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Development of a SWMM-GIS Flood Model for New Orleans Drainage Pumping Station No 4 Basin

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DEVELOPMENT OF A SWMM – GIS FLOOD MODEL FOR NEW ORLEANS DRAINAGE PUMPING STATION No 4 BASIN

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ABSTRACT

An urban flood damage model for the drainage area serve by Pump Station No. 4 (Prentiss, New Orleans, Louisiana) has been completed. This study presents the research effort needed to develop a stormwater management model (SWMM) integrated with GIS that includes a Damage Model to estimate the losses produced by storm events on flood prone areas. The latest LIDAR data are used for the topography.

The drainage area for this study covers approximately 3218 acres, with elevations ranging from -9 ft to 6 ft above sea level. The runoff produced is pumped into Lake Pontchartrain via London Outfall Canal. The study area includes a pump station with a capacity of 106 m^3/s and a complex drainage system including a 10 ft siphon that drains the runoff on the western side.

The hydrology and hydraulic routing for the watershed was estimated using the U.S. EPA Storm Water Management Model (SWMM) and the input of the model was created using a geodatabase composed of nodes, conduits and subcatchment areas developed in ArcGIS 8.2. The GIS was designed to take advantage of the importing node and graphic capabilities of the SWMM. Since all features used by SWMM were georeferenced, node flood elevation data were transferred back for display in geographic space. This approach allows for a more accurate volume computation of flooded areas by using Boolean operations on a Triangular Irregular Network (TIN) surface of node elevations and a TIN surface of LIDAR elevation data.

Flood volumes were obtained for the study area by simulating a series of rain events. These flood volumes were then incorporated into a Damage model to estimate damage rating curves for the

study area. The 1:100 year damage was estimated to be 17.2 million of dollars (2005 US dollars). The average annual flood damage was estimated to be 5.5 million of dollars (2005 US dollars). The developed Annual Flood Maps can be used to set rational flood insurance rates or to plan improvements to the drainage system. This information can be used by FEMA and by the private insurance industry of the State.

1. INTRODUCTION

1.1 Overview

New Orleans is a truly unique city, located in the southeastern portion of Louisiana, between the Mississippi River and Lake Pontchartrain. Geographically, the region is in close proximity to the Gulf of Mexico, and topographically near or below the sea level. These factors combine to make this area prone to flooding due to hurricanes and storm events.

Several research projects relating to the City's flood damage risk have been developed. *Levitan,* (2003) completed a study that compares the hurricane vulnerability of New Orleans and Baton Rouge. The study included three of the major hazards associated with hurricanes, storm surge flooding, extreme rainfall / rainfall flooding and extreme winds/windborne debris. As expected, the study concluded that New Orleans faces far greater hurricane hazards and is more vulnerable to significant damage from hurricanes than Baton Rouge. New Orleans is exposed to significantly greater storm surge and extreme winds. Although rainfall rates and maximum rainfall amounts are not much larger in New Orleans compared to Baton Rouge, the more urban nature, bowl-like topography, and dependency on pumps make it more vulnerable to rainfall flooding as well.

Fischetti, (2001) presents the results obtained from a computer model developed by the Louisiana State University which predicts that counter-clockwise winds of a slow moving, Category 4 hurricane, crossing the Gulf of Mexico from the southwest could drive a sea surge 30 miles inland. Their model predicts that downtown New Orleans could be under 20 feet of water 33 hours after the first storm wind touched the southern barrier Islands.

Needham, (2000) developed a study that examines hurricane based flooding that would be caused by the combination of hurricane associated rainfall and diminished pump station capacity due to storm tides. This study was done for the watershed drained by Pump Station No. 4 in New Orleans. The SLOSH model was used to predict the storm surge to estimate the capacity of the pump station at different storm categories. The results of the model explained that slow moving hurricanes often generate greater rainfall amounts and create larger storm surges resulting in greater flooding in the study area than fast moving hurricanes of the same Category. He also showed that lower Category hurricanes and tropical storms tend to have more total rainfall than the higher Category storms.

Most of the watershed drained by Pump Station No. 4 is below sea level for this reason its annual average rainfall of 58 inches has to be pumped, *Needham, (2000)*. The study area includes some of the lowest areas in the City including the area east of the Inner Harbor Navigation Canal with elevations as low as -9 ft below sea level. In addition this area has been impacted by 14 hurricanes that caused significant damage and by 28 other hurricanes and tropical storms that have caused lower damages *Barbe et al. (2003)*. Figure 1.1 presents a cross-section from the Mississippi River to Lake Pontchartrain that includes the study area.

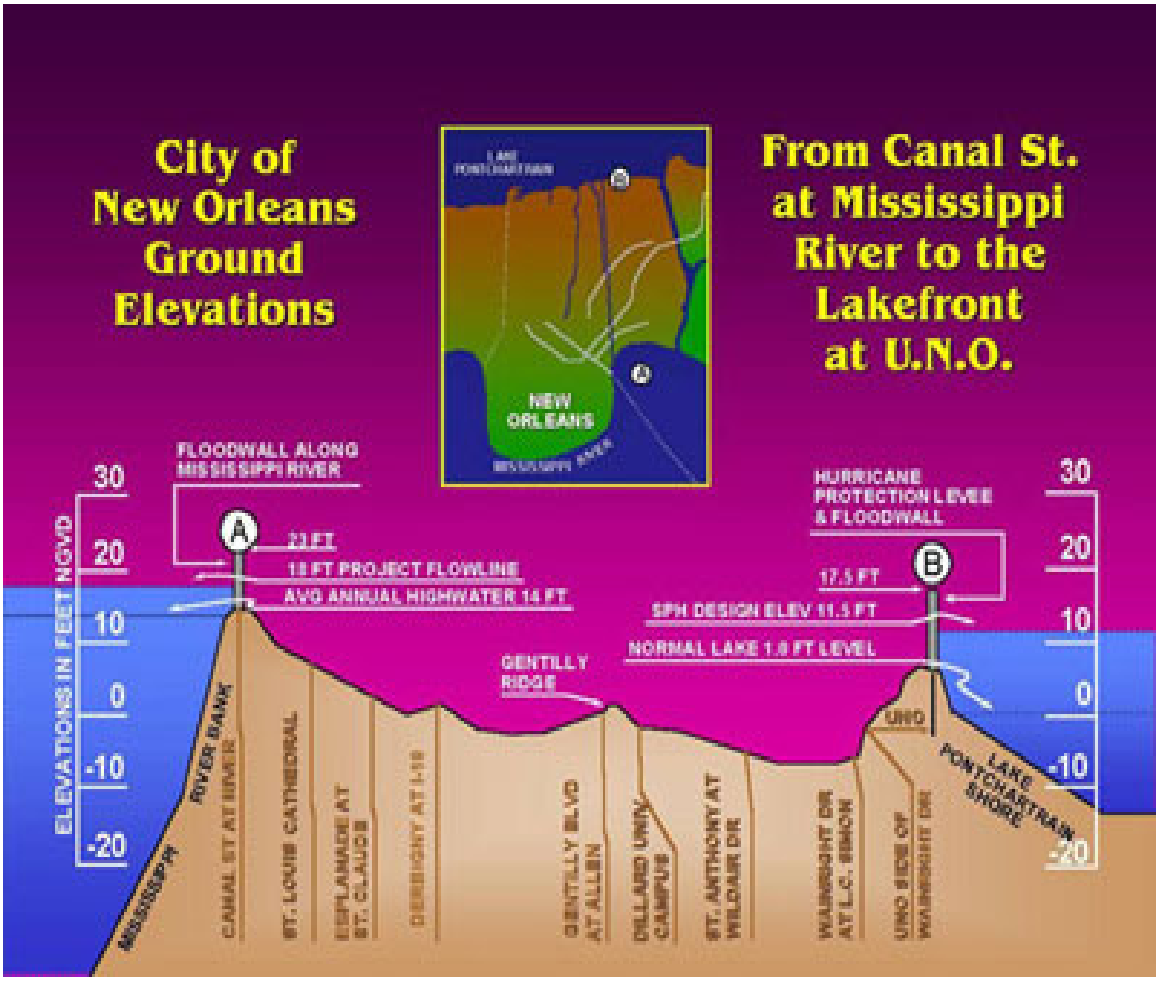

Figure 1.1 Cross-Section Including Area Drained by Pump Station No. 4 (Courtesy of Sewerage and Water Board of New Orleans/US Army Corps of Engineers New Orleans District).

The vulnerability of the drainage basin served by Pump Station No. 4 provided the motivation for developing this urban drainage model. This model could be used on flood prone area to identify zones that require drainage improvements or estimate risk in future developing areas by providing flood maps for different storm scenarios. Also in the case of flood events it could provide a tool for entities like the Federal Emergency Management Agency (FEMA) for estimating damage in the affected areas.

1.2 Objectives

- Develop a drainage database for Pump Station No. 4 drainage area that will include all the features of the actual storm water system.
- Develop stormwater model for the study area using US EPA SWMM with the PCSWMM2002 interface.
- Display the results from the drainage model back to the georeferenced space, and develop flood maps for different storm scenarios.
- Develop a damage model for the study area
- Estimate the annual flood damage and the 1:100 year flood damage for the area.

2.0 LITERATURE REVIEW AND BACKGROUND INFORMATION

2.1 Introduction

Experts believe that in the near future, most stormwater, water and wastewater system professionals will be using geographic information systems (GIS) in the same way they have used a word processor or a spreadsheet *Shamsi, (2002*). The objective of stormwater management is to prevent or mitigate the adverse effect of conveying an excessive quantity and poor quality of stormwater runoff. A GIS can be used to identify appropriate watershed-wide stormwater management control standards and in the case of flooding used as a tool to identify damage in economic terms.

The use of GIS in Urban stormwater models has been limited due to the need for large, detailed and expensive databases that are usually difficult to assemble. In addition, the fact that computer models used in stormwater modeling were not capable of being integrated with GIS. Fortunately efforts in gathering local data and developing georeferenced data are increasing. Softwares integrating GIS are improving. The use of GIS in urban stormwater is becoming more popular everyday. More than 70% of all information processed by local governments is geographically referenced or georeferenced. This georeferenced information includes i.e. land parcel, manhole, sewer segment, or building. *Shamsi et al, (1995)*

The following sections will present the efforts made by many authors in developing urban drainage models and benefits of relating their studies with GIS. The reviewed models were classified according to its relationship with GIS. Urban stormwater models and GIS can be related in different forms; i.e. when GIS works as a separate pre and post processor; or when the model is completely integrated into the GIS.

"The marriage of mathematical stormwater models and (GIS) is a natural development of simulation and database technology" *Heaney, (2000).*

2.2 Using GIS as a Preprocessor

GIS can be used as a pre-processor, by providing input parameters needed to run simulation in a specific stormwater model, or used to store georeferenced data. *Shamsi, (1995)* describes a combined sewer system in The City of Huntington, West Virginia, where the GIS was used to provide Input parameters for the Environmental Protection Agency's Storm Water Management Model (SWMM) which was selected to model the collection system. *VanGelder and Miller, (1996)* used GIS as a spatial database for modeling stormwater from a municipal airport. Georeferenced data were used in connection with maintenance data to develop an operation and management schedule as well as to link node information needed to create a SWMM EXTRAN model.

Pryl et al, (1998) applied a GIS to export parts of the urban stormwater network to a hydraulic simulator for Prague in the Czech Republic. The Danish Hydraulic Institute (DHI) program

Model of Urban Sewers (MOUSE) was used to simulate various scenarios of an urban stormwater master plan.

Mark, (1997) uses the Danish Hydraulic Institute Model MOUSE GIS to simulate the actual drainage system in Dhaka City Bangladesh. The model was used to evaluate and optimized possible solutions for the continuous floods due to rain events. Flood inundation maps for different scenarios, were generated using GIS. MOUSE results were geo-referenced and related through a coordinate system common with the DEM grid. Finally these results were displayed graphically in the GIS.

Barbe, (1993) used data transfer from a GIS and SCADA system to a SWMM model of the Jefferson Parish stormwater system in Louisiana. The RUNOFF block was used to simulate the hydrologic runoff characteristic of the area. Geospatial data were transferred from the GIS to SWMM RUNOFF data file. The EXTRAN file was used to simulate the pipe network where the network connectivity was transferred from GIS to the SWMM EXTRAN data file. One hundred and fifty monitoring sites which contain information about time series were transferred from a SCADA system to the SWMM model for Calibration purposes.

Rodriguez et al (1998) used a GIS to study stormwater aspects of an urban area in Nantes, France. This study used the urban land parcel as the base hydrologic unit of a detailed hydrologic model. A detailed water budget was performed around the owner-defined parcel. This physically based hydrologic model was then used with the stormwater network to analyze the behavior of urban catchments under a wide variety of storm events. The idea of using small hydrologic units based on land ownership for urban stormwater modeling is ideally suited for GIS applications and is useful when simulating the effect of management decisions made at the parcel level.

Sotic et al. (1998) started a preliminary design of CSO facilities in Kumodraz, Yugoslavia with paper maps. Existing paper maps and other data were used to create a GIS, which in turn was used to aid in the design and analysis of the CSO system. This "hydroinformatic" approach consists of developing a set of tools to collect and process data in a consistent manner. The attention to consistency in data transferability is to assure that the greatest value is achieved from the dataset. In this case, the GIS was used to integrate a Digital Elevation Model (DEM), the street network, and the sewer network; then this information was transferred to the BEAMUS hydraulic simulation model *Sotic et al. (1998)*.

A similar hydroinformatic approach is described for the town of Pilsen in the Czech Republic by *Hora et al. (1998)*. Beginning with paper maps, a GIS was built from the ground-up. The complete process is described, ending with an information tool that was used to create a hydrodynamic model of the sewer system, store monitored flow and rain data, evaluate current hydraulic sewer capacity and evaluate the feasibility of alternative sewer developments.

2.3 Using GIS as post-processor

GIS can be used to receive model results. GIS graphical visualization capabilities are used to display the data, before the hydrologic analysis is performed to verify the basic information, or after the analysis to evaluate the results.

Tomicic, (1999) describe an urban flooding alleviation study for the beach resort Playa de Gandia, Valencia. The runoff and flow models were built in MOUSE. A special modeling technique was applied, where a hydrodynamic model built in two layers describes both the underground (pipes) and overland network (streets). Flood inundation maps were generated using GIS (ArcView).

Sorensen, (1996) describes the use of GIS to present model output, as flood inundation maps from the GIS. MIKE GIS was used as a modeling tool, from DHI that interfaces between ArcInfo or ArcView and MIKE, a flood assessment model. *Xu et al. (1998)* describe a mixed land use hydrologic model that uses GIS as a pre- and post-processor of model information. For this application, the model output of time series of simulated flows may be depicted dynamically through an ArcView interface.

2.4 Integration of GIS and Urban Stormwater Models

Urban Stormwater Models are considered to be integrated to GIS when inputs and outputs of the drainage model are provided and presented in GIS i.e. nodes, conduits, subcatchment areas, land use, etc. *Shamsi, (1998)* defines integration as the most advanced use of drainage models and GIS. In his analysis SWMM is used as the hydrologic and hydraulic simulator and is executed from within ArcView. This form of integration includes performing all program tasks within ArcView: creating SWMM input data, editing data files, executing SWMM, and displaying output results (Shamsi 1998). Integration as defined by *Shamsi, (1998)* combines a SWMM Graphical User Interface (GUI) with a GIS to provide a complete data environment.

Feinberg and Uhrick, (1997) discuss integrating an infrastructure database in Broward County, FL with a GIS. A water distribution and wastewater model was used (Hydro Works). The Hydro Works model was used to simulate the wastewater collection system, with close integration with the database of infrastructure characteristics and the GIS. *Refsgaard et al. (1995)* describe the evolution of DHI's land process hydrologic model, SHE, and its extensive use of GIS.

Ribeiro, (1996) describes the use of a raster-based GIS to interface with the Hydrologic Simulation Program FORTRAN (HSPF) to analyze the effects of basin urbanization. *Hellweger, (1996)* developed an ArcView application using the Avenue scripting language to perform the model calculations of USDA's hydrologic model TR-55.

Nielsen et al. (1997) use the MOUSE 2000 program from DHI and MIKE11 to evaluate stormwater in Orestad, a new growth centre between Copenhagen, Denmark and Malmo, Sweden. Integration of GIS, time series, and the hydraulic model were accomplished to better understand flooding characteristics. Maximum inundation and duration of inundation were mapped using MIKE11 GIS. *Shamsi and Fletcher, (1996)* describe in detail the linkage of ArcView and SWMM for the City of Huntington, WV. ArcView is shown to be a user-friendly environment to perform stormwater modeling. *Bellal et al. (1996)* studied partly urbanized basins using a linked GIS and hydrologic model. The hydrologic model was based on a non-urban water budget, with modifications to account for urbanization. The GIS was based on a DEM and raster-based land use data.

From the review of the literature we can observe how GIS can be applied to improve modeling of urban stormwater systems, but no literature has been found that integrates GIS and stormwater modeling tools like PCSWMM with a Damage Model to estimate the damages on flood prone areas. This study addresses this deficiency and can be used to provide a more accurate tool for agencies like FEMA to establish better insurance rates or to plan remediation in flood prone areas.

2.5 FEMA and the Flood Insurance Rate

New Orleans and almost all southeastern Louisiana are included in the Special Flood Hazard Zone, since the entire area is prone to floods. In many areas of the country flood hazard areas usually are along the banks of rivers and lakes with most of the land out of the reach of flooding. To minimize the effects of flooding in the damaged areas the Federal Emergency Management Agency (FEMA), developed the National Flood Insurance Program (NFIP), which provides financial assistance to flood affected owners. The National Flood Insurance Program was established by Congress with the passing of the National Flood Insurance Act of 1968. The Program was later modified and reformed by additional legislative measures including the Flood Disaster Protection Act 1973 and the National Flood Insurance Reform Act of 1994 *FEMA, (1997).*

In order to help owners to protect themselves from excessive losses due to flooding, FEMA required that communities "adopt and enforced a floodplain management ordinance (FEMA 1997), that limits the construction within the Special Flood Hazard Areas (SFHA) (FEMA 1997).

A Special Flood Hazard Area is defined as “an area of land that would be inundated by a flood having a 1 percent chance of occurring in any given year (also known as the base or 100 year flood)” *FEMA, (1997).*

The National Flood Insurance Program covers the entire nation, not every flood prone area is subject to the same sort of flooding. Some communities may be subject to slow moving flood waters from rivers and others may suffer from drainage issues, like in New Orleans’ case. Orleans Parish is divided in three zones according to FIRM: Zone A, Zone X and X500. Zone A is defined as an area which would be inundated by a 100 year flood, Zone X is the 500 year flood zone, and Zone X500 is the area outside both the 100 and 500 year flood zones.

Flood Insurance Rates Maps define the regulatory "floodplain," and other information, based on the "estimated" flooding from an assumed amount of rainfall. It could always rain more, and history tells us that it sometimes does. Furthermore, the maps only define flooding that occurs when a creek or bayou becomes overtopped. They do not define flooding when an area receives extraordinarily intense rainfall and is not able to drain quickly enough through street or roadside drainage systems. This was the case for many areas across the South Louisiana during Tropical Storm Allison.

As results of the constant treat to flooding in New Orleans, insurance premiums are expected to increase even more in order to reflect the actual risk of the area. Many complaints from residents of other states have been heard, to claim, that New Orleans and Louisiana in general are repeat flood stricken “offenders”. The National Wildlife Federation study found that between 1978 and 1995 Louisiana led the nation in flood claims totaling more than $585 millions, *Kivlan, (1999).*

In addition, the May 1995 flood which inundated the New Orleans metropolitan area was considered the most costly flood for the insurance program, with more than 35,000 claims totaling more than $563 millions, *Carr, (1999).*

The current study will provide a more accurate way to predict floods in urban areas by efficiently using the drainage characteristic of the area, as well as the most accurate topography available. Flood maps can be easily created for different storm events, since all the outputs provided by SWMM Model can be displayed in the GIS. The model can be used to identify areas of the City with a better drainage system which could be eligible for a reduction in flood insurance rates. Areas with poor drainage can also be identified in order to improve their actual conditions. In the case of a flood event the model can be used to estimate damage in dollars for an affected area.

2.6 EPA Storm Water Management Model (SWMM)

SWMM is a dynamic rainfall-runoff simulation model, primarily but not exclusively for urban areas. It can be used for a single-event or for long-term (continuous) simulation. Flow routing is performed for surface and sub-surface conveyance and groundwater systems, including the option of fully dynamic hydraulic routing in the EXTRAN Block. Nonpoint source runoff quality and routing may also be simulated, as well as storage, treatment and other best management practices *DCCEEUO, (2004).*

The public domain program known as SWMM was originally developed through funding provided by the USEPA. It was developed between 1969 -1971, and was the first comprehensive model of its type for urban runoff analysis. Maintenance and improvements to SWMM led to Version 2 in 1975, Version 3 in 1981 and now Version 4 (3.4). Version 5.0004 of SWMM is the latest edition of this comprehensive computer model for analysis of quantity and quality problems associated with urban runoff *William, (1996).*

2.6.1 RUNOFF Block EPASWMM

The RUNOFF block is used to generate the runoff hydrograph from a sub-catchment. This module contains information on precipitation, land use, and optionally, sewerage data. The method employs the surface water budget approach and may be visualized as shown in Figure 2.1. The incident rainfall intensity is the input to the control volume on the surface of the plane; the output is a combination of the runoff Q and the infiltration f. Considering a unit breadth of the catchment the continuity and dynamic equations which have to be solved are as shown in Equations 2.1 and 2.2 *Smith (2004).*

$$iL = \left(fL + \frac{Q}{B} \right) + L\frac{\Delta y}{\Delta t} \tag{2.1}$$

$$Q = B\frac{C_M}{n} S^{1/2} \left(y - y_d \right)^{5/3} \tag{2.2}$$

where

L = overland flow length

B = catchment breadth

n = Manning's roughness coefficient

y_d = surface depression storage depth

CM = 1.0 for metric units 1.49 for Imperial or US customary units

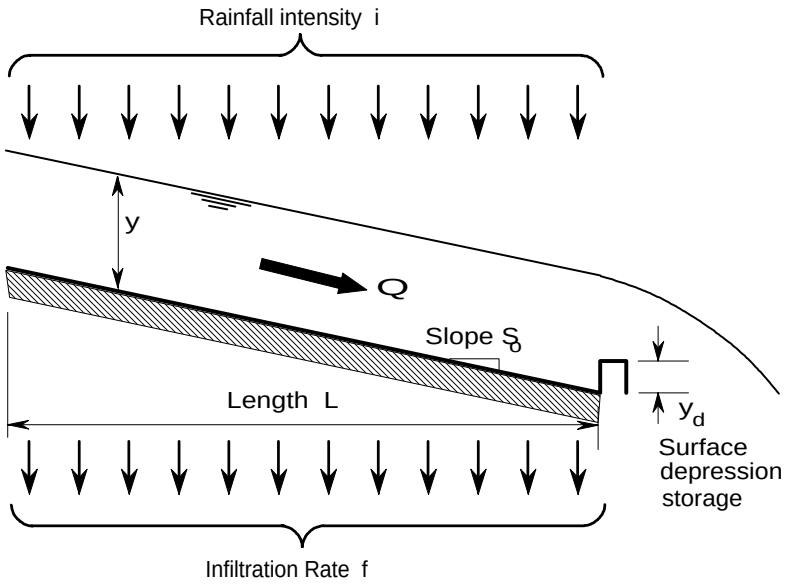

Figure 2.1 Representation of the SWMM/RUNOFF Algorithm**.**

2.6.2 EXTRAN Block EPASWMM

The EXTRAN Block is widely used in hydraulic analysis of urban drainage networks. The EXTRAN Block solves the complete dynamic flow routing equations (St. Venant equations) for accurate simulation of backwater, looped connections, surcharging, and pressure flow. Using SWMM, the modeler can simulate all single phase aspects of the urban hydrologic and quality cycles, including rainfall, snowmelt, surface and subsurface runoff, flow routing through the drainage network, storage and treatment. Statistical analyses may be performed on long-term precipitation data and on output from continuous simulation. SWMM does not include the capability to model air-water mixtures in storm sewers *Li and McCorquodale, (1999).*

2.7 Geographic Information System (GIS)

The Geographic Information System, (GIS) is a system of computer software, hardware and data, and professionals that together help people manipulate, analyze and present information that is tied to a spatial location (geographic location). Spatial features are stored in a coordinate system (latitude/longitude, state plane, UTM, etc.), which references a particular place on the earth. Descriptive attributes in tabular form are associated with spatial features. Spatial data and associated attributes in the same coordinate system can then be layered together for mapping and analysis. GIS can be used for scientific investigations, resource management, and development planning.

Figure 2.2 illustrates how the information layers are superimposed one over the other to provide information about the parcel, district, streets and land use of a certain site.

