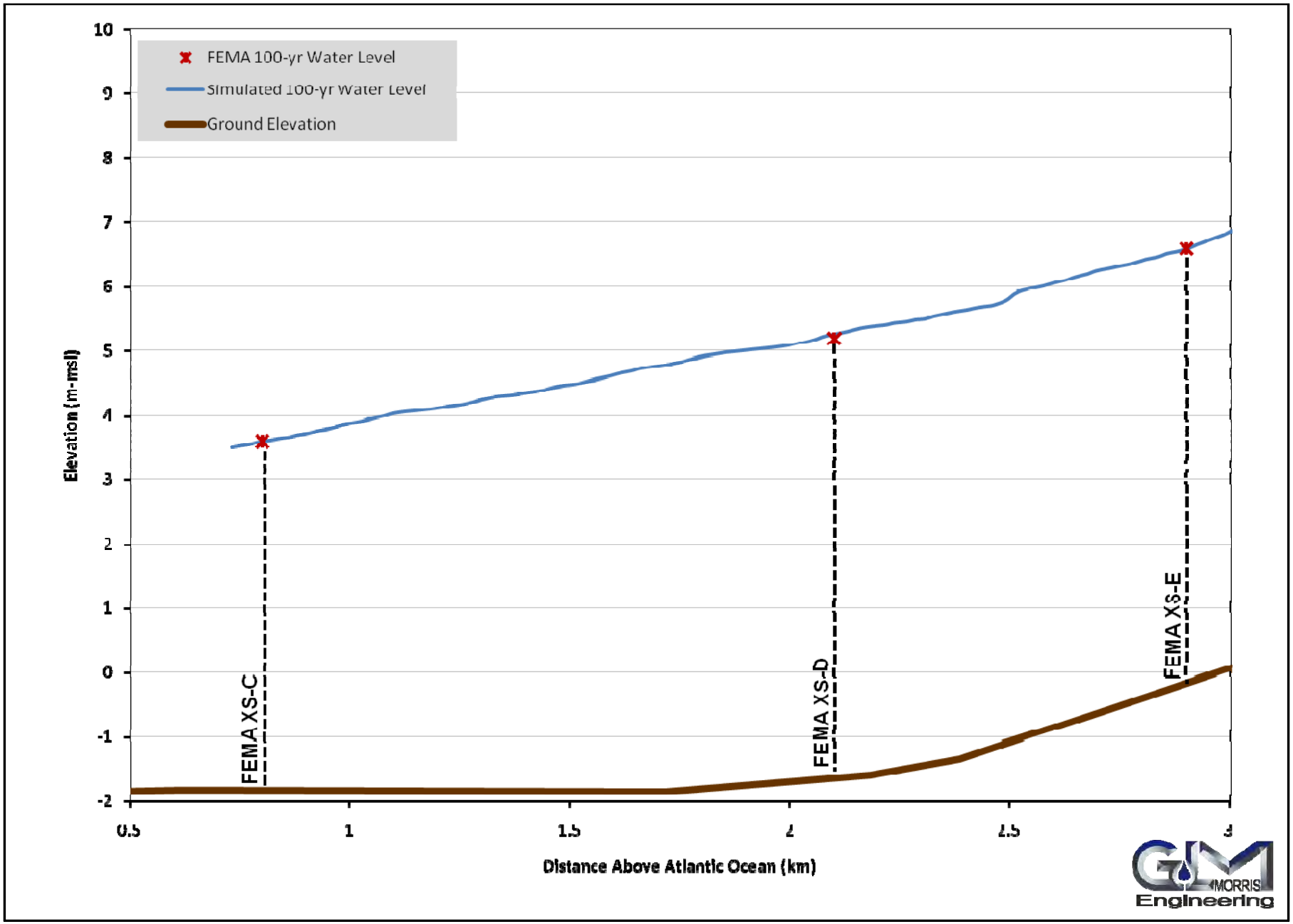


Figure 19: Comparison of FEMA and Duplicate Effective/Existing Condition 100-year Flood Profile.

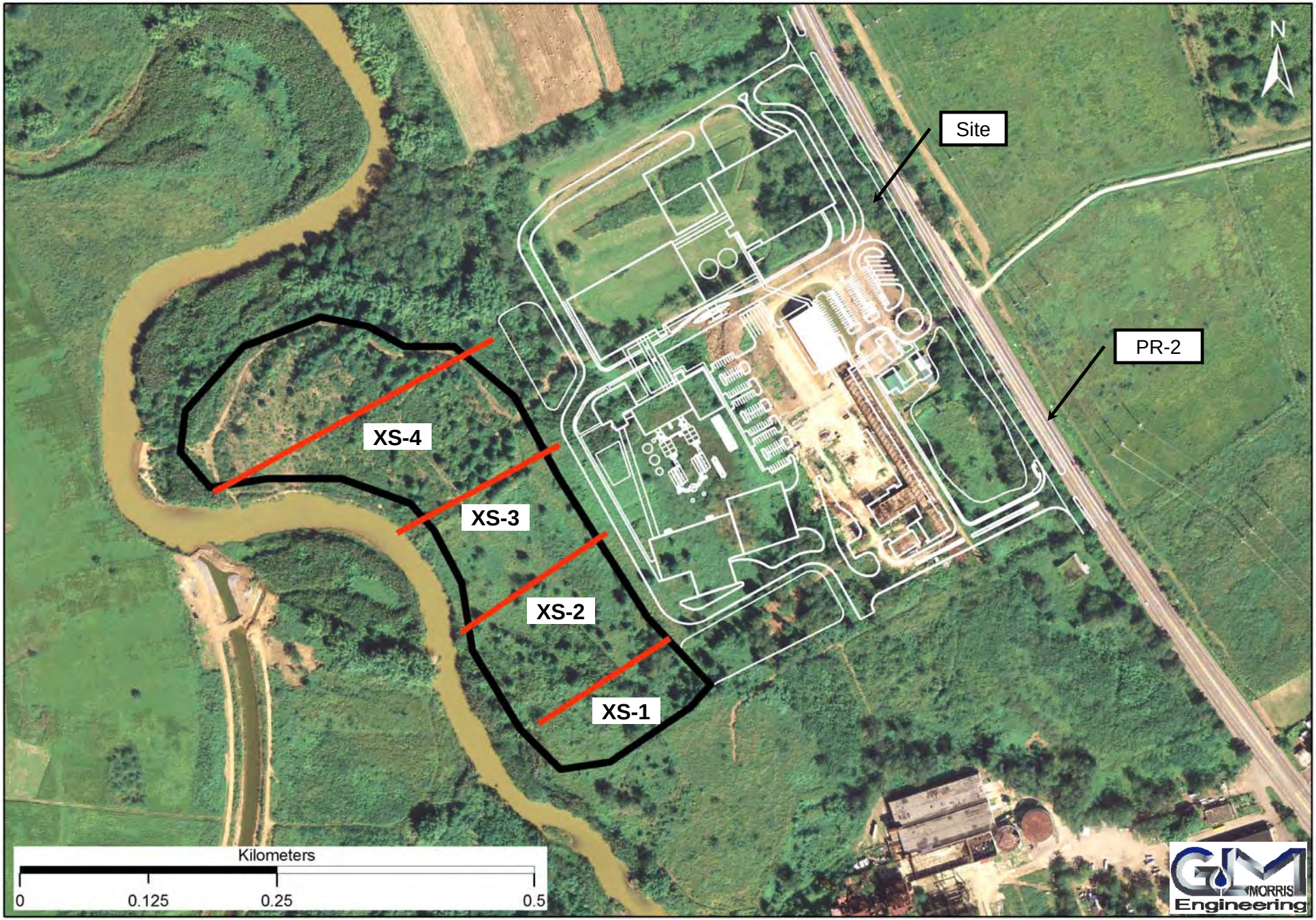


Figure 20: Location of Bank Modification Area.

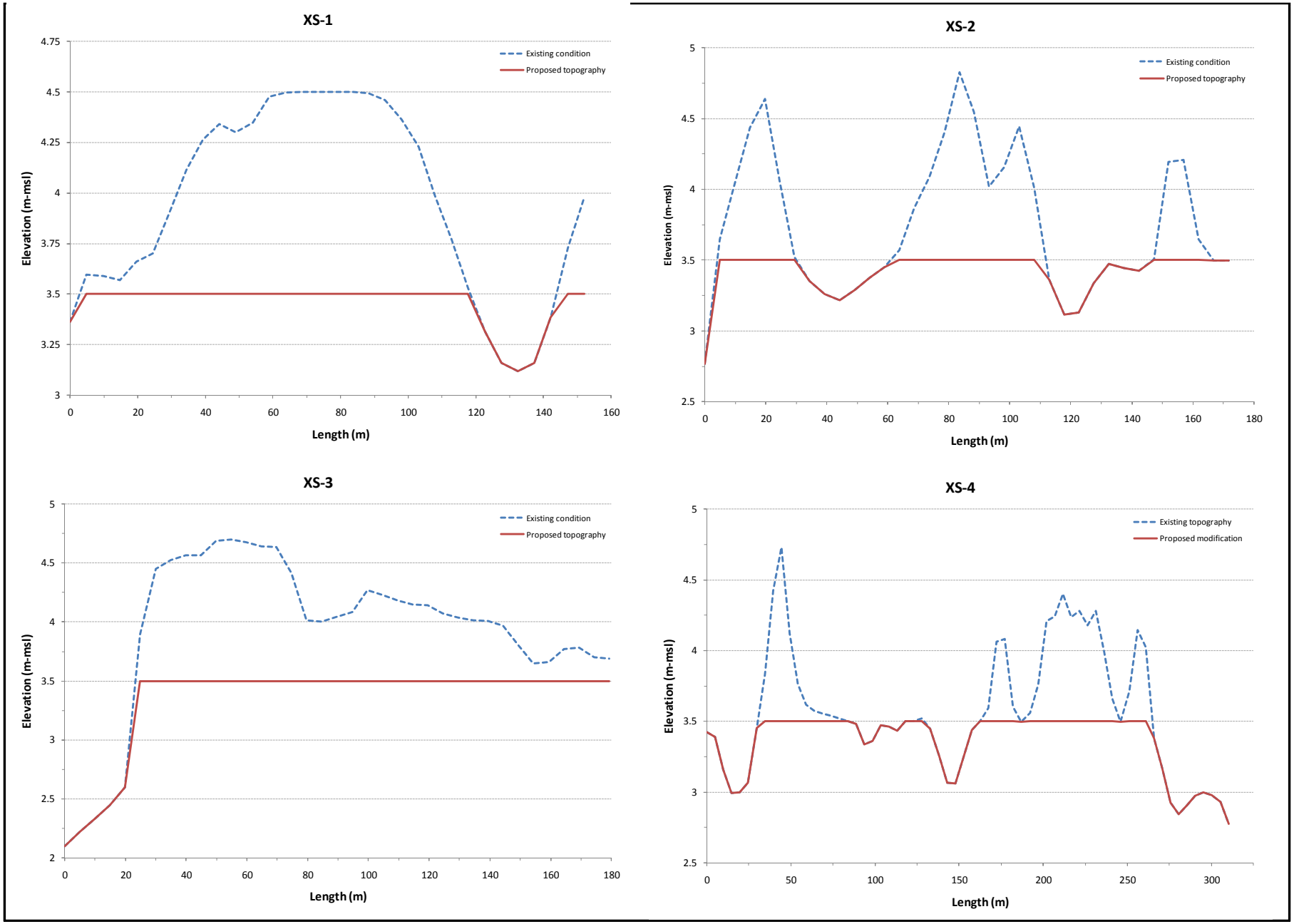


Figure 21: Proposed Geometry of Bank Modification Area

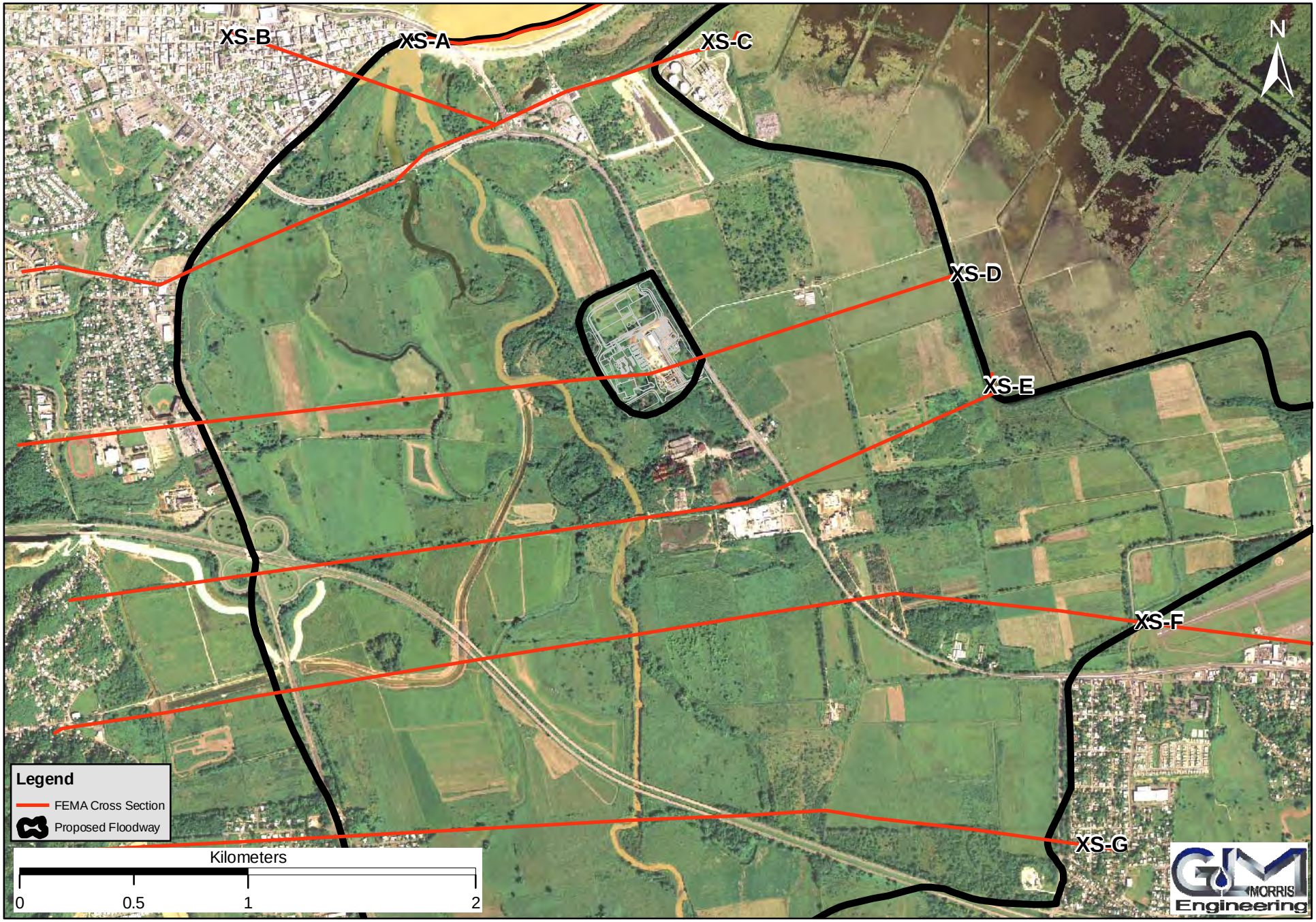


Figure 22: Proposed 100-year Floodway Limits.

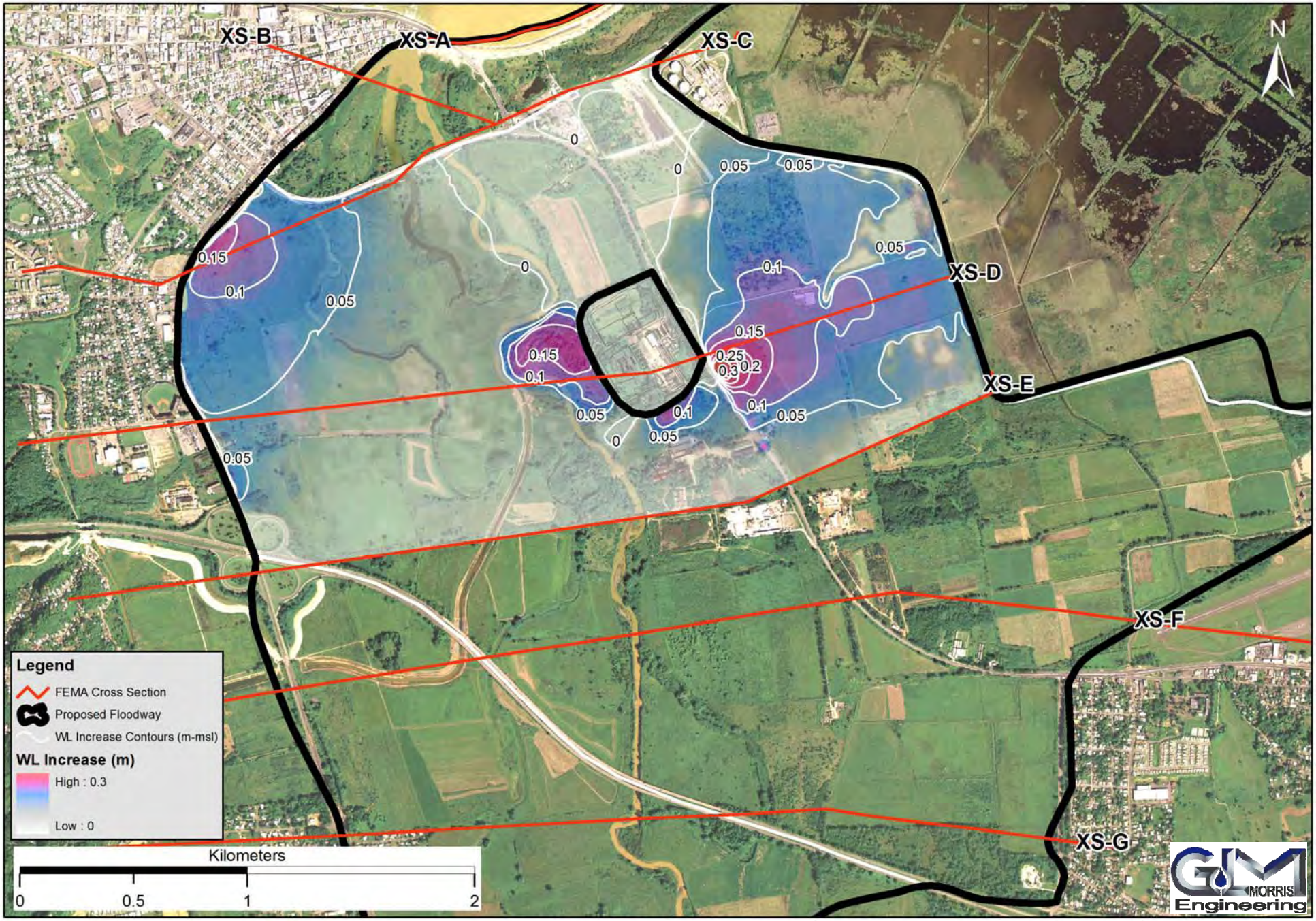


Figure 23: 100-year Water Surface Elevation Differences Attributable to Encroachment.

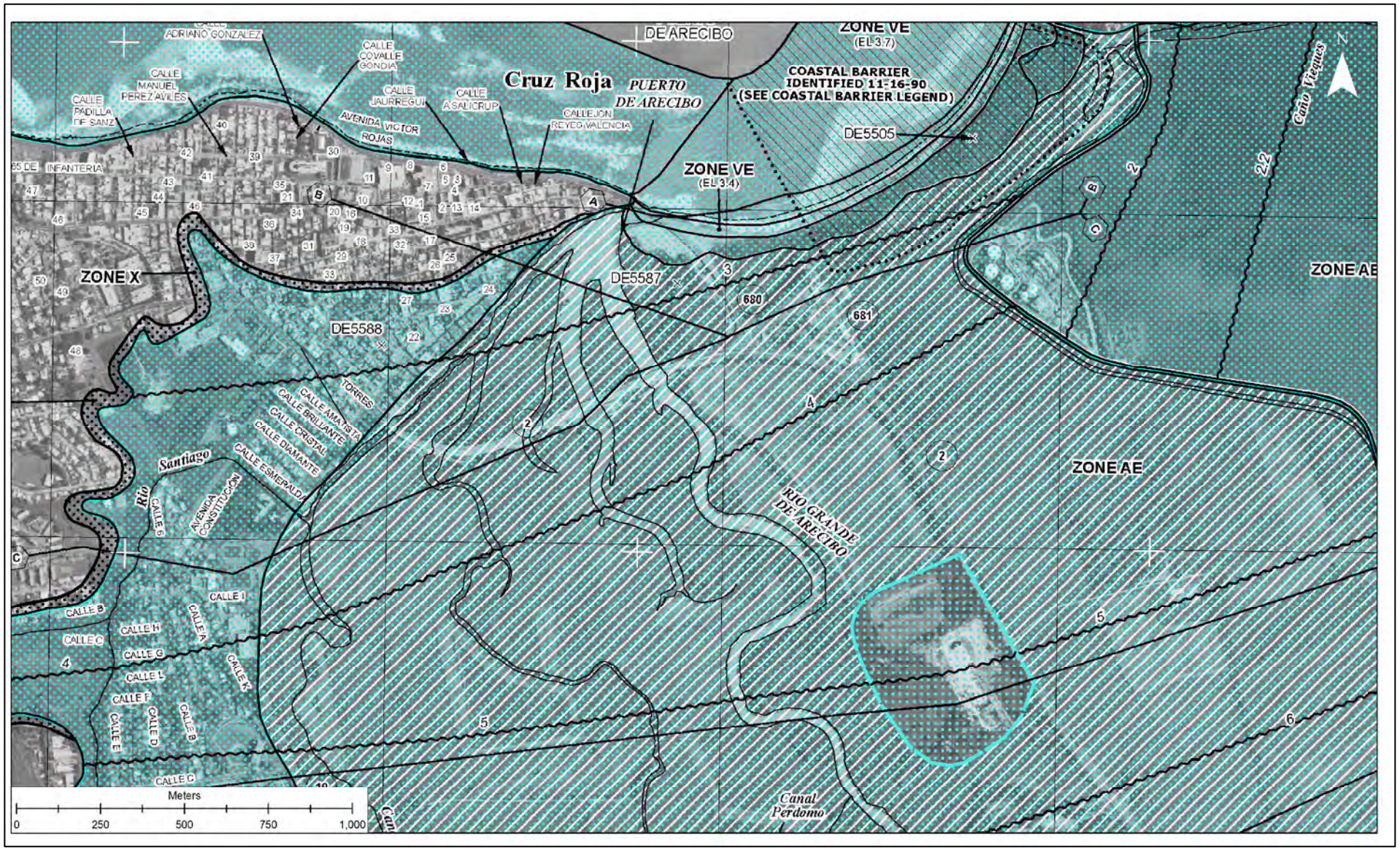


Figure 24: Annotated FIRM panel 230

Puerto Rico

HYDROLOGIC-HYDRAULIC STUDY
RÍO GRANDE DE ARECIBO,
RENEWABLE POWER GENERATION AND
RESOURCE RECOVERY FACILITY,
ARECIBO, PUERTO RICO

Appendix A:

Partial Reproduction of FEMA FIS of
Río Grande de Arecibo

GLM MORRIS ENGINEERING

FLOOD INSURANCE STUDY

VOLUME 1 OF 5

COMMONWEALTH OF PUERTO RICO AND MUNICIPALITIES

COMMUNITY NAME	COMMUNITY NUMBER
COMMONWEALTH OF PUERTO RICO	720000
MUNICIPALITY OF BAYAMÓN	720100
MUNICIPALITY OF PONCE	720101

REVISED:
NOVEMBER 18, 2009

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
72000CV001B

Discharges for lower Río Grande de Manati were developed using statistical analysis of stream gage data and discharge transfer equations. Annual peak flow data available for USGS stream gages at Ciales and at PR Highway 2 were used in the hydrologic analysis. Station skew gages at Ciales and at PR Highway 2 were used in the hydrologic analysis. Station skew was used in computing the peak flow discharges at the stream gage locations. Downstream of PR Highway 2, Río Grande de Manati splits and flows into Cano Tiburones in the west and through an unnamed flow path to the east. Split flow discharges were computed in the hydraulic analysis.

Peak flow discharge computations were developed for the lower reach of Río Grande de Manati for the 10-, 2-, 1-, and 0.2-percent annual chance events using statistical analysis of stream gage data and discharge transfer equations. Peak flow discharges and the hydrologic analysis were presented in the Rio Grande de Manati Hydrology Report dated April 2006 (Dewberry, 2006). Rio Grande de Manati splits and flows into Caño Tiburones in the west and an unnamed flow path in the east. Flows for the lower section Rio Grande de Manti from PR Highway 2 were calculated using the optimized split model.

A summary of the drainage area-peak discharge relationships for all of the streams studied by detailed methods is shown in Table 4, "Summary of Discharges."

TABLE 4 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. kilometers)	PEAK DISCHARGES (cms) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
RÍO CAMUY					
At PR Highway 2	88.1[1]	263	318	366	515
RÍO GRANDE DE ARECIBO					
At confluence of Río Tanama	487	2,890	4,550	5,680	8,640
Downstream of Dos Bocas Dam	415	2,520	4,050	4,930	7,650
CAÑO TIBURONES					
At mouth	46	84	144	189	322
RÍO CIBUCO					
Approximately 6.9 kilometers above mouth	240	750	1,187	1,469	2,170
RÍO INDIO					
At mouth	95.9	272	453	636	907

[1]Represents an approximate drainage area

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (METERS MSL)			
CROSS SECTION	DISTANCE[1]	WIDTH (METERS)	SECTION AREA (SQUARE METERS)	MEAN VELOCITY (METERS PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Rio Grande de Arecibo								
B	0.4	1,402	910	1.5	2.7	2.7	2.7	0.0
C	0.8	2,225	2,230	0.6	3.6	3.6	3.6	0.0
D	2.1	3,414	7,525	0.5	5.2	5.2	5.2	0.0
E	2.9	3,383	7,050	0.6	6.6	6.6	6.6	0.0
F	3.4	3,871	7,710	0.4	7.1	7.1	7.4	0.3
G	4.2	3,109	7,155	0.6	7.8	7.8	8.1	0.3
H	5.1	1,859	5,295	0.9	9.1	9.1	9.4	0.3
I	6.5	1,402	7,245	0.6	11.5	11.5	11.8	0.3
J	6.9	1,372	4,180	1.1	12.8	12.8	13.1	0.3
K	7.4	1,493	5,390	0.9	14.1	14.1	14.5	0.3
L	8.9	2,286	7,710	0.6	15.5	15.5	15.7	0.2
M	9.9	2,103	5,015	0.9	16.6	16.6	16.6	0.1
N	10.7	1,707	5,945	0.8	17.7	17.7	17.7	0.0
O	11.2	671	2,975	1.6	18.6	18.6	18.6	0.0
P	11.9	701	3,500	1.3	20.6	20.6	20.6	0.0
Q	12.6	914	3,380	1.4	22.3	22.3	22.3	0.0
R	13.4	823	4,090	1.2	23.8	23.8	23.8	0.0
S	13.9	823	3,605	1.3	24.7	24.7	24.7	0.0
T	14.9	884	4,200	1.2	26.6	26.6	26.6	0.0
U	16.5	1,158	4,645	1.1	29.6	29.6	29.6	0.0

[1]Kilometers above confluence with Atlantic Ocean

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

COMMONWEALTH OF PUERTO RICO AND MUNICIPALITIES

FLOODWAY DATA

RIO GRANDE DE ARECIBO

Puerto Rico

HYDROLOGIC-HYDRAULIC STUDY
RÍO GRANDE DE ARECIBO,
RENEWABLE POWER GENERATION AND
RESOURCE RECOVERY FACILITY,
ARECIBO, PUERTO RICO

Appendix B:

Time of Concentration Calculations

GLM MORRIS ENGINEERING

Time of Concentration: Lago Caonillas

Segment	Length (m)	U/S Elev (m)	D/S Elev (m)	Slope	2-yr Precip (in)	n-value	Paved? (Y or N)	Avg. Flow Depth (m)	Vel (m/s)	Froude No	Tc (min)	Tc (hrs)
1 Sheet Flow (L<300 ft)	91	1190	1155	0.385	7.71	0.400	---	---	0.15	---	10.17	0.17
2 Shallow Conc. Flow	3787	1155	770	0.102	---	---	N	---	1.6	---	40.55	
3 Channel Flow (Manning)	1726	770	620	0.087	---	0.110	---	1.0	2.7	0.86	10.73	0.18
4 Channel Flow (Manning)	1820	620	560	0.033	---	0.090	---	2.0	3.2	0.72	9.47	0.16
5 Channel Flow (Manning)	16927	560	310	0.015	---	0.070	---	3.0	3.6	0.67	78.12	1.30
6 Channel Flow (Manning)	3933	310	257	0.013	---	0.050	---	4.0	5.9	0.93	11.20	0.19
7 Wave Celerity	5416			---	---	---	---	5.0	7.0	---	12.90	0.21
Total Distance	33,700								**Total Time of Conc.**		**173.1**	**2.21**

Time of Concentration: Tanama at Esperanza

Segment	Length (m)	U/S Elev (m)	D/S Elev (m)	Slope	2-yr Precip (in)	n-value	Paved? (Y or N)	Avg. Flow Depth (m)	Vel (m/s)	Froude No	Tc (min)	Tc (hrs)
1 Sheet Flow (L<300 ft)	91	860	825	0.385	7.04	0.400	---	---	0.14	---	10.64	0.18
2 Shallow Conc. Flow	2223	825	630	0.088	---	---	N	---	1.4	---	25.62	
3 Channel Flow (Manning)	3017	630	560	0.023	---	0.080	---	1.0	1.9	0.61	26.41	0.44
4 Channel Flow (Manning)	4144	560	460	0.024	---	0.080	---	1.5	2.5	0.66	27.14	0.45
5 Channel Flow (Manning)	8258	460	300	0.019	---	0.080	---	2.0	2.8	0.62	49.83	0.83
5 Channel Flow (Manning)	3091	300	260	0.013	---	0.065	---	2.5	3.2	0.65	15.98	0.27
5 Channel Flow (Manning)	1513	260	254	0.004	---	0.040	---	3.5	3.6	0.62	6.95	0.12
6 Channel Flow (Manning)	11373	254	118	0.012	---	0.060	---	4.0	4.6	0.73	41.27	0.69
7 Wave Celerity				---	---	---	---	7.0	8.3	---		
Total Distance	33,710								**Total Time of Conc.**		**203.9**	**2.97**

Time of Concentration: Tanama @ Charco Hondo

Segment	Length (m)	U/S Elev (m)	D/S Elev (m)	Slope	2-yr Precip (in)	n-value	Paved? (Y or N)	Avg. Flow Depth (m)	Vel (m/s)	Froude No	Tc (min)	Tc (hrs)
1 Channel Flow (Manning)	5698	118	30	0.015	---	0.070	---	3.0	3.7	0.68	25.72	0.43
2 Channel Flow (Manning)	2854	30	10.5	0.007	---	0.050	---	4.0	4.2	0.67	11.42	0.19
3 Channel Flow (Manning)		10.5	120		---	0.055	---	2.5				
4 Channel Flow (Manning)		120			---	0.146	---					
5 Wave Celerity				---	---	---	---	7.0	8.3	---		
Total Distance	8,552								**Total Time of Conc.**		**37.1**	**0.62**

Time of Concentration: Rio Vivi

Segment	Length (m)	U/S Elev (m)	D/S Elev (m)	Slope	2-yr Precip (in)	n-value	Paved? (Y or N)	Avg. Flow Depth (m)	Vel (m/s)	Froude No	Tc (min)	Tc (hrs)
1 Sheet Flow (L<300 ft)	91	860	830	0.330	5	0.400	---	---	0.11	---	13.43	0.22
2 Shallow Conc. Flow	2509	830	620	0.084	---	---	N	---	1.4	---	29.61	
2 Shallow Conc. Flow	1641	620	580	0.024	---	---	N	---	0.8	---	35.88	
3 Channel Flow (Manning)	3648	580	500	0.022	---	0.080	---	1.5	2.4	0.63	25.07	0.42
4 Channel Flow (Manning)	3232	500	390	0.034	---	0.090	---	2.0	3.3	0.73	16.55	0.28
5 Channel Flow (Manning)	3340	390	270	0.036	---	0.090	---	2.5	3.9	0.78	14.35	0.24
6 Channel Flow (Manning)	7867	270	130	0.018	---	0.080	---	3.0	3.5	0.64	37.80	0.63
7 Wave Celerity				---	---	---	---	7.0	8.3	---		
Total Distance	22,328								**Total Time of Conc.**		**172.7**	**1.79**

Time of Concentration: Rio Limon

	Segment	Length (m)	U/S Elev (m)	D/S Elev (m)	Slope	2-yr Precip (in)	n-value	Paved? (Y or N)	Avg. Flow Depth (m)	Vel (m/s)	Froude No	Tc (min)	Tc (hrs)
1	Sheet Flow (L<300 ft)	91	855	815	0.440	6.89	0.400	---	---	0.15	---	10.20	0.17
2	Shallow Conc. Flow	2990	815	550	0.089	---	---	N	---	1.5	---	34.29	
3	Channel Flow (Manning)	5022	550	340	0.042	---	0.100	---	1.0	2.0	0.65	40.93	0.68
4	Channel Flow (Manning)	7612	340	150	0.025	---	0.080	---	2.0	3.1	0.71	40.47	0.67
5	Channel Flow (Manning)	7330	150	94	0.008	---	0.050	---	3.0	3.6	0.67	33.60	0.56
6	Channel Flow (Manning)		94			---	0.146	---					
7	Wave Celerity	2710			---	---	---	---	4.0	6.3	---	7.21	0.12
	Total Distance	25,755								**Total Time of Conc.**		**166.7**	**2.21**

Time of Concentration: Rio Caonillas

Segment	Length (m)	U/S Elev (m)	D/S Elev (m)	Slope	2-yr Precip (in)	n-value	Paved? (Y or N)	Avg. Flow Depth (m)	Vel (m/s)	Froude No	Tc (min)	Tc (hrs)
1 Sheet Flow (L<300 ft)	91	600	570	0.330	6.41	0.400	---	---	0.13	---	11.86	0.20
2 Shallow Conc. Flow	1015	570	185	0.379	---	---	N	---	3.0	---	5.63	
3 Channel Flow (Manning)	4089	185	98	0.021	---	0.080	---	2.0	2.9	0.65	23.55	0.39
4 Channel Flow (Manning)		98	150		---	0.090	---	2.0				
5 Channel Flow (Manning)		150	120		---	0.055	---	2.5				
6 Channel Flow (Manning)		120			---	0.146	---					
7 Wave Celerity	5589			---	---	---	---	4.0	6.3	---	14.88	0.25
Total Distance	10,784								**Total Time of Conc.**		**55.9**	**0.84**

Time of Concentration: RGA at Central Cambalache

Segment	Length (m)	U/S Elev (m)	D/S Elev (m)	Slope	2-yr Precip (in)	n-value	Paved? (Y or N)	Avg. Flow Depth (m)	Vel (m/s)	Froude No	Tc (min)	Tc (hrs)
1 Sheet Flow (L<300 ft)	91	192	190	0.022	5.52	0.240	---	---	0.06	---	25.09	0.42
2 Shallow Conc. Flow	1834	190	65	0.068	---	---	N	---	1.3	---	23.98	0.40
2 Shallow Conc. Flow	3874	65	8	0.015	---	---	N	---	0.6	---	109.03	1.82
3 Channel Flow (Manning)	1929	8	3	0.003	---	0.035	---	3.0	3.0	0.56	10.63	0.18
Total Distance	7,728								**Total Time of Conc.**		**168.7**	**2.81**

Time of Concentration: RGA above Arecibo

Segment	Length (m)	U/S Elev (m)	D/S Elev (m)	Slope	2-yr Precip (in)	n-value	Paved? (Y or N)	Avg. Flow Depth (m)	Vel (m/s)	Froude No	Tc (min)	Tc (hrs)
1 Sheet Flow (L<300 ft)	91	385	295	0.989	6.49	0.400	---	---	0.20	---	7.60	0.13
2 Shallow Conc. Flow	832	295	46	0.299	---	---	N	---	2.7	---	5.19	
3 Channel Flow (Manning)	5975	46	16	0.005	---	0.040	---	2.5	3.3	0.66	30.52	0.51
4 Channel Flow (Manning)	10886	16	9	0.001	---	0.035	---	4.0	1.8	0.29	99.38	1.66
5 Channel Flow (Manning)		9	120		---	0.055	---	2.5				
6 Channel Flow (Manning)		120			---	0.146	---					
7 Wave Celerity				---	---	---	---	7.0	8.3	---		
Total Distance	17,784								**Total Time of Conc.**		**142.7**	**2.29**

Time of Concentration: RGA @ Utuado (including Garza wshed)

Segment	Length (m)	U/S Elev (m)	D/S Elev (m)	Slope	2-yr Precip (in)	n-value	Paved? (Y or N)	Avg. Flow Depth (m)	Vel (m/s)	Froude No	Tc (min)	Tc (hrs)
1 Sheet Flow (L<300 ft)	91	980	940	0.440	7.78	0.400	---	---	0.16	---	9.60	0.16
2 Shallow Conc. Flow	331	940	890	0.151	---	---	N	---	1.9	---	2.91	
3 Channel Flow (Manning)	1116	890	800	0.081	---	0.130	---	1.5	2.9	0.75	6.50	0.11
4 Channel Flow (Manning)	1987	800	740	0.030	---	0.090	---	1.8	2.8	0.68	11.81	0.20
5 Channel Flow (Manning)	2653	700	490	0.079	---	0.140	---	2.0	3.2	0.72	13.86	0.23
6 Channel Flow (Manning)	2119	490	450	0.019	---	0.075	---	2.3	3.1	0.67	11.23	0.19
3 Channel Flow (Manning)	1019	450	440	0.010	---	0.055	---	2.5	3.3	0.67	5.12	0.09
4 Channel Flow (Manning)	820	440	430	0.012	---	0.065	---	2.8	3.3	0.64	4.10	0.07
3 Channel Flow (Manning)	846	430	380	0.059	---	0.130	---	3.0	3.9	0.72	3.62	0.06
4 Channel Flow (Manning)	1888	370	270	0.053	---	0.130	---	3.3	3.9	0.69	8.10	0.14
5 Channel Flow (Manning)	2132	270	230	0.019	---	0.080	---	3.5	3.9	0.67	9.00	0.15
6 Channel Flow (Manning)	6439	230	150	0.012	---	0.065	---	3.8	4.1	0.68	25.93	0.43
6 Channel Flow (Manning)	3788	150	130	0.005	---	0.045	---	4.0	4.1	0.65	15.52	0.26
7 Wave Celerity	1258			---	---	---	---	2.0	4.4	---	4.74	0.08
7 Wave Celerity	833			---	---	---	---	2.0	4.4	---	3.14	0.05
Total Distance	27,320								**Total Time of Conc.**		**135.2**	**2.20**

Time of Concentration: RGA at Dos Bocas

Segment	Length (m)	U/S Elev (m)	D/S Elev (m)	Slope	2-yr Precip (in)	n-value	Paved? (Y or N)	Avg. Flow Depth (m)	Vel (m/s)	Froude No	Tc (min)	Tc (hrs)
1 Sheet Flow (L<300 ft)	91	560	548	0.132	6.71	0.240	---	---	0.14	---	11.12	0.19
2 Shallow Conc. Flow	391	548	497	0.130	---	---	N	---	1.8	---	3.70	
3 Channel Flow (Manning)	4682	497	380	0.025	---	0.090	---	1.5	2.3	0.60	33.90	0.57
4 Channel Flow (Manning)	4600	380	100	0.061	---	0.110	---	2.5	4.1	0.83	18.56	0.31
5 Channel Flow (Manning)	4397	100	92	0.002	---	0.035	---	3.0	2.5	0.47	28.91	0.48
6 Channel Flow (Manning)		92			---	0.146	---					
7 Wave Celerity	1785			---	---	---	---	5.0	7.0	---	4.25	0.07
Total Distance	15,946								**Total Time of Conc.**		**100.4**	**1.61**

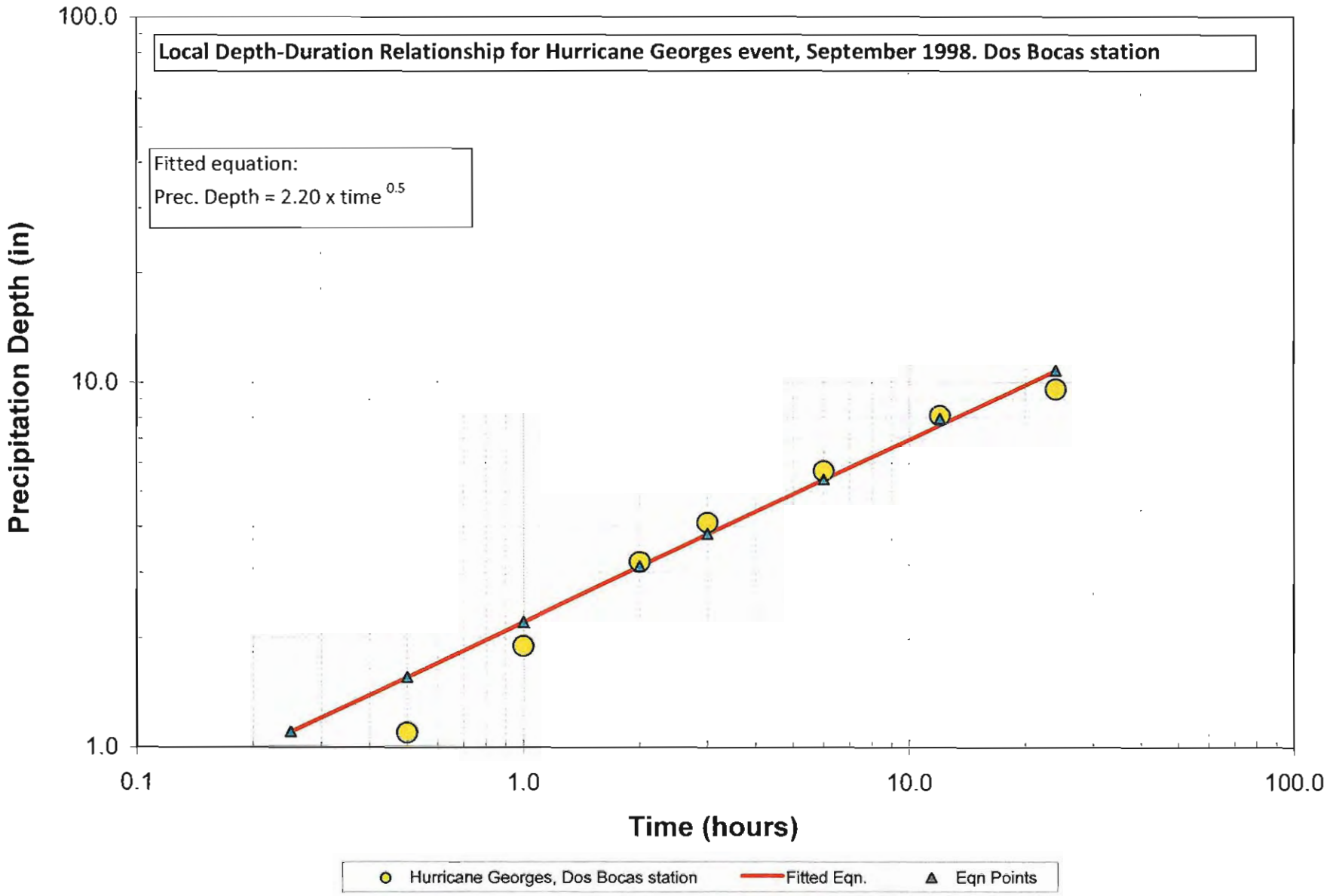
Puerto Rico

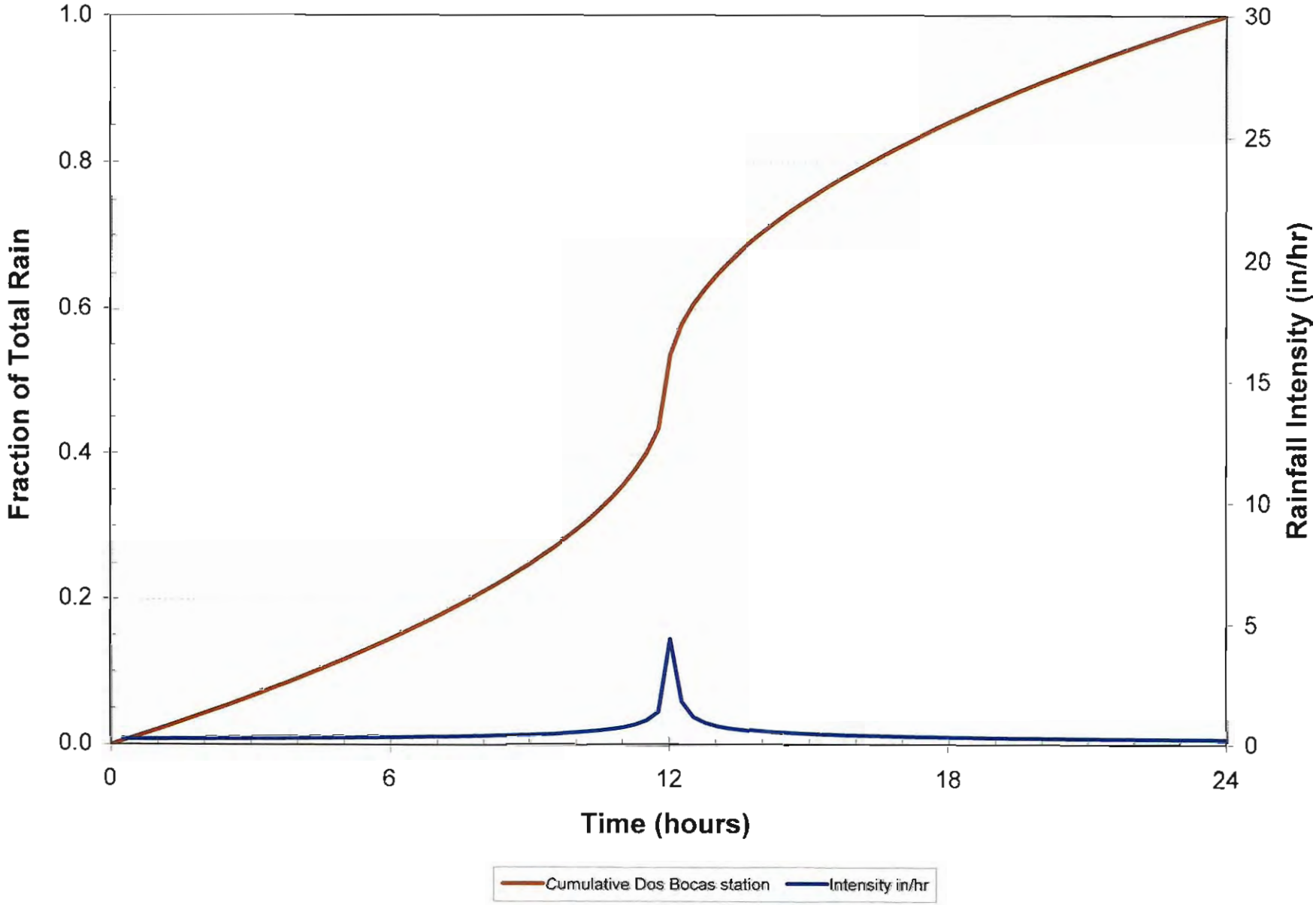
HYDROLOGIC-HYDRAULIC STUDY
RÍO GRANDE DE ARECIBO,
RENEWABLE POWER GENERATION AND
RESOURCE RECOVERY FACILITY,
ARECIBO, PUERTO RICO

Appendix C:

Hurricane Georges NCDC Rainfall Data and Rainfall Distribution Calculations

GLM MORRIS ENGINEERING


Local Depth-Duration Relationship for Hurricane Georges event, September 1998. Dos Bocas station
Fitted equation:
Prec. Depth = 2.20 x time 0.5
Precipitation Depth (in)
100.0
10.0
1.0
0.1
1.0
10.0
100.0
Time (hours)
Hurricane Georges, Dos Bocas station
Fitted Eqn.
Eqn Points


1.0
0.8
0.6
0.4
0.2
0.0
Fraction of Total Rain
30
25
20
15
10
5
0
Rainfall Intensity (in/hr)
0
6
12
18
24
Time (hours)
Cumulative Dos Bocas station
Intensity in/hr

Dos Bocas

This sheet presents the intensity-duration computations based on the fitted power equation.
Results from this sheet are used to compute time-sequential hyetograph values.

Intensity-Duration Relationship

Hour	Cumulative Depth by Eqn (decimal)	(inch)	Decimal Increment
0	0.000	0.000	0.000
0.25	0.102	1.100	0.102
0.5	0.144	1.556	0.042
0.75	0.177	1.905	0.032
1	0.204	2.200	0.027
1.25	0.228	2.460	0.024
1.5	0.250	2.694	0.022
1.75	0.270	2.910	0.020
2	0.289	3.111	0.019
2.25	0.306	3.300	0.018
2.5	0.323	3.479	0.017
2.75	0.339	3.648	0.016
3	0.354	3.811	0.015
3.25	0.368	3.966	0.014
3.5	0.382	4.116	0.014
3.75	0.395	4.260	0.013
4	0.408	4.400	0.013
4.25	0.421	4.535	0.013
4.5	0.433	4.667	0.012
4.75	0.445	4.795	0.012
5	0.456	4.919	0.012
5.25	0.468	5.041	0.011
5.5	0.479	5.159	0.011
5.75	0.489	5.275	0.011
6	0.500	5.389	0.011
6.25	0.510	5.500	0.010
6.5	0.520	5.609	0.010
6.75	0.530	5.716	0.010
7	0.540	5.821	0.010
7.25	0.550	5.924	0.010
7.5	0.559	6.025	0.009
7.75	0.568	6.125	0.009
8	0.577	6.223	0.009
8.25	0.586	6.319	0.009
8.5	0.595	6.414	0.009
8.75	0.604	6.508	0.009
9	0.612	6.600	0.009
9.25	0.621	6.691	0.008
9.5	0.629	6.781	0.008
9.75	0.637	6.869	0.008
10	0.645	6.957	0.008
10.25	0.654	7.043	0.008
10.5	0.661	7.129	0.008
10.75	0.669	7.213	0.008
11	0.677	7.297	0.008
11.25	0.685	7.379	0.008
11.5	0.692	7.461	0.008
11.75	0.700	7.541	0.007
12	0.707	7.621	0.007
12.25	0.714	7.700	0.007
12.5	0.722	7.778	0.007
12.75	0.729	7.856	0.007
13	0.736	7.932	0.007
13.25	0.743	8.008	0.007
13.5	0.750	8.083	0.007
13.75	0.757	8.158	0.007
14	0.764	8.232	0.007
14.25	0.771	8.305	0.007
14.5	0.777	8.377	0.007
14.75	0.784	8.449	0.007
15	0.791	8.521	0.007
15.25	0.797	8.591	0.007
15.5	0.804	8.661	0.007
15.75	0.810	8.731	0.006
16	0.816	8.800	0.006
16.25	0.823	8.868	0.006
16.5	0.829	8.936	0.006
16.75	0.835	9.004	0.006
17	0.842	9.071	0.006
17.25	0.848	9.137	0.006
17.5	0.854	9.203	0.006
17.75	0.860	9.269	0.006
18	0.866	9.334	0.006
18.25	0.872	9.398	0.006
18.5	0.878	9.463	0.006
18.75	0.884	9.526	0.006
19	0.890	9.590	0.006
19.25	0.896	9.652	0.006
19.5	0.901	9.715	0.006
19.75	0.907	9.777	0.006
20	0.913	9.839	0.006
20.25	0.919	9.900	0.006
20.5	0.924	9.961	0.006
20.75	0.930	10.021	0.006
21	0.935	10.082	0.006
21.25	0.941	10.141	0.006
21.5	0.946	10.201	0.006
21.75	0.952	10.260	0.005
22	0.957	10.319	0.005
22.25	0.963	10.377	0.005
22.5	0.968	10.436	0.005
22.75	0.974	10.493	0.005
23	0.979	10.551	0.005
23.25	0.984	10.608	0.005
23.5	0.990	10.665	0.005
23.75	0.995	10.721	0.005
24	1.000	10.778	0.005

Sequential Depth Hyetograph - Distribution #1 (15 minute) **Dos Bocas station**

Hour	Ordered Intensities	Incremental Depth (decimal)	Incremental Depth (inches)	Cumulative Depth (decimal)	Cumulative Depth (inches)	Intensity (inch/hr)
0		0	0	0	0	
0.25	23.75	0.005	0.057	0.005	0.057	0.228
0.5	23.25	0.005	0.057	0.011	0.114	0.229
0.75	22.75	0.005	0.058	0.016	0.172	0.231
1	22.25	0.005	0.058	0.021	0.230	0.234
1.25	21.75	0.005	0.059	0.027	0.288	0.237
1.5	21.25	0.006	0.060	0.032	0.349	0.239
1.75	20.75	0.006	0.061	0.038	0.410	0.242
2	20.25	0.006	0.061	0.044	0.471	0.245
2.25	19.75	0.006	0.062	0.049	0.533	0.248
2.5	19.25	0.006	0.063	0.055	0.596	0.252
2.75	18.75	0.006	0.064	0.061	0.660	0.255
3	18.25	0.006	0.065	0.067	0.724	0.258
3.25	17.75	0.006	0.065	0.073	0.790	0.262
3.5	17.25	0.006	0.066	0.079	0.856	0.266
3.75	16.75	0.006	0.067	0.068	0.924	0.270
4	18.25	0.006	0.068	0.092	0.992	0.274
4.25	15.75	0.006	0.070	0.098	1.062	0.278
4.5	15.25	0.007	0.071	0.105	1.132	0.283
4.75	14.75	0.007	0.072	0.112	1.204	0.288
5	14.25	0.007	0.073	0.119	1.277	0.293
5.25	13.75	0.007	0.075	0.125	1.352	0.298
5.5	13.25	0.007	0.076	0.132	1.428	0.304
5.75	12.75	0.007	0.077	0.140	1.505	0.310
6	12.25	0.007	0.079	0.147	1.584	0.316
6.25	11.75	0.007	0.081	0.154	1.665	0.323
6.5	11.25	0.008	0.082	0.162	1.747	0.330
6.75	10.75	0.008	0.084	0.170	1.832	0.337
7	10.25	0.008	0.086	0.178	1.918	0.346
7.25	9.75	0.008	0.089	0.186	2.007	0.355
7.5	9.25	0.008	0.091	0.195	2.098	0.364
7.75	8.75	0.009	0.094	0.203	2.191	0.375
8	8.25	0.009	0.096	0.212	2.288	0.386
8.25	7.75	0.009	0.100	0.222	2.387	0.398
8.5	7.25	0.010	0.103	0.231	2.491	0.412
8.75	6.75	0.010	0.107	0.241	2.597	0.427
9	8.25	0.010	0.111	0.251	2.708	0.444
9.25	5.75	0.011	0.116	0.262	2.824	0.464
9.5	5.25	0.011	0.121	0.273	2.946	0.486
9.75	4.75	0.012	0.128	0.285	3.074	0.512
10	4.25	0.013	0.135	0.298	3.209	0.542
10.25	3.75	0.013	0.144	0.311	3.354	0.578
10.5	3.25	0.014	0.156	0.326	3.509	0.622
10.75	2.75	0.016	0.170	0.341	3.679	0.679
11	2.25	0.018	0.189	0.359	3.868	0.755
11.25	1.75	0.020	0.216	0.378	4.084	0.864
11.5	1.25	0.024	0.260	0.403	4.343	1.039
11.75	0.76	0.032	0.350	0.435	4.693	1.398
12	0.25	0.102	1.100	0.537	5.793	4.400
12.25	0.5	0.042	0.456	0.580	6.249	1.823
12.5	1	0.027	0.295	0.607	6.543	1.179
12.75	1.5	0.022	0.235	0.629	6.778	0.939
13	2	0.019	0.201	0.648	6.979	0.804
13.25	2.5	0.017	0.179	0.664	7.158	0.714
13.5	3	0.015	0.162	0.679	7.320	0.649
13.75	3.5	0.014	0.150	0.693	7.469	0.599
14	4	0.013	0.140	0.706	7.609	0.559
14.25	4.5	0.012	0.131	0.718	7.741	0.526
14.5	5	0.012	0.125	0.730	7.865	0.498
14.75	5.5	0.011	0.119	0.741	7.984	0.474
15	6	0.011	0.113	0.751	8.097	0.454
15.25	6.5	0.010	0.109	0.761	8.206	0.436
15.5	7	0.010	0.105	0.771	8.311	0.420
15.75	7.5	0.009	0.101	0.781	8.412	0.405
16	8	0.009	0.098	0.790	8.510	0.392
16.25	8.5	0.009	0.095	0.798	8.605	0.380
16.5	9	0.008	0.092	0.807	8.698	0.369
16.75	9.5	0.008	0.090	0.815	8.788	0.359
17	10	0.008	0.088	0.823	8.875	0.350
17.25	10.5	0.008	0.085	0.831	8.960	0.342
17.5	11	0.008	0.083	0.839	9.044	0.334
17.75	11.5	0.008	0.082	0.847	9.125	0.326
18	12	0.007	0.080	0.854	9.205	0.319
18.25	12.5	0.007	0.078	0.861	9.283	0.313
18.5	13	0.007	0.077	0.868	9.360	0.307
18.75	13.5	0.007	0.075	0.875	9.435	0.301
19	14	0.007	0.074	0.882	9.509	0.295
19.25	14.5	0.007	0.073	0.889	9.582	0.290
19.5	15	0.007	0.071	0.896	9.653	0.285
19.75	15.5	0.007	0.070	0.902	9.723	0.281
20	16	0.006	0.069	0.909	9.792	0.276
20.25	16.5	0.006	0.068	0.915	9.860	0.272
20.5	17	0.006	0.067	0.921	9.927	0.268
20.75	17.5	0.006	0.066	0.927	9.993	0.264
21	18	0.006	0.065	0.933	10.058	0.260
21.25	18.5	0.006	0.064	0.939	10.122	0.257
21.5	19	0.006	0.063	0.945	10.185	0.253
21.75	19.5	0.006	0.062	0.951	10.248	0.250
22	20	0.006	0.062	0.957	10.310	0.247
22.25	20.5	0.006	0.061	0.962	10.370	0.244
22.5	21	0.006	0.060	0.968	10.431	0.241
22.75	21.5	0.006	0.059	0.973	10.490	0.238
23	22	0.005	0.059	0.979	10.549	0.235
23.25	22.5	0.005	0.058	0.984	10.607	0.233
23.5	23	0.005	0.057	0.990	10.665	0.230
23.75	23.5	0.005	0.057	0.995	10.721	0.228
24	24	0.005	0.056	1.000	10.776	0.225
			10.77775			

Hour	Cumulative depth (decimal)
0	0
0.25	0.010417
0.5	0.020833
0.75	0.03125
1	0.041667
1.25	0.052083
1.5	0.0625
1.75	0.072917
2	0.083333
2.25	0.09375
2.5	0.104167
2.75	0.114583
3	0.125
3.25	0.135417
3.5	0.145833
3.75	0.15625
4	0.166667
4.25	0.177083
4.5	0.1875
4.75	0.197917
5	0.208333
5.25	0.21875
5.5	0.229167
5.75	0.239583
6	0.25
6.25	0.260417
6.5	0.270833
6.75	0.28125
7	0.291667
7.25	0.302083
7.5	0.3125
7.75	0.322917
8	0.333333
8.25	0.34375
8.5	0.354167
8.75	0.364583
9	0.375
9.25	0.385417
9.5	0.395833
9.75	0.40625
10	0.416667
10.25	0.427083
10.5	0.4375
10.75	0.447917
11	0.458333
11.25	0.46875
11.5	0.479167
11.75	0.489583
12	0.5
12.25	0.510417
12.5	0.520833
12.75	0.53125
13	0.541667
13.25	0.552083
13.5	0.5625
13.75	0.572917
14	0.583333
14.25	0.59375
14.5	0.604167
14.75	0.614583
15	0.625
15.25	0.635417
15.5	0.645833
15.75	0.65625
16	0.666667
16.25	0.677083
16.5	0.6875
16.75	0.697917
17	0.708333
17.25	0.71875
17.5	0.729167
17.75	0.739583
18	0.75
18.25	0.760417
18.5	0.770833
18.75	0.78125
19	0.791667
19.25	0.802083
19.5	0.8125
19.75	0.822917
20	0.833333
20.25	0.84375
20.5	0.854167
20.75	0.864583
21	0.875
21.25	0.885417
21.5	0.895833
21.75	0.90625
22	0.916667
22.25	0.927083
22.5	0.9375
22.75	0.947917
23	0.958333
23.25	0.96875
23.5	0.979167
23.75	0.989583
24	1

Incremental depth (in)

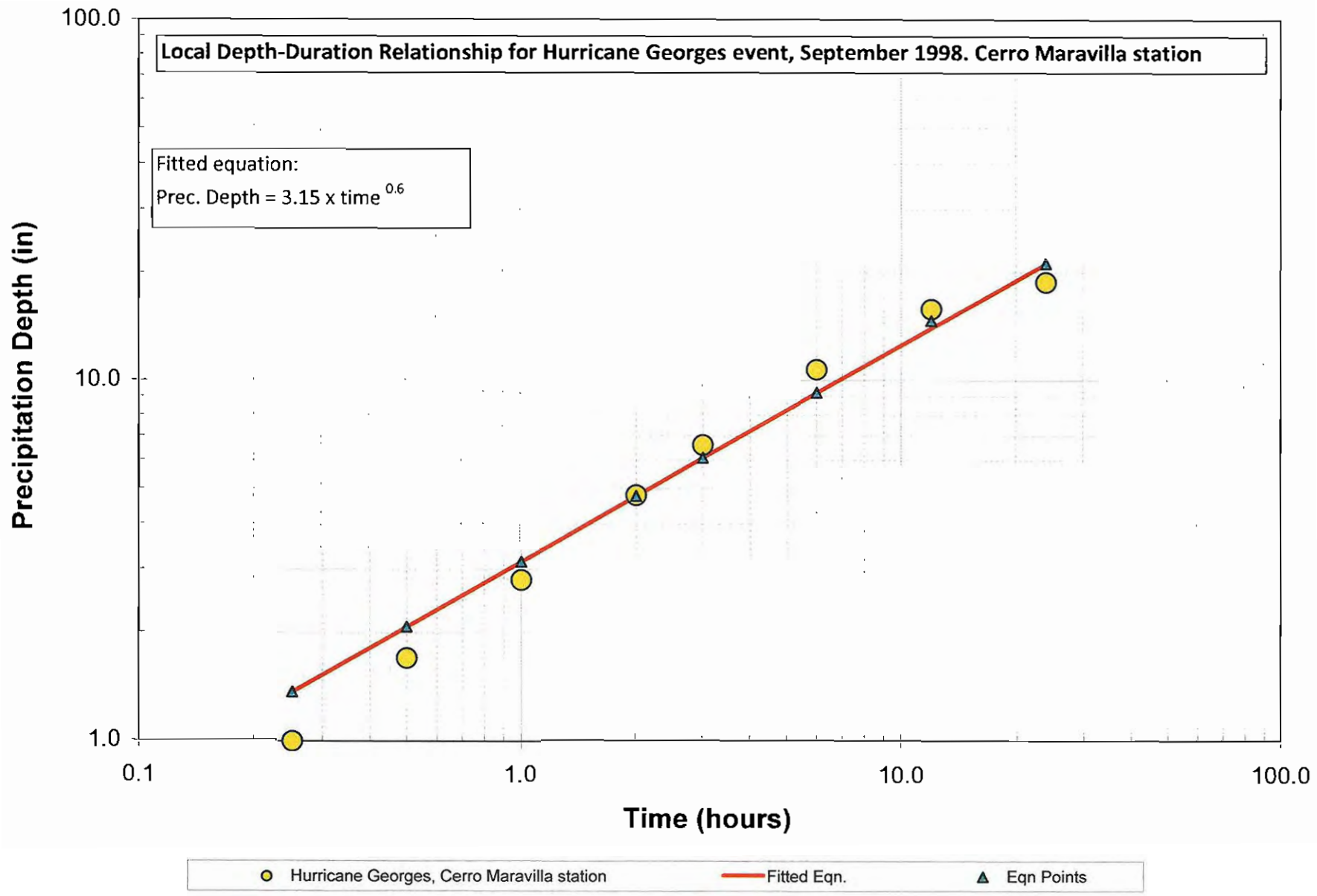
	Precipitation (in)			
7.1 RGA abv Arecibo	5.8 RGA at Cambalache	11.8 Rio Caonillas	6.8 Rio Tanama at Charco Hondo	12 RGA at Dos Bocas
0.000	0.000	0.000	0.000	0.000
0.037	0.030	0.06194	0.035	0.06299
0.038	0.031	0.06261	0.035	0.06367
0.038	0.031	0.06330	0.035	0.06437
0.039	0.031	0.06401	0.036	0.06509
0.039	0.032	0.06475	0.036	0.06584
0.039	0.032	0.06551	0.037	0.06662
0.040	0.033	0.06630	0.037	0.06742
0.040	0.033	0.06712	0.038	0.06825
0.041	0.033	0.06796	0.038	0.06912
0.041	0.034	0.06885	0.039	0.07001
0.042	0.034	0.06977	0.039	0.07095
0.043	0.035	0.07072	0.040	0.07192
0.043	0.035	0.07172	0.040	0.07293
0.044	0.036	0.07276	0.041	0.07399
0.044	0.036	0.07354	0.041	0.07509
0.045	0.037	0.07496	0.042	0.07625
0.046	0.037	0.07617	0.043	0.07746
0.047	0.038	0.07742	0.043	0.07873
0.047	0.039	0.07873	0.044	0.08006
0.048	0.039	0.08011	0.045	0.08147
0.049	0.040	0.08157	0.046	0.08295
0.050	0.041	0.08311	0.046	0.08452
0.051	0.042	0.08474	0.047	0.08617
0.052	0.043	0.08647	0.048	0.08793
0.053	0.043	0.08831	0.049	0.08980
0.054	0.044	0.09027	0.050	0.09180
0.056	0.045	0.09237	0.052	0.09394
0.057	0.047	0.09462	0.053	0.09623
0.058	0.048	0.09705	0.054	0.09869
0.060	0.049	0.09967	0.056	0.10136
0.062	0.050	0.10252	0.057	0.10428
0.064	0.052	0.10563	0.059	0.10742
0.066	0.054	0.10904	0.061	0.11089
0.068	0.055	0.11280	0.063	0.11471
0.070	0.057	0.11696	0.065	0.11896
0.073	0.060	0.12168	0.068	0.12372
0.078	0.062	0.12696	0.071	0.12911
0.080	0.066	0.13301	0.074	0.13526
0.084	0.069	0.14001	0.078	0.14239
0.089	0.073	0.14826	0.083	0.15077
0.095	0.078	0.15816	0.088	0.16084
0.103	0.084	0.17035	0.095	0.17324
0.112	0.091	0.18589	0.104	0.18904
0.124	0.102	0.20663	0.116	0.21013
0.142	0.118	0.23638	0.132	0.24037
0.171	0.140	0.28430	0.159	0.28912
0.230	0.188	0.38278	0.214	0.38927
0.725	0.592	1.20433	0.674	1.22474
0.300	0.245	0.49865	0.279	0.50731
0.194	0.159	0.32270	0.180	0.32817
0.155	0.126	0.25703	0.144	0.26139
0.132	0.108	0.22000	0.123	0.22373
0.116	0.095	0.19544	0.109	0.19875
0.107	0.087	0.17761	0.099	0.18062
0.099	0.081	0.16392	0.092	0.16670
0.092	0.075	0.15297	0.086	0.15556
0.087	0.071	0.14396	0.081	0.14640
0.082	0.067	0.13638	0.076	0.13869
0.078	0.064	0.12988	0.073	0.13208
0.075	0.061	0.12422	0.069	0.12633
0.072	0.059	0.11925	0.067	0.12127
0.069	0.056	0.11483	0.064	0.11678
0.067	0.054	0.11087	0.062	0.11275
0.065	0.053	0.10729	0.060	0.10911
0.063	0.051	0.10404	0.058	0.10580
0.061	0.050	0.10107	0.057	0.10278
0.059	0.048	0.09834	0.055	0.10000
0.056	0.047	0.09581	0.054	0.09744
0.056	0.046	0.09348	0.052	0.09506
0.055	0.045	0.09130	0.051	0.09285
0.054	0.044	0.08927	0.050	0.09078
0.053	0.043	0.08737	0.049	0.08885
0.051	0.042	0.08559	0.048	0.08704
0.050	0.041	0.08391	0.047	0.08533
0.050	0.040	0.08233	0.046	0.08372
0.049	0.040	0.08083	0.045	0.08220
0.048	0.039	0.07941	0.044	0.08078
0.047	0.038	0.07807	0.044	0.07939
0.048	0.038	0.07679	0.043	0.07809
0.045	0.037	0.07557	0.042	0.07685
0.045	0.037	0.07440	0.042	0.07567
0.044	0.036	0.07329	0.041	0.07454
0.043	0.036	0.07223	0.040	0.07346
0.043	0.035	0.07121	0.040	0.07242
0.042	0.035	0.07024	0.039	0.07143
0.042	0.034	0.06930	0.039	0.07048
0.041	0.034	0.06840	0.038	0.06956
0.041	0.033	0.06754	0.038	0.06868
0.040	0.033	0.06670	0.037	0.06783
0.040	0.032	0.06590	0.037	0.06702
0.039	0.032	0.06512	0.036	0.06623
0.039	0.032	0.06437	0.036	0.06547
0.038	0.031	0.06365	0.036	0.06473
0.038	0.031	0.06295	0.035	0.06402
0.037	0.031	0.06227	0.035	0.06333
0.037	0.030	0.06162	0.034	0.06266
7.1	5.8	11.8	6.8	12

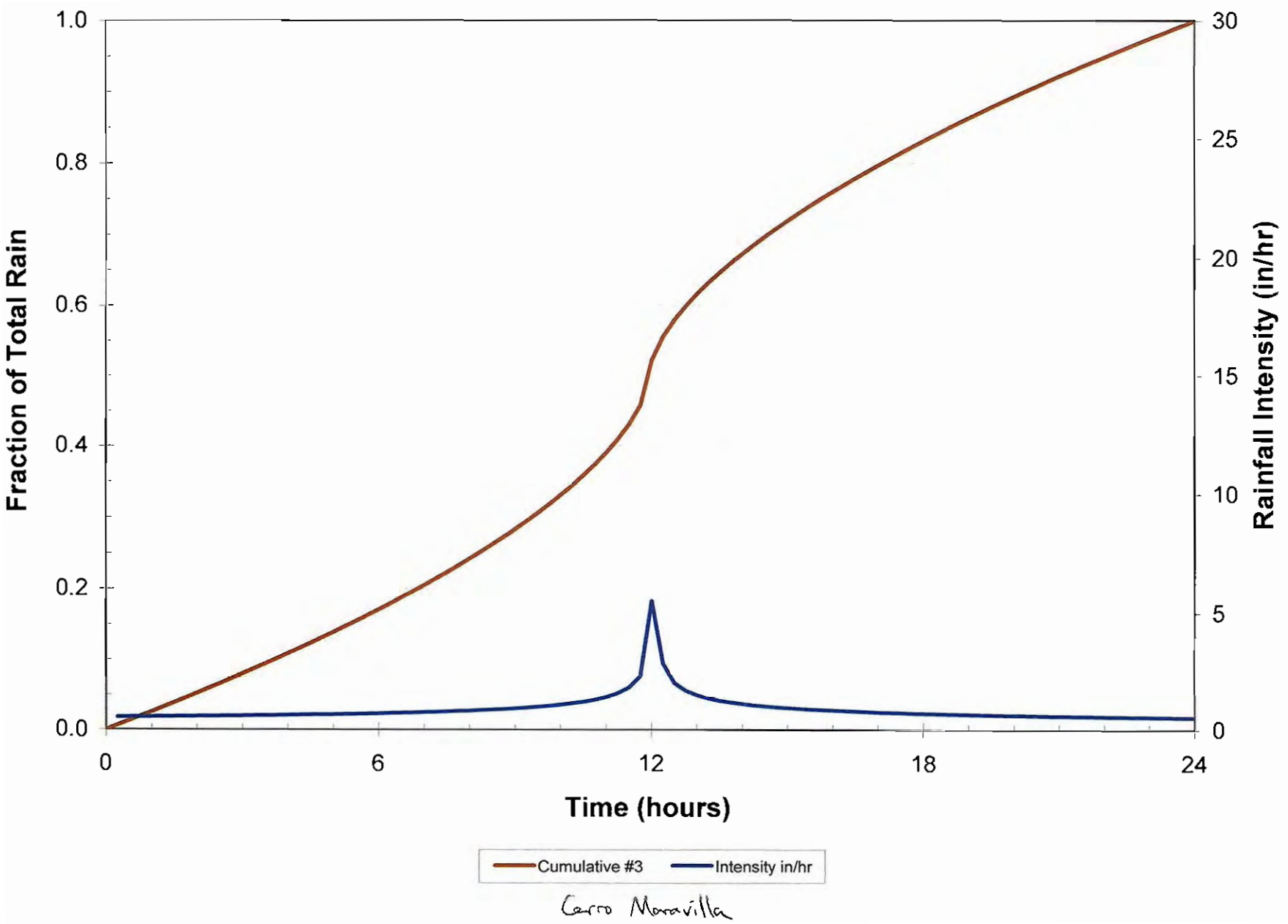
NCDC Dos Bocas station

	Rainfall (inches)		
time	9/20/1998	9/21/1998	9/22/1998
12:00 AM	0.00	0.00	0.60
12:15 AM	0.00	0.00	0.50
12:30 AM	0.00	0.00	0.30
12:45 AM	0.00	0.00	0.20
1:00 AM	0.00	0.00	0.20
1:15 AM	0.00	0.00	0.10
1:30 AM	0.00	0.00	0.10
1:45 AM	0.00	0.00	0.00
2:00 AM	0.00	0.00	0.20
2:15 AM	0.00	0.00	0.10
2:30 AM	0.00	0.00	0.40
2:45 AM	0.00	0.00	0.40
3:00 AM	0.00	0.00	0.30
3:15 AM	0.00	0.00	0.10
3:30 AM	0.00	0.00	0.10
3:45 AM	0.00	0.00	0.10
4:00 AM	0.00	0.00	0.10
4:15 AM	0.00	0.00	0.10
4:30 AM	0.00	0.00	0.10
4:45 AM	0.00	0.00	0.10
5:00 AM	0.00	0.00	0.20
5:15 AM	0.00	0.00	0.10
5:30 AM	0.00	0.00	0.20
5:45 AM	0.00	0.00	0.10
6:00 AM	0.00	0.00	0.30
6:15 AM	0.00	0.00	0
6:30 AM	0.00	0.00	0
6:45 AM	0.00	0.00	0
7:00 AM	0.00	0.00	0
7:15 AM	0.00	0.00	0
7:30 AM	0.00	0.00	0
7:45 AM	0.00	0.00	0
8:00 AM	0.00	0.00	0
8:15 AM	0.00	0.00	0
8:30 AM	0.00	0.00	0
8:45 AM	0.00	0.00	0
9:00 AM	0.00	0.00	0
9:15 AM	0.00	0.00	0
9:30 AM	0.10	0.00	0
9:45 AM	0.00	0.00	0
10:00 AM	0.00	0.00	0
10:15 AM	0.00	0.00	0
10:30 AM	0.00	0.00	0
10:45 AM	0.00	0.00	0
11:00 AM	0.00	0.00	0
11:15 AM	0.00	0.00	0
11:30 AM	0.00	0.00	0
11:45 AM	0.00	0.00	0
12:00 PM	0.00	0.00	0
12:15 PM	0.00	0.00	0.00
12:30 PM	0.00	0.00	0.00
12:45 PM	0.00	0.00	0.10
1:00 PM	0.00	0.00	0.10

NCDC Dos Bocas station

	Rainfall (inches)		
time	9/20/1998	9/21/1998	9/22/1998
1:15 PM	0.00	0.00	0.20
1:30 PM	0.00	0.10	0.10
1:45 PM	0.00	0.00	0.10
2:00 PM	0.00	0.00	0.00
2:15 PM	0.00	0.00	0.10
2:30 PM	0.00	0.00	0.00
2:45 PM	0.00	0.00	0.10
3:00 PM	0.00	0.00	0.10
3:15 PM	0.00	0.00	0.00
3:30 PM	0.00	0.00	0.10
3:45 PM	0.00	0.00	0.10
4:00 PM	0.00	0.00	0.10
4:15 PM	0.00	0.00	0.10
4:30 PM	0.00	0.00	0.10
4:45 PM	0.00	0.10	0.00
5:00 PM	0.00	0.00	0.10
5:15 PM	0.00	0.00	0.00
5:30 PM	0.00	0.00	0.00
5:45 PM	0.20	0.00	0.10
6:00 PM	0.00	0.00	0.00
6:15 PM	0.00	0.10	0
6:30 PM	0.00	0.10	0
6:45 PM	0.00	0.00	0
7:00 PM	0.00	0.00	0
7:15 PM	0.00	0.00	0
7:30 PM	0.00	0.00	0
7:45 PM	0.00	0.10	0
8:00 PM	0.00	0.00	0
8:15 PM	0.00	0.10	0
8:30 PM	0.00	0.10	0
8:45 PM	0.00	0.10	0
9:00 PM	0.00	0.10	0
9:15 PM	0.00	0.00	0
9:30 PM	0.00	0.00	0
9:45 PM	0.00	0.10	0
10:00 PM	0.00	0.00	0
10:15 PM	0.10	0.00	0
10:30 PM	0.00	0.00	0
10:45 PM	0.00	0.00	0
11:00 PM	0.00	0.10	0
11:15 PM	0.00	0.30	0
11:30 PM	0.00	0.40	0
11:45 PM	0.00	0.10	0
SUM	0.40	1.90	7.9


Local Depth-Duration Relationship for Hurricane Georges event, September 1998. Cerro Maravilla station
Fitted equation:
Prec. Depth = 3.15 x time 0.6
Precipitation Depth (in)
100.0
10.0
1.0
0.1
1.0
10.0
100.0
Time (hours)
Hurricane Georges, Cerro Maravilla station
Fitted Eqn.
Eqn Points


1.0
0.8
0.6
0.4
0.2
0.0
Fraction of Total Rain
30
25
20
15
10
5
0
Rainfall Intensity (in/hr)
0
6
12
18
24
Time (hours)
Cumulative #3
Intensity in/hr
Cerro Maravilla

Cerro Maravilla

This sheet presents the intensity-duration computations based on the fitted power equation.
Results from this sheet are used to compute time-sequential hyetograph values.