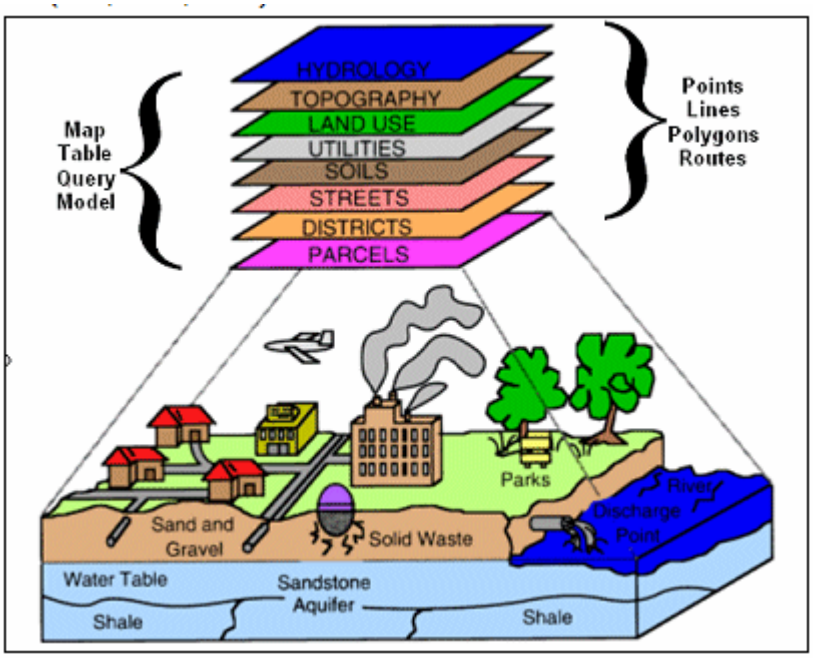

Figure 2.2 GIS Layers of information (courtesy of South Africa Department of Environmental Affairs and Tourism 1999)

Maps are often a result of a GIS analysis, as a way to visualize the geographic information. GIS differs from CAD and other graphical computer applications in that all spatial data is geographically referenced to a map projection in an earth coordinate system. For the most part, spatial data can be "re-projected" from one coordinate system into another; thus data from various sources can be brought together into a common database and integrated using GIS software.

2.7.1 Data Elements

Geographic data can be classified into two main classes: *spatial data* and *attribute data*. The two most popular types of *spatial* data are *raster* and *vector*. Raster references spatial data according to a grid of cells (or pixels), whereas vector data references spatial data to a series of coordinates. Raster data consist of different numerical values assigned to individual pixels. Raster data are more suitable for representing features without discrete boundaries such as forest cover type and precipitation. Vector data, on the other hand, consist of points, lines (or arcs), or polygons (or areas). These features are recorded in a series of coordinates. Denoting a point requires assigning one coordinate pair, a line requires 2 or more coordinate pairs, and a polygon requires 3 or more coordinate pairs. Vector data are more suitable for features that have discrete boundaries such as roads and houses *Minami, (2000)*.

2.7.2 Environmental Applications of the GIS

Environmental fields have long used GIS for a variety of applications. Examples include: floods analysis in urban areas, air/water quality modeling and monitoring, environmentally-sensitive zone mapping, forest modeling and meteorological, hydrological and geological change.

2.7.3 ArcGIS 8.2

ArcGIS® is a desktop mapping program produced by Environmental Systems Research Institute, Inc. (ESRI) that allows creation of maps from scratch starting with geographic data in electronic form. There are several interrelated component programs, the basic ones being *ArcCatalog*, *ArcMap*, and *ArcToolbox*. These three components comprise what is now known as ArcGIS Desktop, and is also known as ArcView. When other advanced components are added, it comprises ArcGIS Workstation, also known as ArcInfo *Thomas (2004)*.

2.7.4 LIDAR Data

Light Detection and Ranging (LIDAR) is a remote sensing system used to collect topographic data from an airplane. LIDAR sensors provide some of the most accurate elevation data in the shortest amount of time by bouncing laser beams off the ground. These data are collected with aircraft-mounted lasers capable of recording elevation measurements at a rate of 15,000 to 30,000 pulses per second and have a vertical precision of two feet or less.

The LIDAR instruments only collect elevation data. To make these data spatially relevant, the positions of the data points must be known. A high-precision global positioning system (GPS)

antenna is mounted on the upper aircraft fuselage. As the LIDAR sensor collects data points, the location of the data are simultaneously recorded by the GPS sensor. After the flight, the data are downloaded and processed using specially designed computer software. The end product is accurate, geographically registered longitude, latitude, and elevation (x,y,z) positions for every data point.

2.7.5 Louisiana LIDAR

Louisiana's statewide LIDAR project began in 2000 largely in response to the high per capita and repetitive flood loss rates recorded by the FEMA, National Flood Insurance Program and the private insurance industry in the State. The project is being funded by FEMA with matching funds and deliverables distribution provided by the state of Louisiana. The area of the state is approximately 50,000 sq. mi. encompassing about 3500 quarter quadrangles (3.75-minute DEM tile size). Areas in procurement include all of south east Louisiana and the majority of the coastal zone. The project will proceed in six phases over six years with the first phase (554 quarter quads) and second phase (473 quarter quads) completed in 2003. Over 900, 5-meter DEM data files, 2-foot contours and associated metadata files have been delivered and can be found on the LSU Atlas web site (http://.atlas.lsu.edu). Approximately 550 additional LIDAR quarterly quadrants are scheduled to be completed in 2004 *Cunningham, (2003)*.

2.8 New Orleans Drainage System

New Orleans Drainage System dates back to the turn of the century. In 1896, the New Orleans Drainage Commission was organized to carry out a master drainage plan that had been developed for the City. In 1903, the Drainage Commission was merged with the Sewerage and

Water Board to consolidate drainage, water, and sewerage programs under one agency for more efficient operations. This combined organization retained the title Sewerage and Water Board, and remains as such today *S&WB, (1998).*

Because the river levees are higher than the lake levees, most rainwater is pumped into Lake Pontchartrain. Exceptions are the two West Bank pumping stations and two stations in Eastern New Orleans that pump rainwater into the Intercostals Waterway or the Industrial Canal.

There are 22 Drainage Pumping Stations in New Orleans. Station personnel are on duty 24 hours a day, seven days a week. There are also 13 underpass stations, each with two or three pumps that are automatically turned on by rising water. These pumps are checked every day and are monitored by field personnel during rain events.

The system's pumping capacity is over 29 billion gallons per day, enough to empty a lake 10 square miles by 13.5 feet deep every 24 hours. That flow rate (over 45,000 cubic feet per second) is more than the flow rate of the Ohio River, the fifth largest river in the USA *S&WB, (1998).*

The Sewer and Water Board (S&WB) drainage network includes approximately 90 miles of open canals and 90 miles of subsurface canals. Many of the subsurface canals are large enough to drive a bus through *S&WB, (1998).*

2.8.1 Drainage Pumping Station No. 4

Drainage Pumping Station No. 4 (DPS4**) is** equipped of six electric pumps aligned in parallel and discharging into the London Canal. The DPS4 has a pumping capacity of 3720 ft^3/s (105 m^3/s) including two 320 ft^3/s horizontal centrifugal pumps, three 1000 ft^3/s screw pump and an 80 ft^3/s pump *Needham, (2000)*. Pumps 1 and 2 are used during dry weather operation, the rest of the pump are put in service during rain events. Table 1.1 presents the pump distribution.

Table 2.1 Drainage Pumping Station No.4 distribution

Pump	Capacity (cfs)	Horse Power (HP)
Pump 1	320	700
Pump 2	320	700
Pump C	1000	2000
Pump D	1000	2000
Pump E	1000	2000
CD Pump	80	1200

Figure 2.3 shows Drainage Pumping Station No. 4 as it looked in 1962, and Figure 2.4 shows Drainage Pumping Station as it looks, now days.

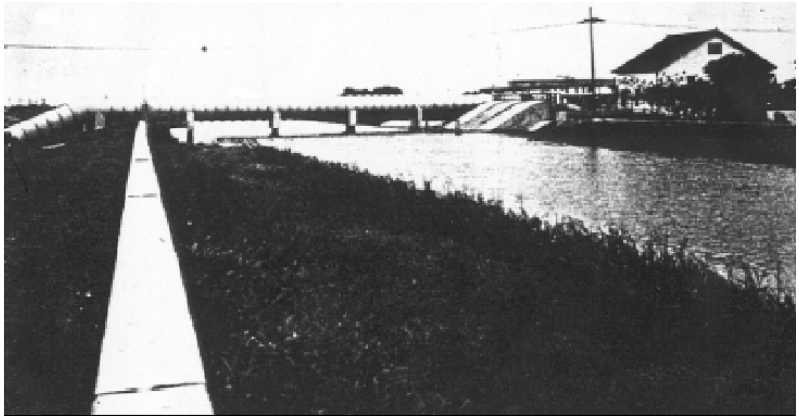

Figure 2.3 DPS4 showing 10 ft steel siphon over the London Avenue Outfall Canal (Courtesy of Sewerage and Water Board)

Figure 2.4 DPS4 viewed from the southwest, across the London Avenue Outfall Canal

(Courtesy of Sewerage and Water Board)

2.9 Study Area

Figure 1.5 shows the area drained by the Pump Station No. 4 (DPS4), the output of which is directed into Lake Pontchartrain via the London Outfall Canal. The study area is bounded to the north by Lake Pontchartrain, to the south by Gentilly Boulevard, on the east by the Inner Harbor Navigation Canal (IHNC) and to the west by the London Outfall Canal. In addition a ten foot (10') siphon drains water into the suction basin of DPS4 (Figure 2.5) from the area bounded by London Outfall Canal on the east, Filmore Avenue on the south, Paris Avenue on the west and Lake Pontchartrain on the north.

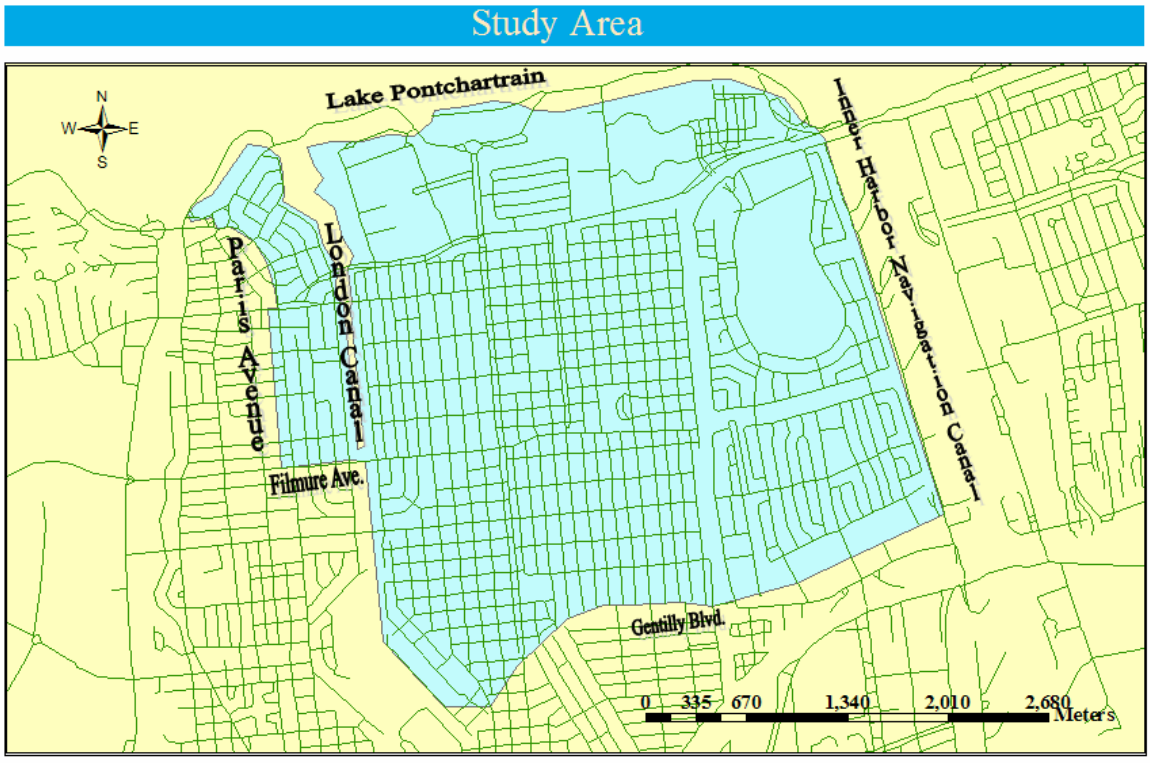

Figure 2.5 Study Area.

2.10 Historical storm events associated with the State of Louisiana

2.10.1 Hurricane Camille

Figure 2.6 Flooded Streets in New Orleans after Hurricane Camille (Courtesy of USGS).

On August 17, 1969, Hurricane Camille made landfall in Louisiana about 55 miles east of New Orleans and subsequently moved onshore through coastal Mississippi and Alabama, causing more than $1.5 billion in damage (1969 dollars). Winds were in excess of 200 mph, forcing a storm surge of 8 m. Figure 2.6 shows some of the flood damage.

2.10.2 Hurricane Betsy

Figure 2.7 St Bernard Louisiana flooding from Hurricane Betsy (Courtesy of St. Bernard Parish Government).

In September 1965 Hurricane Betsy hit New Orleans with winds of at least 125 mph, flooding large parts of the city (Figure 2.7). This hurricane destroyed almost every building in Grand Isle, where the Coast Guard station reported gusts of up to 160 mph. Betsy was caused 75 deaths in the USA, which ranks 18th deadliest among hurricanes. When all of the damage was totaled, it came to more than $1 billion in 1965 dollars.

2.10.3 Hurricane George

Figure 2.8 Lake Pontchartrain during Hurricane George (Courtesy of USGS).

In September 27-28th, 1998 George was formed in the East Atlantic, moving west-northwest and becoming a major hurricane after approaching the Lesser Antilles. The hurricane struck the Mississippi coast at Category 2 intensity. Winds gusted to 55 mph at New Orleans Lakefront Airport; the pressure fell to 29.37 inches. Storm surges above seven feet overflowed some of the land surrounding Lakes Pontchartrain (Figure 2.8) and Borgne; a storm surge of 8.9 feet was noted at Northeast Gardene Bay, east of Pointe a la Hache. A large number of fishing camps were damaged or destroyed along Lake Pontchartrain. Two casualties were left by George in Louisiana.

2.10.4 Isidore

Figure 2.9 Flooded Streets in New Orleans after Tropical Storm Isidore (Courtesy of US TODAY).

In September, 2002, tropical storm Isidore produced more than 15 inches of rain in New Orleans flooding residences in the area. About 110,000 homes and businesses in Louisiana and Mississippi lost power. As the storm moved inland maximum sustained wind was 65 mph to 9 mph were noticed in the City. Figure 2.9 illustrates a flooded street in New Orleans.

2.11 Hurricane Fran and Danny

A previous study was completed that examined hurricanes based on the flooding that would be caused by the combination of hurricane-associated rainfall and diminishing pumping capacity due to storm tides. Two hurricanes Fran and Danny were model to gauge the impact these storms would have had on the drainage area served by DPS4. According to the model, 4716 houses are affected by the fast moving category 3 Hurricane Fran which produced a flood volume of 1180 acre-feet at an economic impact of 230 million dollars. The slow moving Hurricane Danny resulted in a flood volume of 3118 acre-feet affecting 9050 houses at a greater economic impact of 650 million dollars *Barbe et al. (2003).*

Hurricane Fran made landfall as a category 3 hurricane along the southeastern North Carolina coast on September 5, 1996. It was a fast moving storm recorded at a speed near 16 mph and was relatively dry with precipitation accumulation of approximately 6 inches along the storm track where it made landfall. Figure 2.10 shows storm track and flooding from Hurricane Fran.

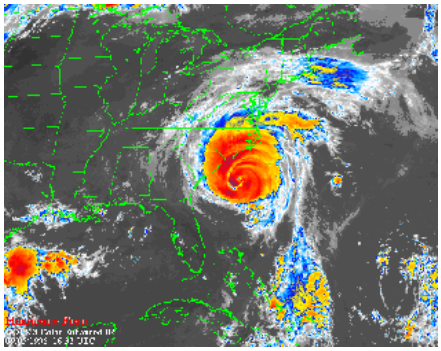

Figure 2.10 Hurricane Fran Satellite view and flooding left after its path in North Carolina (Courtesy of NOAA)

Hurricane Danny first made landfall along the southeastern Louisiana Figure 2.11 coast and later in the vicinity of Mobile Bay in mid July 1997. Danny was a slow moving storm having stalled over Mobile Bay for a period of 15 hours before finally moving inland. Danny was a wet storm with precipitation accumulation in excess of 20 inches along the storm track where it made landfall.

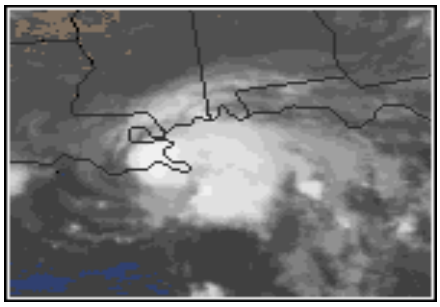

Figure 2.11 Hurricane Danny Satellite view and flooding left after its path in Louisiana (Courtesy of NOAA)

3. METHODOLOGY

3.1 Introduction

The methodology involved in developing a Storm Water Management Model (SWMM) for the study area served by Pumping Station No. 4 can be divided into the following components. Each of these stages will be discussed in detail in the next sections.

- Data Collection
- GIS Data Base
- SWMM Model
- Calibration of Model
- Display Results in GIS

3.2 Data Collection

3.2.1 Maps

Maps were collected from the Engineering Department at the Sewerage and Water Board of New Orleans (SWBNO). Unfortunately none of the maps at the SWBNO were available in digital form. All the maps acquired were hard copies, some dating back to 1930 and older. Three different types of maps were provided by Mr. Clarence Saulsby Jr. from the Engineering Department at the SWBNO, he provided us with drainage maps (Figure 3.1), profiles maps and detail maps.

The drainage maps included information about the manhole location, pipes and canal types, length and diameter. The profile maps contained information about ground elevation, conduit

slopes and the invert elevations for the main drainage trunk on the area. And Detail maps for Drainage Pump Station #4, and the 10 feet siphon that drains the area east of London Canal.

Figure 3.1 Drainage Map (Courtesy of Sewerage and Water Board of New Orleans).

3.2.2 Light Detection and Ranging Data (LIDAR)

The LIDAR data used in this study is product of the Louisiana's statewide LIDAR project, which began in 2000 in response to the high per capita repetitive flood loss rates reported by FEMA, the National Flood Insurance Program and the private insurance industry in the State.

The LIDAR data have an accuracy of 15-30 cm (depending upon land cover) and supports contours of 1– 2 feet vertical map accuracy standards. The LIDAR data was downloaded from the Atlas LSU website *http://atlas.lsu.edu*, which contains statewide GIS data for Louisiana. The LIDAR data from the Spanish Fort 30090A1 quadrant covered the study area, two quarter quadrants were downloaded the South West and South East Spanish Fort, as shown on Figure 3.2.

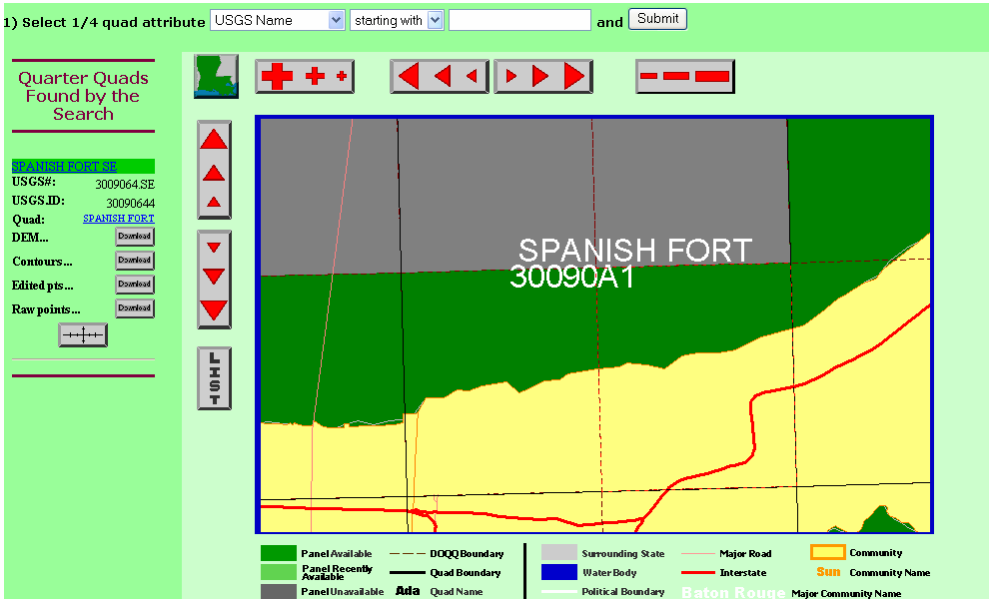

Figure 3.2 LIDAR Downloader from Atlas LSU website.

3.2.3 Precipitation Records

The rainfall records were obtained from National Climatic Data Center (NCDC) web site *http://www.ncdc.noaa.gov/oa/climate/stationlocator.html*. Two stations with hourly data were selected for the study New Orleans International Airport and the New Orleans Audubon station. The New Orleans International Airport station includes the longest hourly record in the area. This station has the following latitude and longitude coordinates $30^{o}00'$N, $90^{o}15'$W and has been in service since May 01, 1946 to present, including 59 years of hourly records. The New Orleans Audubon station at $29^{o}55'$N, $90^{o}08'$W includes 42 years of hourly record which has been in service since 1962.

3.3 GIS Data Base

3.3.1 Creating a New ArcMap

The process of creating a database was started by creating a new map using the ESRI ArcMap 8.2. Once the map was created new layers were imported into it. The LIDAR data files for the Spanish Fort SW and SE quarter quadrants were included, as well as street layer for all roads and streets in New Orleans. Figure 3.3 shows the new map with the LIDAR and New Orleans Street layers.

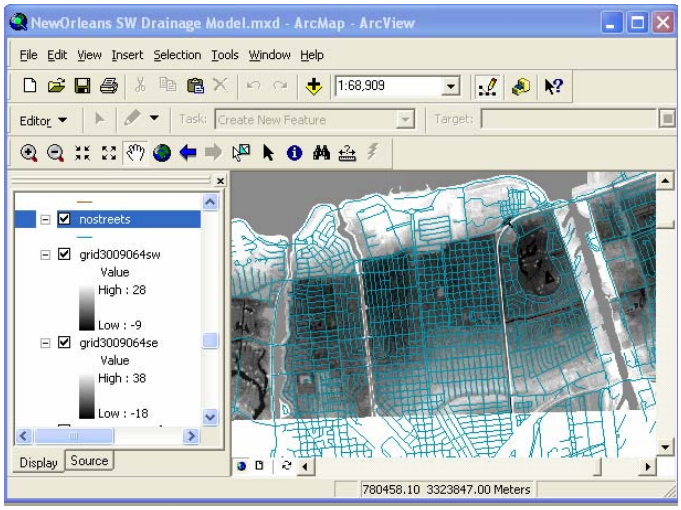

Figure 3.3 New Map including the LIDAR and New Orleans Street Layer.

3.3.2 Map Scanning

The next step was to convert the hard copy maps into digital files. To do this, each of the drainage maps collected at the Sewerage and Water Board of New Orleans were scanned in the Coastal Lab of the Geology Department as shown on Figure 3.4. The scanned images were saved as a TIFF file.

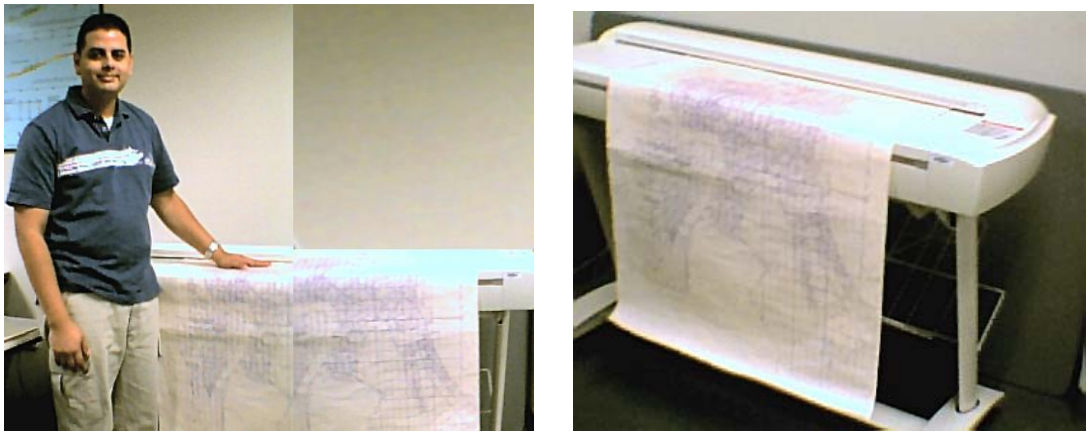

Figure 3.4 Map Scanning

3.3.3 Projecting the Scanned Maps

Georeferencing is the process of defining how raster data (maps) are situated into cardinal coordinates. Georeferenced raster data can be viewed, queried, and analyzed with other geographic data. Since no spatial referencing data were included in the scanned maps, georeferencing was required in order to project the maps into the right location in space. The Georeferencing Tool in ArcGIS 8.2 was used. A minimum of three points was required to place the map; however, the use of more control points could improve the fitting. Adding extra control points created a residual error, but this was not considered a significant problem as long as the residual error remained below 10 units. To make it easier, street intersections (from the street layer) were used as control points. When there were not enough intersections available, geographic features such as rivers and canals were used from the LIDAR layer.