Intensity-Duration Relationship

Hour	Cumulative Depth by E (decimal)	(inch)	Decimal Increment
0	0	0	0
0.25	0.065	1.371	0.065
0.5	0.098	2.078	0.033
0.75	0.125	2.651	0.027
1	0.149	3.150	0.024
1.25	0.170	3.601	0.021
1.5	0.189	4.018	0.020
1.75	0.208	4.407	0.018
2	0.225	4.775	0.017
2.25	0.242	5.124	0.016
2.5	0.257	5.459	0.016
2.75	0.273	5.780	0.015
3	0.287	6.090	0.015
3.25	0.301	6.389	0.014
3.5	0.315	6.680	0.014
3.75	0.328	6.962	0.013
4	0.341	7.237	0.013
4.25	0.354	7.505	0.013
4.5	0.366	7.767	0.012
4.75	0.378	8.023	0.012
5	0.390	8.274	0.012
5.25	0.402	8.519	0.012
5.5	0.413	8.760	0.011
5.75	0.424	8.997	0.011
6	0.435	9.230	0.011
6.25	0.446	9.459	0.011
6.5	0.457	9.684	0.011
6.75	0.467	9.906	0.010
7	0.477	10.124	0.010
7.25	0.488	10.340	0.010
7.5	0.498	10.552	0.010
7.75	0.508	10.762	0.010
8	0.517	10.969	0.010
8.25	0.527	11.173	0.010
8.5	0.536	11.375	0.010
8.75	0.546	11.575	0.009
9	0.555	11.772	0.009
9.25	0.564	11.967	0.009
9.5	0.573	12.160	0.009
9.75	0.582	12.351	0.009
10	0.591	12.540	0.009
10.25	0.600	12.728	0.009
10.5	0.609	12.913	0.009
10.75	0.618	13.097	0.009
11	0.626	13.278	0.009
11.25	0.635	13.459	0.009
11.5	0.643	13.637	0.008
11.75	0.651	13.814	0.008
12	0.660	13.990	0.008
12.25	0.668	14.164	0.008
12.5	0.676	14.337	0.008
12.75	0.684	14.508	0.008

Hour	Cumulative Depth by Eqn (decimal)	(inch)	Decimal Increment
11.25	0.635	13.459	0.009
11.5	0.643	13.637	0.008
11.75	0.651	13.814	0.008
12	0.660	13.990	0.008
12.25	0.668	14.164	0.008
12.5	0.676	14.337	0.008
12.75	0.684	14.508	0.008
13	0.692	14.678	0.008
13.25	0.700	14.847	0.008
13.5	0.708	15.014	0.008
13.75	0.716	15.181	0.008
14	0.724	15.346	0.008
14.25	0.731	15.510	0.008
14.5	0.739	15.672	0.008
14.75	0.747	15.834	0.008
15	0.754	15.994	0.008
15.25	0.762	16.154	0.008
15.5	0.769	16.312	0.007
15.75	0.777	16.469	0.007
16	0.784	16.626	0.007
16.25	0.791	16.781	0.007
16.5	0.799	16.936	0.007
16.75	0.806	17.089	0.007
17	0.813	17.242	0.007
17.25	0.820	17.393	0.007
17.5	0.827	17.544	0.007
17.75	0.834	17.694	0.007
18	0.841	17.843	0.007
18.25	0.848	17.992	0.007
18.5	0.855	18.139	0.007
18.75	0.862	18.286	0.007
19	0.869	18.432	0.007
19.25	0.876	18.577	0.007
19.5	0.883	18.721	0.007
19.75	0.890	18.865	0.007
20	0.896	19.008	0.007
20.25	0.903	19.150	0.007
20.5	0.910	19.291	0.007
20.75	0.916	19.432	0.007
21	0.923	19.572	0.007
21.25	0.930	19.712	0.007
21.5	0.936	19.851	0.007
21.75	0.943	19.989	0.007
22	0.949	20.126	0.006
22.25	0.956	20.263	0.006
22.5	0.962	20.400	0.006
22.75	0.968	20.535	0.006
23	0.975	20.670	0.006
23.25	0.981	20.805	0.006
23.5	0.987	20.939	0.006
23.75	0.994	21.072	0.006
24	1.000	21.205	0.006

Sequential Depth Hyetograph - Distribution #1 (15 minute). **Cerro Maravilla**

Hour	Ordered Intensities	Incremental Depth (decimal)	Incremental Depth (inches)	Cumulative Depth (decimal)	Cumulative Depth (inches)	Intensity (inch/hr)
0		0	0	0	0	
0.25	23.75	0.006	0.133	0 006	0.133	0.533
0.5	23.25	0.006	0.135	0.013	0.268	0.536
0.75	22.75	0.006	0.136	0.019	0.404	0.543
1	22.25	0.006	0.137	0.025	0.540	0.548
1.25	21.75	0.007	0.138	0.032	0.679	0.553
1.5	21.25	0.007	0.139	0.039	0.818	0.558
1.75	20.75	0.007	0.141	0.045	0.959	0.563
2	20.25	0.007	0.142	0.052	1.101	0.569
2.25	19.75	0.007	0.144	0.059	1.245	0.575
2.5	19.25	0.007	0.145	0.066	1.390	0.581
2.75	18.75	0.007	0.147	0.072	1.537	0 587
3	18.25	0.007	0.148	0.079	1.685	0.593
3.25	17.75	0.007	0 150	0.087	1.835	0.600
3.5	17.25	0.007	0.152	0.094	1.987	0,607
3.75	16.75	0.007	0.153	0.101	2.140	0.614
4	16.25	0.007	0.155	0.108	2.295	0.622
4.25	15.75	0.007	0.157	0.116	2.453	0.629
4.5	15.25	0 006	0.159	0.123	2.612	0.638
4.75	14.75	0.008	0.162	0.131	2.774	0.646
5	14.25	0.008	0.164	0.139	2.938	0.655
5.25	13.75	0.008	0.166	0 146	3,104	0.665
5.5	13.25	0.008	0.169	0.154	3.273	0.675
5.75	12.75	0.008	0.171	0.162	3.444	0.685
6	12.25	0.008	0.174	0.171	3.618	0 697
6.25	11.75	0.008	0.177	0.179	3.795	0.708
6.5	11.25	0.009	0.180	0.187	3.975	0.721
6.75	10.75	0.009	0.184	0.196	4.159	0.734
7	10.25	0 009	0.187	0.205	4.346	0.749
7.25	9.75	0.009	0.191	0.214	4.537	0.764
7.5	9 25	0.009	0.195	0.223	4.732	0.781
7.75	8 75	0.009	0.200	0.233	4.932	0.798
8	8.25	0.010	0.204	0.242	5.136	0 818
8.25	7.75	0.010	0.210	0.252	5.346	0.839
8.5	7.25	0.010	0.215	0.262	5.561	0.862
8.75	6.75	0.010	0.222	0.273	5.783	0.887
9	6.25	0.011	0.229	0.284	6.012	0.915
9.25	5.75	0.011	0.237	0.295	6 249	0.947
9.5	5.25	0.012	0.246	0.306	6.495	0.983
9.75	4.75	0.012	0.256	0.318	6 751	1.024
10	4.25	0.013	0.268	0.331	7.019	1.072
10.25	3.75	0.013	0.282	0.344	7.301	1.129
10.5	3.25	0.014	0 300	0.358	7.601	1.198
10.75	2.75	0.015	0.321	0.374	7.922	1.285
11	2 25	0.016	0.350	0.390	8.272	1.398
11.25	1 75	0 018	0.389	0.408	8.661	1.557
11.5	1.25	0.021	0.451	0.430	9.112	1 905
11.75	0.75	0.027	0.572	0.457	9.685	2.290
12	0 25	0 065	1.371	0.521	11.056	5.484
12.25	0.5	0.033	0.707	0.555	11.763	2 828
12.5	1	0.024	0.499	0.578	12.262	1.998
12.75	1.5	0.020	0.416	0.598	12.678	1.665
13	2	0.017	0.368	0.615	13.046	1.470
13.25	2.5	0.016	0.334	0.631	13.380	1.338
13.5	3	0.015	0.310	0.646	13.690	1.239
13.75	3.5	0.014	0.291	0.659	13 981	1.162
14	4	0.013	0.275	0.672	14.256	1.100
14.25	4.5	0.012	0.262	0.685	14.517	1.047
14.5	5	0.012	0.251	0.696	14.768	1.003
14.75	5.5	0.011	0.241	0.708	15.009	0.965
15	6	0.011	0.233	0.719	15.242	0.931
15.25	6 5	0.011	0.225	0.729	15.467	0.901
15.5	7	0.010	0.219	0.740	15.686	0.874
15.75	7.5	0.010	0.212	0.750	15.898	0.850
16	8	0.010	0.207	0.760	16 105	0 828
16.25	8.5	0.010	0.202	0.768	16.307	0.808
16.5	9	0.009	0.197	0.778	16.504	0.789
16.75	9.5	0.009	0.193	0.787	16.697	0.772
17	10	0.009	0.189	0.796	16.887	0.756
17.25	10.5	0.009	0.185	0.805	17.072	0.741
17.5	11	0.009	0.182	0.814	17.254	0.728
17.75	11.5	0.008	0.179	0.822	17.432	0.715
18	12	0.008	0.176	0.830	17.608	0.702
18.25	12.5	0.008	0.173	0.839	17.781	0.691
18.5	13	0.008	0.170	0.847	17.951	0.680
18.75	13.5	0.008	0.167	0.854	18.118	0.670
19	14	0.008	0.165	0.862	18.283	0.660
19.25	14.5	0.008	0.163	0.870	18.446	0.651
19.5	15	0.008	0.160	0.877	18.606	0.642
19.75	15.5	0.007	0.158	0.885	18.765	0.633
20	16	0.007	0.156	0.892	18.921	0.625
20.25	16.5	0.007	0.154	0.900	19.076	0.618
20.5	17	0.007	0.153	0.907	19.228	0.610
20.75	17.5	0.007	0.151	0.914	19.379	0.603
21	18	0.007	0.149	0.921	19.529	0.596
21.25	18.5	0.007	0.147	0.928	19.676	0.590
21.5	19	0.007	0.146	0.935	19.822	0.584
21.75	19.5	0.007	0.144	0.942	19.966	0.578
22	20	0.007	0.143	0.948	20.109	0.572
22.25	20.5	0.007	0.142	0.955	20.250	0.566
22.5	21	0.007	0.140	0.962	20.390	0.561
22.75	21.5	0.007	0.139	0.968	20.529	0.555
23	22	0.008	0.138	0.975	20.667	0.550
23.25	22.5	0.008	0.138	0.981	20.803	0.545
23.5	23	0.006	0.135	0.987	20.938	0.540
23.75	23.5	0.006	0.134	0.994	21.072	0.536
24	24	0.006	0.133	1.000	21.205	0.531

Hour	Cumulative depth (decimal)
0	0
0.010417	0.0062895
0.020833	0.0126331
0.03125	0.0190323
0.041667	0.0254891
0.052083	0.0320051
0.0625	0.0385824
0.072917	0.045223
0.083333	0.0519291
0.09375	0.0587031
0.104167	0.0655473
0.114583	0.0724645
0.125	0.0794574
0.135417	0.0865289
0.145833	0.0936824
0.15625	0.1009211
0.166667	0.1082488
0.177083	0.1156694
0.1875	0.1231871
0.197917	0.1308097
0.208333	0.138533
0.21875	0.1463715
0.229167	0.1543281
0.239583	0.1624093
0.25	0.1706222
0.260417	0.1789748
0.270833	0.1874752
0.28125	0.1961337
0.291667	0.2049606
0.302083	0.2139683
0.3125	0.2231702
0.322917	0.2325819
0.333333	0.2422212
0.34375	0.2521088
0.354167	0.2622678
0.364583	0.2727272
0.375	0.2835201
0.385417	0.2946871
0.395833	0.3062778
0.40625	0 3183548
0.416667	0.330997
0.427083	0.3443105
0.4375	0.3584387
0.447917	0.3735885
0.458333	0.3900762
0.46875	0.4084356
0.479167	0.4297175
0.489583	0.4567108
0 5	0.5213712
0.510417	0.5547175
0.520833	0.5782677
0 53125	0.5979004
0.541667	0.6152362
0.552083	0.6310055
0.5625	0 6456133
0.572917	0.659313
0.583333	0.6722758
0.59375	0 6846241
0.604167	0.6964491
0.614583	0.707821
0.625	0.7187954
0.635417	0.729417
0.645833	0.7397224
0 65625	0.7497425
0.666667	0.7595031
0.677083	0.7690262
0.6875	0.778331
0.697917	0.7874339
0.708333	0.7963497
0 71875	0.8050909
0.729167	0.8136692
0.739583	0.8220948
0.75	0.8303782
0.760417	0.8385223
0.770833	0.8465404
0.78125	0.8544371
0.791667	0.8622188
0.802083	0.8698911
0.8125	0.8774592
0.822917	0.8849278
0.833333	0.8923015
0.84375	0.8995842
0.854167	0.9067798
0.864583	0.9138919
0.875	0 9209237
0.885417	0.9278784
0.895833	0.9347587
0.90625	0.9415675
0.916667	0.9483073
0.927083	0.9549804
0.9375	0.9615891
0.947917	0.9681355
0.958333	0.9746216
0.96875	0.9810494
0.979167	0.9874206
0.989583	0.9937369
1	1

	Precipitation		
	21.1	14	18.5
Hour	Lago Caonillas	Rio Limon	Rio Vivi
0	0	0	0
0.010417	0.132709	0.088053	0.118356
0.020833	0.133849	0.08881	0 117356
0.03125	0.135025	0.08859	0.118386
0.041667	0.136237	0.090394	0.119449
0.052083	0.137488	0.091224	0.120547
0.0625	0.138781	0.092082	0.12188
0.072917	0.140117	0.092969	0.122851
0.083333	0.141498	0.093888	0.124063
0.09375	0.14293	0.094835	0.125318
0.104167	0.144414	0.095819	0.126619
0.114583	0.145952	0.09684	0.127967
0.125	0.147549	0.0979	0.129368
0.135417	0.14921	0.099002	0.130824
0.145833	0.150937	0.100148	0 132338
0.15625	0.152737	0.101342	0.133916
0.166667	0.154614	0.102588	0.135562
0.177083	0.156575	0.103888	0.137281
0.1875	0.158625	0.105249	0.139079
0.197917	0.160772	0 106674	0.140962
0.208333	0.163025	0.108166	0.142937
0.21875	0.165392	0.109739	0.145012
0.229167	0.167885	0.111393	0.147197
0.239583	0.170513	0.113137	0.149502
0.25	0.173292	0.11498	0.151939
0.260417	0.176238	0.116934	0.15452
0.270833	0.179363	0.119008	0.157261
0.28125	0 182693	0 121218	0.160181
0.291667	0.18625	0.123578	0.163299
0.302083	0.190061	0 126107	0.166641
0.3125	0.194181	0.128827	0.170238
0.322917	0.198587	0.131784	0.174117
0.333333	0.203389	0.13495	0.178327
0.34375	0.208623	0.138423	0.182916
0.354167	0.214361	0.14223	0.187947
0.364583	0 220692	0 146431	0.193498
0.375	0.227731	0.151101	0.199669
0.385417	0.235623	0.156338	0.206589
0.395833	0.244585	0.16227	0.214429
0.40625	0.254819	0.169074	0.22342
0.416667	0.266756	0.178095	0.233886
0.427083	0.280913	0.188368	0.246298
0.4375	0.298107	0.197796	0.261373
0.447917	0.319859	0.212096	0.28027
0.458333	0.347892	0.230628	0.305023
0.46875	0.387398	0.257035	0.339653
0.479167	0.449044	0.297944	0.393711
0.489583	0.569561	0.377908	0.499378
0 5	1.364331	0.905243	1.196214
0.510417	0.703608	0.466849	0.616908
0.520833	0.496909	0.329703	0.435679
0 53125	0.414249	0.274857	0.363204
0.541667	0.365788	0.242702	0.320713
0.552083	0.332732	0.22077	0.291731
0.5625	0.308225	0.20451	0.270245
0.572917	0.289003	0.191796	0.253444
0.583333	0.273515	0.181478	0.239811
0.59375	0.260549	0.172876	0.228443
0.604167	0.249508	0.16555	0.218763
0.614583	0.239948	0.159207	0.210381
0.625	0.231559	0.153841	0.203026
0.635417	0.224115	0.148702	0.196499
0.645833	0.217446	0.144277	0.190652
0 65625	0.211424	0.140281	0.185372
0.666667	0.205948	0.136648	0.18057
0.677083	0.200938	0.133324	0.176178
0.6875	0.19833	0.130287	0.172138
0.697917	0.192073	0.127442	0.168405
0.708333	0.188122	0.12482	0.164941
0 71875	0.184441	0.122378	0.161714
0.729167	0.181001	0.120095	0.158697
0.739583	0.177775	0.117955	0.155869
0.75	0.174742	0.115943	0.15321
0.760417	0.171883	0.114046	0.150703
0.770833	0.169181	0.112253	0.148334
0.78125	0.166622	0.110555	0.146091
0.791667	0.164194	0.108944	0.143961
0.802083	0.161885	0.107412	0.141937
0.8125	0.159686	0.105953	0.140009
0.822917	0.157588	0.104561	0.13817
0.833333	0.155584	0.103231	0.136412
0.84375	0.153668	0.101958	0.134731
0.854167	0.151828	0.100739	0.133119
0.864583	0.150065	0.099569	0.131573
0.875	0.148372	0.098448	0.130089
0.885417	0.146743	0.097365	0.128661
0.895833	0.145176	0.096325	0.127287
0.90625	0.143665	0.095323	0.125962
0.916667	0.142209	0.094356	0.124685
0.927083	0.140802	0.093423	0.123452
0.9375	0.139443	0.092522	0.122261
0.947917	0.138129	0.09165	0.121109
0.958333	0.136858	0.090808	0.119994
0.96875	0.135626	0.089988	0.118914
0.979167	0.134432	0.089197	0.117867
0.989583	0.133275	0.088429	0.116852
1	0.132151	0.087683	0.115867

	21.1	14	18.5

NCDC Cerro Maravilla station

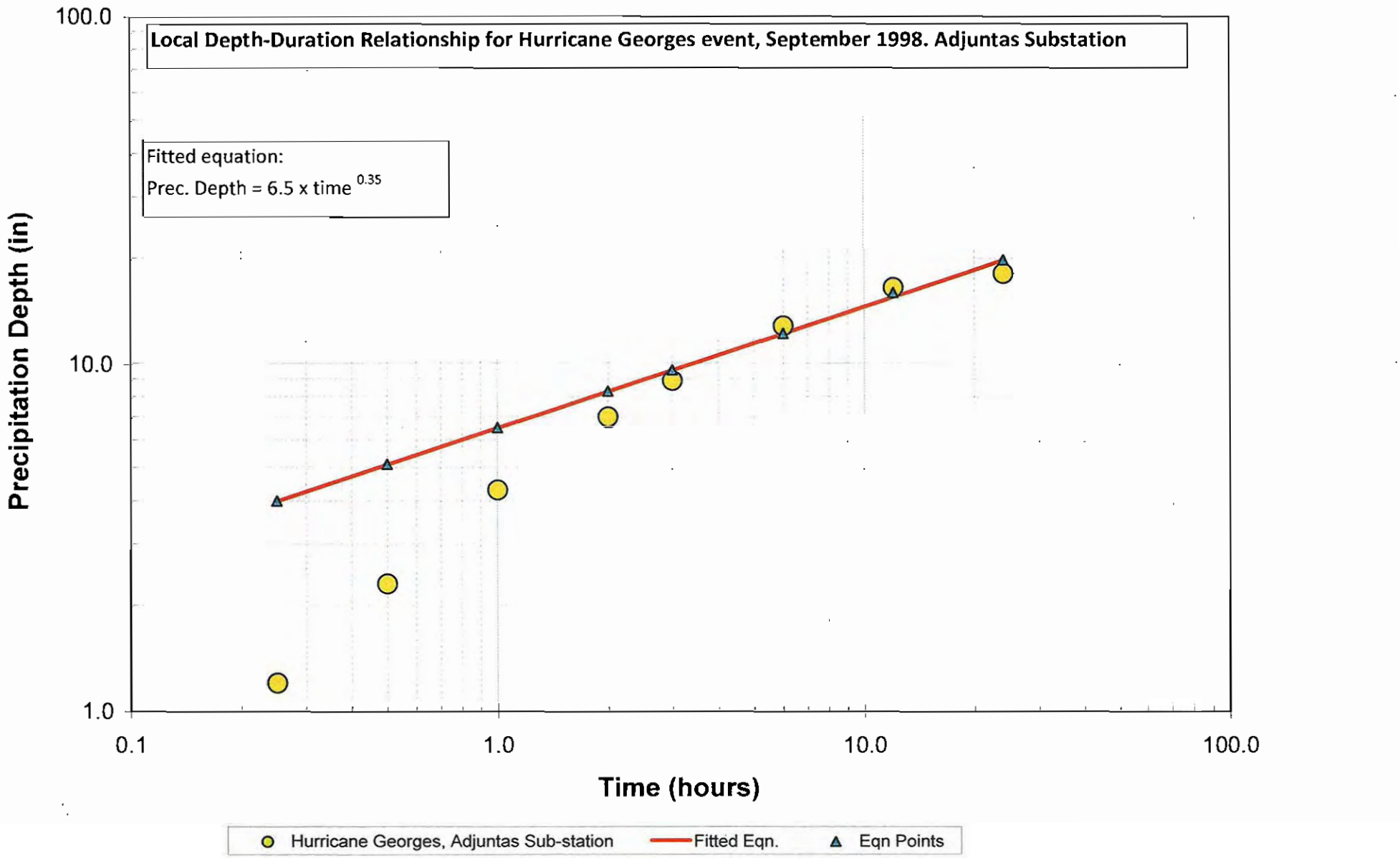
Rainfall (inches)

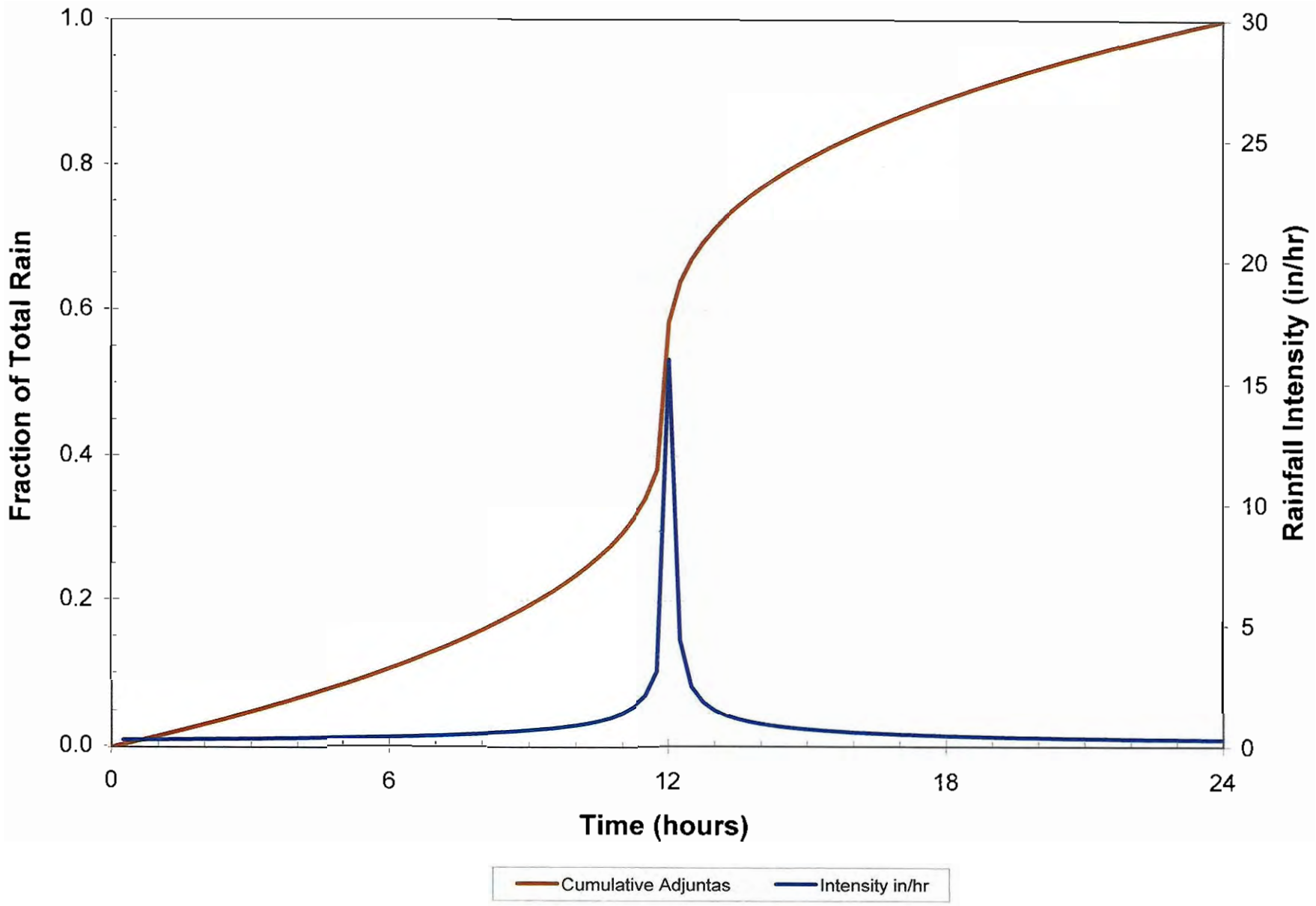
time	9/21/1998	9/22/1998	9/23/1998
12:00 AM	0.00	0.20	0.00
12:15 AM	0.00	0.10	0.00
12:30 AM	0.00	0.00	0.00
12:45 AM	0.00	0.30	0.00
1:00 AM	0.00	0.40	0.00
1:15 AM	0.00	0.40	0.00
1:30 AM	0.00	0.40	0.00
1:45 AM	0.00	0.00	0.00
2:00 AM	0.00	0.00	0.00
2:15 AM	0.00	0.00	0.00
2:30 AM	0.00	0.00	0.00
2:45 AM	0.00	0.00	0.00
3:00 AM	0.00	0.20	0.00
3:15 AM	0.00	0.30	0.00
3:30 AM	0.00	0.40	0.00
3:45 AM	0.00	0.20	0.00
4:00 AM	0.00	0.40	0.10
4:15 AM	0.00	0.30	0.00
4:30 AM	0.00	0.70	0.00
4:45 AM	0.00	0.50	0.00
5:00 AM	0.00	0.30	0.00
5:15 AM	0.00	0.30	0.00
5:30 AM	0.00	0.20	0.00
5:45 AM	0.00	0.30	0.00
6:00 AM	0.00	0.20	0.00
6:15 AM	0.00	0.30	0.00
6:30 AM	0.00	0.10	0.00
6:45 AM	0.00	0.30	0.00
7:00 AM	0.00	0.10	0.00
7:15 AM	0.00	0.10	0.00
7:30 AM	0.00	0.00	0.00
7:45 AM	0.00	0.10	0.00
8:00 AM	0.00	0.00	0.00
8:15 AM	0.00	0.00	0.00
8:30 AM	0.00	0.10	0.00
8:45 AM	0.00	0.00	0.00
9:00 AM	0.00	0.00	0.00
9:15 AM	0.00	0.10	0.00
9:30 AM	0.00	0.30	0.00
9:45 AM	0.00	0.50	0.00
10:00 AM	0.00	0.40	0.00
10:15 AM	0.00	0.50	0.00
10:30 AM	0.00	0.50	0.00
10:45 AM	0.00	0.20	0.00
11:00 AM	0.00	0.00	0.00
11:15 AM	0.00	0.10	0.00
11:30 AM	0.10	0.10	0.00
11:45 AM	0.00	0.50	0.00

NCDC Cerro Maravilla station

Rainfall (inches)

time	9/21/1998	9/22/1998	9/23/1998
12:00 PM	0.00	1.00	0.00
12:15 PM	0.00	0.50	0.00
12:30 PM	0.00	0.20	0.00
12:45 PM	0.00	0.20	0.00
1:00 PM	0.00	0.10	0.00
1:15 PM	0.00	0.00	0.00
1:30 PM	0.10	0.00	0.00
1:45 PM	0.00	0.00	0.00
2:00 PM	0.00	0.20	0.00
2:15 PM	0.10	0.10	0.00
2:30 PM	0.00	0.00	0.00
2:45 PM	0.10	0.00	0.00
3:00 PM	0.00	0.10	0.00
3:15 PM	0.10	0.10	0.00
3:30 PM	0.10	0.00	0.00
3:45 PM	0.10	0.00	0.00
4:00 PM	0.10	0.00	0.00
4:15 PM	0.10	0.00	0.00
4:30 PM	0.10	0.00	0.00
4:45 PM	0.10	0.00	0.00
5:00 PM	0.00	0.00	0.00
5:15 PM	0.10	0.10	0.00
5:30 PM	0.10	0.00	0.00
5:45 PM	0.10	0.00	0.00
6:00 PM	0.10	0.00	0.00
6:15 PM	0.10	0.00	0.00
6:30 PM	0.10	0.00	0.00
6:45 PM	0.10	0.00	0.00
7:00 PM	0.10	0.00	0.00
7:15 PM	0.30	0.00	0.00
7:30 PM	0.20	0.00	0.00
7:45 PM	0.10	0.00	0.00
8:00 PM	0.20	0.00	0.00
8:15 PM	0.10	0.00	0.00
8:30 PM	0.10	0.00	0.00
8:45 PM	0.20	0.10	0.00
9:00 PM	0.20	0.00	0.00
9:15 PM	0.20	0.00	0.00
9:30 PM	0.20	0.00	0.00
9:45 PM	0.00	0.00	0.00
10:00 PM	0.30	0.00	0.00
10:15 PM	0.30	0.00	0.00
10:30 PM	0.60	0.00	0.00
10:45 PM	0.40	0.20	0.00
11:00 PM	0.50	0.00	0.00
11:15 PM	0.20	0.00	0.00
11:30 PM	0.20	0.00	0.00
11:45 PM	0.10	0.00	0.00
SUM	6.30	13.30	0.10


Local Depth-Duration Relationship for Hurricane Georges event, September 1998. Adjuntas Substation
Fitted equation:
Prec. Depth = 6.5 x time 0.35
Precipitation Depth (in)
100.0
10.0
1.0
0.1
1.0
10.0
100.0
Time (hours)
Hurricane Georges, Adjuntas Sub-station
Fitted Eqn.
Eqn Points


1.0
0.8
0.6
0.4
0.2
0.0
Fraction of Total Rain
30
25
20
15
10
5
0
Rainfall Intensity (in/hr)
0
6
12
18
24
Time (hours)
Cumulative Adjuntas
Intensity in/hr

Adjuntas

This sheet presents the intensity-duration computations based on the fitted power equation.
Results from this sheet are used to compute time-sequential hyetograph values.

Intensity-Duration Relationship

Hour	Cumulative Depth by Eqn (decimal)	(inch)	Decimal Increment
0	0	0	0
0.25	0.202	4.001	0.202
0.5	0.258	5.100	0.056
0.75	0.297	5.877	0.039
1	0.329	6.500	0.031
1.25	0.356	7.028	0.027
1.5	0.379	7.491	0.023
1.75	0.400	7.906	0.021
2	0.419	8.285	0.019
2.25	0.437	8.633	0.018
2.5	0.453	8.958	0.016
2.75	0.468	9.261	0.015
3	0.483	9.548	0.014
3.25	0.497	9.819	0.014
3.5	0.510	10.077	0.013
3.75	0.522	10.323	0.012
4	0.534	10.559	0.012
4.25	0.546	10.786	0.011
4.5	0.557	11.004	0.011
4.75	0.567	11.214	0.011
5	0.578	11.417	0.010
5.25	0.587	11.614	0.010
5.5	0.597	11.804	0.010
5.75	0.606	11.989	0.009
6	0.616	12.169	0.009
6.25	0.624	12.344	0.009
6.5	0.633	12.515	0.009
6.75	0.641	12.681	0.008
7	0.650	12.844	0.008
7.25	0.658	13.003	0.008
7.5	0.666	13.158	0.008
7.75	0.673	13.310	0.008
8	0.681	13.458	0.008
8.25	0.688	13.604	0.007
8.5	0.695	13.747	0.007
8.75	0.702	13.887	0.007
9	0.709	14.025	0.007
9.25	0.716	14.160	0.007
9.5	0.723	14.293	0.007
9.75	0.730	14.423	0.007
10	0.736	14.552	0.006
10.25	0.742	14.678	0.006
10.5	0.749	14.802	0.006
10.75	0.755	14.925	0.006
11	0.761	15.045	0.006
11.25	0.767	15.164	0.006
11.5	0.773	15.281	0.006
11.75	0.779	15.397	0.006
12	0.785	15.511	0.006
12.25	0.790	15.623	0.006
12.5	0.796	15.734	0.006
12.75	0.801	15.843	0.006
13	0.807	15.951	0.005
13.25	0.812	16.058	0.005
13.5	0.818	16.163	0.005
13.75	0.823	16.267	0.005
14	0.828	16.370	0.005
14.25	0.833	16.472	0.005
14.5	0.838	16.573	0.005
14.75	0.843	16.672	0.005
15	0.848	16.770	0.005
15.25	0.853	16.868	0.005
15.5	0.858	16.964	0.005
15.75	0.863	17.059	0.005
16	0.868	17.154	0.005
16.25	0.872	17.247	0.005
16.5	0.877	17.339	0.005
16.75	0.882	17.431	0.005
17	0.886	17.521	0.005
17.25	0.891	17.611	0.005
17.5	0.895	17.700	0.004
17.75	0.900	17.788	0.004
18	0.904	17.876	0.004
18.25	0.909	17.962	0.004
18.5	0.913	18.048	0.004
18.75	0.917	18.133	0.004
19	0.921	18.217	0.004
19.25	0.926	18.301	0.004
19.5	0.930	18.383	0.004
19.75	0.934	18.466	0.004
20	0.938	18.547	0.004
20.25	0.942	18.628	0.004
20.5	0.946	18.708	0.004
20.75	0.950	18.788	0.004
21	0.954	18.866	0.004
21.25	0.958	18.945	0.004
21.5	0.962	19.022	0.004
21.75	0.966	19.100	0.004
22	0.970	19.176	0.004
22.25	0.974	19.252	0.004
22.5	0.978	19.328	0.004
22.75	0.981	19.402	0.004
23	0.985	19.477	0.004
23.25	0.989	19.551	0.004
23.5	0.993	19.624	0.004
23.75	0.996	19.697	0.004
24	1.000	19.769	0.004

Adjuntos

Sequential Depth Hyetograph - Distribution #1 (15 minute)

Hour	Ordered Intensities	Incremental Depth (decimal)	Incremental Depth (inches)	Cumulative Depth (decimal)	Cumulative Depth (inches)	Intensity (inch/hr)
0		0	0	0	0	
0.25	23.75	0.004	0.073	0.004	0.073	0.291
0.5	23.25	0.004	0.074	0.007	0.147	0.295
0.75	22.75	0.004	0.075	0.011	0.222	0.300
1	22.25	0.004	0.076	0.015	0.298	0.304
1.25	21.75	0.004	0.077	0.019	0.375	0.309
1.5	21.25	0.004	0.078	0.023	0.453	0.313
1.75	20.75	0.004	0.080	0.027	0.533	0.318
2	20.25	0.004	0.081	0.031	0.613	0.323
2.25	19.75	0.004	0.082	0.035	0.695	0.329
2.5	19.25	0.004	0.084	0.039	0.779	0.334
2.75	18.75	0.004	0.085	0.044	0.864	0.340
3	18.25	0.004	0.087	0.048	0.951	0.346
3.25	17.75	0.004	0.088	0.053	1.039	0.352
3.5	17.25	0.005	0.090	0.057	1.128	0.359
3.75	16.75	0.005	0.092	0.062	1.220	0.366
4	16.25	0.005	0.093	0.066	1.313	0.373
4.25	15.75	0.005	0.095	0.071	1.408	0.381
4.5	15.25	0.005	0.097	0.076	1.506	0.389
4.75	14.75	0.005	0.099	0.081	1.605	0.398
5	14.25	0.005	0.102	0.086	1.707	0.407
5.25	13.75	0.005	0.104	0.092	1.811	0.417
5.5	13.25	0.005	0.107	0.097	1.918	0.427
5.75	12.75	0.006	0.109	0.103	2.027	0.438
6	12.25	0.006	0.112	0.108	2.140	0.449
6.25	11.75	0.006	0.115	0.114	2.255	0.462
6.5	11.25	0.006	0.119	0.120	2.374	0.475
6.75	10.75	0.006	0.122	0.126	2.496	0.490
7	10.25	0.006	0.126	0.133	2.623	0.505
7.25	9.75	0.007	0.131	0.139	2.753	0.522
7.5	9.25	0.007	0.135	0.146	2.888	0.541
7.75	8.75	0.007	0.140	0.153	3.028	0.561
8	8.25	0.007	0.146	0.161	3.174	0.583
8.25	7.75	0.008	0.152	0.168	3.328	0.608
8.5	7.25	0.008	0.159	0.176	3.485	0.635
8.75	6.75	0.008	0.166	0.185	3.651	0.668
9	6.25	0.009	0.175	0.194	3.820	0.700
9.25	5.75	0.009	0.185	0.203	4.011	0.740
9.5	5.25	0.010	0.197	0.213	4.208	0.787
9.75	4.75	0.011	0.210	0.223	4.418	0.841
10	4.25	0.011	0.228	0.235	4.645	0.906
10.25	3.75	0.012	0.246	0.247	4.891	0.985
10.5	3.25	0.014	0.271	0.261	5.162	1.085
10.75	2.75	0.015	0.304	0.276	5.468	1.215
11	2.25	0.018	0.349	0.294	5.815	1.395
11.25	1.75	0.021	0.415	0.315	6.230	1.661
11.5	1.25	0.027	0.528	0.342	6.758	2.112
11.75	0.75	0.039	0.778	0.381	7.536	3.110
12	0.25	0.202	4.001	0.584	11.537	16.005
12.25	0.5	0.055	1.099	0.639	12.636	4.394
12.5	1	0.031	0.623	0.671	13.258	2.490
12.75	1.5	0.023	0.463	0.694	13.721	1.852
13	2	0.019	0.378	0.713	14.099	1.513
13.25	2.5	0.015	0.324	0.730	14.424	1.297
13.5	3	0.014	0.286	0.744	14.710	1.146
13.75	3.5	0.013	0.258	0.757	14.968	1.032
14	4	0.012	0.236	0.769	15.204	0.943
14.25	4.5	0.011	0.218	0.780	15.422	0.872
14.5	5	0.010	0.203	0.790	15.625	0.813
14.75	5.5	0.010	0.191	0.800	15.816	0.763
15	6	0.009	0.180	0.809	15.996	0.720
15.25	6.5	0.009	0.171	0.818	16.180	0.682
15.5	7	0.008	0.152	0.826	16.329	0.650
15.75	7.5	0.008	0.155	0.834	16.484	0.621
16	8	0.006	0.149	0.841	16.633	0.595
16.25	8.5	0.007	0.143	0.848	16.775	0.572
16.5	9	0.007	0.138	0.856	16.913	0.550
16.75	9.5	0.007	0.133	0.862	17.048	0.531
17	10	0.006	0.128	0.869	17.174	0.514
17.25	10.5	0.006	0.124	0.875	17.299	0.497
17.5	11	0.006	0.121	0.881	17.419	0.482
17.75	11.5	0.006	0.117	0.887	17.536	0.468
18	12	0.006	0.114	0.893	17.650	0.455
18.25	12.5	0.006	0.111	0.898	17.761	0.443
18.5	13	0.005	0.108	0.904	17.869	0.432
18.75	13.5	0.005	0.105	0.909	17.974	0.422
19	14	0.005	0.103	0.914	18.077	0.412
19.25	14.5	0.005	0.101	0.920	18.178	0.402
19.5	15	0.005	0.098	0.924	18.276	0.393
19.75	15.5	0.005	0.098	0.929	18.373	0.385
20	16	0.005	0.094	0.934	18.467	0.377
20.25	16.5	0.005	0.092	0.939	18.559	0.370
20.5	17	0.005	0.091	0.943	18.650	0.362
20.75	17.5	0.004	0.089	0.948	18.739	0.356
21	18	0.004	0.087	0.952	18.826	0.349
21.25	18.5	0.004	0.086	0.957	18.912	0.343
21.5	19	0.004	0.084	0.961	18.996	0.337
21.75	19.5	0.004	0.083	0.965	19.079	0.331
22	20	0.004	0.081	0.969	19.160	0.326
22.25	20.5	0.004	0.080	0.973	19.240	0.321
22.5	21	0.004	0.079	0.977	19.319	0.316
22.75	21.5	0.004	0.078	0.981	19.397	0.311
23	22	0.004	0.077	0.985	19.474	0.306
23.25	22.5	0.004	0.075	0.989	19.549	0.302
23.5	23	0.004	0.074	0.993	19.623	0.297
23.75	23.5	0.004	0.073	0.996	19.697	0.293
24	24	0.004	0.072	1.000	19.769	0.289

Hour	Cumulative depth (decimal)	Cumulative depth (inches)
0	0	
0.010417	0.0038634	
0.020833	0.0074183	
0.03125	0.0112067	
0.041667	0.0150505	
0.052083	0.0189519	
0.0625	0.022913	
0.072917	0.0269363	
0.083333	0.0310242	
0.09375	0.0351798	
0.104167	0.0394053	
0.114583	0.0437044	
0.125	0.0480802	
0.135417	0.0525363	
0.145833	0.0570765	
0.15625	0.061705	
0.166667	0.0664264	
0.177083	0.0712454	
0.1875	0.0761673	
0.197917	0.081198	
0.208333	0.0863437	
0.21875	0.0916114	
0.229167	0.0970087	
0.239583	0.102544	
0.25	0.1082267	
0.260417	0.114067	
0.270833	0.1200787	
0.28125	0.1262687	
0.291667	0.1326578	
0.302083	0.1392607	
0.3125	0.1460966	
0.322917	0.1531876	
0.333333	0.1605593	
0.34375	0.1682417	
0.354167	0.1762705	
0.364583	0.1846881	
0.375	0.1935464	
0.385417	0.2029089	
0.395833	0.2128556	
0.40625	0.2234889	
0.416667	0.2349435	
0.427083	0.2474023	
0.4375	0.2611239	
0.447917	0.276494	
0.458333	0.2941308	
0.46875	0.3151387	
0.479167	0.3418451	
0.489583	0.381179	
0.5	0.5835785	
0.510417	0.6391488	
0.520833	0.6706407	
0.53125	0.6940658	
0.541667	0.7132008	
0.552083	0.7296055	
0.5625	0.7440921	
0.572917	0.7571437	
0.583333	0.7690738	
0.59375	0.7800982	
0.604167	0.7903737	
0.614583	0.8000171	
0.625	0.8091188	
0.635417	0.8177494	
0.645833	0.8259668	
0.65625	0.8338175	
0.666667	0.8413405	
0.677083	0.8485684	
0.6875	0.8555289	
0.697917	0.8622457	
0.708333	0.8687395	
0.71875	0.8750261	
0.729167	0.8811272	
0.739583	0.8870507	
0.75	0.8928108	
0.760417	0.8984185	
0.770833	0.9038837	
0.78125	0.9092152	
0.791667	0.914421	
0.802083	0.9195084	
0.8125	0.924484	
0.822917	0.9293538	
0.833333	0.9341233	
0.84375	0.9387978	
0.854167	0.9433815	
0.864583	0.9478791	
0.875	0.9522946	
0.885417	0.9566316	
0.895833	0.9608936	
0.90625	0.9650838	
0.916667	0.9692051	
0.927083	0.9732604	
0.9375	0.9772523	
0.947917	0.9811833	
0.958333	0.9850556	
0.96875	0.9888714	
0.979167	0.9926328	
0.989583	0.9963418	
1	1	

Precipitation

18.5 RGA Ulvado	12.3 Rio Tanama at Esperanza
0.0000	0.0000
0.0681	0.0453
0.0691	0.0459
0.0701	0.0466
0.0711	0.0473
0.0722	0.0480
0.0733	0.0487
0.0744	0.0495
0.0756	0.0503
0.0768	0.0511
0.0782	0.0520
0.0795	0.0529
0.0810	0.0538
0.0824	0.0548
0.0840	0.0558
0.0855	0.0569
0.0873	0.0581
0.0892	0.0593
0.0911	0.0605
0.0931	0.0619
0.0952	0.0633
0.0975	0.0648
0.0999	0.0664
0.1024	0.0681
0.1051	0.0699
0.1080	0.0718
0.1112	0.0739
0.1146	0.0762
0.1182	0.0786
0.1222	0.0812
0.1265	0.0841
0.1312	0.0872
0.1364	0.0907
0.1421	0.0945
0.1485	0.0988
0.1557	0.1035
0.1639	0.1090
0.1732	0.1152
0.1840	0.1223
0.1987	0.1308
0.2119	0.1409
0.2305	0.1532
0.2539	0.1688
0.2843	0.1891
0.3263	0.2168
0.3886	0.2584
0.4941	0.3285
0.7277	0.4836
1.7444	2.4695
1.0281	0.8835
0.5626	0.3874
0.4334	0.2881
0.3540	0.2354
0.3035	0.2018
0.2680	0.1782
0.2415	0.1505
0.2207	0.1487
0.2040	0.1355
0.1901	0.1204
0.1784	0.1188
0.1684	0.1119
0.1597	0.1062
0.1520	0.1011
0.1452	0.0985
0.1392	0.0925
0.1337	0.0889
0.1288	0.0858
0.1243	0.0828
0.1201	0.0799
0.1163	0.0773
0.1128	0.0750
0.1096	0.0729
0.1066	0.0708
0.1037	0.0690
0.1011	0.0672
0.0986	0.0656
0.0963	0.0640
0.0941	0.0626
0.0920	0.0612
0.0901	0.0598
0.0882	0.0587
0.0865	0.0575
0.0848	0.0564
0.0832	0.0553
0.0817	0.0543
0.0802	0.0533
0.0788	0.0524
0.0775	0.0515
0.0762	0.0507
0.0750	0.0499
0.0739	0.0491
0.0727	0.0484
0.0718	0.0478
0.0708	0.0469
0.0696	0.0463
0.0686	0.0456
0.0677	0.0450
18.5	12.3

	NCDC Adjuntas substation Rainfall (inches)			NCDC Adjuntas substation Rainfall (inches)	
time	9/21/1998	9/22/1998	time	9/21/1998	9/22/1998
12:00 AM	0.00	0.90	12:00 PM	0.00	0.00
12:15 AM	0.00	0.50	12:15 PM	0.00	0.00
12:30 AM	0.00	0.40	12:30 PM	0.00	0.00
12:45 AM	0.00	0.50	12:45 PM	0.00	0.00
1:00 AM	0.00	0.70	1:00 PM	0.00	0.00
1:15 AM	0.00	0.60	1:15 PM	0.10	0.00
1:30 AM	0.00	0.50	1:30 PM	0.00	0.00
1:45 AM	0.00	0.20	1:45 PM	0.00	0.00
2:00 AM	0.00	0.30	2:00 PM	0.00	0.00
2:15 AM	0.00	0.40	2:15 PM	0.00	0.00
2:30 AM	0.00	0.40	2:30 PM	0.00	0.20
2:45 AM	0.00	1.20	2:45 PM	0.00	0.00
3:00 AM	0.00	1.10	3:00 PM	0.10	0.00
3:15 AM	0.00	0.60	3:15 PM	0.00	0.00
3:30 AM	0.00	1.10	3:30 PM	0.00	0.00
3:45 AM	0.00	0.40	3:45 PM	0.00	0.10
4:00 AM	0.00	0.30	4:00 PM	0.10	0.00
4:15 AM	0.00	0.30	4:15 PM	0.00	0.00
4:30 AM	0.00	0.20	4:30 PM	0.00	0.00
4:45 AM	0.00	0.10	4:45 PM	0.10	0.00
5:00 AM	0.00	0.20	5:00 PM	0.00	0.00
5:15 AM	0.00	0.10	5:15 PM	0.10	0.10
5:30 AM	0.00	0.10	5:30 PM	0.00	0.00
5:45 AM	0.00	0.20	5:45 PM	0.00	0.10
6:00 AM	0.00	0.00	6:00 PM	0.10	0.00
6:15 AM	0.00	0.30	6:15 PM	0.00	0.20
6:30 AM	0.00	0.20	6:30 PM	0.10	0.00
6:45 AM	0.00	0.30	6:45 PM	0.10	0.00
7:00 AM	0.00	0.40	7:00 PM	0.20	0.00
7:15 AM	0.00	0.30	7:15 PM	0.10	0.00
7:30 AM	0.00	0.10	7:30 PM	0.10	0.00
7:45 AM	0.00	0.10	7:45 PM	0.10	0.00
8:00 AM	0.00	0.10	8:00 PM	0.20	0.00
8:15 AM	0.00	0.00	8:15 PM	0.10	0.00
8:30 AM	0.00	0.20	8:30 PM	0.20	0.00
8:45 AM	0.00	0.20	8:45 PM	0.10	0.00
9:00 AM	0.00	0.10	9:00 PM	0.10	0.00
9:15 AM	0.00	0.10	9:15 PM	0.20	0.00
9:30 AM	0.00	0.20	9:30 PM	0.10	0.00
9:45 AM	0.00	0.10	9:45 PM	0.10	0.00
10:00 AM	0.00	0.00	10:00 PM	0.00	0.10
10:15 AM	0.10	0.10	10:15 PM	0.00	0.00
10:30 AM	0.00	0.10	10:30 PM	0.00	0.00
10:45 AM	0.00	0.30	10:45 PM	0.00	0.00
11:00 AM	0.00	0.10	11:00 PM	0.10	0.00
11:15 AM	0.00	0.00	11:15 PM	0.00	0.00
11:30 AM	0.00	0.00	11:30 PM	0.00	0.00
11:45 AM	0.00	0.10	11:45 PM	0.80	0.00
			SUM	3.40	15.50

Station	ADJUNTAS SUBSTN	Parameter	Prcp	% Coverage	99
PO Code	PR	Latitude	N18:10:29	Begin M/Yr	01/1970
Stn ID	61	Longitude	W066:47:52	End M/Yr	12/2006
County	PONCE	Elevation	1830	# Record Years	37
Years	1970-91,93-97,99-2005				

Station	DOS BOCAS	Parameter	Prcp	% Coverage	97
PO Code	PR	Latitude	N18:20:10	Begin M/Yr	01/1937
Stn ID	3431	Longitude	W066:40:00	End M/Yr	12/2006
County	ARECIBO	Elevation	200	# Record Years	70
Years	1937-45,47-48,52-63,66-69,71-76,79-96,98,2000-04				

Station	CERRO MARAVILLA	Parameter	Prcp	% Coverage	93
PO Code	PR	Latitude	N18:09:17	Begin M/Yr	04/1969
Stn ID	2336	Longitude	W066:33:43	End M/Yr	12/2006
County	PONCE	Elevation	4002	# Record Years	38
Years	1970-79,81-83,85-86,88-91,2004				

Puerto Rico

HYDROLOGIC-HYDRAULIC STUDY
RÍO GRANDE DE ARECIBO,
RENEWABLE POWER GENERATION AND
RESOURCE RECOVERY FACILITY,
ARECIBO, PUERTO RICO

Appendix D:

USGS gage 50024950, Río Grande de Arecibo below Utuado, data for Hurricane George

GLM MORRIS ENGINEERING

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY-PUERTO RICO, CARIBBEAN DISTRICT 03/14/2000

STATION NUMBER 50024950 RIO GRANDE DE ARECIBO BLW UTUADO, P.R. STREAM SOURCE AGENCY USGS
LATITUDE 181807 LONGITUDE 0664215 DRAINAGE AREA 65.62 DATUM 295.30 STATE 72 COUNTY 141
DISCHARGE FROM DCP, IN CFS COMPUTED UNIT VALUES (INSTANTANEOUS)

PROVISIONAL DATA — SEPTEMBER 21, 1998 — SUBJECT TO REVISION

TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
00:15:00	332	05:45:00	308	10:45:00	312	16:15:00	339	20:35:00	817
00:30:00	329	06:00:00	295	11:00:00	325	16:30:00	336	20:45:00	865
00:45:00	325	06:15:00	292	11:15:00	322	16:40:00	329	20:55:00	877
01:00:00	332	06:30:00	295	11:30:00	312	16:45:00	336	21:00:00	871
01:15:00	332	06:40:00	308	11:45:00	305	17:00:00	350	21:05:00	884
01:30:00	329	06:45:00	305	12:00:00	305	17:15:00	372	21:15:00	915
01:45:00	329	07:00:00	308	12:15:00	305	17:30:00	388	21:25:00	993
02:00:00	322	07:15:00	312	12:30:00	305	17:35:00	396	21:30:00	1030
02:15:00	322	07:30:00	305	12:45:00	305	18:15:00	485	21:35:00	1040
02:30:00	312	07:45:00	299	13:00:00	315	18:25:00	523	21:40:00	1080
02:45:00	315	08:00:00	305	13:15:00	325	18:30:00	533	21:45:00	993
03:00:00	312	08:15:00	302	13:30:00	343	18:45:00	538	21:55:00	1100
03:15:00	315	08:30:00	302	13:45:00	365	19:00:00	558	22:30:00	1460
03:30:00	308	08:45:00	302	14:00:00	380	19:15:00	574	22:45:00	1760
03:45:00	308	09:00:00	302	14:15:00	357	19:25:00	563	22:50:00	1950
04:00:00	308	09:15:00	302	14:30:00	350	19:30:00	600	23:00:00	2200
04:15:00	315	09:30:00	302	14:45:00	343	19:45:00	658	23:15:00	3130
04:30:00	315	09:45:00	308	15:00:00	339	19:50:00	695	23:30:00	3650
04:45:00	308	09:50:00	305	15:15:00	343	20:00:00	623	23:45:00	4430
05:00:00	315	10:00:00	299	15:30:00	339	20:10:00	640	23:50:00	5420
05:15:00	308	10:15:00	299	15:45:00	329	20:15:00	682	23:55:00	5590
05:30:00	312	10:30:00	305	16:00:00	336	20:30:00	800	24:00:00	6070

PROVISIONAL DATA — SEPTEMBER 22, 1998 — SUBJECT TO REVISION

00:07:39	21000	04:24:21	60400	09:24:15	11200	14:26:48	8510	19:25:21	6500
00:10:03	21200	04:38:54	49600	09:38:54	10400	14:37:54	9190	19:42:24	6310
00:24:30	31600	04:54:06	40600	09:55:36	10300	14:54:57	11100	19:56:03	6040
00:39:06	39900	05:09:39	34500	10:10:15	10000	15:07:45	12600	20:09:42	5820
00:41:33	40200	05:24:33	28400	10:25:54	9830	15:24:48	12800	20:25:03	5490
00:55:27	42300	05:39:24	24200	10:39:30	9440	15:40:09	11500	20:37:51	5310
01:10:45	40500	05:54:57	22100	10:54:09	9070	15:53:48	10700	20:54:03	4970
01:25:00	36100	06:07:45	20500	11:11:54	8730	16:10:00	9430	21:10:15	4740
01:41:21	37100	06:24:30	19800	11:23:24	8450	16:22:48	8590	21:24:45	4600
01:54:33	40400	06:43:18	19100	11:40:06	8280	16:40:42	8070	21:40:06	4530
02:09:09	40400	06:53:45	19000	11:52:39	8100	16:55:12	7840	21:55:27	4510
02:23:45	40900	07:08:24	19600	12:08:21	8330	17:08:51	7320	22:09:06	4420
02:37:18	42400	07:25:06	20700	12:21:54	8670	17:23:21	7300	22:26:12	4260
02:55:21	46500	07:37:39	20200	12:38:39	8970	17:37:51	6990	22:39:51	4120
03:09:18	49300	07:54:21	19300	12:54:18	9070	17:54:54	6770	22:55:12	3990
03:21:06	55800	08:09:00	18500	13:07:54	9130	18:08:33	6610	23:10:33	3900
03:34:30	67400	08:21:33	17300	13:23:36	8820	18:24:48	6520	23:24:12	3850
03:38:30	70900	08:38:15	15500	13:41:21	8730	18:42:42	6480	23:37:51	3680
03:55:00	76400	08:55:00	13700	13:56:06	8390	18:54:39	6450	23:53:12	3740
04:09:30	67800	09:08:33	12200	14:10:36	8320	19:08:18	6520		

SEPTEMBER 23, 1998
There are no unit-values for this date

SEPTEMBER 24, 1998
There are no unit-values for this date

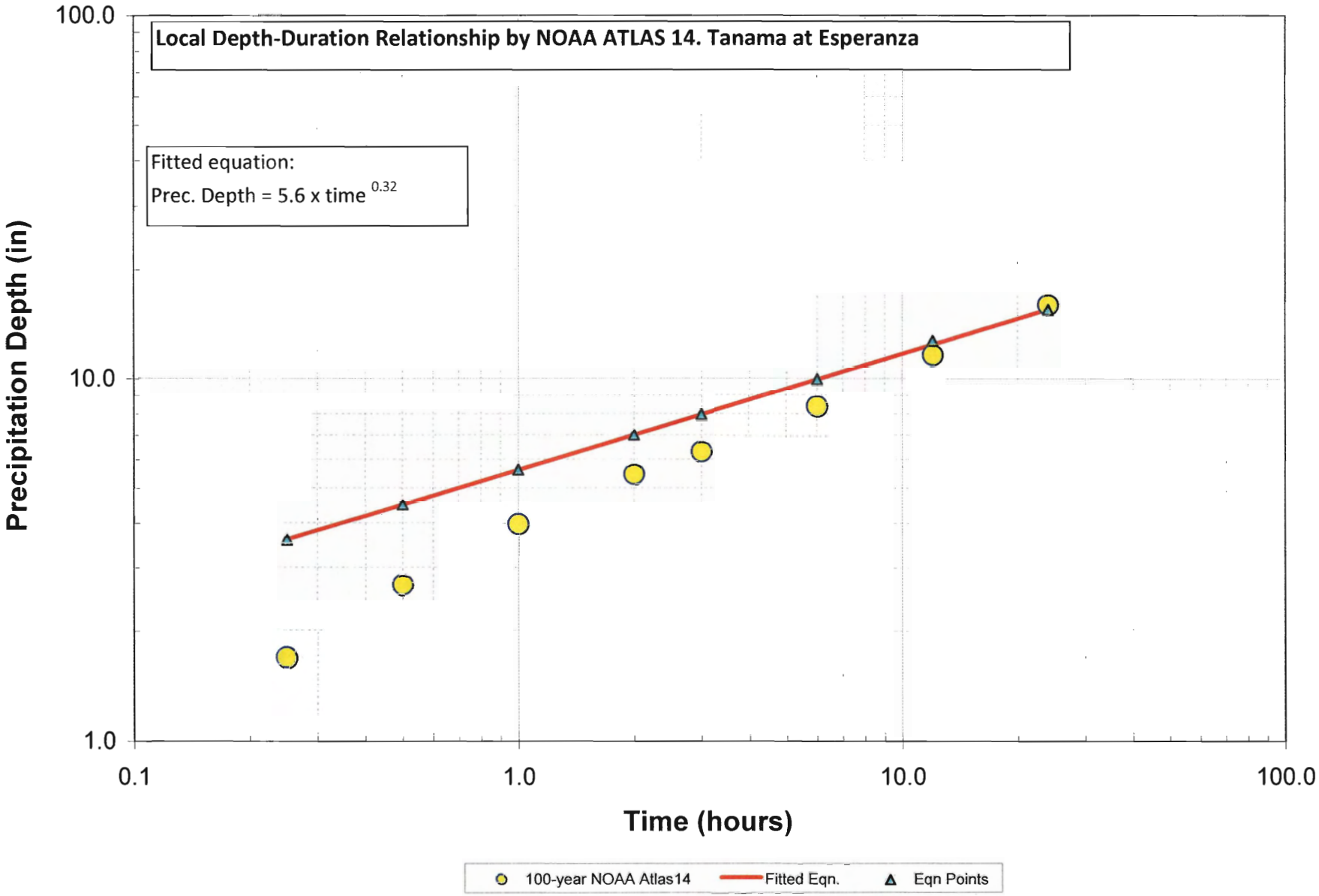
Puerto Rico

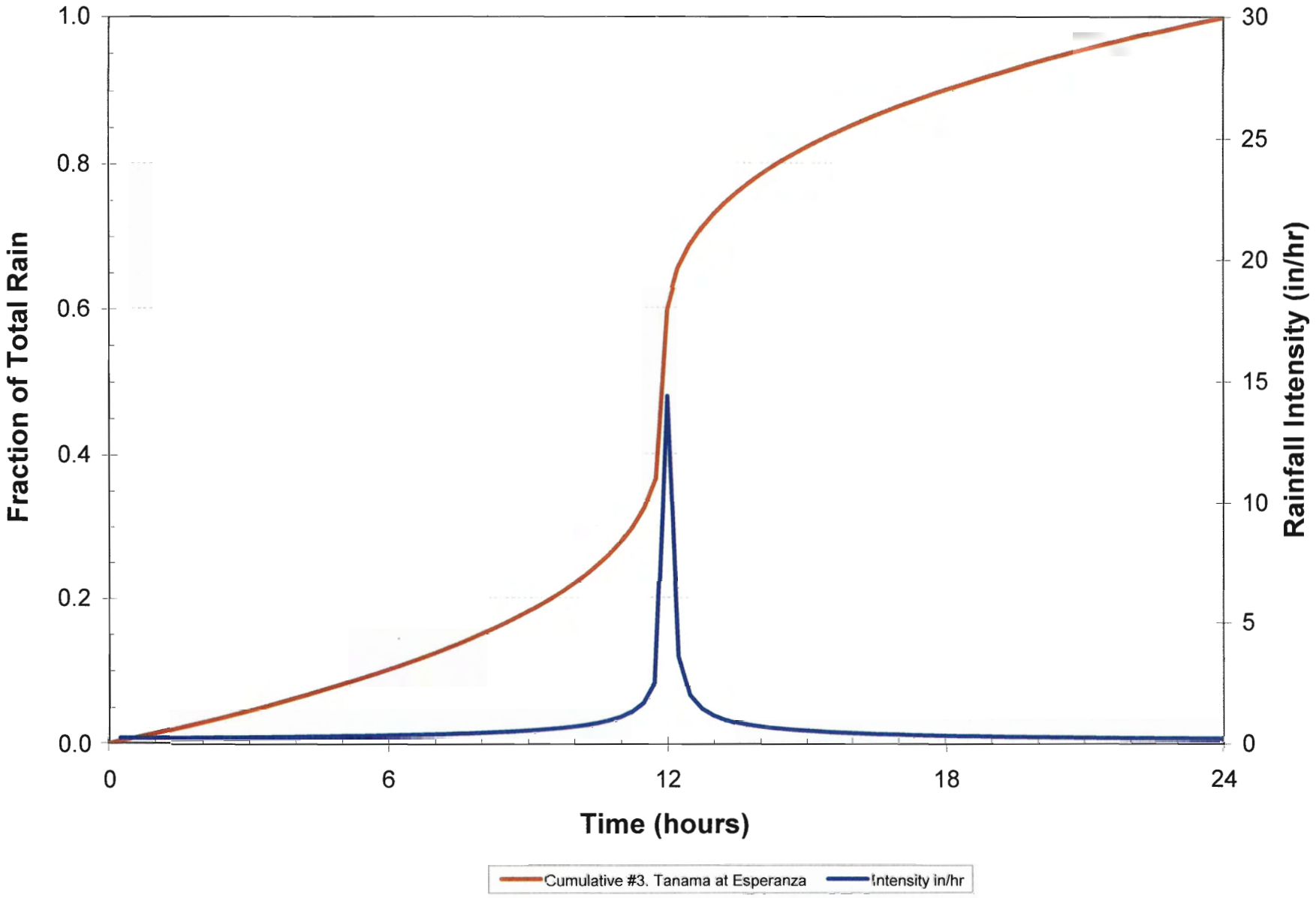
HYDROLOGIC-HYDRAULIC STUDY
RÍO GRANDE DE ARECIBO,
RENEWABLE POWER GENERATION AND
RESOURCE RECOVERY FACILITY,
ARECIBO, PUERTO RICO

Appendix E:

NOAA Atlas-14 Rainfall Data and Rainfall Distribution Calculations

GLM MORRIS ENGINEERING


Local Depth-Duration Relationship by NOAA ATLAS 14. Tanama at Esperanza
Fitted equation:
Prec. Depth = 5.6 x time 0.32
Precipitation Depth (in)
100.0
10.0
1.0
0.1
1.0
10.0
100.0
Time (hours)
100-year NOAA Atlas14
Fitted Eqn.
Eqn Points


1.0
0.8
0.6
0.4
0.2
0.0
Fraction of Total Rain
30
25
20
15
10
5
0
Rainfall Intensity (in/hr)
0
6
12
18
24
Time (hours)
Cumulative #3. Tanama at Esperanza
Intensity in/hr

Sequential Depth Hyetograph - Distribution #1 (15 minute)

Hour	Ordered Intensities	Incremental Depth (decimal)	Incremental Depth (inches)	Cumulative Depth (decimal)	Cumulative Depth (inches)	Intensity (inch/hr)
0		0	0	0	0	
0.25	23.75	0.003	0.052	0.003	0.052	0.209
0.5	23.25	0.003	0.053	0.007	0.105	0.212
0.75	22.75	0.003	0.054	0.010	0.159	0.215
1	22.25	0.004	0.055	0.014	0.213	0.218
1.25	21.75	0.004	0.055	0.017	0.269	0.222
1.5	21.25	0.004	0.056	0.021	0.325	0.225
1.75	20.75	0.004	0.057	0.025	0.382	0.229
2	20.25	0.004	0.058	0.028	0.440	0.233
2.25	19.75	0.004	0.059	0.032	0.500	0.237
2.5	19.25	0.004	0.060	0.036	0.560	0.241
2.75	18.75	0.004	0.061	0.040	0.621	0.245
3	18.25	0.004	0.062	0.044	0.684	0.250
3.25	17.75	0.004	0.064	0.048	0.747	0.255
3.5	17.25	0.004	0.065	0.052	0.812	0.260
3.75	16.75	0.004	0.066	0.057	0.878	0.265
4	16.25	0.004	0.068	0.061	0.946	0.271
4.25	15.75	0.004	0.069	0.066	1.015	0.276
4.5	15.25	0.005	0.071	0.070	1.086	0.283
4.75	14.75	0.005	0.072	0.075	1.158	0.289
5	14.25	0.005	0.074	0.080	1.232	0.296
5.25	13.75	0.005	0.076	0.084	1.308	0.303
5.5	13.25	0.005	0.078	0.090	1.386	0.311
5.75	12.75	0.005	0.080	0.095	1.466	0.320
6	12.25	0.005	0.082	0.100	1.548	0.328
6.25	11.75	0.005	0.084	0.105	1.632	0.338
6.5	11.25	0.006	0.087	0.111	1.719	0.348
6.75	10.75	0.006	0.090	0.117	1.809	0.359
7	10.25	0.006	0.093	0.123	1.902	0.371
7.25	9.75	0.006	0.096	0.129	1.998	0.384
7.5	9.25	0.006	0.100	0.135	2.098	0.398
7.75	8.75	0.007	0.104	0.142	2.201	0.414
8	8.25	0.007	0.108	0.149	2.309	0.431
8.25	7.75	0.007	0.113	0.156	2.422	0.450
8.5	7.25	0.008	0.118	0.164	2.539	0.471
8.75	6.75	0.008	0.124	0.172	2.663	0.495
9	6.25	0.008	0.131	0.180	2.794	0.523
9.25	5.75	0.009	0.138	0.189	2.932	0.554
9.5	5.25	0.010	0.147	0.199	3.080	0.590
9.75	4.75	0.010	0.158	0.209	3.238	0.633
10	4.25	0.011	0.171	0.220	3.409	0.684
10.25	3.75	0.012	0.187	0.232	3.596	0.747
10.5	3.25	0.013	0.206	0.246	3.802	0.826
10.75	2.75	0.015	0.233	0.261	4.035	0.930
11	2.25	0.017	0.269	0.278	4.303	1.074
11.25	1.75	0.021	0.322	0.299	4.625	1.290
11.5	1.25	0.027	0.414	0.326	5.040	1.658
11.75	0.75	0.040	0.621	0.366	5.661	2.486
12	0.25	0.232	3.594	0.598	9.255	14.374
12.25	0.5	0.058	0.892	0.655	10.147	3.570
12.5	1	0.032	0.493	0.687	10.640	1.970
12.75	1.5	0.023	0.361	0.711	11.001	1.445
13	2	0.019	0.292	0.729	11.294	1.170
13.25	2.5	0.016	0.249	0.746	11.543	0.996
13.5	3	0.014	0.219	0.760	11.761	0.874
13.75	3.5	0.013	0.196	0.772	11.957	0.784
14	4	0.012	0.178	0.784	12.136	0.714
14.25	4.5	0.011	0.164	0.794	12.300	0.657
14.5	5	0.010	0.153	0.804	12.452	0.610
14.75	5.5	0.009	0.143	0.813	12.595	0.571
15	6	0.009	0.134	0.822	12.730	0.538
15.25	6.5	0.008	0.127	0.830	12.857	0.509
15.5	7	0.008	0.121	0.838	12.977	0.483
15.75	7.5	0.007	0.115	0.846	13.093	0.461
16	8	0.007	0.110	0.853	13.203	0.440
16.25	8.5	0.007	0.106	0.860	13.308	0.422
16.5	9	0.007	0.102	0.866	13.410	0.406
16.75	9.5	0.006	0.098	0.872	13.508	0.391
17	10	0.006	0.094	0.879	13.602	0.378
17.25	10.5	0.006	0.091	0.884	13.693	0.365
17.5	11	0.006	0.088	0.890	13.782	0.354
17.75	11.5	0.006	0.086	0.896	13.867	0.343
18	12	0.005	0.083	0.901	13.951	0.333
18.25	12.5	0.005	0.081	0.906	14.032	0.324
18.5	13	0.005	0.079	0.911	14.111	0.315
18.75	13.5	0.005	0.077	0.916	14.187	0.307
19	14	0.005	0.075	0.921	14.262	0.300
19.25	14.5	0.005	0.073	0.926	14.335	0.293
19.5	15	0.005	0.071	0.930	14.407	0.286
19.75	15.5	0.005	0.070	0.935	14.477	0.279
20	16	0.004	0.068	0.939	14.545	0.273
20.25	16.5	0.004	0.067	0.944	14.612	0.268
20.5	17	0.004	0.066	0.948	14.678	0.262
20.75	17.5	0.004	0.064	0.952	14.742	0.257
21	18	0.004	0.063	0.956	14.805	0.252
21.25	18.5	0.004	0.062	0.960	14.867	0.248
21.5	19	0.004	0.061	0.964	14.928	0.243
21.75	19.5	0.004	0.060	0.968	14.987	0.239
22	20	0.004	0.059	0.972	15.046	0.235
22.25	20.5	0.004	0.058	0.975	15.104	0.231
22.5	21	0.004	0.057	0.979	15.160	0.227
22.75	21.5	0.004	0.056	0.983	15.216	0.223
23	22	0.004	0.055	0.986	15.271	0.220
23.25	22.5	0.003	0.054	0.990	15.325	0.217
23.5	23	0.003	0.053	0.993	15.379	0.213
23.75	23.5	0.003	0.053	0.997	15.431	0.210
24	24	0.003	0.052	1.000	15.483	0.207

Hour	Cumulative depth (decimal)
0	0
0.010417	0.0033692
0.020833	0.0067878
0.03125	0.0102576
0.041667	0.0137806
0.052083	0.0173587
0.0625	0.0209942
0.072917	0.0246894
0.083333	0.0284468
0.09375	0.032269
0.104167	0.0361589
0.114583	0.0401195
0.125	0.044154
0.135417	0.0482661
0.145833	0.0524594
0.15625	0.0567381
0.166667	0.0611065
0.177083	0.0655696
0.1875	0.0701324
0.197917	0.0748008
0.208333	0.0795809
0.21875	0.0844796
0.229167	0.0895044
0.239583	0.0946637
0.25	0.0999668
0.260417	0.1054239
0.270833	0.1110467
0.28125	0.116848
0.291667	0.1228427
0.302083	0.1290475
0.3125	0.1354815
0.322917	0.1421668
0.333333	0.1491292
0.34375	0.156399
0.354167	0.164012
0.364583	0.1720112
0.375	0.1804489
0.385417	0.1893898
0.395833	0.1989151
0.40625	0.2091293
0.416667	0.2201704
0.427083	0.2322261
0.4375	0.245563
0.447917	0.2605807
0.458333	0.2779229
0.46875	0.2987454
0.479167	0.3255164
0.489583	0.3656571
0.5	0.5977561
0.510417	0.6553934
0.520833	0.687203
0.53125	0.7105409
0.541667	0.7294273
0.552083	0.7455041
0.5625	0.7596199
0.572917	0.7722763
0.583333	0.7837971
0.59375	0.7944049
0.604167	0.8042599
0.614583	0.8134815
0.625	0.8221618
0.635417	0.8303731
0.645833	0.8381732
0.65625	0.8456097
0.666667	0.8527217
0.677083	0.8595422
0.6875	0.8660988
0.697917	0.8724156
0.708333	0.8785131
0.71875	0.8844092
0.729167	0.8901195
0.739583	0.8956579
0.75	0.9010367
0.760417	0.9062667
0.770833	0.9113576
0.78125	0.9163184
0.791667	0.9211569
0.802083	0.9258803
0.8125	0.9304952
0.822917	0.9350074
0.833333	0.9394225
0.84375	0.9437455
0.854167	0.947981
0.864583	0.9521332
0.875	0.9562061
0.885417	0.9602032
0.895833	0.9641281
0.90625	0.9679837
0.916667	0.9717732
0.927083	0.9754992
0.9375	0.9791642
0.947917	0.9827707
0.958333	0.986321
0.96875	0.9898171
0.979167	0.9932611
0.989583	0.9966548
1	1

Rio Tanama at Esperanza			
8.67	13.47	15.95	22.9
10-Yr	50-yr	100-yr	500-yr
0	0	0	0
0.029211305	0.045383655	0.053739368	0.077155582
0.029639326	0.046048641	0.054526787	0.078286108
0.030083182	0.046738231	0.055343339	0.079458462
0.03054383	0.047453909	0.056190783	0.080675169
0.031022307	0.048197287	0.057071026	0.081938965
0.031519739	0.048970114	0.057986141	0.083252829
0.032037354	0.049774297	0.058938384	0.084619999
0.032576489	0.050611915	0.059930219	0.086044013
0.033138609	0.051485243	0.060964338	0.087528735
0.033725317	0.052396772	0.062043691	0.089078403
0.034338375	0.05334924	0.063171521	0.090697669
0.034979723	0.05434566	0.064351394	0.092391657
0.035651503	0.055389359	0.065587251	0.094166022
0.036356084	0.05648402	0.066883453	0.096027027
0.037096099	0.057633731	0.068244841	0.097981621
0.037874477	0.058843046	0.069676806	0.100037546
0.038694493	0.06011705	0.071185371	0.102203448
0.039559817	0.061461446	0.072777287	0.104489021
0.040474578	0.062882649	0.074460153	0.106905172
0.041443442	0.064387907	0.076242548	0.109464223
0.042471698	0.06598544	0.078134207	0.112180147
0.043565375	0.067684614	0.08014622	0.115068868
0.044731375	0.06949615	0.082291284	0.118148615
0.045977641	0.071432391	0.084584011	0.121440367
0.047313365	0.073507615	0.087041311	0.124968403
0.048749247	0.07573845	0.089682871	0.128760987
0.050297831	0.078144381	0.092531765	0.132851248
0.051973919	0.080748408	0.095615227	0.137278288
0.053795126	0.083577895	0.098965659	0.142088627
0.055782587	0.08666568	0.102621945	0.14733809
0.057961907	0.090051544	0.10663119	0.15309431
0.060364439	0.093784198	0.111051073	0.159440098
0.063029029	0.097923993	0.115953058	0.166478058
0.066004452	0.102546709	0.121426876	0.174337019
0.069352884	0.107748945	0.12758691	0.183181206
0.073154962	0.113655979	0.134581505	0.193223602
0.077517367	0.120433556	0.14260692	0.204745986
0.08258456	0.128306115	0.151928919	0.218129921
0.088557618	0.137586057	0.162917417	0.23390651
0.095725834	0.148722835	0.17610462	0.252839861
0.104522649	0.16238986	0.192287919	0.276074818
0.11563142	0.179648816	0.21272447	0.305416324
0.130203072	0.202287818	0.239531604	0.343904309
0.150357096	0.233599779	0.276608499	0.397136967
0.18053094	0.280478865	0.332118626	0.476834893
0.232104566	0.360605363	0.426997442	0.613055888
0.348020287	0.540695879	0.640244934	0.919223135
2.012298034	3.12637307	3.701978506	5.315066318
0.499715075	0.776373941	0.919314354	1.319893336
0.275789307	0.428475429	0.507363258	0.728440038
0.202339791	0.31436182	0.372239869	0.534438432
0.163745277	0.254400102	0.301238428	0.43249906
0.139386123	0.216554911	0.256425452	0.368159426
0.12238387	0.190139645	0.225146796	0.323251512
0.109730867	0.17048152	0.201869357	0.28983124
0.099885583	0.155185559	0.183757214	0.263826972
0.091969523	0.142886905	0.16919422	0.242918347
0.085442338	0.132746055	0.157186309	0.225678148
0.079951913	0.124215948	0.147085699	0.211176333
0.075258156	0.116923572	0.138450703	0.198778752
0.071191272	0.110605126	0.13096895	0.188036925
0.067627509	0.105068344	0.124412775	0.178623985
0.064474364	0.100169514	0.118612008	0.17029561
0.061661195	0.095798882	0.113436686	0.162865211
0.059133044	0.091871061	0.108785703	0.156187624
0.056846457	0.088318545	0.104579123	0.150148083
0.054766593	0.085087197	0.100752843	0.144654552
0.052865155	0.08213306	0.097254811	0.1396323
0.051118909	0.079420036	0.094042284	0.135019957
0.049508585	0.076918182	0.091079807	0.130766619
0.04801805	0.074602437	0.088337704	0.126829682
0.046633691	0.072451651	0.085790931	0.123173186
0.045343933	0.07044784	0.083418192	0.119766558
0.044138865	0.068575607	0.081201257	0.116583622
0.043009949	0.066821686	0.079124417	0.113601827
0.041949787	0.065174583	0.077174061	0.11080163
0.040951932	0.063624283	0.07533833	0.108166004
0.04001074	0.062162015	0.07360684	0.10568004
0.039121245	0.060780066	0.071970457	0.103330624
0.038279061	0.059471621	0.07042111	0.10110617
0.037480296	0.058230633	0.068951641	0.0989964
0.036721486	0.057051721	0.067555676	0.096992161
0.035999535	0.055930074	0.066227519	0.095085278
0.035311667	0.054861378	0.064962063	0.093268416
0.034655384	0.053841756	0.063754715	0.091534982
0.034028435	0.052867708	0.062601332	0.089879028
0.033428783	0.051936068	0.061498165	0.088295171
0.032854579	0.051043965	0.060441815	0.08677853
0.032304143	0.050188789	0.05942919	0.085324667
0.031775943	0.04936816	0.058457472	0.083929537
0.031268579	0.048579904	0.057524088	0.082589443
0.030780772	0.04782203	0.056626679	0.081301001
0.030311344	0.047092711	0.055763084	0.080061106
0.029859216	0.04639027	0.054931315	0.078866904
0.029423393	0.045713161	0.054129541	0.077715767
0.029002955	0.045059955	0.053356071	0.076605269

8.67 13.47 16.0

This sheet presents the intensity-duration computations based on the fitted power equation.
Results from this sheet are used to compute time-sequential hyetograph values.