To permanently place the map in position, a rectification procedure was follow by using commands on the Georeferencing toolbar. The Resample Type as Nearest Neighbor was selected. This created a new file in which the map was georeferenced to map coordinates. Figure 3.5 shows the Georeferenced maps.

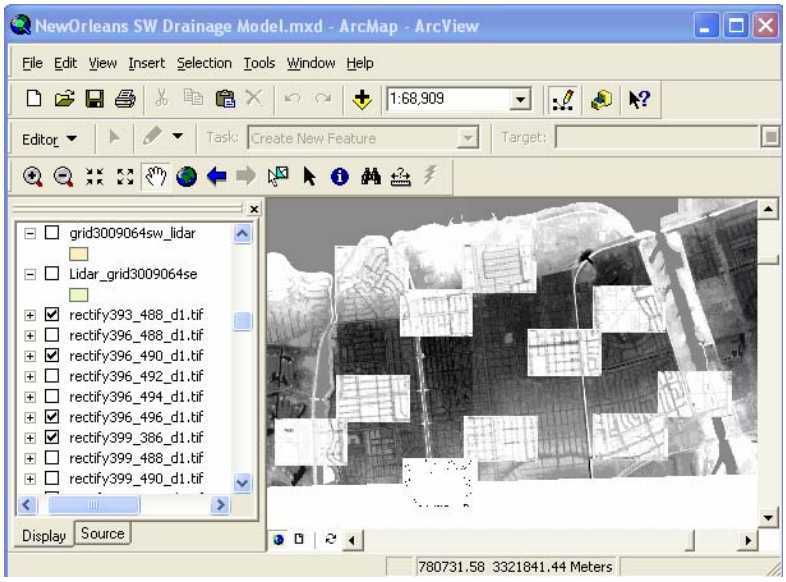

Figure 3.5 Georeferenced drainage Maps.

3.3.4 Personal Geodatabase

Using the ArcCatalog from the ArcGIS 8.2 a new personal geodatabase was created. This geodatabase was projected to a North American Datum (NAD) 1983, Universal Transverse Mercator (UTM) Zone 15. The geodatabase included three feature data sets nodes, conduits and subcatchment areas. The feature data set is a collection of feature classes that share the same spatial reference.

The feature data set contained all the fields required to match the fields used on the PCSWMM2002 when working with EXTRAN and RUNOFF modules. Figure 3.6 shows all the fields needed as to be input for a conduit in the SWMM EXTRAN Model.

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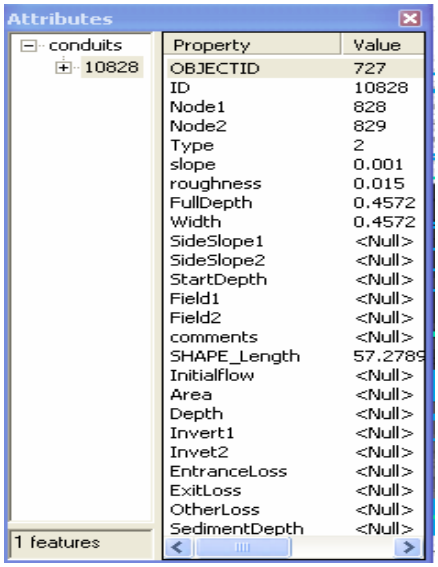

Figure 3.6 Conduit Fields.

Creating the database for this study was not an easy task, it took more than a year to be completed, starting from collecting all the information then digitizing all the features included in the database, running the model and finally calibrating it. After this stage the model was run for different storm scenarios, results were generated and displayed back into the GIS.

3.3.5 Digitizing

Digitizing is the process of converting features on a paper map into digital format. To digitize a map, you use a digitizing tablet connected to your computer to trace over the features of interest. The x,y coordinates of these features are automatically recorded and stored as spatial data.

The digitizing involved in this study consisted of creating a series of features (nodes, conduits and subcatchments) by using a transparent background layer (Drainage map) and redrawing items from it. It is like copying from a picture by overlaying a semi-clear paper over the image. Figure 3.7 illustrates the digitized nodes and conduits.

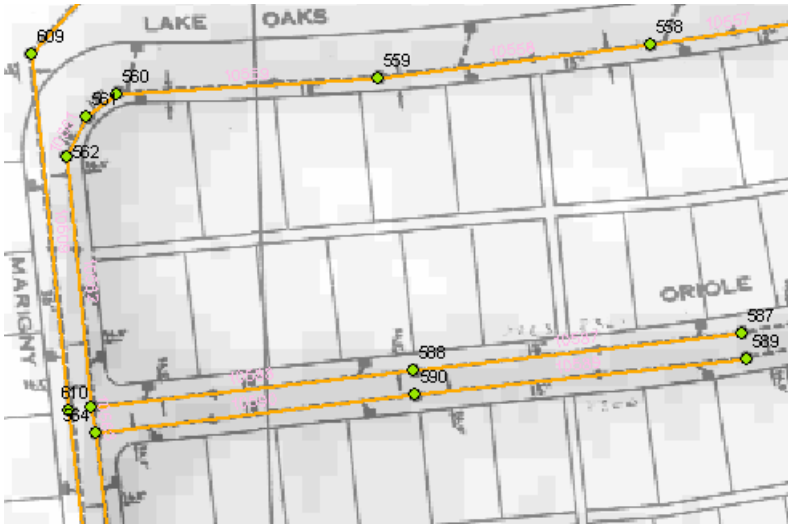

Figure 3.7 Digitized nodes and conduits.

During the digitizing phase nodes and conduits were assigned to four different layers: Nodes RUNOFF, Conduits RUNOFF, Nodes EXTRAN and Conduit EXTRAN. Each of these layer were limited to 2000 items since this is the maximum number of elements that the latest engine of PCSWMM2002 can handle (SWMM version 4.4h May,2001). Figure 3.8 illustrates all five digitized layers including the subcatchments layer.

Once all features were created and all the information relating to the fields was added, as shown in Figure 3.6. Now everything is ready to send these files to the GIS Module in PCSWMM.

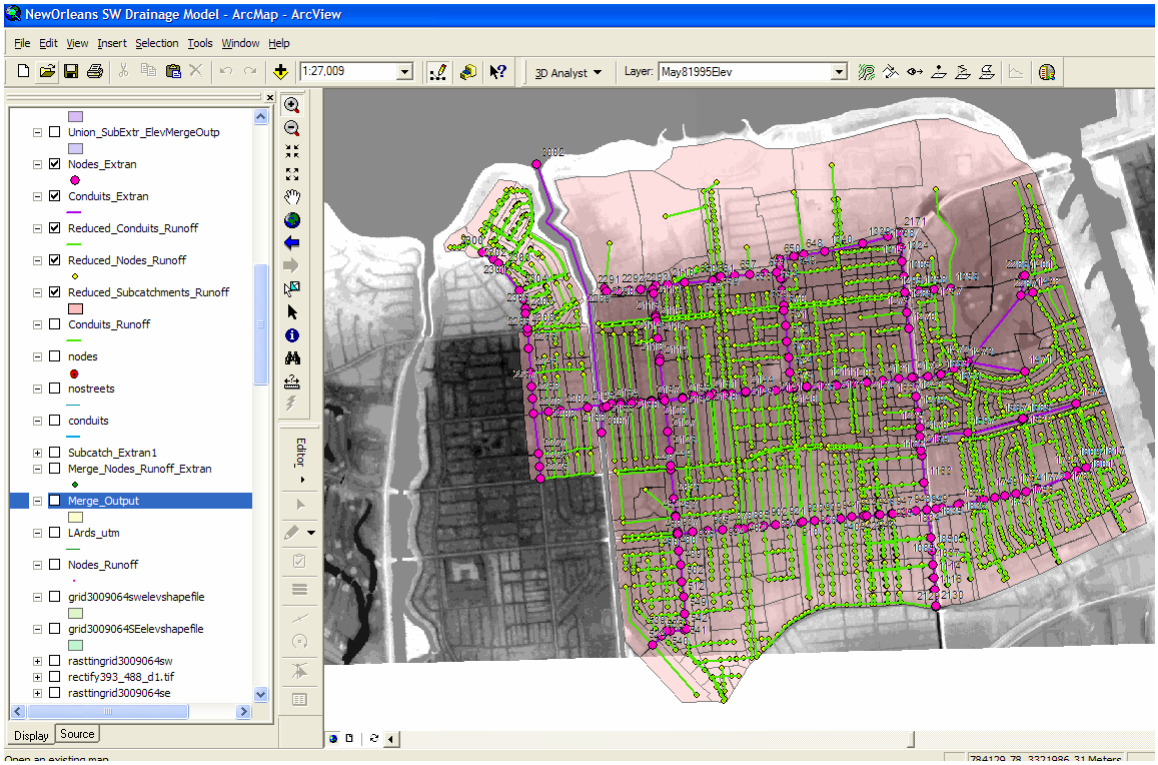

Figure 3.8 Digitized Layers

ArcGIS 8.2 populates a Microsoft Access database. The version of this Access database is 2000, so in order for the PCSWMM2002 to recognize this information, this version has to be exported to the Access version 97. Figure 3.9 shows the Access data base.

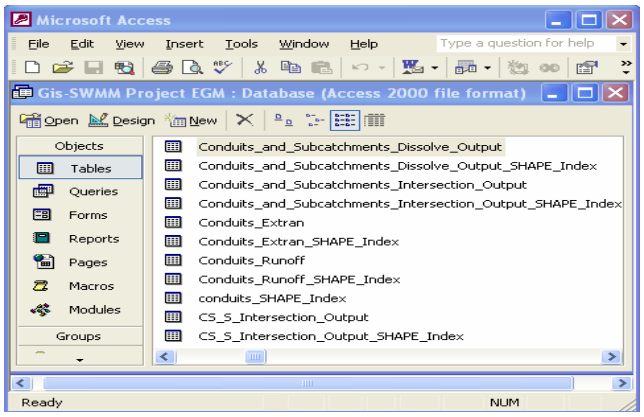

Figure 3.9 Access Database.

3.4 SWMM Model

3.4.1 Starting with PCSWMM

To start the SWMM model a new project folder is created using the PCSWMM Object Manager. Each SWMM input file created or stored under this folder is called an object of the project and is represented in the PCSWMM Object Manager as an icon. Figure 3.10 illustrates the three objects (modules) used in this SWMM simulation; the GIS, EXTRAN and RUNOFF respectively.

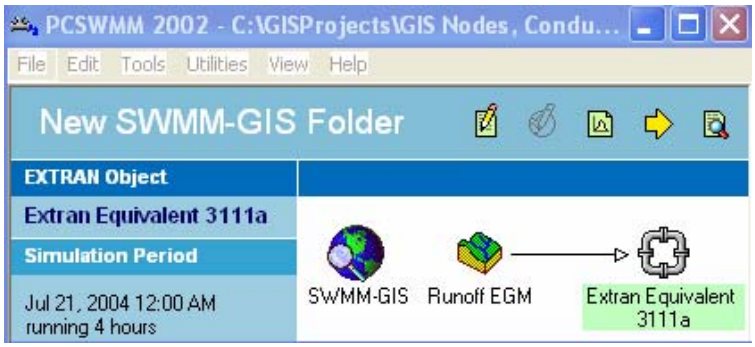

Figure 3.10 GIS, EXTRAN and RUNOFF objects.

After Creating the RUNOFF object (icon with the small watershed shape), we start to insert all the “cards” (Information lines) needed for the hydrologic simulation; titles cards, run control cards, precipitation cards, conduit cards, subcatchment cards, and printing cards.

In the same way as in the RUNOFF module after creating the EXTRAN object (icon with pipe shape), we begin by inserting the cards needed to execute this module. The cards required are the following: title cards, run control / print control, conduits / channels, junctions, storage units, weirs, pumps, boundary conditions, hydrographs. These cards will be filled later by the information imported from the GIS module.

3.4.2 GIS Module

A new GIS object is created in PCSWMM (world icon), the features and data from the GIS are imported to this file. The new SWMM GIS file is used to update the entity data required by the EXTRAN and RUNOFF input files created earlier. Figure 3.11 illustrates the EXTRAN and RUNOFF layers within the SWMM-GIS tool.

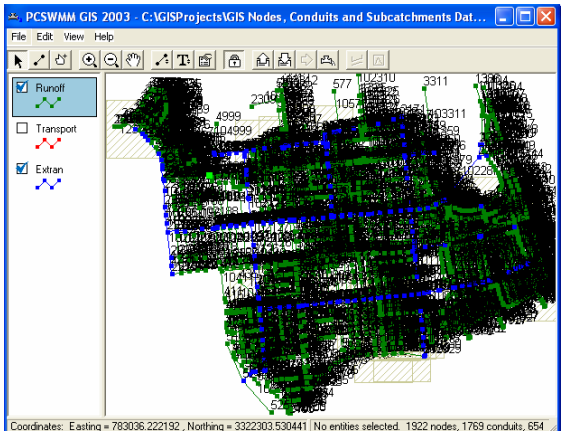

Figure 3.11 Imported RUNOFF and EXTRAN Layers on the PCSWMM.

In order to update the input files, we use the *Update Input File from GIS* tool on the GIS Module. In the *Update Associated Input File from GIS* dialog box, we have to ensure that *All entities on layer* and *Update matching entities* are selected. Figure 3.12 exemplify these explanations.

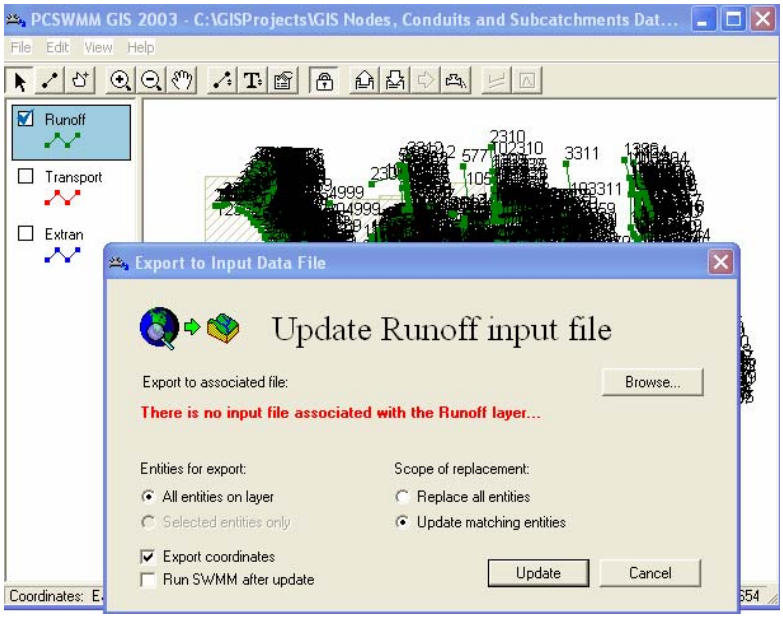

Figure 3.12 Export to Input Data file tool.

Once the files have been updated and reviewed, the RUNOFF AND EXTRAN files can be run and the model is now ready to start with the analysis and calibration procedure.

3.5 Calibration of the Model

3.5.1 May 1995 Local Flooding

In May 8 1995 the City of New Orleans was affected by a meteorological phenomenon known as "Train Echo". This unique effect was produced as result of warm water-laden Gulf air "sandwiched" between a cold front that sited low over the eastern half U.S and Gulf stream air (rushing up from Mexico at 22,000 feet). The water-laden air was pushed upward, colliding with the Gulf Stream air, and releasing its water content (USACOE 1995). Figure 3.13 illustrates this effect.

The “Train Echo Effect” resulted in a considerable amount of rain falling over a concentrated area in short period of time. The May 1995 flood event was truly unique, with flood frequency varied by location, in some areas exceeding a 1:500-year event.

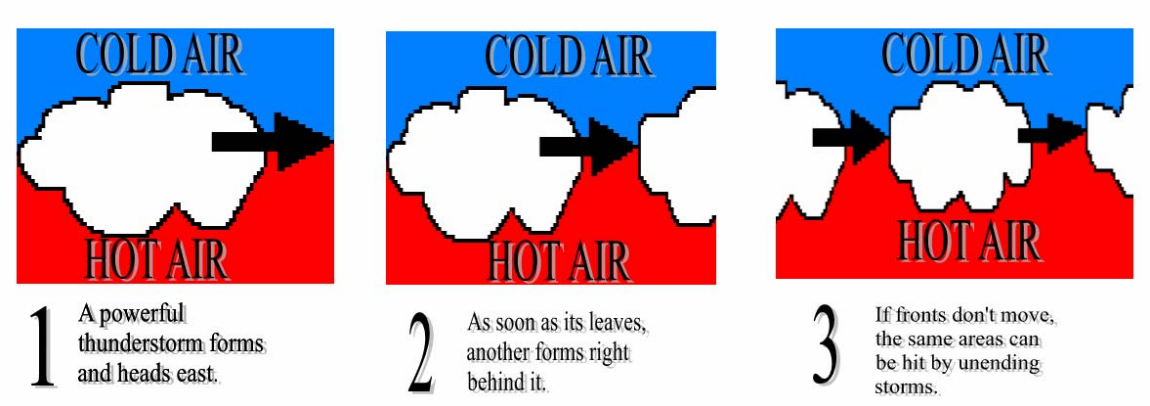

Figure 3.13 Train Echo Effect (Courtesy of the US Army Corp of Engineers (ACOE) 1995)

Twelve parishes were declared disaster areas, Jefferson, St Charles, Orleans, St Tammany, Tangipahoa, St Bernard, St John the Baptist, St James, Ascension, Lafourche, Terrebonne, and Assumption. In Orleans Parish alone the damage was estimated to be $164,507,064 with 12,876 residences affected *USACOE, (1995).*

For the severity of flooded areas and for being considered the most expensive rain event by the insurance industry in the history of South Louisiana, this event was selected to calibrate the Storm Water Model. Reports of areas flooded, areas not flooded, residence reports of flood depths and insurance claims were used to calibrate flood depth throughout the study area.

3.5.2 Fixing Errors

After importing all the information from the GIS Module into the RUNOFF and EXTRAN the model was ready to begin the calibrating process. We first started by fixing minor errors, like nodes that were not connected or missing, correcting typographical input errors, adding missing cross sections, and reducing the number of feature to less than 2000 since this is maximum number of conduits, nodes and subcatchments that PCSWMM can simulate.

Identify the errors in such a large model was possible because every time the SWMM Model (RUNOFF or EXTRAN) is run, an output file is developed, which includes all the errors that stopped the simulation. After determining the errors, the Editor tool in PCSWMM was used to fix all errors.

Reducing the features to less than 2000 was a large task since the entire database had to be reviewed and modified to ensure that the RUNOFF nodes, conduits and subcatchments matched the EXTRAN features. Initially the idea was to have a subcatchment area for each of the RUNOFF nodes, but after acknowledging the limitations of the model and understanding that only the EXTRAN nodes could provide information about flooding heights it was necessary to merge the nodes, conduit and subcatchment areas. For example we merged all the subcatchment areas from more than 2000 to 654; a similar process was applied for the nodes and conduits. Only the conduits with diameter equal or greater than 3.5 ft were included in the EXTRAN module, smaller conduits were considered as gutters and were part of the RUNOFF network.

3.5.3 Storage Cards

During the May 8 1995 storm event, rain was reported to fall at a rate of 2 to 3 inches per hour during the peak storm period. These rainfall rates are not considered “rare” in the area but what was considered unusual was that these rainfall intensities continued for several hours. At the New Orleans Airport rainfall station, a rainfall record was set to 9.69 inches in a three hour period; in less than 5 hours 12.24 inches fell at the airport. In normal conditions the drainage system in New Orleans could handle this amount of rain, but since the rain fell so rapidly many areas of the City rapidly began to inundate; by midnight hundreds of thousands of residents were affected *USACOE, (1995).*

In order to simulate this event in a more accurate condition, Storage Cards were included in most of the EXTRAN nodes. The problem with the SWMM model is that every time we have surcharge in any of the manholes (nodes), all the water that flows out is lost from the system increasing the continuity error and leaving the system with less flow. Storage cards were used to retain the volume of water that under real conditions will either flow down street, until it reaches a catchments area as in Figure 3.14 and then continue flowing into the drainage system, or in the case of low elevation points, inundate the surrounding areas as shown in Figure 3.15.

Figure 3.14 Collection catchment (Courtesy of South Florida Water Management District)

Figure 3.15 Surcharging Manhole (Courtesy of Massachusetts Commonwealth 2005)

Storage areas were calculated at different elevations for each of the EXTRAN nodes, as shown on Figure 3.16. Water remains in this storage element until the conduit has enough capacity to route the volume. A long process was followed in order to obtain the tributary areas of each node at different elevations. This process can be divided into:

1) Creating shape files from both of the LIDAR files SE and SW Spanish Fort quarter quadrants, and then merging these two files together.

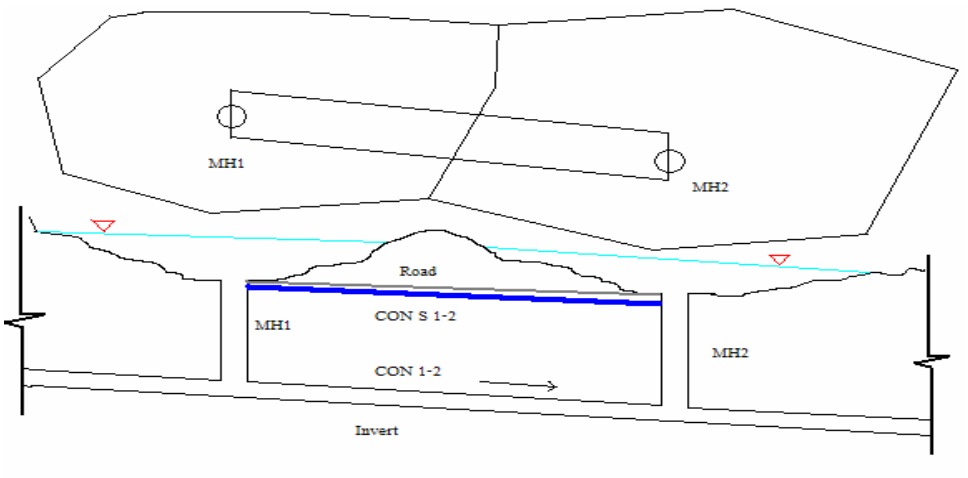

Figure 3.16 Simulated storage at each manholes

2) Develop a new shape file (subcatchment EXTRAN) that included all the tributary areas for each of the EXTRAN manholes (nodes),

3) Create a file that joins (join/intercept) the subcatchment EXTRAN file with the elevation shape file, and

4) Develop a spreadsheet with areas at different elevation.

Since both of the LIDAR files used are raster images, they needed to be converted and merged into a shapefile to combine it with the EXTRAN Subcatchment file. The final elevation file contained small areas similar to contour curves that symbolize merge pixels with same elevation as shown in Figure 3.17.

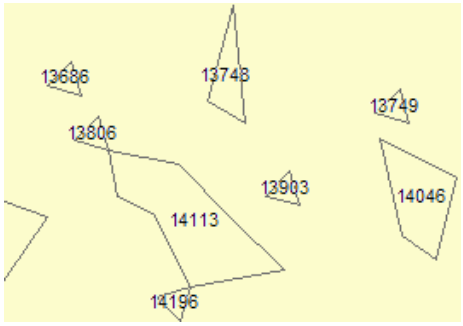

Figure 3.17 LIDAR Shape Field

The EXTRAN Subcatchment file was obtained by digitizing all the tributary areas of each EXTRAN node as shown in Figure 3.18.

Figure 3.18 EXTRAN Node Tributary Areas (Subcatchment EXTRAN)

Figure 3.19 shows the subcatchment EXTRAN file combined with the LIDAR shape file. These files were unified using the "Merge two layer" option from the GeoProcessing Wizard in ARCGIS 8.2. The new file contains areas at different elevations which are assigned after performing a Field Calculation to relate area at different elevation values.

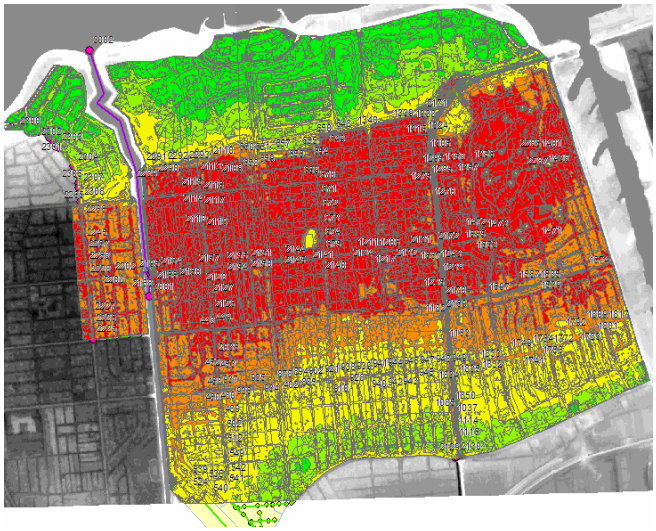

Figure 3.19 Subcatchment EXTRAN File Combined with the LIDAR Shape File

Finally a spreadsheet was used to add all the contour curves within an EXTRAN Subcatchment area, a Pivot Table within EXCEL was used to obtain total sub areas at different elevations.

3.5.4 Weir Cards

In a similar way to the EXTRAN network, the RUNOFF system has volume issues due to surcharging gutters however, in RUNOFF the extra water is not lost but is temporary stored until the gutters can handle the flow. Since the flooding is being computed in EXTRAN this extra volume is spread over time and does not really represent the local flooding for that subcatchment. In order to better represent surcharging of the gutters in RUNOFF, the gutter capacity was increased by decreasing the Manning's n (rugosity of the gutters) until the duration of surcharging was very small. These gutters were routed to a storage node (similar storage as in EXTRAN) with a weir linked to the EXTRAN node in the trunk sewer. This weir was sized to represent the inlet capacity of the trunk system for that subcatchment. Finally each weir length was adjusted to simulate the observed flooding represented by the capacity of the gutters entering the trunk sewer at each location (EXTRAN nodes). Nodes with storage were attached to the "weir" node then linked to the "trunk" node (EXTRAN node). Figure 3.20 illustrates this arrangement.

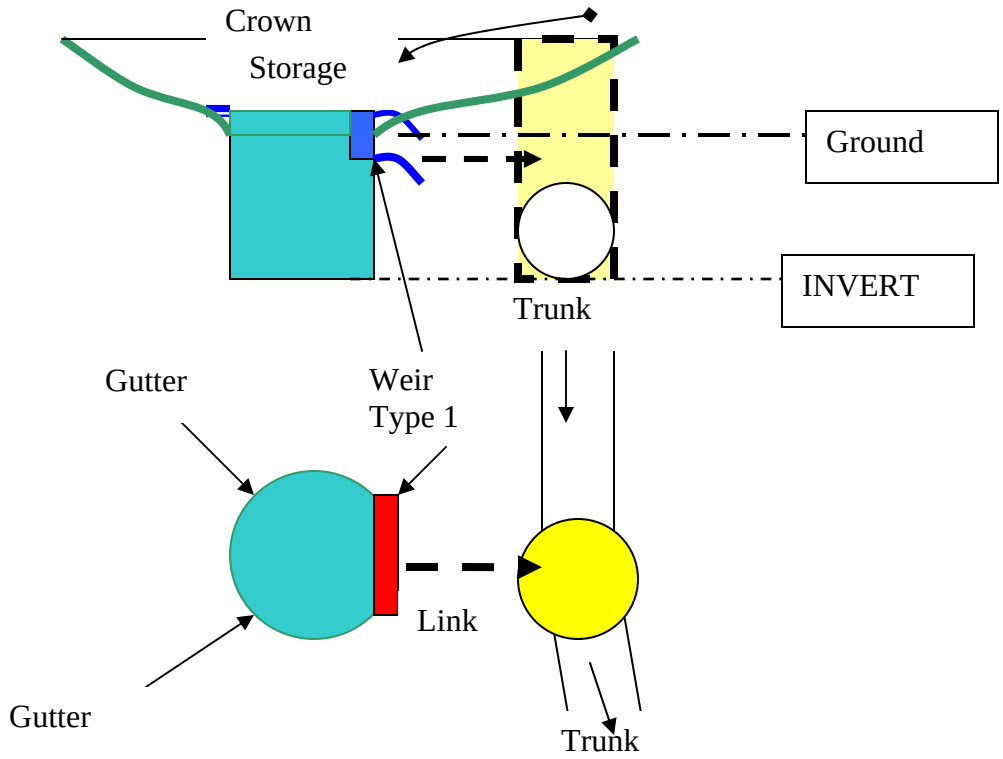

Figure 3.20 Weir connected to trunk system.

3.6 Displaying Results in GIS

Once the model was calibrated to reproduce inundation brought by the May 8, 1995 rain event, we were ready to send the results from the SWMM Model back to the GIS and visually represent the flood volumes over the entire study area. The PCSWMM2002 output contains a table with

flood elevations associated with various nodes. These elevations were copied into the attribute tables of the EXTRAN nodes. The 3D analyst was used to develop a surface layer with all these flood elevations. In a similar way, a surface layer was produced with the ground elevations from the LIDAR. Figure 3.21 demonstrates the two layers; the gray surface represents the flood height and the multicolor surface represents the ground elevation.

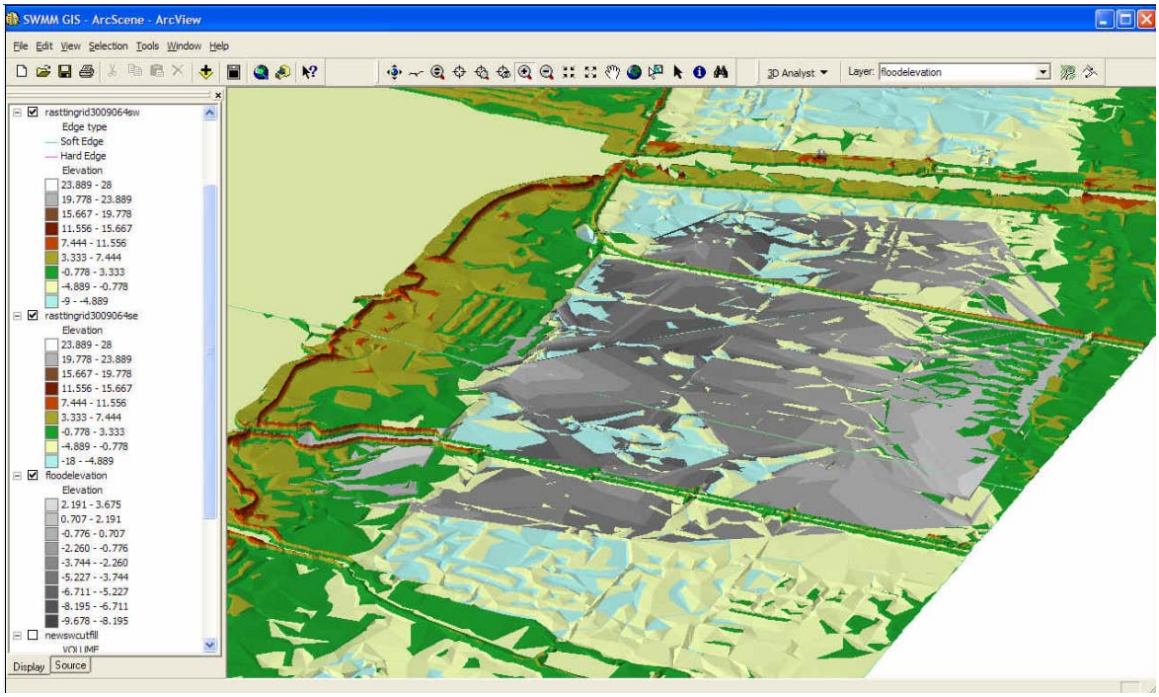

Figure 3.21 Flood and Ground Elevation Surfaces

The next step was to obtain the volume of water above the ground surface. In order to do this, a Cut and Fill (Cut/Fill) operation was needed. Using the Surface Analysis device in the 3D analyst tool, a new volume layer was obtained. The Cut/Fill operation summarizes the areas and volumes of change between two surfaces. It identifies the areas and volume of the surface that have been modified by the addition or removal of surface material (water). The Cut/Fill function will produce a raster displaying regions of surface material addition, surface material removal,

and areas where the surface has not changed over the time period. Negative volume values (blue) indicate areas that have been filled, positive volume values (red) indicate regions that have been cut. Figure 3.22 shows these results.

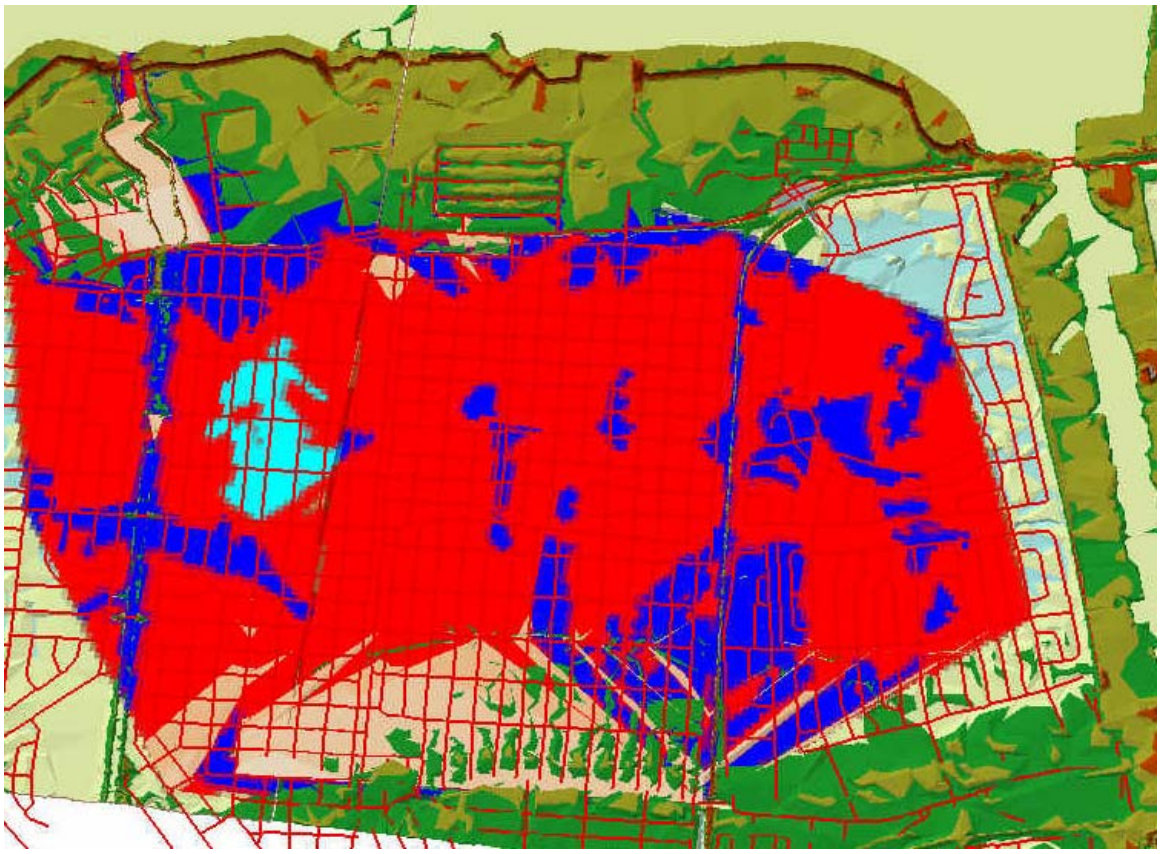

Figure 3.22 Flood Volume Layer

4. RESULTS

The following chapter presents the results and analysis derived from different simulation conducted for seven storm events in the study area. The results described in this chapter reflect the sequence pursued through out the development of the model.

4.1 Rainfall Analysis

A rainfall analysis was performed for the historic record of the New Orleans Airport Station (NOAS). The hourly rainfalls for each 24 hours in the record were accumulated and then plotted against time, to determine if there was a relationship between shape of the mass curve with time.

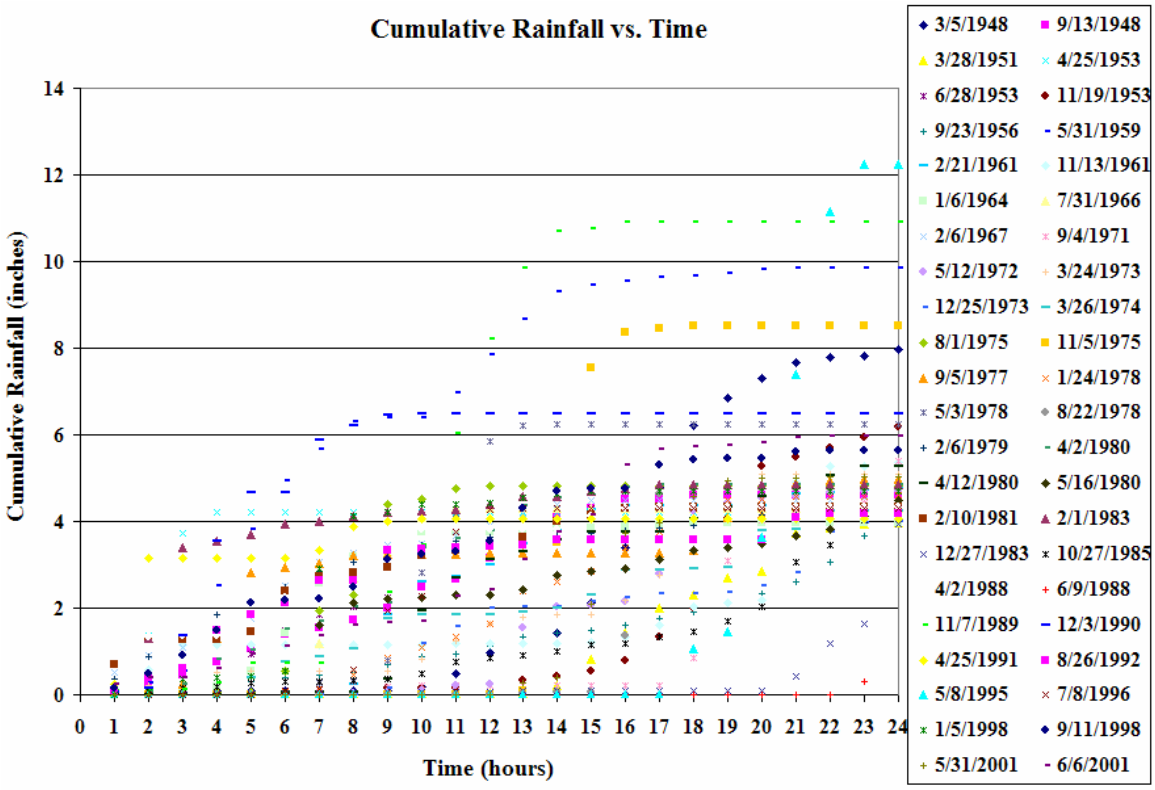

Figure 4.1 Mass Curve of New Orleans Airport 24 Hours Historic Record.

Figure 4.1 shows the plotted series for the cumulative rainfall versus time in hours. From the entire history only the days with a cumulative record higher than 3.9 in were selected. Unfortunately no clear relationship was observed for the record that was the reviewed.

The highest three records were selected to be used as input for the SWMM-GIS flood model Figure 4.2 shows the cumulative rainfall records for three of the storm events: May 8 1995 with 13.92 in (353.52 mm), Nov 7 1989 with 10.92 in (277.37 mm) and May 31 1959 with 9.85 in (250.19 mm).

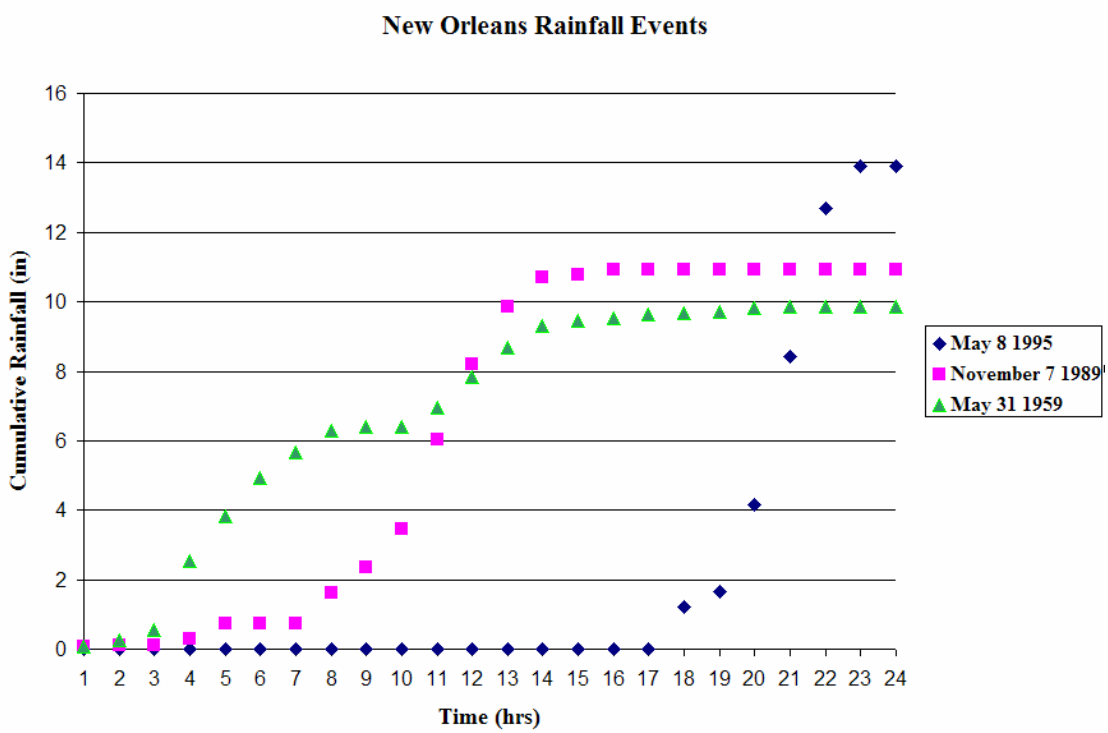

Figure 4.2 Cumulative Rainfall vs. Time for May 8 1995, Nov 7 1989 and May 31 1989.

Rainfall amounts used from the Airport Station for the rain event of May 8 1995 were adjusted to represent the estimated rainfall that was observed in the study area of 13.92 in (353.52 mm).

Five more rain events were used to examine their effects on the Study Area, i.e. Tropical Storm Isidore (September 25, 26 2001) with 9.55 in (242.57 mm), December 3 1990 with 6.47 in (164.3 mm), January 24 1978 with 4.6 in (116.8 mm), November 5 1975 with 8.52 in (216.4 mm) and a Synthetic Storm with 18 in (457 mm) from the analysis prepared by *Needham (2000)* for a slow storm, which has a forward speed equal to or less than 5 mph, including intensities over a range from .25 in/hr – 1.75 in/hr. Figures 4.3 and 4.4 illustrate the cumulative rainfall for Tropical Storm Isidore and synthetic storm events respectively. Cumulative rainfall for the other rain events can be found in Appendix B.

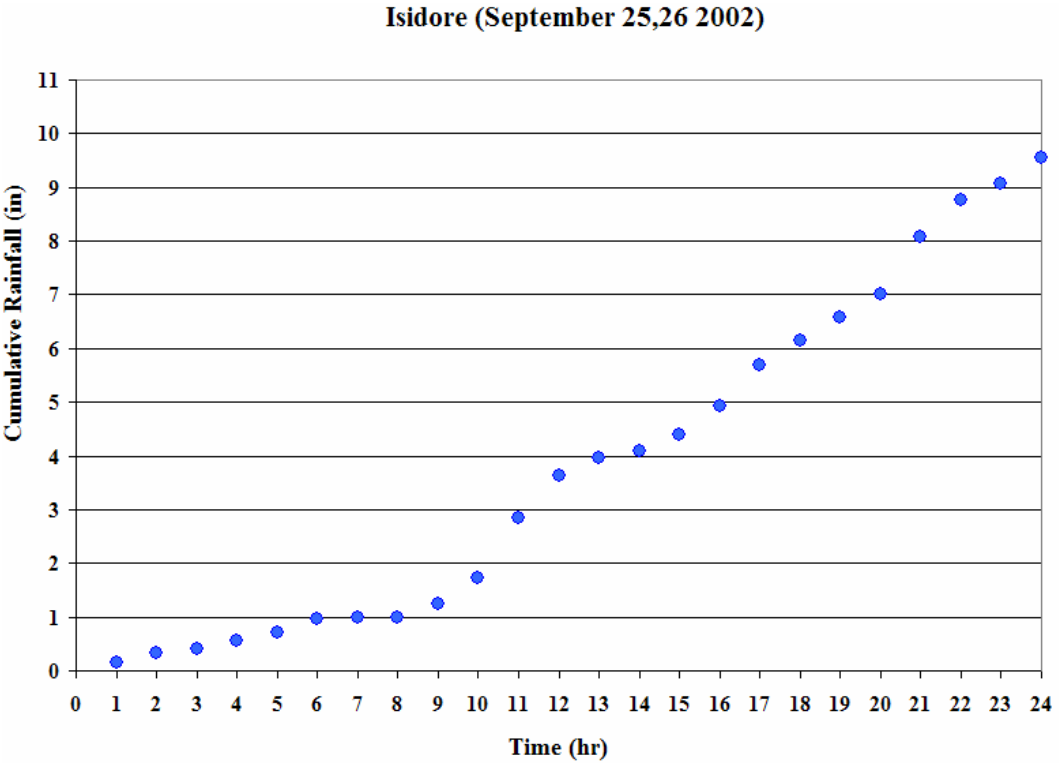

Figure 4.3 Cumulative Rainfall versus Time for Tropical Storm Isidore

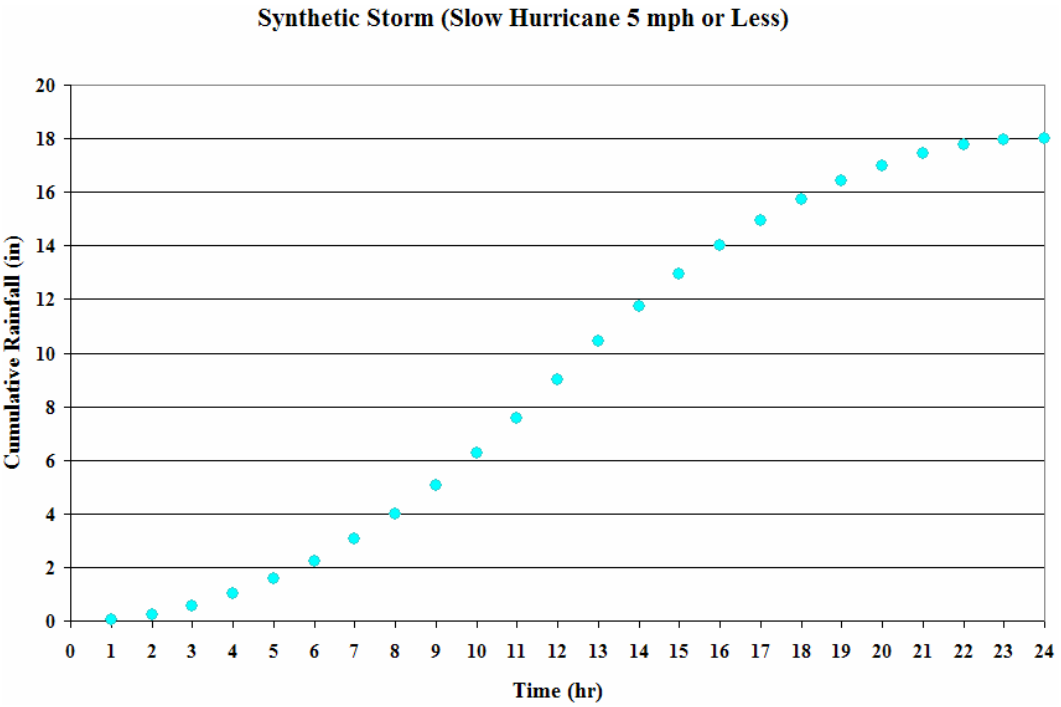

Figure 4.4 Cumulative Rainfall versus Time for Synthetic storm (Needham, 2000)

The rainfall records collected consisted of intensities averaged over a one hour interval, which means that higher possible rainfall intensities can be expected over shorter time intervals. The reduction due to averaging over one hour can significantly reduce the runoff due to peak intensities that are expected during a storm event. To account for this reduction in rainfall volume a disaggregation of the data was needed from intensities averaged over one hour to intensities at 15 or 20 minute intervals. To accomplish this, intensity duration curves from the Louisiana Department of Transportation and Development (LDTD) for Region I were used *LDTD (1984)*. Figure 4.5 presents the twenty minutes disaggregated intensities in in/hr for Louisiana Region 1.