Tanama at Esperanza

Intensity-Duration Relationship

Hour	Cumulative Depth by E (decimal)	(inch)	Decimal Increment
0.000	0.000	0.000	0.000
0.250	0.232	3.594	0.232
0.500	0.290	4.486	0.058
0.750	0.330	5.107	0.040
1.000	0.362	5.600	0.032
1.250	0.388	6.014	0.027
1.500	0.412	6.376	0.023
1.750	0.433	6.698	0.021
2.000	0.452	6.991	0.019
2.250	0.469	7.259	0.017
2.500	0.485	7.508	0.016
2.750	0.500	7.741	0.015
3.000	0.514	7.959	0.014
3.250	0.527	8.166	0.013
3.500	0.540	8.362	0.013
3.750	0.552	8.548	0.012
4.000	0.564	8.727	0.012
4.250	0.575	8.898	0.011
4.500	0.585	9.062	0.011
4.750	0.595	9.220	0.010
5.000	0.605	9.373	0.010
5.250	0.615	9.520	0.010
5.500	0.624	9.663	0.009
5.750	0.633	9.801	0.009
6.000	0.642	9.936	0.009
6.250	0.650	10.066	0.008
6.500	0.658	10.193	0.008
6.750	0.666	10.317	0.008
7.000	0.674	10.438	0.008
7.250	0.682	10.556	0.008
7.500	0.689	10.671	0.007
7.750	0.696	10.784	0.007
8.000	0.704	10.894	0.007
8.250	0.711	11.002	0.007
8.500	0.717	11.107	0.007
8.750	0.724	11.211	0.007
9.000	0.731	11.312	0.007
9.250	0.737	11.412	0.006
9.500	0.743	11.510	0.006
9.750	0.750	11.606	0.006
10.000	0.756	11.700	0.006
10.250	0.762	11.793	0.006
10.500	0.768	11.884	0.006
10.750	0.773	11.974	0.006
11.000	0.779	12.062	0.006

Intensity-Duration Relationship

Hour	Cumulative Depth by E (decimal)	(inch)	Decimal Increment
11.250	0.785	12.149	0.006
11.500	0.790	12.235	0.006
11.750	0.796	12.320	0.005
12.000	0.801	12.403	0.005
12.250	0.806	12.485	0.005
12.500	0.812	12.566	0.005
12.750	0.817	12.646	0.005
13.000	0.822	12.725	0.005
13.250	0.827	12.803	0.005
13.500	0.832	12.879	0.005
13.750	0.837	12.955	0.005
14.000	0.842	13.030	0.005
14.250	0.846	13.104	0.005
14.500	0.851	13.177	0.005
14.750	0.856	13.250	0.005
15.000	0.860	13.321	0.005
15.250	0.865	13.392	0.005
15.500	0.869	13.462	0.005
15.750	0.874	13.531	0.004
16.000	0.878	13.599	0.004
16.250	0.883	13.667	0.004
16.500	0.887	13.734	0.004
16.750	0.891	13.800	0.004
17.000	0.896	13.865	0.004
17.250	0.900	13.930	0.004
17.500	0.904	13.995	0.004
17.750	0.908	14.058	0.004
18.000	0.912	14.121	0.004
18.250	0.916	14.184	0.004
18.500	0.920	14.246	0.004
18.750	0.924	14.307	0.004
19.000	0.928	14.368	0.004
19.250	0.932	14.428	0.004
19.500	0.936	14.488	0.004
19.750	0.940	14.547	0.004
20.000	0.943	14.606	0.004
20.250	0.947	14.664	0.004
20.500	0.951	14.721	0.004
20.750	0.955	14.779	0.004
21.000	0.958	14.835	0.004
21.250	0.962	14.892	0.004
21.500	0.965	14.947	0.004
21.750	0.969	15.003	0.004
22.000	0.973	15.058	0.004
22.250	0.976	15.112	0.004
22.500	0.980	15.167	0.003
22.750	0.983	15.220	0.003
23.000	0.986	15.274	0.003
23.250	0.990	15.327	0.003
23.500	0.993	15.379	0.003
23.750	0.997	15.431	0.003
24.000	1.000	15.483	0.003

POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

Puerto Rico 18.32 N 66.75 W 1312 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 3, Version 4
G.M. Bonnin, D. Martin, B. Lin, T Parzybok, M.Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2006
Extracted: Mon Jul 5 2010

Tunami @ Esperanza

Confidence Limits | Seasonality | Related Info | GIS data | Maps | Docs | Return to State Map

Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.61	0.84	1.08	1.73	2.56	3.10	3.21	3.52	3.79	4.45	5.37	6.01	7.66	9.07	12.99	16.48	20.80	24.77
2	0.73	1.00	1.28	2.05	3.05	3.71	3.85	4.32	4.74	5.64	6.78	7.56	9.55	11.26	16.02	20.26	25.50	30.32
5	0.75	1.02	1.31	2.10	3.12	3.93	4.19	5.00	5.88	7.32	8.71	9.48	11.58	13.31	18.35	22.97	28.65	33.73
10	0.79	1.08	1.38	2.21	3.29	4.23	4.61	5.71	7.01	8.93	10.55	11.24	13.43	15.13	20.33	25.28	31.28	36.56
25	0.85	1.16	1.49	2.39	3.54	4.71	5.26	6.75	8.73	11.42	13.42	13.87	16.10	17.70	22.99	28.33	34.71	40.16
50	0.91	1.24	1.59	2.55	3.78	5.10	5.81	7.63	10.21	13.61	15.93	16.16	18.37	19.87	25.08	30.71	37.35	42.89
100	0.96	1.32	1.69	2.71	4.02	5.50	6.38	8.56	11.84	16.05	18.71	18.82	20.93	22.33	27.15	33.04	39.89	45.49
200	1.03	1.40	1.80	2.88	4.28	5.93	6.99	9.57	13.65	18.80	21.85	22.07	23.81	25.10	29.76	35.62	42.47	48.10
500	1.11	1.52	1.95	3.13	4.64	6.51	7.84	11.00	16.32	22.93	26.54	26.80	28.51	29.67	33.69	40.02	46.14	51.43
1000	1.18	1.61	2.07	3.32	4.92	6.96	8.52	12.15	18.56	26.45	30.54	30.84	32.51	33.67	36.84	43.47	49.40	54.14

*These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting forces estimates near zero to appear as zero.

* Upper bound of the 90% confidence interval Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.64	0.87	1.12	1.79	2.65	3.21	3.35	3.81	4.27	4.97	6.02	6.67	8.34	9.80	13.85	17.52	22.03	26.17
2	0.75	1.03	1.32	2.11	3.13	3.83	4.04	4.67	5.35	6.34	7.62	8.40	10.41	12.17	17.07	21.52	27.02	32.00
5	0.77	1.05	1.35	2.17	3.22	4.08	4.43	5.47	6.71	8.26	9.82	10.55	12.65	14.42	19.56	24.39	30.32	35.56
10	0.82	1.12	1.44	2.30	3.41	4.43	4.92	6.29	8.07	10.11	11.95	12.56	14.73	16.45	21.74	26.90	33.17	38.61
25	0.90	1.22	1.57	2.51	3.73	4.98	5.69	7.57	10.22	13.07	15.37	15.66	17.84	19.41	24.74	30.34	37.04	42.61
50	0.96	1.31	1.69	2.70	4.01	5.46	6.37	8.69	12.16	15.72	18.42	18.44	20.53	21.95	27.14	33.09	40.06	45.70
100	1.03	1.42	1.82	2.91	4.31	5.97	7.09	9.91	14.39	18.74	21.89	22.10	23.62	24.89	29.58	35.85	43.05	48.74
200	1.12	1.52	1.96	3.13	4.65	6.53	7.89	11.31	16.95	22.16	25.88	26.14	27.15	28.22	32.65	38.90	46.14	51.84
500	1.23	1.68	2.15	3.45	5.12	7.30	9.04	13.33	20.87	27.43	32.09	32.41	33.05	33.80	37.36	44.16	50.60	55.88
1000	1.31	1.80	2.31	3.69	5.48	7.90	9.95	14.98	24.20	31.91	37.42	37.79	38.16	38.77	41.20	48.36	54.65	59.22

*The **upper** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **greater** than.
**These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

* Lower bound of the 90% confidence interval Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.60	0.82	1.05	1.68	2.49	2.98	3.07	3.27	3.40	4.01	4.86	5.50	7.07	8.44	12.21	15.52	19.64	23.45
2	0.71	0.97	1.25	2.00	2.96	3.58	3.69	4.02	4.26	5.09	6.12	6.90	8.83	10.47	15.07	19.11	24.09	28.73
5	0.73	0.99	1.27	2.04	3.02	3.78	3.98	4.59	5.21	6.52	7.81	8.60	10.64	12.34	17.24	21.63	27.05	31.94
10	0.76	1.04	1.34	2.14	3.17	4.03	4.34	5.17	6.08	7.86	9.36	10.10	12.25	13.94	19.02	23.72	29.45	34.53
25	0.81	1.11	1.43	2.29	3.39	4.43	4.86	5.97	7.36	9.82	11.63	12.22	14.48	16.11	21.34	26.43	32.51	37.81
50	0.86	1.18	1.51	2.42	3.58	4.76	5.29	6.62	8.40	11.49	13.53	14.01	16.30	17.87	23.10	28.45	34.78	40.18
100	0.90	1.23	1.58	2.53	3.76	5.05	5.70	7.26	9.49	13.27	15.58	16.04	18.30	19.83	24.79	30.38	36.91	42.35
200	0.95	1.30	1.66	2.66	3.95	5.37	6.13	7.95	10.65	15.22	17.80	18.25	20.48	22.00	26.92	32.48	39.01	44.50
500	1.01	1.38	1.77	2.84	4.21	5.79	6.71	8.89	12.27	18.06	20.96	21.50	24.00	25.56	30.09	36.05	41.94	47.18
1000	1.06	1.45	1.86	2.97	4.41	6.11	7.18	9.62	13.56	20.42	23.55	24.16	26.91	28.59	32.54	38.81	44.57	49.33

* The **lower** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **less** than.

** These precipitation frequency estimates are based on a partial duration maxima series. **ARI** is the Average Recurrence Interval.

Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

Text version of tables

Related Information

Maps & Aerials

Click here to see topographic maps and aerial photographs available for this location from Microsoft Research Maps

Climate Data Sources

National Climatic Data Center (NCDC) database

Locate NCDC climate stations within:

+/-30 minutes or +/-1 degree of this location. Digital ASCII data can be obtained directly from NCDC.

Note: Precipitation frequency results are based on analysis of precipitation data from a variety of sources, but largely NCDC. The following links provide general information about observing sites in the area, regardless of if their data was used in this study. For detailed information about the stations used in this study, please refer to the matching documentation available at the PF Document page

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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
Office of Hydrologic Development
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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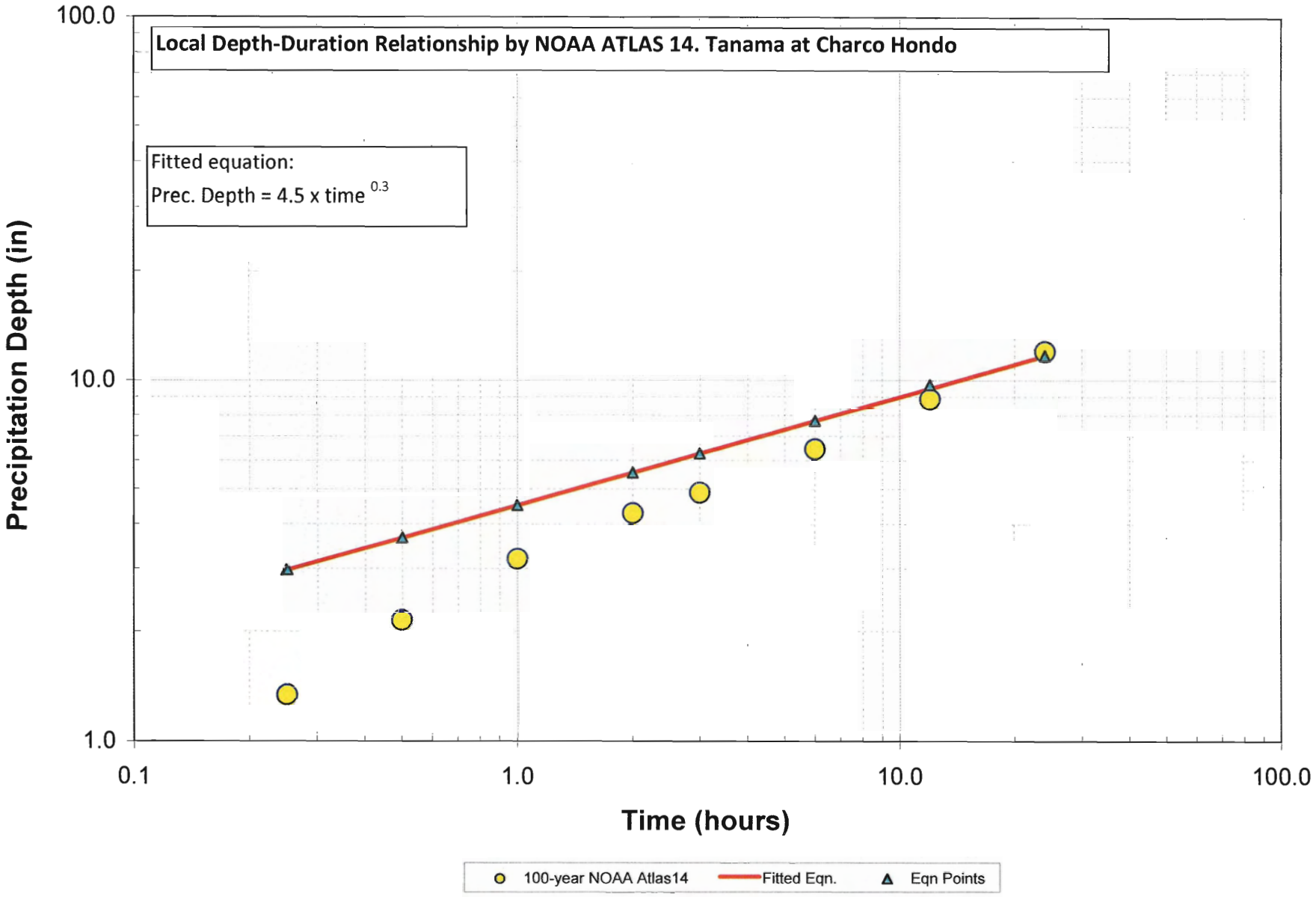
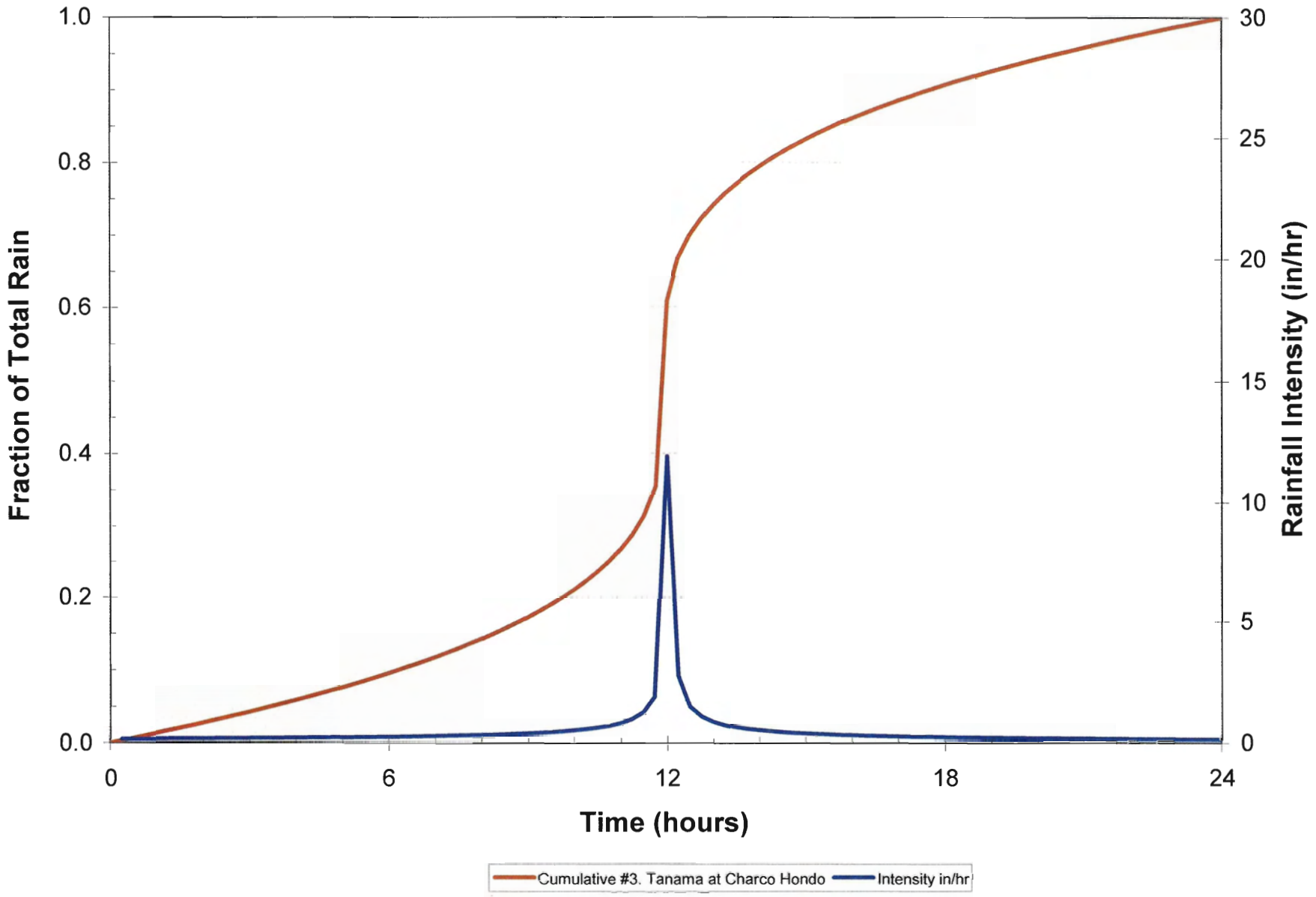

Local Depth-Duration Relationship by NOAA ATLAS 14. Tanama at Charco Hondo
Fitted equation:
Prec. Depth = 4.5 x time 0.3
Precipitation Depth (in)
100.0
10.0
1.0
0.1
1.0
10.0
100.0
Time (hours)
100-year NOAA Atlas14
Fitted Eqn.
Eqn Points


1.0
0.8
0.6
0.4
0.2
0.0
Fraction of Total Rain
30
25
20
15
10
5
0
Rainfall Intensity (in/hr)
0
6
12
18
24
Time (hours)
Cumulative #3. Tanama at Charco Hondo
Intensity in/hr

Sequential Depth Hyetograph - Distribution #1 (15 minute)

Hour	Ordered Intensities	Incremental Depth (decimal)	Incremental Depth (inches)	Cumulative Depth (decimal)	Cumulative Depth (inches)	Intensity (inch/hr)
0		0	0	0	0	
0.25	23.75	0.003	0.037	0.003	0.037	0.148
0.5	23.25	0.003	0.037	0.006	0.074	0.150
0.75	22.75	0.003	0.038	0.010	0.112	0.152
1	22.25	0.003	0.039	0.013	0.151	0.154
1.25	21.75	0.003	0.039	0.016	0.190	0.157
1.5	21.25	0.003	0.040	0.020	0.230	0.160
1.75	20.75	0.003	0.041	0.023	0.271	0.162
2	20.25	0.004	0.041	0.027	0.312	0.165
2.25	19.75	0.004	0.042	0.030	0.354	0.168
2.5	19.25	0.004	0.043	0.034	0.397	0.171
2.75	18.75	0.004	0.044	0.038	0.440	0.174
3	18.25	0.004	0.044	0.042	0.485	0.178
3.25	17.75	0.004	0.045	0.045	0.530	0.181
3.5	17.25	0.004	0.046	0.049	0.576	0.185
3.75	16.75	0.004	0.047	0.053	0.623	0.189
4	16.25	0.004	0.048	0.058	0.672	0.193
4.25	15.75	0.004	0.049	0.062	0.721	0.197
4.5	15.25	0.004	0.050	0.066	0.771	0.202
4.75	14.75	0.004	0.052	0.070	0.823	0.206
5	14.25	0.005	0.053	0.075	0.876	0.212
5.25	13.75	0.005	0.054	0.080	0.930	0.217
5.5	13.25	0.005	0.056	0.084	0.986	0.223
5.75	12.75	0.005	0.057	0.089	1.043	0.229
6	12.25	0.005	0.059	0.094	1.102	0.235
6.25	11.75	0.005	0.061	0.100	1.162	0.242
6.5	11.25	0.005	0.062	0.105	1.225	0.250
6.75	10.75	0.006	0.065	0.110	1.289	0.258
7	10.25	0.006	0.067	0.116	1.356	0.267
7.25	9.75	0.006	0.069	0.122	1.425	0.277
7.5	9.25	0.006	0.072	0.128	1.497	0.287
7.75	8.75	0.006	0.075	0.135	1.572	0.299
8	8.25	0.007	0.078	0.141	1.650	0.312
8.25	7.75	0.007	0.081	0.148	1.731	0.326
8.5	7.25	0.007	0.085	0.156	1.816	0.342
8.75	6.75	0.008	0.090	0.163	1.906	0.359
9	6.25	0.008	0.095	0.171	2.001	0.380
9.25	5.75	0.009	0.101	0.180	2.102	0.403
9.5	5.25	0.009	0.108	0.189	2.209	0.430
9.75	4.75	0.010	0.116	0.199	2.325	0.462
10	4.25	0.011	0.125	0.210	2.450	0.501
10.25	3.75	0.012	0.137	0.222	2.587	0.548
10.5	3.25	0.013	0.152	0.235	2.739	0.608
10.75	2.75	0.015	0.172	0.249	2.911	0.687
11	2.25	0.017	0.199	0.266	3.110	0.797
11.25	1.75	0.021	0.241	0.287	3.351	0.962
11.5	1.25	0.027	0.312	0.314	3.663	1.246
11.75	0.75	0.040	0.473	0.354	4.135	1.891
12	0.25	0.254	2.969	0.608	7.104	11.876
12.25	0.5	0.059	0.686	0.667	7.790	2.745
12.5	1	0.032	0.372	0.699	8.163	1.488
12.75	1.5	0.023	0.271	0.722	8.433	1.082
13	2	0.019	0.218	0.741	8.651	0.870
13.25	2.5	0.016	0.184	0.757	8.835	0.737
13.5	3	0.014	0.161	0.771	8.996	0.645
13.75	3.5	0.012	0.144	0.783	9.140	0.576
14	4	0.011	0.131	0.794	9.271	0.523
14.25	4.5	0.010	0.120	0.804	9.391	0.481
14.5	5	0.010	0.111	0.814	9.502	0.445
14.75	5.5	0.009	0.104	0.823	9.606	0.416
15	6	0.008	0.098	0.831	9.704	0.391
15.25	6.5	0.008	0.092	0.839	9.796	0.369
15.5	7	0.007	0.088	0.847	9.884	0.350
15.75	7.5	0.007	0.083	0.854	9.967	0.333
16	8	0.007	0.080	0.861	10.047	0.318
16.25	8.5	0.007	0.076	0.867	10.123	0.305
16.5	9	0.006	0.073	0.873	10.196	0.293
16.75	9.5	0.006	0.070	0.879	10.267	0.282
17	10	0.006	0.068	0.885	10.335	0.272
17.25	10.5	0.006	0.066	0.891	10.400	0.263
17.5	11	0.005	0.064	0.896	10.464	0.254
17.75	11.5	0.005	0.062	0.902	10.525	0.246
18	12	0.005	0.060	0.907	10.585	0.239
18.25	12.5	0.005	0.058	0.912	10.643	0.232
18.5	13	0.005	0.056	0.916	10.700	0.226
18.75	13.5	0.005	0.055	0.921	10.755	0.220
19	14	0.005	0.054	0.926	10.808	0.214
19.25	14.5	0.004	0.052	0.930	10.860	0.209
19.5	15	0.004	0.051	0.935	10.911	0.204
19.75	15.5	0.004	0.050	0.939	10.961	0.199
20	16	0.004	0.049	0.943	11.010	0.195
20.25	16.5	0.004	0.048	0.947	11.058	0.191
20.5	17	0.004	0.047	0.951	11.104	0.187
20.75	17.5	0.004	0.046	0.955	11.150	0.183
21	18	0.004	0.045	0.959	11.195	0.179
21.25	18.5	0.004	0.044	0.963	11.239	0.176
21.5	19	0.004	0.043	0.966	11.282	0.173
21.75	19.5	0.004	0.042	0.970	11.324	0.170
22	20	0.004	0.042	0.973	11.366	0.167
22.25	20.5	0.004	0.041	0.977	11.407	0.164
22.5	21	0.003	0.040	0.980	11.447	0.161
22.75	21.5	0.003	0.040	0.984	11.487	0.158
23	22	0.003	0.039	0.987	11.526	0.156
23.25	22.5	0.003	0.038	0.990	11.564	0.153
23.5	23	0.003	0.038	0.994	11.602	0.151
23.75	23.5	0.003	0.037	0.997	11.639	0.149
24	24	0.003	0.037	1.000	11.676	0.146

Hour	Cumulative depth (decimal)
0	0
0.010417	0.0031597
0.020833	0.006367
0.03125	0.0096238
0.041667	0.0129319
0.052083	0.0162934
0.0625	0.0197104
0.072917	0.0231851
0.083333	0.0267201
0.09375	0.0303179
0.104167	0.0339813
0.114583	0.0377132
0.125	0.0415169
0.135417	0.0453958
0.145833	0.0493537
0.15625	0.0533945
0.166667	0.0575226
0.177083	0.0617428
0.1875	0.0660602
0.197917	0.0704803
0.208333	0.0750094
0.21875	0.0796542
0.229167	0.0844222
0.239583	0.0893217
0.25	0.0943616
0.260417	0.0995524
0.270833	0.1049055
0.28125	0.1104336
0.291667	0.1161515
0.302083	0.1220757
0.3125	0.1282254
0.322917	0.1346225
0.333333	0.1412927
0.34375	0.1482663
0.354167	0.1555789
0.364583	0.1632737
0.375	0.1714032
0.385417	0.180032
0.395833	0.1892421
0.40625	0.1991386
0.416667	0.2098608
0.427083	0.2215985
0.4375	0.2346224
0.447917	0.2493388
0.458333	0.2664054
0.46875	0.2870075
0.479167	0.313692
0.489583	0.3541854
0.5	0.6084691
0.510417	0.6672454
0.520833	0.6991141
0.53125	0.7222827
0.541667	0.7409156
0.552083	0.7567016
0.5625	0.7705091
0.572917	0.7828494
0.583333	0.7940514
0.59375	0.8043407
0.604167	0.813879
0.614583	0.822787
0.625	0.8311571
0.635417	0.839062
0.645833	0.8465598
0.65625	0.853698
0.666667	0.8605158
0.677083	0.867046
0.6875	0.8733165
0.697917	0.8793509
0.708333	0.8851697
0.71875	0.8907908
0.729167	0.8962296
0.739583	0.9015
0.75	0.906614
0.760417	0.9115825
0.770833	0.9164152
0.78125	0.9211206
0.791667	0.9257067
0.802083	0.9301805
0.8125	0.9345485
0.822917	0.9388166
0.833333	0.9429901
0.84375	0.947074
0.854167	0.9510729
0.864583	0.9549908
0.875	0.9588317
0.885417	0.9625991
0.895833	0.9662963
0.90625	0.9699265
0.916667	0.9734926
0.927083	0.9769971
0.9375	0.9804427
0.947917	0.9838317
0.958333	0.9871662
0.96875	0.9904484
0.979167	0.9936803
0.989583	0.9968635
1	1

Tanama @ Charco Hondo			
7.24	10.45	11.99	15.99
10-Yr	50-yr	100-yr	500-yr
0	0	0	0
0.022875921	0.033018423	0.037884295	0.050522926
0.023221045	0.033516563	0.038455846	0.051285153
0.023579092	0.034033358	0.0390488	0.052075923
0.023950849	0.034569941	0.039664458	0.052896972
0.024337169	0.035127543	0.040304234	0.053750184
0.024738979	0.035707504	0.040969663	0.054637607
0.02515729	0.036311281	0.041662418	0.055561473
0.025593204	0.036940467	0.042384325	0.056524217
0.026047928	0.037596802	0.043137384	0.057528504
0.026522785	0.038282197	0.043923784	0.058577256
0.027019228	0.038998748	0.044745932	0.059673682
0.027538859	0.039748768	0.045606481	0.06082132
0.028083446	0.040534809	0.046508359	0.062024075
0.028654949	0.041359699	0.047454812	0.063286276
0.029255543	0.042226578	0.048449443	0.064612726
0.029887654	0.043138948	0.049496267	0.066008783
0.030553991	0.04410072	0.050599773	0.067480431
0.031257596	0.045116281	0.051764996	0.069034386
0.032001891	0.046190574	0.052997606	0.070678209
0.032790745	0.047329183	0.05430401	0.072420444
0.033628551	0.048538447	0.055691481	0.074270791
0.034520315	0.049825593	0.057168312	0.076240309
0.035471776	0.051198903	0.058744004	0.078341671
0.03648954	0.052667913	0.060429501	0.080589468
0.037581261	0.05424367	0.062237474	0.083000602
0.038755855	0.055939044	0.064182693	0.085594767
0.040023782	0.057769133	0.066282478	0.088395065
0.0413974	0.059751772	0.068557296	0.091428788
0.042891424	0.061908202	0.071031516	0.094728436
0.044523532	0.064263938	0.073734413	0.09833305
0.046315161	0.066849922	0.076701489	0.102289976
0.048292589	0.069704082	0.079976262	0.106657251
0.050488412	0.072873468	0.083612716	0.111506867
0.052943612	0.076417229	0.087678716	0.11692933
0.055710494	0.080410865	0.092260887	0.123040165
0.058856993	0.084952428	0.097471733	0.129989409
0.062473125	0.090171845	0.103460328	0.137975866
0.066680984	0.096245343	0.110428867	0.14726919
0.071650822	0.103418659	0.118659303	0.158245393
0.077628075	0.112046047	0.128558096	0.171446535
0.08498129	0.122659458	0.140735589	0.187686578
0.094292977	0.13609967	0.156156463	0.20825203
0.106547052	0.153786836	0.176450159	0.235315933
0.123561639	0.178345184	0.204627632	0.272893731
0.14915918	0.215291911	0.24701914	0.329427527
0.193196112	0.278853503	0.319947704	0.426685887
0.293171898	0.423155571	0.485515339	0.647488764
1.841014446	2.657265326	3.048862321	4.065997374
0.425540204	0.614212035	0.704727493	0.939832578
0.230729547	0.333028144	0.382105976	0.509580864
0.167740833	0.242112114	0.277791794	0.370466287
0.134902212	0.194713829	0.223408498	0.297940107
0.114290674	0.164963749	0.189274196	0.252418215
0.099966138	0.144288141	0.165551656	0.220781566
0.089343515	0.128955764	0.147959771	0.197320829
0.081102815	0.117061384	0.134312535	0.179120721
0.074494147	0.10752263	0.12336807	0.164525058
0.069057503	0.099675539	0.114364566	0.152517882
0.064493823	0.093088461	0.10680676	0.142438707
0.060599626	0.087467693	0.100357669	0.133838125
0.057231278	0.08260592	0.094779424	0.126398914
0.054284275	0.078352303	0.089898959	0.119890271
0.051680629	0.074594277	0.085587118	0.114139952
0.049360866	0.071246001	0.081745412	0.109016608
0.047278782	0.068240783	0.078297319	0.104418193
0.045397892	0.065525964	0.075182421	0.10026413
0.043688977	0.063059366	0.072352326	0.096489882
0.042128334	0.060806781	0.06976778	0.093043103
0.040696521	0.058740145	0.067396587	0.089880853
0.039377429	0.056836206	0.065212067	0.086967553
0.038157585	0.055075519	0.063191911	0.08427345
0.037025631	0.053441691	0.061317309	0.081773459
0.035971918	0.051920794	0.059572279	0.079446267
0.034988193	0.050500914	0.057943153	0.077273647
0.034067348	0.049171794	0.056418163	0.075239903
0.033203232	0.047924554	0.05498712	0.073331446
0.032390487	0.046751462	0.053641151	0.071536448
0.031624426	0.045645754	0.052372496	0.069844555
0.030900931	0.044601482	0.051174332	0.068246669
0.030216363	0.043613396	0.050040634	0.066734757
0.029567497	0.042676843	0.048966062	0.065301696
0.028951464	0.04178768	0.047945864	0.063941149
0.028365703	0.040942209	0.046975798	0.062647457
0.027807915	0.040137116	0.046052059	0.061415548
0.027276039	0.039369421	0.04517123	0.060240865
0.026768212	0.038636439	0.044330229	0.059119297
0.026282752	0.037935741	0.043526271	0.058047129
0.025818135	0.037265126	0.042756829	0.057020992
0.025372974	0.036622593	0.042019607	0.056037824
0.024946005	0.03600632	0.041312514	0.055094837
0.024536076	0.035414641	0.04063364	0.054189484
0.024142132	0.034846034	0.039981239	0.053319433
0.023763205	0.034299101	0.039353706	0.052482548
0.023398405	0.03377256	0.038749569	0.051676864
0.023046914	0.033265228	0.038167473	0.050900575
0.022707977	0.032776017	0.037606167	0.050152011

7.24 10.45 12.0

This sheet presents the intensity-duration computations based on the fitted power equation.
Results from this sheet are used to compute time-sequential hyetograph values.

Tanama at Charco Hondo

Intensity-Duration Relationship

Hour	Cumulative Depth by E (decimal)	(inch)	Decimal Increment
0	0.000	0.000	0.000
0.25	0.254	2.969	0.254
0.5	0.313	3.655	0.059
0.75	0.354	4.128	0.040
1	0.385	4.500	0.032
1.25	0.412	4.812	0.027
1.5	0.435	5.082	0.023
1.75	0.456	5.323	0.021
2	0.475	5.540	0.019
2.25	0.492	5.739	0.017
2.5	0.507	5.924	0.016
2.75	0.522	6.096	0.015
3	0.536	6.257	0.014
3.25	0.549	6.409	0.013
3.5	0.561	6.553	0.012
3.75	0.573	6.690	0.012
4	0.584	6.821	0.011
4.25	0.595	6.946	0.011
4.5	0.605	7.066	0.010
4.75	0.615	7.182	0.010
5	0.625	7.293	0.010
5.25	0.634	7.400	0.009
5.5	0.643	7.504	0.009
5.75	0.651	7.605	0.009
6	0.660	7.703	0.008
6.25	0.668	7.798	0.008
6.5	0.676	7.890	0.008
6.75	0.683	7.980	0.008
7	0.691	8.068	0.007
7.25	0.698	8.153	0.007
7.5	0.705	8.236	0.007
7.75	0.712	8.318	0.007
8	0.719	8.397	0.007
8.25	0.726	8.475	0.007
8.5	0.732	8.551	0.007
8.75	0.739	8.626	0.006
9	0.745	8.699	0.006
9.25	0.751	8.771	0.006
9.5	0.757	8.842	0.006
9.75	0.763	8.911	0.006
10	0.769	8.979	0.006
10.25	0.775	9.045	0.006
10.5	0.780	9.111	0.006
10.75	0.786	9.176	0.006
11	0.791	9.239	0.005

Intensity-Duration Relationship

Hour	Cumulative Depth by E (decimal)	(inch)	Decimal Increment
11.25	0.797	9.302	0.005
11.5	0.802	9.363	0.005
11.75	0.807	9.424	0.005
12	0.812	9.483	0.005
12.25	0.817	9.542	0.005
12.5	0.822	9.600	0.005
12.75	0.827	9.658	0.005
13	0.832	9.714	0.005
13.25	0.837	9.770	0.005
13.5	0.841	9.825	0.005
13.75	0.846	9.879	0.005
14	0.851	9.932	0.005
14.25	0.855	9.985	0.005
14.5	0.860	10.037	0.004
14.75	0.864	10.089	0.004
15	0.868	10.140	0.004
15.25	0.873	10.190	0.004
15.5	0.877	10.240	0.004
15.75	0.881	10.290	0.004
16	0.885	10.338	0.004
16.25	0.890	10.386	0.004
16.5	0.894	10.434	0.004
16.75	0.898	10.481	0.004
17	0.902	10.528	0.004
17.25	0.906	10.574	0.004
17.5	0.910	10.620	0.004
17.75	0.913	10.665	0.004
18	0.917	10.710	0.004
18.25	0.921	10.755	0.004
18.5	0.925	10.799	0.004
18.75	0.929	10.842	0.004
19	0.932	10.885	0.004
19.25	0.936	10.928	0.004
19.5	0.940	10.970	0.004
19.75	0.943	11.012	0.004
20	0.947	11.054	0.004
20.25	0.950	11.095	0.004
20.5	0.954	11.136	0.004
20.75	0.957	11.177	0.003
21	0.961	11.217	0.003
21.25	0.964	11.257	0.003
21.5	0.968	11.297	0.003
21.75	0.971	11.336	0.003
22	0.974	11.375	0.003
22.25	0.978	11.413	0.003
22.5	0.981	11.452	0.003
22.75	0.984	11.490	0.003
23	0.987	11.527	0.003
23.25	0.991	11.565	0.003
23.5	0.994	11.602	0.003
23.75	0.997	11.639	0.003
24	1.000	11.676	0.003

POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

Puerto Rico 18.405 N 66.735 W 459 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 3, Version 4
G.M. Bonnin, D. Martin, B. Lin, T Parzybok, M.Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2006
Extracted: Mon Jul 5 2010

Tanama @ Chenco Hond.

Confidence Limits | Seasonality | Related Info | GIS data | Maps | Docs | Return to State Map

Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.50	0.68	0.87	1.40	2.07	2.48	2.74	3.02	3.26	3.82	4.80	5.40	6.46	7.51	10.33	12.78	16.10	19.27
2	0.62	0.85	1.09	1.75	2.59	3.19	3.32	3.72	4.08	4.86	6.05	6.80	8.09	9.37	12.82	15.82	19.85	23.69
5	0.64	0.88	1.13	1.81	2.68	3.39	3.61	4.28	4.98	6.20	7.66	8.46	9.89	11.20	14.92	18.21	22.58	26.63
10	0.67	0.92	1.18	1.89	2.80	3.59	3.89	4.75	5.77	7.36	9.08	9.88	11.38	12.67	16.56	20.11	24.73	28.94
25	0.71	0.97	1.24	1.99	2.95	3.87	4.28	5.40	6.91	9.06	11.16	11.92	13.44	14.64	18.66	22.55	27.48	31.84
50	0.74	1.01	1.30	2.08	3.08	4.09	4.59	5.91	7.85	10.47	12.91	13.61	15.13	16.24	20.25	24.38	29.52	33.99
100	0.77	1.05	1.35	2.16	3.20	4.30	4.89	6.43	8.83	11.98	14.75	15.47	16.90	17.91	21.78	26.14	31.46	36.01
200	0.80	1.09	1.40	2.24	3.33	4.51	5.21	6.96	9.88	13.61	16.76	17.51	18.77	19.65	23.50	28.05	33.40	38.00
500	0.84	1.15	1.47	2.36	3.50	4.79	5.62	7.69	11.35	15.95	19.63	20.47	21.71	22.49	25.78	30.71	36.10	40.51
1000	0.87	1.19	1.53	2.44	3.62	5.00	5.94	8.24	12.54	17.86	21.99	22.90	24.15	24.90	27.51	32.72	38.21	42.51

*These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting forces estimates near zero to appear as zero.

* Upper bound of the 90% confidence interval Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.54	0.74	0.95	1.51	2.25	2.75	2.88	3.26	3.65	4.23	5.31	5.96	7.08	8.16	11.12	13.71	17.23	20.54
2	0.65	0.88	1.13	1.81	2.69	3.31	3.49	4.01	4.57	5.38	6.73	7.50	8.87	10.20	13.81	16.97	21.24	25.25
5	0.67	0.91	1.17	1.88	2.78	3.53	3.80	4.61	5.58	6.87	8.49	9.33	10.80	12.17	16.04	19.53	24.15	28.38
10	0.70	0.95	1.23	1.96	2.91	3.75	4.11	5.15	6.51	8.17	10.09	10.92	12.45	13.78	17.83	21.59	26.48	30.90
25	0.75	1.02	1.31	2.10	3.11	4.08	4.58	5.92	7.92	10.15	12.55	13.29	14.82	16.01	20.20	24.33	29.57	34.12
50	0.78	1.07	1.37	2.20	3.26	4.36	4.97	6.58	9.13	11.85	14.66	15.36	16.84	17.87	22.00	26.45	31.92	36.58
100	0.82	1.12	1.44	2.31	3.42	4.63	5.36	7.26	10.45	13.69	16.97	17.65	19.01	19.87	23.81	28.55	34.20	38.96
200	0.86	1.18	1.52	2.43	3.60	4.94	5.80	8.02	11.94	15.72	19.54	20.23	21.33	21.97	25.86	30.82	36.53	41.34
500	0.92	1.26	1.62	2.59	3.84	5.33	6.40	9.07	14.08	18.72	23.41	24.11	25.11	25.45	28.64	34.06	39.82	44.40
1000	0.96	1.32	1.69	2.71	4.02	5.62	6.85	9.89	15.82	21.19	26.61	27.33	28.28	28.48	30.82	36.57	42.47	46.87

*The **upper** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **greater** than.
**These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

* Lower bound of the 90% confidence interval Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.49	0.67	0.86	1.38	2.05	2.46	2.60	2.80	2.93	3.46	4.36	4.94	5.93	6.93	9.61	11.92	15.04	18.06
2	0.60	0.81	1.05	1.68	2.49	3.04	3.16	3.46	3.68	4.40	5.50	6.20	7.43	8.65	11.94	14.75	18.54	22.21
5	0.62	0.84	1.08	1.74	2.57	3.24	3.43	3.96	4.46	5.58	6.95	7.71	9.06	10.32	13.87	16.95	21.06	24.94
10	0.64	0.88	1.13	1.81	2.68	3.42	3.67	4.37	5.11	6.58	8.18	8.95	10.38	11.64	15.35	18.66	23.01	27.04
25	0.68	0.93	1.19	1.90	2.82	3.66	4.00	4.89	5.98	7.97	9.89	10.63	12.14	13.34	17.21	20.81	25.44	29.65
50	0.70	0.96	1.23	1.97	2.93	3.84	4.24	5.27	6.66	9.08	11.25	11.97	13.53	14.68	18.57	22.37	27.19	31.52
100	0.72	0.99	1.27	2.03	3.02	4.00	4.47	5.64	7.33	10.23	12.66	13.41	14.94	16.03	19.82	23.83	28.80	33.21
200	0.75	1.02	1.31	2.10	3.11	4.16	4.68	6.00	8.02	11.44	14.16	14.96	16.39	17.41	21.24	25.39	30.39	34.87
500	0.78	1.06	1.36	2.18	3.23	4.35	4.96	6.48	8.93	13.12	16.21	17.13	18.63	19.67	23.07	27.51	32.54	36.88
1000	0.80	1.09	1.40	2.24	3.32	4.49	5.17	6.83	9.62	14.47	17.82	18.86	20.43	21.54	24.40	29.07	34.21	38.45

* The **lower** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **less** than.

** These precipitation frequency estimates are based on a partial duration maxima series. **ARI** is the Average Recurrence Interval.

Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

Text version of tables

Related Information

Maps & Aerials

Click here to see topographic maps and aerial photographs available for this location from Microsoft Research Maps

Climate Data Sources

National Climatic Data Center (NCDC) database

Locate NCDC climate stations within:

+/-30 minutes or +/-1 degree of this location. Digital ASCII data can be obtained directly from **NCDC**.

Note: Precipitation frequency results are based on analysis of precipitation data from a variety of sources, but largely NCDC. The following links provide general information about observing sites in the area, regardless of if their data was used in this study. For detailed information about the stations used in this study, please refer to the matching documentation available at the PF Document page

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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
Office of Hydrologic Development
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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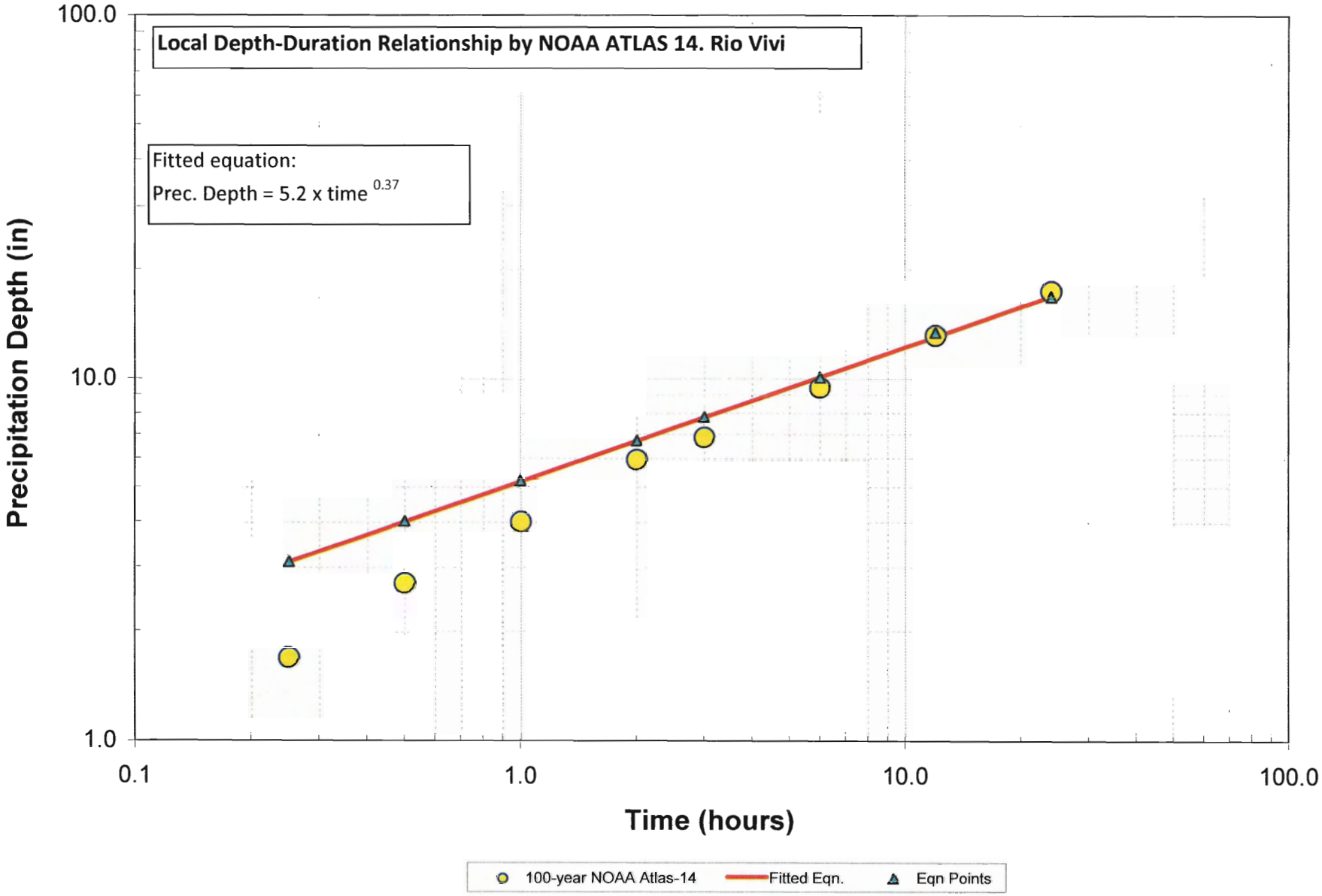
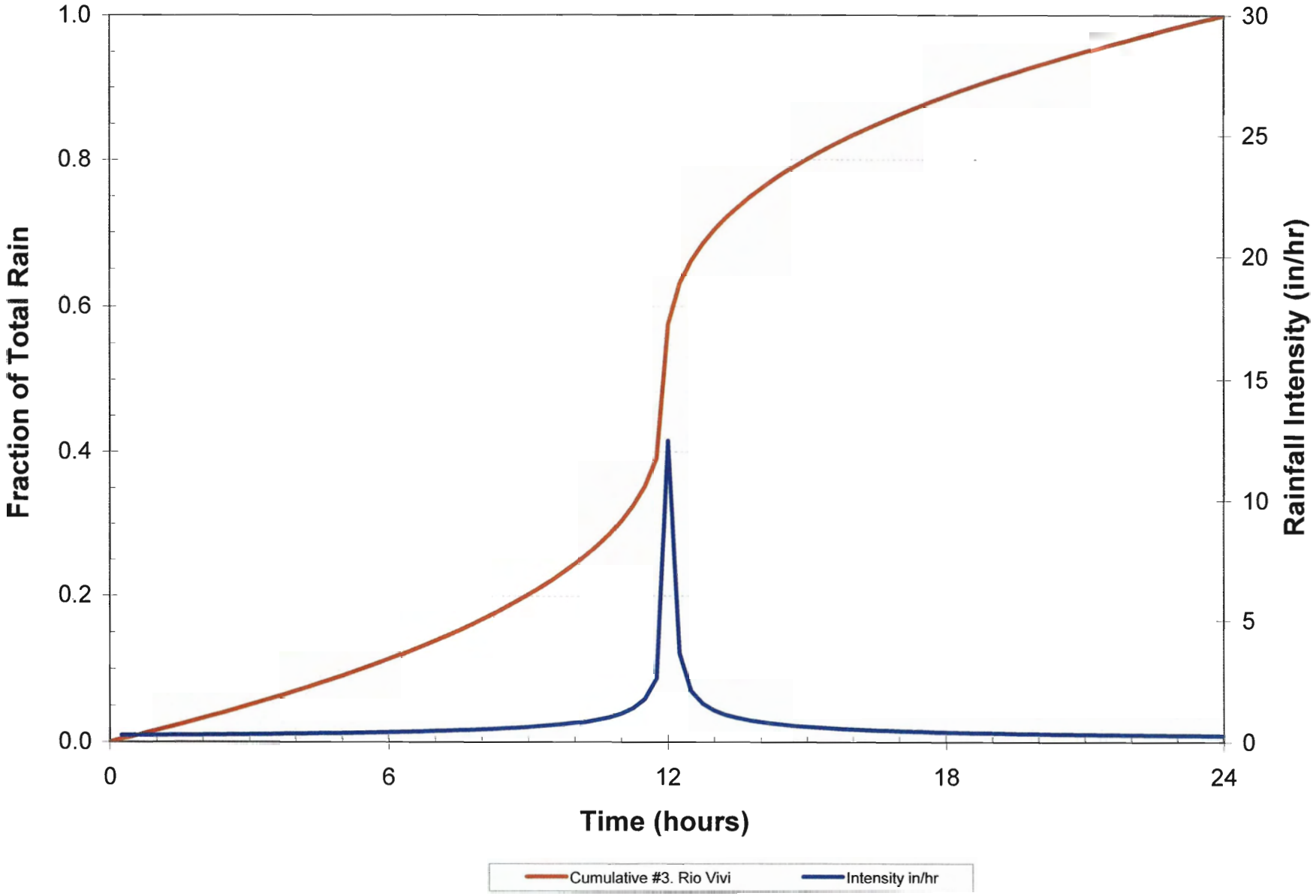

Local Depth-Duration Relationship by NOAA ATLAS 14. Rio Vivi
Fitted equation:
Prec. Depth = 5.2 x time 0.37
Precipitation Depth (in)
100.0
10.0
1.0
0.1
1.0
10.0
100.0
Time (hours)
100-year NOAA Atlas-14
Fitted Eqn.
Eqn Points


1.0
0.8
0.6
0.4
0.2
0.0
Fraction of Total Rain
30
25
20
15
10
5
0
Rainfall Intensity (in/hr)
0
6
12
18
24
Time (hours)
Cumulative #3. Rio Vivi
Intensity in/hr

Sequential Depth Hyetograph - Distribution #1 (15 minute)

Hour	Ordered Intensities	Incremental Depth (decimal)	Incremental Depth (inches)	Cumulative Depth (decimal)	Cumulative Depth (inches)	Intensity (inch/hr)
0		0	0	0	0	
0.25	23.75	0.004	0.066	0.004	0.066	0.262
0.5	23.25	0.004	0.066	0.008	0.132	0.266
0.75	22.75	0.004	0.067	0.012	0.200	0.270
1	22.25	0.004	0.068	0.016	0.268	0.273
1.25	21.75	0.004	0.069	0.020	0.337	0.277
1.5	21.25	0.004	0.070	0.024	0.408	0.282
1.75	20.75	0.004	0.071	0.028	0.479	0.286
2	20.25	0.004	0.073	0.033	0.552	0.290
2.25	19.75	0.004	0.074	0.037	0.625	0.295
2.5	19.25	0.004	0.075	0.042	0.700	0.300
2.75	18.75	0.005	0.076	0.046	0.777	0.305
3	18.25	0.005	0.078	0.051	0.854	0.310
3.25	17.75	0.005	0.079	0.055	0.933	0.316
3.5	17.25	0.005	0.080	0.060	1.013	0.321
3.75	16.75	0.005	0.082	0.065	1.095	0.327
4	16.25	0.005	0.083	0.070	1.179	0.334
4.25	15.75	0.005	0.085	0.075	1.264	0.340
4.5	15.25	0.005	0.087	0.080	1.351	0.348
4.75	14.75	0.005	0.089	0.085	1.439	0.355
5	14.25	0.005	0.091	0.091	1.530	0.363
5.25	13.75	0.006	0.093	0.096	1.623	0.371
5.5	13.25	0.006	0.095	0.102	1.718	0.380
5.75	12.75	0.006	0.097	0.108	1.815	0.389
6	12.25	0.006	0.100	0.114	1.915	0.399
6.25	11.75	0.006	0.103	0.120	2.018	0.410
6.5	11.25	0.006	0.105	0.126	2.123	0.422
6.75	10.75	0.006	0.109	0.132	2.232	0.434
7	10.25	0.007	0.112	0.139	2.344	0.448
7.25	9.75	0.007	0.116	0.146	2.459	0.462
7.5	9.25	0.007	0.119	0.153	2.579	0.478
7.75	8.75	0.007	0.124	0.160	2.702	0.495
8	8.25	0.008	0.129	0.168	2.831	0.514
8.25	7.75	0.008	0.134	0.176	2.965	0.535
8.5	7.25	0.008	0.140	0.184	3.104	0.558
8.75	6.75	0.009	0.146	0.193	3.250	0.585
9	6.25	0.009	0.154	0.202	3.404	0.614
9.25	5.75	0.010	0.162	0.212	3.566	0.648
9.5	5.25	0.010	0.172	0.222	3.738	0.687
9.75	4.75	0.011	0.183	0.233	3.921	0.733
10	4.25	0.012	0.197	0.244	4.118	0.788
10.25	3.75	0.013	0.214	0.257	4.332	0.855
10.5	3.25	0.014	0.235	0.271	4.567	0.939
10.75	2.75	0.016	0.262	0.287	4.828	1.048
11	2.25	0.018	0.299	0.304	5.128	1.197
11.25	1.75	0.021	0.355	0.325	5.482	1.418
11.5	1.25	0.027	0.448	0.352	5.930	1.790
11.75	0.75	0.039	0.651	0.391	6.581	2.605
12	0.25	0.185	3.113	0.575	9.695	12.454
12.25	0.5	0.054	0.910	0.629	10.605	3.641
12.5	1	0.031	0.525	0.660	11.130	2.100
12.75	1.5	0.023	0.394	0.684	11.524	1.576
13	2	0.019	0.324	0.703	11.848	1.296
13.25	2.5	0.017	0.279	0.720	12.127	1.116
13.5	3	0.015	0.247	0.734	12.374	0.989
13.75	3.5	0.013	0.224	0.748	12.598	0.894
14	4	0.012	0.205	0.760	12.803	0.820
14.25	4.5	0.011	0.190	0.771	12.993	0.759
14.5	5	0.011	0.177	0.781	13.170	0.709
14.75	5.5	0.010	0.167	0.791	13.337	0.667
15	6	0.009	0.158	0.801	13.495	0.631
15.25	6.5	0.009	0.150	0.810	13.644	0.599
15.5	7	0.008	0.143	0.818	13.787	0.571
15.75	7.5	0.008	0.137	0.826	13.924	0.546
16	8	0.008	0.131	0.834	14.055	0.524
16.25	8.5	0.007	0.126	0.841	14.181	0.504
16.5	9	0.007	0.122	0.849	14.302	0.486
16.75	9.5	0.007	0.117	0.856	14.420	0.470
17	10	0.007	0.114	0.862	14.534	0.455
17.25	10.5	0.007	0.110	0.869	14.644	0.441
17.5	11	0.006	0.107	0.875	14.751	0.428
17.75	11.5	0.006	0.104	0.881	14.855	0.416
18	12	0.006	0.101	0.887	14.956	0.405
18.25	12.5	0.006	0.099	0.893	15.054	0.394
18.5	13	0.006	0.096	0.899	15.151	0.385
18.75	13.5	0.006	0.094	0.905	15.244	0.376
19	14	0.005	0.092	0.910	15.336	0.367
19.25	14.5	0.005	0.090	0.915	15.426	0.359
19.5	15	0.005	0.088	0.921	15.514	0.351
19.75	15.5	0.005	0.086	0.926	15.600	0.344
20	16	0.005	0.084	0.931	15.684	0.337
20.25	16.5	0.005	0.083	0.936	15.767	0.331
20.5	17	0.005	0.081	0.940	15.848	0.324
20.75	17.5	0.005	0.080	0.945	15.927	0.318
21	18	0.005	0.078	0.950	16.006	0.313
21.25	18.5	0.005	0.077	0.954	16.082	0.307
21.5	19	0.004	0.076	0.959	16.158	0.302
21.75	19.5	0.004	0.074	0.963	16.232	0.297
22	20	0.004	0.073	0.968	16.305	0.293
22.25	20.5	0.004	0.072	0.972	16.377	0.288
22.5	21	0.004	0.071	0.976	16.448	0.284
22.75	21.5	0.004	0.070	0.980	16.518	0.279
23	22	0.004	0.069	0.984	16.587	0.275
23.25	22.5	0.004	0.068	0.988	16.655	0.272
23.5	23	0.004	0.067	0.992	16.722	0.268
23.75	23.5	0.004	0.066	0.996	16.788	0.264
24	24	0.004	0.065	1.000	16.853	0.261

Hour	Cumulative depth (decimal)				
		Río Vivi			
		8.98	14.48	17.38	25.6
		10-Yr	50-yr	100-yr	500-yr
0	0	0	0	0	0
0.010417	0.0038926	0.034955679	0.05636506	0.067653642	0.099650934
0.020833	0.007838	0.035429954	0.057129814	0.068571558	0.101002986
0.03125	0.0118382	0.035921244	0.057922006	0.069522408	0.102403546
0.041667	0.015895	0.036430557	0.05874326	0.070508139	0.103855487
0.052083	0.0200107	0.036958985	0.059595335	0.071530865	0.105361918
0.0625	0.0241875	0.037507713	0.060480142	0.072592878	0.106926219
0.072917	0.0284279	0.038078028	0.06139976	0.073696673	0.108552062
0.083333	0.0327342	0.038671335	0.062356451	0.074844967	0.11024345
0.09375	0.0371094	0.039289168	0.06335269	0.076040729	0.112004756
0.104167	0.0415563	0.039933206	0.064391183	0.077287207	0.113840765
0.114583	0.0460781	0.040605289	0.065474897	0.078587964	0.115756725
0.125	0.050678	0.041307441	0.066607099	0.079946919	0.117758408
0.135417	0.0553597	0.042041897	0.067791388	0.081368392	0.119852177
0.145833	0.0601271	0.042811121	0.069031742	0.082857159	0.122045068
0.15625	0.0649844	0.043617852	0.070332571	0.084418514	0.124344877
0.166667	0.0699359	0.044465128	0.071698782	0.086058344	0.126760277
0.177083	0.0749867	0.045356345	0.073135844	0.087783216	0.129300939
0.1875	0.0801421	0.046295299	0.074649881	0.089600479	0.13197769
0.197917	0.0854079	0.047286257	0.076247773	0.091518391	0.134802693
0.208333	0.0907903	0.04833403	0.077937277	0.093546262	0.137789661
0.21875	0.0962963	0.049444065	0.079727178	0.095694637	0.140954126
0.229167	0.1019335	0.050622558	0.081627465	0.097975507	0.144313751
0.239583	0.1077104	0.05187659	0.083649558	0.100402577	0.147888721
0.25	0.1136363	0.053214295	0.085806569	0.102991586	0.151702221
0.260417	0.1197215	0.054645064	0.088113644	0.105760714	0.155781029
0.270833	0.1259776	0.056179812	0.090588383	0.108731084	0.160156257
0.28125	0.1324176	0.057831302	0.093251364	0.111927397	0.16486429
0.291667	0.1390562	0.059614564	0.096126824	0.115378743	0.169947977
0.302083	0.14591	0.061547438	0.099243531	0.119119652	0.175458176
0.3125	0.1529982	0.063651281	0.102635919	0.123191455	0.181455768
0.322917	0.1603425	0.065951896	0.106345597	0.127644094	0.188014315
0.333333	0.1679684	0.068480793	0.110423372	0.132538551	0.195223642
0.34375	0.1759057	0.071276897	0.114932012	0.137950163	0.203194717
0.354167	0.1841895	0.074388932	0.119950082	0.143973233	0.212066443
0.364583	0.192862	0.077878803	0.125577402	0.150727572	0.222015296
0.375	0.2019741	0.081826511	0.131942971	0.158368014	0.233269341
0.385417	0.2115885	0.086337492	0.139216803	0.167098621	0.246129154
0.395833	0.2217838	0.091553932	0.147628166	0.177194581	0.261000073
0.40625	0.2326605	0.097672842	0.157494739	0.189037194	0.278443737
0.416667	0.2443505	0.104976261	0.169271298	0.203172318	0.299264173
0.427083	0.2570325	0.113884413	0.183635445	0.220413262	0.32465935
0.4375	0.2709586	0.125055673	0.201648791	0.242034254	0.356506151
0.447917	0.2865032	0.139590912	0.225086459	0.270165929	0.397942911
0.458333	0.3042649	0.159500235	0.257189688	0.308698672	0.454700001
0.46875	0.325306	0.188948362	0.304673974	0.365692933	0.53865012
0.479167	0.3518618	0.238471201	0.384528173	0.461540031	0.679828814
0.489583	0.3905056	0.347021488	0.559562489	0.671629562	0.989281748
0.5	0.575245	1.658960251	2.67502722	3.210771622	4.729329892
0.510417	0.6292541	0.485001725	0.78205178	0.938678172	1.382632981
0.520833	0.6604091	0.279771865	0.451124343	0.541473831	0.797567899
0.53125	0.6837948	0.210003001	0.338623993	0.406442335	0.598672254
0.541667	0.703017	0.172615599	0.278337847	0.334082305	0.492089012
0.552083	0.7195748	0.148688697	0.239756385	0.287773893	0.423878691
0.5625	0.7342526	0.131807062	0.212535218	0.255100972	0.375752871
0.572917	0.747519	0.119132278	0.192097482	0.230570044	0.339619857
0.583333	0.7596789	0.109195845	0.17607526	0.211338951	0.311293277
0.59375	0.7709433	0.101154319	0.163108523	0.195775285	0.28836866
0.604167	0.7814651	0.094485416	0.152355103	0.182868211	0.269357089
0.614583	0.7913589	0.088846778	0.143262956	0.171955123	0.253282574
0.625	0.8007134	0.084003737	0.135453687	0.162581843	0.239476132
0.635417	0.8095987	0.079789542	0.128658415	0.154425639	0.227462392
0.645833	0.8180711	0.076082133	0.122680322	0.147250276	0.216893387
0.65625	0.8261769	0.072789911	0.117371705	0.14087847	0.207507987
0.666667	0.8339545	0.069842662	0.112619348	0.135174328	0.19910603
0.677083	0.8414361	0.067185575	0.108334869	0.130031769	0.191531259
0.6875	0.8486494	0.064775174	0.104448165	0.125366651	0.184659739
0.697917	0.8556178	0.062576493	0.100902853	0.121111297	0.178391784
0.708333	0.8623618	0.060561057	0.097653018	0.117210598	0.17264622
0.71875	0.8688992	0.058705419	0.094660854	0.113619174	0.167356206
0.729167	0.8752455	0.056990084	0.091894923	0.110299293	0.162466162
0.739583	0.8814146	0.055398691	0.089328847	0.107219292	0.157929452
0.75	0.8874188	0.053917403	0.086940312	0.10435239	0.153706628
0.760417	0.893269	0.052534429	0.084710304	0.101675765	0.149764073
0.770833	0.8989749	0.05123965	0.08262251	0.099169835	0.146072945
0.78125	0.9045456	0.050024334	0.080662846	0.096817697	0.142608346
0.791667	0.9099889	0.048880896	0.078819084	0.094604674	0.139348657
0.802083	0.9153121	0.047802717	0.077080551	0.092517954	0.136275007
0.8125	0.9205219	0.046783991	0.075437883	0.090546298	0.133370842
0.822917	0.9256243	0.0458196	0.07388283	0.088679805	0.130621577
0.833333	0.9306249	0.044905017	0.07240809	0.08690971	0.128014303
0.84375	0.9355287	0.044036218	0.071007176	0.085228227	0.125537549
0.854167	0.9403405	0.043209616	0.069674303	0.08362841	0.123181088
0.864583	0.9450645	0.042421999	0.068404292	0.082104046	0.120935764
0.875	0.9497049	0.041670483	0.067192494	0.080649554	0.118793359
0.885417	0.9542653	0.040952472	0.066034721	0.079259907	0.116746468
0.895833	0.9587492	0.040265619	0.06492719	0.077930564	0.114788403
0.90625	0.9631599	0.0396078	0.063866476	0.076657413	0.112913106
0.916667	0.9675003	0.038977085	0.062849464	0.075436719	0.111115075
0.927083	0.9717733	0.038371715	0.061873322	0.074265078	0.109389299
0.9375	0.9759816	0.037790087	0.060935463	0.073139389	0.107731205
0.947917	0.9801275	0.037230734	0.060033522	0.07205681	0.106136613
0.958333	0.9842135	0.03669231	0.059165329	0.071014739	0.104601687
0.96875	0.9882418	0.036173582	0.058328893	0.070010785	0.103122905
0.979167	0.9922143	0.035673411	0.057522382	0.069042748	0.101697029
0.989583	0.9961331	0.035190749	0.056744104	0.0681086	0.100321067
1	1	0.034724629	0.055992498	0.067206465	0.098992262

8.98 14.48 17.4

This sheet presents the intensity-duration computations based on the fitted power equation.
Results from this sheet are used to compute time-sequential hyetograph values.

Rio Vivi

Intensity-Duration Relationship

Hour	Cumulative Depth by E (decimal)	(inch)	Decimal Increment
0	0.000	0.000	0.000
0.25	0.185	3.113	0.185
0.5	0.239	4.024	0.054
0.75	0.277	4.675	0.039
1	0.309	5.200	0.031
1.25	0.335	5.648	0.027
1.5	0.358	6.042	0.023
1.75	0.380	6.396	0.021
2	0.399	6.720	0.019
2.25	0.417	7.020	0.018
2.5	0.433	7.299	0.017
2.75	0.449	7.561	0.016
3	0.463	7.808	0.015
3.25	0.477	8.043	0.014
3.5	0.490	8.266	0.013
3.75	0.503	8.480	0.013
4	0.515	8.685	0.012
4.25	0.527	8.882	0.012
4.5	0.538	9.072	0.011
4.75	0.549	9.255	0.011
5	0.560	9.432	0.011
5.25	0.570	9.604	0.010
5.5	0.580	9.771	0.010
5.75	0.589	9.933	0.010
6	0.599	10.091	0.009
6.25	0.608	10.244	0.009
6.5	0.617	10.394	0.009
6.75	0.625	10.540	0.009
7	0.634	10.683	0.008
7.25	0.642	10.823	0.008
7.5	0.650	10.959	0.008
7.75	0.658	11.093	0.008
8	0.666	11.224	0.008
8.25	0.674	11.352	0.008
8.5	0.681	11.479	0.007
8.75	0.688	11.602	0.007
9	0.696	11.724	0.007
9.25	0.703	11.843	0.007
9.5	0.710	11.961	0.007
9.75	0.717	12.076	0.007
10	0.723	12.190	0.007
10.25	0.730	12.302	0.007
10.5	0.736	12.412	0.007
10.75	0.743	12.521	0.006
11	0.749	12.628	0.006

Intensity-Duration Relationship

Hour	Cumulative Depth by E (decimal)	(inch)	Decimal Increment
11.25	0.756	12.733	0.006
11.5	0.762	12.837	0.006
11.75	0.768	12.939	0.006
12	0.774	13.041	0.006
12.25	0.780	13.141	0.006
12.5	0.786	13.239	0.006
12.75	0.791	13.337	0.006
13	0.797	13.433	0.006
13.25	0.803	13.528	0.006
13.5	0.808	13.622	0.006
13.75	0.814	13.714	0.006
14	0.819	13.806	0.005
14.25	0.825	13.897	0.005
14.5	0.830	13.987	0.005
14.75	0.835	14.075	0.005
15	0.840	14.163	0.005
15.25	0.846	14.250	0.005
15.5	0.851	14.336	0.005
15.75	0.856	14.421	0.005
16	0.861	14.505	0.005
16.25	0.866	14.589	0.005
16.5	0.871	14.671	0.005
16.75	0.875	14.753	0.005
17	0.880	14.834	0.005
17.25	0.885	14.915	0.005
17.5	0.890	14.994	0.005
17.75	0.894	15.073	0.005
18	0.899	15.151	0.005
18.25	0.904	15.229	0.005
18.5	0.908	15.306	0.005
18.75	0.913	15.382	0.005
19	0.917	15.458	0.004
19.25	0.922	15.533	0.004
19.5	0.926	15.607	0.004
19.75	0.930	15.681	0.004
20	0.935	15.754	0.004
20.25	0.939	15.826	0.004
20.5	0.943	15.898	0.004
20.75	0.948	15.970	0.004
21	0.952	16.041	0.004
21.25	0.956	16.111	0.004
21.5	0.960	16.181	0.004
21.75	0.964	16.250	0.004
22	0.968	16.319	0.004
22.25	0.972	16.388	0.004
22.5	0.976	16.455	0.004
22.75	0.980	16.523	0.004
23	0.984	16.590	0.004
23.25	0.988	16.656	0.004
23.5	0.992	16.722	0.004
23.75	0.996	16.788	0.004
24	1.000	16.853	0.004

POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

Puerto Rico 18.227 N 66.676 W 1312 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 3, Version 4
G.M. Bonnin, D. Martin, B. Lin, T Parzybok, M.Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2006
Extracted: Mon Jul 5 2010

Rio Vivi

Confidence Limits | Seasonality | Related Info | GIS data | Maps | Docs | Return to State Map

Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.51	0.70	0.90	1.44	2.13	2.85	2.97	3.38	3.67	4.21	5.22	5.91	7.18	8.41	11.78	14.88	18.93	22.73
2	0.64	0.87	1.12	1.79	2.66	3.44	3.62	4.19	4.63	5.40	6.67	7.50	9.05	10.56	14.65	18.43	23.36	28.01
5	0.70	0.95	1.22	1.96	2.90	3.90	4.18	5.09	5.99	7.30	8.94	9.79	11.42	12.99	17.33	21.41	26.78	31.80
10	0.76	1.03	1.32	2.12	3.15	4.32	4.72	5.94	7.29	9.11	11.12	11.89	13.51	15.07	19.55	23.84	29.55	34.84
25	0.83	1.14	1.47	2.35	3.48	4.93	5.51	7.20	9.32	11.96	14.58	15.08	16.55	18.05	22.55	27.04	33.16	38.73
50	0.90	1.23	1.58	2.53	3.75	5.43	6.16	8.27	11.10	14.49	17.67	17.94	19.18	20.57	24.91	29.49	35.89	41.66
100	0.97	1.32	1.70	2.72	4.03	5.94	6.85	9.40	13.07	17.35	21.16	21.33	22.27	23.63	27.29	31.91	38.55	44.48
200	1.04	1.42	1.82	2.91	4.32	6.48	7.59	10.64	15.30	20.60	25.15	25.28	25.98	27.37	30.66	34.92	41.24	47.30
500	1.13	1.54	1.98	3.17	4.71	7.22	8.62	12.42	18.63	25.51	31.19	31.29	31.92	33.21	36.25	40.87	45.69	51.53
1000	1.20	1.64	2.11	3.38	5.01	7.79	9.44	13.88	21.45	29.73	36.42	36.47	37.01	38.37	40.77	45.53	50.10	54.92

* These precipitation frequency estimates are based on a partial duration series. **ARI** is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting forces estimates near zero to appear as zero.

* Upper bound of the 90% confidence interval Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.56	0.76	0.98	1.56	2.32	2.99	3.17	3.72	4.21	4.78	5.96	6.65	7.97	9.26	12.78	16.05	20.33	24.31
2	0.67	0.92	1.18	1.89	2.80	3.65	3.88	4.63	5.33	6.14	7.63	8.47	10.07	11.63	15.91	19.87	25.10	29.96
5	0.73	1.00	1.28	2.05	3.04	4.12	4.48	5.63	6.92	8.28	10.21	11.03	12.67	14.29	18.80	23.07	28.76	33.98
10	0.79	1.08	1.39	2.23	3.31	4.58	5.08	6.61	8.49	10.35	12.72	13.42	15.00	16.59	21.23	25.70	31.75	37.24
25	0.88	1.21	1.55	2.48	3.68	5.27	5.99	8.10	10.98	13.65	16.78	17.14	18.49	19.96	24.59	29.27	35.76	41.55
50	0.96	1.31	1.68	2.69	3.99	5.85	6.77	9.40	13.23	16.64	20.47	20.53	21.56	22.88	27.28	32.08	38.85	44.84
100	1.03	1.41	1.81	2.90	4.31	6.45	7.61	10.85	15.85	20.07	24.73	24.98	25.23	26.46	30.04	34.87	41.92	48.07
200	1.12	1.53	1.96	3.14	4.66	7.12	8.54	12.50	18.88	23.99	29.67	29.97	30.27	30.89	33.96	38.37	45.06	51.34
500	1.24	1.69	2.17	3.47	5.14	8.05	9.89	14.92	23.58	30.06	37.34	37.71	38.09	38.47	40.55	45.31	50.34	56.34
1000	1.32	1.81	2.32	3.72	5.52	8.78	10.96	16.91	27.58	35.27	44.02	44.46	44.91	45.36	45.99	50.84	55.61	60.42

* The **upper** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **greater** than.
** These precipitation frequency estimates are based on a partial duration series. **ARI** is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

* Lower bound of the 90% confidence interval Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.51	0.69	0.89	1.42	2.11	2.69	2.81	3.12	3.28	3.76	4.65	5.32	6.53	7.71	10.90	13.83	17.64	21.27
2	0.61	0.83	1.07	1.72	2.54	3.27	3.43	3.87	4.13	4.82	5.92	6.75	8.23	9.67	13.56	17.14	21.80	26.21
5	0.67	0.91	1.17	1.87	2.77	3.70	3.93	4.66	5.28	6.47	7.90	8.76	10.34	11.85	16.00	19.88	24.95	29.72
10	0.72	0.98	1.26	2.02	3.00	4.08	4.41	5.37	6.32	8.01	9.72	10.54	12.15	13.68	17.98	22.06	27.45	32.48
25	0.79	1.08	1.39	2.22	3.29	4.60	5.07	6.38	7.84	10.28	12.46	13.12	14.68	16.18	20.58	24.88	30.64	35.99
50	0.84	1.16	1.48	2.37	3.52	5.03	5.59	7.18	9.10	12.25	14.78	15.36	16.80	18.24	22.58	26.99	33.02	38.55
100	0.90	1.23	1.57	2.52	3.74	5.42	6.12	8.00	10.44	14.37	17.34	17.95	19.25	20.73	24.53	29.00	35.24	40.92
200	0.95	1.30	1.67	2.67	3.97	5.84	6.67	8.87	11.90	16.74	20.13	20.86	22.09	23.69	27.31	31.50	37.45	43.27
500	1.02	1.40	1.80	2.88	4.27	6.38	7.41	10.09	13.96	20.23	24.24	25.17	26.57	28.20	31.86	36.49	41.09	46.78
1000	1.08	1.47	1.89	3.02	4.49	6.80	8.00	11.04	15.62	23.11	27.64	28.76	30.28	32.13	35.43	40.32	44.74	49.53

* The **lower** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **less** than.

** These precipitation frequency estimates are based on a partial duration maxima series. **ARI** is the Average Recurrence Interval.

Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

Text version of tables

Related Information

Maps & Aerials

Click here to see topographic maps and aerial photographs available for this location from Microsoft Research Maps

Climate Data Sources

National Climatic Data Center (NCDC) database

Locate NCDC climate stations within:

+/-30 minutes or +/-1 degree of this location. Digital ASCII data can be obtained directly from NCDC.

Note: Precipitation frequency results are based on analysis of precipitation data from a variety of sources, but largely NCDC. The following links provide general information about observing sites in the area, regardless of if their data was used in this study. For detailed information about the stations used in this study, please refer to the matching documentation available at the PF Document page

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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
Office of Hydrologic Development
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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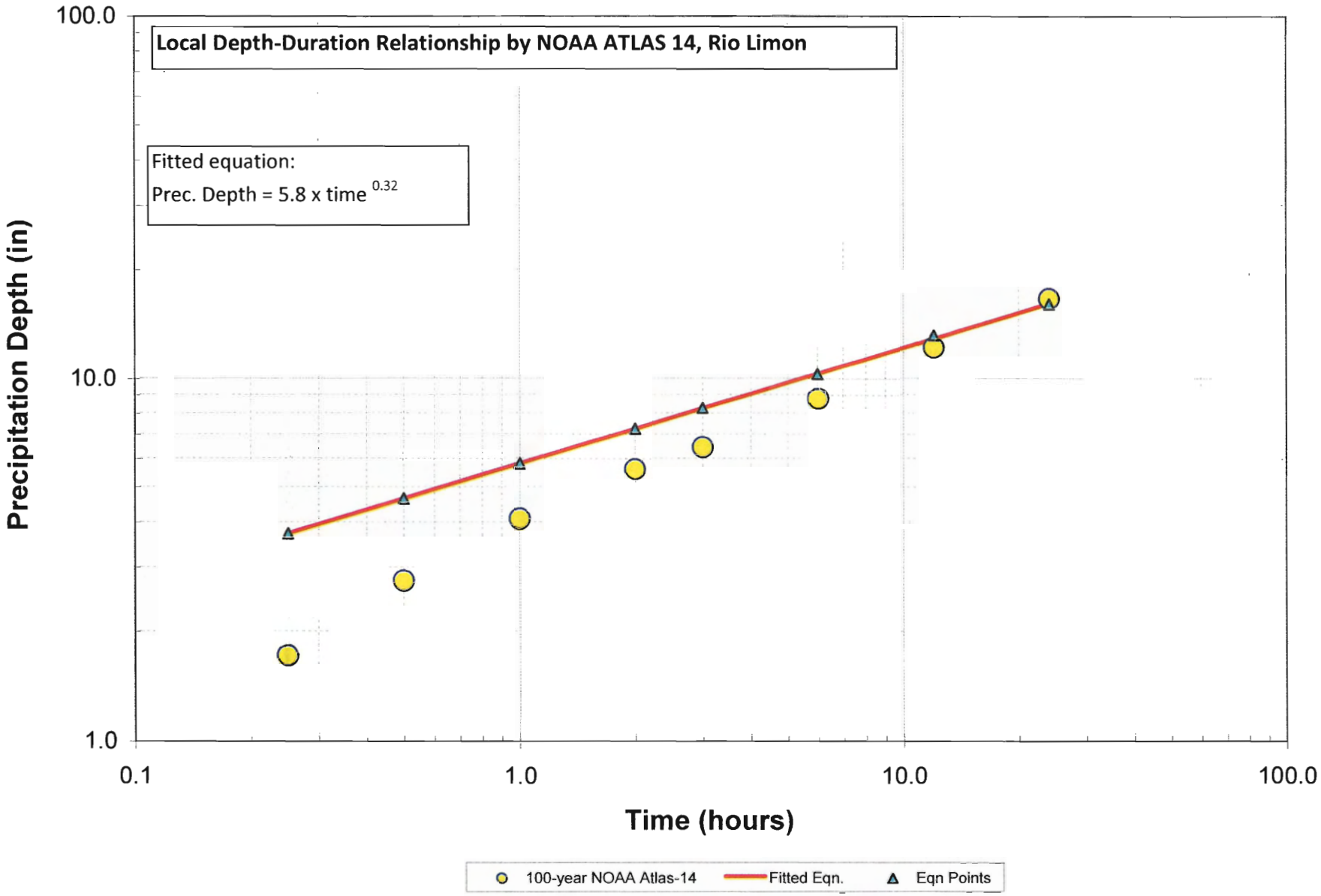
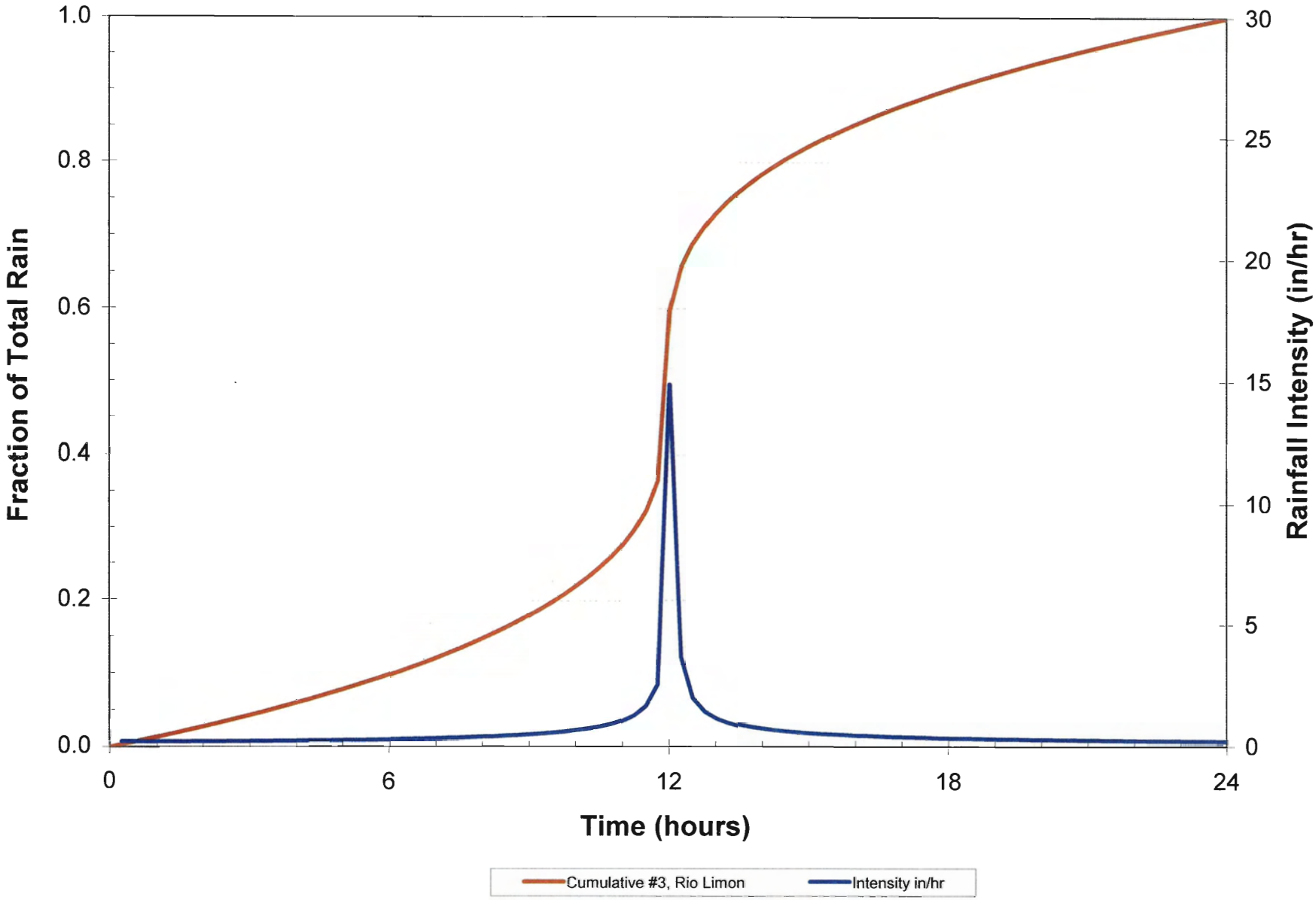

Local Depth-Duration Relationship by NOAA ATLAS 14, Rio Limon
Fitted equation:
Prec. Depth = 5.8 x time 0.32
Precipitation Depth (in)
100.0
10.0
1.0
0.1
1.0
10.0
100.0
Time (hours)
100-year NOAA Atlas-14
Fitted Eqn.
Eqn Points


1.0
0.8
0.6
0.4
0.2
0.0
Fraction of Total Rain
30
25
20
15
10
5
0
Rainfall Intensity (in/hr)
0
6
12
18
24
Time (hours)
Cumulative #3, Rio Limon
Intensity in/hr

Sequential Depth Hyetograph - Distribution #1 (15 minute)

Hour	Ordered Intensities	Incremental Depth (decimal)	Incremental Depth (inches)	Cumulative Depth (decimal)	Cumulative Depth (inches)	Intensity (inch/hr)
0		0	0	0	0	
0.25	23.75	0.003	0.054	0.003	0.054	0.216
0.5	23.25	0.003	0.055	0.007	0.109	0.219
0.75	22.75	0.003	0.056	0.010	0.164	0.223
1	22.25	0.004	0.056	0.014	0.221	0.226
1.25	21.75	0.004	0.057	0.017	0.278	0.230
1.5	21.25	0.004	0.058	0.021	0.337	0.233
1.75	20.75	0.004	0.059	0.025	0.396	0.237
2	20.25	0.004	0.060	0.028	0.456	0.241
2.25	19.75	0.004	0.061	0.032	0.517	0.245
2.5	19.25	0.004	0.062	0.036	0.580	0.250
2.75	18.75	0.004	0.064	0.040	0.643	0.254
3	18.25	0.004	0.065	0.044	0.708	0.259
3.25	17.75	0.004	0.066	0.048	0.774	0.264
3.5	17.25	0.004	0.067	0.052	0.841	0.269
3.75	16.75	0.004	0.069	0.057	0.910	0.274
4	16.25	0.004	0.070	0.061	0.980	0.280
4.25	15.75	0.004	0.072	0.066	1.051	0.286
4.5	15.25	0.005	0.073	0.070	1.125	0.293
4.75	14.75	0.005	0.075	0.075	1.200	0.299
5	14.25	0.005	0.077	0.080	1.276	0.307
5.25	13.75	0.005	0.079	0.084	1.355	0.314
5.5	13.25	0.005	0.081	0.090	1.435	0.322
5.75	12.75	0.005	0.083	0.095	1.518	0.331
6	12.25	0.005	0.085	0.100	1.603	0.340
6.25	11.75	0.005	0.088	0.105	1.691	0.350
6.5	11.25	0.006	0.090	0.111	1.781	0.361
6.75	10.75	0.006	0.093	0.117	1.874	0.372
7	10.25	0.006	0.096	0.123	1.970	0.385
7.25	9.75	0.006	0.099	0.129	2.069	0.398
7.5	9.25	0.006	0.103	0.135	2.173	0.413
7.75	8.75	0.007	0.107	0.142	2.280	0.429
8	8.25	0.007	0.112	0.149	2.391	0.447
8.25	7.75	0.007	0.117	0.156	2.508	0.466
8.5	7.25	0.008	0.122	0.164	2.630	0.488
8.75	6.75	0.008	0.128	0.172	2.758	0.513
9	6.25	0.008	0.135	0.180	2.894	0.541
9.25	5.75	0.009	0.143	0.189	3.037	0.574
9.5	5.25	0.010	0.153	0.199	3.190	0.611
9.75	4.75	0.010	0.164	0.209	3.354	0.655
10	4.25	0.011	0.177	0.220	3.531	0.708
10.25	3.75	0.012	0.193	0.232	3.724	0.773
10.5	3.25	0.013	0.214	0.246	3.938	0.855
10.75	2.75	0.015	0.241	0.261	4.179	0.963
11	2.25	0.017	0.278	0.278	4.457	1.112
11.25	1.75	0.021	0.334	0.299	4.791	1.336
11.5	1.25	0.027	0.429	0.326	5.220	1.717
11.75	0.75	0.040	0.644	0.366	5.864	2.575
12	0.25	0.232	3.722	0.598	9.586	14.888
12.25	0.5	0.058	0.924	0.655	10.510	3.697
12.5	1	0.032	0.510	0.687	11.020	2.040
12.75	1.5	0.023	0.374	0.711	11.394	1.497
13	2	0.019	0.303	0.729	11.697	1.211
13.25	2.5	0.016	0.258	0.746	11.955	1.031
13.5	3	0.014	0.226	0.760	12.181	0.905
13.75	3.5	0.013	0.203	0.772	12.384	0.812
14	4	0.012	0.185	0.784	12.569	0.739
14.25	4.5	0.011	0.170	0.794	12.739	0.680
14.5	5	0.010	0.158	0.804	12.897	0.632
14.75	5.5	0.009	0.148	0.813	13.045	0.592
15	6	0.009	0.139	0.822	13.184	0.557
15.25	6.5	0.008	0.132	0.830	13.316	0.527
15.5	7	0.008	0.125	0.838	13.441	0.500
15.75	7.5	0.007	0.119	0.846	13.560	0.477
16	8	0.007	0.114	0.853	13.674	0.456
16.25	8.5	0.007	0.109	0.860	13.784	0.437
16.5	9	0.007	0.105	0.866	13.889	0.421
16.75	9.5	0.006	0.101	0.872	13.990	0.405
17	10	0.006	0.098	0.879	14.088	0.391
17.25	10.5	0.006	0.095	0.884	14.182	0.378
17.5	11	0.006	0.092	0.890	14.274	0.366
17.75	11.5	0.006	0.089	0.896	14.363	0.355
18	12	0.005	0.086	0.901	14.449	0.345
18.25	12.5	0.005	0.084	0.906	14.533	0.335
18.5	13	0.005	0.082	0.911	14.615	0.327
18.75	13.5	0.005	0.080	0.916	14.694	0.318
19	14	0.005	0.078	0.921	14.772	0.310
19.25	14.5	0.005	0.076	0.926	14.847	0.303
19.5	15	0.005	0.074	0.930	14.921	0.296
19.75	15.5	0.005	0.072	0.935	14.994	0.289
20	16	0.004	0.071	0.939	15.065	0.283
20.25	16.5	0.004	0.069	0.944	15.134	0.277
20.5	17	0.004	0.068	0.948	15.202	0.272
20.75	17.5	0.004	0.067	0.952	15.268	0.266
21	18	0.004	0.065	0.956	15.334	0.261
21.25	18.5	0.004	0.064	0.960	15.398	0.256
21.5	19	0.004	0.063	0.964	15.461	0.252
21.75	19.5	0.004	0.062	0.968	15.523	0.247
22	20	0.004	0.061	0.972	15.583	0.243
22.25	20.5	0.004	0.060	0.975	15.643	0.239
22.5	21	0.004	0.059	0.979	15.702	0.235
22.75	21.5	0.004	0.058	0.983	15.760	0.231
23	22	0.004	0.057	0.986	15.817	0.228
23.25	22.5	0.003	0.056	0.990	15.873	0.224
23.5	23	0.003	0.055	0.993	15.928	0.221
23.75	23.5	0.003	0.054	0.997	15.982	0.218
24	24	0.003	0.054	1.000	16.036	0.215

Hour	Cumulative depth (decimal)	Cumulative depth (inches)
0	0	0
0.25	0.010417	0.0033692
0.5	0.020833	0.0067878
0.75	0.03125	0.0102576
1	0.041667	0.0137806
1.25	0.052083	0.0173587
1.5	0.0625	0.0209942
1.75	0.072917	0.0246894
2	0.083333	0.0284468
2.25	0.09375	0.032269
2.5	0.104167	0.0361589
2.75	0.114583	0.0401195
3	0.125	0.044154
3.25	0.135417	0.0482661
3.5	0.145833	0.0524594
3.75	0.15625	0.0567381
4	0.166667	0.0611065
4.25	0.177083	0.0655696
4.5	0.1875	0.0701324
4.75	0.197917	0.0748008
5	0.208333	0.0795809
5.25	0.21875	0.0844796
5.5	0.229167	0.0895044
5.75	0.239583	0.0946637
6	0.25	0.0999668
6.25	0.260417	0.1054239
6.5	0.270833	0.1110467
6.75	0.28125	0.116848
7	0.291667	0.1228427
7.25	0.302083	0.1290475
7.5	0.3125	0.1354815
7.75	0.322917	0.1421668
8	0.333333	0.1491292
8.25	0.34375	0.156399
8.5	0.354167	0.164012
8.75	0.364583	0.1720112
9	0.375	0.1804489
9.25	0.385417	0.1893898
9.5	0.395833	0.1989151
9.75	0.40625	0.2091293
10	0.416667	0.2201704
10.25	0.427083	0.2322261
10.5	0.4375	0.245563
10.75	0.447917	0.2605807
11	0.458333	0.2779229
11.25	0.46875	0.2987454
11.5	0.479167	0.3255164
11.75	0.489583	0.3656571
12	0.5	0.5977561
12.25	0.510417	0.6553934
12.5	0.520833	0.687203
12.75	0.53125	0.7105409
13	0.541667	0.7294273
13.25	0.552083	0.7455041
13.5	0.5625	0.7596199
13.75	0.572917	0.7722763
14	0.583333	0.7837971
14.25	0.59375	0.7944049
14.5	0.604167	0.8042599
14.75	0.614583	0.8134815
15	0.625	0.8221618
15.25	0.635417	0.8303731
15.5	0.645833	0.8381732
15.75	0.65625	0.8456097
16	0.666667	0.8527217
16.25	0.677083	0.8595422
16.5	0.6875	0.8660988
16.75	0.697917	0.8724156
17	0.708333	0.8785131
17.25	0.71875	0.8844092
17.5	0.729167	0.8901195
17.75	0.739583	0.8956579
18	0.75	0.9010367
18.25	0.760417	0.9062667
18.5	0.770833	0.9113576
18.75	0.78125	0.9163184
19	0.791667	0.9211569
19.25	0.802083	0.9258803
19.5	0.8125	0.9304952
19.75	0.822917	0.9350074
20	0.833333	0.9394225
20.25	0.84375	0.9437455
20.5	0.854167	0.947981
20.75	0.864583	0.9521332
21	0.875	0.9562061
21.25	0.885417	0.9602032
21.5	0.895833	0.9641281
21.75	0.90625	0.9679837
22	0.916667	0.9717732
22.25	0.927083	0.9754992
22.5	0.9375	0.9791642
22.75	0.947917	0.9827707
23	0.958333	0.986321
23.25	0.96875	0.9898171
23.5	0.979167	0.9932611
23.75	0.989583	0.9966548
24	1	1

Rio Limon			
8.72	13.86	16.54	24.07
10-Yr	50-yr	100-yr	500-yr
0	0	0	0
0.029379767	0.046697658	0.055727219	0.081097592
0.029810256	0.047381898	0.056543766	0.082285879
0.030256672	0.048091454	0.057390523	0.08351813
0.030719977	0.048827853	0.058269314	0.084797
0.031201213	0.049592754	0.059182117	0.086125367
0.031701514	0.050387957	0.060131082	0.087506358
0.032222113	0.051215423	0.06111855	0.088943379
0.032764358	0.052077293	0.062147073	0.090440148
0.033329719	0.052975907	0.063219445	0.092000728
0.033919811	0.053913828	0.064338724	0.09362957
0.034536405	0.054893873	0.065508273	0.095331567
0.035181452	0.055919142	0.06673179	0.097112104
0.035857105	0.05699306	0.068013363	0.098977125
0.03656575	0.058119415	0.069357512	0.100933211
0.037310032	0.059302414	0.070769258	0.102987669
0.0380929	0.060546742	0.072254193	0.105148635
0.038917645	0.061857633	0.07381856	0.107425196
0.039787959	0.063240953	0.075469363	0.109827543
0.040707996	0.064703305	0.077214478	0.11236714
0.041682446	0.066252145	0.079062805	0.115056936
0.042716632	0.067895932	0.081024438	0.117911622
0.043816617	0.069644302	0.083110877	0.120947932
0.044989342	0.071508288	0.085335288	0.124185029
0.046242795	0.073500589	0.087712824	0.127644963
0.047586221	0.075635898	0.090261021	0.131353251
0.049030385	0.077931323	0.093000294	0.135339606
0.050587899	0.080406913	0.09595457	0.139638845
0.052273654	0.083086335	0.099152091	0.144292069
0.054105364	0.085997745	0.102626458	0.149348177
0.056104286	0.089174931	0.106417992	0.154865844
0.058296174	0.092658827	0.110575541	0.16091616
0.060712562	0.096499553	0.115158918	0.167586165
0.063392518	0.100759209	0.12024223	0.174983705
0.066385101	0.105515768	0.125918528	0.183244194
0.069752843	0.110868625	0.132306425	0.192540246
0.073576848	0.116946687	0.139559755	0.203095725
0.07796441	0.123920496	0.147882035	0.215206807
0.083060826	0.132020992	0.15754886	0.229274551
0.089068331	0.141569617	0.168943829	0.245857192
0.096277886	0.153028842	0.182618834	0.26575788
0.105125433	0.167091571	0.199400764	0.29017995
0.116298268	0.184850229	0.220593275	0.321020564
0.130953955	0.208144704	0.24839202	0.361474966
0.151224208	0.240363247	0.286840412	0.417427371
0.181572064	0.288599634	0.344403892	0.501197199
0.233443116	0.371046053	0.442792331	0.644377958
0.350027325	0.556350771	0.663927976	0.96618781
2.023902982	3.216891667	3.838916895	5.586622108
0.502596939	0.798852473	0.95332034	1.387328935
0.277379788	0.440881176	0.526130927	0.765657281
0.203506687	0.32346361	0.386009243	0.561743802
0.164689599	0.261765807	0.312381417	0.454596174
0.140189965	0.222824876	0.265910782	0.386969318
0.123089659	0.195644802	0.23347511	0.339766983
0.110363686	0.17541751	0.209336625	0.304639211
0.100461624	0.159678682	0.190554503	0.277306341
0.092499912	0.147023943	0.175452815	0.255329459
0.085935085	0.136589482	0.163000724	0.237208429
0.080412997	0.127812401	0.152526487	0.221965692
0.075692171	0.120308887	0.143572077	0.208934697
0.071601833	0.113807501	0.135813569	0.197644051
0.068017517	0.108110412	0.129014878	0.187750188
0.064846189	0.103069745	0.122999537	0.178996303
0.062016796	0.098572569	0.117632777	0.171186272
0.059474065	0.094531025	0.112809751	0.164167516
0.057174292	0.090875652	0.108447567	0.157819404
0.055082432	0.087550746	0.104479751	0.1520452
0.053170029	0.084511078	0.100852325	0.146766352
0.051413713	0.081719502	0.097520964	0.141918356
0.049794101	0.079145212	0.094448903	0.137447709
0.04829497	0.076762419	0.091605368	0.133309626
0.046902628	0.07454936	0.088964388	0.129466314
0.045605432	0.072487532	0.086503881	0.125885635
0.044393414	0.070561092	0.084204939	0.122540078
0.043257988	0.06875639	0.082051276	0.119405938
0.042191712	0.067061598	0.080028776	0.116462674
0.041188103	0.065466411	0.07812514	0.113692389
0.040241482	0.063961806	0.076329601	0.111079413
0.039346858	0.062539845	0.074632687	0.108609962
0.038499817	0.061193516	0.073026029	0.106271857
0.037696446	0.059916598	0.071502203	0.104054294
0.03693326	0.058703553	0.0700546	0.101947656
0.036207145	0.05754943	0.068677314	0.099943346
0.03551531	0.056449792	0.067365048	0.098033658
0.034855242	0.055400649	0.06611304	0.096211661
0.034224678	0.054398398	0.064916992	0.0944711
0.033621567	0.053439785	0.063773018	0.092806321
0.033044052	0.052521853	0.062677593	0.091212193
0.032490441	0.051641917	0.061627511	0.08968405
0.031959195	0.050797528	0.060619849	0.08821764
0.031448906	0.049986449	0.059651938	0.086809078
0.030958285	0.049206632	0.058721334	0.085454807
0.03048615	0.048456198	0.057825794	0.084151564
0.030031415	0.047733419	0.056963257	0.082896348
0.029593078	0.047036704	0.056131824	0.081686397
0.029170216	0.046364586	0.055329744	0.080519162

8.72 13.86 16.5

This sheet presents the intensity-duration computations based on the fitted power equation.
Results from this sheet are used to compute time-sequential hyetograph values.

Rio Limon

Intensity-Duration Relationship

Hour	Cumulative Depth by E (decimal)	(inch)	Decimal Increment
0	0.000	0.000	0.000
0.25	0.232	3.722	0.232
0.5	0.290	4.646	0.058
0.75	0.330	5.290	0.040
1	0.362	5.800	0.032
1.25	0.388	6.229	0.027
1.5	0.412	6.604	0.023
1.75	0.433	6.937	0.021
2	0.452	7.240	0.019
2.25	0.469	7.518	0.017
2.5	0.485	7.776	0.016
2.75	0.500	8.017	0.015
3	0.514	8.243	0.014
3.25	0.527	8.457	0.013
3.5	0.540	8.660	0.013
3.75	0.552	8.854	0.012
4	0.564	9.038	0.012
4.25	0.575	9.215	0.011
4.5	0.585	9.385	0.011
4.75	0.595	9.549	0.010
5	0.605	9.707	0.010
5.25	0.615	9.860	0.010
5.5	0.624	10.008	0.009
5.75	0.633	10.151	0.009
6	0.642	10.290	0.009
6.25	0.650	10.426	0.008
6.5	0.658	10.557	0.008
6.75	0.666	10.686	0.008
7	0.674	10.811	0.008
7.25	0.682	10.933	0.008
7.5	0.689	11.052	0.007
7.75	0.696	11.169	0.007
8	0.704	11.283	0.007
8.25	0.711	11.394	0.007
8.5	0.717	11.504	0.007
8.75	0.724	11.611	0.007
9	0.731	11.716	0.007
9.25	0.737	11.819	0.006
9.5	0.743	11.921	0.006
9.75	0.750	12.020	0.006
10	0.756	12.118	0.006
10.25	0.762	12.214	0.006
10.5	0.768	12.309	0.006
10.75	0.773	12.402	0.006
11	0.779	12.493	0.006

Intensity-Duration Relationship

Hour	Cumulative Depth by E (decimal)	(inch)	Decimal Increment
11.25	0.785	12.583	0.006
11.5	0.790	12.672	0.006
11.75	0.796	12.760	0.005
12	0.801	12.846	0.005
12.25	0.806	12.931	0.005
12.5	0.812	13.015	0.005
12.75	0.817	13.098	0.005
13	0.822	13.179	0.005
13.25	0.827	13.260	0.005
13.5	0.832	13.339	0.005
13.75	0.837	13.418	0.005
14	0.842	13.495	0.005
14.25	0.846	13.572	0.005
14.5	0.851	13.648	0.005
14.75	0.856	13.723	0.005
15	0.860	13.797	0.005
15.25	0.865	13.870	0.005
15.5	0.869	13.942	0.005
15.75	0.874	14.014	0.004
16	0.878	14.085	0.004
16.25	0.883	14.155	0.004
16.5	0.887	14.224	0.004
16.75	0.891	14.293	0.004
17	0.896	14.361	0.004
17.25	0.900	14.428	0.004
17.5	0.904	14.494	0.004
17.75	0.908	14.560	0.004
18	0.912	14.626	0.004
18.25	0.916	14.690	0.004
18.5	0.920	14.754	0.004
18.75	0.924	14.818	0.004
19	0.928	14.881	0.004
19.25	0.932	14.943	0.004
19.5	0.936	15.005	0.004
19.75	0.940	15.066	0.004
20	0.943	15.127	0.004
20.25	0.947	15.187	0.004
20.5	0.951	15.247	0.004
20.75	0.955	15.306	0.004
21	0.958	15.365	0.004
21.25	0.962	15.423	0.004
21.5	0.965	15.481	0.004
21.75	0.969	15.539	0.004
22	0.973	15.596	0.004
22.25	0.976	15.652	0.004
22.5	0.980	15.708	0.003
22.75	0.983	15.764	0.003
23	0.986	15.819	0.003
23.25	0.990	15.874	0.003
23.5	0.993	15.928	0.003
23.75	0.997	15.982	0.003
24	1.000	16.036	0.003

POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

Puerto Rico 18.292 N 66.588 W 1312 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 3, Version 4
G.M. Bonnin, D. Martin, B. Lin, T Parzybok, M.Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2006
Extracted: Mon Jul 5 2010

Rio Limon

Confidence Limits | Seasonality | Related Info | GIS data | Maps | Docs | Return to State Map

Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.55	0.75	0.96	1.54	2.29	2.82	2.94	3.32	3.62	4.17	5.33	6.08	7.54	8.63	12.26	15.35	19.25	22.86
2	0.67	0.91	1.17	1.88	2.79	3.40	3.57	4.11	4.56	5.34	6.79	7.71	9.50	10.82	15.22	18.99	23.73	28.14
5	0.71	0.98	1.25	2.00	2.98	3.79	4.06	4.94	5.82	7.16	9.03	9.99	11.88	13.21	17.87	21.95	27.14	31.85
10	0.77	1.05	1.35	2.15	3.20	4.16	4.54	5.70	7.01	8.88	11.17	12.08	14.01	15.28	20.09	24.39	29.89	34.84
25	0.84	1.15	1.48	2.37	3.51	4.70	5.24	6.83	8.83	11.55	14.53	15.24	17.13	18.23	23.11	27.61	33.50	38.68
50	0.91	1.24	1.59	2.55	3.78	5.14	5.81	7.76	10.41	13.91	17.51	18.05	19.75	20.64	25.49	30.10	36.25	41.58
100	0.97	1.33	1.71	2.73	4.05	5.58	6.41	8.76	12.15	16.55	20.87	21.36	22.86	23.57	27.89	32.56	38.91	44.35
200	1.04	1.42	1.82	2.92	4.33	6.04	7.05	9.84	14.09	19.53	24.69	25.17	26.53	27.12	31.10	35.07	41.62	47.15
500	1.13	1.55	1.99	3.19	4.73	6.67	7.94	11.38	16.97	24.02	30.46	30.98	32.43	32.79	36.38	40.63	45.14	50.73
1000	1.21	1.65	2.12	3.39	5.03	7.16	8.65	12.63	19.39	27.86	35.42	35.94	37.49	37.73	40.64	45.02	49.44	53.44

* These precipitation frequency estimates are based on a partial duration series. **ARI** is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting forces estimates near zero to appear as zero.

* Upper bound of the 90% confidence interval Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.59	0.80	1.03	1.65	2.45	2.97	3.13	3.65	4.15	4.72	6.11	6.90	8.45	9.57	13.37	16.62	20.83	24.60
2	0.70	0.96	1.23	1.97	2.93	3.60	3.82	4.51	5.23	6.06	7.82	8.75	10.65	12.01	16.61	20.55	25.68	30.27
5	0.75	1.02	1.32	2.11	3.13	4.01	4.34	5.41	6.69	8.12	10.40	11.35	13.33	14.66	19.51	23.75	29.35	34.24
10	0.81	1.11	1.42	2.27	3.38	4.42	4.87	6.29	8.13	10.07	12.89	13.74	15.75	16.99	21.98	26.41	32.38	37.49
25	0.90	1.23	1.57	2.52	3.74	5.03	5.68	7.61	10.38	13.19	16.88	17.47	19.38	20.39	25.40	30.02	36.43	41.75
50	0.97	1.33	1.70	2.73	4.05	5.55	6.38	8.77	12.38	16.00	20.47	20.82	22.48	23.19	28.13	32.89	39.58	45.05
100	1.05	1.43	1.84	2.94	4.36	6.07	7.10	10.01	14.66	19.14	24.64	24.88	26.20	26.68	30.94	35.73	42.70	48.29
200	1.13	1.55	1.99	3.18	4.71	6.66	7.91	11.44	17.33	22.80	29.46	29.60	30.66	30.92	34.70	38.68	45.89	51.52
500	1.25	1.71	2.19	3.51	5.21	7.47	9.09	13.54	21.39	28.38	36.88	36.91	37.97	38.35	40.96	45.20	50.16	55.80
1000	1.34	1.83	2.35	3.77	5.59	8.11	10.02	15.25	24.84	33.21	43.28	43.31	44.38	44.83	46.09	50.44	55.33	59.11

* The **upper** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **greater** than.
** These precipitation frequency estimates are based on a partial duration series. **ARI** is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

* Lower bound of the 90% confidence interval Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.53	0.73	0.94	1.50	2.22	2.65	2.77	3.06	3.23	3.73	4.72	5.42	6.80	7.86	11.28	14.20	17.82	21.26
2	0.64	0.88	1.12	1.80	2.67	3.23	3.38	3.80	4.06	4.77	6.01	6.88	8.56	9.83	14.00	17.57	21.99	26.17
5	0.68	0.93	1.20	1.92	2.84	3.60	3.82	4.53	5.13	6.37	7.94	8.84	10.63	11.93	16.37	20.24	25.06	29.55
10	0.73	1.00	1.28	2.05	3.04	3.92	4.24	5.17	6.08	7.82	9.71	10.59	12.44	13.71	18.33	22.40	27.52	32.25
25	0.80	1.09	1.40	2.24	3.32	4.39	4.83	6.08	7.47	9.98	12.36	13.12	14.99	16.16	20.91	25.22	30.68	35.68
50	0.85	1.16	1.49	2.38	3.53	4.75	5.29	6.80	8.60	11.82	14.60	15.29	17.06	18.11	22.89	27.30	33.04	38.17
100	0.90	1.23	1.58	2.52	3.75	5.10	5.75	7.53	9.79	13.83	17.04	17.81	19.48	20.44	24.84	29.33	35.23	40.50
200	0.95	1.30	1.67	2.67	3.96	5.45	6.21	8.28	11.06	16.02	19.71	20.60	22.26	23.23	27.45	31.36	37.45	42.83
500	1.02	1.40	1.79	2.87	4.25	5.91	6.84	9.34	12.85	19.21	23.59	24.72	26.64	27.57	31.72	36.01	40.28	45.74
1000	1.07	1.47	1.88	3.02	4.47	6.25	7.34	10.16	14.29	21.87	26.81	28.12	30.28	31.30	35.06	39.60	43.84	47.92

* The **lower** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **less** than.

** These precipitation frequency estimates are based on a partial duration maxima series. **ARI** is the Average Recurrence Interval.

Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

Text version of tables

Related Information

Maps & Aerials

Click here to see topographic maps and aerial photographs available for this location from Microsoft Research Maps

Climate Data Sources

National Climatic Data Center (NCDC) database

Locate NCDC climate stations within:

+/-30 minutes or +/-1 degree of this location. Digital ASCII data can be obtained directly from NCDC.

Note: Precipitation frequency results are based on analysis of precipitation data from a variety of sources, but largely NCDC. The following links provide general information about observing sites in the area, regardless of if their data was used in this study. For detailed information about the stations used in this study, please refer to the matching documentation available at the PF Document page

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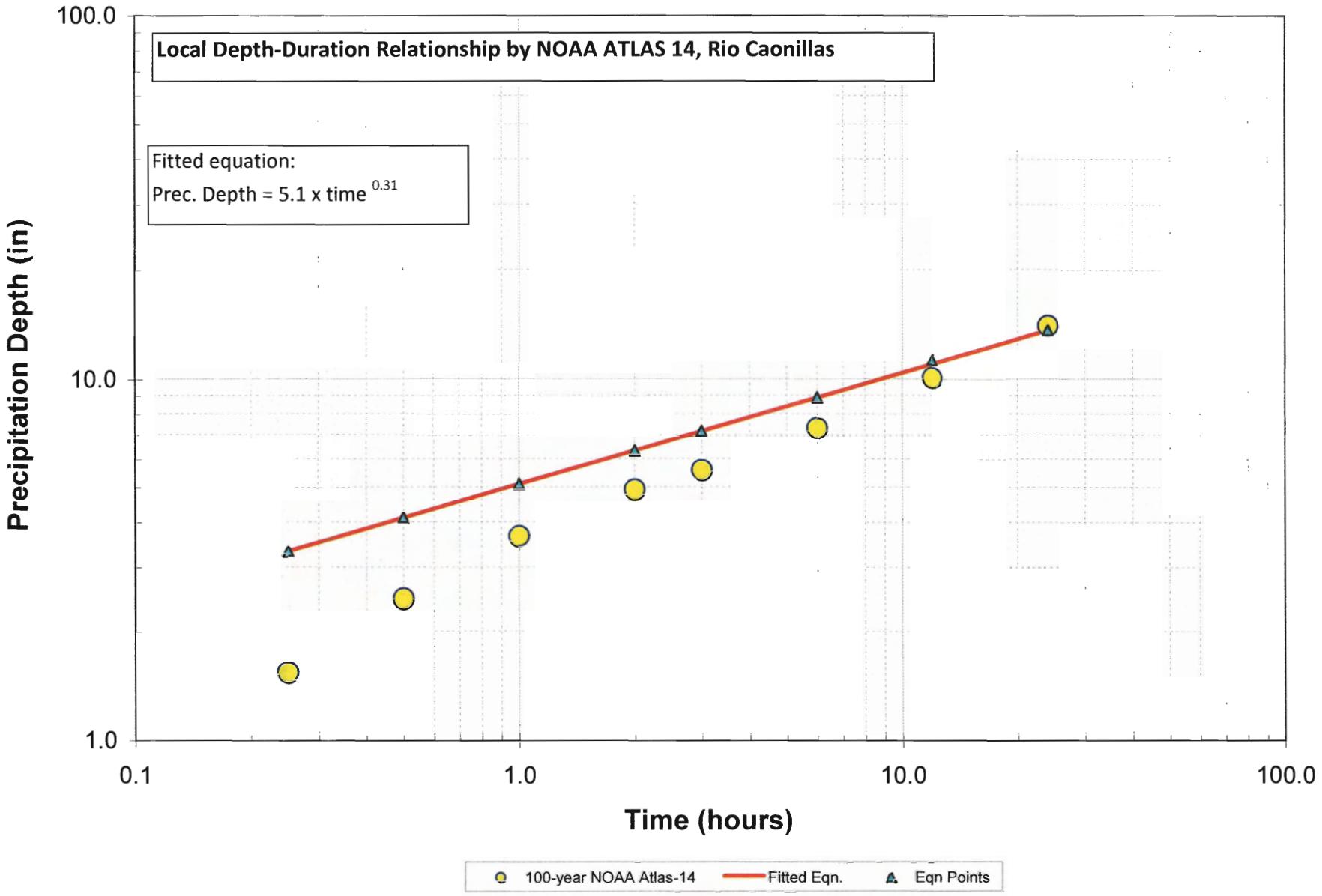
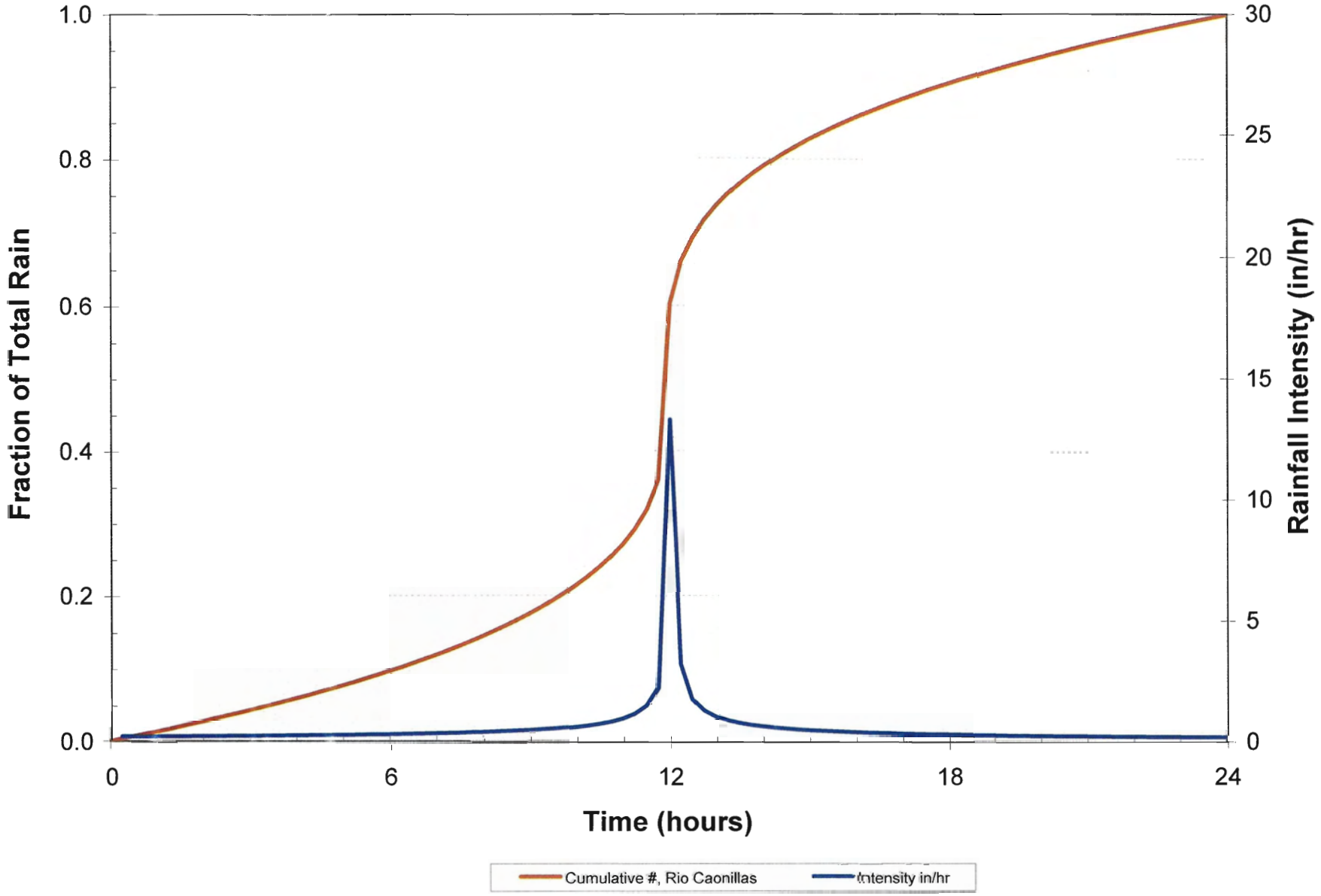
US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
Office of Hydrologic Development
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer


Local Depth-Duration Relationship by NOAA ATLAS 14, Rio Caonillas
Fitted equation:
Prec. Depth = 5.1 x time 0.31
Precipitation Depth (in)
100.0
10.0
1.0
0.1
1.0
10.0
100.0
Time (hours)
100-year NOAA Atlas-14
Fitted Eqn.
Eqn Points


1.0
0.8
0.6
0.4
0.2
0.0
Fraction of Total Rain
30
25
20
15
10
5
0
Rainfall Intensity (in/hr)
0
6
12
18
24
Time (hours)
Cumulative #, Rio Caonillas
Intensity in/hr

Sequential Depth Hyetograph - Distribution #1 (15 minute)

Hour	Ordered Intensities	Incremental Depth (decimal)	Incremental Depth (inches)	Cumulative Depth (decimal)	Cumulative Depth (inches)	Intensity (inch/hr)
0		0	0	0	0	
0.25	23.75	0.003	0.045	0.003	0.045	0.178
0.5	23.25	0.003	0.045	0.007	0.090	0.181
0.75	22.75	0.003	0.046	0.010	0.136	0.184
1	22.25	0.003	0.047	0.013	0.182	0.187
1.25	21.75	0.003	0.047	0.017	0.230	0.190
1.5	21.25	0.004	0.048	0.020	0.278	0.193
1.75	20.75	0.004	0.049	0.024	0.327	0.196
2	20.25	0.004	0.050	0.028	0.377	0.199
2.25	19.75	0.004	0.051	0.031	0.427	0.203
2.5	19.25	0.004	0.052	0.035	0.479	0.206
2.75	18.75	0.004	0.053	0.039	0.532	0.210
3	18.25	0.004	0.054	0.043	0.585	0.214
3.25	17.75	0.004	0.055	0.047	0.640	0.218
3.5	17.25	0.004	0.056	0.051	0.695	0.223
3.75	16.75	0.004	0.057	0.055	0.752	0.227
4	16.25	0.004	0.058	0.059	0.810	0.232
4.25	15.75	0.004	0.059	0.064	0.870	0.237
4.5	15.25	0.004	0.061	0.068	0.930	0.243
4.75	14.75	0.005	0.062	0.073	0.992	0.248
5	14.25	0.005	0.064	0.077	1.056	0.254
5.25	13.75	0.005	0.065	0.082	1.121	0.261
5.5	13.25	0.005	0.067	0.087	1.188	0.268
5.75	12.75	0.005	0.069	0.092	1.257	0.275
6	12.25	0.005	0.071	0.097	1.327	0.283
6.25	11.75	0.005	0.073	0.102	1.400	0.291
6.5	11.25	0.005	0.075	0.108	1.475	0.300
6.75	10.75	0.006	0.077	0.114	1.552	0.310
7	10.25	0.006	0.080	0.120	1.632	0.320
7.25	9.75	0.006	0.083	0.126	1.715	0.331
7.5	9.25	0.006	0.086	0.132	1.801	0.344
7.75	8.75	0.007	0.089	0.138	1.891	0.357
8	8.25	0.007	0.093	0.145	1.984	0.373
8.25	7.75	0.007	0.097	0.152	2.081	0.389
8.5	7.25	0.007	0.102	0.160	2.183	0.408
8.75	6.75	0.008	0.107	0.168	2.290	0.429
9	6.25	0.008	0.113	0.176	2.404	0.453
9.25	5.75	0.009	0.120	0.185	2.524	0.480
9.5	5.25	0.009	0.128	0.194	2.652	0.512
9.75	4.75	0.010	0.137	0.204	2.789	0.550
10	4.25	0.011	0.149	0.215	2.938	0.595
10.25	3.75	0.012	0.163	0.227	3.100	0.650
10.5	3.25	0.013	0.180	0.240	3.280	0.720
10.75	2.75	0.015	0.203	0.255	3.484	0.813
11	2.25	0.017	0.235	0.272	3.719	0.940
11.25	1.75	0.021	0.283	0.293	4.002	1.132
11.5	1.25	0.027	0.365	0.320	4.367	1.461
11.75	0.75	0.040	0.551	0.360	4.918	2.204
12	0.25	0.243	3.318	0.603	8.236	13.274
12.25	0.5	0.058	0.795	0.661	9.032	3.182
12.5	1	0.032	0.435	0.693	9.467	1.741
12.75	1.5	0.023	0.318	0.716	9.785	1.271
13	2	0.019	0.256	0.735	10.041	1.026
13.25	2.5	0.016	0.218	0.751	10.259	0.871
13.5	3	0.014	0.191	0.765	10.450	0.763
13.75	3.5	0.013	0.171	0.778	10.620	0.683
14	4	0.011	0.155	0.789	10.776	0.621
14.25	4.5	0.010	0.143	0.799	10.918	0.571
14.5	5	0.010	0.133	0.809	11.051	0.530
14.75	5.5	0.009	0.124	0.818	11.175	0.495
15	6	0.009	0.116	0.827	11.291	0.466
15.25	6.5	0.008	0.110	0.835	11.401	0.440
15.5	7	0.008	0.105	0.842	11.506	0.418
15.75	7.5	0.007	0.100	0.850	11.606	0.398
16	8	0.007	0.095	0.857	11.701	0.381
16.25	8.5	0.007	0.091	0.863	11.792	0.365
16.5	9	0.006	0.088	0.870	11.880	0.351
16.75	9.5	0.006	0.084	0.876	11.964	0.338
17	10	0.006	0.081	0.882	12.045	0.326
17.25	10.5	0.006	0.079	0.888	12.124	0.315
17.5	11	0.006	0.076	0.893	12.200	0.305
17.75	11.5	0.005	0.074	0.899	12.274	0.295
18	12	0.005	0.072	0.904	12.346	0.287
18.25	12.5	0.005	0.070	0.909	12.415	0.279
18.5	13	0.005	0.068	0.914	12.483	0.271
18.75	13.5	0.005	0.066	0.919	12.549	0.264
19	14	0.005	0.064	0.923	12.614	0.258
19.25	14.5	0.005	0.063	0.928	12.676	0.251
19.5	15	0.004	0.061	0.933	12.738	0.245
19.75	15.5	0.004	0.060	0.937	12.798	0.240
20	16	0.004	0.059	0.941	12.856	0.235
20.25	16.5	0.004	0.057	0.945	12.914	0.230
20.5	17	0.004	0.056	0.950	12.970	0.225
20.75	17.5	0.004	0.055	0.954	13.025	0.220
21	18	0.004	0.054	0.958	13.079	0.216
21.25	18.5	0.004	0.053	0.961	13.132	0.212
21.5	19	0.004	0.052	0.965	13.184	0.208
21.75	19.5	0.004	0.051	0.969	13.235	0.205
22	20	0.004	0.050	0.973	13.286	0.201
22.25	20.5	0.004	0.049	0.976	13.335	0.198
22.5	21	0.004	0.049	0.980	13.384	0.194
22.75	21.5	0.003	0.048	0.983	13.431	0.191
23	22	0.003	0.047	0.987	13.478	0.188
23.25	22.5	0.003	0.046	0.990	13.525	0.185
23.5	23	0.003	0.046	0.993	13.570	0.182
23.75	23.5	0.003	0.045	0.997	13.615	0.180
24	24	0.003	0.044	1.000	13.660	0.177

Hour	Cumulative depth (decimal)
0	0
0.010417	0.0032645
0.020833	0.0065775
0.03125	0.0099408
0.041667	0.0133564
0.052083	0.0168264
0.0625	0.0203527
0.072917	0.0239379
0.083333	0.0275843
0.09375	0.0312945
0.104167	0.0350714
0.114583	0.038918
0.125	0.0428375
0.135417	0.0468333
0.145833	0.0509093
0.15625	0.0550695
0.166667	0.0593183
0.177083	0.0636605
0.1875	0.0681012
0.197917	0.0726461
0.208333	0.0773015
0.21875	0.082074
0.229167	0.0869713
0.239583	0.0920016
0.25	0.0971742
0.260417	0.1024992
0.270833	0.1079883
0.28125	0.1136544
0.291667	0.1195121
0.302083	0.1255781
0.3125	0.1318716
0.322917	0.1384146
0.333333	0.145233
0.34375	0.1523568
0.354167	0.159822
0.364583	0.1676716
0.375	0.175958
0.385417	0.1847461
0.395833	0.1941173
0.40625	0.2041767
0.416667	0.2150628
0.427083	0.2269646
0.4375	0.240151
0.447917	0.255025
0.458333	0.2722378
0.46875	0.2929606
0.479167	0.3197022
0.489583	0.3600399
0.5	0.6029781
0.510417	0.6612123
0.520833	0.693068
0.53125	0.7163332
0.541667	0.7351022
0.552083	0.7510413
0.5625	0.7650093
0.572917	0.7775132
0.583333	0.7888794
0.59375	0.7993321
0.604167	0.8090325
0.614583	0.8181007
0.625	0.826629
0.635417	0.8346897
0.645833	0.8423412
0.65625	0.8496308
0.666667	0.8565978
0.677083	0.863275
0.6875	0.8696903
0.697917	0.8758675
0.708333	0.8818272
0.71875	0.8875871
0.729167	0.8931629
0.739583	0.8985685
0.75	0.9038159
0.760417	0.9089161
0.770833	0.9138789
0.78125	0.9187128
0.791667	0.9234258
0.802083	0.9280252
0.8125	0.9325172
0.822917	0.936908
0.833333	0.9412028
0.84375	0.9454068
0.854167	0.9495244
0.864583	0.9535598
0.875	0.957517
0.885417	0.9613997
0.895833	0.965211
0.90625	0.9689542
0.916667	0.9726322
0.927083	0.9762476
0.9375	0.9798031
0.947917	0.9833009
0.958333	0.9867435
0.96875	0.9901327
0.979167	0.9934706
0.989583	0.9967592
1	1

	Rio Caonillas			
	7.92	10.13	14.04	19.63
	10-Yr	50-yr	100-yr	500-yr
	0	0	0	0
	0.025854563	0.033069031	0.04583309	0.064081449
	0.026239011	0.033560755	0.046514611	0.065034317
	0.026637769	0.034070783	0.0472215	0.066022652
	0.027051704	0.034600223	0.047955294	0.067048605
	0.027481757	0.035150278	0.048717661	0.068114507
	0.027928951	0.035722256	0.049510413	0.069222892
	0.028394398	0.036317583	0.050335524	0.07037652
	0.028879315	0.036937811	0.05119515	0.071578404
	0.029385031	0.037584642	0.052091646	0.072831838
	0.029913003	0.038259939	0.053027596	0.074140434
	0.030464831	0.038965749	0.054005836	0.07550816
	0.031042278	0.039704328	0.055029493	0.076939383
	0.031647292	0.040478165	0.056102017	0.078438931
	0.032282027	0.041290017	0.05722723	0.080012145
	0.032948878	0.042142946	0.058409375	0.081664959
	0.033650511	0.043040363	0.059653178	0.083403981
	0.034389906	0.043986079	0.060963924	0.085236597
	0.035170403	0.044984367	0.062347533	0.087171088
	0.035995765	0.046040038	0.063810675	0.089216777
	0.036870241	0.047158528	0.065360882	0.091384195
	0.037798652	0.048346003	0.067006701	0.093685295
	0.038786494	0.049609494	0.068757877	0.096133698
	0.039840063	0.05095705	0.070625566	0.098745005
	0.040966604	0.052397942	0.072622616	0.101537177
	0.042174507	0.053942899	0.074763899	0.104531007
	0.043473544	0.055604419	0.077066736	0.107750715
	0.044875171	0.057397157	0.079551439	0.111224697
	0.046392918	0.059338417	0.082241992	0.114986488
	0.04804289	0.061448798	0.085166942	0.119076002
	0.049844421	0.063753029	0.088360565	0.12354116
	0.051820947	0.066281085	0.091864407	0.12844005
	0.05400118	0.069069692	0.095729365	0.133843835
	0.056420716	0.072164375	0.100018541	0.139840738
	0.059124274	0.075622335	0.104811213	0.146541604
	0.062168901	0.079516537	0.110208507	0.15408782
	0.065628632	0.083941673	0.116341667	0.162662886
	0.069601491	0.08902312	0.123384462	0.172509757
	0.074220325	0.094930795	0.131572394	0.1839577
	0.079670212	0.10190142	0.141233558	0.197465437
	0.086217695	0.110275915	0.152840459	0.213693605
	0.094262571	0.120565637	0.167101831	0.233633115
	0.104435949	0.133577799	0.185136456	0.258848193
	0.117802293	0.150673893	0.208831338	0.291977149
	0.136325217	0.174365461	0.24166743	0.33788687
	0.164124418	0.209921762	0.290947832	0.406788173
	0.211793862	0.270892906	0.375452755	0.524938574
	0.319474044	0.408620211	0.566340351	0.791827713
	1.924071024	2.46096458	3.410853179	4.768878056
	0.46121464	0.589912159	0.81760777	1.14313679
	0.252297296	0.322698435	0.447254297	0.625327767
	0.184260571	0.235676715	0.326643739	0.456696339
	0.148650482	0.190129973	0.263516764	0.368435476
	0.126237264	0.161462561	0.223784241	0.312883522
	0.110626955	0.141496346	0.196111421	0.27419282
	0.099030356	0.126663826	0.175553812	0.245450237
	0.090020576	0.115139954	0.159581931	0.223119181
	0.082785726	0.105886289	0.146756515	0.20518735
	0.076827096	0.09826496	0.136193489	0.190418674
	0.071820085	0.091860791	0.127317423	0.17800862
	0.067543597	0.08639099	0.119736376	0.167409193
	0.063841418	0.081655753	0.113173423	0.158233212
	0.060599793	0.077509584	0.107426906	0.150198729
	0.057733761	0.073843813	0.102346213	0.143095168
	0.055178486	0.070575513	0.097816407	0.136761828
	0.05288356	0.06764021	0.093748129	0.131073772
	0.050809155	0.064986962	0.090070775	0.125932288
	0.048923354	0.062574947	0.086727764	0.121258263
	0.047200253	0.06037103	0.083673175	0.116987495
	0.04561859	0.05834802	0.080869319	0.113067288
	0.044160742	0.056483373	0.078284951	0.109453959
	0.042811961	0.054758228	0.075893931	0.106110959
	0.04155981	0.053156676	0.073674209	0.103007459
	0.040393717	0.051665196	0.071607044	0.100117256
	0.039304634	0.050272216	0.069676397	0.097417926
	0.038284771	0.048967769	0.067868458	0.094890159
	0.037327378	0.047743225	0.066171261	0.092517226
	0.036426577	0.046591064	0.064574387	0.090284559
	0.035577223	0.045504706	0.063068714	0.088179405
	0.034774792	0.044478364	0.061646222	0.086190552
	0.034015288	0.043506928	0.060299829	0.084308095
	0.033295168	0.042585866	0.059023253	0.082523252
	0.032611278	0.041711142	0.057810902	0.080828206
	0.0319608	0.040879155	0.056657782	0.079215974
	0.031341209	0.040086673	0.055559417	0.077680296
	0.030750235	0.039330793	0.05451178	0.076215544
	0.030185828	0.038608894	0.053511241	0.074816643
	0.029646138	0.037918609	0.052554518	0.073479002
	0.029129485	0.037257789	0.051638633	0.07219846
	0.028634343	0.036624481	0.05076088	0.070971231
	0.028159319	0.036016907	0.049918793	0.069793868
	0.027703144	0.035433441	0.049110119	0.068663222
	0.027264654	0.034872594	0.048332796	0.067576409
	0.026842783	0.034333003	0.047584933	0.066530786
	0.026436549	0.033813414	0.046864791	0.065523921
	0.02604505	0.033312671	0.04617077	0.064553577
	0.025667453	0.03282971	0.045501394	0.06361769

7.92 10.13 14.0

This sheet presents the intensity-duration computations based on the fitted power equation.
Results from this sheet are used to compute time-sequential hyetograph values.

Rio Caonillas

Intensity-Duration Relationship

Hour	Cumulative Depth by E (decimal)	(inch)	Decimal Increment
0.000	0.000	0.000	0.000
0.250	0.243	3.318	0.243
0.500	0.301	4.114	0.058
0.750	0.342	4.665	0.040
1.000	0.373	5.100	0.032
1.250	0.400	5.465	0.027
1.500	0.423	5.783	0.023
1.750	0.444	6.066	0.021
2.000	0.463	6.323	0.019
2.250	0.480	6.558	0.017
2.500	0.496	6.775	0.016
2.750	0.511	6.979	0.015
3.000	0.525	7.169	0.014
3.250	0.538	7.349	0.013
3.500	0.551	7.520	0.013
3.750	0.562	7.683	0.012
4.000	0.574	7.838	0.011
4.250	0.585	7.987	0.011
4.500	0.595	8.130	0.010
4.750	0.605	8.267	0.010
5.000	0.615	8.399	0.010
5.250	0.624	8.527	0.009
5.500	0.633	8.651	0.009
5.750	0.642	8.771	0.009
6.000	0.651	8.888	0.009
6.250	0.659	9.001	0.008
6.500	0.667	9.111	0.008
6.750	0.675	9.218	0.008
7.000	0.683	9.323	0.008
7.250	0.690	9.425	0.007
7.500	0.697	9.524	0.007
7.750	0.704	9.622	0.007
8.000	0.711	9.717	0.007
8.250	0.718	9.810	0.007
8.500	0.725	9.901	0.007
8.750	0.731	9.991	0.007
9.000	0.738	10.078	0.006
9.250	0.744	10.164	0.006
9.500	0.750	10.249	0.006
9.750	0.756	10.331	0.006
10.000	0.762	10.413	0.006
10.250	0.768	10.493	0.006
10.500	0.774	10.572	0.006
10.750	0.780	10.649	0.006
11.000	0.785	10.725	0.006

Intensity-Duration Relationship

Hour	Cumulative Depth by E (decimal)	(inch)	Decimal Increment
11.250	0.791	10.800	0.005
11.500	0.796	10.874	0.005
11.750	0.801	10.947	0.005
12.000	0.807	11.018	0.005
12.250	0.812	11.089	0.005
12.500	0.817	11.159	0.005
12.750	0.822	11.227	0.005
13.000	0.827	11.295	0.005
13.250	0.832	11.362	0.005
13.500	0.837	11.428	0.005
13.750	0.841	11.493	0.005
14.000	0.846	11.558	0.005
14.250	0.851	11.621	0.005
14.500	0.855	11.684	0.005
14.750	0.860	11.746	0.005
15.000	0.864	11.808	0.004
15.250	0.869	11.868	0.004
15.500	0.873	11.928	0.004
15.750	0.878	11.987	0.004
16.000	0.882	12.046	0.004
16.250	0.886	12.104	0.004
16.500	0.890	12.162	0.004
16.750	0.894	12.218	0.004
17.000	0.899	12.275	0.004
17.250	0.903	12.330	0.004
17.500	0.907	12.385	0.004
17.750	0.911	12.440	0.004
18.000	0.915	12.494	0.004
18.250	0.919	12.548	0.004
18.500	0.922	12.601	0.004
18.750	0.926	12.653	0.004
19.000	0.930	12.705	0.004
19.250	0.934	12.757	0.004
19.500	0.938	12.808	0.004
19.750	0.941	12.859	0.004
20.000	0.945	12.909	0.004
20.250	0.949	12.959	0.004
20.500	0.952	13.008	0.004
20.750	0.956	13.057	0.004
21.000	0.959	13.106	0.004
21.250	0.963	13.154	0.004
21.500	0.966	13.202	0.003
21.750	0.970	13.249	0.003
22.000	0.973	13.296	0.003
22.250	0.977	13.343	0.003
22.500	0.980	13.389	0.003
22.750	0.984	13.435	0.003
23.000	0.987	13.480	0.003
23.250	0.990	13.526	0.003
23.500	0.993	13.571	0.003
23.750	0.997	13.615	0.003
24.000	1.000	13.660	0.003

POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

Puerto Rico 18.315 N 66.66 W 347 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 3, Version 4
G.M. Bonnin, D. Martin, B. Lin, T Parzybok, M.Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2006
Extracted: Mon Jul 5 2010

Rio Coconiller

Confidence Limits | Seasonality | Related Info | GIS data | Maps | Docs | Return to State Map

Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.57	0.78	1.00	1.61	2.39	2.83	2.90	3.16	3.40	4.07	5.11	5.86	7.24	8.30	11.69	14.76	18.87	22.56
2	0.69	0.94	1.20	1.93	2.86	3.41	3.50	3.87	4.24	5.16	6.46	7.37	9.06	10.33	14.49	18.20	23.22	27.66
5	0.71	0.97	1.24	1.99	2.96	3.66	3.84	4.50	5.23	6.67	8.30	9.27	11.05	12.33	16.77	20.84	26.28	30.96
10	0.75	1.02	1.31	2.10	3.11	3.92	4.19	5.06	6.16	8.08	10.02	10.97	12.80	14.02	18.62	22.99	28.77	33.65
25	0.80	1.09	1.40	2.24	3.33	4.30	4.70	5.87	7.54	10.22	12.66	13.50	15.31	16.36	21.07	25.82	32.01	37.07
50	0.84	1.15	1.48	2.37	3.52	4.61	5.11	6.53	8.70	12.06	14.94	15.67	17.40	18.27	22.96	27.99	34.47	39.63
100	0.89	1.22	1.56	2.50	3.71	4.90	5.54	7.21	9.96	14.08	17.45	18.14	19.69	20.35	24.82	30.10	36.84	42.07
200	0.94	1.28	1.64	2.63	3.90	5.22	5.98	7.93	11.34	16.32	20.26	20.92	22.27	22.74	27.02	32.35	39.23	44.51
500	1.00	1.37	1.76	2.81	4.17	5.64	6.59	8.94	13.33	19.64	24.41	25.17	26.36	26.52	30.30	36.11	42.50	47.62
1000	1.05	1.44	1.84	2.95	4.37	5.96	7.06	9.74	14.98	22.42	27.92	28.74	29.98	30.04	32.87	39.01	45.42	50.05

* These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting forces estimates near zero to appear as zero.

* Upper bound of the 90% confidence interval Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.60	0.82	1.05	1.69	2.51	2.97	3.06	3.43	3.86	4.53	5.73	6.51	7.93	9.01	12.56	15.78	20.14	23.96
2	0.71	0.97	1.25	2.00	2.97	3.57	3.70	4.21	4.82	5.77	7.27	8.21	9.94	11.23	15.56	19.46	24.77	29.38
5	0.74	1.01	1.29	2.07	3.07	3.82	4.06	4.87	5.95	7.49	9.36	10.34	12.13	13.41	18.00	22.27	28.02	32.86
10	0.78	1.06	1.37	2.19	3.25	4.11	4.45	5.51	7.06	9.09	11.35	12.28	14.11	15.28	20.04	24.62	30.75	35.76
25	0.84	1.15	1.48	2.37	3.51	4.55	5.05	6.47	8.79	11.62	14.49	15.25	16.99	17.94	22.78	27.79	34.38	39.54
50	0.90	1.22	1.57	2.52	3.73	4.92	5.57	7.31	10.31	13.86	17.27	17.91	19.48	20.16	24.94	30.29	37.19	42.48
100	0.95	1.30	1.67	2.67	3.97	5.30	6.10	8.19	12.01	16.37	20.43	20.97	22.27	22.66	27.12	32.76	39.95	45.34
200	1.01	1.39	1.78	2.85	4.23	5.72	6.70	9.20	13.96	19.18	24.03	24.45	25.45	25.54	29.71	35.44	42.82	48.20
500	1.10	1.50	1.93	3.09	4.58	6.28	7.55	10.65	16.86	23.48	29.53	29.94	30.60	30.91	33.64	39.95	46.80	51.96
1000	1.17	1.59	2.04	3.27	4.86	6.71	8.20	11.80	19.27	27.12	34.16	34.61	35.23	35.58	36.78	43.49	50.43	54.98

* The **upper** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **greater** than.
** These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

* Lower bound of the 90% confidence interval Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.56	0.76	0.97	1.56	2.31	2.71	2.76	2.93	3.05	3.69	4.61	5.32	6.65	7.68	10.92	13.82	17.71	21.24
2	0.66	0.90	1.16	1.86	2.75	3.27	3.34	3.61	3.81	4.68	5.82	6.69	8.32	9.56	13.53	17.05	21.79	26.07
5	0.68	0.93	1.20	1.92	2.85	3.50	3.65	4.17	4.67	6.00	7.42	8.35	10.09	11.36	15.61	19.47	24.61	29.16
10	0.72	0.98	1.26	2.01	2.98	3.73	3.96	4.64	5.40	7.20	8.87	9.81	11.61	12.85	17.27	21.41	26.86	31.61
25	0.76	1.04	1.34	2.14	3.17	4.05	4.37	5.29	6.45	8.91	10.98	11.85	13.69	14.83	19.40	23.90	29.72	34.67
50	0.80	1.09	1.40	2.24	3.33	4.30	4.70	5.79	7.29	10.34	12.71	13.52	15.37	16.39	20.99	25.73	31.83	36.90
100	0.83	1.14	1.46	2.34	3.47	4.52	5.01	6.28	8.14	11.86	14.56	15.41	17.15	18.05	22.50	27.48	33.76	38.94
200	0.87	1.19	1.52	2.44	3.62	4.75	5.33	6.78	9.04	13.49	16.55	17.47	19.12	19.95	24.28	29.30	35.71	40.96
500	0.92	1.25	1.61	2.57	3.81	5.05	5.75	7.46	10.26	15.82	19.38	20.51	22.19	22.88	26.91	32.35	38.31	43.46
1000	0.95	1.30	1.67	2.67	3.96	5.27	6.07	7.96	11.20	17.72	21.68	22.98	24.85	25.61	28.91	34.67	40.67	45.40

* The **lower** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **less** than.