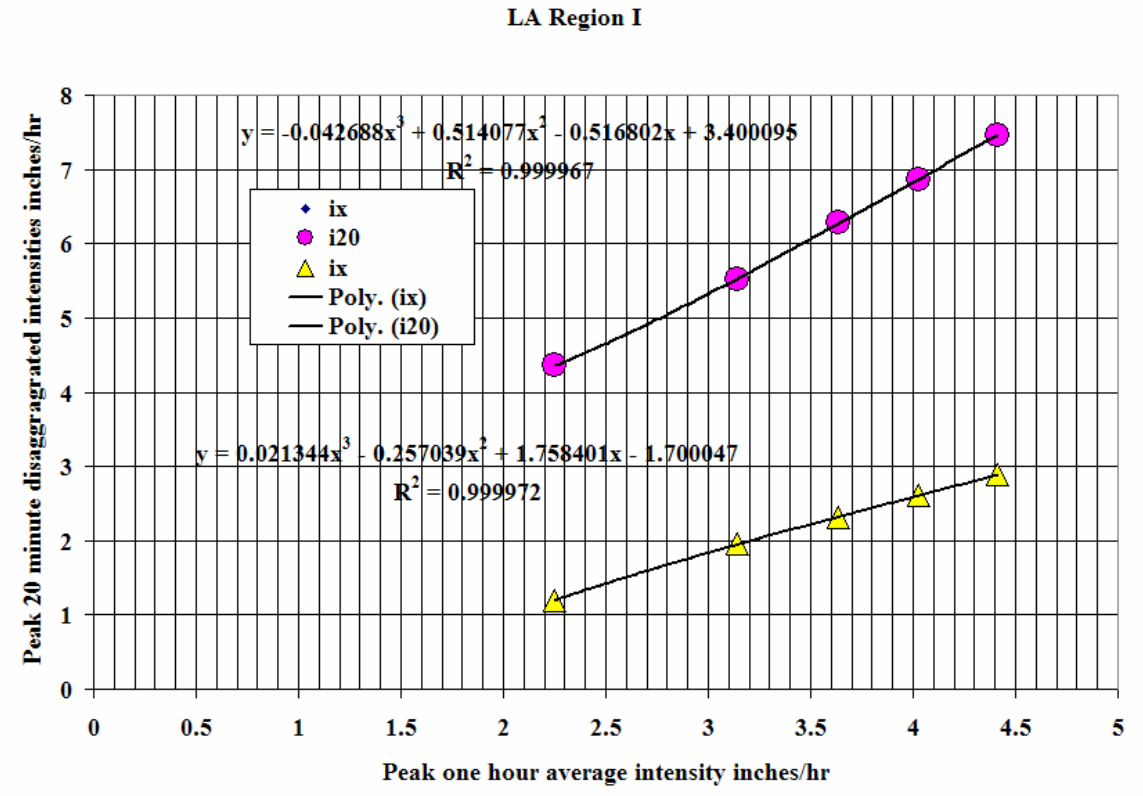

Figure 4.5 Twenty minutes disaggregated intensities relationship for Louisiana Region 1

The disaggregation relationships used significantly increased rainfall intensity values at the peak of the hyetograph, for the analyzed storm events. Equation 4.1 was used to derived the lower extreme intensity values and Equation 4.2 was used to obtained the mid high intensity value.

$$y = 0.021344x3 - 0.257039x2 + 1.758401x - 1.700047 \quad (4.1)$$

$$y = -0.042688x3 + 0.514077x2 - 0.516802x + 3.400095 \quad (4.2)$$

where x = hourly rainfall intensity, and y = twenty minute rainfall intensity.

This process was repeated for other peaks in the hyetograph. Otherwise, the rest of the intensities in the record were treated as constant. Figure 4.6 shows the five rain events presented in 20 minute interval along with the disaggregation relationships were used as well.

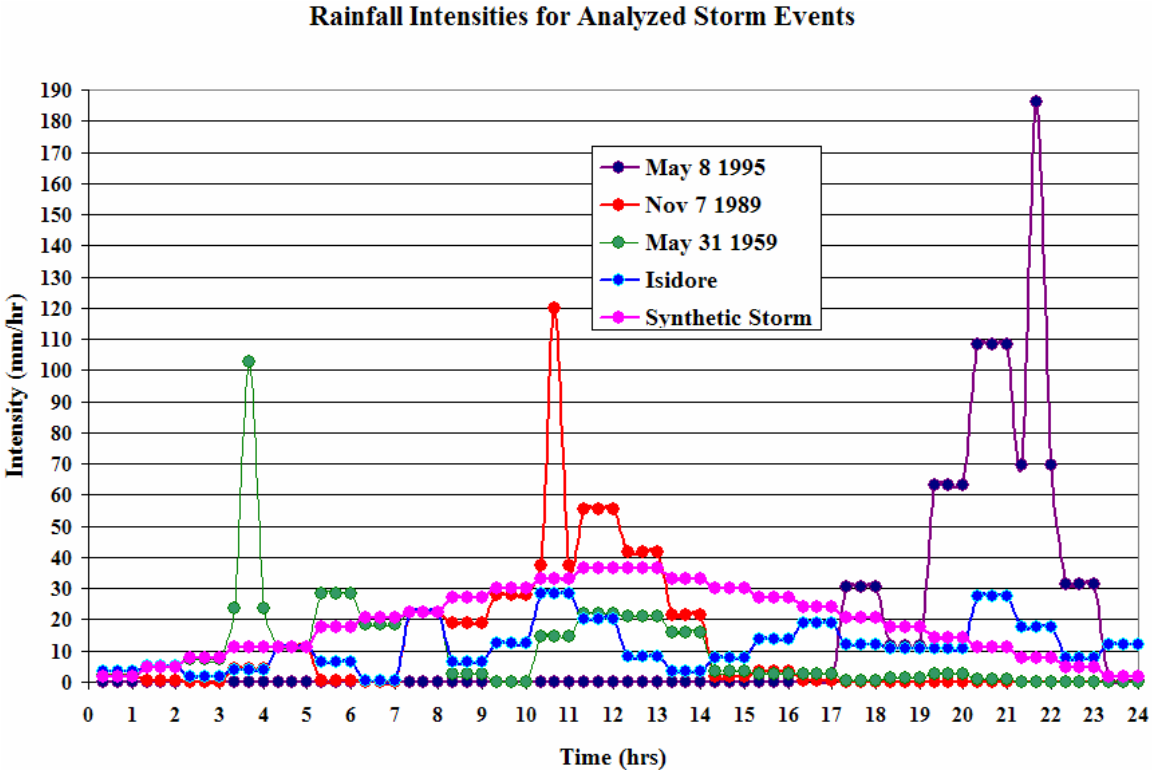

Figure 4.6 Analyzed Storm events presented in 20 minutes intervals.

4.2 RUNOFF Module Results

The following results and discussion refer to the storm event of May 8 1995. The results for the other storm events can be found in Appendix B. The results for the analyzed rain events are presented with a similar structure.

Figure 4.7 shows the rainfall hyetograph for the storm event of May 8, 1995 that was used as input for the RUNOFF block of PCSWMM 2002.

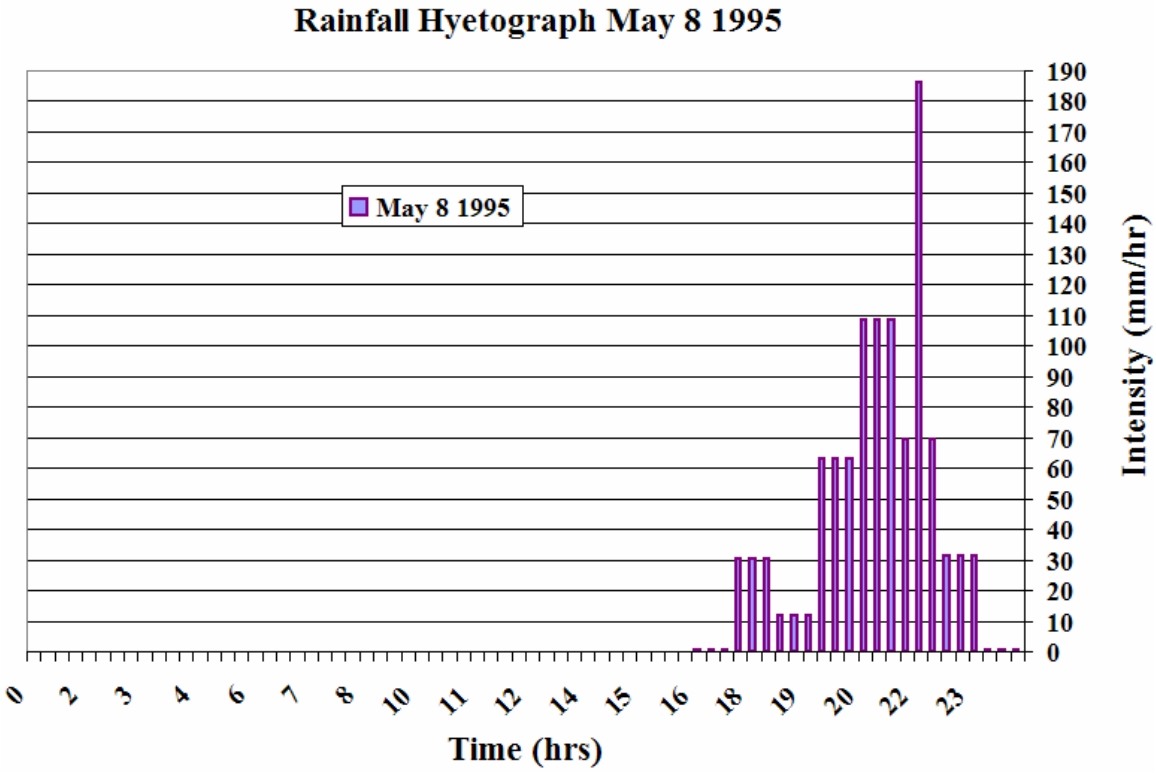

Figure 4.7 Input Rainfall Hyetograph for the Storm of May 8 1995

The simulated rain event lasted 8 hours resulting in a rainfall of approximately 354 mm and a volume of 4.10×10^6 m^3 over the entire Study Area, with a continuity error of -0.002%. Table 4.1 show a summary of results obtained from the RUNOFF simulation.

Table 4.1 Results Summary

Result Summary	m^3	(mm) over Study Area
Total Precipitation (Rain plus Snow)	4.61E+06	353.516
Total Infiltration	4.80E+05	36.886
Total Evaporation	2.03E+04	1.557
Surface Runoff from Watersheds	4.10E+06	314.696
Total Water remaining in Surface Storage	5.02E+03	0.385

Continuity error	-0.002%

The continuity error was obtained by subtracting the total infiltration, total evaporation and surface runoff from the watershed from the total precipitation and then dividing the result by the total precipitation. The continuity error is almost zero, which indicates that the simulation results are acceptable. Figure 4.8 is the Surface Hydrograph output obtained from the summation of all inlets.

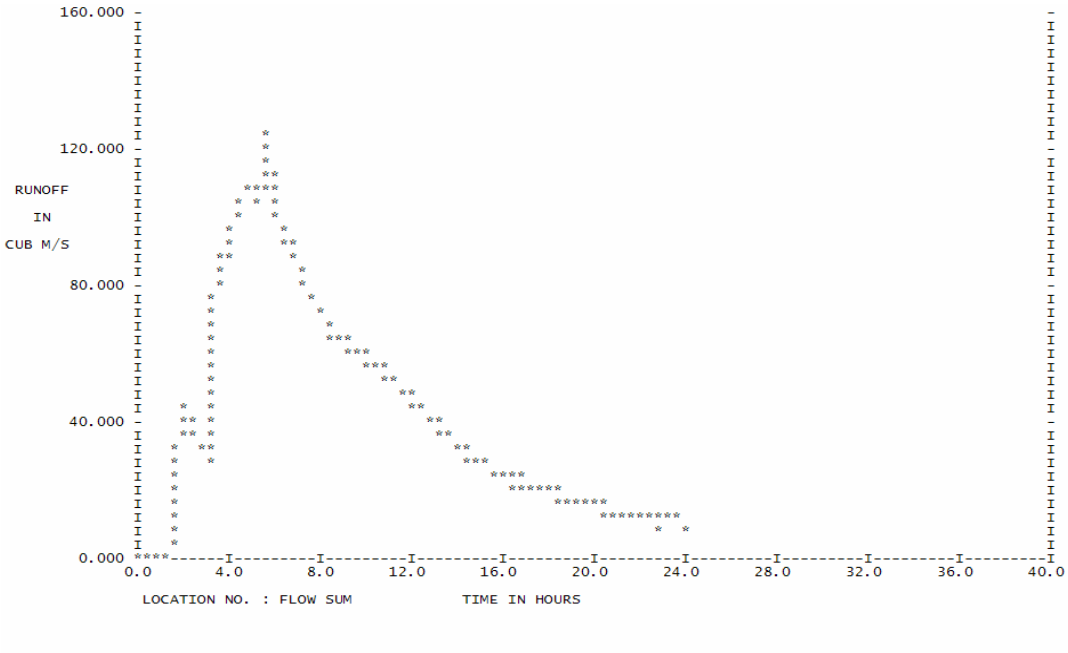

Figure 4.8 Hydrograph Output May 8 1995 Storm

4.3 EXTRAN Module Results

As mentioned before the following results will refer to the storm event of May 8 1995. The EXTRAN module was used to model the surcharge elevation in each of the 226 manholes (nodes) throughout the Study Area. Figure 4.9 shows the EXTRAN nodes and conduits included in this analysis.

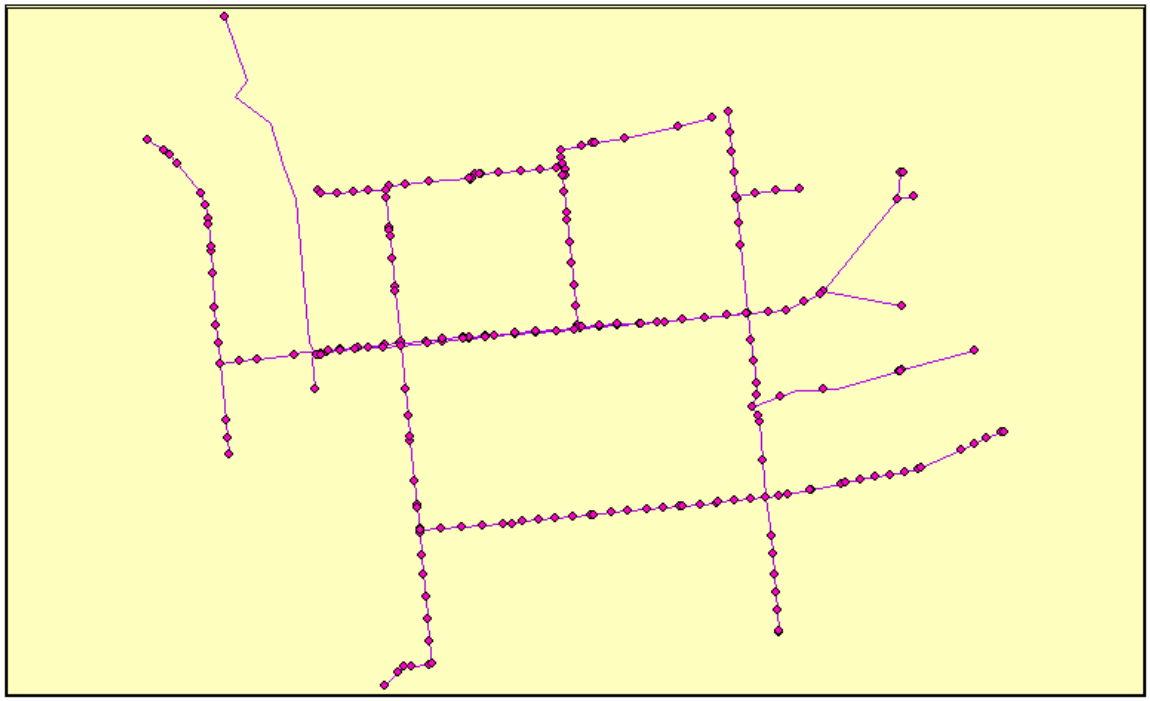

Figure 4.9 EXTRAN nodes and Conduits

Since most of the nodes were provided with storage, surcharge elevations in the affected areas could be easily identified by using the Dynamic Hydraulic Gradeline (DHGL). This tool displays the profile of any selection of channels or conduits from a SWMM EXTRAN model. The computed hydraulic gradeline can be superimposed on this profile for any time within the simulation period, or dynamically played back for the period of simulation. A profile showing peak values for both conduit flows and junction depths can also be displayed as shown on Figure 4.10.

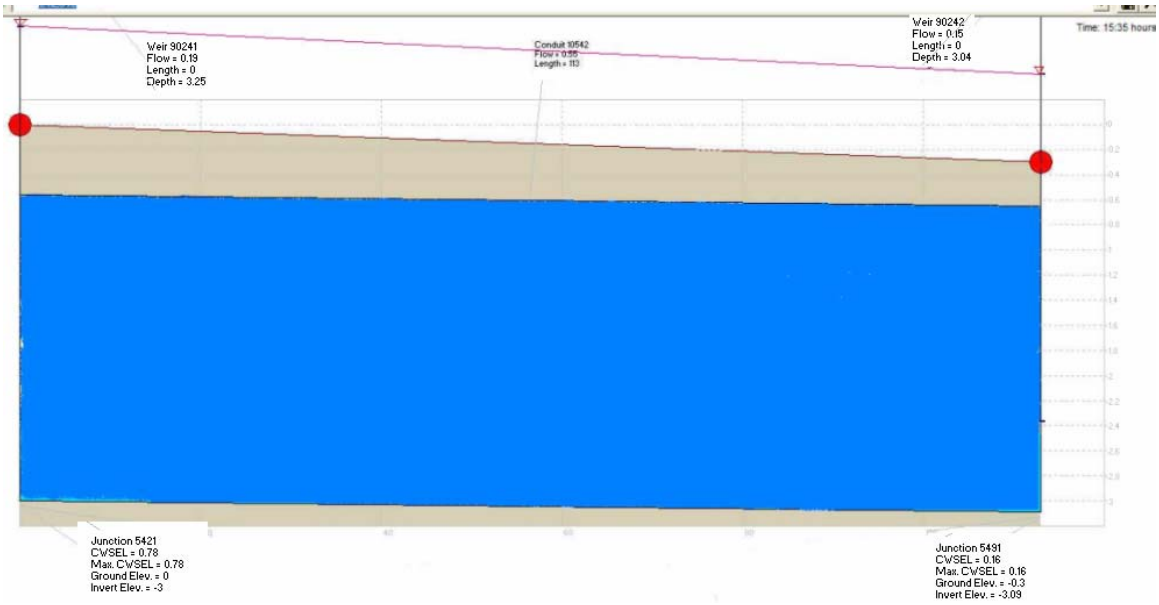

Figure 4.10 Dynamic Hydraulic Gradeline Plot for nodes 5421 (542) and 5491 (549)

The output file of the EXTRAN module provides a summary table with all the information related to the nodes and weir including its respective surcharge elevation. Table 4.2 presents a portion of this information. As noticed on Table 4.2 the numbers of the weir nodes include an extra number "1" at the end of the its junction number, which is used to distinguish between the trunk nodes and their respective weirs. Only the nodes were used to visually represent the surcharge elevation on the GIS, but if the value of the surcharge elevation or "Maximum Junction Elevation" (as named in Table 4.2) of the weir node was higher than the value of the related ground level of the associated node, this value was used to represent the flood elevation.

It is important to mention that a continuity error of -7.8% was observed in this simulation, this error can be explained due to the stored water in the drainage conduits and in each of the proposed storage nodes. In real conditions not all of the runoff is routed into the stormwater

system, some of it in the case of surcharge can be deposited in points of low elevation, as is commonly observed in New Orleans.

Table 4.2 Nodes and Weir Result Summary Table

JUNCTION NUMBER	GROUND ELEVATION (M)	UPPERMOST PIPE CROWN ELEVATION (M)	MEAN JUNCTION ELEVATION (M)	JUNCTION AVERAGE % CHANGE	MAXIMUM JUNCTION ELEV. (M)	TIME OF OCCURENCE HR.	TIME OF OCCURENCE MIN.	METERS OF SURCHARGE AT MAX ELEVATION	METERS MAX. DEPTH IS BELOW GROUND ELEVATION	LENGTH OF SURCHARGE (MIN)	LENGTH OF FLOODING (MIN)	MAXIMUM JUNCTION AREA (SQ.MET)
2121	-1.42	-1.52	-3.09	0.0444	-2.50	5	52	0.00	1.08	0.0	0.0	2.342E+03
402	-0.82	-1.45	-1.77	0.0012	-1.63	7	24	0.00	0.82	0.0	0.0	4.716E+01
4021	1.62	1.52	-0.22	0.0008	0.09	16	16	0.00	1.53	0.0	0.0	1.503E+06
309	-0.91	-2.17	-2.98	0.0023	-2.44	5	48	0.00	1.53	0.0	0.0	2.756E+01
3091	3.15	3.05	-0.35	0.0008	0.35	23	53	0.00	2.80	0.0	0.0	3.533E+06
350	-0.82	-0.82	-2.01	0.0005	-1.89	7	23	0.00	1.07	0.0	0.0	1.027E+02
3501	1.32	1.22	-0.80	0.0007	-0.56	7	0	0.00	1.88	0.0	0.0	8.547E+05
448	-1.32	-1.32	-3.07	0.0026	-2.77	7	28	0.00	1.45	0.0	0.0	3.561E+02
4481	1.93	1.83	-1.12	0.0007	-0.81	23	53	0.00	2.74	0.0	0.0	6.355E+06
449	-1.36	-1.36	-3.08	0.0023	-2.78	7	28	0.00	1.41	0.0	0.0	2.030E+02
4491	1.93	1.83	-4.41	0.0000	-4.41	0	0	0.00	6.34	0.0	0.0	1.801E+03
452	-0.73	-0.73	-2.87	0.0069	-2.62	7	30	0.00	1.89	0.0	0.0	1.990E+02
4521	-0.20	-0.30	-0.61	0.0014	-0.20	2	4	0.10	0.00	887.9	886.3	4.191E+06
453	-0.72	-0.72	-2.85	0.0076	-2.61	7	30	0.00	1.89	0.0	0.0	1.771E+02
4531	1.01	0.91	-0.40	0.0010	0.00	11	48	0.00	1.01	0.0	0.0	1.086E+06
460	-0.52	-0.52	-2.75	0.0014	-2.53	7	22	0.00	2.01	0.0	0.0	1.766E+02
4601	1.93	1.83	-0.57	0.0009	-0.07	10	43	0.00	2.00	0.0	0.0	8.355E+05
468	-0.48	-0.48	-2.73	0.0007	-2.52	7	22	0.00	2.04	0.0	0.0	1.542E+02
4681	1.62	1.52	-0.25	0.0009	0.08	17	50	0.00	1.54	0.0	0.0	1.175E+06
480	-0.61	-1.00	-2.68	0.0007	-2.49	10	37	0.00	1.88	0.0	0.0	2.538E+02
4801	1.32	1.22	-0.48	0.0009	-0.15	9	30	0.00	1.47	0.0	0.0	1.205E+06
489	-0.30	-0.92	-2.63	0.0007	-2.46	10	38	0.00	2.16	0.0	0.0	2.566E+02
4891	0.10	0.00	-0.16	0.0013	0.10	1	58	0.10	0.00	1315.0	664.8	2.760E+06
502	-0.61	-0.83	-2.59	0.0006	-2.43	10	39	0.00	1.82	0.0	0.0	2.665E+02
5021	0.10	0.00	-0.47	0.0012	-0.18	8	50	0.00	0.28	0.0	0.0	1.766E+06
540	-0.61	-1.24	-2.39	0.0004	-2.31	10	54	0.00	1.70	0.0	0.0	9.389E+01
5401	0.10	0.00	-2.76	0.0000	-2.76	0	0	0.00	2.86	0.0	0.0	1.801E+03
541	0.10	0.00	-2.46	0.0003	-2.35	10	53	0.00	2.45	0.0	0.0	1.883E+03
542	0.00	-0.56	-2.46	0.0004	-2.35	10	53	0.00	2.35	0.0	0.0	1.335E+02
5421	1.32	1.22	0.44	0.0011	0.78	16	45	0.00	0.54	0.0	0.0	4.418E+06
539	0.10	0.00	-2.34	0.0002	-2.28	10	55	0.00	2.38	0.0	0.0	1.853E+03
549	-0.30	-0.65	-2.50	0.0004	-2.37	10	45	0.00	2.07	0.0	0.0	2.557E+02
5491	0.40	0.30	-0.04	0.0014	0.40	7	58	0.10	0.00*	336.7	312.2	1.969E+06
512	-0.30	-0.74	-2.55	0.0005	-2.40	10	43	0.00	2.10	0.0	0.0	2.610E+02
5121	0.10	0.00	-0.25	0.0014	0.10	1	56	0.10	0.00	757.3	756.1	1.856E+06
524	-0.61	-1.15	-2.12	0.0003	-2.08	23	53	0.00	1.47	0.0	0.0	5.163E+01
5241	3.35	3.25	-0.04	0.0006	0.30	23	53	0.00	3.05	0.0	0.0	2.404E+06

4.4 GIS Results

From the output results of the EXTRAN runs, for the 5 analyzed rain events, flood elevations were obtained for each of the nodes. As mentioned before only the nodes are used to transfer the flood elevation into the GIS. The results of the respective weirs nodes were utilized instead of the nodes values if they provided higher surcharge elevations. Table 4.3 shows surcharge elevations at each of the EXTRAN nodes (manholes).