** These precipitation frequency estimates are based on a partial duration maxima series. **ARI** is the Average Recurrence Interval.

Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

Text version of tables

Related Information

Maps & Aerials

Click here to see topographic maps and aerial photographs available for this location from Microsoft Research Maps

Climate Data Sources

National Climatic Data Center (NCDC) database

Locate NCDC climate stations within:

+/-30 minutes or +/-1 degree of this location. Digital ASCII data can be obtained directly from NCDC

Note: Precipitation frequency results are based on analysis of precipitation data from a variety of sources, but largely NCDC. The following links provide general information about observing sites in the area, regardless of if their data was used in this study. For detailed information about the stations used in this study, please refer to the matching documentation available at the PF Document page

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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
Office of Hydrologic Development
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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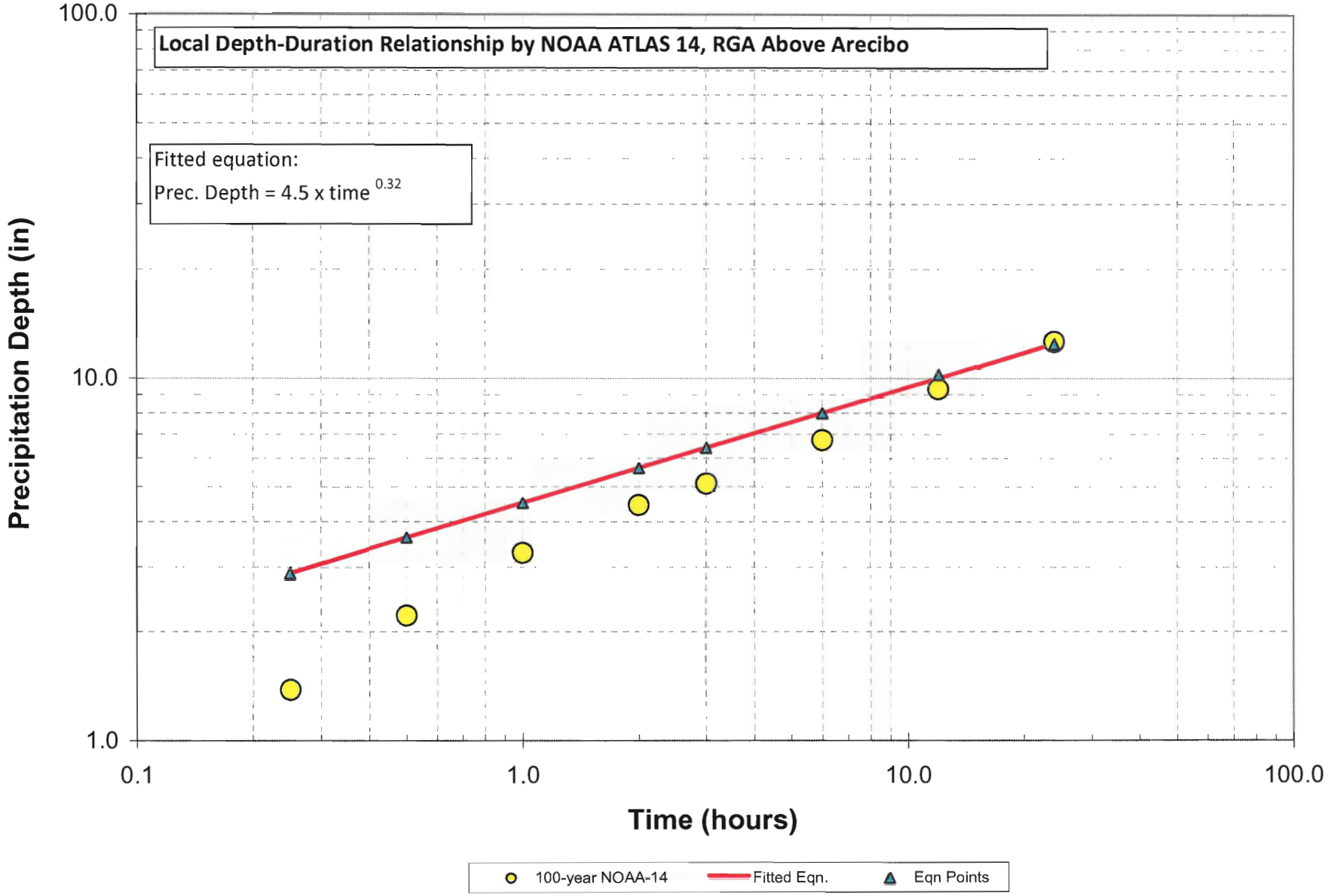
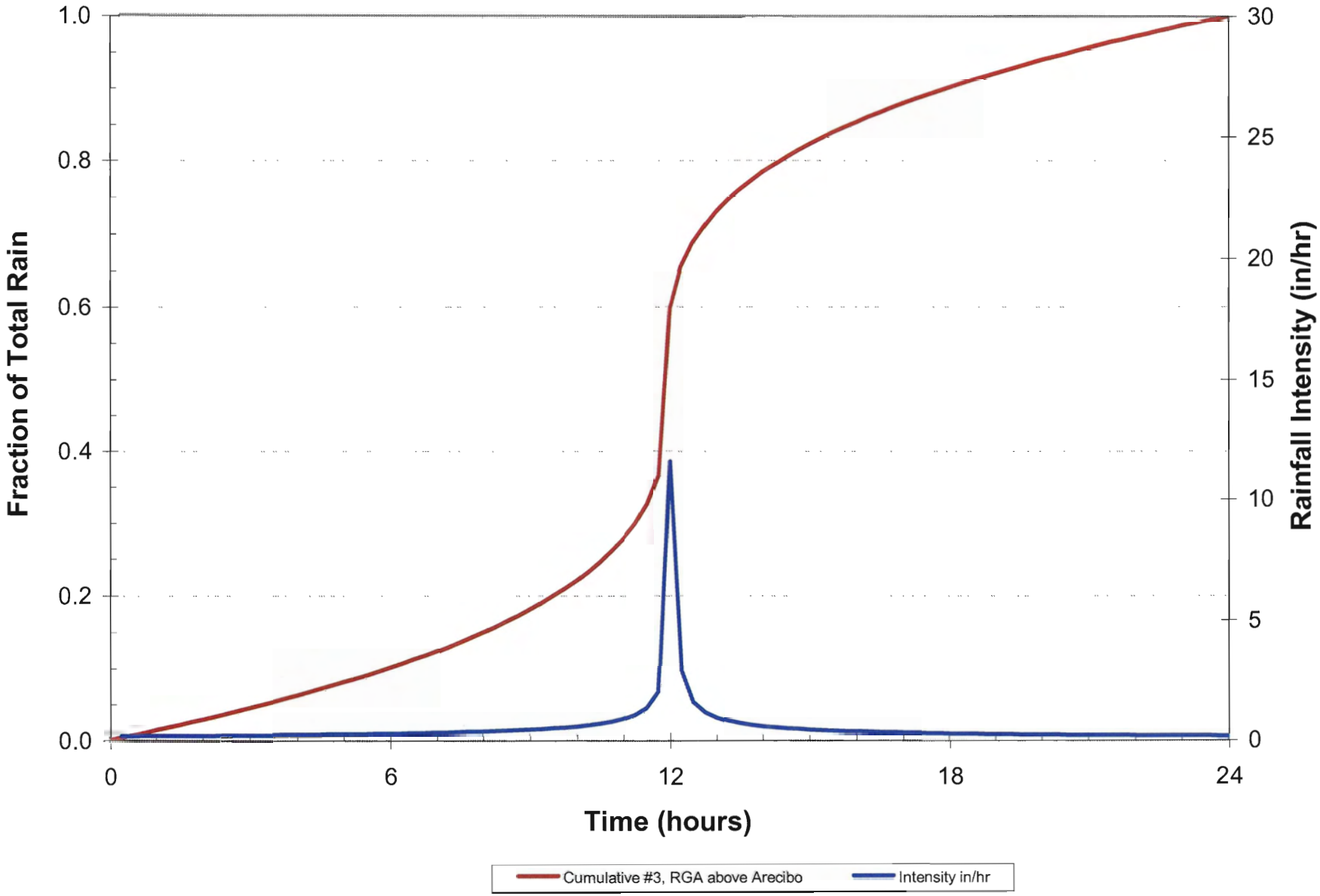

Local Depth-Duration Relationship by NOAA ATLAS 14, RGA Above Arecibo
Fitted equation:
Prec. Depth = 4.5 x time 0.32
Precipitation Depth (in)
100.0
10.0
1.0
0.1
1.0
10.0
100.0
Time (hours)
100-year NOAA-14
Fitted Eqn.
Eqn Points


1.0
0.8
0.6
0.4
0.2
0.0
Fraction of Total Rain
30
25
20
15
10
5
0
Rainfall Intensity (in/hr)
0
6
12
18
24
Time (hours)
Cumulative #3, RGA above Arecibo
Intensity in/hr

Sequential Depth Hyetograph - Distribution #1 (15 minute)

Hour	Ordered Intensities	Incremental Depth (decimal)	Incremental Depth (inches)	Cumulative Depth (decimal)	Cumulative Depth (inches)	Intensity (inch/hr)
0		0	0	0	0	
0.25	23.75	0.003	0.042	0.003	0.042	0.168
0.5	23.25	0.003	0.043	0.007	0.084	0.170
0.75	22.75	0.003	0.043	0.010	0.128	0.173
1	22.25	0.004	0.044	0.014	0.171	0.175
1.25	21.75	0.004	0.045	0.017	0.216	0.178
1.5	21.25	0.004	0.045	0.021	0.261	0.181
1.75	20.75	0.004	0.046	0.025	0.307	0.184
2	20.25	0.004	0.047	0.028	0.354	0.187
2.25	19.75	0.004	0.048	0.032	0.401	0.190
2.5	19.25	0.004	0.048	0.036	0.450	0.194
2.75	18.75	0.004	0.049	0.040	0.499	0.197
3	18.25	0.004	0.050	0.044	0.549	0.201
3.25	17.75	0.004	0.051	0.048	0.601	0.205
3.5	17.25	0.004	0.052	0.052	0.653	0.209
3.75	16.75	0.004	0.053	0.057	0.706	0.213
4	16.25	0.004	0.054	0.061	0.760	0.217
4.25	15.75	0.004	0.056	0.066	0.816	0.222
4.5	15.25	0.005	0.057	0.070	0.873	0.227
4.75	14.75	0.005	0.058	0.075	0.931	0.232
5	14.25	0.005	0.059	0.080	0.990	0.238
5.25	13.75	0.005	0.061	0.084	1.051	0.244
5.5	13.25	0.005	0.063	0.090	1.114	0.250
5.75	12.75	0.005	0.064	0.095	1.178	0.257
6	12.25	0.005	0.066	0.100	1.244	0.264
6.25	11.75	0.005	0.068	0.105	1.312	0.272
6.5	11.25	0.006	0.070	0.111	1.382	0.280
6.75	10.75	0.006	0.072	0.117	1.454	0.289
7	10.25	0.006	0.075	0.123	1.528	0.298
7.25	9.75	0.006	0.077	0.129	1.606	0.309
7.5	9.25	0.006	0.080	0.135	1.686	0.320
7.75	8.75	0.007	0.083	0.142	1.769	0.333
8	8.25	0.007	0.087	0.149	1.855	0.346
8.25	7.75	0.007	0.090	0.156	1.946	0.362
8.5	7.25	0.008	0.095	0.164	2.041	0.379
8.75	6.75	0.008	0.100	0.172	2.140	0.398
9	6.25	0.008	0.105	0.180	2.245	0.420
9.25	5.75	0.009	0.111	0.189	2.356	0.445
9.5	5.25	0.010	0.119	0.199	2.475	0.474
9.75	4.75	0.010	0.127	0.209	2.602	0.508
10	4.25	0.011	0.137	0.220	2.739	0.549
10.25	3.75	0.012	0.150	0.232	2.889	0.600
10.5	3.25	0.013	0.166	0.246	3.055	0.664
10.75	2.75	0.015	0.187	0.261	3.242	0.747
11	2.25	0.017	0.216	0.278	3.458	0.863
11.25	1.75	0.021	0.259	0.299	3.717	1.036
11.5	1.25	0.027	0.333	0.326	4.050	1.332
11.75	0.75	0.040	0.499	0.366	4.549	1.998
12	0.25	0.232	2.888	0.598	7.437	11.551
12.25	0.5	0.058	0.717	0.655	8.154	2.868
12.5	1	0.032	0.396	0.687	8.550	1.583
12.75	1.5	0.023	0.290	0.711	8.840	1.161
13	2	0.019	0.235	0.729	9.075	0.940
13.25	2.5	0.016	0.200	0.746	9.275	0.800
13.5	3	0.014	0.176	0.760	9.451	0.702
13.75	3.5	0.013	0.157	0.772	9.608	0.630
14	4	0.012	0.143	0.784	9.752	0.573
14.25	4.5	0.011	0.132	0.794	9.884	0.528
14.5	5	0.010	0.123	0.804	10.006	0.490
14.75	5.5	0.009	0.115	0.813	10.121	0.459
15	6	0.009	0.108	0.822	10.229	0.432
15.25	6.5	0.008	0.102	0.830	10.331	0.409
15.5	7	0.008	0.097	0.838	10.428	0.388
15.75	7.5	0.007	0.093	0.846	10.521	0.370
16	8	0.007	0.088	0.853	10.609	0.354
16.25	8.5	0.007	0.085	0.860	10.694	0.339
16.5	9	0.007	0.082	0.866	10.776	0.326
16.75	9.5	0.006	0.079	0.872	10.854	0.314
17	10	0.006	0.076	0.879	10.930	0.303
17.25	10.5	0.006	0.073	0.884	11.004	0.293
17.5	11	0.006	0.071	0.890	11.075	0.284
17.75	11.5	0.006	0.069	0.896	11.144	0.276
18	12	0.005	0.067	0.901	11.210	0.268
18.25	12.5	0.005	0.065	0.906	11.276	0.260
18.5	13	0.005	0.063	0.911	11.339	0.253
18.75	13.5	0.005	0.062	0.916	11.401	0.247
19	14	0.005	0.060	0.921	11.461	0.241
19.25	14.5	0.005	0.059	0.926	11.520	0.235
19.5	15	0.005	0.057	0.930	11.577	0.230
19.75	15.5	0.005	0.056	0.935	11.633	0.225
20	16	0.004	0.055	0.939	11.688	0.220
20.25	16.5	0.004	0.054	0.944	11.742	0.215
20.5	17	0.004	0.053	0.948	11.795	0.211
20.75	17.5	0.004	0.052	0.952	11.846	0.207
21	18	0.004	0.051	0.956	11.897	0.203
21.25	18.5	0.004	0.050	0.960	11.947	0.199
21.5	19	0.004	0.049	0.964	11.995	0.195
21.75	19.5	0.004	0.048	0.968	12.043	0.192
22	20	0.004	0.047	0.972	12.091	0.189
22.25	20.5	0.004	0.046	0.975	12.137	0.185
22.5	21	0.004	0.046	0.979	12.182	0.182
22.75	21.5	0.004	0.045	0.983	12.227	0.179
23	22	0.004	0.044	0.986	12.272	0.177
23.25	22.5	0.003	0.043	0.990	12.315	0.174
23.5	23	0.003	0.043	0.993	12.358	0.171
23.75	23.5	0.003	0.042	0.997	12.400	0.169
24	24	0.003	0.042	1.000	12.442	0.166

Hour	Cumulative depth (decimal)	
0	0	
0.010417	0.0033692	
0.020833	0.0067878	
0.03125	0.0102576	
0.041667	0.0137806	
0.052083	0.0173587	
0.0625	0.0209942	
0.072917	0.0246894	
0.083333	0.0284468	
0.09375	0.032269	
0.104167	0.0361589	
0.114583	0.0401195	
0.125	0.044154	
0.135417	0.0482661	
0.145833	0.0524594	
0.15625	0.0567381	
0.166667	0.0611065	
0.177083	0.0655696	
0.1875	0.0701324	
0.197917	0.0748008	
0.208333	0.0795809	
0.21875	0.0844796	
0.229167	0.0895044	
0.239583	0.0946637	
0.25	0.0999668	
0.260417	0.1054239	
0.270833	0.1110467	
0.28125	0.116848	
0.291667	0.1228427	
0.302083	0.1290475	
0.3125	0.1354815	
0.322917	0.1421668	
0.333333	0.1491292	
0.34375	0.156399	
0.354167	0.164012	
0.364583	0.1720112	
0.375	0.1804489	
0.385417	0.1893898	
0.395833	0.1989151	
0.40625	0.2091293	
0.416667	0.2201704	
0.427083	0.2322261	
0.4375	0.245563	
0.447917	0.2605807	
0.458333	0.2779229	
0.46875	0.2987454	
0.479167	0.3255164	
0.489583	0.3656571	
0.5	0.5977561	
0.510417	0.6553934	
0.520833	0.687203	
0.53125	0.7105409	
0.541667	0.7294273	
0.552083	0.7455041	
0.5625	0.7596199	
0.572917	0.7722763	
0.583333	0.7837971	
0.59375	0.7944049	
0.604167	0.8042599	
0.614583	0.8134815	
0.625	0.8221618	
0.635417	0.8303731	
0.645833	0.8381732	
0.65625	0.8456097	
0.666667	0.8527217	
0.677083	0.8595422	
0.6875	0.8660988	
0.697917	0.8724156	
0.708333	0.8785131	
0.71875	0.8844092	
0.729167	0.8901195	
0.739583	0.8956579	
0.75	0.9010367	
0.760417	0.9062667	
0.770833	0.9113576	
0.78125	0.9163184	
0.791667	0.9211569	
0.802083	0.9258803	
0.8125	0.9304952	
0.822917	0.9350074	
0.833333	0.9394225	
0.84375	0.9437455	
0.854167	0.947981	
0.864583	0.9521332	
0.875	0.9562061	
0.885417	0.9602032	
0.895833	0.9641281	
0.90625	0.9679837	
0.916667	0.9717732	
0.927083	0.9754992	
0.9375	0.9791642	
0.947917	0.9827707	
0.958333	0.986321	
0.96875	0.9898171	
0.979167	0.9932611	
0.989583	0.9966548	
1	1	

RGA abv Arecibo			
7.39	10.9	12.61	17.15
10-Yr	50-yr	100-yr	500-yr
0	0	0	0
0.024898679	0.036724709	0.042486109	0.057782455
0.025263508	0.03726282	0.043108639	0.058629116
0.025641836	0.03782084	0.043754201	0.059507102
0.026034476	0.038399971	0.044424187	0.060418303
0.026442312	0.039001516	0.045120103	0.061364771
0.026866306	0.039626892	0.045843588	0.062348734
0.027307502	0.040277642	0.046596428	0.06337262
0.027767042	0.040955447	0.047380568	0.064439075
0.028246173	0.041662149	0.048198138	0.065550996
0.028746262	0.042399764	0.04905147	0.066711555
0.029268811	0.043170506	0.049943127	0.067924237
0.029815473	0.043976815	0.05087593	0.069192878
0.030388074	0.044821382	0.051852993	0.070521715
0.030988634	0.045707188	0.052877765	0.071915437
0.031619397	0.04663754	0.053954072	0.073379249
0.032282859	0.047616124	0.055086177	0.074918948
0.032981811	0.048647056	0.056278842	0.07654101
0.033719383	0.049734949	0.057537404	0.078252695
0.034499093	0.050884995	0.05886787	0.080062171
0.035324917	0.052103058	0.060277024	0.081978665
0.036201366	0.05339579	0.061772561	0.084012643
0.037133578	0.054770771	0.06336325	0.08617603
0.038127435	0.056236677	0.065059128	0.088482478
0.039189708	0.057803494	0.066871748	0.090947699
0.040328231	0.059482777	0.068814479	0.093589874
0.041552127	0.061287981	0.070902884	0.096430172
0.042872084	0.063234874	0.073155207	0.099493402
0.044300723	0.065342067	0.075592979	0.102808849
0.045853055	0.067631705	0.078241816	0.106411352
0.047547095	0.070130357	0.081132459	0.110342718
0.04940467	0.072870218	0.084302151	0.114653599
0.051452503	0.075890702	0.087796491	0.119406013
0.053723705	0.079240648	0.091671978	0.124676799
0.05625985	0.082981376	0.095999555	0.13056244
0.059113935	0.087191054	0.100869651	0.137185925
0.062354691	0.09197106	0.106399547	0.144706759
0.06607305	0.097455513	0.112744405	0.153335968
0.070392145	0.103826032	0.120114337	0.163359308
0.075483367	0.111335413	0.128801795	0.175174526
0.0815933	0.120347358	0.139227539	0.18935387
0.089091393	0.131406791	0.152021985	0.206754722
0.098560115	0.145372835	0.168179032	0.228728819
0.110980473	0.163692444	0.189372635	0.25755279
0.128159047	0.189030259	0.218685465	0.29741917
0.15387816	0.22696508	0.262571528	0.357105607
0.197837686	0.291803894	0.337582304	0.459122641
0.296640129	0.437534156	0.506174835	0.688413832
1.715211358	2.529878728	2.92676796	3.980497265
0.425939378	0.628246173	0.726805894	0.988479071
0.235073008	0.346724734	0.401119165	0.545534789
0.172467249	0.254383358	0.294291206	0.400245376
0.139570657	0.205861998	0.23815778	0.323902135
0.11880778	0.175237456	0.202728837	0.275717649
0.104315663	0.153862074	0.178000069	0.24208574
0.093530693	0.137954608	0.159597028	0.21705702
0.085138922	0.12557703	0.145277647	0.197582208
0.078391554	0.11562489	0.133764208	0.181923565
0.072828014	0.107418857	0.124270806	0.169012238
0.06814817	0.100516246	0.116285308	0.158151708
0.064147379	0.094615214	0.109458518	0.148867057
0.060680912	0.089502292	0.103543477	0.140822413
0.057643286	0.085021897	0.098360194	0.133772984
0.054955658	0.081057736	0.093774133	0.127535795
0.052557813	0.077520995	0.089682546	0.121971108
0.050402906	0.074342581	0.0860055	0.116970208
0.048453901	0.071467865	0.082679796	0.112447145
0.046681098	0.06885304	0.079654756	0.108332994
0.04506038	0.066462536	0.076889227	0.104571788
0.043571942	0.064267141	0.074349417	0.101117566
0.042199359	0.062242627	0.072007296	0.097932206
0.04092888	0.060368713	0.069839401	0.094983801
0.039748901	0.058628285	0.067825933	0.092245421
0.038649557	0.05700679	0.065950057	0.089694169
0.0376224	0.055491768	0.064197357	0.087310442
0.036660153	0.054072485	0.062555417	0.085077351
0.035756509	0.05273964	0.061013474	0.08298026
0.034905972	0.051485128	0.059562153	0.081006418
0.034103733	0.050301853	0.058193245	0.079144659
0.03334556	0.049183572	0.056899527	0.077385162
0.032627712	0.048124771	0.05567462	0.07571925
0.031946873	0.047120557	0.054512865	0.074139225
0.031300091	0.046166575	0.053409221	0.072638234
0.030684725	0.045258931	0.052359186	0.071210153
0.03009841	0.044394137	0.051358722	0.069849491
0.029539018	0.043569053	0.050404198	0.068551308
0.029004629	0.042780847	0.049492338	0.06731115
0.028493507	0.042026959	0.048620179	0.066124986
0.028004076	0.041305065	0.047785033	0.064989161
0.027534904	0.040613051	0.046984457	0.063900351
0.027084685	0.039948994	0.046216221	0.062855527
0.026652226	0.039311132	0.045478291	0.061851919
0.026236436	0.038697856	0.044768804	0.060886994
0.025836313	0.038107688	0.04408605	0.059958426
0.025450935	0.037539269	0.043428457	0.059064079
0.025079455	0.036991347	0.042794577	0.058201982
0.024721089	0.03646277	0.042183076	0.057370321

7.39 10.9 12.6

This sheet presents the intensity-duration computations based on the fitted power equation.
Results from this sheet are used to compute time-sequential hyetograph values.
RGA above Arecibo

Intensity-Duration Relationship

Hour	Cumulative Depth by Eqn (decimal)	(inch)	Decimal Increment
0	0	0	0
0.25	0.232	2.888	0.232
0.5	0.290	3.605	0.058
0.75	0.330	4.104	0.040
1	0.362	4.500	0.032
1.25	0.388	4.833	0.027
1.5	0.412	5.123	0.023
1.75	0.433	5.383	0.021
2	0.452	5.617	0.019
2.25	0.469	5.833	0.017
2.5	0.485	6.033	0.016
2.75	0.500	6.220	0.015
3	0.514	6.396	0.014
3.25	0.527	6.562	0.013
3.5	0.540	6.719	0.013
3.75	0.552	6.869	0.012
4	0.564	7.012	0.012
4.25	0.575	7.150	0.011
4.5	0.585	7.282	0.011
4.75	0.595	7.409	0.010
5	0.605	7.532	0.010
5.25	0.615	7.650	0.010
5.5	0.624	7.765	0.009
5.75	0.633	7.876	0.009
6	0.642	7.984	0.009
6.25	0.650	8.089	0.008
6.5	0.658	8.191	0.008
6.75	0.666	8.291	0.008
7	0.674	8.388	0.008
7.25	0.682	8.482	0.008
7.5	0.689	8.575	0.007
7.75	0.696	8.665	0.007
8	0.704	8.754	0.007
8.25	0.711	8.841	0.007
8.5	0.717	8.925	0.007
8.75	0.724	9.009	0.007
9	0.731	9.090	0.007
9.25	0.737	9.170	0.006
9.5	0.743	9.249	0.006
9.75	0.750	9.326	0.006
10	0.756	9.402	0.006
10.25	0.762	9.476	0.006
10.5	0.768	9.550	0.006
10.75	0.773	9.622	0.006
11	0.779	9.693	0.006

Intensity-Duration Relationship

Hour	Cumulative Depth by E (decimal)	(inch)	Decimal Increment
11.25	0.785	9.763	0.006
11.5	0.790	9.832	0.006
11.75	0.796	9.900	0.005
12	0.801	9.967	0.005
12.25	0.806	10.033	0.005
12.5	0.812	10.098	0.005
12.75	0.817	10.162	0.005
13	0.822	10.225	0.005
13.25	0.827	10.288	0.005
13.5	0.832	10.349	0.005
13.75	0.837	10.410	0.005
14	0.842	10.471	0.005
14.25	0.846	10.530	0.005
14.5	0.851	10.589	0.005
14.75	0.856	10.647	0.005
15	0.860	10.704	0.005
15.25	0.865	10.761	0.005
15.5	0.869	10.817	0.005
15.75	0.874	10.873	0.004
16	0.878	10.928	0.004
16.25	0.883	10.982	0.004
16.5	0.887	11.036	0.004
16.75	0.891	11.089	0.004
17	0.896	11.142	0.004
17.25	0.900	11.194	0.004
17.5	0.904	11.246	0.004
17.75	0.908	11.297	0.004
18	0.912	11.347	0.004
18.25	0.916	11.398	0.004
18.5	0.920	11.447	0.004
18.75	0.924	11.497	0.004
19	0.928	11.546	0.004
19.25	0.932	11.594	0.004
19.5	0.936	11.642	0.004
19.75	0.940	11.689	0.004
20	0.943	11.737	0.004
20.25	0.947	11.783	0.004
20.5	0.951	11.830	0.004
20.75	0.955	11.876	0.004
21	0.958	11.921	0.004
21.25	0.962	11.967	0.004
21.5	0.965	12.011	0.004
21.75	0.969	12.056	0.004
22	0.973	12.100	0.004
22.25	0.976	12.144	0.004
22.5	0.980	12.187	0.003
22.75	0.983	12.231	0.003
23	0.986	12.273	0.003
23.25	0.990	12.316	0.003
23.5	0.993	12.358	0.003
23.75	0.997	12.400	0.003
24	1.000	12.442	0.003

POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

Puerto Rico 18.39 N 66.693 W 183 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 3, Version 4
G.M. Bonnin, D. Martin, B. Lin, T Parzybok, M.Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2006
Extracted: Mon Jul 5 2010

RGA above Arecibo

Confidence Limits | Seasonality | Related Info | GIS data | Maps | Docs | Return to State Map

Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.49	0.67	0.86	1.38	2.05	2.49	2.73	3.03	3.28	3.81	4.80	5.42	6.52	7.60	10.48	12.99	16.36	19.56
2	0.62	0.84	1.08	1.74	2.58	3.17	3.31	3.73	4.11	4.85	6.06	6.83	8.18	9.49	13.03	16.08	20.18	24.07
5	0.64	0.88	1.13	1.81	2.68	3.40	3.63	4.31	5.04	6.26	7.72	8.55	10.03	11.38	15.20	18.55	23.00	27.10
10	0.67	0.92	1.18	1.89	2.81	3.62	3.92	4.82	5.88	7.51	9.21	10.04	11.58	12.91	16.90	20.50	25.23	29.50
25	0.71	0.98	1.25	2.00	2.98	3.92	4.34	5.51	7.10	9.35	11.42	12.18	13.74	14.99	19.11	23.02	28.06	32.52
50	0.75	1.02	1.31	2.10	3.11	4.16	4.67	6.07	8.11	10.91	13.30	13.97	15.48	16.62	20.78	24.93	30.18	34.75
100	0.78	1.06	1.37	2.19	3.25	4.38	5.01	6.63	9.18	12.58	15.30	15.97	17.36	18.36	22.40	26.77	32.20	36.87
200	0.81	1.11	1.43	2.28	3.38	4.62	5.35	7.23	10.33	14.41	17.50	18.17	19.40	20.27	24.23	28.64	34.22	38.97
500	0.86	1.17	1.50	2.41	3.57	4.92	5.81	8.04	11.96	17.07	20.68	21.42	22.59	23.34	26.81	31.59	36.84	41.62
1000	0.89	1.22	1.56	2.50	3.71	5.16	6.17	8.67	13.29	19.27	23.31	24.10	25.29	26.02	28.78	33.84	39.18	43.59

*These precipitation frequency estimates are based on a partial duration series. **ARI** is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting forces estimates near zero to appear as zero.

* Upper bound of the 90% confidence interval Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.54	0.74	0.94	1.51	2.24	2.75	2.88	3.27	3.69	4.24	5.32	5.99	7.16	8.28	11.32	13.97	17.55	20.92
2	0.64	0.88	1.13	1.80	2.68	3.31	3.49	4.04	4.63	5.41	6.75	7.55	8.98	10.36	14.07	17.29	21.67	25.73
5	0.67	0.92	1.18	1.88	2.79	3.55	3.82	4.67	5.69	6.98	8.59	9.43	10.98	12.40	16.39	19.93	24.67	28.96
10	0.70	0.96	1.23	1.97	2.93	3.78	4.15	5.23	6.69	8.38	10.26	11.09	12.70	14.08	18.25	22.06	27.11	31.56
25	0.75	1.03	1.32	2.11	3.14	4.14	4.65	6.07	8.20	10.53	12.87	13.58	15.18	16.43	20.73	24.89	30.30	34.90
50	0.79	1.08	1.39	2.23	3.30	4.43	5.07	6.78	9.50	12.39	15.12	15.75	17.25	18.33	22.64	27.09	32.75	37.46
100	0.83	1.14	1.46	2.34	3.47	4.73	5.50	7.51	10.93	14.42	17.62	18.20	19.51	20.43	24.56	29.27	35.13	39.96
200	0.88	1.20	1.54	2.47	3.67	5.05	5.97	8.34	12.56	16.70	20.43	20.96	22.04	22.73	26.73	31.48	37.58	42.42
500	0.94	1.28	1.65	2.64	3.92	5.47	6.62	9.50	14.94	20.07	24.65	25.15	26.10	26.50	29.86	35.05	40.77	45.62
1000	0.98	1.35	1.73	2.77	4.11	5.79	7.11	10.42	16.89	22.89	28.18	28.66	29.56	29.86	32.32	37.83	43.70	48.06

*The **upper** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **greater** than.
These precipitation frequency estimates are based on a partial duration series. **ARI is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

* Lower bound of the 90% confidence interval Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.49	0.67	0.86	1.37	2.03	2.46	2.59	2.80	2.94	3.44	4.36	4.94	5.98	7.00	9.74	12.11	15.26	18.32
2	0.59	0.81	1.04	1.66	2.47	3.03	3.15	3.46	3.69	4.38	5.50	6.22	7.49	8.74	12.10	14.98	18.81	22.53
5	0.62	0.84	1.08	1.73	2.57	3.24	3.43	3.98	4.51	5.62	7.00	7.77	9.16	10.46	14.07	17.24	21.39	25.32
10	0.65	0.88	1.13	1.81	2.69	3.43	3.70	4.41	5.18	6.69	8.29	9.07	10.53	11.83	15.60	18.99	23.40	27.49
25	0.68	0.93	1.20	1.91	2.84	3.69	4.04	4.97	6.11	8.20	10.11	10.84	12.36	13.61	17.53	21.21	25.89	30.17
50	0.71	0.97	1.24	1.99	2.95	3.89	4.31	5.39	6.84	9.42	11.57	12.27	13.78	14.97	18.94	22.81	27.70	32.09
100	0.73	1.00	1.28	2.06	3.05	4.06	4.56	5.79	7.58	10.71	13.09	13.81	15.26	16.37	20.26	24.33	29.36	33.85
200	0.76	1.03	1.33	2.13	3.15	4.23	4.80	6.20	8.34	12.06	14.71	15.48	16.83	17.89	21.75	25.83	31.01	35.57
500	0.79	1.08	1.38	2.21	3.28	4.45	5.11	6.74	9.35	13.97	16.96	17.86	19.27	20.32	23.81	28.21	33.09	37.69
1000	0.81	1.11	1.42	2.28	3.38	4.61	5.34	7.13	10.12	15.51	18.76	19.77	21.26	22.40	25.33	29.98	34.96	39.24

* The **lower** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **less** than.

** These precipitation frequency estimates are based on a partial duration maxima series. **ARI** is the Average Recurrence Interval.

Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

Text version of tables

Related Information

Maps & Aerials

Click here to see topographic maps and aerial photographs available for this location from Microsoft Research Maps

Climate Data Sources

National Climatic Data Center (NCDC) database

Locate NCDC climate stations within:

+/-30 minutes or +/-1 degree of this location. Digital ASCII data can be obtained directly from NCDC.

Note: Precipitation frequency results are based on analysis of precipitation data from a variety of sources, but largely NCDC. The following links provide general information about observing sites in the area, regardless of if their data was used in this study. For detailed information about the stations used in this study, please refer to the matching documentation available at the PF Document page

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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
Office of Hydrologic Development
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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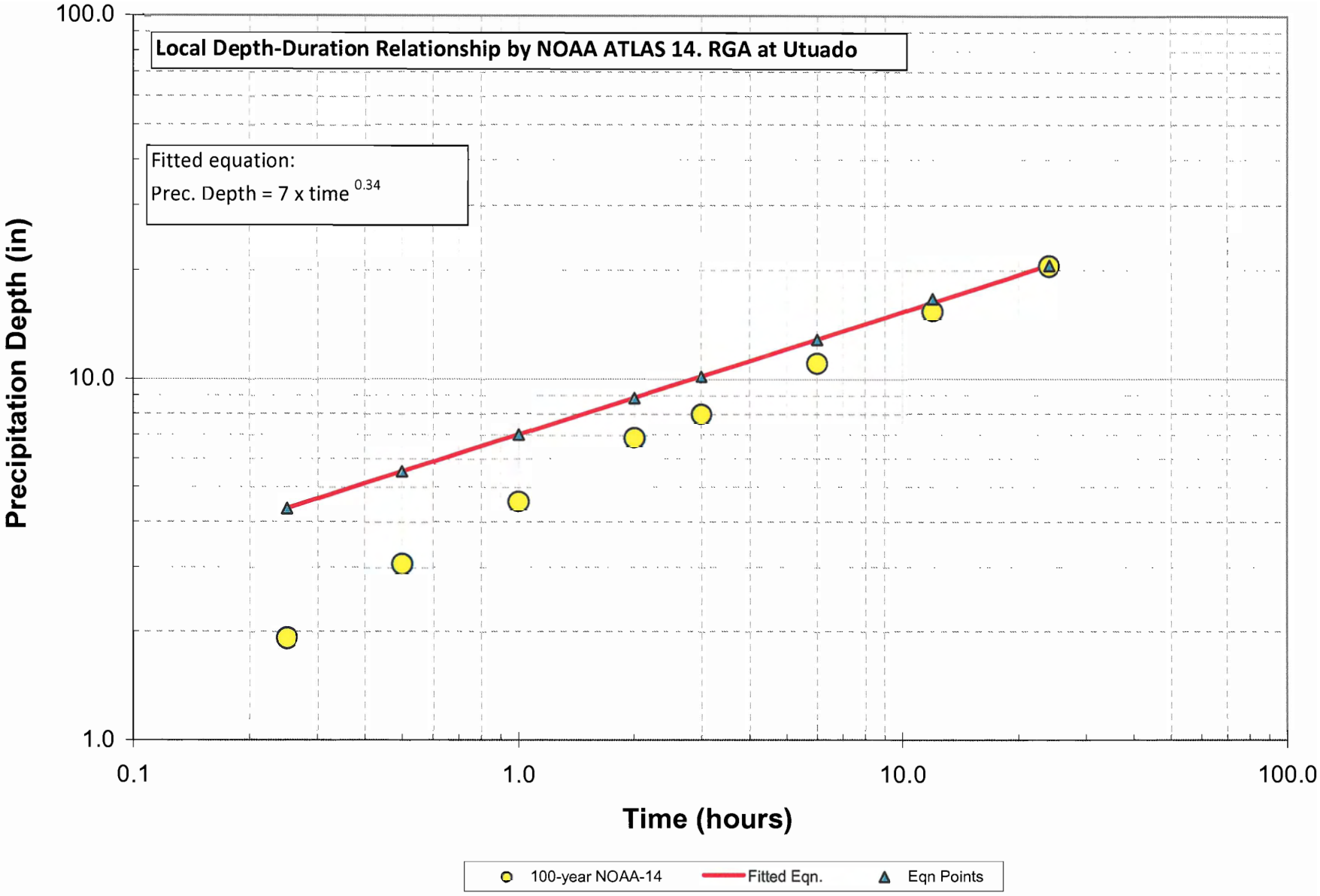
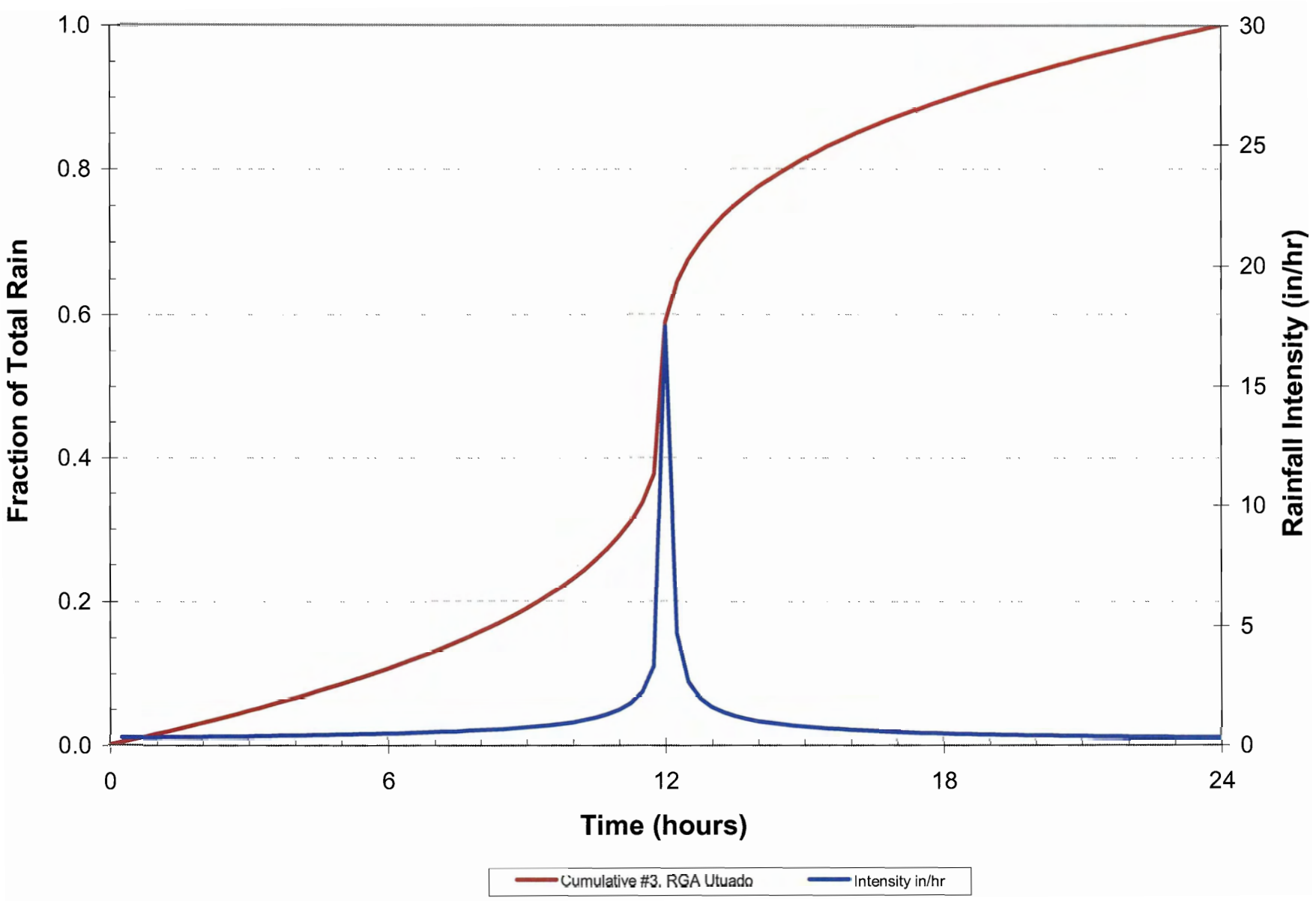

Local Depth-Duration Relationship by NOAA ATLAS 14. RGA at Utuado
Fitted equation:
Prec. Depth = 7 x time 0.34
Precipitation Depth (in)
100.0
10.0
1.0
0.1
1.0
10.0
100.0
Time (hours)
100-year NOAA-14
Fitted Eqn.
Eqn Points


1.0
0.8
0.6
0.4
0.2
0.0
Fraction of Total Rain
30
25
20
15
10
5
0
Rainfall Intensity (in/hr)
0
6
12
18
24
Time (hours)
Cumulative #3, RGA Utuado
Intensity in/hr

Sequential Depth Hyetograph - Distribution #1 (15 minute)

Hour	Ordered Intensities	Incremental Depth (decimal)	Incremental Depth (inches)	Cumulative Depth (decimal)	Cumulative Depth (inches)	Intensity (inch/hr)
0		0	0	0	0	
0.25	23.75	0.004	0.074	0.004	0.074	0.295
0.5	23.25	0.004	0.075	0.007	0.149	0.299
0.75	22.75	0.004	0.076	0.011	0.225	0.304
1	22.25	0.004	0.077	0.015	0.302	0.308
1.25	21.75	0.004	0.078	0.018	0.380	0.313
1.5	21.25	0.004	0.079	0.022	0.459	0.318
1.75	20.75	0.004	0.081	0.026	0.540	0.323
2	20.25	0.004	0.082	0.030	0.622	0.328
2.25	19.75	0.004	0.083	0.034	0.706	0.334
2.5	19.25	0.004	0.085	0.038	0.790	0.339
2.75	18.75	0.004	0.086	0.043	0.877	0.345
3	18.25	0.004	0.088	0.047	0.965	0.352
3.25	17.75	0.004	0.090	0.051	1.054	0.358
3.5	17.25	0.004	0.091	0.056	1.146	0.365
3.75	16.75	0.005	0.093	0.060	1.239	0.372
4	16.25	0.005	0.095	0.065	1.334	0.380
4.25	15.75	0.005	0.097	0.069	1.431	0.388
4.5	15.25	0.005	0.099	0.074	1.530	0.396
4.75	14.75	0.005	0.101	0.079	1.631	0.405
5	14.25	0.005	0.104	0.084	1.735	0.415
5.25	13.75	0.005	0.106	0.089	1.841	0.425
5.5	13.25	0.005	0.109	0.095	1.949	0.435
5.75	12.75	0.005	0.112	0.100	2.061	0.446
6	12.25	0.006	0.115	0.105	2.176	0.459
6.25	11.75	0.006	0.118	0.111	2.294	0.471
6.5	11.25	0.006	0.121	0.117	2.415	0.485
6.75	10.75	0.006	0.125	0.123	2.540	0.500
7	10.25	0.006	0.129	0.129	2.669	0.516
7.25	9.75	0.006	0.134	0.136	2.803	0.534
7.5	9.25	0.007	0.138	0.143	2.941	0.553
7.75	8.75	0.007	0.144	0.150	3.084	0.574
8	8.25	0.007	0.149	0.157	3.234	0.597
8.25	7.75	0.008	0.156	0.164	3.389	0.623
8.5	7.25	0.008	0.163	0.172	3.552	0.651
8.75	6.75	0.008	0.171	0.181	3.723	0.683
9	6.25	0.009	0.180	0.189	3.903	0.720
9.25	5.75	0.009	0.190	0.198	4.093	0.761
9.5	5.25	0.010	0.202	0.208	4.296	0.810
9.75	4.75	0.011	0.217	0.219	4.512	0.866
10	4.25	0.011	0.234	0.230	4.746	0.934
10.25	3.75	0.012	0.254	0.242	5.000	1.017
10.5	3.25	0.014	0.281	0.256	5.281	1.122
10.75	2.75	0.015	0.315	0.271	5.596	1.259
11	2.25	0.018	0.362	0.289	5.958	1.448
11.25	1.75	0.021	0.432	0.310	6.390	1.729
11.5	1.25	0.027	0.552	0.337	6.942	2.207
11.75	0.75	0.040	0.817	0.376	7.759	3.270
12	0.25	0.212	4.369	0.588	12.128	17.477
12.25	0.5	0.056	1.161	0.644	13.289	4.645
12.5	1	0.032	0.652	0.676	13.942	2.609
12.75	1.5	0.023	0.483	0.699	14.425	1.932
13	2	0.019	0.393	0.718	14.818	1.573
13.25	2.5	0.016	0.336	0.735	15.154	1.345
13.5	3	0.014	0.296	0.749	15.451	1.186
13.75	3.5	0.013	0.267	0.762	15.717	1.067
14	4	0.012	0.243	0.774	15.961	0.974
14.25	4.5	0.011	0.225	0.785	16.185	0.899
14.5	5	0.010	0.209	0.795	16.395	0.837
14.75	5.5	0.010	0.196	0.804	16.591	0.784
15	6	0.009	0.185	0.813	16.776	0.740
15.25	6.5	0.008	0.175	0.822	16.951	0.701
15.5	7	0.008	0.167	0.830	17.118	0.667
15.75	7.5	0.008	0.159	0.838	17.277	0.637
16	8	0.007	0.152	0.845	17.429	0.610
16.25	8.5	0.007	0.146	0.852	17.575	0.585
16.5	9	0.007	0.141	0.859	17.716	0.563
16.75	9.5	0.007	0.136	0.866	17.852	0.543
17	10	0.006	0.131	0.872	17.983	0.525
17.25	10.5	0.006	0.127	0.878	18.110	0.508
17.5	11	0.006	0.123	0.884	18.234	0.493
17.75	11.5	0.006	0.120	0.890	18.353	0.478
18	12	0.006	0.116	0.896	18.469	0.465
18.25	12.5	0.005	0.113	0.901	18.582	0.452
18.5	13	0.005	0.110	0.906	18.693	0.441
18.75	13.5	0.005	0.107	0.912	18.800	0.430
19	14	0.005	0.105	0.917	18.905	0.419
19.25	14.5	0.005	0.102	0.922	19.007	0.410
19.5	15	0.005	0.100	0.926	19.108	0.401
19.75	15.5	0.005	0.098	0.931	19.206	0.392
20	16	0.005	0.096	0.936	19.302	0.384
20.25	16.5	0.005	0.094	0.940	19.396	0.376
20.5	17	0.004	0.092	0.945	19.488	0.369
20.75	17.5	0.004	0.090	0.949	19.578	0.362
21	18	0.004	0.089	0.954	19.667	0.355
21.25	18.5	0.004	0.087	0.958	19.754	0.348
21.5	19	0.004	0.086	0.962	19.840	0.342
21.75	19.5	0.004	0.084	0.966	19.924	0.337
22	20	0.004	0.083	0.970	20.006	0.331
22.25	20.5	0.004	0.081	0.974	20.088	0.326
22.5	21	0.004	0.080	0.978	20.168	0.320
22.75	21.5	0.004	0.079	0.982	20.247	0.315
23	22	0.004	0.078	0.985	20.324	0.311
23.25	22.5	0.004	0.077	0.989	20.401	0.306
23.5	23	0.004	0.075	0.993	20.476	0.302
23.75	23.5	0.004	0.074	0.996	20.551	0.297
24	24	0.004	0.073	1.000	20.624	0.293

Hour	Cumulative depth (decimal)	
0	0	
0.25	0.010417	0.003578689
0.5	0.020833	0.007208261
0.75	0.03125	0.010890577
1	0.041667	0.014627608
1.25	0.052083	0.018421445
1.5	0.0625	0.022274313
1.75	0.072917	0.026188576
2	0.083333	0.030166756
2.25	0.09375	0.034211546
2.5	0.104167	0.038325823
2.75	0.114583	0.04251267
3	0.125	0.046775396
3.25	0.135417	0.051117556
3.5	0.145833	0.055542983
3.75	0.15625	0.060055812
4	0.166667	0.06466052
4.25	0.177083	0.06936196
4.5	0.1875	0.074165414
4.75	0.197917	0.079076636
5	0.208333	0.084101924
5.25	0.21875	0.089248183
5.5	0.229167	0.094523017
5.75	0.239583	0.099934822
6	0.25	0.105492912
6.25	0.260417	0.111207658
6.5	0.270833	0.117090662
6.75	0.28125	0.123154966
7	0.291667	0.129415314
7.25	0.302083	0.135888468
7.5	0.3125	0.142593615
7.75	0.322917	0.14955287
8	0.333333	0.156791935
8.25	0.34375	0.164340947
8.5	0.354167	0.172235608
8.75	0.364583	0.180518703
9	0.375	0.18924219
9.25	0.385417	0.198470144
9.5	0.395833	0.208283021
9.75	0.40625	0.218784036
10	0.416667	0.230109087
10.25	0.427083	0.242442922
10.5	0.4375	0.256047124
10.75	0.447917	0.271312297
11	0.458333	0.288865848
11.25	0.46875	0.309828886
11.5	0.479167	0.336581751
11.75	0.489583	0.376217744
12	0.5	0.588067409
12.25	0.510417	0.644367854
12.5	0.520833	0.675994521
12.75	0.53125	0.699411176
13	0.541667	0.7184798
13.25	0.552083	0.734788863
13.5	0.5625	0.749163476
13.75	0.572917	0.762093378
14	0.583333	0.773895778
14.25	0.59375	0.784789251
14.5	0.604167	0.794931541
14.75	0.614583	0.804440658
15	0.625	0.813407465
15.25	0.635417	0.821903586
15.5	0.645833	0.8299866
15.75	0.65625	0.837703572
16	0.666667	0.845093526
16.25	0.677083	0.852189218
16.5	0.6875	0.859018448
16.75	0.697917	0.865605031
17	0.708333	0.871969546
17.25	0.71875	0.878129911
17.5	0.729167	0.884101835
17.75	0.739583	0.889899175
18	0.75	0.895534224
18.25	0.760417	0.901017945
18.5	0.770833	0.906360161
18.75	0.78125	0.91156971
19	0.791667	0.916654579
19.25	0.802083	0.921622011
19.5	0.8125	0.926478597
19.75	0.822917	0.931230355
20	0.833333	0.935882797
20.25	0.84375	0.940440983
20.5	0.854167	0.944909574
20.75	0.864583	0.94929287
21	0.875	0.953594852
21.25	0.885417	0.95781921
21.5	0.895833	0.961969374
21.75	0.90625	0.966048535
22	0.916667	0.970059672
22.25	0.927083	0.974005568
22.5	0.9375	0.977888828
22.75	0.947917	0.981711894
23	0.958333	0.985477059
23.25	0.96875	0.989186478
23.5	0.979167	0.992842183
23.75	0.989583	0.996446088
24	1	1

RGA at Utuado			
10.09	16.85	20.49	31
10-Yr	50-yr	100-yr	500-yr
0	0	0	0
0.036108969	0.060300905	0.073327332	0.11093935
0.036622386	0.061158296	0.07436994	0.112516746
0.037154569	0.062047025	0.075450655	0.114151796
0.03770664	0.062968968	0.07657176	0.115847953
0.03827982	0.063926161	0.077735729	0.11760896
0.038875431	0.064920813	0.07894525	0.119438885
0.039494914	0.065955332	0.080203249	0.121342154
0.04013984	0.06703234	0.081512917	0.123323593
0.040811928	0.068154706	0.08287774	0.125388479
0.041513056	0.069325569	0.084301538	0.12754259
0.04224529	0.070548378	0.085788503	0.129792269
0.043010902	0.071826928	0.087343249	0.132144496
0.043812399	0.073165404	0.088970868	0.134606975
0.044652555	0.074568439	0.090676992	0.137188226
0.045534446	0.076041172	0.09246787	0.139897705
0.046461499	0.077589322	0.094350457	0.142745934
0.047437537	0.079219276	0.09633252	0.145744661
0.048466843	0.080938187	0.098422757	0.14890705
0.049554236	0.082754101	0.100630951	0.152247901
0.050705153	0.084676098	0.102968146	0.15578392
0.051925758	0.086714472	0.105446857	0.159534044
0.053223069	0.088880943	0.108081337	0.163519837
0.054605115	0.091188919	0.11088789	0.167765964
0.056081129	0.093653817	0.113885265	0.172300792
0.057661785	0.096293467	0.117095142	0.17715712
0.059359505	0.099128608	0.120542741	0.182373107
0.06118883	0.102183526	0.124257594	0.187993431
0.063166911	0.105486863	0.128274529	0.194070786
0.065314132	0.109072658	0.132634942	0.200667799
0.067654931	0.112981723	0.137388458	0.20785955
0.070218883	0.117263448	0.142595136	0.215736906
0.073042162	0.121978238	0.148328433	0.224411002
0.076169532	0.127200853	0.154679257	0.234019373
0.079657132	0.133025043	0.16176161	0.2447345
0.083576431	0.139570155	0.169720622	0.256775953
0.088019983	0.146990755	0.178744248	0.270428096
0.093110052	0.155491019	0.189080771	0.286066564
0.099011925	0.16534697	0.201065841	0.304199174
0.105955247	0.176942112	0.215165808	0.325531482
0.114269758	0.190827099	0.232050282	0.351076561
0.124448401	0.20782513	0.252720292	0.382348904
0.137266392	0.229230794	0.278750087	0.421730244
0.154025601	0.257218174	0.312783406	0.473220379
0.177115329	0.295777334	0.35967226	0.544160081
0.211517056	0.353227195	0.429532655	0.649854187
0.269936404	0.450785769	0.548166197	0.829338804
0.399927174	0.667866489	0.812141506	1.228715797
2.137563116	3.569666849	4.340799628	6.567339603
0.568071493	0.948662503	1.153596124	1.745313804
0.319113064	0.53290933	0.648030395	0.98042666
0.236274053	0.394570644	0.479807269	0.725916317
0.192402409	0.321306302	0.390716091	0.591127322
0.164558454	0.274807726	0.334172718	0.505580979
0.14503984	0.24221222	0.294535809	0.445612986
0.130462717	0.217868858	0.264933703	0.400826979
0.119086217	0.198870441	0.241831177	0.365874402
0.109915138	0.183555012	0.223207252	0.337697649
0.102335702	0.170897579	0.207815513	0.314410977
0.095946995	0.160228629	0.194841817	0.294782642
0.090475081	0.151090695	0.183729872	0.277971012
0.085725858	0.143159633	0.174085513	0.263379741
0.081557613	0.136198788	0.16562096	0.250573439
0.077864252	0.130030986	0.158120766	0.239226147
0.074564632	0.124520719	0.15142015	0.229088563
0.071595538	0.11956242	0.145390741	0.219966471
0.068906927	0.11507252	0.139930916	0.211706119
0.066458621	0.110983921	0.134959083	0.204184069
0.064217957	0.10724208	0.130408915	0.197299969
0.062158086	0.103802155	0.126225885	0.190971324
0.060256712	0.100626918	0.122364721	0.185129641
0.058495158	0.097685175	0.118787492	0.179717532
0.056857645	0.094950577	0.115462156	0.174686521
0.055330746	0.0924007	0.112361445	0.169995354
0.053902954	0.090016331	0.109461995	0.16560868
0.05256435	0.087780901	0.106743659	0.161496019
0.051306328	0.085680042	0.104188965	0.157630938
0.050121387	0.083701227	0.101782678	0.153990387
0.049002955	0.081833477	0.099511451	0.150554172
0.047945244	0.080067131	0.097363532	0.147304515
0.046943139	0.078393646	0.095328534	0.144225698
0.045992099	0.076805437	0.093397235	0.141303772
0.045088078	0.07529575	0.09156142	0.138526306
0.04422746	0.073858543	0.089813742	0.135882186
0.043406998	0.072488397	0.088147611	0.133361442
0.042623773	0.071180434	0.086557097	0.1309551
0.041875148	0.069930252	0.085036846	0.128655063
0.041158737	0.068733867	0.083582014	0.126453999
0.040472376	0.067587664	0.082188204	0.124345257
0.039814093	0.066488352	0.080851414	0.122322783
0.039182093	0.065432931	0.079567997	0.12038106
0.038574734	0.064418659	0.078334618	0.11851504
0.037990511	0.063443024	0.077148224	0.116720104
0.037428044	0.062503721	0.076006009	0.114992009
0.036886064	0.061598629	0.074905396	0.113326855
0.036363399	0.060725795	0.073844008	0.111721047
0.03585897	0.059883414	0.072819653	0.110171266

10.09 16.85 20.5

This sheet presents the intensity-duration computations based on the fitted power equation.
Results from this sheet are used to compute time-sequential hyetograph values.

RGA at Utuado

Intensity-Duration Relationship

Hour	Cumulative Depth by Eqn (decimal)	(inch)	Decimal Increment
0	0.000	0.000	0.000
0.25	0.212	4.369	0.212
0.5	0.268	5.530	0.056
0.75	0.308	6.348	0.040
1	0.339	7.000	0.032
1.25	0.366	7.552	0.027
1.5	0.390	8.035	0.023
1.75	0.411	8.467	0.021
2	0.430	8.860	0.019
2.25	0.447	9.222	0.018
2.5	0.463	9.559	0.016
2.75	0.479	9.874	0.015
3	0.493	10.170	0.014
3.25	0.507	10.451	0.014
3.5	0.520	10.717	0.013
3.75	0.532	10.972	0.012
4	0.544	11.215	0.012
4.25	0.555	11.449	0.011
4.5	0.566	11.673	0.011
4.75	0.577	11.890	0.011
5	0.587	12.099	0.010
5.25	0.596	12.301	0.010
5.5	0.606	12.497	0.010
5.75	0.615	12.688	0.009
6	0.624	12.873	0.009
6.25	0.633	13.053	0.009
6.5	0.641	13.228	0.008
6.75	0.650	13.399	0.008
7	0.658	13.565	0.008
7.25	0.666	13.728	0.008
7.5	0.673	13.887	0.008
7.75	0.681	14.043	0.008
8	0.688	14.195	0.007
8.25	0.696	14.345	0.007
8.5	0.703	14.491	0.007
8.75	0.710	14.635	0.007
9	0.716	14.775	0.007
9.25	0.723	14.914	0.007
9.5	0.730	15.050	0.007
9.75	0.736	15.183	0.006
10	0.743	15.314	0.006
10.25	0.749	15.443	0.006
10.5	0.755	15.570	0.006
10.75	0.761	15.696	0.006
11	0.767	15.819	0.006
11.25	0.773	15.940	0.006
11.5	0.779	16.060	0.006
11.75	0.784	16.177	0.006
12	0.790	16.294	0.006
12.25	0.796	16.408	0.006
12.5	0.801	16.521	0.005
12.75	0.806	16.633	0.005
13	0.812	16.743	0.005
13.25	0.817	16.852	0.005
13.5	0.822	16.959	0.005
13.75	0.827	17.066	0.005
14	0.833	17.170	0.005
14.25	0.838	17.274	0.005
14.5	0.843	17.377	0.005
14.75	0.847	17.478	0.005
15	0.852	17.578	0.005
15.25	0.857	17.677	0.005
15.5	0.862	17.775	0.005
15.75	0.867	17.872	0.005
16	0.871	17.968	0.005
16.25	0.876	18.063	0.005
16.5	0.880	18.157	0.005
16.75	0.885	18.250	0.005
17	0.889	18.342	0.004
17.25	0.894	18.433	0.004
17.5	0.898	18.524	0.004
17.75	0.903	18.613	0.004
18	0.907	18.702	0.004
18.25	0.911	18.790	0.004
18.5	0.915	18.877	0.004
18.75	0.919	18.963	0.004
19	0.924	19.049	0.004
19.25	0.928	19.134	0.004
19.5	0.932	19.218	0.004
19.75	0.936	19.301	0.004
20	0.940	19.384	0.004
20.25	0.944	19.466	0.004
20.5	0.948	19.548	0.004
20.75	0.952	19.628	0.004
21	0.956	19.708	0.004
21.25	0.959	19.788	0.004
21.5	0.963	19.867	0.004
21.75	0.967	19.945	0.004
22	0.971	20.023	0.004
22.25	0.975	20.100	0.004
22.5	0.978	20.176	0.004
22.75	0.982	20.252	0.004
23	0.986	20.328	0.004
23.25	0.989	20.402	0.004
23.5	0.993	20.477	0.004
23.75	0.996	20.551	0.004
24	1.000	20.624	0.004

POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

Puerto Rico 18.202 N 66.718 W 1617 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 3, Version 4
G.M. Bonnin, D. Martin, B. Lin, T Parzybok, M.Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2006
Extracted: Mon Jul 5 2010

RGAP Utuado

Confidence Limits | Seasonality | Related Info | GIS data | Maps | Docs | Return to State Map

Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.55	0.76	0.97	1.56	2.31	3.17	3.21	3.65	3.96	4.52	5.63	6.39	7.79	9.10	12.57	15.90	20.19	24.15
2	0.68	0.93	1.20	1.92	2.85	3.73	3.92	4.55	5.04	5.85	7.24	8.16	9.86	11.45	15.64	19.69	24.93	29.80
5	0.75	1.03	1.32	2.11	3.13	4.26	4.58	5.62	6.65	8.08	9.93	10.85	12.59	14.22	18.59	22.93	28.65	33.94
10	0.82	1.12	1.44	2.31	3.43	4.78	5.25	6.67	8.23	10.26	12.59	13.41	15.09	16.70	21.12	25.60	31.68	37.28
25	0.92	1.26	1.62	2.60	3.85	5.56	6.26	8.26	10.74	13.75	16.90	17.36	18.83	20.30	24.62	29.17	35.68	41.60
50	1.01	1.38	1.77	2.83	4.20	6.22	7.11	9.62	12.96	16.91	20.82	20.98	22.12	23.45	27.43	31.93	38.74	44.88
100	1.10	1.50	1.92	3.08	4.57	6.89	8.01	11.09	15.48	20.51	25.32	25.38	26.26	27.55	30.29	34.68	41.74	48.04
200	1.19	1.62	2.08	3.33	4.95	7.60	8.98	12.70	18.32	24.65	30.52	30.83	31.21	32.50	34.68	38.15	44.79	51.22
500	1.31	1.79	2.30	3.69	5.47	8.59	10.36	15.05	22.64	30.99	38.52	38.90	39.02	40.22	42.06	45.72	49.91	55.99
1000	1.41	1.93	2.48	3.97	5.89	9.38	11.46	16.99	26.33	36.49	45.51	45.97	46.43	46.92	48.10	51.71	55.36	59.89

*These precipitation frequency estimates are based on a partial duration series. **ARI** is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting forces estimates near zero to appear as zero.

* Upper bound of the 90% confidence interval Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.60	0.82	1.05	1.68	2.49	3.25	3.44	4.06	4.58	5.23	6.54	7.28	8.68	10.04	13.62	17.09	21.62	25.77
2	0.72	0.99	1.27	2.03	3.01	3.96	4.22	5.07	5.84	6.77	8.42	9.32	11.02	12.64	16.95	21.18	26.70	31.78
5	0.79	1.09	1.39	2.23	3.31	4.53	4.96	6.33	7.80	9.37	11.57	12.42	14.08	15.73	20.16	24.67	30.67	36.16
10	0.87	1.20	1.53	2.46	3.64	5.12	5.72	7.57	9.74	11.91	14.69	15.36	16.90	18.49	22.94	27.55	33.94	39.75
25	0.99	1.35	1.73	2.77	4.11	6.00	6.88	9.47	12.84	16.00	19.77	19.99	21.20	22.60	26.82	31.50	38.34	44.48
50	1.08	1.48	1.90	3.04	4.50	6.74	7.88	11.14	15.66	19.72	24.47	24.72	25.02	26.24	30.01	34.65	41.78	48.13
100	1.18	1.61	2.07	3.32	4.92	7.53	8.96	13.02	19.00	24.06	29.92	30.21	30.52	31.05	33.30	37.82	45.20	51.72
200	1.29	1.76	2.26	3.62	5.37	8.39	10.16	15.16	22.85	28.99	36.33	36.70	37.06	37.43	38.36	41.80	48.71	55.39
500	1.44	1.97	2.53	4.05	6.01	9.62	11.92	18.32	28.91	36.75	46.32	46.78	47.25	47.73	48.20	50.53	54.66	60.97
1000	1.56	2.13	2.74	4.38	6.50	10.58	13.34	20.96	34.13	43.46	55.13	55.68	56.24	56.80	57.37	57.53	61.04	65.61

*The **upper** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **greater** than.
These precipitation frequency estimates are based on a partial duration series. **ARI is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

* Lower bound of the 90% confidence interval Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.54	0.74	0.94	1.51	2.25	2.88	3.01	3.32	3.49	3.98	4.95	5.71	7.08	8.34	11.67	14.83	18.91	22.68
2	0.65	0.89	1.14	1.83	2.72	3.52	3.69	4.14	4.43	5.15	6.36	7.29	8.96	10.49	14.52	18.41	23.38	27.98
5	0.71	0.97	1.25	2.00	2.97	3.99	4.25	5.04	5.75	7.05	8.65	9.62	11.37	12.97	17.24	21.41	26.84	31.85
10	0.78	1.06	1.36	2.18	3.24	4.46	4.83	5.90	6.99	8.86	10.84	11.75	13.52	15.12	19.49	23.82	29.61	34.91
25	0.86	1.18	1.52	2.43	3.60	5.12	5.66	7.14	8.83	11.60	14.21	14.91	16.60	18.14	22.51	26.98	33.18	38.84
50	0.94	1.28	1.64	2.63	3.90	5.66	6.34	8.16	10.41	14.02	17.13	17.72	19.24	20.71	24.89	29.37	35.86	41.72
100	1.00	1.37	1.76	2.82	4.18	6.18	7.03	9.21	12.08	16.67	20.38	21.05	22.50	24.01	27.25	31.67	38.40	44.41
200	1.08	1.47	1.89	3.03	4.49	6.75	7.76	10.35	13.95	19.68	23.99	24.79	26.29	27.93	30.89	34.56	40.92	47.08
500	1.18	1.61	2.06	3.31	4.90	7.49	8.77	11.96	16.63	24.18	29.39	30.42	32.14	33.88	36.94	40.98	45.13	51.03
1000	1.25	1.71	2.19	3.51	5.21	8.06	9.56	13.21	18.80	27.91	33.91	35.17	37.03	38.93	41.72	45.94	49.69	54.22

* The **lower** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **less** than.

** These precipitation frequency estimates are based on a partial duration maxima series. **ARI** is the Average Recurrence Interval.

Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

Text version of tables

Related Information

Maps & Aerials

Click here to see topographic maps and aerial photographs available for this location from Microsoft Research Maps

Climate Data Sources

National Climatic Data Center (NCDC) database

Locate NCDC climate stations within:

+/-30 minutes or +/-1 degree of this location. Digital ASCII data can be obtained directly from **NCDC**.

Note: Precipitation frequency results are based on analysis of precipitation data from a variety of sources, but largely NCDC. The following links provide general information about observing sites in the area, regardless of if their data was used in this study. For detailed information about the stations used in this study, please refer to the matching documentation available at the PF Document page

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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
Office of Hydrologic Development
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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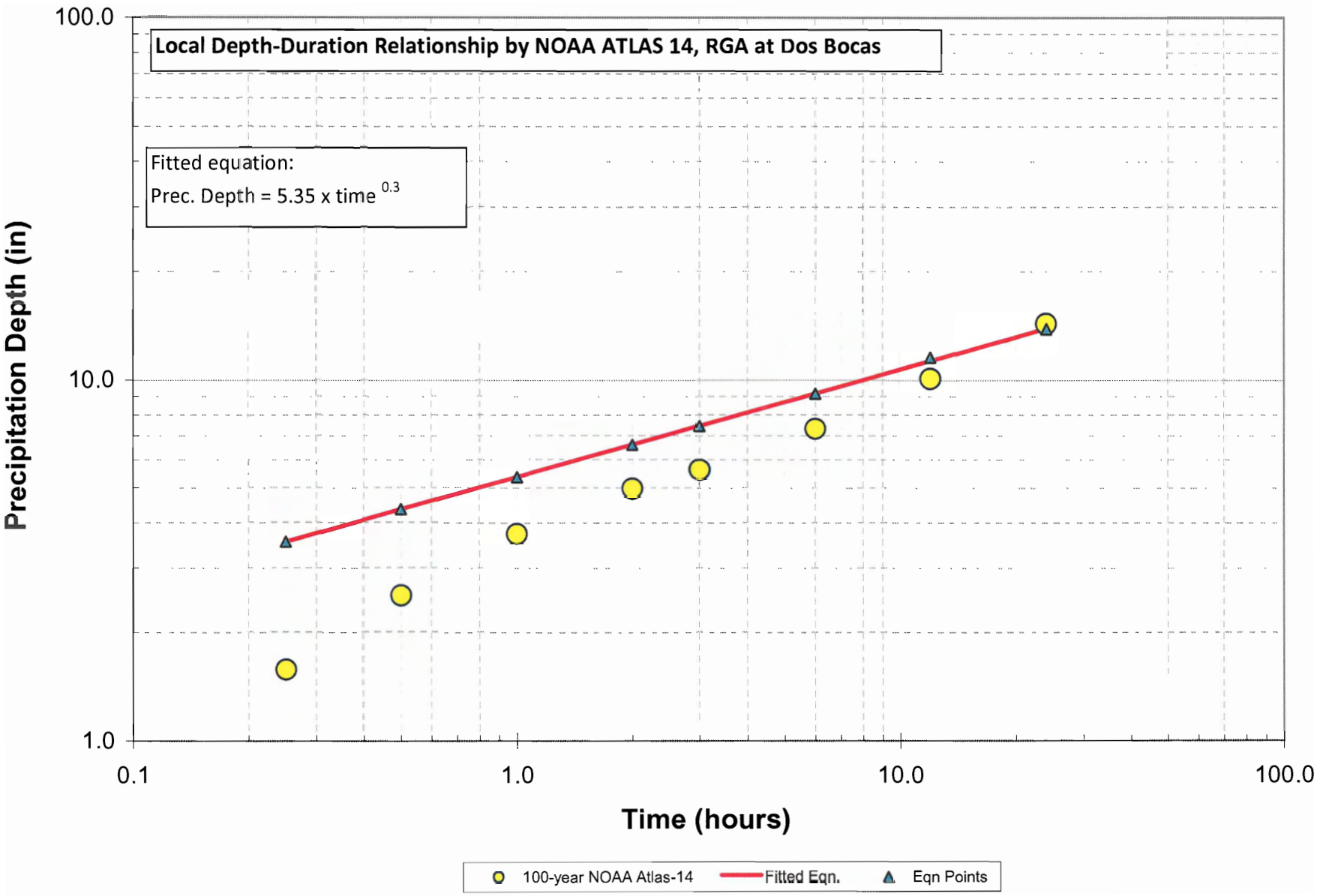
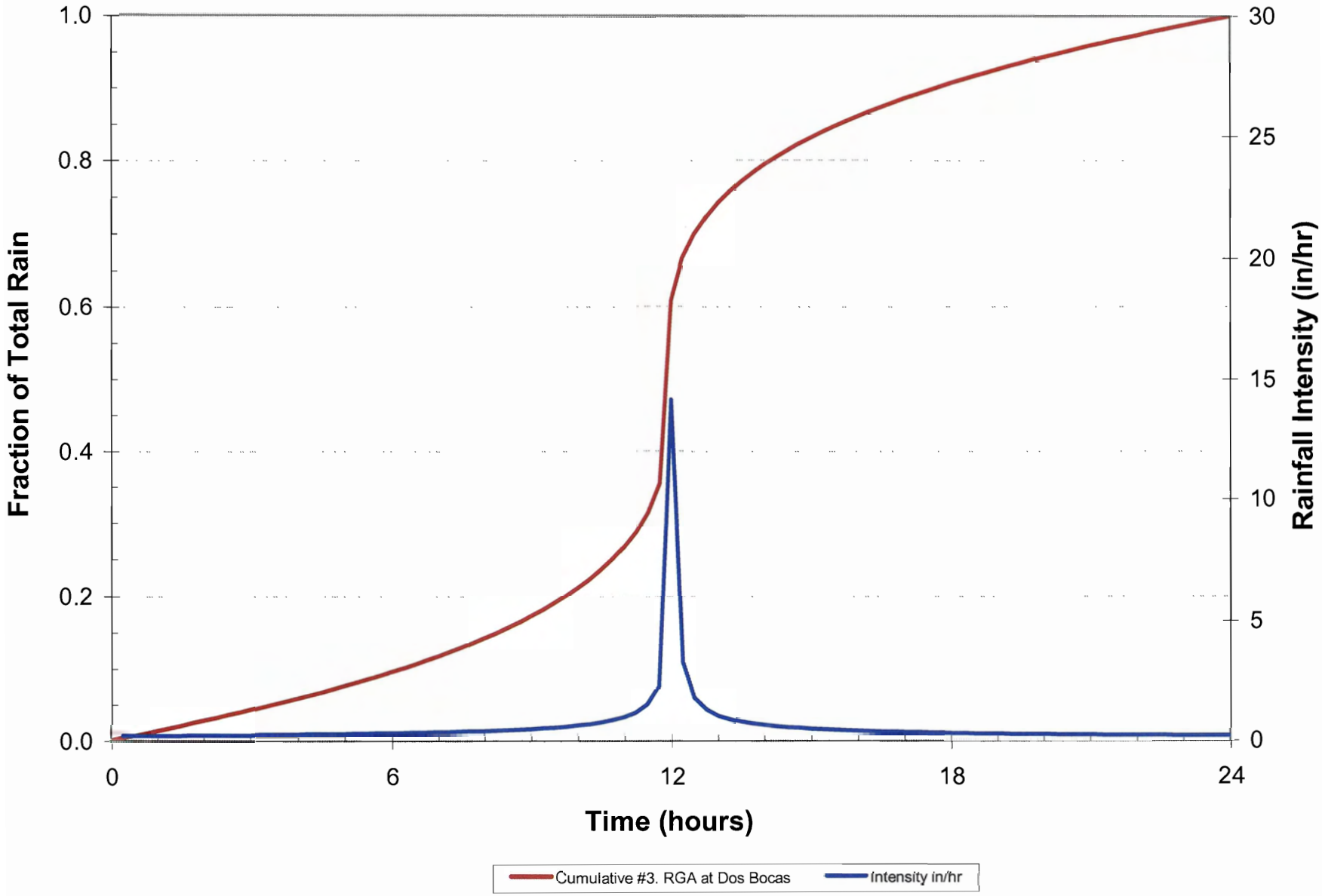

Local Depth-Duration Relationship by NOAA ATLAS 14, RGA at Dos Bocas
Fitted equation:
Prec. Depth = 5.35 x time 0.3
Precipitation Depth (in)
100.0
10.0
1.0
0.1
1.0
10.0
100.0
Time (hours)
100-year NOAA Atlas-14
Fitted Eqn.
Eqn Points


Fraction of Total Rain
1.0
0.8
0.6
0.4
0.2
0.0
Rainfall Intensity (in/hr)
30
25
20
15
10
5
0
0
6
12
18
24
Time (hours)
Cumulative #3. RGA at Dos Bocas
Intensity in/hr

Sequential Depth Hyetograph - Distribution #1 (15 minute)

Hour	Ordered Intensities	Incremental Depth (decimal)	Incremental Depth (inches)	Cumulative Depth (decimal)	Cumulative Depth (inches)	Intensity (inch/hr)
0		0	0	0	0	
0.25	23.75	0.003	0.044	0.003	0.044	0.175
0.5	23.25	0.003	0.045	0.006	0.088	0.178
0.75	22.75	0.003	0.045	0.010	0.134	0.181
1	22.25	0.003	0.046	0.013	0.180	0.184
1.25	21.75	0.003	0.047	0.016	0.226	0.187
1.5	21.25	0.003	0.047	0.020	0.274	0.190
1.75	20.75	0.003	0.048	0.023	0.322	0.193
2	20.25	0.004	0.049	0.027	0.371	0.196
2.25	19.75	0.004	0.050	0.030	0.421	0.200
2.5	19.25	0.004	0.051	0.034	0.472	0.203
2.75	18.75	0.004	0.052	0.038	0.523	0.207
3	18.25	0.004	0.053	0.042	0.576	0.211
3.25	17.75	0.004	0.054	0.045	0.630	0.215
3.5	17.25	0.004	0.055	0.049	0.685	0.220
3.75	16.75	0.004	0.056	0.053	0.741	0.224
4	16.25	0.004	0.057	0.058	0.798	0.229
4.25	15.75	0.004	0.059	0.062	0.857	0.234
4.5	15.25	0.004	0.060	0.066	0.917	0.240
4.75	14.75	0.004	0.061	0.070	0.978	0.245
5	14.25	0.005	0.063	0.075	1.041	0.251
5.25	13.75	0.005	0.064	0.080	1.106	0.258
5.5	13.25	0.005	0.066	0.084	1.172	0.265
5.75	12.75	0.005	0.068	0.089	1.240	0.272
6	12.25	0.005	0.070	0.094	1.310	0.280
6.25	11.75	0.005	0.072	0.100	1.382	0.288
6.5	11.25	0.005	0.074	0.105	1.456	0.297
6.75	10.75	0.006	0.077	0.110	1.533	0.307
7	10.25	0.006	0.079	0.116	1.612	0.317
7.25	9.75	0.006	0.082	0.122	1.695	0.329
7.5	9.25	0.006	0.085	0.128	1.780	0.341
7.75	8.75	0.006	0.089	0.135	1.869	0.355
8	8.25	0.007	0.093	0.141	1.961	0.370
8.25	7.75	0.007	0.097	0.148	2.058	0.387
8.5	7.25	0.007	0.102	0.156	2.160	0.406
8.75	6.75	0.008	0.107	0.163	2.266	0.427
9	6.25	0.008	0.113	0.171	2.379	0.451
9.25	5.75	0.009	0.120	0.180	2.499	0.479
9.5	5.25	0.009	0.128	0.189	2.627	0.511
9.75	4.75	0.010	0.137	0.199	2.764	0.549
10	4.25	0.011	0.149	0.210	2.913	0.595
10.25	3.75	0.012	0.163	0.222	3.076	0.652
10.5	3.25	0.013	0.181	0.235	3.257	0.723
10.75	2.75	0.015	0.204	0.249	3.461	0.817
11	2.25	0.017	0.237	0.266	3.698	0.948
11.25	1.75	0.021	0.286	0.287	3.984	1.144
11.5	1.25	0.027	0.370	0.314	4.354	1.482
11.75	0.75	0.040	0.562	0.354	4.916	2.248
12	0.25	0.254	3.530	0.608	8.446	14.119
12.25	0.5	0.059	0.816	0.667	9.262	3.263
12.5	1	0.032	0.442	0.699	9.704	1.769
12.75	1.5	0.023	0.322	0.722	10.026	1.286
13	2	0.019	0.259	0.741	10.285	1.035
13.25	2.5	0.016	0.219	0.757	10.504	0.876
13.5	3	0.014	0.192	0.771	10.695	0.767
13.75	3.5	0.012	0.171	0.783	10.867	0.685
14	4	0.011	0.155	0.794	11.022	0.622
14.25	4.5	0.010	0.143	0.804	11.165	0.571
14.5	5	0.010	0.132	0.814	11.297	0.530
14.75	5.5	0.009	0.124	0.823	11.421	0.495
15	6	0.008	0.116	0.831	11.537	0.465
15.25	6.5	0.008	0.110	0.839	11.647	0.439
15.5	7	0.007	0.104	0.847	11.751	0.416
15.75	7.5	0.007	0.099	0.854	11.850	0.396
16	8	0.007	0.095	0.861	11.945	0.379
16.25	8.5	0.007	0.091	0.867	12.035	0.363
16.5	9	0.006	0.087	0.873	12.122	0.348
16.75	9.5	0.006	0.084	0.879	12.206	0.335
17	10	0.006	0.081	0.885	12.287	0.323
17.25	10.5	0.006	0.078	0.891	12.365	0.312
17.5	11	0.005	0.075	0.896	12.440	0.302
17.75	11.5	0.005	0.073	0.902	12.514	0.293
18	12	0.005	0.071	0.907	12.585	0.284
18.25	12.5	0.005	0.069	0.912	12.654	0.276
18.5	13	0.005	0.067	0.916	12.721	0.268
18.75	13.5	0.005	0.065	0.921	12.786	0.261
19	14	0.005	0.064	0.926	12.850	0.255
19.25	14.5	0.004	0.062	0.930	12.912	0.248
19.5	15	0.004	0.061	0.935	12.972	0.243
19.75	15.5	0.004	0.059	0.939	13.032	0.237
20	16	0.004	0.058	0.943	13.090	0.232
20.25	16.5	0.004	0.057	0.947	13.146	0.227
20.5	17	0.004	0.056	0.951	13.202	0.222
20.75	17.5	0.004	0.054	0.955	13.256	0.218
21	18	0.004	0.053	0.959	13.309	0.213
21.25	18.5	0.004	0.052	0.963	13.362	0.209
21.5	19	0.004	0.051	0.966	13.413	0.205
21.75	19.5	0.004	0.050	0.970	13.463	0.202
22	20	0.004	0.049	0.973	13.513	0.198
22.25	20.5	0.004	0.049	0.977	13.562	0.195
22.5	21	0.003	0.048	0.980	13.609	0.191
22.75	21.5	0.003	0.047	0.984	13.656	0.188
23	22	0.003	0.046	0.987	13.703	0.185
23.25	22.5	0.003	0.046	0.990	13.748	0.182
23.5	23	0.003	0.045	0.994	13.793	0.179
23.75	23.5	0.003	0.044	0.997	13.837	0.177
24	24	0.003	0.044	1.000	13.881	0.174

Hour	Cumulative depth (decimal)
0	0
0.010417	0.0031597
0.020833	0.006367
0.03125	0.0096238
0.041667	0.0129319
0.052083	0.0162934
0.0625	0.0197104
0.072917	0.0231851
0.083333	0.0267201
0.09375	0.0303179
0.104167	0.0339813
0.114583	0.0377132
0.125	0.0415169
0.135417	0.0453958
0.145833	0.0493537
0.15625	0.0533945
0.166667	0.0575226
0.177083	0.0617428
0.1875	0.0660602
0.197917	0.0704803
0.208333	0.0750094
0.21875	0.0796542
0.229167	0.0844222
0.239583	0.0893217
0.25	0.0943616
0.260417	0.0995524
0.270833	0.1049055
0.28125	0.1104336
0.291667	0.1161515
0.302083	0.1220757
0.3125	0.1282254
0.322917	0.1346225
0.333333	0.1412927
0.34375	0.1482663
0.354167	0.1555789
0.364583	0.1632737
0.375	0.1714032
0.385417	0.180032
0.395833	0.1892421
0.40625	0.1991386
0.416667	0.2098608
0.427083	0.2215985
0.4375	0.2346224
0.447917	0.2493388
0.458333	0.2664054
0.46875	0.2870075
0.479167	0.313692
0.489583	0.3541854
0.5	0.6084691
0.510417	0.6672454
0.520833	0.6991141
0.53125	0.7222827
0.541667	0.7409156
0.552083	0.7567016
0.5625	0.7705091
0.572917	0.7828494
0.583333	0.7940514
0.59375	0.8043407
0.604167	0.813879
0.614583	0.822787
0.625	0.8311571
0.635417	0.839062
0.645833	0.8465598
0.65625	0.853698
0.666667	0.8605158
0.677083	0.867046
0.6875	0.8733165
0.697917	0.8793509
0.708333	0.8851697
0.71875	0.8907908
0.729167	0.8962296
0.739583	0.9015
0.75	0.906614
0.760417	0.9115825
0.770833	0.9164152
0.78125	0.9211206
0.791667	0.9257067
0.802083	0.9301805
0.8125	0.9345485
0.822917	0.9388166
0.833333	0.9429901
0.84375	0.947074
0.854167	0.9510729
0.864583	0.9549908
0.875	0.9588317
0.885417	0.9625991
0.895833	0.9662963
0.90625	0.9699265
0.916667	0.9734926
0.927083	0.9769971
0.9375	0.9804427
0.947917	0.9838317
0.958333	0.9871662
0.96875	0.9904484
0.979167	0.9936803
0.989583	0.9968635
1	1

RGA at Dos Bocas			
7.98	12.19	14.32	20.18
10-Yr	50-yr	100-yr	500-yr
0	0	0	0
0.025214068	0.038516227	0.045246298	0.063761892
0.025594466	0.039097311	0.045928917	0.064723851
0.02598911	0.039700156	0.046637099	0.065721833
0.026398864	0.040326084	0.047372397	0.066758029
0.026824669	0.040976531	0.0481365	0.067834816
0.027267549	0.04165306	0.04893124	0.068954778
0.027728615	0.04235737	0.049758617	0.070120733
0.028209084	0.04309132	0.050620812	0.071335754
0.028710285	0.04385694	0.051520212	0.072603203
0.029233677	0.044656457	0.052459431	0.073926768
0.029780862	0.045492319	0.053441346	0.075310501
0.030353604	0.046367223	0.054469125	0.076758864
0.030953854	0.047284145	0.055546264	0.078276788
0.03158377	0.048246385	0.05667664	0.079869734
0.032245751	0.049257607	0.057864555	0.081543766
0.032942469	0.050321893	0.059114807	0.083305643
0.033676913	0.051443806	0.060432756	0.085162921
0.034452433	0.052628466	0.061824416	0.087124073
0.035272802	0.053881636	0.063296557	0.08919864
0.036142285	0.055209832	0.064856833	0.091397408
0.037065723	0.056620446	0.066513929	0.093732618
0.038048635	0.058121912	0.06827775	0.096218226
0.039097344	0.059723888	0.070159645	0.098870226
0.040219134	0.061437499	0.072172681	0.101707033
0.041422439	0.063275631	0.074331996	0.104749978
0.042717088	0.065253297	0.076655226	0.108023915
0.04411461	0.067388108	0.07916306	0.111558
0.045628626	0.069700871	0.08187994	0.115386675
0.047275355	0.072216362	0.084834972	0.119550959
0.04907428	0.074964345	0.088063119	0.124100121
0.051049031	0.077980913	0.091606782	0.129093916
0.053228572	0.081310312	0.095517938	0.134605586
0.05564883	0.085007424	0.099861059	0.140725989
0.058354975	0.089141247	0.104717199	0.147569348
0.06140466	0.093799851	0.110189816	0.155281459
0.064872763	0.099097617	0.11641328	0.164051675
0.0688585	0.105186105	0.123565629	0.174130893
0.073496444	0.112270883	0.131888355	0.185859428
0.078974249	0.120638608	0.141718201	0.199711822
0.085562436	0.130702518	0.153540612	0.216372175
0.093667223	0.143083138	0.16808454	0.236867739
0.103930657	0.158761241	0.186502131	0.262822137
0.11743722	0.179393448	0.210739472	0.296977832
0.136190868	0.208040937	0.244392635	0.34440247
0.164404732	0.251139559	0.295022025	0.415750312
0.212942675	0.325284613	0.382122696	0.538494134
0.323136982	0.493614011	0.579864859	0.817155926
2.029184431	3.099719074	3.64134349	5.131446342
0.469034645	0.716482747	0.841676205	1.186105154
0.254312401	0.38847972	0.456360098	0.643110809
0.184885614	0.282425518	0.331774686	0.467542819
0.14869056	0.227135079	0.26682316	0.376011968
0.125972317	0.192431397	0.226055587	0.318561575
0.110183671	0.168313151	0.197723079	0.278634897
0.09847531	0.150427824	0.176712587	0.249026537
0.08939233	0.136552945	0.160413303	0.226057295
0.08210819	0.12542592	0.147342015	0.207637002
0.076115866	0.116272232	0.136588873	0.192483481
0.071085733	0.108588357	0.127562369	0.179763171
0.066793511	0.102031692	0.119860035	0.168908904
0.063080884	0.096360398	0.113197777	0.159520331
0.059832668	0.091398524	0.107368898	0.15130617
0.056962903	0.08701476	0.102219144	0.144049045
0.054406037	0.083108971	0.097630883	0.137583186
0.052111143	0.079603363	0.093512728	0.131779808
0.050038009	0.076436507	0.089792517	0.12653722
0.048154425	0.073559203	0.086412452	0.121773972
0.046434269	0.070931546	0.083325655	0.117424003
0.04485611	0.0685208	0.080493672	0.113433121
0.043402193	0.066299842	0.077884638	0.109756424
0.042057669	0.064245988	0.075471908	0.106356361
0.040810019	0.062340116	0.073233016	0.103201275
0.039648606	0.060565979	0.071148877	0.10026427
0.038564334	0.058909678	0.069203166	0.097522338
0.03754937	0.05735925	0.067381826	0.094955674
0.036596932	0.055904336	0.06567269	0.092547129
0.035701116	0.054535916	0.064065161	0.090281771
0.034856757	0.053246099	0.062549971	0.088146537
0.034059313	0.052027949	0.061118968	0.086129943
0.033304775	0.05087534	0.05976496	0.084221851
0.032589589	0.049782844	0.058481569	0.082413272
0.031910592	0.048745629	0.057263118	0.080696209
0.03126496	0.047759381	0.056104539	0.079063519
0.030650161	0.046820233	0.055001291	0.077508803
0.030063921	0.045924712	0.053949292	0.076026307
0.029504189	0.045069683	0.052944861	0.074610845
0.028969111	0.044252314	0.051984671	0.073257727
0.028457005	0.043470037	0.051065704	0.071962702
0.027966344	0.042720518	0.050185218	0.070721907
0.027495735	0.04200163	0.049340717	0.069531821
0.027043907	0.041311433	0.048529919	0.06838923
0.026609698	0.040648148	0.047750737	0.067291192
0.026192041	0.040010148	0.047001256	0.066235011
0.025789955	0.039395934	0.046279719	0.065218207
0.025402538	0.038804128	0.045584504	0.064238499
0.025028958	0.038233459	0.044914121	0.063293782

7.98 12.19 14.3

This sheet presents the intensity-duration computations based on the fitted power equation.
Results from this sheet are used to compute time-sequential hyetograph values.

RGA at Dos Bocas

Intensity-Duration Relationship

Hour	Cumulative Depth by E (decimal)	(inch)	Decimal Increment
0	0.000	0.000	0.000
0.25	0.254	3.530	0.254
0.5	0.313	4.346	0.059
0.75	0.354	4.908	0.040
1	0.385	5.350	0.032
1.25	0.412	5.720	0.027
1.5	0.435	6.042	0.023
1.75	0.456	6.328	0.021
2	0.475	6.587	0.019
2.25	0.492	6.824	0.017
2.5	0.507	7.043	0.016
2.75	0.522	7.247	0.015
3	0.536	7.439	0.014
3.25	0.549	7.619	0.013
3.5	0.561	7.791	0.012
3.75	0.573	7.954	0.012
4	0.584	8.109	0.011
4.25	0.595	8.258	0.011
4.5	0.605	8.401	0.010
4.75	0.615	8.538	0.010
5	0.625	8.671	0.010
5.25	0.634	8.798	0.009
5.5	0.643	8.922	0.009
5.75	0.651	9.042	0.009
6	0.660	9.158	0.008
6.25	0.668	9.271	0.008
6.5	0.676	9.381	0.008
6.75	0.683	9.487	0.008
7	0.691	9.591	0.007
7.25	0.698	9.693	0.007
7.5	0.705	9.792	0.007
7.75	0.712	9.889	0.007
8	0.719	9.983	0.007
8.25	0.726	10.076	0.007
8.5	0.732	10.167	0.007
8.75	0.739	10.255	0.006
9	0.745	10.343	0.006
9.25	0.751	10.428	0.006
9.5	0.757	10.512	0.006
9.75	0.763	10.594	0.006
10	0.769	10.675	0.006
10.25	0.775	10.754	0.006
10.5	0.780	10.832	0.006
10.75	0.786	10.909	0.006
11	0.791	10.984	0.005

Intensity-Duration Relationship

Hour	Cumulative Depth by E (decimal)	(inch)	Decimal Increment
11.25	0.797	11.059	0.005
11.5	0.802	11.132	0.005
11.75	0.807	11.204	0.005
12	0.812	11.275	0.005
12.25	0.817	11.345	0.005
12.5	0.822	11.414	0.005
12.75	0.827	11.482	0.005
13	0.832	11.549	0.005
13.25	0.837	11.615	0.005
13.5	0.841	11.680	0.005
13.75	0.846	11.745	0.005
14	0.851	11.808	0.005
14.25	0.855	11.871	0.005
14.5	0.860	11.933	0.004
14.75	0.864	11.995	0.004
15	0.868	12.055	0.004
15.25	0.873	12.115	0.004
15.5	0.877	12.175	0.004
15.75	0.881	12.233	0.004
16	0.885	12.291	0.004
16.25	0.890	12.348	0.004
16.5	0.894	12.405	0.004
16.75	0.898	12.461	0.004
17	0.902	12.517	0.004
17.25	0.906	12.572	0.004
17.5	0.910	12.626	0.004
17.75	0.913	12.680	0.004
18	0.917	12.733	0.004
18.25	0.921	12.786	0.004
18.5	0.925	12.838	0.004
18.75	0.929	12.890	0.004
19	0.932	12.941	0.004
19.25	0.936	12.992	0.004
19.5	0.940	13.043	0.004
19.75	0.943	13.093	0.004
20	0.947	13.142	0.004
20.25	0.950	13.191	0.004
20.5	0.954	13.240	0.004
20.75	0.957	13.288	0.003
21	0.961	13.336	0.003
21.25	0.964	13.383	0.003
21.5	0.968	13.430	0.003
21.75	0.971	13.477	0.003
22	0.974	13.523	0.003
22.25	0.978	13.569	0.003
22.5	0.981	13.615	0.003
22.75	0.984	13.660	0.003
23	0.987	13.705	0.003
23.25	0.991	13.749	0.003
23.5	0.994	13.793	0.003
23.75	0.997	13.837	0.003
24	1.000	13.881	0.003

POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

Puerto Rico 18.292 N 66.697 W 1312 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 3, Version 4
G.M. Bonnin, D. Martin, B. Lin, T Parzybok, M.Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2006
Extracted: Tue Jul 6 2010

RGA @ Dos Bocas

Confidence Limits | Seasonality | Related Info | GIS data | Maps | Docs | Return to State Map

Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.54	0.74	0.95	1.52	2.25	2.72	2.87	3.16	3.42	4.03	5.08	5.76	7.05	8.20	11.61	14.70	18.79	22.52
2	0.66	0.90	1.16	1.85	2.75	3.35	3.46	3.88	4.26	5.11	6.41	7.24	8.83	10.22	14.39	18.14	23.11	27.63
5	0.69	0.94	1.21	1.93	2.86	3.62	3.83	4.54	5.29	6.65	8.27	9.12	10.79	12.23	16.68	20.80	26.21	31.00
10	0.73	0.99	1.27	2.04	3.02	3.90	4.20	5.13	6.26	8.10	10.02	10.81	12.52	13.91	18.55	22.98	28.72	33.73
25	0.78	1.07	1.37	2.20	3.26	4.31	4.74	5.99	7.72	10.30	12.71	13.33	14.97	16.25	21.00	25.82	31.97	37.18
50	0.83	1.13	1.46	2.33	3.46	4.65	5.18	6.69	8.95	12.22	15.06	15.51	17.03	18.18	22.88	27.99	34.41	39.75
100	0.88	1.20	1.54	2.47	3.66	4.98	5.63	7.43	10.28	14.32	17.65	18.00	19.31	20.30	24.73	30.11	36.78	42.20
200	0.93	1.27	1.63	2.61	3.87	5.32	6.11	8.21	11.75	16.68	20.56	20.87	21.88	22.74	26.99	32.40	39.16	44.66
500	1.00	1.36	1.75	2.80	4.16	5.79	6.77	9.30	13.90	20.18	24.88	25.18	26.11	26.57	30.39	36.32	42.47	47.78
1000	1.05	1.44	1.84	2.95	4.37	6.15	7.28	10.18	15.68	23.13	28.55	28.85	29.71	30.12	33.06	39.34	45.47	50.26

* These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting forces estimates near zero to appear as zero.

* Upper bound of the 90% confidence interval Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.57	0.78	1.01	1.61	2.39	2.89	3.00	3.42	3.84	4.48	5.66	6.36	7.70	8.90	12.46	15.72	20.04	23.90
2	0.68	0.93	1.20	1.91	2.84	3.49	3.64	4.21	4.80	5.71	7.17	8.02	9.64	11.09	15.44	19.40	24.66	29.32
5	0.71	0.97	1.24	1.99	2.95	3.76	4.02	4.91	5.96	7.43	9.24	10.09	11.78	13.26	17.89	22.22	27.92	32.85
10	0.75	1.03	1.32	2.11	3.14	4.07	4.44	5.58	7.10	9.06	11.22	12.00	13.69	15.10	19.92	24.57	30.65	35.76
25	0.82	1.12	1.44	2.30	3.41	4.55	5.08	6.61	8.88	11.63	14.40	14.94	16.50	17.76	22.66	27.76	34.29	39.57
50	0.88	1.20	1.54	2.46	3.65	4.95	5.63	7.50	10.46	13.92	17.22	17.55	18.94	19.99	24.82	30.26	37.09	42.51
100	0.94	1.28	1.64	2.63	3.90	5.37	6.21	8.45	12.25	16.50	20.44	20.62	21.68	22.52	26.98	32.73	39.83	45.36
200	1.00	1.37	1.76	2.81	4.17	5.83	6.85	9.55	14.31	19.43	24.11	24.19	24.81	25.44	29.64	35.44	42.66	48.23
500	1.09	1.49	1.92	3.07	4.55	6.46	7.76	11.11	17.41	23.89	29.74	30.04	30.10	30.11	33.72	40.13	46.70	52.00
1000	1.16	1.59	2.04	3.26	4.84	6.95	8.47	12.37	19.98	27.66	34.56	34.91	35.26	35.61	36.99	43.81	50.42	55.06

* The **upper** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **greater** than.
** These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

* Lower bound of the 90% confidence interval Precipitation Frequency Estimates (inches)

RGA e Dos Bocas

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.54	0.73	0.94	1.51	2.24	2.68	2.74	2.95	3.09	3.65	4.61	5.27	6.50	7.62	10.83	13.75	17.62	21.18
2	0.64	0.88	1.12	1.80	2.67	3.23	3.32	3.63	3.86	4.64	5.82	6.63	8.14	9.48	13.43	16.99	21.70	26.03
5	0.67	0.91	1.17	1.87	2.78	3.48	3.65	4.22	4.76	6.01	7.46	8.30	9.91	11.30	15.54	19.45	24.55	29.17
10	0.70	0.96	1.23	1.97	2.92	3.73	3.98	4.73	5.54	7.25	8.95	9.76	11.42	12.80	17.21	21.41	26.83	31.64
25	0.75	1.02	1.31	2.10	3.12	4.08	4.43	5.41	6.63	9.03	11.12	11.82	13.48	14.79	19.36	23.91	29.70	34.74
50	0.79	1.08	1.38	2.21	3.28	4.36	4.78	5.94	7.53	10.52	12.92	13.52	15.15	16.38	20.96	25.75	31.82	36.98
100	0.82	1.12	1.44	2.31	3.43	4.61	5.11	6.46	8.43	12.11	14.84	15.44	16.94	18.10	22.47	27.50	33.78	39.03
200	0.86	1.18	1.51	2.42	3.59	4.87	5.46	7.01	9.39	13.82	16.91	17.58	18.91	20.03	24.32	29.36	35.71	41.04
500	0.91	1.25	1.60	2.56	3.80	5.19	5.90	7.74	10.70	16.28	19.86	20.70	22.11	23.03	27.06	32.56	38.35	43.53
1000	0.95	1.29	1.66	2.66	3.95	5.44	6.25	8.29	11.72	18.30	22.26	23.25	24.77	25.78	29.14	34.98	40.76	45.49

* The **lower** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **less** than.

** These precipitation frequency estimates are based on a partial duration maxima series. **ARI** is the Average Recurrence Interval.

Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

Text version of tables

Related Information

Maps & Aerials

Click here to see topographic maps and aerial photographs available for this location from Microsoft Research Maps

Climate Data Sources

National Climatic Data Center (NCDC) database

Locate NCDC climate stations within:

+/-30 minutes or +/-1 degree of this location. Digital ASCII data can be obtained directly from NCDC.

Note: Precipitation frequency results are based on analysis of precipitation data from a variety of sources, but largely NCDC. The following links provide general information about observing sites in the area, regardless of if their data was used in this study. For detailed information about the stations used in this study, please refer to the matching documentation available at the PF Document page

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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
Office of Hydrologic Development
1325 East West Highway
Silver Spring, MD 20910
Questions? HDSC.Questions@noaa.gov

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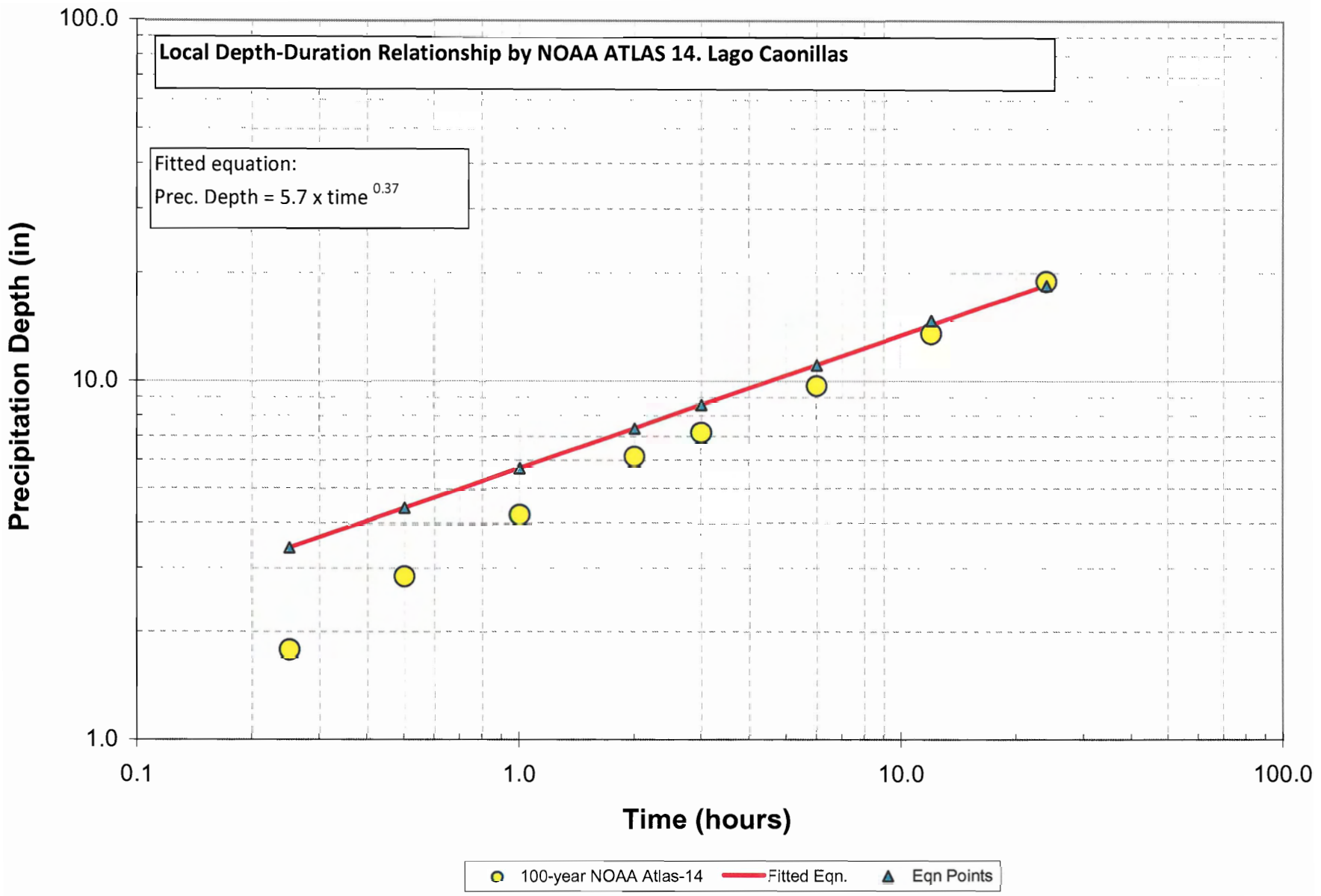
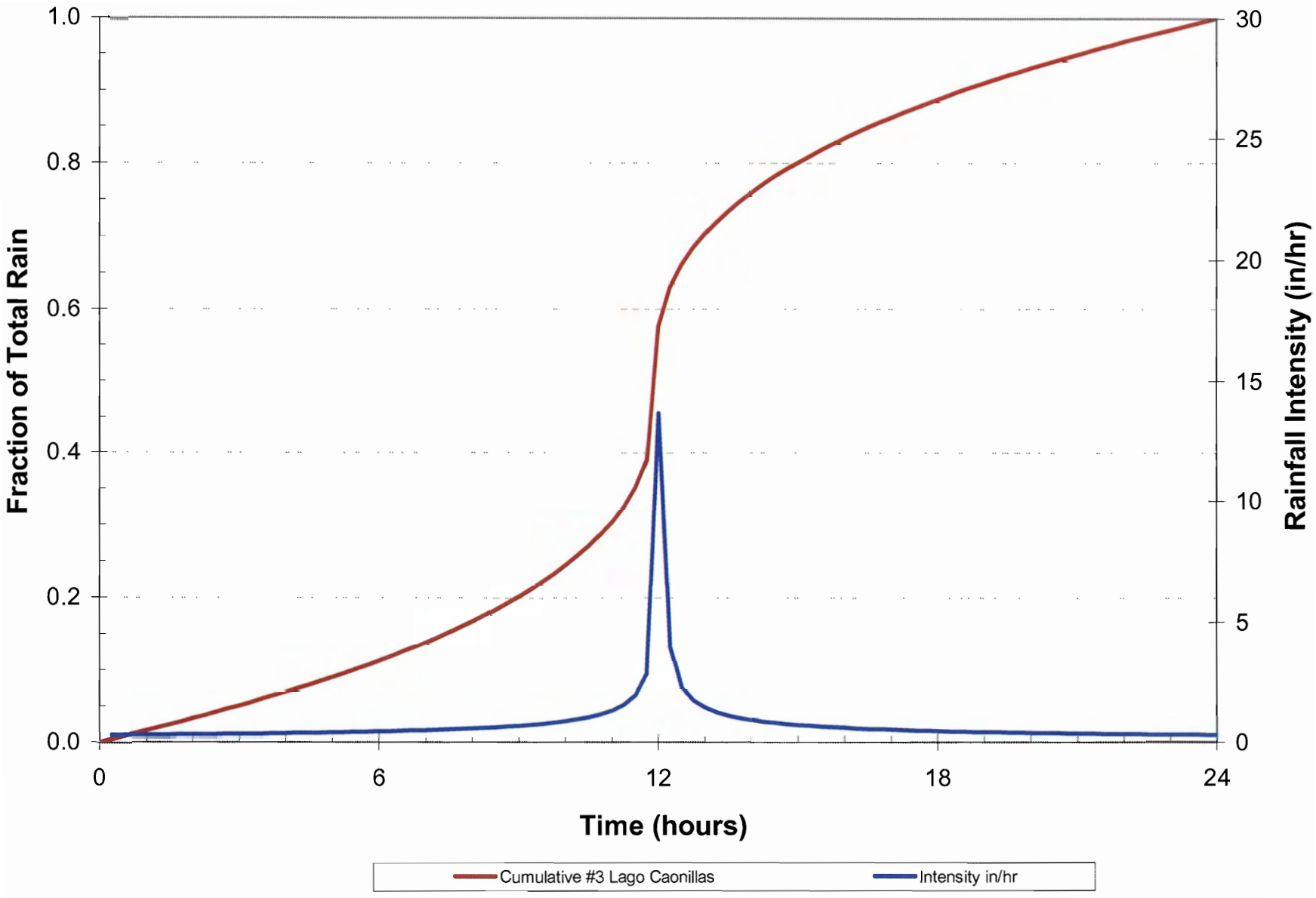

Local Depth-Duration Relationship by NOAA ATLAS 14. Lago Caonillas
Fitted equation:
Prec. Depth = 5.7 x time 0.37
Precipitation Depth (in)
100.0
10.0
1.0
0.1
1.0
10.0
100.0
Time (hours)
100-year NOAA Atlas-14
Fitted Eqn.
Eqn Points


1.0
0.8
0.6
0.4
0.2
0.0
Fraction of Total Rain
30
25
20
15
10
5
0
Rainfall Intensity (in/hr)
0
6
12
18
24
Time (hours)
Cumulative #3 Lago Caonillas
Intensity in/hr

Sequential Depth Hyetograph - Distribution #1 (15 minute) Lago Caonillas

Hour	Ordered Intensities	Incremental Depth (decimal)	Incremental Depth (inches)	Cumulative Depth (decimal)	Cumulative Depth (inches)	Intensity (inch/hr)
0		0	0	0	0	
0.25	23.75	0.004	0.072	0.004	0.072	0.288
0.5	23.25	0.004	0.073	0.008	0.145	0.292
0.75	22.75	0.004	0.074	0.012	0.219	0.296
1	22.25	0.004	0.075	0.016	0.294	0.300
1.25	21.75	0.004	0.076	0.020	0.370	0.304
1.5	21.25	0.004	0.077	0.024	0.447	0.309
1.75	20.75	0.004	0.078	0.028	0.525	0.313
2	20.25	0.004	0.080	0.033	0.605	0.318
2.25	19.75	0.004	0.081	0.037	0.686	0.323
2.5	19.25	0.004	0.082	0.042	0.768	0.329
2.75	18.75	0.005	0.084	0.046	0.851	0.334
3	18.25	0.005	0.085	0.051	0.936	0.340
3.25	17.75	0.005	0.086	0.055	1.023	0.346
3.5	17.25	0.005	0.088	0.060	1.111	0.352
3.75	16.75	0.005	0.090	0.065	1.200	0.359
4	16.25	0.005	0.091	0.070	1.292	0.366
4.25	15.75	0.005	0.093	0.075	1.385	0.373
4.5	15.25	0.005	0.095	0.080	1.481	0.381
4.75	14.75	0.005	0.097	0.085	1.578	0.389
5	14.25	0.005	0.099	0.091	1.677	0.398
5.25	13.75	0.006	0.102	0.096	1.779	0.407
5.5	13.25	0.006	0.104	0.102	1.883	0.417
5.75	12.75	0.006	0.107	0.108	1.990	0.427
6	12.25	0.006	0.109	0.114	2.099	0.438
6.25	11.75	0.006	0.112	0.120	2.212	0.450
6.5	11.25	0.006	0.116	0.126	2.327	0.462
6.75	10.75	0.006	0.119	0.132	2.446	0.476
7	10.25	0.007	0.123	0.139	2.569	0.491
7.25	9.75	0.007	0.127	0.146	2.695	0.506
7.5	9.25	0.007	0.131	0.153	2.826	0.524
7.75	8.75	0.007	0.136	0.160	2.962	0.543
8	8.25	0.008	0.141	0.168	3.103	0.564
8.25	7.75	0.008	0.147	0.176	3.250	0.587
8.5	7.25	0.008	0.153	0.184	3.403	0.612
8.75	6.75	0.009	0.160	0.193	3.563	0.641
9	6.25	0.009	0.168	0.202	3.731	0.673
9.25	5.75	0.010	0.178	0.212	3.909	0.710
9.5	5.25	0.010	0.188	0.222	4.097	0.753
9.75	4.75	0.011	0.201	0.233	4.298	0.804
10	4.25	0.012	0.216	0.244	4.514	0.864
10.25	3.75	0.013	0.234	0.257	4.748	0.937
10.5	3.25	0.014	0.257	0.271	5.006	1.029
10.75	2.75	0.016	0.287	0.287	5.293	1.149
11	2.25	0.018	0.328	0.304	5.621	1.312
11.25	1.75	0.021	0.389	0.325	6.010	1.555
11.5	1.25	0.027	0.491	0.352	6.500	1.962
11.75	0.75	0.039	0.714	0.391	7.214	2.856
12	0.25	0.185	3.413	0.575	10.627	13.651
12.25	0.5	0.054	0.998	0.629	11.625	3.991
12.5	1	0.031	0.576	0.660	12.200	2.302
12.75	1.5	0.023	0.432	0.684	12.632	1.728
13	2	0.019	0.355	0.703	12.987	1.420
13.25	2.5	0.017	0.306	0.720	13.293	1.224
13.5	3	0.015	0.271	0.734	13.564	1.085
13.75	3.5	0.013	0.245	0.748	13.809	0.980
14	4	0.012	0.225	0.760	14.034	0.899
14.25	4.5	0.011	0.208	0.771	14.242	0.832
14.5	5	0.011	0.194	0.781	14.437	0.778
14.75	5.5	0.010	0.183	0.791	14.619	0.731
15	6	0.009	0.173	0.801	14.792	0.691
15.25	6.5	0.009	0.164	0.810	14.956	0.657
15.5	7	0.008	0.157	0.818	15.113	0.626
15.75	7.5	0.008	0.150	0.826	15.263	0.599
16	8	0.008	0.144	0.834	15.406	0.575
16.25	8.5	0.007	0.138	0.841	15.544	0.553
16.5	9	0.007	0.133	0.849	15.678	0.533
16.75	9.5	0.007	0.129	0.856	15.806	0.515
17	10	0.007	0.125	0.862	15.931	0.498
17.25	10.5	0.007	0.121	0.869	16.052	0.483
17.5	11	0.006	0.117	0.875	16.169	0.469
17.75	11.5	0.006	0.114	0.881	16.283	0.456
18	12	0.006	0.111	0.887	16.394	0.444
18.25	12.5	0.006	0.108	0.893	16.502	0.432
18.5	13	0.006	0.105	0.899	16.607	0.422
18.75	13.5	0.006	0.103	0.905	16.710	0.412
19	14	0.005	0.101	0.910	16.811	0.402
19.25	14.5	0.005	0.098	0.915	16.909	0.393
19.5	15	0.005	0.096	0.921	17.005	0.385
19.75	15.5	0.005	0.094	0.926	17.100	0.377
20	16	0.005	0.092	0.931	17.192	0.370
20.25	16.5	0.005	0.091	0.936	17.283	0.362
20.5	17	0.005	0.089	0.940	17.372	0.356
20.75	17.5	0.005	0.087	0.945	17.459	0.349
21	18	0.005	0.086	0.950	17.545	0.343
21.25	18.5	0.005	0.084	0.954	17.629	0.337
21.5	19	0.004	0.083	0.959	17.712	0.331
21.75	19.5	0.004	0.081	0.963	17.793	0.326
22	20	0.004	0.080	0.968	17.873	0.321
22.25	20.5	0.004	0.079	0.972	17.952	0.316
22.5	21	0.004	0.078	0.976	18.030	0.311
22.75	21.5	0.004	0.077	0.980	18.107	0.306
23	22	0.004	0.075	0.984	18.182	0.302
23.25	22.5	0.004	0.074	0.988	18.256	0.298
23.5	23	0.004	0.073	0.992	18.330	0.294
23.75	23.5	0.004	0.072	0.996	18.402	0.290
24	24	0.004	0.071	1.000	18.474	0.286

Hour	Cumulative depth (decimal)	
0	0	0
0.010417	0.0038926	0.03666843
0.020833	0.007838	0.037165943
0.03125	0.0118382	0.037681305
0.041667	0.015895	0.038215574
0.052083	0.0200107	0.038769893
0.0625	0.0241875	0.039345507
0.072917	0.0284279	0.039943766
0.083333	0.0327342	0.040566145
0.09375	0.0371094	0.04121425
0.104167	0.0415563	0.041889844
0.114583	0.0460781	0.042594857
0.125	0.050678	0.043331414
0.135417	0.0553597	0.044101856
0.145833	0.0601271	0.044908771
0.15625	0.0649844	0.045755029
0.166667	0.0699359	0.046643821
0.177083	0.0749867	0.047578705
0.1875	0.0801421	0.048563666
0.197917	0.0854079	0.049603178
0.208333	0.0907903	0.050702289
0.21875	0.0962963	0.051866714
0.229167	0.1019335	0.05310295
0.239583	0.1077104	0.054418428
0.25	0.1136363	0.055821676
0.260417	0.1197215	0.05732255
0.270833	0.1259776	0.058932498
0.28125	0.1324176	0.060664907
0.291667	0.1390562	0.062535545
0.302083	0.14591	0.064563126
0.3125	0.1529982	0.066770052
0.322917	0.1603425	0.069183392
0.333333	0.1679684	0.071836199
0.34375	0.1759057	0.074769306
0.354167	0.1841895	0.078033824
0.364583	0.192862	0.081694691
0.375	0.2019741	0.085835828
0.385417	0.2115885	0.090567837
0.395833	0.2217838	0.096039871
0.40625	0.2326605	0.102458594
0.416667	0.2443505	0.110119864
0.427083	0.2570325	0.119464495
0.4375	0.2709586	0.131183123
0.447917	0.2865032	0.146430555
0.458333	0.3042649	0.167315391
0.46875	0.325306	0.198206411
0.479167	0.3518618	0.250155759
0.489583	0.3905056	0.364024768
0.5	0.575245	1.740245609
0.510417	0.6292541	0.50876573
0.520833	0.6604091	0.293480063
0.53125	0.6837948	0.220292681
0.541667	0.703017	0.181073378
0.552083	0.7195748	0.155974112
0.5625	0.7342526	0.138265314
0.572917	0.747519	0.124969494
0.583333	0.7596789	0.114546198
0.59375	0.7709433	0.106110655
0.604167	0.7814651	0.099114991
0.614583	0.7913589	0.093200072
0.625	0.8007134	0.088119733
0.635417	0.8095987	0.083699052
0.645833	0.8180711	0.079809989
0.65625	0.8261769	0.076356455
0.666667	0.8339545	0.073264797
0.677083	0.8414361	0.070477518
0.6875	0.8486494	0.067949013
0.697917	0.8556178	0.065642602
0.708333	0.8623618	0.063528414
0.71875	0.8688992	0.061581854
0.729167	0.8752455	0.059782471
0.739583	0.8814146	0.058113103
0.75	0.8874188	0.056559236
0.760417	0.893269	0.055108499
0.770833	0.8989749	0.053750279
0.78125	0.9045456	0.052475415
0.791667	0.9099889	0.051275951
0.802083	0.9153121	0.050144944
0.8125	0.9205219	0.049076302
0.822917	0.9256243	0.048064658
0.833333	0.9306249	0.047105263
0.84375	0.9355287	0.046193895
0.854167	0.9403405	0.045326791
0.864583	0.9450645	0.044500582
0.875	0.9497049	0.043712244
0.885417	0.9542653	0.042959052
0.895833	0.9587492	0.042238545
0.90625	0.9631599	0.041548495
0.916667	0.9675003	0.040886875
0.927083	0.9717733	0.040251843
0.9375	0.9759816	0.039641717
0.947917	0.9801275	0.039054957
0.958333	0.9842135	0.038490152
0.96875	0.9882418	0.037946007
0.979167	0.9922143	0.037421328
0.989583	0.9961331	0.036915018
1	1	0.036426059

Lago Caonillas

9.42	15.61	18.92	28.4
10-Yr	50-yr	100-yr	500-yr
0	0	0	0
0.03666843	0.060763714	0.073648269	0.110550255
0.037165943	0.061588149	0.074647519	0.112050188
0.037681305	0.062442162	0.075682621	0.113603934
0.038215574	0.063327506	0.076755696	0.115214681
0.038769893	0.064246076	0.077869043	0.116885878
0.039345507	0.065199933	0.079025159	0.118621274
0.039943766	0.066191316	0.080226758	0.120424943
0.040566145	0.067222666	0.0814768	0.122301327
0.04121425	0.06829665	0.082778515	0.124255276
0.041889844	0.069416185	0.08413544	0.126292098
0.042594857	0.070584471	0.085551454	0.128417616
0.043331414	0.071805029	0.087030823	0.130638233
0.044101856	0.073081738	0.08857825	0.132961009
0.044908771	0.074418887	0.090198933	0.135393747
0.045755029	0.075821232	0.091898636	0.137945098
0.046643821	0.07729406	0.093683767	0.140624682
0.047578705	0.078843268	0.095561475	0.143443229
0.048563666	0.080475459	0.097539762	0.14641275
0.049603178	0.082198048	0.099627615	0.149546737
0.050702289	0.084019399	0.101835171	0.152860405
0.051866714	0.085948981	0.104173909	0.156370984
0.05310295	0.087997564	0.106656881	0.160098067
0.054418428	0.090177458	0.109299008	0.164064049
0.055821676	0.092502799	0.112117422	0.168294651
0.05732255	0.094989916	0.115131916	0.172819579
0.058932498	0.09765778	0.118365484	0.177673348
0.060664907	0.100528577	0.121845014	0.182896321
0.062535545	0.103628434	0.125602176	0.188536037
0.064563126	0.106988365	0.129674558	0.194648914
0.066770052	0.11064549	0.134107153	0.201302493
0.069183392	0.114644666	0.13895433	0.208578381
0.071836199	0.119040666	0.144282473	0.216576228
0.074769306	0.123901154	0.150173596	0.225419139
0.078033824	0.129310827	0.156730355	0.23526121
0.081694691	0.135377296	0.16408318	0.246298219
0.085835828	0.142239626	0.172400622	0.258783175
0.090567837	0.150081098	0.181904828	0.273049531
0.096039871	0.159148872	0.192895366	0.289546956
0.102458594	0.16978542	0.205787325	0.308898521
0.110119864	0.182481006	0.221174928	0.331996192
0.119464495	0.197966112	0.239943551	0.360168967
0.131183123	0.217385196	0.263480327	0.395499011
0.146430555	0.242651908	0.294104682	0.441467917
0.167315391	0.27726043	0.336051719	0.504432813
0.198206411	0.328450327	0.398096104	0.597564977
0.250155759	0.414536241	0.502435983	0.75418509
0.364024768	0.603230003	0.731141042	1.097484439
1.740245609	2.883782798	3.495270374	5.246600349
0.50876573	0.843082064	1.021852188	1.533858463
0.293480063	0.486329488	0.589452525	0.884801888
0.220292681	0.365049761	0.442456212	0.664152031
0.181073378	0.300058964	0.363684535	0.545911247
0.155974112	0.258466655	0.313272845	0.470240423
0.138265314	0.229121184	0.277704856	0.416850841
0.124969494	0.207088514	0.251000301	0.376765779
0.114546198	0.189815939	0.230065187	0.345340979
0.106110655	0.175837296	0.213122463	0.319908982
0.099114991	0.164244694	0.199071723	0.29881802
0.093200072	0.154443007	0.187191653	0.280985356
0.088119733	0.146024313	0.176987829	0.265668834
0.083699052	0.138698747	0.168108924	0.252341091
0.079809989	0.132254132	0.160297769	0.240616101
0.076356455	0.126531238	0.153361372	0.230204174
0.073264797	0.121408013	0.147151801	0.220883252
0.070477518	0.116789178	0.141553571	0.212479991
0.067949013	0.112599161	0.136475088	0.204856898
0.065642602	0.108777178	0.131842678	0.197903386
0.063528414	0.10527373	0.127596347	0.1915294
0.061581854	0.102048062	0.123686696	0.185660791
0.059782471	0.099066281	0.120072648	0.180235899
0.058113103	0.096299951	0.116719736	0.175202986
0.056559236	0.093725018	0.113598805	0.170518291
0.055108499	0.091320983	0.11068501	0.166144518
0.053750279	0.089070261	0.107957036	0.162049673
0.052475415	0.086957667	0.105396481	0.158206134
0.051275951	0.084970021	0.102987367	0.154589916
0.050144944	0.083095815	0.100715747	0.151180085
0.049076302	0.081324955	0.098569388	0.147958278
0.048064658	0.079648548	0.096537509	0.144908312
0.047105263	0.078058721	0.094610571	0.142015867
0.046193895	0.076548482	0.092780095	0.139268219
0.045326791	0.075111593	0.091038523	0.136654019
0.044500582	0.073742472	0.089379088	0.134163113
0.043712244	0.072436107	0.087795717	0.131786382
0.042959052	0.071187983	0.086282936	0.129515613
0.042238545	0.069994022	0.084835804	0.127343385
0.041548495	0.068850531	0.083449842	0.125262977
0.040886875	0.067754153	0.082120985	0.123268286
0.040251843	0.066701834	0.080845528	0.121353753
0.039641717	0.065690786	0.079620094	0.119514306
0.039054957	0.064718458	0.07844159	0.117745305
0.038490152	0.063782513	0.077307184	0.116042496
0.037946007	0.062880803	0.076214272	0.114401973
0.037421328	0.062011352	0.07516046	0.112820141
0.036915018	0.061172338	0.074143539	0.111293684
0.036426059	0.060362078	0.073161468	0.10981954

9.42 15.61 18.9

This sheet presents the intensity-duration computations based on the fitted power equation.
Results from this sheet are used to compute time-sequential hyetograph values.
Lago Caonillas

Intensity-Duration Relationship

Hour	Cumulative Depth by Eqn (decimal)	Cumulative Depth by Eqn (inch)	Decimal Increment	Hour	Cumulative Depth by Eqn (decimal)	Cumulative Depth by Eqn (inch)	Decimal Increment
0	0.000	0.000	0.000	11.25	0.756	13.957	0.006
0.25	0.185	3.413	0.185	11.5	0.762	14.071	0.006
0.5	0.239	4.411	0.054	11.75	0.768	14.184	0.006
0.75	0.277	5.124	0.039	12	0.774	14.295	0.006
1	0.309	5.700	0.031	12.25	0.780	14.404	0.006
1.25	0.335	6.191	0.027	12.5	0.786	14.512	0.006
1.5	0.358	6.623	0.023	12.75	0.791	14.619	0.006
1.75	0.380	7.011	0.021	13	0.797	14.724	0.006
2	0.399	7.366	0.019	13.25	0.803	14.828	0.006
2.25	0.417	7.695	0.018	13.5	0.808	14.931	0.006
2.5	0.433	8.000	0.017	13.75	0.814	15.033	0.006
2.75	0.449	8.288	0.016	14	0.819	15.134	0.005
3	0.463	8.559	0.015	14.25	0.825	15.233	0.005
3.25	0.477	8.816	0.014	14.5	0.830	15.331	0.005
3.5	0.490	9.061	0.013	14.75	0.835	15.429	0.005
3.75	0.503	9.295	0.013	15	0.840	15.525	0.005
4	0.515	9.520	0.012	15.25	0.846	15.620	0.005
4.25	0.527	9.736	0.012	15.5	0.851	15.714	0.005
4.5	0.538	9.944	0.011	15.75	0.856	15.808	0.005
4.75	0.549	10.145	0.011	16	0.861	15.900	0.005
5	0.560	10.339	0.011	16.25	0.866	15.992	0.005
5.25	0.570	10.528	0.010	16.5	0.871	16.082	0.005
5.5	0.580	10.710	0.010	16.75	0.875	16.172	0.005
5.75	0.589	10.888	0.010	17	0.880	16.261	0.005
6	0.599	11.061	0.009	17.25	0.885	16.349	0.005
6.25	0.608	11.229	0.009	17.5	0.890	16.436	0.005
6.5	0.617	11.393	0.009	17.75	0.894	16.523	0.005
6.75	0.625	11.554	0.009	18	0.899	16.608	0.005
7	0.634	11.710	0.008	18.25	0.904	16.693	0.005
7.25	0.642	11.863	0.008	18.5	0.908	16.778	0.005
7.5	0.650	12.013	0.008	18.75	0.913	16.861	0.005
7.75	0.658	12.160	0.008	19	0.917	16.944	0.004
8	0.666	12.303	0.008	19.25	0.922	17.026	0.004
8.25	0.674	12.444	0.008	19.5	0.926	17.108	0.004
8.5	0.681	12.582	0.007	19.75	0.930	17.188	0.004
8.75	0.688	12.718	0.007	20	0.935	17.269	0.004
9	0.696	12.851	0.007	20.25	0.939	17.348	0.004
9.25	0.703	12.982	0.007	20.5	0.943	17.427	0.004
9.5	0.710	13.111	0.007	20.75	0.948	17.505	0.004
9.75	0.717	13.238	0.007	21	0.952	17.583	0.004
10	0.723	13.362	0.007	21.25	0.956	17.660	0.004
10.25	0.730	13.485	0.007	21.5	0.960	17.737	0.004
10.5	0.736	13.606	0.007	21.75	0.964	17.813	0.004
10.75	0.743	13.724	0.006	22	0.968	17.888	0.004
11	0.749	13.842	0.006	22.25	0.972	17.963	0.004
				22.5	0.976	18.038	0.004
				22.75	0.980	18.112	0.004
				23	0.984	18.185	0.004
				23.25	0.988	18.258	0.004
				23.5	0.992	18.330	0.004
				23.75	0.996	18.402	0.004
				24	1.000	18.474	0.004

POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

Puerto Rico 18.219 N 66.611 W 1574 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 3, Version 4
G.M. Bonnin, D. Martin, B. Lin, T Parzybok, M.Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2006
Extracted: Mon Jul 5 2010

Lago Cerrillos

Confidence Limits | Seasonality | Related Info | GIS data | Maps | Docs | Return to State Map

Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.49	0.67	0.86	1.37	2.04	2.85	2.88	3.26	3.63	4.22	5.43	6.14	7.52	8.41	11.25	13.86	17.44	20.82
2	0.61	0.84	1.08	1.73	2.56	3.40	3.54	4.08	4.63	5.46	7.00	7.86	9.54	10.62	14.07	17.27	21.65	25.79
5	0.69	0.94	1.21	1.94	2.88	3.96	4.21	5.11	6.13	7.57	9.62	10.49	12.26	13.34	16.97	20.40	25.19	29.73
10	0.76	1.04	1.34	2.14	3.18	4.46	4.83	6.02	7.55	9.59	12.18	12.94	14.70	15.68	19.35	22.87	27.98	32.80
25	0.86	1.17	1.51	2.41	3.58	5.19	5.72	7.39	9.79	12.79	16.29	16.71	18.32	19.03	22.58	26.12	31.58	36.74
50	0.94	1.28	1.64	2.63	3.90	5.78	6.46	8.53	11.76	15.68	20.02	20.18	21.39	21.80	25.14	28.60	34.30	39.69
100	1.01	1.39	1.78	2.85	4.23	6.39	7.24	9.77	13.96	18.95	24.28	24.29	25.27	25.43	27.71	31.03	36.92	42.51
200	1.10	1.50	1.93	3.08	4.57	7.04	8.07	11.12	16.46	22.69	29.19	29.48	29.99	30.29	31.57	33.67	39.58	45.33
500	1.21	1.65	2.12	3.40	5.04	7.94	9.25	13.08	20.22	28.39	36.70	37.07	37.40	37.77	38.12	40.31	43.30	49.23
1000	1.30	1.77	2.28	3.65	5.41	8.65	10.20	14.69	23.42	33.33	43.26	43.69	43.79	44.23	44.67	45.59	48.31	52.14

* These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting forces estimates near zero to appear as zero.

* Upper bound of the 90% confidence interval Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.54	0.74	0.95	1.52	2.25	2.96	3.10	3.61	4.20	4.85	6.31	7.04	8.47	9.38	12.34	15.06	18.91	22.46
2	0.66	0.90	1.15	1.84	2.73	3.64	3.84	4.53	5.34	6.26	8.13	9.03	10.77	11.86	15.44	18.76	23.47	27.84
5	0.73	1.00	1.29	2.06	3.06	4.23	4.54	5.64	7.08	8.64	11.17	12.05	13.82	14.88	18.60	22.15	27.30	32.07
10	0.81	1.11	1.42	2.28	3.38	4.78	5.22	6.69	8.80	10.95	14.14	14.87	16.57	17.48	21.23	24.84	30.34	35.40
25	0.92	1.25	1.61	2.58	3.82	5.57	6.24	8.26	11.49	14.65	19.00	19.29	20.77	21.32	24.82	28.42	34.34	39.74
50	1.00	1.37	1.76	2.82	4.18	6.25	7.10	9.65	13.93	18.02	23.44	23.67	24.39	24.54	27.72	31.23	37.39	43.01
100	1.09	1.49	1.91	3.06	4.55	6.95	8.01	11.15	16.73	21.83	28.64	28.92	28.96	29.25	30.70	34.02	40.43	46.25
200	1.19	1.62	2.08	3.34	4.95	7.73	9.05	12.90	20.05	26.29	34.75	35.10	35.45	35.80	36.16	37.10	43.52	49.50
500	1.32	1.81	2.32	3.72	5.51	8.82	10.56	15.48	25.17	33.22	44.23	44.67	45.12	45.57	46.02	46.48	47.97	54.09
1000	1.43	1.95	2.50	4.01	5.95	9.68	11.77	17.61	29.54	39.22	52.51	53.04	53.57	54.10	54.65	55.19	55.74	57.58

* The **upper** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **greater** than.
** These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

* Lower bound of the 90% confidence interval Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.48	0.65	0.84	1.34	2.00	2.61	2.70	3.00	3.23	3.75	4.78	5.46	6.76	7.64	10.33	12.79	16.15	19.33
2	0.58	0.80	1.02	1.64	2.43	3.21	3.33	3.75	4.10	4.86	6.16	6.98	8.57	9.63	12.90	15.93	20.04	23.94
5	0.66	0.90	1.15	1.84	2.73	3.73	3.94	4.67	5.38	6.70	8.40	9.25	10.95	12.03	15.52	18.77	23.25	27.53
10	0.72	0.98	1.26	2.02	2.99	4.18	4.48	5.45	6.51	8.39	10.50	11.29	13.02	14.05	17.62	20.98	25.74	30.32
25	0.80	1.10	1.41	2.26	3.35	4.81	5.24	6.58	8.21	10.98	13.71	14.30	15.97	16.84	20.39	23.82	28.91	33.82
50	0.87	1.19	1.52	2.44	3.62	5.31	5.84	7.47	9.63	13.22	16.49	16.97	18.41	19.09	22.55	25.94	31.27	36.38
100	0.93	1.27	1.64	2.62	3.89	5.79	6.46	8.38	11.15	15.70	19.58	20.07	21.43	22.00	24.66	27.98	33.46	38.78
200	1.00	1.36	1.75	2.80	4.16	6.30	7.08	9.35	12.79	18.46	22.95	23.56	25.01	25.58	27.83	30.14	35.63	41.13
500	1.08	1.48	1.90	3.05	4.52	6.96	7.96	10.71	15.16	22.56	27.98	28.77	30.54	30.93	33.19	35.79	38.68	44.37
1000	1.15	1.57	2.02	3.23	4.79	7.48	8.64	11.78	17.09	25.98	32.21	33.13	35.11	35.45	37.40	40.17	42.88	46.74

* The **lower** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **less** than.

** These precipitation frequency estimates are based on a partial duration maxima series. **ARI** is the Average Recurrence Interval.

Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

Text version of tables

Related Information

Maps & Aerials

Click here to see topographic maps and aerial photographs available for this location from Microsoft Research Maps

Climate Data Sources

National Climatic Data Center (NCDC) database

Locate NCDC climate stations within:

+/-30 minutes or +/-1 degree of this location. Digital ASCII data can be obtained directly from NCDC.

Note: Precipitation frequency results are based on analysis of precipitation data from a variety of sources, but largely NCDC. The following links provide general information about observing sites in the area, regardless of if their data was used in this study. For detailed information about the stations used in this study, please refer to the matching documentation available at the PF Document page

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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
Office of Hydrologic Development
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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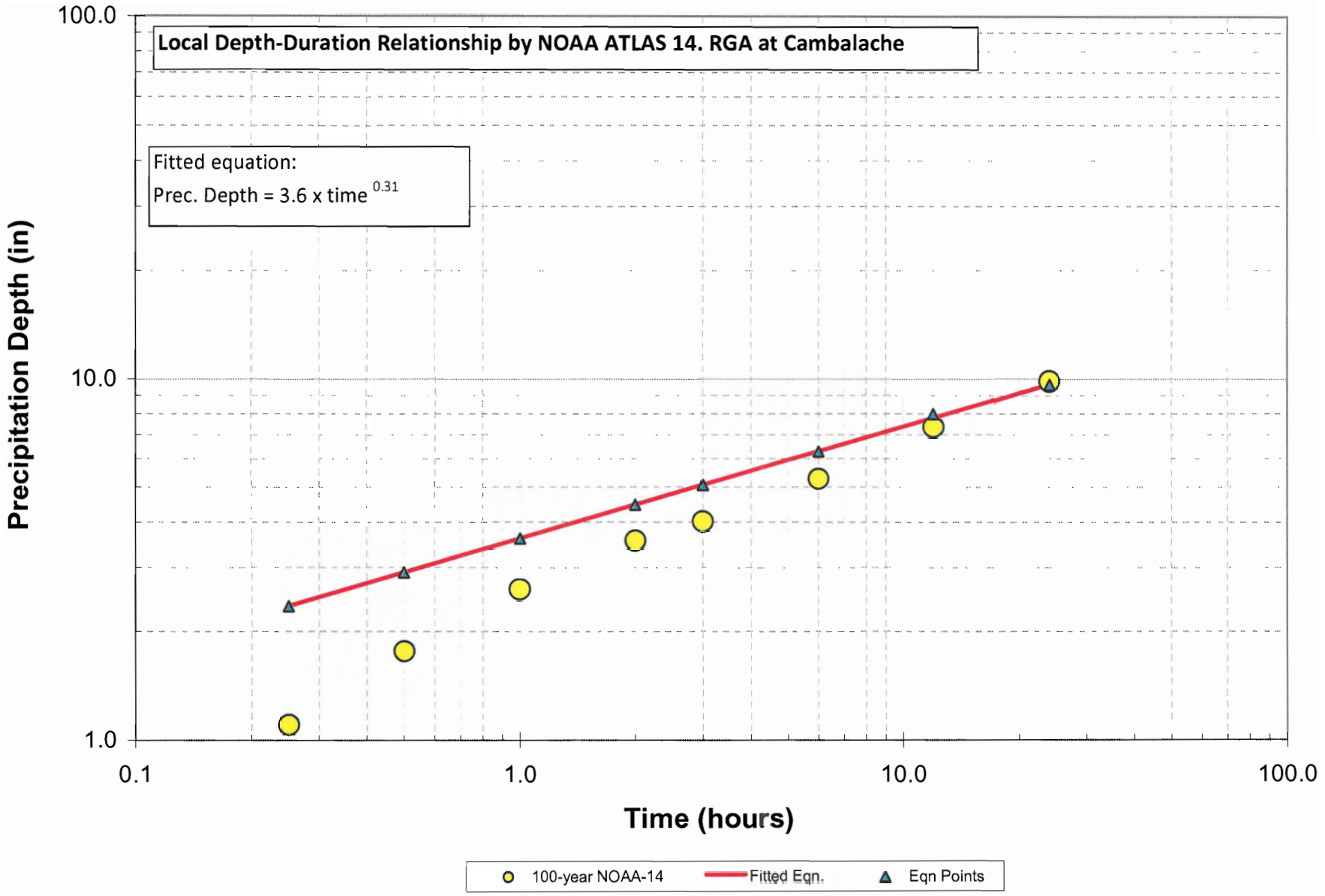
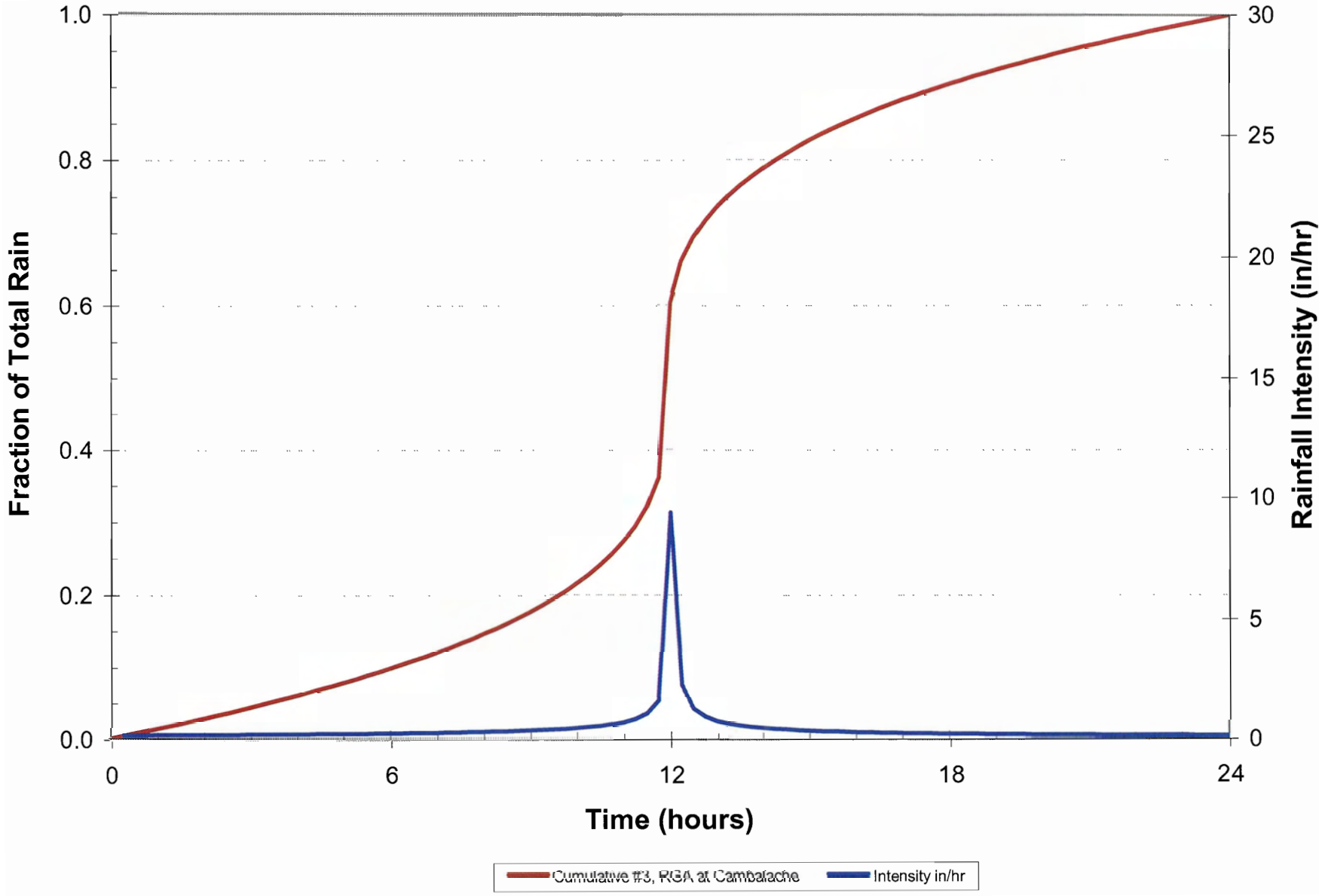

Local Depth-Duration Relationship by NOAA ATLAS 14. RGA at Cambalache
Fitted equation:
Prec. Depth = 3.6 x time 0.31
Precipitation Depth (in)
100.0
10.0
1.0
0.1
1.0
10.0
100.0
Time (hours)
100-year NOAA-14
Fitted Eqn.
Eqn Points


1.0
0.8
0.6
0.4
0.2
0.0
Fraction of Total Rain
30
25
20
15
10
5
0
Rainfall Intensity (in/hr)
0
6
12
18
24
Time (hours)
Cumulative #3, RGA at Cambalache
Intensity in/hr

Sequential Depth Hyetograph - Distribution #1 (15 minute)

Hour	Ordered Intensities	Incremental Depth (decimal)	Incremental Depth (inches)	Cumulative Depth (decimal)	Cumulative Depth (inches)	Intensity (inch/hr)
0		0	0	0	0	
0.25	23.75	0.003	0.031	0.003	0.031	0.126
0.5	23.25	0.003	0.032	0.007	0.063	0.128
0.75	22.75	0.003	0.032	0.010	0.096	0.130
1	22.25	0.003	0.033	0.013	0.129	0.132
1.25	21.75	0.003	0.033	0.017	0.162	0.134
1.5	21.25	0.004	0.034	0.020	0.196	0.136
1.75	20.75	0.004	0.035	0.024	0.231	0.138
2	20.25	0.004	0.035	0.028	0.266	0.141
2.25	19.75	0.004	0.036	0.031	0.302	0.143
2.5	19.25	0.004	0.036	0.035	0.338	0.146
2.75	18.75	0.004	0.037	0.039	0.375	0.148
3	18.25	0.004	0.038	0.043	0.413	0.151
3.25	17.75	0.004	0.039	0.047	0.452	0.154
3.5	17.25	0.004	0.039	0.051	0.491	0.157
3.75	16.75	0.004	0.040	0.055	0.531	0.160
4	16.25	0.004	0.041	0.059	0.572	0.164
4.25	15.75	0.004	0.042	0.064	0.614	0.167
4.5	15.25	0.004	0.043	0.068	0.657	0.171
4.75	14.75	0.005	0.044	0.073	0.700	0.175
5	14.25	0.005	0.045	0.077	0.745	0.180
5.25	13.75	0.005	0.046	0.082	0.791	0.184
5.5	13.25	0.005	0.047	0.087	0.839	0.189
5.75	12.75	0.005	0.049	0.092	0.887	0.194
6	12.25	0.005	0.050	0.097	0.937	0.199
6.25	11.75	0.005	0.051	0.102	0.988	0.205
6.5	11.25	0.005	0.053	0.108	1.041	0.212
6.75	10.75	0.006	0.055	0.114	1.096	0.219
7	10.25	0.006	0.056	0.120	1.152	0.226
7.25	9.75	0.006	0.058	0.126	1.211	0.234
7.5	9.25	0.006	0.061	0.132	1.272	0.243
7.75	8.75	0.007	0.063	0.138	1.335	0.252
8	8.25	0.007	0.066	0.145	1.400	0.263
8.25	7.75	0.007	0.069	0.152	1.469	0.275
8.5	7.25	0.007	0.072	0.160	1.541	0.288
8.75	6.75	0.008	0.076	0.168	1.617	0.303
9	6.25	0.008	0.080	0.176	1.697	0.320
9.25	5.75	0.009	0.085	0.185	1.781	0.339
9.5	5.25	0.009	0.090	0.194	1.872	0.361
9.75	4.75	0.010	0.097	0.204	1.969	0.388
10	4.25	0.011	0.105	0.215	2.074	0.420
10.25	3.75	0.012	0.115	0.227	2.188	0.459
10.5	3.25	0.013	0.127	0.240	2.316	0.509
10.75	2.75	0.015	0.143	0.255	2.459	0.574
11	2.25	0.017	0.166	0.272	2.625	0.664
11.25	1.75	0.021	0.200	0.293	2.825	0.799
11.5	1.25	0.027	0.258	0.320	3.083	1.031
11.75	0.75	0.040	0.389	0.360	3.472	1.556
12	0.25	0.243	2.342	0.603	5.814	9.370
12.25	0.5	0.058	0.561	0.661	6.375	2.246
12.5	1	0.032	0.307	0.693	6.683	1.229
12.75	1.5	0.023	0.224	0.716	6.907	0.897
13	2	0.019	0.181	0.735	7.088	0.724
13.25	2.5	0.016	0.154	0.751	7.242	0.615
13.5	3	0.014	0.135	0.765	7.376	0.539
13.75	3.5	0.013	0.121	0.778	7.497	0.482
14	4	0.011	0.110	0.789	7.606	0.438
14.25	4.5	0.010	0.101	0.799	7.707	0.403
14.5	5	0.010	0.094	0.809	7.801	0.374
14.75	5.5	0.009	0.087	0.818	7.888	0.350
15	6	0.009	0.082	0.827	7.970	0.329
15.25	6.5	0.008	0.078	0.835	8.048	0.311
15.5	7	0.008	0.074	0.842	8.122	0.295
15.75	7.5	0.007	0.070	0.850	8.192	0.281
16	8	0.007	0.067	0.857	8.259	0.269
16.25	8.5	0.007	0.064	0.863	8.324	0.258
16.5	9	0.006	0.062	0.870	8.386	0.247
16.75	9.5	0.006	0.060	0.876	8.445	0.238
17	10	0.006	0.057	0.882	8.503	0.230
17.25	10.5	0.006	0.056	0.888	8.558	0.222
17.5	11	0.006	0.054	0.893	8.612	0.215
17.75	11.5	0.005	0.052	0.899	8.664	0.208
18	12	0.005	0.051	0.904	8.715	0.202
18.25	12.5	0.005	0.049	0.909	8.764	0.197
18.5	13	0.005	0.048	0.914	8.812	0.191
18.75	13.5	0.005	0.047	0.919	8.858	0.186
19	14	0.005	0.045	0.923	8.904	0.182
19.25	14.5	0.005	0.044	0.928	8.948	0.177
19.5	15	0.004	0.043	0.933	8.991	0.173
19.75	15.5	0.004	0.042	0.937	9.034	0.169
20	16	0.004	0.041	0.941	9.075	0.166
20.25	16.5	0.004	0.041	0.945	9.116	0.162
20.5	17	0.004	0.040	0.950	9.155	0.159
20.75	17.5	0.004	0.039	0.954	9.194	0.156
21	18	0.004	0.038	0.958	9.232	0.153
21.25	18.5	0.004	0.037	0.961	9.270	0.150
21.5	19	0.004	0.037	0.965	9.307	0.147
21.75	19.5	0.004	0.036	0.969	9.343	0.144
22	20	0.004	0.035	0.973	9.378	0.142
22.25	20.5	0.004	0.035	0.976	9.413	0.139
22.5	21	0.004	0.034	0.980	9.447	0.137
22.75	21.5	0.003	0.034	0.983	9.481	0.135
23	22	0.003	0.033	0.987	9.514	0.133
23.25	22.5	0.003	0.033	0.990	9.547	0.131
23.5	23	0.003	0.032	0.993	9.579	0.129
23.75	23.5	0.003	0.032	0.997	9.611	0.127
24	24	0.003	0.031	1.000	9.642	0.125

Hour	Cumulative depth (decimal)	RGA @ Cambalache 6.32 10-Yr	8.75 50-yr	9.83 100-yr	12.45 500-yr
0	0	0	0	0	0
0.010417	0.0032645	0.020631419	0.028564069	0.032089692	0.04064259
0.020833	0.0065775	0.020938201	0.028988806	0.032566853	0.04124693
0.03125	0.0099408	0.021256402	0.029429353	0.033061777	0.041873766
0.041667	0.0133564	0.021586713	0.029886668	0.033575537	0.042524459
0.052083	0.0168264	0.021929887	0.03036179	0.034109302	0.04320049
0.0625	0.0203527	0.022286738	0.030855848	0.034664342	0.043903464
0.072917	0.0239379	0.022658156	0.031370074	0.035242037	0.044635134
0.083333	0.0275843	0.02304511	0.031905809	0.035843898	0.045397408
0.09375	0.0312945	0.023448661	0.032464523	0.036471573	0.046192378
0.104167	0.0350714	0.023869972	0.033047825	0.037126871	0.047022334
0.114583	0.038918	0.024310319	0.033657483	0.037811778	0.04788979
0.125	0.0428375	0.024771111	0.034295446	0.038528484	0.04879752
0.135417	0.0468333	0.025253899	0.034963864	0.039279404	0.049748583
0.145833	0.0509093	0.025760405	0.035665118	0.040067213	0.050746368
0.15625	0.0550695	0.026292539	0.036401854	0.040894883	0.051794638
0.166667	0.0593183	0.026852428	0.037177016	0.041765722	0.052897583
0.177083	0.0636605	0.02744245	0.037993898	0.042683431	0.054059889
0.1875	0.0681012	0.028065271	0.038856191	0.043652155	0.055286808
0.197917	0.0726461	0.028723894	0.039768049	0.044676562	0.056584252
0.208333	0.0773015	0.029421707	0.040734168	0.045761928	0.057958901
0.21875	0.082074	0.030162561	0.041759874	0.046914236	0.059418335
0.229167	0.0869713	0.030950839	0.042851241	0.048140308	0.060971194
0.239583	0.0920016	0.031791565	0.044015221	0.049447957	0.062627372
0.25	0.0971742	0.032690522	0.045259821	0.050846177	0.06439826
0.260417	0.1024992	0.033654405	0.04659431	0.052345379	0.066297047
0.270833	0.1079883	0.03469101	0.048029483	0.053957694	0.068339093
0.28125	0.1136544	0.03580948	0.049577998	0.05569734	0.070542409
0.291667	0.1195121	0.037020612	0.051254802	0.05758111	0.072928262
0.302083	0.1255781	0.038337256	0.053077688	0.059628991	0.075521968
0.3125	0.1318716	0.039774841	0.055068016	0.061864982	0.07835392
0.322917	0.1384146	0.041352069	0.057251678	0.064318171	0.081460959
0.333333	0.145233	0.043091851	0.059660395	0.067024192	0.084888219
0.34375	0.1523568	0.045022591	0.062333493	0.070027227	0.088691655
0.354167	0.159822	0.047179976	0.065320379	0.07338278	0.092941567
0.364583	0.1676716	0.049609527	0.068684077	0.077161654	0.097727629
0.375	0.175958	0.052370323	0.072506381	0.08145574	0.103166222
0.385417	0.1847461	0.055540584	0.076895587	0.0863867	0.109411435
0.395833	0.1941173	0.05922632	0.081998465	0.092119419	0.116672102
0.40625	0.2041767	0.06357522	0.088019489	0.098883609	0.125239159
0.416667	0.2150628	0.068799979	0.095253135	0.107010093	0.135531604
0.427083	0.2269646	0.075219628	0.104141098	0.116995085	0.148177906
0.4375	0.240151	0.083337778	0.115380626	0.129621892	0.164170148
0.447917	0.255025	0.09400385	0.130147736	0.146211685	0.185181635
0.458333	0.2722378	0.108784769	0.150611824	0.169201627	0.21429911
0.46875	0.2929606	0.13096797	0.181324326	0.203704928	0.257998612
0.479167	0.3197022	0.169007223	0.233989431	0.262870412	0.332933533
0.489583	0.3600399	0.254933833	0.352954279	0.396518921	0.502203517
0.5	0.6029781	1.535369807	2.125709781	2.388083102	3.024581345
0.510417	0.6612123	0.368039965	0.509549002	0.572441908	0.725015437
0.520833	0.693068	0.201328145	0.278737543	0.31314172	0.396603704
0.53125	0.7163332	0.147036213	0.203570707	0.228697148	0.289652034
0.541667	0.7351022	0.118620082	0.164228753	0.184499273	0.233674054
0.552083	0.7510413	0.100734787	0.139466674	0.156680847	0.198441154
0.5625	0.7650093	0.088278075	0.122220437	0.137305931	0.173902221
0.572917	0.7775132	0.079024223	0.109408537	0.122912676	0.155672718
0.583333	0.7888794	0.071834601	0.099454551	0.111730084	0.141509618
0.59375	0.7993321	0.066061337	0.091461503	0.102750466	0.130136653
0.604167	0.8090325	0.061306471	0.084878421	0.095354843	0.120769867
0.614583	0.8181007	0.057310977	0.079346685	0.089140333	0.112898997
0.625	0.826629	0.053898426	0.074622029	0.08383252	0.106176488
0.635417	0.8346897	0.050944162	0.07053187	0.079237518	0.100356775
0.645833	0.8423412	0.048357411	0.066950529	0.075214137	0.095261038
0.65625	0.8496308	0.046070375	0.063784143	0.071656928	0.090755723
0.666667	0.8565978	0.044031317	0.06096108	0.068485419	0.086738908
0.677083	0.863275	0.042200012	0.05842565	0.065637044	0.083131353
0.6875	0.8696903	0.040544679	0.056133852	0.063062373	0.079870452
0.697917	0.8758675	0.039039848	0.054050423	0.060721789	0.07690603
0.708333	0.8818272	0.037664848	0.052146744	0.058583142	0.074197367
0.71875	0.8875871	0.036402713	0.050399326	0.056620043	0.071711041
0.729167	0.8931629	0.03523938	0.048788698	0.054810617	0.069419348
0.739583	0.8985685	0.03416308	0.047298568	0.053136563	0.067299106
0.75	0.9038159	0.033163889	0.045915194	0.051582441	0.065330762
0.760417	0.9089161	0.03223337	0.044626897	0.050135131	0.063497699
0.770833	0.9138789	0.031364304	0.043423681	0.048783404	0.061785694
0.78125	0.9187128	0.030550474	0.042296938	0.047517589	0.0601825
0.791667	0.9234258	0.029786494	0.041239212	0.046329309	0.058677507
0.802083	0.9280252	0.029067673	0.040244009	0.045211269	0.057261475
0.8125	0.9325172	0.028389905	0.039305644	0.044157084	0.055926317
0.822917	0.936908	0.027749582	0.03841912	0.043161137	0.054664919
0.833333	0.9412028	0.027143513	0.037580022	0.04221847	0.053471002
0.84375	0.9454068	0.026568872	0.036784435	0.041324685	0.052338996
0.854167	0.9495244	0.026023141	0.036028874	0.040475867	0.051263941
0.864583	0.9535598	0.025504073	0.035310228	0.039668519	0.05024141
0.875	0.957517	0.025009652	0.034625705	0.038899506	0.049267432
0.885417	0.9613997	0.024538066	0.033972797	0.038166011	0.048338437
0.895833	0.965211	0.024087681	0.033349242	0.037465492	0.047451207
0.90625	0.9689542	0.02365702	0.032752994	0.036795649	0.046602831
0.916667	0.9726322	0.023244741	0.032182197	0.036154399	0.045790668
0.927083	0.9762476	0.022849627	0.031635164	0.035539847	0.045012319
0.9375	0.9798031	0.022470568	0.031110359	0.034950266	0.044265597
0.947917	0.9833009	0.022106549	0.030606378	0.034384079	0.043548503
0.958333	0.9867435	0.021756643	0.030121935	0.033839842	0.04285921
0.96875	0.9901327	0.021419998	0.029655852	0.033316231	0.042196041
0.979167	0.9934706	0.021095832	0.029207046	0.03281203	0.041557454
0.989583	0.9967592	0.020783424	0.028774519	0.032326116	0.040942029
1	1	0.020482109	0.028357351	0.031857458	0.040348459

6.32 8.75 9.8

This sheet presents the intensity-duration computations based on the fitted power equation.
Results from this sheet are used to compute time-sequential hyetograph values.