Table 4.3 Surcharge Elevation May 8 1995 Storm Event

ID	Surcharge Elevation (ft)	ID	Surcharge Elevation (ft)	ID	Surcharge Elevation (ft)	ID	Surcharge Elevation (ft)	ID	Surcharge Elevation (ft)	ID	Surcharge Elevation (ft)
309	1.15	672	-4.66	1239	-2.85	1792	-0.23	2142	-2.79	2268	-3.77
350	-1.84	673	-3.84	1243	-2.72	1801	-0.89	2143	-4.86	2286	-7.22
402	0.30	674	-2.17	1265	-4.04	1809	-1.80	2144	-4.66	2287	-7.28
448	-2.66	675	-7.97	1270	-3.25	1817	-0.36	2145	-4.63	2288	-0.20
449	-9.12	878	-1.84	1275	-3.18	1832	-7.41	2146	-3.67	2289	0.00
452	-0.66	885	-0.16	1285	-0.39	1833	-7.41	2147	-4.27	2290	-8.17
453	0.00	894	-0.66	1295	-3.71	1834	-7.45	2148	-3.61	2291	-8.20
460	-0.23	902	-0.66	1305	-3.97	1835	-7.48	2149	-3.67	2292	-8.23
468	0.26	910	0.13	1315	-3.31	1850	0.03	2150	-4.66	2293	-8.20
480	-0.49	921	-0.49	1324	-2.17	2028	-3.67	2151	-3.94	2300	0.16
489	0.33	928	-0.33	1338	-7.38	2029	-3.67	2152	-3.94	2301	0.00
502	-0.59	934	-0.56	1339	-7.41	2036	-9.15	2153	-3.94	2302	-0.07
512	0.33	935	-1.31	1340	-7.45	2109	-1.61	2154	-3.94	2303	-0.13
524	0.98	936	-1.67	1341	-0.79	2110	-8.14	2155	-3.94	2304	-0.49
536	0.33	937	-8.27	1356	-1.48	2111	-8.20	2156	-4.66	2305	-1.02
539	-7.48	938	0.59	1357	-3.15	2112	-8.20	2157	-3.94	2306	-1.57
540	-7.58	939	-5.28	1358	-7.55	2113	-8.23	2159	-4.66	2307	-1.80
541	-7.71	940	0.26	1401	-3.38	2114	-8.27	2160	-5.22	2308	-2.62
542	2.56	941	-2.43	1438	-4.00	2115	-4.13	2161	-4.66	21581	-6.00
549	1.31	942	-0.43	1471	-4.43	2116	-3.35	2162	-4.20		
647	-7.45	943	-1.64	1472	-7.35	2117	-4.66	2163	-3.15		
648	-7.48	944	-1.12	1473	-3.84	2118	-8.27	2164	-4.20		
649	-7.51	945	-0.59	1539	-5.09	2119	-8.27	2165	-9.71		
650	0.33	946	0.33	1567	-4.30	2120	-8.10	2166	-9.42		
652	-7.64	947	-7.28	1616	-4.95	2121	-8.20	2167	1.74		
653	-7.64	948	-7.38	1653	-7.41	2126	-9.19	2168	1.54		
654	-7.68	949	-7.48	1665	-7.48	2127	-9.28	2169	-6.99		
655	-7.71	1037	-0.46	1666	-3.67	2128	-9.25	2170	-7.55		
656	1.57	1085	-0.20	1667	-7.58	2129	0.85	2171	-7.55		
657	-7.87	1114	-2.72	1674	-2.85	2130	-7.48	2172	-7.68		
658	-7.97	1116	1.84	1685	-7.35	2131	-4.82	2195	-2.23		
659	-8.01	1143	-3.77	1697	-2.66	2132	-0.62	2202	-3.67		
660	-8.01	1163	-1.97	1710	-0.72	2133	-4.66	2208	-4.79		
661	-8.04	1182	-1.94	1724	0.03	2134	-4.66	2225	-4.79		
665	-4.10	1200	-4.66	1732	-0.95	2135	-3.67	2226	-4.86		
666	-7.74	1206	-3.54	1741	-0.89	2136	-5.97	2227	-4.86		
667	-7.78	1211	-5.45	1749	-0.95	2137	-8.37	2228	-4.69		
668	-5.94	1217	-3.77	1756	-0.85	2138	-7.84	2245	-3.44		
669	-3.67	1222	-4.56	1764	-0.33	2139	-7.97	2265	-0.69		
670	-3.67	1229	-2.66	1772	-0.33	2140	-3.67	2266	-3.05		
671	-6.53	1235	-3.18	1783	-0.95	2141	-3.67	2267	-3.58		

A Surface was created with the flood elevations, Figures 4.11 to 4.13 show these surfaces for two of the rain events analyzed. Then the volume between the ground elevation surface (LIDAR) and the surcharge elevation surface was obtained, Table 4.4 presents the flood volume produced over the entire Study Area and Figure 4.13 presents a flood volume layer.

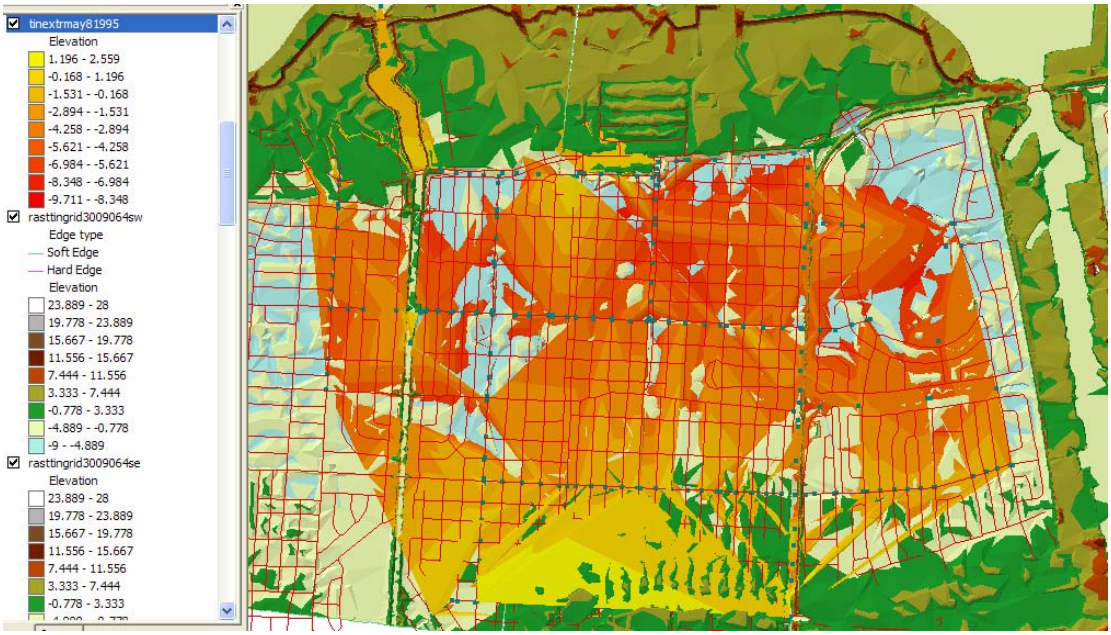

Figure 4.11 May 8 1995 Storm Flood Elevation Surface

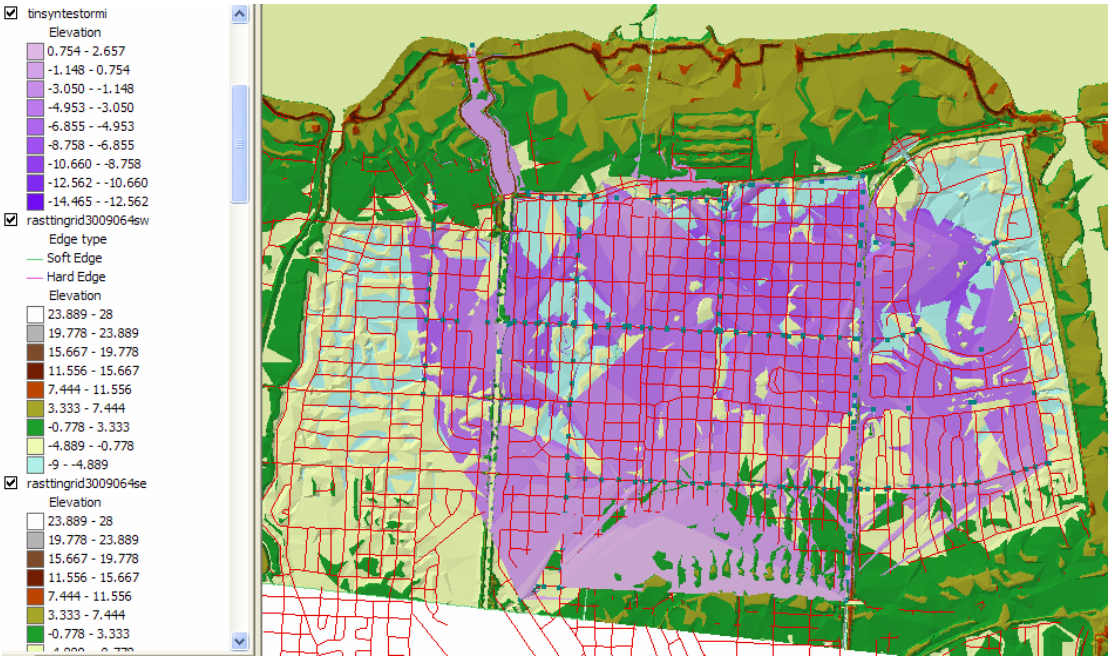

Figure 4.12 Synthetic Storm Flood Elevation Surface

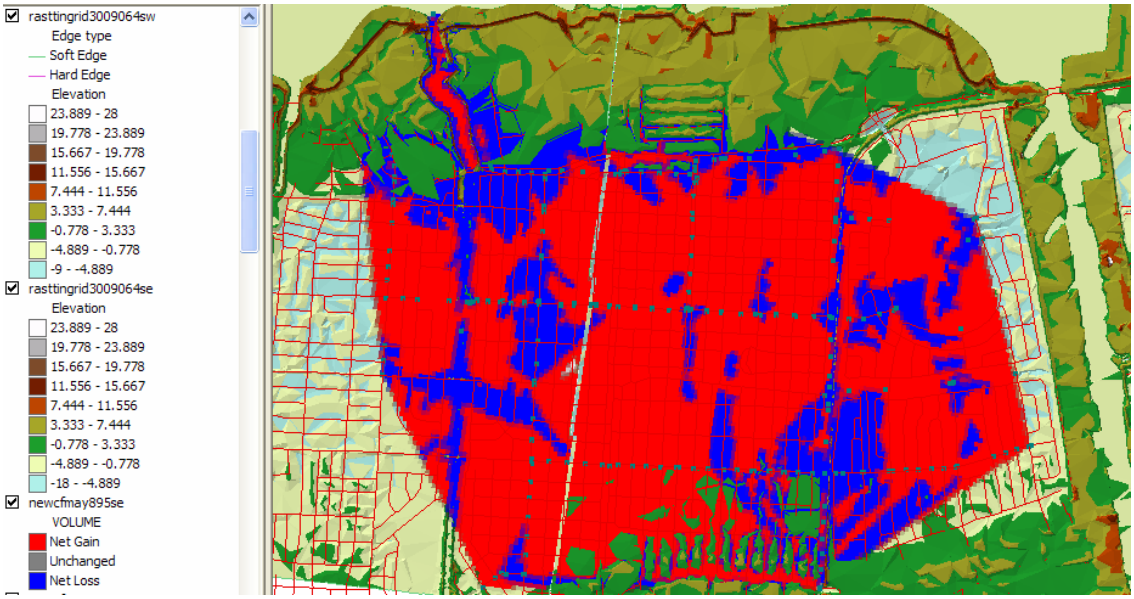

Figure 4.13 Flood Volumes for May 8 1995 Storm

Table 4.4 Flood Volumes.

Rain Event	Rainfall (in)	Volume (m3)	Volume (acre-ft)
May 8 1995	13.92	1104417	895
Synthetic Storm	18	1009065	818
Nov 7 1989	10.92	1001027	812
Nov 5 1975	8.52	855307	693
Dec 3 1990	6.47	804202	652
May 31 1959	9.85	799254	648
Isidore	9.55	791253	641
Jan 24 1978	4.6	562911	456

It can be observed that even though the Synthetic Storm (18 in) had a higher amount of rainfall, it produced a lower flood volume compared to May 8 1995 (13.92 in) storm, or the November 7 1989 storm (10.92 in). The reason for this is that the Synthetic storm was distributed more uniformly throughout 24 hours, allowing the stormwater system to respond more efficiently with the demand on the drainage system. Similarly the storm event of December 3 1990 (6.47in)

resulted in a higher flood volume compared to Isidore (9.55 in) and the May 31 1959 storm (9.85 in).

4.5 Damage Model

A Damage Model was developed to estimate the damage produced by floods in residential areas. The method involved determining area of impact for the simulated excess storage volume for each event. Cumulative volumes at 1ft contour intervals were calculated to determine the elevation for which storage occurs. All areas at or below this elevation were delineated for each event and residences lying within impacted areas were counted.

A digital orthophoto image was used for counting the residences at each cumulative volume. With this information, a graphs relating the number of houses, elevation, and excess volume were plotted. As shown on Figures 4.14, Figure 4.15, Figure 4.16 and Table 4.5 which also included an estimated price of a house versus elevation.

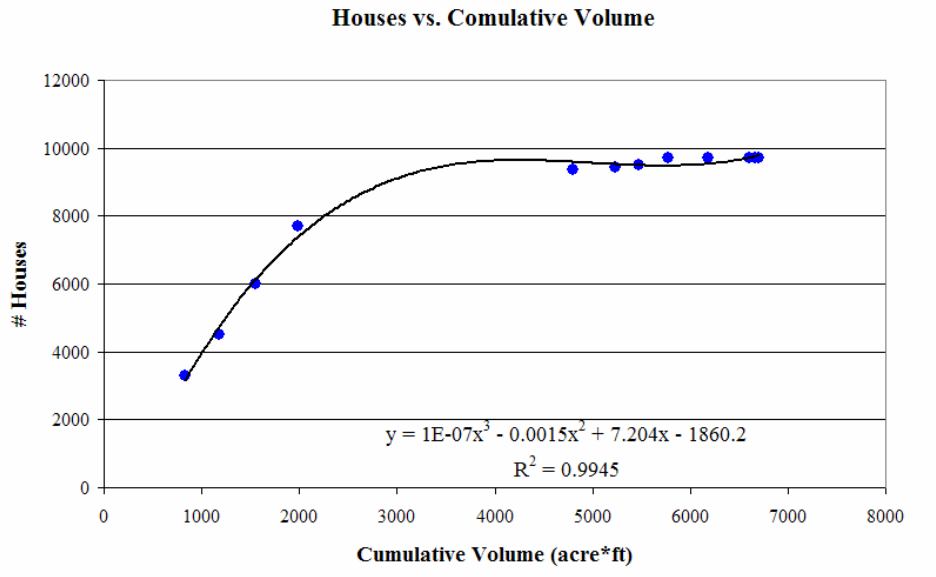

Figure 4.14 Houses versus Cumulative Volume

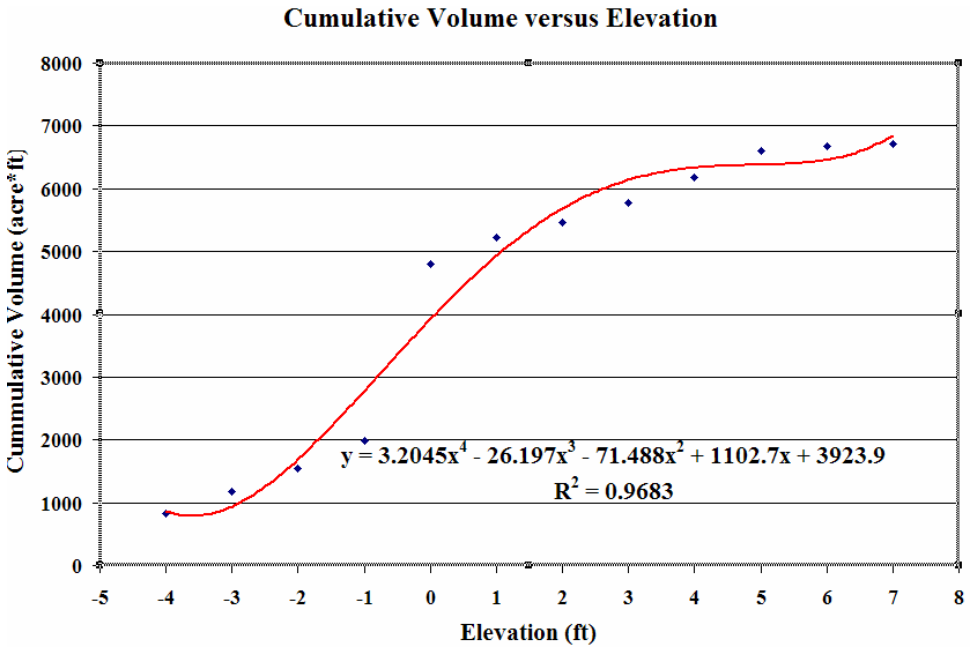

Figure 4.15 Cumulative Volumes versus Elevations

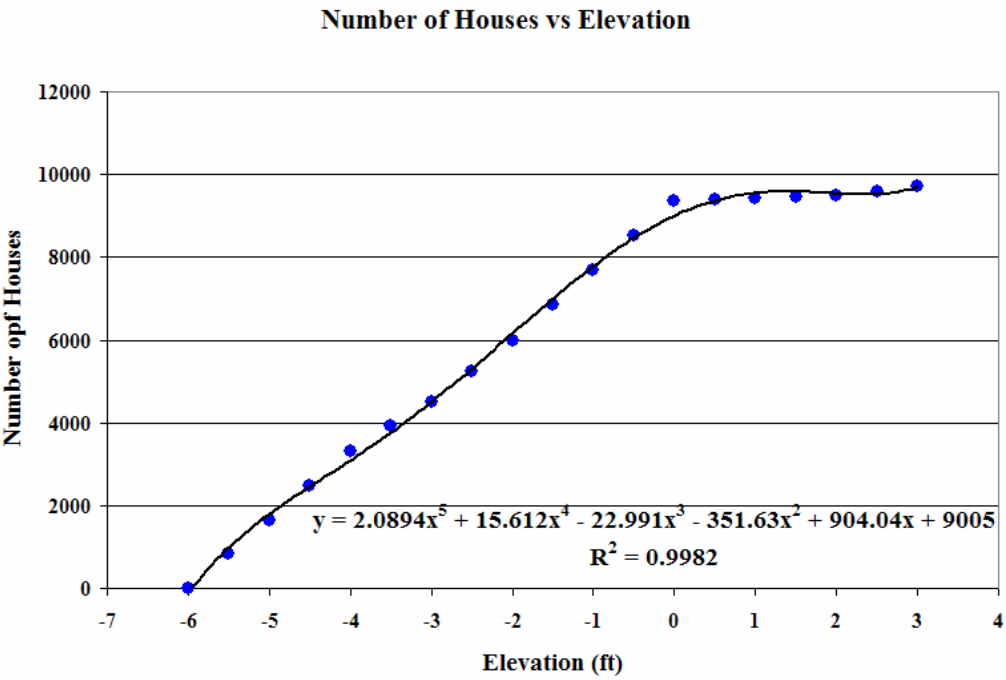

Figure 4.16 Number of houses below Certain Elevations

Table 4.5 Elevation, Number of Houses below Certain Elevations and Price per House for Elevation Interval.

Elevation	No Houses	Price ($) / house
-6	0	70
-5.5	825.25	75
-5	1650.5	79
-4.5	2475.75	82
-4	3301	85
-3.5	3909.5	90
-3	4518	100
-2.5	5259	110
-2	6000	120
-1.5	6843.25	130
-1	7686.5	140
-0.5	8529.75	145
0	9373	150
0.5	9404.75	170
1	9436.5	180
1.5	9468.25	190
2	9500	200
2.5	9600	250
3	9700	300

In order to determine the residential damage cost, residences were classified according foundation type and elevation. To estimate the proportion of houses built on slabs (Figure 4.17) and piers (Figure 4.18) a field survey was performed in the study area, Table 4.5 presents these results.

Table 4.6 Sampled Residences Foundation Distribution.

Street Name	Slab	Elevated
Cameron	14.06%	85.94%
Music	28.93%	71.07%
Virgil	45.90%	54.10%
Pratt	95.73%	4.27%

Figure 4.17 House Built on Slabs

Figure 4.18 House Built on Piers

Table 4.7 presents the data from the Urban Flood Damage Assessment Version 3.5 which relates damage and elevation for a 1 story building. Based on this information Figure 4.19 was plotted, and from this plot, equations were obtained to calculate the damage at different depths of flooding for residences constructed on slab or on piers.

Table 4.7 Percent Flood Damage Relationship at Different Flood Depths

Depth (ft)	Elevated	Slab
0.02	4	4.2
0.5	5.4	26.7
1	20.5	33.9
1.5	40.5	38.6
2	41.5	40.2
2.5	45.1	41.3
3	52.3	47
4	53.1	58.9
5	57.1	58.9
6	66.8	58.9
7	66.8	58.9
8	66.8	69.9
9	66.8	69.9
10	74.3	82.1
11	74.3	82.1
12	84.4	82.1
13	84.4	82.1

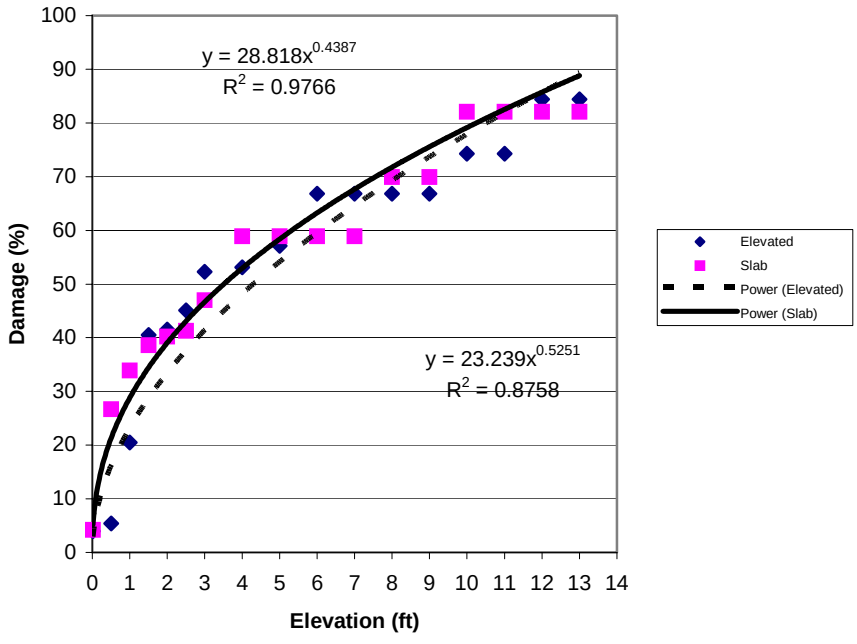

Figure 4.19 Flood Damage Relationships (Urban Flood Damage Assessment Version 3.5)

Using all the variables including ground elevation, number of houses affected per elevation, proportion of houses built on slab or columns, price of house and the flood damage relationships for a 1 story building, a model relating total damage due to flood stage y_f was derived and presented as follows:

$$D_a = \sum_{j}^{All-Classes} \int_{y_{o_j}}^{y_f} \bar{C}_{\$}(\delta_{Elev})_j \left[\left(\frac{dD_{\%}}{dy} \right)_{slab} \bar{f}_{slab} + \left(\frac{dD_{\%}}{dy} \right)_{piers} \left(1 - \bar{f}_{slab} \right) \right] dy \qquad (4.3)$$

where

D_a = *Damage*
$C_{\$}$ = *Average house value $ for class* $_j$
δ_{Elev} = *Number of Houses within a certain elevation class.*
$D_{\%}$= *Damage Percent*
$f_{slab\ j}$ = *Fraction of houses on slab*
j = refers to houses with a given elevation class
y = depth of flooding from the current elevation to the maximum elevation

From the Damage Model a Relationship between elevation and damage in economic term was derived and is presented in Figure 4.20.