RGA at Cambalache

Intensity-Duration Relationship

Hour	Cumulative Depth by E (decimal)	(inch)	Decimal Increment
0	0.000	0.000	0.000
0.25	0.243	2.342	0.243
0.5	0.301	2.904	0.058
0.75	0.342	3.293	0.040
1	0.373	3.600	0.032
1.25	0.400	3.858	0.027
1.5	0.423	4.082	0.023
1.75	0.444	4.282	0.021
2	0.463	4.463	0.019
2.25	0.480	4.629	0.017
2.5	0.496	4.783	0.016
2.75	0.511	4.926	0.015
3	0.525	5.061	0.014
3.25	0.538	5.188	0.013
3.5	0.551	5.308	0.013
3.75	0.562	5.423	0.012
4	0.574	5.533	0.011
4.25	0.585	5.638	0.011
4.5	0.595	5.738	0.010
4.75	0.605	5.835	0.010
5	0.615	5.929	0.010
5.25	0.624	6.019	0.009
5.5	0.633	6.107	0.009
5.75	0.642	6.192	0.009
6	0.651	6.274	0.009
6.25	0.659	6.354	0.008
6.5	0.667	6.431	0.008
6.75	0.675	6.507	0.008
7	0.683	6.581	0.008
7.25	0.690	6.653	0.007
7.5	0.697	6.723	0.007
7.75	0.704	6.792	0.007
8	0.711	6.859	0.007
8.25	0.718	6.925	0.007
8.5	0.725	6.989	0.007
8.75	0.731	7.052	0.007
9	0.738	7.114	0.006
9.25	0.744	7.175	0.006
9.5	0.750	7.234	0.006
9.75	0.756	7.293	0.006
10	0.762	7.350	0.006
10.25	0.768	7.407	0.006
10.5	0.774	7.462	0.006
10.75	0.780	7.517	0.006
11	0.785	7.571	0.006

Intensity-Duration Relationship

Hour	Cumulative Depth by E (decimal)	(inch)	Decimal Increment
11.25	0.791	7.624	0.005
11.5	0.796	7.676	0.005
11.75	0.801	7.727	0.005
12	0.807	7.778	0.005
12.25	0.812	7.828	0.005
12.5	0.817	7.877	0.005
12.75	0.822	7.925	0.005
13	0.827	7.973	0.005
13.25	0.832	8.020	0.005
13.5	0.837	8.067	0.005
13.75	0.841	8.113	0.005
14	0.846	8.158	0.005
14.25	0.851	8.203	0.005
14.5	0.855	8.248	0.005
14.75	0.860	8.291	0.005
15	0.864	8.335	0.004
15.25	0.869	8.378	0.004
15.5	0.873	8.420	0.004
15.75	0.878	8.462	0.004
16	0.882	8.503	0.004
16.25	0.886	8.544	0.004
16.5	0.890	8.585	0.004
16.75	0.894	8.625	0.004
17	0.899	8.664	0.004
17.25	0.903	8.704	0.004
17.5	0.907	8.743	0.004
17.75	0.911	8.781	0.004
18	0.915	8.819	0.004
18.25	0.919	8.857	0.004
18.5	0.922	8.895	0.004
18.75	0.926	8.932	0.004
19	0.930	8.968	0.004
19.25	0.934	9.005	0.004
19.5	0.938	9.041	0.004
19.75	0.941	9.077	0.004
20	0.945	9.112	0.004
20.25	0.949	9.147	0.004
20.5	0.952	9.182	0.004
20.75	0.956	9.217	0.004
21	0.959	9.251	0.004
21.25	0.963	9.285	0.004
21.5	0.966	9.319	0.003
21.75	0.970	9.352	0.003
22	0.973	9.385	0.003
22.25	0.977	9.418	0.003
22.5	0.980	9.451	0.003
22.75	0.984	9.483	0.003
23	0.987	9.516	0.003
23.25	0.990	9.548	0.003
23.5	0.993	9.579	0.003
23.75	0.997	9.611	0.003
24	1.000	9.642	0.003

POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

Puerto Rico 18.436 N 66.708 W 22 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 3, Version 4
G.M Bonnin, D. Martin, B. Lin, T Parzybok, M.Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2006
Extracted: Tue Jul 6 2010

RGA @ Cambalache

Confidence Limits | Seasonality | Related Info | GIS data | Maps | Docs | Return to State Map

Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.40	0.54	0.70	1.11	1.65	2.00	2.39	2.67	2.90	3.37	4.28	4.84	5.53	6.44	8.54	10.29	12.77	15.38
2	0.53	0.73	0.94	1.50	2.22	2.78	2.92	3.31	3.66	4.30	5.42	6.11	6.97	8.10	10.70	12.85	15.87	19.04
5	0.56	0.77	0.98	1.57	2.34	3.00	3.21	3.82	4.45	5.49	6.81	7.62	8.64	9.83	12.70	15.09	18.38	21.75
10	0.58	0.80	1.02	1.64	2.43	3.15	3.42	4.18	5.10	6.44	7.93	8.81	9.92	11.11	14.15	16.75	20.24	23.76
25	0.60	0.82	1.06	1.70	2.52	3.33	3.67	4.63	5.97	7.75	9.47	10.44	11.61	12.75	15.97	18.81	22.54	26.25
50	0.62	0.84	1.08	1.74	2.58	3.46	3.85	4.96	6.64	8.79	10.68	11.73	12.92	13.98	17.28	20.33	24.21	28.05
100	0.63	0.86	1.10	1.77	2.62	3.56	4.02	5.27	7.33	9.85	11.89	13.05	14.19	15.14	18.52	21.74	25.77	29.71
200	0.64	0.88	1.12	1.80	2.67	3.65	4.18	5.57	8.01	10.95	13.13	14.45	15.48	16.32	19.68	23.17	27.30	31.33
500	0.65	0.89	1.15	1.84	2.73	3.77	4.37	5.93	8.93	12.45	14.78	16.36	17.39	18.21	21.11	24.91	29.24	33.36
1000	0.66	0.90	1.16	1.86	2.75	3.84	4.49	6.20	9.63	13.61	16.03	17.83	18.88	19.74	22.09	26.13	30.63	34.83

* These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting forces estimates near zero to appear as zero.

* Upper bound of the 90% confidence interval Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.46	0.63	0.81	1.30	1.93	2.41	2.54	2.90	3.27	3.75	4.67	5.29	6.06	7.02	9.28	11.14	13.80	16.57
2	0.56	0.77	0.98	1.57	2.33	2.93	3.10	3.60	4.11	4.81	5.93	6.69	7.65	8.84	11.62	13.92	17.18	20.52
5	0.59	0.81	1.03	1.65	2.45	3.15	3.40	4.13	5.00	6.12	7.39	8.27	9.39	10.67	13.74	16.32	19.88	23.43
10	0.61	0.83	1.07	1.71	2.54	3.31	3.62	4.53	5.74	7.17	8.60	9.55	10.78	12.04	15.33	18.13	21.91	25.63
25	0.64	0.87	1.12	1.79	2.66	3.52	3.93	5.07	6.80	8.68	10.37	11.41	12.68	13.86	17.34	20.44	24.50	28.39
50	0.66	0.90	1.15	1.84	2.73	3.68	4.17	5.49	7.66	9.90	11.82	12.96	14.23	15.28	18.83	22.17	26.45	30.45
100	0.67	0.92	1.18	1.89	2.80	3.83	4.39	5.90	8.56	11.20	13.31	14.59	15.78	16.66	20.29	23.87	28.29	32.45
200	0.69	0.95	1.21	1.94	2.88	3.99	4.64	6.36	9.54	12.58	14.90	16.34	17.40	18.09	21.69	25.55	30.15	34.36
500	0.71	0.97	1.25	2.00	2.97	4.16	4.95	6.91	10.85	14.48	17.13	18.82	19.89	20.39	23.46	27.71	32.52	36.82
1000	0.73	0.99	1.27	2.04	3.03	4.28	5.15	7.32	11.85	15.97	18.89	20.77	21.85	22.33	24.77	29.29	34.31	38.63

* The **upper** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **greater** than.
** These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

* Lower bound of the 90% confidence interval Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.39	0.54	0.69	1.10	1.64	1.98	2.22	2.43	2.58	3.00	3.93	4.45	5.06	5.92	7.88	9.50	11.80	14.27
2	0.50	0.68	0.88	1.41	2.09	2.60	2.73	3.03	3.26	3.84	4.97	5.61	6.37	7.43	9.86	11.85	14.67	17.65
5	0.53	0.72	0.93	1.49	2.21	2.82	3.01	3.51	3.98	4.91	6.29	7.00	7.92	9.03	11.69	13.90	16.96	20.12
10	0.55	0.75	0.97	1.55	2.30	2.96	3.21	3.83	4.50	5.74	7.31	8.09	9.09	10.20	13.01	15.41	18.64	21.93
25	0.57	0.78	1.00	1.61	2.39	3.13	3.43	4.21	5.19	6.86	8.65	9.49	10.58	11.65	14.62	17.23	20.66	24.13
50	0.59	0.80	1.03	1.65	2.44	3.24	3.58	4.46	5.68	7.71	9.66	10.55	11.69	12.71	15.76	18.52	22.09	25.69
100	0.60	0.81	1.05	1.68	2.49	3.33	3.71	4.69	6.17	8.57	10.64	11.63	12.71	13.66	16.78	19.70	23.39	27.09
200	0.60	0.82	1.06	1.70	2.52	3.40	3.82	4.89	6.63	9.42	11.64	12.73	13.76	14.61	17.73	20.86	24.65	28.44
500	0.61	0.84	1.07	1.72	2.55	3.47	3.94	5.14	7.21	10.57	12.95	14.23	15.27	16.16	18.87	22.24	26.20	30.05
1000	0.62	0.84	1.08	1.73	2.57	3.52	4.02	5.30	7.63	11.46	13.91	15.36	16.42	17.39	19.62	23.16	27.28	31.20

* The **lower** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **less** than.

** These precipitation frequency estimates are based on a partial duration maxima series. **ARI** is the Average Recurrence Interval.

Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

Text version of tables

Related Information

Maps & Aerials

Click here to see topographic maps and aerial photographs available for this location from Microsoft Research Maps.

Climate Data Sources

National Climatic Data Center (NCDC) database

Locate NCDC climate stations within:

+/-30 minutes or +/-1 degree of this location. Digital ASCII data can be obtained directly from **NCDC**.

Note: Precipitation frequency results are based on analysis of precipitation data from a variety of sources, but largely NCDC. The following links provide general information about observing sites in the area, regardless of if their data was used in this study. For detailed information about the stations used in this study, please refer to the matching documentation available at the PF Document page

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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
Office of Hydrologic Development
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Puerto Rico

HYDROLOGIC-HYDRAULIC STUDY
RÍO GRANDE DE ARECIBO,
RENEWABLE POWER GENERATION AND
RESOURCE RECOVERY FACILITY,
ARECIBO, PUERTO RICO

Appendix F:

Input Data and Results of HEC-HMS Hydrologic Model

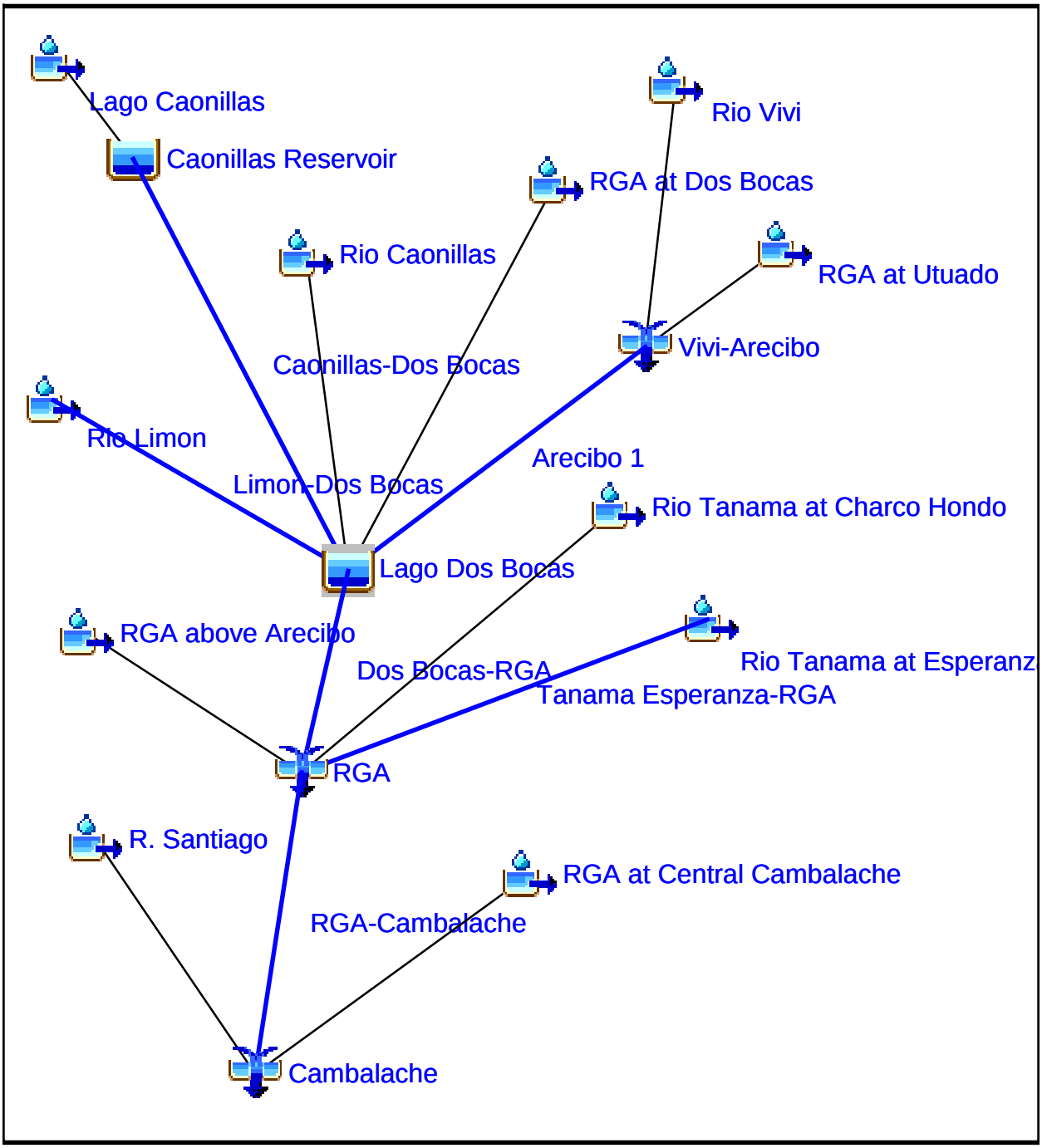
GLM MORRIS ENGINEERING

HEC-HMS

Project : 100-yr (23mar10)

Basin Model : Rio Grande de Arecibo

Sep 20 14:24:07 BOT 2010



Project: 10-yr Simulation Run: 10-yr

Start of Run: 01Jan2000, 00:00 Basin Model: Rio Grande de Arecibo
End of Run: 03Jan2000, 00:00 Meteorologic Model: 10-yr
Compute Time: 20Sep2010, 13:29:49 Control Specifications: 10-yr

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
RGA at Utuado	125	867.1	01Jan2000, 14:40	152.55
Rio Vivi	43	408.3	01Jan2000, 13:00	113.13
Vivi-Arecibo	168	1024.2	01Jan2000, 14:20	142.46
Arecibo 1	168	1024.2	01Jan2000, 15:10	142.46
Lago Caonillas	125	1464.6	01Jan2000, 13:15	164.22
Caonillas Reservoir	125	544.4	01Jan2000, 15:05	139.98
Caonillas-Dos Bocas	125	544.4	01Jan2000, 15:30	139.91
Rio Limon	90	1343.0	01Jan2000, 12:45	135.42
Limon-Dos Bocas	90	1342.7	01Jan2000, 12:50	135.42
RGA at Dos Bocas	35	351.3	01Jan2000, 13:00	101.38
Rio Caonillas	18	233.6	01Jan2000, 12:40	100.13
Lago Dos Bocas	436	1325.2	01Jan2000, 17:05	121.89
Dos Bocas-RGA	436	1325.2	01Jan2000, 18:05	121.66
Rio Tanama at Esperanza	80	555.9	01Jan2000, 14:30	140.91
Tanama Esperanza-RGA	80	555.9	01Jan2000, 15:10	140.91
RGA above Arecibo	26	274.6	01Jan2000, 13:00	108.55
Rio Tanama at Charco Hondo	11	151.8	01Jan2000, 12:35	112.80
RGA	553	1615.0	01Jan2000, 17:35	123.65
RGA-Cambalache	553	1614.9	01Jan2000, 17:50	123.60
RGA at Central Cambalache	12	87.7	01Jan2000, 13:25	92.91
R. Santiago	11	124.5	01Jan2000, 12:40	92.91
Cambalache	576	1636.4	01Jan2000, 17:50	122.37

```
Basin: Rio Grande de Arecibo
     Description: Rio Grande de Arecibo
     Last Modified Date: 13 August 2010
     Last Modified Time: 20:30:20
     Version: 3.4
     Unit System: Metric
     Missing Flow To Zero: No
     Enable Flow Ratio: No
     Allow Blending: No
     Compute Local Flow At Junctions: No

     Enable Sediment Routing: No

     Enable Quality Routing: No
End:

Subbasin: RGA at Utuado
     Canvas X: 785.3982300884954
     Canvas Y: 4446.902654867256
     Label X: 0.0
     Label Y: -13.0
     Area: 125
     Downstream: Vivi-Arecibo

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 65

     Transform: SCS
     Lag: 150
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Subbasin: Rio Vivi
     Canvas X: -1081.8713450292398
     Canvas Y: 4551.656920077972
     Label X: 1.0
     Label Y: -14.0
     Area: 43
     Downstream: Vivi-Arecibo

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 63

     Transform: SCS
     Lag: 60
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Junction: Vivi-Arecibo
```

     Canvas X: -785.3982300884954
     Canvas Y: 3296.4601769911505
     Downstream: Arecibo 1
End:

Reach: Arecibo 1
     Canvas X: -3810.9161793372323
     Canvas Y: 282.65107212475596
     From Canvas X: -785.3982300884954
     From Canvas Y: 3296.4601769911505
     Label X: 1.0
     Label Y: 0.0
     Downstream: Lago Dos Bocas

     Route: Lag
     Lag: 50
     Channel Loss: None
End:

Subbasin: Lago Caonillas
     Canvas X: -7124.756335282651
     Canvas Y: 4590.643274853801
     Label X: -1.0
     Label Y: -19.0
     Area: 125
     Downstream: Caonillas Reservoir

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 76

     Transform: SCS
     Lag: 75
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Reservoir: Caonillas Reservoir
     Canvas X: -6520.46783625731
     Canvas Y: 3304.093567251462
     Downstream: Caonillas-Dos Bocas

     Route: Controlled Outflow
     Routing Curve: Elevation-Storage
     Initial Elevation: 250.73
     Elevation-Storage Table: Caonillas
     Adaptive Control: On
     Main Tailwater Condition: None
     Auxiliary Tailwater Condition: None

     Spillway: Broad-Crested Spillway
     Spillway Outlet: Main
     Spillway Crest Length: 61
     Spillway Crest Elevation: 251.76
     Spillway Coefficient: 3.2
     End Spillway:

     Evaporation Method: Zero Evaporation

```
     End Evaporation:
End:

Reach: Caonillas-Dos Bocas
     Canvas X: -3810.9161793372323
     Canvas Y: 282.65107212475596
     From Canvas X: -6520.46783625731
     From Canvas Y: 3304.093567251462
     Downstream: Lago Dos Bocas

     Route: Lag
     Lag: 25
     Channel Loss: None
End:

Subbasin: Rio Limon
     Canvas X: -7545.824847250509
     Canvas Y: 2494.908350305499
     Label X: 0.0
     Label Y: -17.0
     Area: 90
     Downstream: Limon-Dos Bocas

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 72

     Transform: SCS
     Lag: 50
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Reach: Limon-Dos Bocas
     Canvas X: -3810.9161793372323
     Canvas Y: 282.65107212475596
     From Canvas X: -7545.824847250509
     From Canvas Y: 2494.908350305499
     Downstream: Lago Dos Bocas

     Route: Lag
     Lag: 3.5
     Channel Loss: None
End:

Subbasin: RGA at Dos Bocas
     Canvas X: -2997.787610619469
     Canvas Y: 3384.9557522123896
     Area: 35
     Downstream: Lago Dos Bocas

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 66
```

```
     Transform: SCS
     Lag: 60
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Subbasin: Rio Caonillas
     Canvas X: -4266.802443991854
     Canvas Y: 3981.6700610997964
     Area: 18
     Downstream: Lago Dos Bocas

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 66

     Transform: SCS
     Lag: 40.31
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Reservoir: Lago Dos Bocas
     Canvas X: -3810.9161793372323
     Canvas Y: 282.65107212475596
     Label X: -1.0
     Label Y: 1.0
     Downstream: Dos Bocas-RGA

     Route: Controlled Outflow
     Routing Curve: Elevation-Storage
     Initial Elevation: 86.69
     Elevation-Storage Table: Dos Bocas St
     Adaptive Control: On
     Main Tailwater Condition: None
     Auxiliary Tailwater Condition: None

     Spillway: Broad-Crested Spillway
     Spillway Outlet: Main
     Spillway Crest Length: 110
     Spillway Crest Elevation: 89.92
     Spillway Coefficient: 2.2
     End Spillway:

     Evaporation Method: Zero Evaporation
     End Evaporation:
End:

Reach: Dos Bocas-RGA
     Canvas X: -3674.463937621832
     Canvas Y: -1354.7758284600395
     From Canvas X: -3810.9161793372323
     From Canvas Y: 282.65107212475596
     Downstream: RGA

     Route: Lag
```

```
     Lag: 60
     Channel Loss: None
End:

Subbasin: Rio Tanama at Esperanza
     Canvas X: -1272.1238938053093
     Canvas Y: 88.49557522123905
     Label X: -2.0
     Label Y: -19.0
     Area: 80
     Downstream: Tanama Esperanza-RGA

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 72

     Transform: SCS
     Lag: 145
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Reach: Tanama Esperanza-RGA
     Canvas X: -3674.463937621832
     Canvas Y: -1354.7758284600395
     From Canvas X: -1376.0971829208947
     From Canvas Y: 39.33637330353395
     Downstream: RGA

     Route: Lag
     Lag: 40
     Channel Loss: None
End:

Subbasin: RGA above Arecibo
     Canvas X: -6205.7522123893805
     Canvas Y: -176.9911504424781
     Area: 26
     Downstream: RGA

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 73

     Transform: SCS
     Lag: 60
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Subbasin: Rio Tanama at Charco Hondo
     Canvas X: -2599.557522123894
     Canvas Y: 818.5840707964599
```

```
     Area: 11
     Downstream: RGA

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 74

     Transform: SCS
     Lag: 40
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Junction: RGA
     Canvas X: -3674.463937621832
     Canvas Y: -1354.7758284600395
     Label X: -1.0
     Label Y: 0.0
     Downstream: RGA-Cambalache
End:

Reach: RGA-Cambalache
     Canvas X: -4348.26883910387
     Canvas Y: -4327.902240325866
     From Canvas X: -3674.463937621832
     From Canvas Y: -1354.7758284600395
     Downstream: Cambalache

     Route: Lag
     Lag: 17.46
     Channel Loss: None
End:

Subbasin: RGA at Central Cambalache
     Canvas X: -2861.507128309572
     Canvas Y: -2556.0081466395113
     Area: 12
     Downstream: Cambalache

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 76

     Transform: SCS
     Lag: 84
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Subbasin: R. Santiago
     Canvas X: -6208.576998050682
     Canvas Y: -2602.3391812865502
     Area: 11
```

```
     Downstream: Cambalache

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 76

     Transform: SCS
     Lag: 45
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Junction: Cambalache
     Canvas X: -4348.26883910387
     Canvas Y: -4327.902240325866
End:

Basin Schematic Properties:
     Last View N: 5000.0
     Last View S: -5000.0
     Last View W: -5000.0
     Last View E: 5000.0
     Maximum View N: 5000.0
     Maximum View S: -5000.0
     Maximum View W: -5000.0
     Maximum View E: 5000.0
     Extent Method: Elements
     Buffer: 0
     Draw Icons: Yes
     Draw Icon Labels: Yes
     Draw Map Objects: No
     Draw Gridlines: No
     Draw Flow Direction: No
     Fix Element Locations: No
     Fix Hydrologic Order: No
End:
```

```
Basin: Rio Grande de Arecibo
     Description: Rio Grande de Arecibo
     Last Modified Date: 13 August 2010
     Last Modified Time: 20:30:20
     Version: 3.4
     Unit System: Metric
     Missing Flow To Zero: No
     Enable Flow Ratio: No
     Allow Blending: No
     Compute Local Flow At Junctions: No

     Enable Sediment Routing: No

     Enable Quality Routing: No
End:

Subbasin: RGA at Utuado
     Canvas X: 785.3982300884954
     Canvas Y: 4446.902654867256
     Label X: 0.0
     Label Y: -13.0
     Area: 125
     Downstream: Vivi-Arecibo

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 65

     Transform: SCS
     Lag: 150
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Subbasin: Rio Vivi
     Canvas X: -1081.8713450292398
     Canvas Y: 4551.656920077972
     Label X: 1.0
     Label Y: -14.0
     Area: 43
     Downstream: Vivi-Arecibo

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 63

     Transform: SCS
     Lag: 60
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Junction: Vivi-Arecibo
```

     Canvas X: -785.3982300884954
     Canvas Y: 3296.4601769911505
     Downstream: Arecibo 1
End:

Reach: Arecibo 1
     Canvas X: -3810.9161793372323
     Canvas Y: 282.65107212475596
     From Canvas X: -785.3982300884954
     From Canvas Y: 3296.4601769911505
     Label X: 1.0
     Label Y: 0.0
     Downstream: Lago Dos Bocas

     Route: Lag
     Lag: 50
     Channel Loss: None
End:

Subbasin: Lago Caonillas
     Canvas X: -7124.756335282651
     Canvas Y: 4590.643274853801
     Label X: -1.0
     Label Y: -19.0
     Area: 125
     Downstream: Caonillas Reservoir

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 76

     Transform: SCS
     Lag: 75
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Reservoir: Caonillas Reservoir
     Canvas X: -6520.46783625731
     Canvas Y: 3304.093567251462
     Downstream: Caonillas-Dos Bocas

     Route: Controlled Outflow
     Routing Curve: Elevation-Storage
     Initial Elevation: 250.73
     Elevation-Storage Table: Caonillas
     Adaptive Control: On
     Main Tailwater Condition: None
     Auxiliary Tailwater Condition: None

     Spillway: Broad-Crested Spillway
     Spillway Outlet: Main
     Spillway Crest Length: 61
     Spillway Crest Elevation: 251.76
     Spillway Coefficient: 3.2
     End Spillway:

     Evaporation Method: Zero Evaporation

```
     End Evaporation:
End:

Reach: Caonillas-Dos Bocas
     Canvas X: -3810.9161793372323
     Canvas Y: 282.65107212475596
     From Canvas X: -6520.46783625731
     From Canvas Y: 3304.093567251462
     Downstream: Lago Dos Bocas

     Route: Lag
     Lag: 25
     Channel Loss: None
End:

Subbasin: Rio Limon
     Canvas X: -7545.824847250509
     Canvas Y: 2494.908350305499
     Label X: 0.0
     Label Y: -17.0
     Area: 90
     Downstream: Limon-Dos Bocas

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 72

     Transform: SCS
     Lag: 50
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Reach: Limon-Dos Bocas
     Canvas X: -3810.9161793372323
     Canvas Y: 282.65107212475596
     From Canvas X: -7545.824847250509
     From Canvas Y: 2494.908350305499
     Downstream: Lago Dos Bocas

     Route: Lag
     Lag: 3.5
     Channel Loss: None
End:

Subbasin: RGA at Dos Bocas
     Canvas X: -2997.787610619469
     Canvas Y: 3384.9557522123896
     Area: 35
     Downstream: Lago Dos Bocas

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 66
```

```
     Transform: SCS
     Lag: 60
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Subbasin: Rio Caonillas
     Canvas X: -4266.802443991854
     Canvas Y: 3981.6700610997964
     Area: 18
     Downstream: Lago Dos Bocas

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 66

     Transform: SCS
     Lag: 40.31
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Reservoir: Lago Dos Bocas
     Canvas X: -3810.9161793372323
     Canvas Y: 282.65107212475596
     Label X: -1.0
     Label Y: 1.0
     Downstream: Dos Bocas-RGA

     Route: Controlled Outflow
     Routing Curve: Elevation-Storage
     Initial Elevation: 86.69
     Elevation-Storage Table: Dos Bocas St
     Adaptive Control: On
     Main Tailwater Condition: None
     Auxiliary Tailwater Condition: None

     Spillway: Broad-Crested Spillway
     Spillway Outlet: Main
     Spillway Crest Length: 110
     Spillway Crest Elevation: 89.92
     Spillway Coefficient: 2.2
     End Spillway:

     Evaporation Method: Zero Evaporation
     End Evaporation:
End:

Reach: Dos Bocas-RGA
     Canvas X: -3674.463937621832
     Canvas Y: -1354.7758284600395
     From Canvas X: -3810.9161793372323
     From Canvas Y: 282.65107212475596
     Downstream: RGA

     Route: Lag
```

```
     Lag: 60
     Channel Loss: None
End:

Subbasin: Rio Tanama at Esperanza
     Canvas X: -1272.1238938053093
     Canvas Y: 88.49557522123905
     Label X: -2.0
     Label Y: -19.0
     Area: 80
     Downstream: Tanama Esperanza-RGA

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 72

     Transform: SCS
     Lag: 145
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Reach: Tanama Esperanza-RGA
     Canvas X: -3674.463937621832
     Canvas Y: -1354.7758284600395
     From Canvas X: -1376.0971829208947
     From Canvas Y: 39.33637330353395
     Downstream: RGA

     Route: Lag
     Lag: 40
     Channel Loss: None
End:

Subbasin: RGA above Arecibo
     Canvas X: -6205.7522123893805
     Canvas Y: -176.9911504424781
     Area: 26
     Downstream: RGA

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 73

     Transform: SCS
     Lag: 60
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Subbasin: Rio Tanama at Charco Hondo
     Canvas X: -2599.557522123894
     Canvas Y: 818.5840707964599
```

```
     Area: 11
     Downstream: RGA

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 74

     Transform: SCS
     Lag: 40
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Junction: RGA
     Canvas X: -3674.463937621832
     Canvas Y: -1354.7758284600395
     Label X: -1.0
     Label Y: 0.0
     Downstream: RGA-Cambalache
End:

Reach: RGA-Cambalache
     Canvas X: -4348.26883910387
     Canvas Y: -4327.902240325866
     From Canvas X: -3674.463937621832
     From Canvas Y: -1354.7758284600395
     Downstream: Cambalache

     Route: Lag
     Lag: 17.46
     Channel Loss: None
End:

Subbasin: RGA at Central Cambalache
     Canvas X: -2861.507128309572
     Canvas Y: -2556.0081466395113
     Area: 12
     Downstream: Cambalache

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 76

     Transform: SCS
     Lag: 84
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Subbasin: R. Santiago
     Canvas X: -6208.576998050682
     Canvas Y: -2602.3391812865502
     Area: 11
```

```
     Downstream: Cambalache

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 76

     Transform: SCS
     Lag: 45
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Junction: Cambalache
     Canvas X: -4348.26883910387
     Canvas Y: -4327.902240325866
End:

Basin Schematic Properties:
     Last View N: 5000.0
     Last View S: -5000.0
     Last View W: -5000.0
     Last View E: 5000.0
     Maximum View N: 5000.0
     Maximum View S: -5000.0
     Maximum View W: -5000.0
     Maximum View E: 5000.0
     Extent Method: Elements
     Buffer: 0
     Draw Icons: Yes
     Draw Icon Labels: Yes
     Draw Map Objects: No
     Draw Gridlines: No
     Draw Flow Direction: No
     Fix Element Locations: No
     Fix Hydrologic Order: No
End:
```

Project: 50-yr Simulation Run: 50-yr

Start of Run: 01Jan2000, 00:00 Basin Model: Rio Grande de Arecibo
End of Run: 03Jan2000, 00:00 Meteorologic Model: 50-yr
Compute Time: 20Sep2010, 13:32:21 Control Specifications: 50-yr

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
RGA at Utuado	125	1815.9	01Jan2000, 14:35	308.68
Rio Vivi	43	854.9	01Jan2000, 13:00	234.46
Vivi-Arecibo	168	2142.0	01Jan2000, 14:10	289.69
Arecibo 1	168	2142.0	01Jan2000, 15:00	289.69
Lago Caonillas	125	2749.6	01Jan2000, 13:15	314.21
Caonillas Reservoir	125	1392.4	01Jan2000, 14:30	289.65
Caonillas-Dos Bocas	125	1392.4	01Jan2000, 14:55	289.57
Rio Limon	90	2527.1	01Jan2000, 12:45	256.15
Limon-Dos Bocas	90	2521.9	01Jan2000, 12:50	256.15
RGA at Dos Bocas	35	679.7	01Jan2000, 13:00	193.93
Rio Caonillas	18	347.9	01Jan2000, 12:35	147.58
Lago Dos Bocas	436	3349.5	01Jan2000, 16:15	255.53
Dos Bocas-RGA	436	3349.5	01Jan2000, 17:15	255.26
Rio Tanama at Esperanza	80	1020.9	01Jan2000, 14:30	253.78
Tanama Esperanza-RGA	80	1020.9	01Jan2000, 15:10	253.78
RGA above Arecibo	26	477.9	01Jan2000, 12:55	189.20
Rio Tanama at Charco Hondo	11	255.7	01Jan2000, 12:35	187.05
RGA	553	4013.6	01Jan2000, 16:40	250.58
RGA-Cambalache	553	4013.6	01Jan2000, 17:00	250.52
RGA at Central Cambalache	12	140.5	01Jan2000, 13:25	148.46
R. Santiago	11	199.3	01Jan2000, 12:40	148.46
Cambalache	576	4052.2	01Jan2000, 16:55	246.44

```
Basin: Rio Grande de Arecibo
     Description: Rio Grande de Arecibo
     Last Modified Date: 13 August 2010
     Last Modified Time: 20:40:18
     Version: 3.4
     Unit System: Metric
     Missing Flow To Zero: No
     Enable Flow Ratio: No
     Allow Blending: No
     Compute Local Flow At Junctions: No

     Enable Sediment Routing: No

     Enable Quality Routing: No
End:

Subbasin: RGA at Utuado
     Canvas X: 785.3982300884954
     Canvas Y: 4446.902654867256
     Label X: 0.0
     Label Y: -13.0
     Area: 125
     Downstream: Vivi-Arecibo

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 65

     Transform: SCS
     Lag: 150
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Subbasin: Rio Vivi
     Canvas X: -1081.8713450292398
     Canvas Y: 4551.656920077972
     Label X: 1.0
     Label Y: -14.0
     Area: 43
     Downstream: Vivi-Arecibo

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 63

     Transform: SCS
     Lag: 60
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Junction: Vivi-Arecibo
```

     Canvas X: -785.3982300884954
     Canvas Y: 3296.4601769911505
     Downstream: Arecibo 1
End:

Reach: Arecibo 1
     Canvas X: -3810.9161793372323
     Canvas Y: 282.65107212475596
     From Canvas X: -785.3982300884954
     From Canvas Y: 3296.4601769911505
     Label X: 1.0
     Label Y: 0.0
     Downstream: Lago Dos Bocas

     Route: Lag
     Lag: 50
     Channel Loss: None
End:

Subbasin: Lago Caonillas
     Canvas X: -7124.756335282651
     Canvas Y: 4590.643274853801
     Label X: -1.0
     Label Y: -19.0
     Area: 125
     Downstream: Caonillas Reservoir

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 76

     Transform: SCS
     Lag: 75
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Reservoir: Caonillas Reservoir
     Canvas X: -6520.46783625731
     Canvas Y: 3304.093567251462
     Downstream: Caonillas-Dos Bocas

     Route: Controlled Outflow
     Routing Curve: Elevation-Storage
     Initial Elevation: 250.73
     Elevation-Storage Table: Caonillas
     Adaptive Control: On
     Main Tailwater Condition: None
     Auxiliary Tailwater Condition: None

     Spillway: Broad-Crested Spillway
     Spillway Outlet: Main
     Spillway Crest Length: 61
     Spillway Crest Elevation: 251.76
     Spillway Coefficient: 3.2
     End Spillway:

     Evaporation Method: Zero Evaporation

```
     End Evaporation:
End:

Reach: Caonillas-Dos Bocas
     Canvas X: -3810.9161793372323
     Canvas Y: 282.65107212475596
     From Canvas X: -6520.46783625731
     From Canvas Y: 3304.093567251462
     Downstream: Lago Dos Bocas

     Route: Lag
     Lag: 25
     Channel Loss: None
End:

Subbasin: Rio Limon
     Canvas X: -7545.824847250509
     Canvas Y: 2494.908350305499
     Label X: 0.0
     Label Y: -17.0
     Area: 90
     Downstream: Limon-Dos Bocas

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 72

     Transform: SCS
     Lag: 50
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Reach: Limon-Dos Bocas
     Canvas X: -3810.9161793372323
     Canvas Y: 282.65107212475596
     From Canvas X: -7545.824847250509
     From Canvas Y: 2494.908350305499
     Downstream: Lago Dos Bocas

     Route: Lag
     Lag: 3.5
     Channel Loss: None
End:

Subbasin: RGA at Dos Bocas
     Canvas X: -2997.787610619469
     Canvas Y: 3384.9557522123896
     Area: 35
     Downstream: Lago Dos Bocas

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 66
```

```
     Transform: SCS
     Lag: 60
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Subbasin: Rio Caonillas
     Canvas X: -4266.802443991854
     Canvas Y: 3981.6700610997964
     Area: 18
     Downstream: Lago Dos Bocas

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 66

     Transform: SCS
     Lag: 40.31
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Reservoir: Lago Dos Bocas
     Canvas X: -3810.9161793372323
     Canvas Y: 282.65107212475596
     Label X: -1.0
     Label Y: 1.0
     Downstream: Dos Bocas-RGA

     Route: Controlled Outflow
     Routing Curve: Elevation-Storage
     Initial Elevation: 86.69
     Elevation-Storage Table: Dos Bocas St
     Adaptive Control: On
     Main Tailwater Condition: None
     Auxiliary Tailwater Condition: None

     Spillway: Broad-Crested Spillway
     Spillway Outlet: Main
     Spillway Crest Length: 110
     Spillway Crest Elevation: 89.92
     Spillway Coefficient: 2.2
     End Spillway:

     Evaporation Method: Zero Evaporation
     End Evaporation:
End:

Reach: Dos Bocas-RGA
     Canvas X: -3460.0389863547753
     Canvas Y: -1198.8304093567258
     From Canvas X: -3810.9161793372323
     From Canvas Y: 282.65107212475596
     Downstream: RGA

     Route: Lag
```

```
     Lag: 60
     Channel Loss: None
End:

Subbasin: Rio Tanama at Esperanza
     Canvas X: -1272.1238938053093
     Canvas Y: 88.49557522123905
     Label X: -2.0
     Label Y: -19.0
     Area: 80
     Downstream: Tanama Esperanza-RGA

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 72

     Transform: SCS
     Lag: 145
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Reach: Tanama Esperanza-RGA
     Canvas X: -3460.0389863547753
     Canvas Y: -1198.8304093567258
     From Canvas X: -1376.0971829208947
     From Canvas Y: 39.33637330353395
     Downstream: RGA

     Route: Lag
     Lag: 40
     Channel Loss: None
End:

Subbasin: RGA above Arecibo
     Canvas X: -6205.7522123893805
     Canvas Y: -176.9911504424781
     Area: 26
     Downstream: RGA

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 73

     Transform: SCS
     Lag: 60
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Subbasin: Rio Tanama at Charco Hondo
     Canvas X: -2599.557522123894
     Canvas Y: 818.5840707964599
```

```
     Area: 11
     Downstream: RGA

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 74

     Transform: SCS
     Lag: 40
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Junction: RGA
     Canvas X: -3460.0389863547753
     Canvas Y: -1198.8304093567258
     Label X: -1.0
     Label Y: 0.0
     Downstream: RGA-Cambalache
End:

Reach: RGA-Cambalache
     Canvas X: -4348.26883910387
     Canvas Y: -4327.902240325866
     From Canvas X: -3460.0389863547753
     From Canvas Y: -1198.8304093567258
     Downstream: Cambalache

     Route: Lag
     Lag: 17.46
     Channel Loss: None
End:

Subbasin: RGA at Central Cambalache
     Canvas X: -2861.507128309572
     Canvas Y: -2556.0081466395113
     Area: 12
     Downstream: Cambalache

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 76

     Transform: SCS
     Lag: 84
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Subbasin: R. Santiago
     Canvas X: -6208.576998050682
     Canvas Y: -2602.3391812865502
     Area: 11
```

```
     Downstream: Cambalache

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 76

     Transform: SCS
     Lag: 45
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Junction: Cambalache
     Canvas X: -4348.26883910387
     Canvas Y: -4327.902240325866
End:

Basin Schematic Properties:
     Last View N: 5000.0
     Last View S: -5000.0
     Last View W: -5000.0
     Last View E: 5000.0
     Maximum View N: 5000.0
     Maximum View S: -5000.0
     Maximum View W: -5000.0
     Maximum View E: 5000.0
     Extent Method: Elements
     Buffer: 0
     Draw Icons: Yes
     Draw Icon Labels: Yes
     Draw Map Objects: No
     Draw Gridlines: No
     Draw Flow Direction: No
     Fix Element Locations: No
     Fix Hydrologic Order: No
End:
```

Project: 100-yr (23mar10) Simulation Run: 100-yr

Start of Run: 01Jan2000, 00:00 Basin Model: Rio Grande de Arecibo
End of Run: 03Jan2000, 00:00 Meteorologic Model: 100-yr
Compute Time: 13Aug2010, 16:26:28 Control Specifications: 100-yr

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
RGA at Utuado	125	2338.5	01Jan2000, 14:35	396.21
Rio Vivi	43	1098.0	01Jan2000, 13:00	302.12
Vivi-Arecibo	168	2758.2	01Jan2000, 14:10	372.13
Arecibo 1	168	2758.2	01Jan2000, 15:00	372.13
Lago Caonillas	125	3432.8	01Jan2000, 13:15	396.13
Caonillas Reservoir	125	1878.4	01Jan2000, 14:20	371.46
Caonillas-Dos Bocas	125	1878.4	01Jan2000, 14:45	371.37
Rio Limon	90	3148.9	01Jan2000, 12:45	321.13
Limon-Dos Bocas	90	3140.9	01Jan2000, 12:50	321.13
RGA at Dos Bocas	35	851.3	01Jan2000, 13:00	243.26
Rio Caonillas	18	559.4	01Jan2000, 12:35	236.71
Lago Dos Bocas	436	4561.9	01Jan2000, 16:00	331.70
Dos Bocas-RGA	436	4561.9	01Jan2000, 17:00	331.41
Rio Tanama at Esperanza	80	1264.2	01Jan2000, 14:30	313.85
Tanama Esperanza-RGA	80	1264.2	01Jan2000, 15:10	313.85
RGA above Arecibo	26	579.0	01Jan2000, 12:55	229.88
Rio Tanama at Charco Hondo	11	306.2	01Jan2000, 12:35	223.79
RGA	553	5469.1	01Jan2000, 16:25	321.95
RGA-Cambalache	553	5468.1	01Jan2000, 16:40	321.88
RGA at Central Cambalache	12	164.3	01Jan2000, 13:25	173.93
R. Santiago	11	233.1	01Jan2000, 12:40	173.93
Cambalache	576	5516.8	01Jan2000, 16:40	315.98

```
Basin: Rio Grande de Arecibo
     Description: Rio Grande de Arecibo
     Last Modified Date: 13 August 2010
     Last Modified Time: 20:24:35
     Version: 3.4
     Unit System: Metric
     Missing Flow To Zero: No
     Enable Flow Ratio: No
     Allow Blending: No
     Compute Local Flow At Junctions: No

     Enable Sediment Routing: No

     Enable Quality Routing: No
End:

Subbasin: RGA at Utuado
     Canvas X: 785.3982300884954
     Canvas Y: 4446.902654867256
     Label X: 0.0
     Label Y: -13.0
     Area: 125
     Downstream: Vivi-Arecibo

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 65

     Transform: SCS
     Lag: 150
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Subbasin: Rio Vivi
     Canvas X: -1081.8713450292398
     Canvas Y: 4551.656920077972
     Label X: 1.0
     Label Y: -14.0
     Area: 43
     Downstream: Vivi-Arecibo

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 63

     Transform: SCS
     Lag: 60
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Junction: Vivi-Arecibo
```

     Canvas X: -785.3982300884954
     Canvas Y: 3296.4601769911505
     Downstream: Arecibo 1
End:

Reach: Arecibo 1
     Canvas X: -3693.9571150097463
     Canvas Y: 107.2124756335279
     From Canvas X: -785.3982300884954
     From Canvas Y: 3296.4601769911505
     Label X: 1.0
     Label Y: 0.0
     Downstream: Lago Dos Bocas

     Route: Lag
     Lag: 50
     Channel Loss: None
End:

Subbasin: Lago Caonillas
     Canvas X: -7124.756335282651
     Canvas Y: 4590.643274853801
     Label X: -1.0
     Label Y: -19.0
     Area: 125
     Downstream: Caonillas Reservoir

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 76

     Transform: SCS
     Lag: 75
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Reservoir: Caonillas Reservoir
     Canvas X: -6442.495126705653
     Canvas Y: 3284.6003898635477
     Downstream: Caonillas-Dos Bocas

     Route: Controlled Outflow
     Routing Curve: Elevation-Storage
     Initial Elevation: 250.73
     Elevation-Storage Table: Caonillas
     Adaptive Control: On
     Main Tailwater Condition: None
     Auxiliary Tailwater Condition: None

     Spillway: Broad-Crested Spillway
     Spillway Outlet: Main
     Spillway Crest Length: 61
     Spillway Crest Elevation: 251.76
     Spillway Coefficient: 3.2
     End Spillway:

     Evaporation Method: Zero Evaporation

```
     End Evaporation:
End:

Reach: Caonillas-Dos Bocas
     Canvas X: -3693.9571150097463
     Canvas Y: 107.2124756335279
     From Canvas X: -6442.495126705653
     From Canvas Y: 3284.6003898635477
     Downstream: Lago Dos Bocas

     Route: Lag
     Lag: 25
     Channel Loss: None
End:

Subbasin: Rio Limon
     Canvas X: -7545.824847250509
     Canvas Y: 2494.908350305499
     Label X: 0.0
     Label Y: -17.0
     Area: 90
     Downstream: Limon-Dos Bocas

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 72

     Transform: SCS
     Lag: 50
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Reach: Limon-Dos Bocas
     Canvas X: -3693.9571150097463
     Canvas Y: 107.2124756335279
     From Canvas X: -7545.824847250509
     From Canvas Y: 2494.908350305499
     Downstream: Lago Dos Bocas

     Route: Lag
     Lag: 3.5
     Channel Loss: None
End:

Subbasin: RGA at Dos Bocas
     Canvas X: -2997.787610619469
     Canvas Y: 3384.9557522123896
     Area: 35
     Downstream: Lago Dos Bocas

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 66
```

```
     Transform: SCS
     Lag: 60
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Subbasin: Rio Caonillas
     Canvas X: -4266.802443991854
     Canvas Y: 3981.6700610997964
     Area: 18
     Downstream: Lago Dos Bocas

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 66

     Transform: SCS
     Lag: 40.31
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Reservoir: Lago Dos Bocas
     Canvas X: -3693.9571150097463
     Canvas Y: 107.2124756335279
     Label X: -1.0
     Label Y: 1.0
     Downstream: Dos Bocas-RGA

     Route: Controlled Outflow
     Routing Curve: Elevation-Storage
     Initial Elevation: 86.69
     Elevation-Storage Table: Dos Bocas St
     Adaptive Control: On
     Main Tailwater Condition: None
     Auxiliary Tailwater Condition: None

     Spillway: Broad-Crested Spillway
     Spillway Outlet: Main
     Spillway Crest Length: 110
     Spillway Crest Elevation: 89.92
     Spillway Coefficient: 2.2
     End Spillway:

     Evaporation Method: Zero Evaporation
     End Evaporation:
End:

Reach: Dos Bocas-RGA
     Canvas X: -3674.463937621832
     Canvas Y: -1354.7758284600395
     From Canvas X: -3693.9571150097463
     From Canvas Y: 107.2124756335279
     Downstream: RGA

     Route: Lag
```

```
     Lag: 60
     Channel Loss: None
End:

Subbasin: Rio Tanama at Esperanza
     Canvas X: -1272.1238938053093
     Canvas Y: 88.49557522123905
     Label X: -2.0
     Label Y: -19.0
     Area: 80
     Downstream: Tanama Esperanza-RGA

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 72

     Transform: SCS
     Lag: 145
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Reach: Tanama Esperanza-RGA
     Canvas X: -3674.463937621832
     Canvas Y: -1354.7758284600395
     From Canvas X: -1376.0971829208947
     From Canvas Y: 39.33637330353395
     Downstream: RGA

     Route: Lag
     Lag: 40
     Channel Loss: None
End:

Subbasin: RGA above Arecibo
     Canvas X: -6205.7522123893805
     Canvas Y: -176.9911504424781
     Area: 26
     Downstream: RGA

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 73

     Transform: SCS
     Lag: 60
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Subbasin: Rio Tanama at Charco Hondo
     Canvas X: -2599.557522123894
     Canvas Y: 818.5840707964599
```

```
     Area: 11
     Downstream: RGA

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 74

     Transform: SCS
     Lag: 40
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Junction: RGA
     Canvas X: -3674.463937621832
     Canvas Y: -1354.7758284600395
     Label X: -1.0
     Label Y: 0.0
     Downstream: RGA-Cambalache
End:

Reach: RGA-Cambalache
     Canvas X: -4348.26883910387
     Canvas Y: -4327.902240325866
     From Canvas X: -3674.463937621832
     From Canvas Y: -1354.7758284600395
     Downstream: Cambalache

     Route: Lag
     Lag: 17.46
     Channel Loss: None
End:

Subbasin: RGA at Central Cambalache
     Canvas X: -2861.507128309572
     Canvas Y: -2556.0081466395113
     Area: 12
     Downstream: Cambalache

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 76

     Transform: SCS
     Lag: 84
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Subbasin: R. Santiago
     Canvas X: -6208.576998050682
     Canvas Y: -2602.3391812865502
     Area: 11
```

```
     Downstream: Cambalache

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 76

     Transform: SCS
     Lag: 45
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Junction: Cambalache
     Canvas X: -4348.26883910387
     Canvas Y: -4327.902240325866
End:

Basin Schematic Properties:
     Last View N: 5000.0
     Last View S: -5000.0
     Last View W: -5000.0
     Last View E: 5000.0
     Maximum View N: 5000.0
     Maximum View S: -5000.0
     Maximum View W: -5000.0
     Maximum View E: 5000.0
     Extent Method: Elements
     Buffer: 0
     Draw Icons: Yes
     Draw Icon Labels: Yes
     Draw Map Objects: No
     Draw Gridlines: No
     Draw Flow Direction: No
     Fix Element Locations: No
     Fix Hydrologic Order: No
End:
```

Project: 500-yr Simulation Run: 500-yr

Start of Run: 01Jan2000, 00:00 Basin Model: Rio Grande de Arecibo
End of Run: 03Jan2000, 00:00 Meteorologic Model: 500-yr
Compute Time: 20Sep2010, 13:58:36 Control Specifications: 500-yr

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
RGA at Utuado	125	3849.5	01Jan2000, 14:30	654.58
Rio Vivi	43	1793.3	01Jan2000, 12:55	500.15
Vivi-Arecibo	168	4536.7	01Jan2000, 14:10	615.05
Arecibo 1	168	4536.7	01Jan2000, 15:00	615.05
Lago Caonillas	125	5374.7	01Jan2000, 13:10	633.30
Caonillas Reservoir	125	3312.7	01Jan2000, 14:10	608.39
Caonillas-Dos Bocas	125	3312.7	01Jan2000, 14:35	608.29
Rio Limon	90	4887.1	01Jan2000, 12:45	506.98
Limon-Dos Bocas	90	4870.7	01Jan2000, 12:50	506.98
RGA at Dos Bocas	35	1331.5	01Jan2000, 12:55	383.29
Rio Caonillas	18	867.5	01Jan2000, 12:35	369.96
Lago Dos Bocas	436	8163.7	01Jan2000, 15:30	548.10
Dos Bocas-RGA	436	8163.7	01Jan2000, 16:30	547.78
Rio Tanama at Esperanza	80	1946.7	01Jan2000, 14:25	485.14
Tanama Esperanza-RGA	80	1946.7	01Jan2000, 15:05	485.14
RGA above Arecibo	26	848.0	01Jan2000, 12:55	340.16
Rio Tanama at Charco Hondo	11	437.4	01Jan2000, 12:35	320.99
RGA	553	9796.8	01Jan2000, 16:05	524.44
RGA-Cambalache	553	9794.8	01Jan2000, 16:25	524.37
RGA at Central Cambalache	12	222.5	01Jan2000, 13:20	236.89
R. Santiago	11	315.3	01Jan2000, 12:40	236.89
Cambalache	576	9863.9	01Jan2000, 16:25	512.89

```
Basin: Rio Grande de Arecibo
     Description: Rio Grande de Arecibo
     Last Modified Date: 13 August 2010
     Last Modified Time: 20:50:39
     Version: 3.4
     Unit System: Metric
     Missing Flow To Zero: No
     Enable Flow Ratio: No
     Allow Blending: No
     Compute Local Flow At Junctions: No

     Enable Sediment Routing: No

     Enable Quality Routing: No
End:

Subbasin: RGA at Utuado
     Canvas X: 785.3982300884954
     Canvas Y: 4446.902654867256
     Label X: 0.0
     Label Y: -13.0
     Area: 125
     Downstream: Vivi-Arecibo

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 65

     Transform: SCS
     Lag: 150
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Subbasin: Rio Vivi
     Canvas X: -1081.8713450292398
     Canvas Y: 4551.656920077972
     Label X: 1.0
     Label Y: -14.0
     Area: 43
     Downstream: Vivi-Arecibo

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 63

     Transform: SCS
     Lag: 60
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Junction: Vivi-Arecibo
```

     Canvas X: -785.3982300884954
     Canvas Y: 3296.4601769911505
     Downstream: Arecibo 1
End:

Reach: Arecibo 1
     Canvas X: -3810.9161793372323
     Canvas Y: 282.65107212475596
     From Canvas X: -785.3982300884954
     From Canvas Y: 3296.4601769911505
     Label X: 1.0
     Label Y: 0.0
     Downstream: Lago Dos Bocas

     Route: Lag
     Lag: 50
     Channel Loss: None
End:

Subbasin: Lago Caonillas
     Canvas X: -7124.756335282651
     Canvas Y: 4590.643274853801
     Label X: -1.0
     Label Y: -19.0
     Area: 125
     Downstream: Caonillas Reservoir

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 76

     Transform: SCS
     Lag: 75
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Reservoir: Caonillas Reservoir
     Canvas X: -6520.46783625731
     Canvas Y: 3304.093567251462
     Downstream: Caonillas-Dos Bocas

     Route: Controlled Outflow
     Routing Curve: Elevation-Storage
     Initial Elevation: 250.73
     Elevation-Storage Table: Caonillas
     Adaptive Control: On
     Main Tailwater Condition: None
     Auxiliary Tailwater Condition: None

     Spillway: Broad-Crested Spillway
     Spillway Outlet: Main
     Spillway Crest Length: 61
     Spillway Crest Elevation: 251.76
     Spillway Coefficient: 3.2
     End Spillway:

     Evaporation Method: Zero Evaporation

```
     End Evaporation:
End:

Reach: Caonillas-Dos Bocas
     Canvas X: -3810.9161793372323
     Canvas Y: 282.65107212475596
     From Canvas X: -6520.46783625731
     From Canvas Y: 3304.093567251462
     Downstream: Lago Dos Bocas

     Route: Lag
     Lag: 25
     Channel Loss: None
End:

Subbasin: Rio Limon
     Canvas X: -7545.824847250509
     Canvas Y: 2494.908350305499
     Label X: 0.0
     Label Y: -17.0
     Area: 90
     Downstream: Limon-Dos Bocas

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 72

     Transform: SCS
     Lag: 50
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Reach: Limon-Dos Bocas
     Canvas X: -3810.9161793372323
     Canvas Y: 282.65107212475596
     From Canvas X: -7545.824847250509
     From Canvas Y: 2494.908350305499
     Downstream: Lago Dos Bocas

     Route: Lag
     Lag: 3.5
     Channel Loss: None
End:

Subbasin: RGA at Dos Bocas
     Canvas X: -2997.787610619469
     Canvas Y: 3384.9557522123896
     Area: 35
     Downstream: Lago Dos Bocas

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 66
```

```
     Transform: SCS
     Lag: 60
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Subbasin: Rio Caonillas
     Canvas X: -4266.802443991854
     Canvas Y: 3981.6700610997964
     Area: 18
     Downstream: Lago Dos Bocas

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 66

     Transform: SCS
     Lag: 40.31
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Reservoir: Lago Dos Bocas
     Canvas X: -3810.9161793372323
     Canvas Y: 282.65107212475596
     Label X: -1.0
     Label Y: 1.0
     Downstream: Dos Bocas-RGA

     Route: Controlled Outflow
     Routing Curve: Elevation-Storage
     Initial Elevation: 86.69
     Elevation-Storage Table: Dos Bocas St
     Adaptive Control: On
     Main Tailwater Condition: None
     Auxiliary Tailwater Condition: None

     Spillway: Broad-Crested Spillway
     Spillway Outlet: Main
     Spillway Crest Length: 110
     Spillway Crest Elevation: 89.92
     Spillway Coefficient: 2.2
     End Spillway:

     Evaporation Method: Zero Evaporation
     End Evaporation:
End:

Reach: Dos Bocas-RGA
     Canvas X: -3674.463937621832
     Canvas Y: -1354.7758284600395
     From Canvas X: -3810.9161793372323
     From Canvas Y: 282.65107212475596
     Downstream: RGA

     Route: Lag
```

```
     Lag: 60
     Channel Loss: None
End:

Subbasin: Rio Tanama at Esperanza
     Canvas X: -1272.1238938053093
     Canvas Y: 88.49557522123905
     Label X: -2.0
     Label Y: -19.0
     Area: 80
     Downstream: Tanama Esperanza-RGA

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 72

     Transform: SCS
     Lag: 145
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Reach: Tanama Esperanza-RGA
     Canvas X: -3674.463937621832
     Canvas Y: -1354.7758284600395
     From Canvas X: -1376.0971829208947
     From Canvas Y: 39.33637330353395
     Downstream: RGA

     Route: Lag
     Lag: 40
     Channel Loss: None
End:

Subbasin: RGA above Arecibo
     Canvas X: -6205.7522123893805
     Canvas Y: -176.9911504424781
     Area: 26
     Downstream: RGA

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 73

     Transform: SCS
     Lag: 60
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Subbasin: Rio Tanama at Charco Hondo
     Canvas X: -2599.557522123894
     Canvas Y: 818.5840707964599
```

```
     Area: 11
     Downstream: RGA

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 74

     Transform: SCS
     Lag: 40
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Junction: RGA
     Canvas X: -3674.463937621832
     Canvas Y: -1354.7758284600395
     Label X: -1.0
     Label Y: 0.0
     Downstream: RGA-Cambalache
End:

Reach: RGA-Cambalache
     Canvas X: -4348.26883910387
     Canvas Y: -4327.902240325866
     From Canvas X: -3674.463937621832
     From Canvas Y: -1354.7758284600395
     Downstream: Cambalache

     Route: Lag
     Lag: 17.46
     Channel Loss: None
End:

Subbasin: RGA at Central Cambalache
     Canvas X: -2861.507128309572
     Canvas Y: -2556.0081466395113
     Area: 12
     Downstream: Cambalache

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 76

     Transform: SCS
     Lag: 84
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Subbasin: R. Santiago
     Canvas X: -6208.576998050682
     Canvas Y: -2602.3391812865502
     Area: 11
```

```
     Downstream: Cambalache

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 76

     Transform: SCS
     Lag: 45
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Junction: Cambalache
     Canvas X: -4348.26883910387
     Canvas Y: -4327.902240325866
End:

Basin Schematic Properties:
     Last View N: 5000.0
     Last View S: -5000.0
     Last View W: -5000.0
     Last View E: 5000.0
     Maximum View N: 5000.0
     Maximum View S: -5000.0
     Maximum View W: -5000.0
     Maximum View E: 5000.0
     Extent Method: Elements
     Buffer: 0
     Draw Icons: Yes
     Draw Icon Labels: Yes
     Draw Map Objects: No
     Draw Gridlines: No
     Draw Flow Direction: No
     Fix Element Locations: No
     Fix Hydrologic Order: No
End:
```

Project: Rio Grande de Arecibo Simulation Run: Georges

Start of Run: 01Jan2000, 00:00 Basin Model: Rio Grande de Arecibo
End of Run: 03Jan2000, 00:00 Meteorologic Model: Georges
Compute Time: 20Sep2010, 11:58:31 Control Specifications: Georges

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
RGA at Utuado	125	1880.8	01Jan2000, 16:05	343.00
Rio Vivi	43	561.5	01Jan2000, 13:00	328.66
Vivi-Arecibo	168	2110.5	01Jan2000, 16:05	339.33
Arecibo 1	168	2110.5	01Jan2000, 16:55	339.33
Lago Caonillas	125	1972.1	01Jan2000, 13:15	450.41
Caonillas Reservoir	125	1343.0	01Jan2000, 14:35	425.41
Caonillas-Dos Bocas	125	1343.0	01Jan2000, 15:00	425.30
Rio Limon	90	987.9	01Jan2000, 12:50	259.52
Limon-Dos Bocas	90	985.9	01Jan2000, 12:50	259.52
RGA at Dos Bocas	35	350.6	01Jan2000, 13:00	189.59
Rio Caonillas	18	211.6	01Jan2000, 12:40	185.04
Lago Dos Bocas	436	3279.6	01Jan2000, 17:50	315.09
Dos Bocas-RGA	436	3279.6	01Jan2000, 18:50	314.77
Rio Tanama at Esperanza	80	791.6	01Jan2000, 14:30	218.81
Tanama Esperanza-RGA	80	791.6	01Jan2000, 15:10	218.81
RGA above Arecibo	26	140.3	01Jan2000, 13:00	102.16
Rio Tanama at Charco Hondo	11	65.8	01Jan2000, 12:40	93.86
RGA	553	3625.1	01Jan2000, 18:35	286.50
RGA-Cambalache	553	3624.6	01Jan2000, 18:50	286.42
RGA at Central Cambalache	12	43.8	01Jan2000, 13:30	81.48
R. Santiago	11	54.2	01Jan2000, 12:45	81.48
Cambalache	576	3648.6	01Jan2000, 18:50	278.24

```
Basin: Rio Grande de Arecibo
     Description: Rio Grande de Arecibo
     Last Modified Date: 13 August 2010
     Last Modified Time: 19:45:57
     Version: 3.4
     Unit System: Metric
     Missing Flow To Zero: No
     Enable Flow Ratio: No
     Allow Blending: No
     Compute Local Flow At Junctions: No

     Enable Sediment Routing: No

     Enable Quality Routing: No
End:

Subbasin: RGA at Utuado
     Canvas X: 785.3982300884954
     Canvas Y: 4446.902654867256
     Label X: 0.0
     Label Y: -13.0
     Area: 125
     Downstream: Vivi-Arecibo

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 65

     Transform: SCS
     Lag: 150
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Subbasin: Rio Vivi
     Canvas X: -1081.8713450292398
     Canvas Y: 4551.656920077972
     Label X: 1.0
     Label Y: -14.0
     Area: 43
     Downstream: Vivi-Arecibo

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 63

     Transform: SCS
     Lag: 60
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Junction: Vivi-Arecibo
```

     Canvas X: -785.3982300884954
     Canvas Y: 3296.4601769911505
     Downstream: Arecibo 1
End:

Reach: Arecibo 1
     Canvas X: -3674.463937621832
     Canvas Y: 243.6647173489273
     From Canvas X: -785.3982300884954
     From Canvas Y: 3296.4601769911505
     Label X: 1.0
     Label Y: 0.0
     Downstream: Lago Dos Bocas

     Route: Lag
     Lag: 50
     Channel Loss: None
End:

Subbasin: Lago Caonillas
     Canvas X: -7124.756335282651
     Canvas Y: 4590.643274853801
     Label X: -1.0
     Label Y: -19.0
     Area: 125
     Downstream: Caonillas Reservoir

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 76

     Transform: SCS
     Lag: 75
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Reservoir: Caonillas Reservoir
     Canvas X: -6520.46783625731
     Canvas Y: 3304.093567251462
     Downstream: Caonillas-Dos Bocas

     Route: Controlled Outflow
     Routing Curve: Elevation-Storage
     Initial Elevation: 250.73
     Elevation-Storage Table: Caonillas
     Adaptive Control: On
     Main Tailwater Condition: None
     Auxiliary Tailwater Condition: None

     Spillway: Broad-Crested Spillway
     Spillway Outlet: Main
     Spillway Crest Length: 61
     Spillway Crest Elevation: 251.76
     Spillway Coefficient: 3.2
     End Spillway:

     Evaporation Method: Zero Evaporation

```
     End Evaporation:
End:

Reach: Caonillas-Dos Bocas
     Canvas X: -3674.463937621832
     Canvas Y: 243.6647173489273
     From Canvas X: -6520.46783625731
     From Canvas Y: 3304.093567251462
     Downstream: Lago Dos Bocas

     Route: Lag
     Lag: 25
     Channel Loss: None
End:

Subbasin: Rio Limon
     Canvas X: -7545.824847250509
     Canvas Y: 2494.908350305499
     Label X: 0.0
     Label Y: -17.0
     Area: 90
     Downstream: Limon-Dos Bocas

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 72

     Transform: SCS
     Lag: 50
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Reach: Limon-Dos Bocas
     Canvas X: -3674.463937621832
     Canvas Y: 243.6647173489273
     From Canvas X: -7545.824847250509
     From Canvas Y: 2494.908350305499
     Downstream: Lago Dos Bocas

     Route: Lag
     Lag: 3.5
     Channel Loss: None
End:

Subbasin: RGA at Dos Bocas
     Canvas X: -2997.787610619469
     Canvas Y: 3384.9557522123896
     Area: 35
     Downstream: Lago Dos Bocas

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 66
```

```
     Transform: SCS
     Lag: 60
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Subbasin: Rio Caonillas
     Canvas X: -4266.802443991854
     Canvas Y: 3981.6700610997964
     Area: 18
     Downstream: Lago Dos Bocas

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 66

     Transform: SCS
     Lag: 40.31
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Reservoir: Lago Dos Bocas
     Canvas X: -3674.463937621832
     Canvas Y: 243.6647173489273
     Label X: -1.0
     Label Y: 1.0
     Downstream: Dos Bocas-RGA

     Route: Controlled Outflow
     Routing Curve: Elevation-Storage
     Initial Elevation: 86.69
     Elevation-Storage Table: Dos Bocas St
     Adaptive Control: On
     Main Tailwater Condition: None
     Auxiliary Tailwater Condition: None

     Spillway: Broad-Crested Spillway
     Spillway Outlet: Main
     Spillway Crest Length: 110
     Spillway Crest Elevation: 89.92
     Spillway Coefficient: 2.2
     End Spillway:

     Evaporation Method: Zero Evaporation
     End Evaporation:
End:

Reach: Dos Bocas-RGA
     Canvas X: -3576.9980506822612
     Canvas Y: -1237.8167641325535
     From Canvas X: -3674.463937621832
     From Canvas Y: 243.6647173489273
     Downstream: RGA

     Route: Lag
```

```
     Lag: 60
     Channel Loss: None
End:

Subbasin: Rio Tanama at Esperanza
     Canvas X: -2148.67617107943
     Canvas Y: -30.549898167006177
     Label X: -2.0
     Label Y: -19.0
     Area: 80
     Downstream: Tanama Esperanza-RGA

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 72

     Transform: SCS
     Lag: 145
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Reach: Tanama Esperanza-RGA
     Canvas X: -3576.9980506822612
     Canvas Y: -1237.8167641325535
     From Canvas X: -2128.3095723014258
     From Canvas Y: -71.28309572301441
     Downstream: RGA

     Route: Lag
     Lag: 40
     Channel Loss: None
End:

Subbasin: RGA above Arecibo
     Canvas X: -6205.7522123893805
     Canvas Y: -176.9911504424781
     Area: 26
     Downstream: RGA

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 73

     Transform: SCS
     Lag: 60
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Subbasin: Rio Tanama at Charco Hondo
     Canvas X: -2599.557522123894
     Canvas Y: 818.5840707964599
```

```
     Area: 11
     Downstream: RGA

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 74

     Transform: SCS
     Lag: 40
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Junction: RGA
     Canvas X: -3576.9980506822612
     Canvas Y: -1237.8167641325535
     Label X: -1.0
     Label Y: 0.0
     Downstream: RGA-Cambalache
End:

Reach: RGA-Cambalache
     Canvas X: -4348.26883910387
     Canvas Y: -4327.902240325866
     From Canvas X: -3576.9980506822612
     From Canvas Y: -1237.8167641325535
     Downstream: Cambalache

     Route: Lag
     Lag: 17.46
     Channel Loss: None
End:

Subbasin: RGA at Central Cambalache
     Canvas X: -2861.507128309572
     Canvas Y: -2556.0081466395113
     Area: 12
     Downstream: Cambalache

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 76

     Transform: SCS
     Lag: 84
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Subbasin: R. Santiago
     Canvas X: -6384.01559454191
     Canvas Y: -2153.9961013645225
     Area: 11
```

```
     Downstream: Cambalache

     Canopy: None

     Surface: None

     LossRate: SCS
     Percent Impervious Area: 0.0
     Curve Number: 76

     Transform: SCS
     Lag: 45
     Unitgraph Type: STANDARD

     Baseflow: None
End:

Junction: Cambalache
     Canvas X: -4348.26883910387
     Canvas Y: -4327.902240325866
End:

Basin Schematic Properties:
     Last View N: 5000.0
     Last View S: -5000.0
     Last View W: -5000.0
     Last View E: 5000.0
     Maximum View N: 5000.0
     Maximum View S: -5000.0
     Maximum View W: -5000.0
     Maximum View E: 5000.0
     Extent Method: Elements
     Buffer: 0
     Draw Icons: Yes
     Draw Icon Labels: Yes
     Draw Map Objects: No
     Draw Gridlines: No
     Draw Flow Direction: No
     Fix Element Locations: No
     Fix Hydrologic Order: No
End:
```

Project: Rio Grande de Arecibo
Simulation Run: Georges Juntion: RGA

Date	Time	Inflow from (m^3/s) Dos Bocas-RGA	Tanama Esperanza-RGA	RGA above Arecibo	Río Tanama at Charco Hondo	Outflow
1-Jan-00	0:00	0	0	0	0	0
1-Jan-00	0:05	0	0	0	0	0
1-Jan-00	0:10	0	0	0	0	0
1-Jan-00	0:15	0	0	0	0	0
1-Jan-00	0:20	0	0	0	0	0
1-Jan-00	0:25	0	0	0	0	0
1-Jan-00	0:30	0	0	0	0	0
1-Jan-00	0:35	0	0	0	0	0
1-Jan-00	0:40	0	0	0	0	0
1-Jan-00	0:45	0	0	0	0	0
1-Jan-00	0:50	0	0	0	0	0
1-Jan-00	0:55	0	0	0	0	0
1-Jan-00	1:00	0	0	0	0	0
1-Jan-00	1:05	0	0	0	0	0
1-Jan-00	1:10	0	0	0	0	0
1-Jan-00	1:15	0	0	0	0	0
1-Jan-00	1:20	0	0	0	0	0
1-Jan-00	1:25	0	0	0	0	0
1-Jan-00	1:30	0	0	0	0	0
1-Jan-00	1:35	0	0	0	0	0
1-Jan-00	1:40	0	0	0	0	0
1-Jan-00	1:45	0	0	0	0	0
1-Jan-00	1:50	0	0	0	0	0
1-Jan-00	1:55	0	0	0	0	0
1-Jan-00	2:00	0	0	0	0	0
1-Jan-00	2:05	0	0	0	0	0
1-Jan-00	2:10	0	0	0	0	0
1-Jan-00	2:15	0	0	0	0	0
1-Jan-00	2:20	0	0	0	0	0
1-Jan-00	2:25	0	0	0	0	0
1-Jan-00	2:30	0	0	0	0	0
1-Jan-00	2:35	0	0	0	0	0
1-Jan-00	2:40	0	0	0	0	0
1-Jan-00	2:45	0	0	0	0	0
1-Jan-00	2:50	0	0	0	0	0
1-Jan-00	2:55	0	0	0	0	0
1-Jan-00	3:00	0	0	0	0	0
1-Jan-00	3:05	0	0	0	0	0
1-Jan-00	3:10	0	0	0	0	0
1-Jan-00	3:15	0	0	0	0	0
1-Jan-00	3:20	0	0	0	0	0
1-Jan-00	3:25	0	0	0	0	0
1-Jan-00	3:30	0	0	0	0	0
1-Jan-00	3:35	0	0	0	0	0
1-Jan-00	3:40	0	0	0	0	0
1-Jan-00	3:45	0	0	0	0	0
1-Jan-00	3:50	0	0	0	0	0

Inflow at RGA reach per river

Inflow from RGA = 3,313 m^3/s

Inflow from Tanama = 811 m^3/s

		Inflow from (m^3/s)				
Date	Time	Dos Bocas-RGA	Tanama Esperanza-RGA	RGA above Arecibo	Río Tanama at Charco Hondo	Outflow
1-Jan-00	3:55	0	0	0	0	0
1-Jan-00	4:00	0	0	0	0	0
1-Jan-00	4:05	0	0	0	0	0
1-Jan-00	4:10	0	0	0	0	0
1-Jan-00	4:15	0	0	0	0	0
1-Jan-00	4:20	0	0	0	0	0
1-Jan-00	4:25	0	0	0	0	0
1-Jan-00	4:30	0	0	0	0	0
1-Jan-00	4:35	0	0	0	0	0
1-Jan-00	4:40	0	0	0	0	0
1-Jan-00	4:45	0	0	0	0	0
1-Jan-00	4:50	0	0	0	0	0
1-Jan-00	4:55	0	0	0	0	0.1
1-Jan-00	5:00	0	0	0	0	0.1
1-Jan-00	5:05	0	0	0.1	0.1	0.2
1-Jan-00	5:10	0	0	0.1	0.1	0.3
1-Jan-00	5:15	0	0.1	0.2	0.1	0.4
1-Jan-00	5:20	0	0.1	0.3	0.2	0.5
1-Jan-00	5:25	0	0.1	0.3	0.2	0.7
1-Jan-00	5:30	0	0.2	0.5	0.3	1
1-Jan-00	5:35	0	0.3	0.6	0.4	1.2
1-Jan-00	5:40	0	0.3	0.7	0.5	1.5
1-Jan-00	5:45	0	0.4	0.9	0.6	1.9
1-Jan-00	5:50	0	0.5	1.1	0.7	2.2
1-Jan-00	5:55	0	0.7	1.3	0.8	2.7
1-Jan-00	6:00	0	0.8	1.5	0.9	3.1
1-Jan-00	6:05	0	1	1.7	1	3.6
1-Jan-00	6:10	0	1.2	1.9	1.1	4.2
1-Jan-00	6:15	0	1.4	2.2	1.2	4.8
1-Jan-00	6:20	0	1.7	2.4	1.3	5.4
1-Jan-00	6:25	0	2	2.7	1.4	6
1-Jan-00	6:30	0	2.3	2.9	1.5	6.8
1-Jan-00	6:35	0	2.6	3.2	1.7	7.5
1-Jan-00	6:40	0	3	3.5	1.8	8.3
1-Jan-00	6:45	0	3.5	3.8	1.9	9.1
1-Jan-00	6:50	0	3.9	4.1	2	10
1-Jan-00	6:55	0	4.4	4.4	2.2	10.9
1-Jan-00	7:00	0	5	4.7	2.3	11.9
1-Jan-00	7:05	0	5.5	5	2.4	12.9
1-Jan-00	7:10	0	6.1	5.3	2.5	14
1-Jan-00	7:15	0	6.8	5.6	2.7	15.1
1-Jan-00	7:20	0	7.5	5.9	2.8	16.2
1-Jan-00	7:25	0	8.2	6.2	3	17.4
1-Jan-00	7:30	0	9	6.6	3.1	18.6
1-Jan-00	7:35	0	9.7	6.9	3.2	19.9
1-Jan-00	7:40	0	10.6	7.3	3.4	21.2
1-Jan-00	7:45	0	11.4	7.6	3.5	22.6
1-Jan-00	7:50	0	12.4	7.9	3.7	24
1-Jan-00	7:55	0	13.3	8.3	3.8	25.4
1-Jan-00	8:00	0	14.3	8.7	4	26.9

		Inflow from (m^3/s)				
Date	Time	Dos Bocas-RGA	Tanama Esperanza-RGA	RGA above Arecibo	Río Tanama at Charco Hondo	Outflow
1-Jan-00	8:05	0	15.3	9	4.1	28.4
1-Jan-00	8:10	0	16.3	9.4	4.3	30
1-Jan-00	8:15	0	17.4	9.8	4.4	31.6
1-Jan-00	8:20	0	18.5	10.2	4.6	33.3
1-Jan-00	8:25	0	19.7	10.6	4.8	35
1-Jan-00	8:30	0	20.8	11	4.9	36.7
1-Jan-00	8:35	0	22	11.4	5.1	38.5
1-Jan-00	8:40	0	23.3	11.8	5.3	40.3
1-Jan-00	8:45	0	24.5	12.2	5.5	42.2
1-Jan-00	8:50	0	25.8	12.6	5.6	44.1
1-Jan-00	8:55	0	27.2	13.1	5.8	46
1-Jan-00	9:00	0	28.5	13.5	6	48
1-Jan-00	9:05	0	29.9	14	6.2	50.1
1-Jan-00	9:10	0	31.3	14.4	6.4	52.2
1-Jan-00	9:15	0	32.8	14.9	6.6	54.3
1-Jan-00	9:20	0	34.3	15.4	6.8	56.5
1-Jan-00	9:25	0	35.8	15.9	7	58.7
1-Jan-00	9:30	0	37.3	16.4	7.3	61
1-Jan-00	9:35	0	38.9	16.9	7.5	63.3
1-Jan-00	9:40	0	40.6	17.5	7.7	65.7
1-Jan-00	9:45	0	42.2	18	8	68.2
1-Jan-00	9:50	0	43.9	18.6	8.2	70.7
1-Jan-00	9:55	0	45.7	19.2	8.5	73.3
1-Jan-00	10:00	0	47.4	19.8	8.8	76
1-Jan-00	10:05	0	49.3	20.4	9.1	78.7
1-Jan-00	10:10	0	51.1	21.1	9.4	81.5
1-Jan-00	10:15	1.2	53	21.7	9.7	85.7
1-Jan-00	10:20	4.1	55	22.4	10	91.5
1-Jan-00	10:25	8.1	57	23.2	10.3	98.6
1-Jan-00	10:30	12.9	59.1	23.9	10.7	106.6
1-Jan-00	10:35	18.6	61.2	24.7	11.1	115.6
1-Jan-00	10:40	25.1	63.4	25.6	11.5	125.5
1-Jan-00	10:45	32.3	65.6	26.4	11.9	136.3
1-Jan-00	10:50	40.3	67.9	27.4	12.3	147.9
1-Jan-00	10:55	49	70.3	28.3	12.8	160.4
1-Jan-00	11:00	58.4	72.8	29.3	13.3	173.8
1-Jan-00	11:05	68.5	75.3	30.4	13.9	188
1-Jan-00	11:10	79.2	77.9	31.6	14.4	203.2
1-Jan-00	11:15	90.7	80.6	32.8	15.1	219.2
1-Jan-00	11:20	102.8	83.4	34.2	15.8	236.2
1-Jan-00	11:25	115.6	86.3	35.6	16.6	254.2
1-Jan-00	11:30	129.1	89.3	37.2	17.4	273.1
1-Jan-00	11:35	143.3	92.5	39	18.4	293.1
1-Jan-00	11:40	158.1	95.8	40.9	19.5	314.3
1-Jan-00	11:45	173.6	99.2	43.1	20.8	336.8
1-Jan-00	11:50	189.8	102.8	45.9	22.7	361.1
1-Jan-00	11:55	206.6	106.6	49.6	25.4	388.3
1-Jan-00	12:00	224.2	110.6	54.6	29.3	418.7
1-Jan-00	12:05	242.5	114.8	60.8	34.4	452.4
1-Jan-00	12:10	261.4	119.2	68	40.7	489.3

		Inflow from (m^3/s)				
Date	Time	Dos Bocas-RGA	Tanama Esperanza-RGA	RGA above Arecibo	Río Tanama at Charco Hondo	Outflow
1-Jan-00	12:15	281.2	124	76.5	47.8	529.4
1-Jan-00	12:20	301.6	129.2	86.2	54.5	571.5
1-Jan-00	12:25	322.9	134.7	96.7	59.9	614.2
1-Jan-00	12:30	345	141.6	107.3	63.6	657.4
1-Jan-00	12:35	367.9	150	117	65.5	700.4
1-Jan-00	12:40	391.7	159.9	125.3	65.8	742.8
1-Jan-00	12:45	416.6	171.8	131.7	64.7	784.8
1-Jan-00	12:50	442.5	185.7	136.3	62.4	826.9
1-Jan-00	12:55	469.8	201.6	139.1	59.2	869.7
1-Jan-00	13:00	498.8	218.9	140.3	55.5	913.4
1-Jan-00	13:05	529.9	237.7	139.8	51.8	959.2
1-Jan-00	13:10	563.5	258.1	137.9	48.5	1008
1-Jan-00	13:15	600.3	280	135	45.4	1060.7
1-Jan-00	13:20	640.4	303.7	131	42.7	1117.8
1-Jan-00	13:25	684.3	329.2	126	40.2	1179.7
1-Jan-00	13:30	731.8	356.5	120.5	38	1246.7
1-Jan-00	13:35	782.6	385.7	114.9	35.9	1319.2
1-Jan-00	13:40	836.2	416.8	109.7	34.1	1396.8
1-Jan-00	13:45	892.1	449.1	104.8	32.5	1478.5
1-Jan-00	13:50	949.6	482.9	100.2	31	1563.7
1-Jan-00	13:55	1008.3	517.3	96	29.6	1651.2
1-Jan-00	14:00	1067.6	550.8	92.1	28.4	1738.9
1-Jan-00	14:05	1127.1	583.2	88.4	27.4	1826.1
1-Jan-00	14:10	1186.6	614.2	85	26.4	1912.2
1-Jan-00	14:15	1245.9	643	81.7	25.5	1996.1
1-Jan-00	14:20	1304.8	669.5	78.7	24.7	2077.6
1-Jan-00	14:25	1363.1	693.4	75.8	23.9	2156.3
1-Jan-00	14:30	1420.8	714.7	73.3	23.3	2232.1
1-Jan-00	14:35	1477.7	733.4	70.8	22.6	2304.6
1-Jan-00	14:40	1533.7	749.2	68.6	22.1	2373.5
1-Jan-00	14:45	1588.6	762.2	66.5	21.5	2438.9
1-Jan-00	14:50	1642.4	772.4	64.5	21.1	2500.4
1-Jan-00	14:55	1694.8	780.2	62.7	20.6	2558.3
1-Jan-00	15:00	1745.8	786.1	61	20.2	2613
1-Jan-00	15:05	1795.2	790	59.4	19.8	2664.4
1-Jan-00	15:10	1843	791.6	57.9	19.4	2712
1-Jan-00	15:15	1889.2	790.6	56.5	19	2755.4
1-Jan-00	15:20	1933.7	787	55.2	18.7	2794.6
1-Jan-00	15:25	1976.7	781.3	54	18.4	2830.3
1-Jan-00	15:30	2018.4	774.2	52.8	18.1	2863.5
1-Jan-00	15:35	2058.8	765.7	51.8	17.8	2894.1
1-Jan-00	15:40	2098.3	756	50.8	17.6	2922.6
1-Jan-00	15:45	2136.9	745.1	49.8	17.3	2949.1
1-Jan-00	15:50	2174.8	733.2	48.9	17.1	2974
1-Jan-00	15:55	2212.2	719.9	48	16.9	2997.1
1-Jan-00	16:00	2249.3	705.5	47.3	16.7	3018.6
1-Jan-00	16:05	2286.1	689.7	46.5	16.5	3038.7
1-Jan-00	16:10	2322.9	672.7	45.8	16.3	3057.7
1-Jan-00	16:15	2359.9	654.6	45.1	16.1	3075.7
1-Jan-00	16:20	2397.3	635.3	44.4	15.9	3092.9

		Inflow from (m^3/s)				
Date	Time	Dos Bocas-RGA	Tanama Esperanza-RGA	RGA above Arecibo	Río Tanama at Charco Hondo	Outflow
1-Jan-00	16:25	2435.1	616	43.8	15.7	3110.7
1-Jan-00	16:30	2473.6	597.1	43.2	15.6	3129.5
1-Jan-00	16:35	2512.8	578.6	42.6	15.4	3149.4
1-Jan-00	16:40	2552.8	560.9	42.1	15.3	3171.1
1-Jan-00	16:45	2593.6	544.3	41.5	15.1	3194.5
1-Jan-00	16:50	2634.9	528.7	41	15	3219.6
1-Jan-00	16:55	2676.6	513.8	40.5	14.8	3245.7
1-Jan-00	17:00	2718.5	499.3	40	14.7	3272.6
1-Jan-00	17:05	2760.5	485.5	39.6	14.6	3300.1
1-Jan-00	17:10	2802.1	472.2	39.1	14.4	3327.9
1-Jan-00	17:15	2843.3	459.3	38.7	14.3	3355.7
1-Jan-00	17:20	2883.7	447.1	38.3	14.2	3383.3
1-Jan-00	17:25	2923.1	435.4	38	14.1	3410.5
1-Jan-00	17:30	2961.2	424.3	37.6	14	3437.1
1-Jan-00	17:35	2997.9	413.9	37.3	13.9	3462.9
1-Jan-00	17:40	3032.9	403.7	36.9	13.7	3487.3
1-Jan-00	17:45	3066	393.7	36.6	13.6	3510
1-Jan-00	17:50	3097.2	384	36.3	13.5	3531
1-Jan-00	17:55	3126.3	374.5	36	13.4	3550.3
1-Jan-00	18:00	3153.2	365.4	35.7	13.3	3567.6
1-Jan-00	18:05	3177.6	356.7	35.4	13.2	3582.9
1-Jan-00	18:10	3199.5	348.1	35.1	13.2	3595.8
1-Jan-00	18:15	3218.8	339.6	34.8	13.1	3606.3
1-Jan-00	18:20	3235.4	331.4	34.6	13	3614.3
1-Jan-00	18:25	3249.3	323.6	34.3	12.9	3620.1
1-Jan-00	18:30	3260.6	316.2	34.1	12.8	3623.7
1-Jan-00	18:35	3269.3	309.3	33.8	12.7	3625.1
1-Jan-00	18:40	3275.3	302.5	33.6	12.6	3624.1
1-Jan-00	18:45	3278.8	295.9	33.4	12.6	3620.6
1-Jan-00	18:50	3279.6	289.5	33.1	12.5	3614.7
1-Jan-00	18:55	3277.8	283.3	32.9	12.4	3606.5
1-Jan-00	19:00	3273.5	277.5	32.7	12.3	3595.9
1-Jan-00	19:05	3266.6	271.8	32.5	12.3	3583.1
1-Jan-00	19:10	3257.1	266.3	32.3	12.2	3567.9
1-Jan-00	19:15	3245.3	260.9	32.1	12.1	3550.4
1-Jan-00	19:20	3231.3	255.7	31.9	12	3530.9
1-Jan-00	19:25	3215.2	250.7	31.7	12	3509.6
1-Jan-00	19:30	3197.3	246	31.5	11.9	3486.6
1-Jan-00	19:35	3177.8	241.4	31.3	11.8	3462.3
1-Jan-00	19:40	3156.8	236.9	31.1	11.8	3436.6
1-Jan-00	19:45	3134.7	232.6	30.9	11.7	3409.9
1-Jan-00	19:50	3111.4	228.4	30.7	11.7	3382.2
1-Jan-00	19:55	3087.2	224.3	30.6	11.6	3353.7
1-Jan-00	20:00	3062.2	220.5	30.4	11.5	3324.6
1-Jan-00	20:05	3036.5	216.8	30.2	11.5	3295
1-Jan-00	20:10	3010.1	213.3	30.1	11.4	3264.8
1-Jan-00	20:15	2983.2	209.8	29.9	11.4	3234.2
1-Jan-00	20:20	2956	206.4	29.7	11.3	3203.4
1-Jan-00	20:25	2928.4	203.2	29.6	11.2	3172.4
1-Jan-00	20:30	2900.6	200	29.4	11.2	3141.3

		Inflow from (m^3/s)				
Date	Time	Dos Bocas-RGA	Tanama Esperanza-RGA	RGA above Arecibo	Río Tanama at Charco Hondo	Outflow
1-Jan-00	20:35	2872.6	197	29.3	11.1	3110.1
1-Jan-00	20:40	2844.5	194.1	29.1	11.1	3078.8
1-Jan-00	20:45	2816.3	191.2	29	11	3047.6
1-Jan-00	20:50	2788.1	188.5	28.8	11	3016.3
1-Jan-00	20:55	2759.8	185.8	28.7	10.9	2985.3
1-Jan-00	21:00	2731.6	183.2	28.6	10.9	2954.3
1-Jan-00	21:05	2703.5	180.8	28.4	10.8	2923.5
1-Jan-00	21:10	2675.5	178.3	28.3	10.8	2892.9
1-Jan-00	21:15	2647.6	175.9	28.2	10.7	2862.4
1-Jan-00	21:20	2619.8	173.7	28	10.7	2832.2
1-Jan-00	21:25	2592.3	171.4	27.9	10.6	2802.3
1-Jan-00	21:30	2565	169.3	27.8	10.6	2772.7
1-Jan-00	21:35	2538	167.2	27.6	10.6	2743.4
1-Jan-00	21:40	2511.2	165.2	27.5	10.5	2714.4
1-Jan-00	21:45	2484.7	163.2	27.4	10.5	2685.8
1-Jan-00	21:50	2458.6	161.3	27.3	10.4	2657.5
1-Jan-00	21:55	2432.7	159.4	27.2	10.4	2629.7
1-Jan-00	22:00	2407.2	157.6	27	10.3	2602.2
1-Jan-00	22:05	2382	155.9	26.9	10.3	2575.1
1-Jan-00	22:10	2357.1	154.2	26.8	10.3	2548.4
1-Jan-00	22:15	2332.6	152.5	26.7	10.2	2522.1
1-Jan-00	22:20	2308.5	150.9	26.6	10.2	2496.2
1-Jan-00	22:25	2284.7	149.4	26.5	10.1	2470.7
1-Jan-00	22:30	2261.2	147.9	26.4	10.1	2445.7
1-Jan-00	22:35	2238.2	146.5	26.3	10.1	2421
1-Jan-00	22:40	2215.5	145.1	26.2	10	2396.7
1-Jan-00	22:45	2193.1	143.7	26.1	10	2372.9
1-Jan-00	22:50	2171.1	142.3	26	10	2349.4
1-Jan-00	22:55	2149.5	141	25.9	9.9	2326.3
1-Jan-00	23:00	2128.3	139.7	25.8	9.9	2303.6
1-Jan-00	23:05	2107.4	138.4	25.7	9.8	2281.3
1-Jan-00	23:10	2086.9	137.1	25.6	9.8	2259.4
1-Jan-00	23:15	2066.7	135.9	25.5	9.8	2237.9
1-Jan-00	23:20	2046.9	134.7	25.4	9.7	2216.7
1-Jan-00	23:25	2027.5	133.5	25.3	9.7	2195.9
1-Jan-00	23:30	2008.4	132.3	25.2	9.7	2175.5
1-Jan-00	23:35	1989.6	131.1	25.1	9.6	2155.5
1-Jan-00	23:40	1971.2	130	25	9.6	2135.8
1-Jan-00	23:45	1953.2	128.9	24.9	9.6	2116.5
1-Jan-00	23:50	1935.4	127.8	24.8	9.5	2097.6
1-Jan-00	23:55	1918	126.7	24.8	9.5	2079
2-Jan-00	0:00	1900.9	125.6	24.7	9.5	2060.7
2-Jan-00	0:05	1884.2	124.6	24.5	9.4	2042.7
2-Jan-00	0:10	1867.7	123.6	24.4	9.3	2024.9
2-Jan-00	0:15	1851.5	122.6	24.1	9	2007.2
2-Jan-00	0:20	1835.7	121.6	23.7	8.7	1989.6
2-Jan-00	0:25	1820.1	120.6	23.2	8.1	1972.1
2-Jan-00	0:30	1804.8	119.7	22.5	7.4	1954.5
2-Jan-00	0:35	1789.9	118.7	21.6	6.7	1936.9
2-Jan-00	0:40	1775.2	117.8	20.5	5.8	1919.3

		Inflow from (m^3/s)				
Date	Time	Dos Bocas-RGA	Tanama Esperanza-RGA	RGA above Arecibo	Río Tanama at Charco Hondo	Outflow
2-Jan-00	0:45	1760.7	116.9	19.3	5	1901.9
2-Jan-00	0:50	1746.6	116	17.9	4.2	1884.7
2-Jan-00	0:55	1732.7	115.1	16.5	3.5	1867.8
2-Jan-00	1:00	1719	114.2	15	2.9	1851.2
2-Jan-00	1:05	1705.6	113.3	13.6	2.4	1834.9
2-Jan-00	1:10	1692.5	112.3	12.2	2	1818.9
2-Jan-00	1:15	1679.4	111.3	10.8	1.6	1803.2
2-Jan-00	1:20	1666.5	110.2	9.6	1.3	1787.7
2-Jan-00	1:25	1653.6	109.1	8.4	1.1	1772.2
2-Jan-00	1:30	1640.6	107.9	7.4	0.9	1756.7
2-Jan-00	1:35	1627.3	106.6	6.4	0.7	1741
2-Jan-00	1:40	1613.7	105.2	5.6	0.6	1725.1
2-Jan-00	1:45	1599.7	103.7	4.9	0.5	1708.8
2-Jan-00	1:50	1585.3	102.1	4.3	0.4	1692.1
2-Jan-00	1:55	1570.5	100.3	3.8	0.3	1674.9
2-Jan-00	2:00	1555.2	98.4	3.3	0.3	1657.2
2-Jan-00	2:05	1539.5	96.4	2.9	0.2	1639.1
2-Jan-00	2:10	1523.5	94.3	2.6	0.2	1620.5
2-Jan-00	2:15	1507.1	92	2.2	0.2	1601.5
2-Jan-00	2:20	1490.4	89.6	2	0.1	1582.1
2-Jan-00	2:25	1473.4	87.1	1.7	0.1	1562.4
2-Jan-00	2:30	1456.2	84.6	1.5	0.1	1542.4
2-Jan-00	2:35	1438.8	81.9	1.3	0.1	1522.1
2-Jan-00	2:40	1421.2	79.3	1.2	0.1	1501.6
2-Jan-00	2:45	1403.4	76.5	1	0	1481
2-Jan-00	2:50	1385.4	73.8	0.9	0	1460.1
2-Jan-00	2:55	1367.3	71	0.8	0	1439.2
2-Jan-00	3:00	1349.1	68.3	0.7	0	1418.1
2-Jan-00	3:05	1330.9	65.5	0.6	0	1397
2-Jan-00	3:10	1312.6	62.8	0.5	0	1375.9
2-Jan-00	3:15	1294.2	60.1	0.4	0	1354.8
2-Jan-00	3:20	1275.9	57.4	0.4	0	1333.7
2-Jan-00	3:25	1257.7	54.7	0.3	0	1312.7
2-Jan-00	3:30	1239.5	52.2	0.3	0	1291.9
2-Jan-00	3:35	1221.4	49.7	0.3	0	1271.3
2-Jan-00	3:40	1203.4	47.2	0.2	0	1250.9
2-Jan-00	3:45	1185.6	44.8	0.2	0	1230.7
2-Jan-00	3:50	1168	42.5	0.2	0	1210.7
2-Jan-00	3:55	1150.6	40.3	0.1	0	1191
2-Jan-00	4:00	1133.3	38.1	0.1	0	1171.5
2-Jan-00	4:05	1116.2	36	0.1	0	1152.4
2-Jan-00	4:10	1099.4	34	0.1	0	1133.5
2-Jan-00	4:15	1082.7	32.1	0.1	0	1114.9
2-Jan-00	4:20	1066.2	30.3	0.1	0	1096.6
2-Jan-00	4:25	1049.9	28.6	0	0	1078.6
2-Jan-00	4:30	1033.9	27	0	0	1060.9
2-Jan-00	4:35	1018	25.5	0	0	1043.5
2-Jan-00	4:40	1002.3	24.1	0	0	1026.4
2-Jan-00	4:45	986.8	22.8	0	0	1009.6
2-Jan-00	4:50	971.4	21.6	0	0	993

		Inflow from (m^3/s)				
Date	Time	Dos Bocas-RGA	Tanama Esperanza-RGA	RGA above Arecibo	Río Tanama at Charco Hondo	Outflow
2-Jan-00	4:55	956.2	20.4	0	0	976.6
2-Jan-00	5:00	941.2	19.3	0	0	960.5
2-Jan-00	5:05	926.3	18.3	0	0	944.6
2-Jan-00	5:10	911.6	17.3	0	0	928.9
2-Jan-00	5:15	897.1	16.3	0	0	913.4
2-Jan-00	5:20	882.6	15.5	0	0	898.1
2-Jan-00	5:25	868.3	14.6	0	0	883
2-Jan-00	5:30	854.2	13.8	0	0	868.1
2-Jan-00	5:35	840.2	13.1	0	0	853.3
2-Jan-00	5:40	826.3	12.4	0	0	838.7
2-Jan-00	5:45	812.6	11.7	0	0	824.3
2-Jan-00	5:50	799	11.1	0	0	810.1
2-Jan-00	5:55	785.6	10.5	0	0	796
2-Jan-00	6:00	772.3	9.9	0	0	782.2
2-Jan-00	6:05	759.1	9.4	0	0	768.5
2-Jan-00	6:10	746.1	8.8	0	0	754.9
2-Jan-00	6:15	733.2	8.4	0	0	741.6
2-Jan-00	6:20	720.5	7.9	0	0	728.4
2-Jan-00	6:25	707.9	7.5	0	0	715.4
2-Jan-00	6:30	695.5	7	0	0	702.6
2-Jan-00	6:35	683.3	6.7	0	0	690
2-Jan-00	6:40	671.2	6.3	0	0	677.5
2-Jan-00	6:45	659.3	6	0	0	665.2
2-Jan-00	6:50	647.5	5.6	0	0	653.2
2-Jan-00	6:55	635.9	5.3	0	0	641.3
2-Jan-00	7:00	624.5	5	0	0	629.5
2-Jan-00	7:05	613.3	4.7	0	0	618
2-Jan-00	7:10	602.2	4.5	0	0	606.7
2-Jan-00	7:15	591.3	4.2	0	0	595.6
2-Jan-00	7:20	580.6	4	0	0	584.6
2-Jan-00	7:25	570.1	3.8	0	0	573.9
2-Jan-00	7:30	559.7	3.6	0	0	563.3
2-Jan-00	7:35	549.6	3.4	0	0	552.9
2-Jan-00	7:40	539.6	3.2	0	0	542.8
2-Jan-00	7:45	529.8	3	0	0	532.8
2-Jan-00	7:50	520.2	2.8	0	0	523
2-Jan-00	7:55	510.8	2.7	0	0	513.4
2-Jan-00	8:00	501.5	2.5	0	0	504
2-Jan-00	8:05	492.4	2.4	0	0	494.8
2-Jan-00	8:10	483.6	2.2	0	0	485.8
2-Jan-00	8:15	474.8	2.1	0	0	476.9
2-Jan-00	8:20	466.3	2	0	0	468.3
2-Jan-00	8:25	457.9	1.9	0	0	459.8
2-Jan-00	8:30	449.7	1.8	0	0	451.5
2-Jan-00	8:35	441.7	1.7	0	0	443.3
2-Jan-00	8:40	433.8	1.6	0	0	435.3
2-Jan-00	8:45	426	1.5	0	0	427.5
2-Jan-00	8:50	418.5	1.4	0	0	419.9
2-Jan-00	8:55	411.1	1.3	0	0	412.4
2-Jan-00	9:00	403.8	1.2	0	0	405

		Inflow from (m^3/s)				
Date	Time	Dos Bocas-RGA	Tanama Esperanza-RGA	RGA above Arecibo	Río Tanama at Charco Hondo	Outflow
2-Jan-00	9:05	396.7	1.2	0	0	397.9
2-Jan-00	9:10	389.7	1.1	0	0	390.8
2-Jan-00	9:15	382.9	1	0	0	383.9
2-Jan-00	9:20	376.2	1	0	0	377.2
2-Jan-00	9:25	369.7	0.9	0	0	370.6
2-Jan-00	9:30	363.3	0.8	0	0	364.1
2-Jan-00	9:35	357	0.8	0	0	357.8
2-Jan-00	9:40	350.9	0.7	0	0	351.6
2-Jan-00	9:45	344.8	0.7	0	0	345.5
2-Jan-00	9:50	338.9	0.7	0	0	339.6
2-Jan-00	9:55	333.2	0.6	0	0	333.8
2-Jan-00	10:00	327.5	0.6	0	0	328.1
2-Jan-00	10:05	322	0.5	0	0	322.5
2-Jan-00	10:10	316.6	0.5	0	0	317.1
2-Jan-00	10:15	311.3	0.5	0	0	311.7
2-Jan-00	10:20	306.1	0.4	0	0	306.5
2-Jan-00	10:25	301	0.4	0	0	301.4
2-Jan-00	10:30	296	0.4	0	0	296.4
2-Jan-00	10:35	291.1	0.3	0	0	291.4
2-Jan-00	10:40	286.3	0.3	0	0	286.6
2-Jan-00	10:45	281.6	0.3	0	0	281.9
2-Jan-00	10:50	277	0.3	0	0	277.3
2-Jan-00	10:55	272.5	0.2	0	0	272.8
2-Jan-00	11:00	268.1	0.2	0	0	268.4
2-Jan-00	11:05	263.8	0.2	0	0	264
2-Jan-00	11:10	259.6	0.2	0	0	259.8
2-Jan-00	11:15	255.5	0.2	0	0	255.6
2-Jan-00	11:20	251.4	0.2	0	0	251.5
2-Jan-00	11:25	247.4	0.1	0	0	247.6
2-Jan-00	11:30	243.5	0.1	0	0	243.6
2-Jan-00	11:35	239.7	0.1	0	0	239.8
2-Jan-00	11:40	236	0.1	0	0	236.1
2-Jan-00	11:45	232.3	0.1	0	0	232.4
2-Jan-00	11:50	228.7	0.1	0	0	228.8
2-Jan-00	11:55	225.2	0.1	0	0	225.2
2-Jan-00	12:00	221.7	0.1	0	0	221.8
2-Jan-00	12:05	218.3	0	0	0	218.4
2-Jan-00	12:10	215	0	0	0	215
2-Jan-00	12:15	211.8	0	0	0	211.8
2-Jan-00	12:20	208.6	0	0	0	208.6
2-Jan-00	12:25	205.4	0	0	0	205.5
2-Jan-00	12:30	202.4	0	0	0	202.4
2-Jan-00	12:35	199.4	0	0	0	199.4
2-Jan-00	12:40	196.4	0	0	0	196.4
2-Jan-00	12:45	193.5	0	0	0	193.5
2-Jan-00	12:50	190.7	0	0	0	190.7
2-Jan-00	12:55	187.9	0	0	0	187.9
2-Jan-00	13:00	185.2	0	0	0	185.2
2-Jan-00	13:05	182.5	0	0	0	182.5
2-Jan-00	13:10	179.8	0	0	0	179.8

		Inflow from (m^3/s)				
Date	Time	Dos Bocas-RGA	Tanama Esperanza-RGA	RGA above Arecibo	Río Tanama at Charco Hondo	Outflow
2-Jan-00	13:15	177.3	0	0	0	177.3
2-Jan-00	13:20	174.7	0	0	0	174.7
2-Jan-00	13:25	172.2	0	0	0	172.2
2-Jan-00	13:30	169.8	0	0	0	169.8
2-Jan-00	13:35	167.4	0	0	0	167.4
2-Jan-00	13:40	165.1	0	0	0	165.1
2-Jan-00	13:45	162.7	0	0	0	162.7
2-Jan-00	13:50	160.5	0	0	0	160.5
2-Jan-00	13:55	158.3	0	0	0	158.3
2-Jan-00	14:00	156.1	0	0	0	156.1
2-Jan-00	14:05	153.9	0	0	0	153.9
2-Jan-00	14:10	151.8	0	0	0	151.8
2-Jan-00	14:15	149.8	0	0	0	149.8
2-Jan-00	14:20	147.7	0	0	0	147.7
2-Jan-00	14:25	145.7	0	0	0	145.7
2-Jan-00	14:30	143.8	0	0	0	143.8
2-Jan-00	14:35	141.8	0	0	0	141.8
2-Jan-00	14:40	139.9	0	0	0	139.9
2-Jan-00	14:45	138.1	0	0	0	138.1
2-Jan-00	14:50	136.3	0	0	0	136.3
2-Jan-00	14:55	134.5	0	0	0	134.5
2-Jan-00	15:00	132.7	0	0	0	132.7
2-Jan-00	15:05	131	0	0	0	131
2-Jan-00	15:10	129.3	0	0	0	129.3
2-Jan-00	15:15	127.6	0	0	0	127.6
2-Jan-00	15:20	126	0	0	0	126
2-Jan-00	15:25	124.3	0	0	0	124.3
2-Jan-00	15:30	122.8	0	0	0	122.8
2-Jan-00	15:35	121.2	0	0	0	121.2
2-Jan-00	15:40	119.7	0	0	0	119.7
2-Jan-00	15:45	118.1	0	0	0	118.1
2-Jan-00	15:50	116.7	0	0	0	116.7
2-Jan-00	15:55	115.2	0	0	0	115.2
2-Jan-00	16:00	113.8	0	0	0	113.8
2-Jan-00	16:05	112.4	0	0	0	112.4
2-Jan-00	16:10	111	0	0	0	111
2-Jan-00	16:15	109.6	0	0	0	109.6
2-Jan-00	16:20	108.3	0	0	0	108.3
2-Jan-00	16:25	106.9	0	0	0	106.9
2-Jan-00	16:30	105.6	0	0	0	105.6
2-Jan-00	16:35	104.4	0	0	0	104.4
2-Jan-00	16:40	103.1	0	0	0	103.1
2-Jan-00	16:45	101.9	0	0	0	101.9
2-Jan-00	16:50	100.6	0	0	0	100.6
2-Jan-00	16:55	99.4	0	0	0	99.4
2-Jan-00	17:00	98.3	0	0	0	98.3
2-Jan-00	17:05	97.1	0	0	0	97.1
2-Jan-00	17:10	96	0	0	0	96
2-Jan-00	17:15	94.8	0	0	0	94.8
2-Jan-00	17:20	93.7	0	0	0	93.7

		Inflow from (m^3/s)				
Date	Time	Dos Bocas-RGA	Tanama Esperanza-RGA	RGA above Arecibo	Río Tanama at Charco Hondo	Outflow
2-Jan-00	17:25	92.6	0	0	0	92.6
2-Jan-00	17:30	91.6	0	0	0	91.6
2-Jan-00	17:35	90.5	0	0	0	90.5
2-Jan-00	17:40	89.5	0	0	0	89.5
2-Jan-00	17:45	88.4	0	0	0	88.4
2-Jan-00	17:50	87.4	0	0	0	87.4
2-Jan-00	17:55	86.4	0	0	0	86.4
2-Jan-00	18:00	85.5	0	0	0	85.5
2-Jan-00	18:05	84.5	0	0	0	84.5
2-Jan-00	18:10	83.6	0	0	0	83.6
2-Jan-00	18:15	82.6	0	0	0	82.6
2-Jan-00	18:20	81.7	0	0	0	81.7
2-Jan-00	18:25	80.8	0	0	0	80.8
2-Jan-00	18:30	79.9	0	0	0	79.9
2-Jan-00	18:35	79	0	0	0	79
2-Jan-00	18:40	78.2	0	0	0	78.2
2-Jan-00	18:45	77.3	0	0	0	77.3
2-Jan-00	18:50	76.5	0	0	0	76.5
2-Jan-00	18:55	75.6	0	0	0	75.6
2-Jan-00	19:00	74.8	0	0	0	74.8
2-Jan-00	19:05	74	0	0	0	74
2-Jan-00	19:10	73.2	0	0	0	73.2
2-Jan-00	19:15	72.4	0	0	0	72.4
2-Jan-00	19:20	71.7	0	0	0	71.7
2-Jan-00	19:25	70.9	0	0	0	70.9
2-Jan-00	19:30	70.1	0	0	0	70.1
2-Jan-00	19:35	69.4	0	0	0	69.4
2-Jan-00	19:40	68.7	0	0	0	68.7
2-Jan-00	19:45	68	0	0	0	68
2-Jan-00	19:50	67.2	0	0	0	67.2
2-Jan-00	19:55	66.5	0	0	0	66.5
2-Jan-00	20:00	65.9	0	0	0	65.9
2-Jan-00	20:05	65.2	0	0	0	65.2
2-Jan-00	20:10	64.5	0	0	0	64.5
2-Jan-00	20:15	63.8	0	0	0	63.8
2-Jan-00	20:20	63.2	0	0	0	63.2
2-Jan-00	20:25	62.5	0	0	0	62.5
2-Jan-00	20:30	61.9	0	0	0	61.9
2-Jan-00	20:35	61.3	0	0	0	61.3
2-Jan-00	20:40	60.7	0	0	0	60.7
2-Jan-00	20:45	60.1	0	0	0	60.1
2-Jan-00	20:50	59.5	0	0	0	59.5
2-Jan-00	20:55	58.9	0	0	0	58.9
2-Jan-00	21:00	58.3	0	0	0	58.3
2-Jan-00	21:05	57.7	0	0	0	57.7
2-Jan-00	21:10	57.1	0	0	0	57.1
2-Jan-00	21:15	56.6	0	0	0	56.6
2-Jan-00	21:20	56	0	0	0	56
2-Jan-00	21:25	55.5	0	0	0	55.5
2-Jan-00	21:30	54.9	0	0	0	54.9

		Inflow from (m^3/s)				
Date	Time	Dos Bocas-RGA	Tanama Esperanza-RGA	RGA above Arecibo	Río Tanama at Charco Hondo	Outflow
2-Jan-00	21:35	54.4	0	0	0	54.4
2-Jan-00	21:40	53.9	0	0	0	53.9
2-Jan-00	21:45	53.3	0	0	0	53.3
2-Jan-00	21:50	52.8	0	0	0	52.8
2-Jan-00	21:55	52.3	0	0	0	52.3
2-Jan-00	22:00	51.8	0	0	0	51.8
2-Jan-00	22:05	51.3	0	0	0	51.3
2-Jan-00	22:10	50.8	0	0	0	50.8
2-Jan-00	22:15	50.4	0	0	0	50.4
2-Jan-00	22:20	49.9	0	0	0	49.9
2-Jan-00	22:25	49.4	0	0	0	49.4
2-Jan-00	22:30	48.9	0	0	0	48.9
2-Jan-00	22:35	48.5	0	0	0	48.5
2-Jan-00	22:40	48	0	0	0	48
2-Jan-00	22:45	47.6	0	0	0	47.6
2-Jan-00	22:50	47.2	0	0	0	47.2
2-Jan-00	22:55	46.7	0	0	0	46.7
2-Jan-00	23:00	46.3	0	0	0	46.3
2-Jan-00	23:05	45.9	0	0	0	45.9
2-Jan-00	23:10	45.4	0	0	0	45.4
2-Jan-00	23:15	45	0	0	0	45
2-Jan-00	23:20	44.6	0	0	0	44.6
2-Jan-00	23:25	44.2	0	0	0	44.2
2-Jan-00	23:30	43.8	0	0	0	43.8
2-Jan-00	23:35	43.4	0	0	0	43.4
2-Jan-00	23:40	43	0	0	0	43
2-Jan-00	23:45	42.6	0	0	0	42.6
2-Jan-00	23:50	42.3	0	0	0	42.3
2-Jan-00	23:55	41.9	0	0	0	41.9
3-Jan-00	0:00	41.5	0	0	0	41.5

Puerto Rico

HYDROLOGIC-HYDRAULIC STUDY
RÍO GRANDE DE ARECIBO,
RENEWABLE POWER GENERATION AND
RESOURCE RECOVERY FACILITY,
ARECIBO, PUERTO RICO

Appendix G:

Log-Pearson III Analysis for USGS gage 50027750, Río Grande de Arecibo above Arecibo

GLM MORRIS ENGINEERING

NRCS Log-Pearson Frequency Analysis Spreadsheet, Version 2.0, 3/2003

Project: *Renova*
Streamgage: *Rio Grande de Arecibo above Arecibo*
Date: *2/17/2010* **Performed By:** *L. Esteban*

Without Generalized Skew

Average:	8.7836
Standard Deviation:	1.16671473
Skew Coefficient[1]:	1.14961742
Length of systematic record:	20
Number of historic peaks:	0
Length of Data Record:	20
Length of Historic Record:[5]	----

Recurrence Interval[2] (years)	Percent Chance	K-Value	Ln(Q)	Peak[4] Discharge (cfs)	90% Confidence Interval Upper (cfs)	90% Confidence Interval Lower (cfs)
200	0.5	3.618	13.0043	444,000	2,230,000	169,000
100	1	3.118	12.4211	248,000	1,020,000	105,000
50	2	2.605	11.8232	136,000	459,000	64,600
25	4	2.076	11.2061	73,600	202,000	38,800
10	10	1.341	10.3475	31,200	66,200	18,700
5	20	0.739	9.6452	15,400	27,500	9,920
2	50	-0.187	8.5649	5,240	8,090	3,290
1.25	80	-0.846	7.7965	2,430	3,820	1,330

With Generalized Skew

Generalized Skew Coefficient[3]:	-0.4700
MSE Generalized Skew[3]:	0.5600
A:	-0.175115
B:	0.641099
station skew:	1.149617
MSE Station Skew:	0.42844497
Weighted skew coefficient[1]:	0.44758851

Recurrence Interval[2] (years)	Percent Chance	K-Value	Ln(Q)	Peak[4] Discharge (cfs)	90% Confidence Interval Upper (cfs)	90% Confidence Interval Lower (cfs)
200	0.5	2.993	12.2753	214,000	839,000	93,500
100	1	2.649	11.8739	143,000	491,000	67,300
50	2	2.285	11.4493	93,800	279,000	47,500
25	4	1.894	10.9936	59,500	153,000	32,500
10	10	1.320	10.3234	30,400	64,200	18,300
5	20	0.812	9.7312	16,800	30,500	10,700
2	50	-0.074	8.6971	5,990	9,290	3,810
1.25	80	-0.855	7.7855	2,410	3,780	1,310

(1) Station and generalized skews must be between -2.00 and +3.00 in this spreadsheet.

(2) Considering the relatively short length of most gage records, less frequent peak estimates need to be used with considerable care.

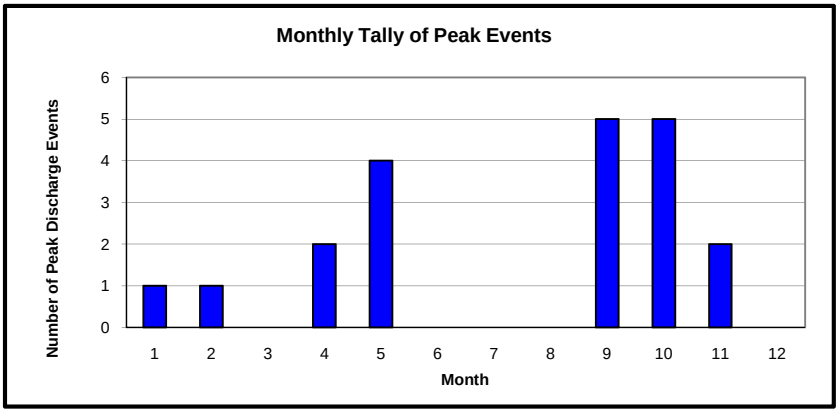
(3) Computed one of four ways (see "generalized skew coefficient" worksheet): Mean and variance (standard deviation^2) of station skews coefficients in region; skew isolines drawn on a map or regions; skew prediction equations; read from Plate 1 of Bulletin 17B (reproduced in this spreadsheet), with MSE Generalized Skew = 0.302.

(4) Results are automatically rounded to three significant figures, the dominant number of significant figures in the K-Value table.

(5) Historic frequency analysis assumes that intervening years reflect systematic record.

Comments:

Peak Timing:



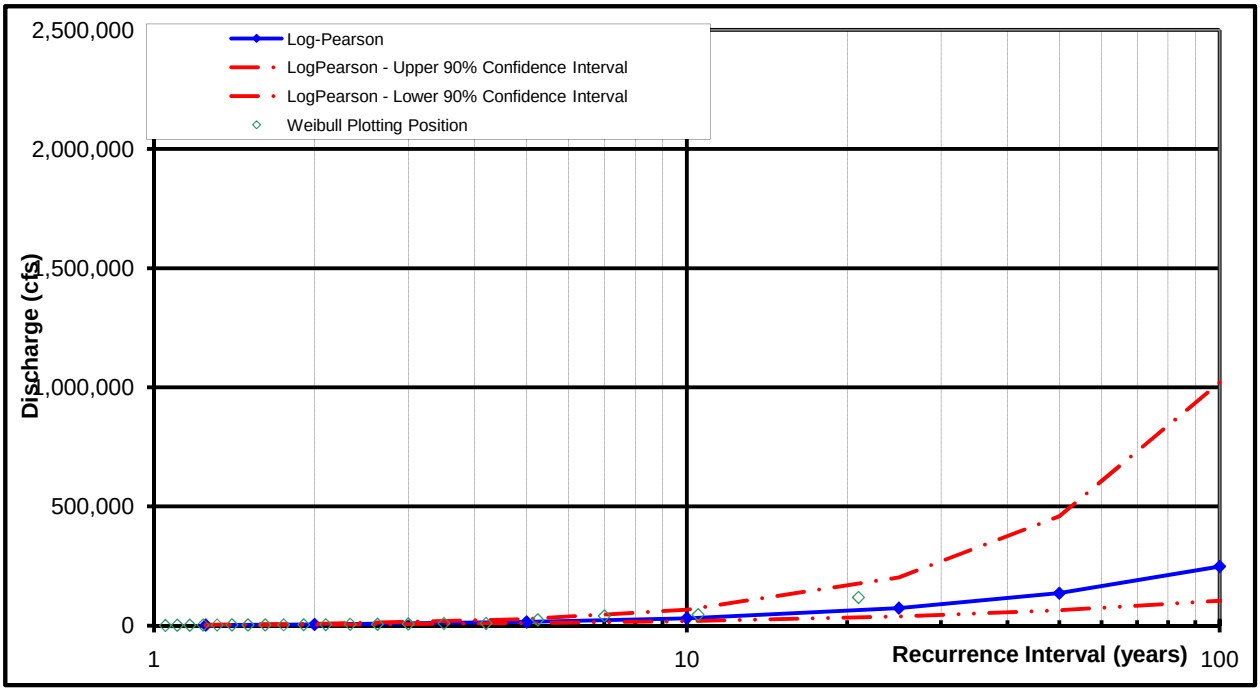
Month	Count
1	1
2	1
3	0
4	2
5	4
6	0
7	0
8	0
9	5
10	5
11	2
12	0

NRCS Log-Pearson Frequency Analysis Spreadsheet, Version 2.0, 3/2003 *Page 3 of 3*

Project: *Renova*
Streamgage: *Rio Grande de Arecibo above Arecibo*
Date: *2/17/2010* **Performed By:** *L. Esteban*

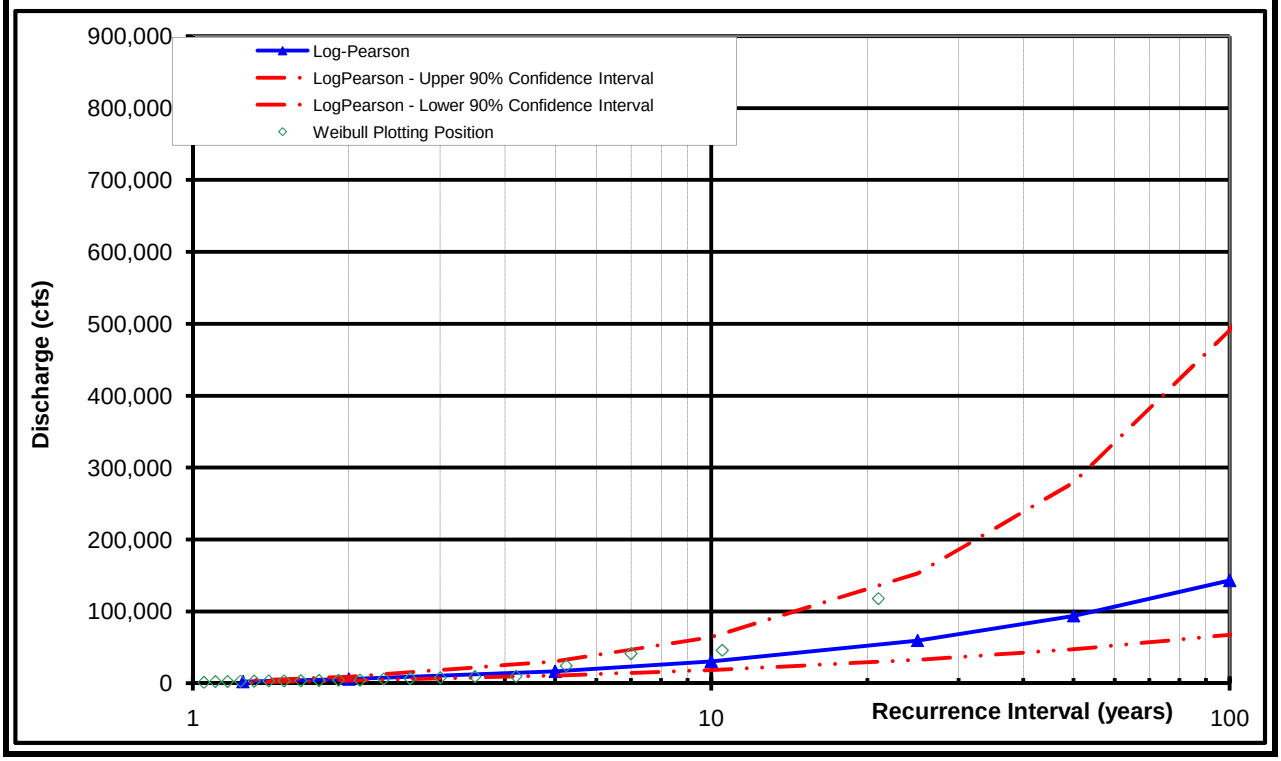
Discharge-Frequency, with Gage Skew

Rio Grande de Arecibo above Arecibo



Discharge-Frequency, with Generalized Skew

Rio Grande de Arecibo above Arecibo



NRCS Log-Pearson Frequency Analysis Spreadsheet, Version 2.0, 3/2003

Project: *Renova*
Streamgage: *Rio Grande de Arecibo above Arecibo*
Date: *2/17/2010* **Performed By:** *L. Esteban*

Input Data

Station ID: *50027750* **Latitude, Longitude:** -- --
Drainage Area (mi²): *0* **County:** *Arecibo*
Number of low outliers eliminated: *0* **State:** *PR*

	Date	Discharge (cfs)	Historic?	Outlier?
1	09/13/1982	9,310	n	n
2	04/21/1983	7,730	n	n
3	09/13/1984	5,920	n	n
4	05/18/1985	45,800	n	n
5	10/07/1985	41,200	n	n
6	02/12/1987	2,370	n	n
7	11/27/1987	9,680	n	n
8	10/30/1988	3,400	n	n
9	10/23/1989	3,300	n	n
10	10/17/1990	4,100	n	n
11	05/23/1992	3,880	n	n
12	05/28/1993	2,800	n	n
13	11/16/1993	1,270	n	n
14	09/16/1995	6,450	n	n
15	09/10/1996	24,400	n	n
16	01/22/1997	4,280	n	n
17	09/22/1998	117,598	n	y
18	10/31/1999	2,870	n	n
19	05/07/2001	2,270	n	n
20	04/30/2002	3,250	n	n
21	----	----	n	n
22	----	----	n	n
23	----	----	n	n
24	----	----	n	n
25	----	----	n	n
26	----	----	n	n
27	----	----	n	n
28	----	----	n	n
29	----	----	n	n
30	----	----	n	n
31	----	----	n	n
32	----	----	n	n
33	----	----	n	n
34	----	----	n	n
35	----	----	n	n
36	----	----	n	n
37	----	----	n	n
38	----	----	n	n
39	----	----	n	n
40	----	----	n	n
41	----	----	n	n
42	----	----	n	n
43	----	----	n	n
44	----	----	n	n
45	----	----	n	n
46	----	----	n	n
47	----	----	n	n
48	----	----	n	n
49	----	----	n	n
50	----	----	n	n

	Date	Discharge (cfs)	Historic?	Outlier?
51	----	----	n	n
52	----	----	n	n
53	----	----	n	n
54	----	----	n	n
55	----	----	n	n
56	----	----	n	n
57	----	----	n	n
58	----	----	n	n
59	----	----	n	n
60	----	----	n	n
61	----	----	n	n
62	----	----	n	n
63	----	----	n	n
64	----	----	n	n
65	----	----	n	n
66	----	----	n	n
67	----	----	n	n
68	----	----	n	n
69	----	----	n	n
70	----	----	n	n
71	----	----	n	n
72	----	----	n	n
73	----	----	n	n
74	----	----	n	n
75	----	----	n	n
76	----	----	n	n
77	----	----	n	n
78	----	----	n	n
79	----	----	n	n
80	----	----	n	n
81	----	----	n	n
82	----	----	n	n
83	----	----	n	n
84	----	----	n	n
85	----	----	n	n
86	----	----	n	n
87	----	----	n	n
88	----	----	n	n
89	----	----	n	n
90	----	----	n	n
91	----	----	n	n
92	----	----	n	n
93	----	----	n	n
94	----	----	n	n
95	----	----	n	n
96	----	----	n	n
97	----	----	n	n
98	----	----	n	n
99	----	----	n	n
100	----	----	n	n

	Date	Discharge (cfs)	Historic?	Outlier?
101	----	----	n	n
102	----	----	n	n
103	----	----	n	n
104	----	----	n	n
105	----	----	n	n
106	----	----	n	n
107	----	----	n	n
108	----	----	n	n
109	----	----	n	n
110	----	----	n	n
111	----	----	n	n
112	----	----	n	n
113	----	----	n	n
114	----	----	n	n
115	----	----	n	n
116	----	----	n	n
117	----	----	n	n
118	----	----	n	n
119	----	----	n	n
120	----	----	n	n
121	----	----	n	n
122	----	----	n	n
123	----	----	n	n
124	----	----	n	n
125	----	----	n	n
126	----	----	n	n
127	----	----	n	n
128	----	----	n	n
129	----	----	n	n
130	----	----	n	n
131	----	----	n	n
132	----	----	n	n
133	----	----	n	n
134	----	----	n	n
135	----	----	n	n
136	----	----	n	n
137	----	----	n	n
138	----	----	n	n
139	----	----	n	n
140	----	----	n	n
141	----	----	n	n
142	----	----	n	n
143	----	----	n	n
144	----	----	n	n
145	----	----	n	n
146	----	----	n	n
147	----	----	n	n
148	----	----	n	n
149	----	----	n	n
150	----	----	n	n

Puerto Rico

HYDROLOGIC-HYDRAULIC STUDY
RÍO GRANDE DE ARECIBO,
RENEWABLE POWER GENERATION AND
RESOURCE RECOVERY FACILITY,
ARECIBO, PUERTO RICO

Appendix H:

FEMA MT-2 Forms

GLM MORRIS ENGINEERING

U.S. DEPARTMENT OF HOMELAND SECURITY - FEDERAL EMERGENCY MANAGEMENT AGENCY

OVERVIEW & CONCURRENCE FORM

O.M.B No. 1660-0016
Expires: 12/31/2010

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 1 hour per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, U.S. Department of Homeland Security, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

A. REQUESTED RESPONSE FROM DHS-FEMA

This request is for a (check one):

☒ CLOMR: A letter from DHS-FEMA commenting on whether a proposed project, if built as proposed, would justify a map revision, or proposed hydrology changes (See 44 CFR Ch. 1, Parts 60, 65 & 72).

☐ LOMR: A letter from DHS-FEMA officially revising the current NFIP map to show the changes to floodplains, regulatory floodway or flood elevations. (See 44 CFR Ch. 1, Parts 60, 65 & 72)

B. OVERVIEW

1. The NFIP map panel(s) affected for all impacted communities is (are):

Community No.	Community Name	State	Map No.	Panel No.	Effective Date
Ex: 480301	City of Katy	TX	480301	0005D	02/08/83
480287	Harris County	TX	48201C	0220G	09/28/90
72000	Commonwealth of Puerto Rico	PR	72000C	230J	11/18/09

2. a. Flooding Source: Rio Grande de Arecibo

b. Types of Flooding: ☒ Riverine ☐ Coastal ☐ Shallow Flooding (e.g., Zones AO and AH)
☐ Alluvial fan ☐ Lakes ☐ Other (Attach Description)

3. Project Name/Identifier: Arecibo Resource Recovery

4. FEMA zone designations affected: AE (choices: A, AH, AO, A1-A30, A99, AE, AR, V, V1-V30, VE, B, C, D, X)

5. Basis for Request and Type of Revision:

a. The basis for this revision request is (check all that apply)

☐ Physical Change ☒ Improved Methodology/Data ☒ Regulatory Floodway Revision ☐ Base Map Changes
☐ Coastal Analysis ☐ Hydraulic Analysis ☐ Hydrologic Analysis ☐ Corrections
☐ Weir-Dam Changes ☐ Levee Certification ☐ Alluvial Fan Analysis ☐ Natural Changes
☐ New Topographic Data ☐ Other (Attach Description)

Note: A photograph and narrative description of the area of concern is not required, but is very helpful during review.

b. The area of revision encompasses the following structures (check all that apply)

Structures: ☐ Channelization ☐ Levee/Floodwall ☐ Bridge/Culvert
☐ Dam ☐ Fill ☐ Other (Attach Description)

C. REVIEW FEE

Has the review fee for the appropriate request category been included?	☐ Yes	Fee amount: $____
	☐ No, Attach Explanation	

Please see the DHS-FEMA Web site at http://www.fema.gov/plan/prevent/fhm/frm_fees.shtm **for Fee Amounts and Exemptions.**

D. SIGNATURE

All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Name: José D. Miranda	Company: Gregory L. Morris Engineering, P.S.C.	
Mailing Address: P.O. Box 9024157 Viejo San Juan P.R. 00902-4157	Daytime Telephone No.: 787-723-8005	Fax No.: 787-721-3196
	E-Mail Address: dmiranda@gmaeng.com	
Signature of Requester (required):	Date: October 5, 2010	

As the community official responsible for floodplain management, I hereby acknowledge that we have received and reviewed this Letter of Map Revision (LOMR) or conditional LOMR request. Based upon the community's review, we find the completed or proposed project meets or is designed to meet all of the community floodplain management requirements, including the requirement that no fill be placed in the regulatory floodway, and that all necessary Federal, State, and local permits have been, or in the case of a conditional LOMR, will be obtained. In addition, we have determined that the land and any existing or proposed structures to be removed from the SFHA are or will be reasonably safe from flooding as defined in 44CFR 65.2(c), and that we have available upon request by FEMA, all analyses and documentation used to make this determination.

Community Official's Name and Title:	Community Name:	
Mailing Address:	Daytime Telephone No.:	Fax No.:
	E-Mail Address:	
Community Official's Signature (required):	Date:	

CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

This certification is to be signed and sealed by a licensed land surveyor, registered professional engineer, or architect authorized by law to certify elevation information data, hydrologic and hydraulic analysis, and any other supporting information as per NFIP regulations paragraph 65.2(b) and as described in the MT-2 Forms Instructions. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Certifier's Name: José D. Miranda	License No.: 18045	Expiration Date: March 1, 2011
Company Name: Gregory L. Morris Engineering, P.S.C.	Telephone No.: 787-723-8005	Fax No.: 787-721-3196
Signature:		Date: October 5, 2010

Ensure the forms that are appropriate to your revision request are included in your submittal.

Form Name and (Number)	Required if ...
☒ Riverine Hydrology and Hydraulics Form (Form 2)	New or revised discharges or water-surface elevations
☐ Riverine Structures Form (Form 3)	Channel is modified, addition/revision of bridge/culverts, addition/revision of levee/floodwall, addition/revision of dam
☐ Coastal Analysis Form (Form 4)	New or revised coastal elevations
☐ Coastal Structures Form (Form 5)	Addition/revision of coastal structure
☐ Alluvial Fan Flooding Form (Form 6)	Flood control measures on alluvial fans

Seal (Optional)

U.S. DEPARTMENT OF HOMELAND SECURITY - FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

O.M.B No. 1660-0016
Expires: 12/31/2010

PAPERWORK REDUCTION ACT

Public reporting burden for this form is estimated to average 3.25 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, U.S. Department of Homeland Security, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

Flooding Source: Rio Grande de Arecibo
Note: Fill out one form for each flooding source studied

A. HYDROLOGY

1. Reason for New Hydrologic Analysis (check all that apply)

☐ Not revised (skip to section B) ☐ No existing analysis ☒ Improved data
☐ Alternative methodology ☐ Proposed Conditions (CLOMR) ☐ Changed physical condition of watershed

2. Comparison of Representative 1%-Annual-Chance Discharges

Location	Drainage Area (Sq. Mi.)	Effective/FIS (cfs)	Revised (cfs)
Downstream Dos Bocas Dam	160	174,101	174,101
at Confluence Río Tanamá	188	200,587	193,136

3. Methodology for New Hydrologic Analysis (check all that apply)

☐ Statistical Analysis of Gage Records ☒ Precipitation/Runoff Model HEC-HMS
☐ Regional Regression Equations ☐ Other (please attach description)

Please enclose all relevant models in digital format, maps, computations (including computation of parameters) and documentation to support the new analysis.

4. Review/Approval of Analysis

If your community requires a regional, state, or federal agency to review the hydrologic analysis, please attach evidence of approval/review.

5. Impacts of Sediment Transport on Hydrology

Was sediment transport considered? ☐ Yes ☒ No If yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation for why sediment transport was not considered.

B. HYDRAULICS

1. Reach to be Revised

	Description	Cross Section	Water-Surface Elevations (ft.)	
			Effective	Proposed/Revised
Downstream Limit	0.8 km upstream of mouth	FEMA C	11.81	11.84
Upstream Limit	2.9 km upstream of mouth	FEMA E	21.65	21.69

2. Hydraulic Method/Model Used

FLO-2D

B. HYDRAULICS (CONTINUED)

3. Pre-Submittal Review of Hydraulic Models

DHS-FEMA has developed two review programs, CHECK-2 and CHECK-RAS, to aid in the review of HEC-2 and HEC-RAS hydraulic models, respectively. These review programs may help verify that the hydraulic estimates and assumptions in the model data are in accordance with NFIP requirements, and that the data are comparable with the assumptions and limitations of HEC-2/HEC-RAS. CHECK-2 and CHECK-RAS identify areas of potential error or concern. **These tools do not replace engineering judgment.** CHECK-2 and CHECK-RAS can be downloaded from http://www.fema.gov/plan/prevent/fhm/frm_soft.shtm. We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS. Review of your submittal and resolution of valid modeling discrepancies may result in reduced review time.

4. Models Submitted

	Natural Run		Floodway Run		Datum
Duplicate Effective Model*	File Name: Existing	Plan Name:	File Name:	Plan Name:	MSL
Corrected Effective Model*	File Name:	Plan Name:	File Name:	Plan Name:	
Existing or Pre-Project Conditions Model	File Name:	Plan Name:	File Name:	Plan Name:	
Revised or Post-Project Conditions Model	File Name:	Plan Name:	File Name: Proposed	Plan Name:	MSL
Other - (attach description)	File Name:	Plan Name:	File Name:	Plan Name:	

* For details, refer to the corresponding section of the instructions.

☒ Digital Models Submitted? (Required)

C. MAPPING REQUIREMENTS

A **certified topographic map** must be submitted showing the following information (where applicable): the boundaries of the effective, existing, and proposed conditions 1%-annual-chance floodplain (for approximate Zone A revisions) or the boundaries of the 1%- and 0.2%-annual-chance floodplains and regulatory floodway (for detailed Zone AE, AO, and AH revisions); location and alignment of all cross sections with stationing control indicated; stream, road, and other alignments (e.g., dams, levees, etc.); current community easements and boundaries; boundaries of the requester's property; certification of a registered professional engineer registered in the subject State; location and description of reference marks; and the referenced vertical datum (NGVD, NAVD, etc.).

☒ Digital Mapping (GIS/CADD) Data Submitted

Note that the boundaries of the existing or proposed conditions floodplains and regulatory floodway to be shown on the revised FIRM and/or FBFM must tie-in with the effective floodplain and regulatory floodway boundaries. Please attach a **copy of the effective FIRM and/or FBFM**, annotated to show the boundaries of the revised 1%- and 0.2%-annual-chance floodplains and regulatory floodway that tie-in with the boundaries of the effective 1%- and 0.2%-annual-chance floodplain and regulatory floodway at the upstream and downstream limits of the area of revision.

☒ Annotated FIRM and/or FBFM (Required)

D. COMMON REGULATORY REQUIREMENTS*

1. For LOMR/CLOMR requests, do Base Flood Elevations (BFEs) increase? ☐ Yes ☒ No

   a. For CLOMR requests, if either of the following is true, please submit **evidence of compliance with Section 65.12 of the NFIP regulations**:
      - The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot.
      - The proposed project encroaches upon a SFHA with or without BFEs established and would result in increases above 1.00 foot.

   b. For LOMR requests, does this request require property owner notification and acceptance of BFE increases? ☐ Yes ☒ No
      If Yes, please attach **proof of property owner notification and acceptance (if available)**. Elements of and examples of property owner notification can be found in the MT-2 Form 2 Instructions.

2. Does the request involve the placement or proposed placement of fill? ☐ Yes ☒ No

   If Yes, the community must be able to certify that the area to be removed from the special flood hazard area, to include any structures or proposed structures, meets all of the standards of the local floodplain ordinances, and is reasonably safe from flooding in accordance with the NFIP regulations set forth at 44 CFR 60.3(a)(3), 65.5(a)(4), and 65.6(a)(14). Please see the MT-2 instructions for more information.

3. For LOMR requests, is the regulatory floodway being revised? ☒ Yes ☐ No

   If Yes, attach **evidence of regulatory floodway revision notification**. As per Paragraph 65.7(b)(1) of the NFIP Regulations, notification is required for requests involving revisions to the regulatory floodway. (Not required for revisions to approximate 1%-annual-chance floodplains [studied Zone A designation] unless a regulatory floodway is being added. Elements and examples of regulatory floodway revision notification can be found in the MT-2 Form 2 Instructions.)

4. For LOMR/CLOMR requests, does this request have the potential to impact an endangered species? ☐ Yes ☒ No

   If Yes, please submit documentation to the community to show that you have complied with Sections 9 and 10 of the Endangered Species Act (ESA). Section 9 of the ESA prohibits anyone from "taking" or harming an endangered species. If an action might harm an endangered species, a permit is required from U.S. Fish and Wildlife Service or National Marine Fisheries Service under Section 10 of the ESA.

   For actions authorized, funded, or being carried out by Federal or State agencies, please submit documentation from the agency showing its compliance with Section 7(a)(2) of the ESA.