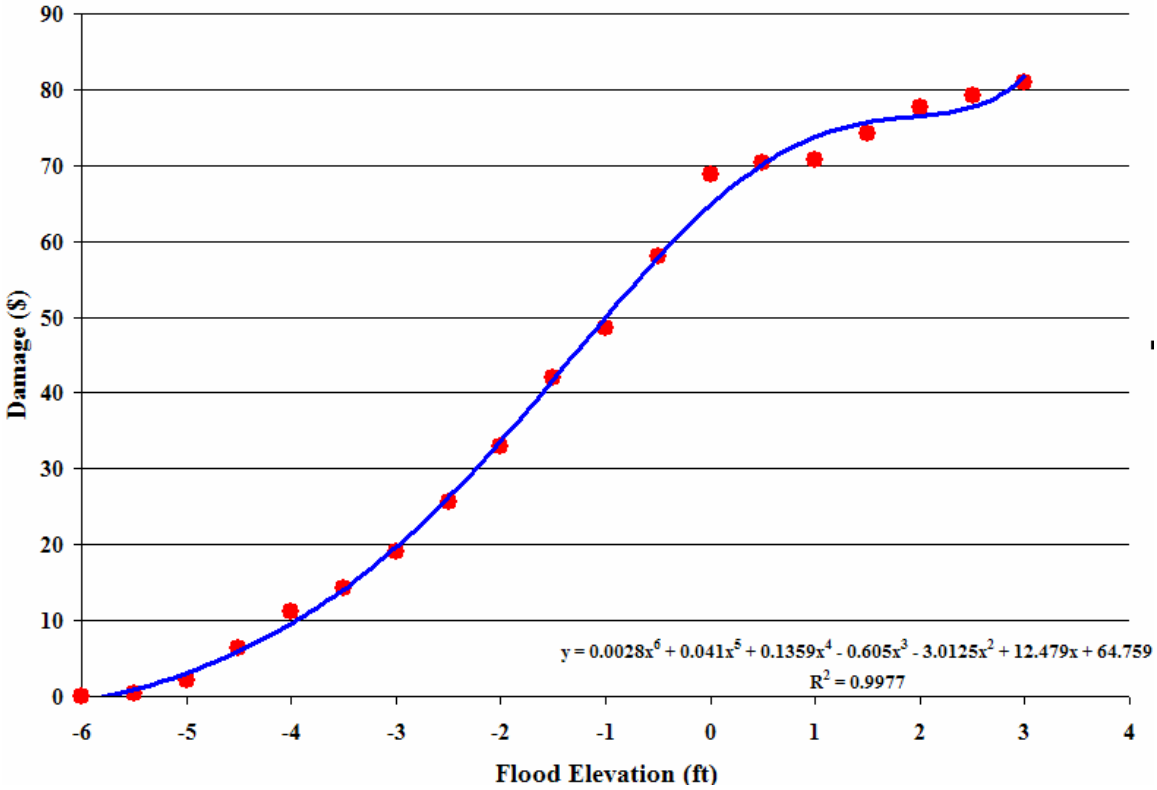

Figure 4.20 Relationship between Damage ($) and Elevation

The Damage model was used to estimate the losses that might be produced by the simulated rain events summarized in Table 4.8.

Table 4.8 Damage in 2005 million Dollars generated by the analyzed Rain Events

Rain Event	Volume (acre-ft)	No Houses Affected	Damage (million of $)
Danny	3118	9050	59.0
Fran	1180	4716	21.0
May 8 1995	895	3488	17.6
Synthetic Storm	818	3127	14.9
Nov 7 1989	812	3104	14.7
Nov 5 1975	693	2795	12.3
Dec 3 1990	652	2712	11.6
May 31 1959	648	2704	11.5
Isidore	641	2692	11.4
Jan 24 1978	456	2404	9.0

A Rating curve of cumulative flood volume versus damage that include all the previous 5 storm events and Hurricane Fran, Danny was developed, Figure 4.21 shows these results.

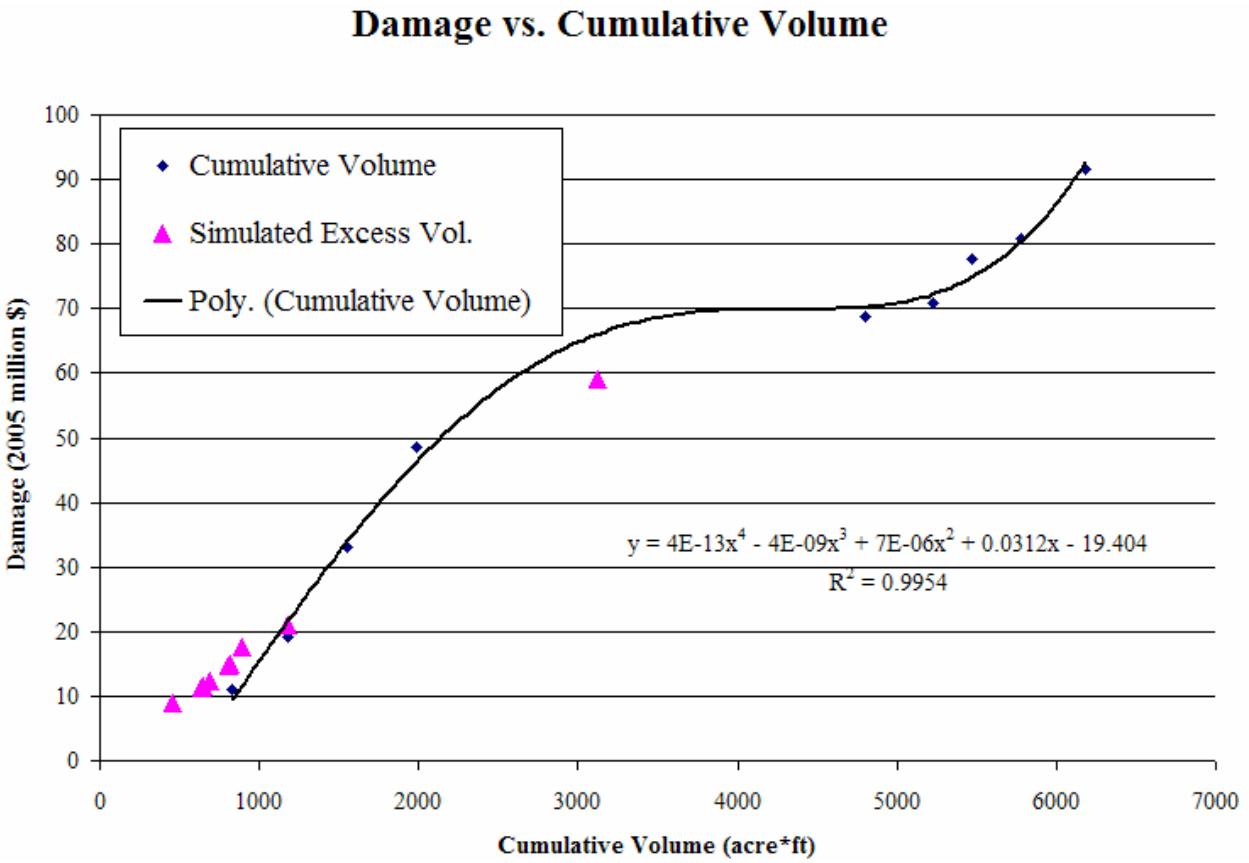

Figure 4.21 Damage Model Rating Curve.

5. DISCUSSION

5.1 Effect of Hyetograph Characteristics on Flood Volume

In a rainfall event, precipitation is distributed in time over the duration of the storm. This can be represented by using a rainfall hyetograph (Figure 5.1) which is a graphical representation of the variation of rainfall intensity with time. Rainfall intensity is usually plotted in the form of a bar graph. It is therefore assumed that the rainfall intensity remains constant over the time step used to describe the hyetograph. This approximation becomes a truer representation of reality as the time step gets smaller. If the time step is too large, especially for short duration events or for very small catchments, the peak values of both rainfall and runoff can be "smeared" as result of the loss of accuracy.

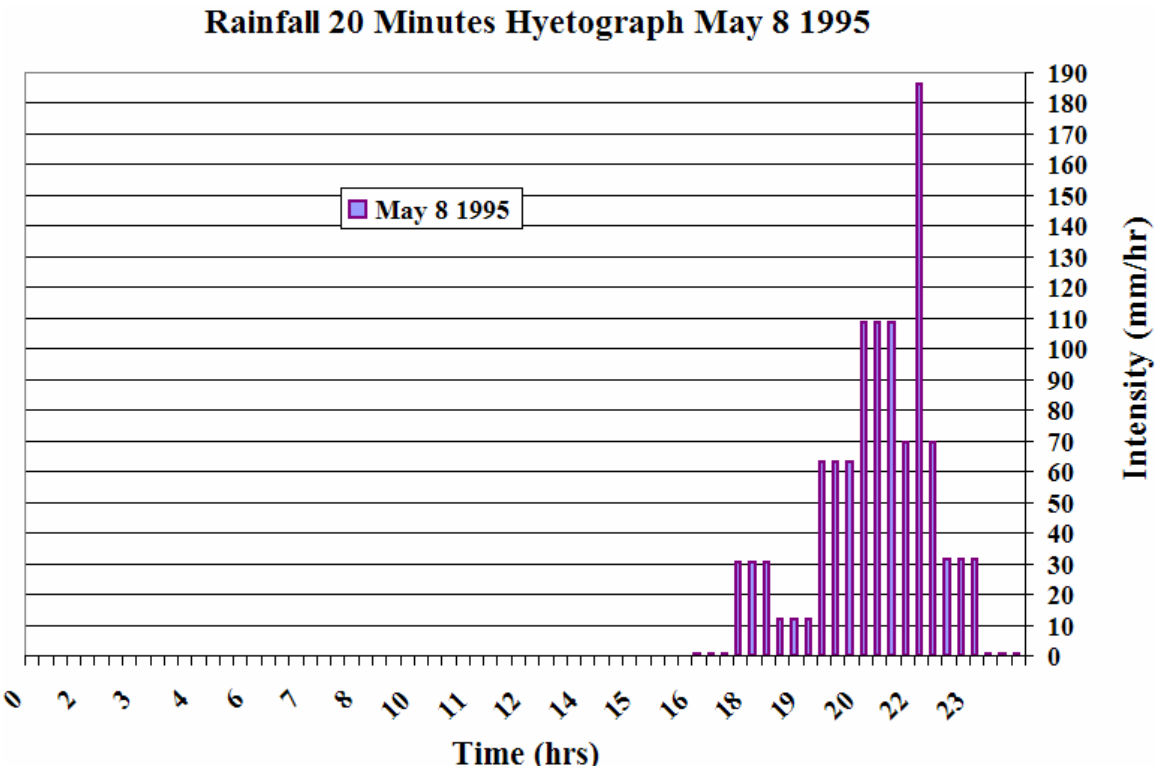

Figure 5.1 Twenty Minutes Rainfall Hyetograph for May 8 1995 Storm

To represent the effect of the hyetograph time step, the storm event of May 8 1995 was analyzed using a time step of 1 hr and compared with the results obtained for a time step of 20 minutes. Figure 5.2 shows the hyetograph for this storm event for a 1 hr time step.

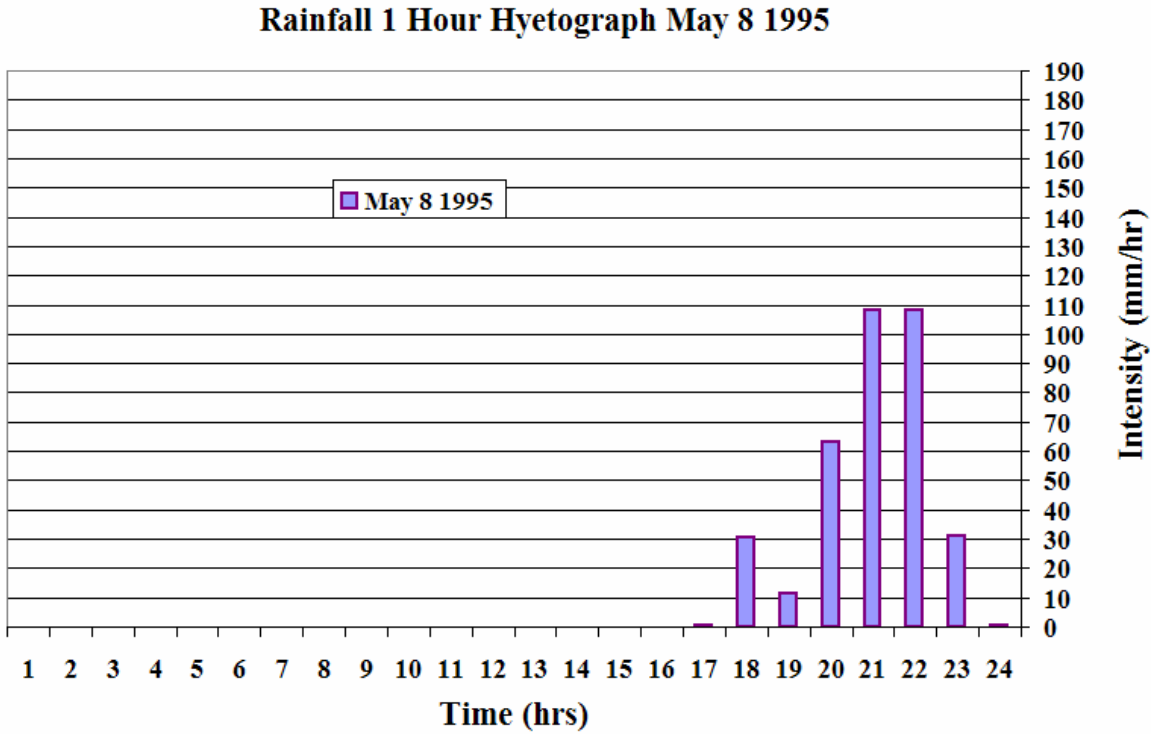

Figure 5.2 Hourly Rainfall Hyetograph for the May 8 1995 Storm

Rainfall intensities for this rain event were collected for 1 hour intervals. To convert the intensity values from one hour intervals to 20 minutes intervals the disaggregation relationships developed from the Louisiana Department of Transportation and Development (LDTD) for Region I were used *LDTD, (1984)*. So from Figure 5.2 we can clearly observe that the peak of the hyetograph has an intensity of around 186 mm/h and from Figure 5.1 the peak only reached a value of 108 mm/h.

The SWMM model was used to obtain the Flood Elevations for the May 8 1995 hourly record. With these flood elevations a Flood Surface was developed for the study area and later volumes

were obtained using the cut and fill operations in the GIS. The flood volumes were incorporated into the damage model to obtain the damage in dollars for this event. Table 5.1 presents the volumes, number of house affected and the damage in dollars for May 8 1995 hourly and 20 minutes record.

Table 5.1 Volumes, No. Houses, Damage for May 8 1995 Hourly and 20 Minutes Record

Rain Event	Volume (acre-ft)	No Houses Affected	Damage (million of $)
20 minutes interval	895	3488	193
Hourly interval	893	3473	192

From the results in Table 5.1 it can be seen that the flood volume for the 20 minutes record is slightly higher than the hourly distribution showing that a smaller rainfall intensity time step could improves the rainfall simulation. The small difference in flood volumes might because the model for the study area included large storages areas in most of the EXTRAN nodes, which attenuated the peak of the hydrograph due to a higher concentration time compared to the intensity time step. In drainage areas with large storages areas the intensity time step should be related to the storage concentration time in order to accurately represent the runoff estimates.

5.2 Flooding Related to Inadequate Inlet, Trunk and Pumping Capacity

During the rain event of May 8 1995 flooding occurred through out the City, mainly because of the intensity of the rainfall and the amount of precipitation that fell is such a short time, 13.92 in a period of 8 hours. From the EXTRAN simulation it was observed that even though the major trunk system had enough capacity to alleviate the flood, runoff was not being routed into this system. Rainfall was falling at such a rate that runoff entering in the trunk system was limited in some areas by the catch basins inlets and by the initial sections of the drainage system with lower capacity.

Figure 5.3 presents a plot of the output (Flow, Velocity and Depth) from Pump Station # 4 discharging into the London Canal.

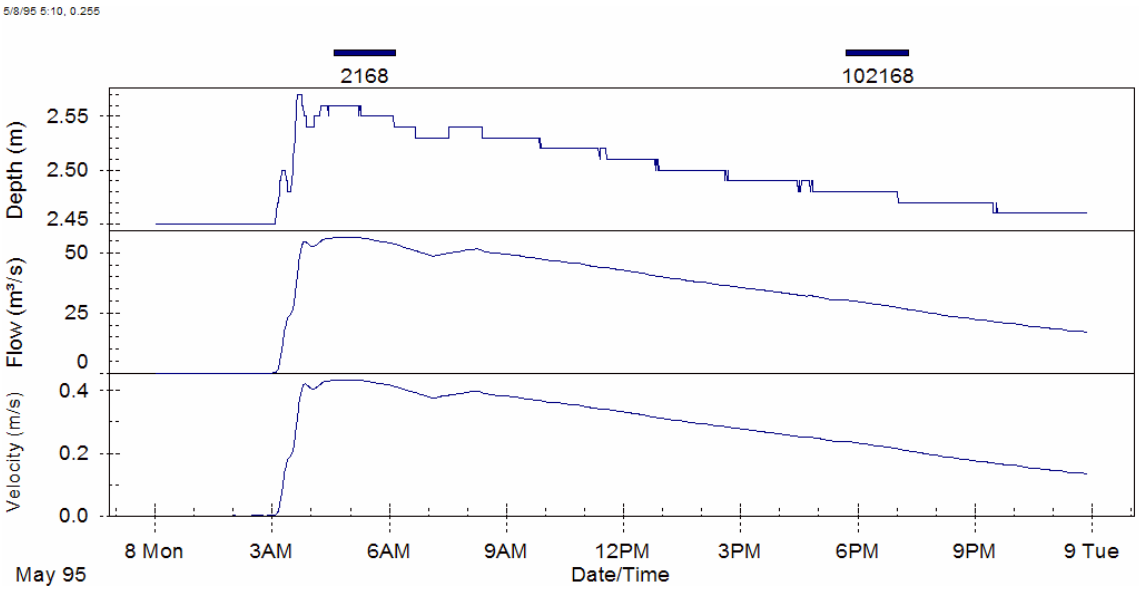

Figure 5.3 Output at discharge point of Drainage Pump Station # 4 for May 8 1995

The Maximum flow obtained from this simulation at the discharge point of Pump Station No 4 was 56.4 m^3/s and the present capacity of the pump station is approximately 106 m^3/s which demonstrates that even though the stormwater and pumping system had enough capacity, runoff was not routed rapidly enough in the system.

In many areas of the City having enough inlet capacity to route the runoff into the trunk system does not always prevents flooding. New Orleans was built on swamp lands which results in high water table and subsidence problems. Subsidence and water table changes cause high irregularities on streets, e.g. potholes, bumps and ridges. It is very common to observe that the street is at lower elevation than the sides of the street where water is suppose to flow though inlets into the truck system. Runoff gets ponded in the streets and retarded from flowing to the elevated inlets resulting in flooding of the surrounding areas, Figure 5.4 illustrate this case.

Figure 5.4 Elevated Inlet.

5.3 Uncertainty in the Input Data.

5.3.1 Rainfall uncertainty

All measurements including rainfall contain uncertainties. Uncertainties are the result of human error, equipment errors and method limitations. A possible cause of rainfall measurement error for extreme events is overtopping of the rain gauge which may result in an under estimated precipitation volume. The standard error can be used to reflect how much sampling uncertainties a statistic might have. The standard error of a sample of size *n* is the sample's standard deviation divided by the square root of *n*. Equation 5.1 presents the standard deviation and Equation 5.2 shows the standard error.

$$s = \sqrt{\text{var}} = \sqrt{\frac{\Sigma\left(X - \overline{X}\right)^2}{N-1}} \qquad (5.1)$$

where s = standard deviation, X = value, $\overline{X}$ = mean of the value, N = number o values

$$SE = s/\sqrt{N} \qquad (5.2)$$

where SE = standard error in the mean

The standard error was calculated for the rainfall measurement of the May 8 1995 rain event. The eight rainfall stations nearest to the study area were used. Table 5.2 presents the rainfall totals recorded in gauge stations and Table 5.3 the statistics of the records. The standard error was also presented as a percentage of the mean (uncertainty). This was done by dividing the standard error in the mean by the mean and the multiplying by 100. The rain event of May 8 1995 resulted in an uncertainty of 11.40% in the measurement of rainfall.

Table 5.2 Preliminary Rainfall Total, May 8, 1995

Station	Total (in)
Gentilly	14.1
Lakefront Airport	10.84
Hayne Blvd.	12.9
Mid City	14.2
Audubon Park	10.94
Broadmoor	13.8
Bonnabel Canal	12.59
Metarie Rd	10.6
New Orleans Airport	12.24

Table 5.3 Standard Error for the May 8 1995 storm rainfall estimates.

Mean	12.47
Standar Deviation	1.42
Standar Error in the Mean	0.47
Uncertainty	11.40%

If the uncertainty of 11.40% is added as a positive amount to the rainfall used in the RUNOFF simulation, it will be considered a complete contribution to the runoff estimates. Based on the total volume obtained of 4.61 $x10^6$ m^3 (3324 acre-ft) over the entire watershed for the 13.92 inches (353.52 mm), a volume of 5.26 $x10^5$ m^3 equivalent to the 11.40% uncertainty (40.3 mm) could be added to the runoff volume of ($4.10x10^6$ m^3) to estimate the increase in the flood damage. The increased runoff resulted in $4.62x10^6$ m^3. The cumulative flood volume simulated for the May 8 1995 event of 895 acre-ft which is approximately 26.94% of the total runoff volume resulted in a damage of 17.65 million dollars. If we used a similar ratio to obtain the flood volume after adding the 11.40% uncertainty excess volume, we get a cumulative flood volume of 1010 acre-ft which resulted in 28.8 million dollars.

On the other hand if we subtract the 11.40 % uncertainty volume to the runoff volume we ended with a $3.57x10^6$ m^3. Making the same assumption that flood volume is 26.94 % of runoff volume it can be obtained a flood volume of 781 acre-ft a total damage of 14 million dollars.

5.3.2 Ground and Invert Elevation Uncertainties

The LIDAR systems being used in the Louisiana project are accurate to 15-30 cm RMSE, depending upon land cover, so in areas of the City where trees cover streets, a reduction of accuracy can be expected. Also considering that the study area includes very flat areas and when having an accuracy of 30 cm (1ft) this can significantly over or under estimate the elevation and flood volume calculations. Flood Volumes in GIS are calculated using cut and fill operations between the ground and the flood elevation surfaces, having uncertainties in the ground elevations affect the volume estimates.

Another source of uncertainty in the model are the invert elevations. As mentioned before, the invert elevations were obtained from drainage maps at Sewerage and Water Board. Most of drainage maps were produced at least 30 years ago, some dating the 1930's. As result of subsidence many of the elevations used may not reflect the actual conditions of the drainage system, i.e. conduit slopes used on the EXTRAN model could affect the flow distribution though out the system. The elevation of the inverts and manhole tops may have changed significantly relative to the very recent LIDAR (NADV88) elevations *Cunningham et al (2003).*

5.3.3 Manning's n value Uncertainties

Hydraulic capacity is the amount of water a pipe can convey. The hydraulic capacity of all types of pipe depends on the smoothness of it's the interior pipe wall; the smoother the wall is, the greater the hydraulic capacity of the pipe is. Smoothness of pipe is represented by Manning's n Roughness Coefficient commonly called Manning's n. The lower the Manning's n value, the greater the volume of water that will flow through pipe.

The Manning's n value used on the EXTRAN module was of .015 which is a conservative value used on rough concrete pipes. But in an old stormwater system like in New Orleans, the Manning's n might be higher, reducing the hydraulic capacity of the drainage system and increasing the amount of flooding in the watershed.

5.4 Damage Frequency Analysis

Damage frequency analysis is a method of determining the probability of calculated damages for different flood events with the objective of defining the probability of distribution of the data for subsequent use in damage estimates *Giron* (2002).

A spreadsheet with seven rain events (Isidore, May 8 1995, December 3 1990, November 7 1989, January 24 1978, November 5 1975 and May 31 1959) was prepared to complete the frequency analysis. The damages for each storm were arranged in decreasing order, assigning a rank number for each event. After this, the probability of occurrence *(p)* and return period *(T)* for each rank number was obtained, using Equation 5.3 and 5.4.

$$p = \frac{Rank}{N+1} \tag{5.3}$$

where N = number of annual damage events in the series

$$T = \frac{1}{p} \tag{5.4}$$

Since it is known (COE report 1995) that the 1995 storm was the greatest in over 100 years, it was assigned a rank of 0.5 in the 55 year record or a Tr of 112 years, i.e. there is only a 50% chance that this would occur in a 55 year record. The other storms were treated by their normal ranking. The storm drainage inlets and local sewers are designed to have no serviceability problems betweem the 5 and the 2 year storm event; therefore it was assume that the damage for the 30% probability (3.3 year return period) could be close to zero, Figure 5.5 presents the results. The area under this curve (Figure 5.5) gives an annual damage of about 4 million dollars.

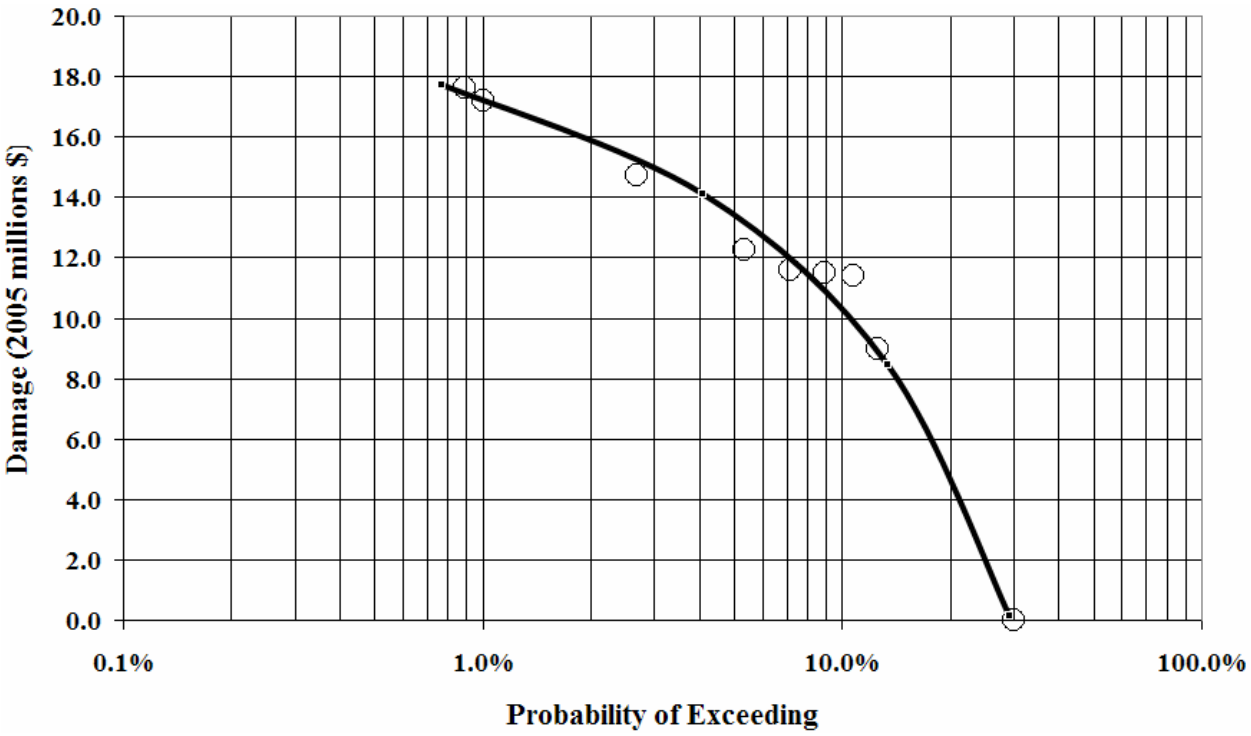

Figure 5.5 Rainfall Damage Frequency Curve for the Area drain by Pump Station No. 4

The 1:100 year damage was estimated to be 17.2 million dollars and the annual average damage was estimated to be 5.5 million in 2005 dollars. Adding more rain events into this curve will provide a better approximation of the 1:100 damage and the annual damage. The return period for these events is presented in Table 5.3.3.

Table 5.4 Damage Frequency Table

Rain Event	Rank	Probability	Return Period	Damage (million of $)
		1.00%	100	17.20
May 8 1995	0.5	0.89%	112	17.65
Nov 7 1989	1.5	2.68%	37	14.73
Nov 5 1975	3	5.36%	19	12.26
Dec 3 1990	4	7.14%	14	11.58
May 31 1959	5	8.93%	11	11.52
Isidore	6	10.71%	9	11.41
Jan 24 1978	7	12.50%	8	8.96

The damage model resulted in higher damage estimates ($) for the flooded areas within the drainage area served by Pump Station No. 4, compared to the claims reported after the May 8 1995 rain event. After a storm event not all the damages are covered by the insurance companies, like in the case of damages lower than the deductible amount of the insurance policies. Also damages due to flooded vehicles or damages produced by later effects of flooding i.e. terminates are not included. In order to improve the model estimates a correction factor was used. The results obtained reflected the actual damage observed in the study area. The correction factor was derived by relating the total damage claims for the Orleans Parish including the estimated damage per house, and by the total number of houses in the study area. Table 5.3.3 presents the

damage results. The actual total damage could be more than double the amount estimated by the average per capita FEMA claims.

Based on the 1995 report of the Corp of Engineers (COE) for the May 8 1995 damages, the amount of money paid in claims for Orleans parish was of 164.5 million dollars and the amount paid in Jefferson Parish was of 415.26 million dollars. The number of houses for Orleans Parish was estimated assuming 4 people per house for a population of 454,674 (based on the census of 2000 perform by the US census Bureau) which resulted in 113669 houses. Orleans and Jefferson Parishes both have approximately the same number of residences which means that almost 2.5 times more was paid in Jefferson Parish. This can be explained due to higher residence prices in this Parish.

5.5 Method Advantages and Importance of the Study

As mentioned before the current study provides a tool to estimate the damage as result of flood associated rainfall and diminishing conveyance capacity of the trunk drainage system during hurricanes and extreme rainfall events. Annual Flood Maps can be developed for the entire area under various storm events. These can be used to set rational flood rates or to plan improvements to the drainage system. This information can be used by agencies like FEMA.

This study can be used to estimate the flood risk by simulating different storm events in order to propose drainage improvement in flood prone areas of the City. In the same way the model can be used to identify areas with better drainage that could be eligible for reduction in flood insurance rates.

During a flood event, affected areas can be identified to help route traffic around flooded areas and also provide emergency response to the affected population. Similarly the model could be used for emergency planning for routing traffic during floods.

The methodology used to create this model can be applied in similar flood prone areas. Areas that have LIDAR data available and an existing drainage database can simplify the procedure. Another advantage of the method involves the use of PCSWMM® which not only provides an interface with GIS but also simulates the hydrology and hydraulic characteristic of the studied area. The output generated by the PCSWMM® can be associated to the manholes data in GIS to represent flood elevation and simulate flood volumes. PCSWMM® is an inexpensive interface for the US EPA SWMM computational Engine. PCSWMM® can be purchased for a nominal

price from Computational Hydraulics Inc. (2004). Similar software's i.e. DHI Mike 11 GIS are far more expensive and do not use the US EPA SWMM Engine. PCSWMM® is designed for convenient updates to the US EPA SWMM Engine.

5.6 Secondary System (Streets)

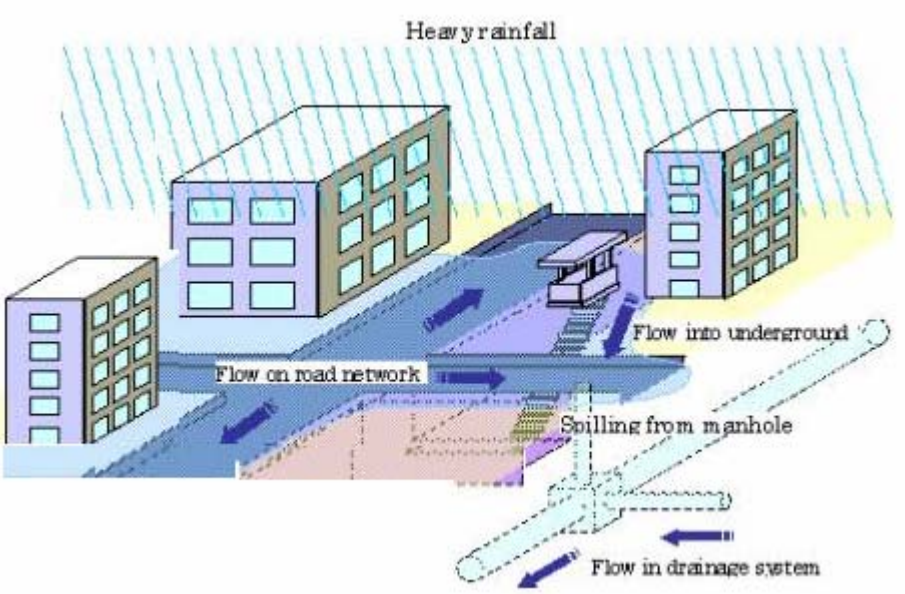

Figure 5.6 Runoff throughout the Streets *Iwata et al. (2000)*

The mechanism of runoff and flooding in urbanized areas is greatly different from that of non-urbanized areas. When the runoff exceeds the discharge capacity of the drainage network, floodwater flows along the roads and streets, behaving as a channel. For this reason the mechanism of flooding in urbanized areas can be expressed by: flow on surface area (street network) and by flow in drainage system. Both systems are connected at the manholes and through runoff inlets, where floodwater is exchanged. Runoff will enter into the drainage system through catchment basins when drainage network has capacity, and spill from manhole/inlets when drainage system is full *Iwata et al. (2000).* Figure 5.6 illustrates the runoff flow throughout the streets.

In order to better simulate the flow distribution in a drainage area during flood events a secondary system composed of streets should be included in the model. The actual model was build to capture the excess of runoff that leaves the drainage system and stored until the system had enough capacity to rout it. A secondary system (street network) could better distribute the runoff thought the system, providing more accurate flood elevations improving the flood map outputs.

Another possible improvement to accurately defining flooded areas could be presented by using a tool like ArcHydro which directs runoff though a high to a low elevation drainage path. This tool defines a drainage path from low to high points like in the case of rivers analysis. If the flow path in this tool is reverse from high to low points, a simulation of surcharge volumes filling immediate low areas and then distributing into surrounding lower areas could be model within the GIS.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions were derived from this study.

1. A SWMM GIS Drainage Model has been completed for the watershed served by Pump Station #4. The Methodology used in this model can be applied to other flood prone areas with or without a drainage database, and simulate the hydrology and hydraulic characteristics that are useful in improving their drainage characteristics. It also provides a tool for flood damage estimates.
2. It was observed for the study area that during high intensity rain events flooding might be caused by inadequate inlet capacity, and not by lack of capacity in the main trunk system or insufficient pumping capacity.
3. Flood maps have been developed for 8 storm events Tropical Storm Isidore, May 8 1995, December 3 1990, November 7 1989, January 24 1978, November 5 1975, May 31 1959 and an 18 inches synthetic storm to simulate the rainfall effects on the study area.
4. Runoff estimates can be significantly affected by the intensity time step especially in small watershed. It was noticed for the study area that when using rainfall data with a smaller time step, the runoff volumes were not significantly affected. The model for the study area included large storages in most of the EXTRAN nodes which attenuated the peak of the hydrograph due to a higher concentration time compared to the intensity time step. So in drainage areas with large storages areas the intensity time step should be related to the storage concentration time in order to accurately represent the runoff estimates.
5. A damage model for 1 story buildings for the study area has been developed, which

provides estimates of flood damage in dollars. The damage model was calibrated using the insurance claims presented during the May 8 1995 rain event.

6. Graphs relating damage with cumulative flood volumes and elevations were developed for the study area.
7. A damage frequency analysis was completed for the area served by Pumping Station No. 4 (DPS4). The 1:100 year damage was estimated to be equal to 17.2 million dollars and the approximate annual damage was of 5.5 million dollars.

6.1 Recommendation

1. Use rainfall data with a time step smaller than 1hr to improve the runoff calculations.
2. Developing an interface program used to input flood elevation results from SWMM directly into the GIS database can significantly reduce the time needed to simulate the damage for a rainfall event.
3. Run simulations of the model using different Manning's n values to estimate how these changes might affect the runoff volumes for the drainage system.
4. Re-survey manhole ground and invert elevations to account for subsidence. Using historical and new data determine an empirical model for subsidence.
5. If available it is recommended to use accurate LIDAR data to improve flood volume estimates.
6. When applying the methodology developed in this model using recent invert and ground elevations can significantly improve the flood estimates.

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APPENDIX A

A.1 RUNOFF Input Data

```
$RUNOFF
**===========================================================================
* Title Lines
A1   'May 8 1995 rain event'
A1   ''
* METRIC ISNOW NRGAG INFILM KWALTY IVAP NHR NMN NDAY MONTH IYRSTR IVCHAN
B1  1      0      1      0      0      0      0      0      8      5      1995   1
* IPRN1 IPRN2 IPRN3 IRPNGW
B2  0      0      2      0
B3  60     60     60     2      24
* ROPT
D1  0
* KTYPE KINC KPRINT KTHIS KTIME KPREP NHISTO THISTO TZRAIN
E1  0      12     0      0      0      0      24     20     0
* RAIN(X)...
E3  .289   .289   .289   30.326  30.326  30.326  11.553  11.553  11.553  63.252  63.252  63.252
E3  108.308 108.308 108.308 69.459  186.007 69.452  31.193  31.193  31.193  .289    .289    .289
*E3  4.7    5      5.4    5.8    6.3    6.9    7.7    8.5    9.6    11     12.8   15.3
*E3  18.8   24     32.5   48     82.9   220    220    82.9   48     32.5   24     18.8
*E3  15.3   12.8   11     9.6    8.5    7.7    6.9    6.3    5.8    5.4    5      4.7
*E3  4.7    4.7    4.7    4.7    4.7    4.7    4.7    4.7    4.7    4.7    4.7    4.7
*
*   NAMEG   NGTO    NP      GWIDTH  GLEN    G3      GS1     GS2     G6      DFULL   GDEPTH
G1  1060    1061    2       .3048   25.47054 0.001  0       0       .006    0.3048  0       784711.090935286 3323090.91199261
G1  1061    1062    2       .3048   55.8321 0.001   0       0       .006    0.3048  0       784714.467541656 3323046.1719337
G1  1062    1063    2       .381    38.30764 0.001  0       0       .006    0.381   0       784796.772373107 3323054.19137888
G1  1063    1064    2       .381    36.9107 0.001   0       0       .006    0.381   0       784890.473250335 3323064.74327739
G1  1064    1065    2       .4572   36.01682 0.001  0       0       .006    0.4572  0       784504.695751976 3323117.50278147
G1  1065    10166   2       .4572   32.73563 0.001  0       0       .006    0.4572  0       784500.474992572 3323164.77529949
G1  1067    1064    2       .381    91.12429 0.001  0       0       .006    0.381   0       784522.845022028 3323121.30146724
G1  1074    1075    2       .381    67.52354 0.001  0       0       .006    0.381   0       784613.591372287 3323172.79474466
G1  1075    1076    2       .381    6.149273 0.001  0       0       .006    0.381   0       784608.948533482 3323225.97632238
G1  1076    1077    2       .381    69.64301 0.001  0       0       .006    0.381   0       784700.961110409 3323134.80789849
G1  1077    1078    2       .4572   6.292299 0.001  0       0       .006    0.4572  0       784695.474124337 3323180.81418984
G1  1078    1079    2       .4572   72.50501 0.001  0       0       .006    0.4572  0       784691.253359166 3323233.15162029
G1  1079    1080    2       .4572   5.679152 0.001  0       0       .006    0.4572  0       784706.870175882 3323135.65205152
G1  1080    1081    2       .4572   68.70406 0.001  0       0       .006    0.4572  0       784702.227337077 3323181.23626347
G1  1081    1082    2       .5334   72.88902 0.001  0       0       .006    0.5334  0       784698.428651306 3323234.41784696
G1  1082    10183   2       .6096   7.367064 0.001  0       0       .006    0.6096  0       784786.220468829 3323242.85936577
G1  1083    1084    2       .254    35.95525 0.001  0       0       .006    0.254   0       784874.856439386 3323251.72296398
G1  1084    1085    2       .254    41.77036 0.001  0       0       .006    0.254   0       784924.661410737 3323256.36580278
G1  1085    10166   2       .254    52.76871 0.001  0       0       .006    0.254   0       784948.297672628 3323261.00863582
G1  1087    1088    2       .254    20.21556 0.001  0       0       .006    0.254   0       784487.390634959 3323311.6577602
G1  1088    1089    2       .254    54.88168 0.001  0       0       .006    0.254   0       784490.345167695 3323268.60600736
G1  1089    1090    2       .3048   48.61209 0.001  0       0       .006    0.3048  0       784494.988000733 3323223.44386905
G1  1090    1091    2       .381    71.34972 0.001  0       0       .006    0.381   0       784500.474992572 3323363.57311702
G1  1092    1093    2       .254    29.73586 0.001  0       0       .006    0.254   0       784510.182738048 3323269.02808099
G1  1093    1094    2       .3048   46.66893 0.001  0       0       .006    0.3048  0       784513.981423819 3323224.71009572
G1  1094    1095    2       .3048   47.10685 0.001  0       0       .006    0.3048  0       784592.909643133 3323321.78758508
G1  1095    1096    2       .3048   47.03187 0.001  0       0       .006    0.3048  0       784598.396629205 3323276.20337313
G1  1096    1097    2       .381    23.84701 0.001  0       0       .006    0.381   0       784601.773241342 3323232.30746726
G1  1098    1099    2       .254    28.21901 0.001  0       0       .006    0.254   0       784603.883621044 3323277.04752617
G1  1099    10200   2       .254    47.99077 0.001  0       0       .006    0.254   0       784607.682306814 3323232.30746726
G1  10200   10201   2       .3048   45.37221 0.001  0       0       .006    0.3048  0
G1  10201   10202   2       .381    49.62913 0.001  0       0       .006    0.381   0
G1  10202   10203   2       .381    20.56747 0.001  0       0       .006    0.381   0
G1  10203   1097    2       .6096   79.08855 0.001  0       0       .006    0.6096  0
G1  1097    1091    2       .6096   78.8886 0.001   0       0       .006    0.6096  0       784600.507014674 3323322.20966448
G1  1091    10186   2       .762    74.39146 0.001  0       0       .006    0.762   0       784506.384052278 3323313.76813991
G1  10204   10205   2       .3048   66.8763 0.001   0       0       .006    0.3048  0
G1  10205   10206   2       .381    108.2046 0.001  0       0       .006    0.381   0
G1  10206   10207   2       .381    10.42126 0.001  0       0       .006    0.381   0
G1  10207   10203   2       .6096   85.74529 0.001  0       0       .006    0.6096  0
G1  10208   10209   2       .3048   64.8215 0.001   0       0       .006    0.3048  0
G1  10209   10210   2       .381    142.2777 0.001  0       0       .006    0.381   0
G1  10210   10211   2       .4572   7.396665 0.001  0       0       .006    0.4572  0
G1  10211   10212   2       .4572   133.8337 0.001  0       0       .006    0.4572  0
G1  10212   10213   2       .5334   137.4733 0.001  0       0       .006    0.5334  0
G1  10214   10215   2       .3048   63.25458 0.001  0       0       .006    0.3048  0
G1  10215   10216   2       .381    142.4682 0.001  0       0       .006    0.381   0
G1  10216   10217   2       .381    8.856338 0.001  0       0       .006    0.381   0
```

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G1  10217  10218  2    .4572  130.9039 0.001  0    0    .006   0.4572  0
G1  10218  10219  2    .5334  132.5788 0.001  0    0    .006   0.5334  0
G1  10220  10207  2    .3048  65.09307 0.001  0    0    .006   0.3048  0
G1  10221  10222  2    .3048  62.23018 0.001  0    0    .006   0.3048  0
G1  10222  10223  2    .381   147.2674 0.001  0    0    .006   0.381   0
G1  102107 102122 2    .6096  79.94714 0.001  0    0    .006   0.6096  0
G1  102122 102123 2    .6096  81.50261 0.001  0    0    .006   0.6096  0
G1  102123 102124 2    .6096  81.37756 0.001  0    0    .006   0.6096  0
G1  102124 102125 2    .762   9.304091 0.001  0    0    .006   0.762   0
G1  102091 102125 2    .6858  101.2939 0.001  0    0    .006   0.6858  0
G1  10367  10368  2    .4572  66.72973 0.001  0    0    .006   0.4572  0
G1  10368  10369  2    .4572  30.80713 0.001  0    0    .006   0.4572  0
G1  10369  10370  2    .4572  48.01543 0.001  0    0    .006   0.4572  0
G1  10370  10371  2    .5334  49.00971 0.001  0    0    .006   0.5334  0
G1  10371  10372  2    .5334  30.92289 0.001  0    0    .006   0.5334  0
G1  10372  10373  2    .5334  82.06773 0.001  0    0    .006   0.5334  0
G1  10373  10374  2    .5334  21.6451 0.001  0    0    .006   0.5334  0
G1  10376  10375  2    .4572  53.73069 0.001  0    0    .006   0.4572  0
G1  10377  10376  2    .4572  58.38744 0.001  0    0    .006   0.4572  0
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G1  10379  10378  2    .381   60.51718 0.001  0    0    .006   0.381   0
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G1  10382  10381  2    .3048  57.86108 0.001  0    0    .006   0.3048  0
G1  10383  10384  2    .3048  55.12972 0.001  0    0    .006   0.3048  0
G1  10384  10385  2    .381   60.44703 0.001  0    0    .006   0.381   0
G1  10385  10386  2    .381   47.61846 0.001  0    0    .006   0.381   0
G1  10386  10387  2    .4572  54.94715 0.001  0    0    .006   0.4572  0
G1  10387  10388  2    .4572  57.66391 0.001  0    0    .006   0.4572  0
G1  10388  10389  2    .5334  108.1945 0.001  0    0    .006   0.5334  0
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G1  10394  10393  2    .381   115.0584 0.001  0    0    .006   0.381   0
G1  10395  10394  2    .3048  19.39223 0.001  0    0    .006   0.3048  0
G1  10396  10395  2    .3048  70.55557 0.001  0    0    .006   0.3048  0
G1  10403  4021   2    .6096  96.98419 0.001  0    0    .006   0.6096  0
G1  10404  10403  2    .6096  87.80207 0.001  0    0    .006   0.6096  0
G1  10405  10404  2    .6096  150.3557 0.001  0    0    .006   0.6096  0
G1  10406  10405  2    .5334  112.6637 0.001  0    0    .006   0.5334  0
G1  10407  10406  2    .5334  110.7868 0.001  0    0    .006   0.5334  0
G1  10408  10407  2    .4572  113.1818 0.001  0    0    .006   0.4572  0
G1  10409  10408  2    .381   126.7465 0.001  0    0    .006   0.381   0
G1  10410  10409  2    .254   119.8626 0.001  0    0    .006   0.254   0
G1  10223  10224  2    .4572  121.4769 0.001  0    0    .006   0.4572  0
G1  10224  10225  2    .5334  144.4258 0.001  0    0    .006   0.5334  0
G1  10226  10227  2    .254   28.30423 0.001  0    0    .006   0.254   0
G1  10227  10228  2    .254   35.24121 0.001  0    0    .006   0.254   0
G1  10228  10229  2    .3048  22.84028 0.001  0    0    .006   0.3048  0
G1  10229  10230  2    .381   41.28875 0.001  0    0    .006   0.381   0
G1  10230  10231  2    .4572  50.54551 0.001  0    0    .006   0.4572  0
G1  10231  10232  2    .4572  23.58675 0.001  0    0    .006   0.4572  0
G1  10232  10233  2    .4572  40.90503 0.001  0    0    .006   0.4572  0
G1  10233  10234  2    .4572  40.47919 0.001  0    0    .006   0.4572  0
G1  10234  10235  2    .5334  24.54302 0.001  0    0    .006   0.5334  0
G1  10235  10236  2    .5334  88.08507 0.001  0    0    .006   0.5334  0
G1  10236  10237  2    .5334  7.367264 0.001  0    0    .006   0.5334  0
G1  10304  10305  2    .4572  31.25481 0.001  0    0    .006   0.4572  0
G1  10305  10306  2    .4572  45.83451 0.001  0    0    .006   0.4572  0
G1  10306  10307  2    .5334  166.6888 0.001  0    0    .006   0.5334  0
G1  10307  10308  2    .5334  20.32658 0.001  0    0    .006   0.5334  0
G1  10310  3091   2    .4572  49.74523 0.001  0    0    .006   0.4572  0
G1  10311  10310  2    .381   56.69571 0.001  0    0    .006   0.381   0
G1  10312  10311  2    .381   57.88055 0.001  0    0    .006   0.381   0
G1  10313  10312  2    .381   60.25284 0.001  0    0    .006   0.381   0
G1  10314  10313  2    .3048  22.93538 0.001  0    0    .006   0.3048  0
G1  10315  10314  2    .3048  54.63167 0.001  0    0    .006   0.3048  0
G1  10316  10315  2    .254   57.42584 0.001  0    0    .006   0.254   0
G1  10342  102019 2    .4572  40.0216 0.001  0    0    .006   0.4572  0
G1  102019 102020 2    .4572  54.57494 0.001  0    0    .006   0.4572  0
G1  102125 102086 2    1.2192  40.03641 0.001  0    0    .006   1.2192  0
G1  102086 102079 2    1.2192  120.3558 0.001  0    0    .006   1.2192  0
G1  1020291 10344  2    .3048  60.09392 0.001  0    0    .006   0.3048  0
G1  1020301 1020311 2    .381   60.55098 0.001  0    0    .006   0.381   0
G1  1020311 1020321 2    .381   48.53465 0.001  0    0    .006   0.381   0
G1  10317  10318  2    .3048  54.91816 0.001  0    0    .006   0.3048  0
G1  10318  10319  2    .3048  59.23932 0.001  0    0    .006   0.3048  0
G1  10319  10320  2    .381   45.07091 0.001  0    0    .006   0.381   0
G1  10320  10321  2    .4572  56.72718 0.001  0    0    .006   0.4572  0
G1  10321  10322  2    .4572  55.33009 0.001  0    0    .006   0.4572  0
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G1  10322  10323  2    .5334  108.9486 0.001  0    0    .006   0.5334  0
G1  10343  10342  2    .3048  59.27566 0.001  0    0    .006   0.3048  0
G1  10344  10343  2    .3048  56.69572 0.001  0    0    .006   0.3048  0
G1  10345  10344  2    .3048  53.61977 0.001  0    0    .006   0.3048  0
G1  10346  10345  2    .3048  60.98478 0.001  0    0    .006   0.3048  0
G1  10347  10348  2    .381   59.08849 0.001  0    0    .006   0.381   0
G1  10348  10349  2    .4572  98.59075 0.001  0    0    .006   0.4572  0
G1  10349  3501   2    .5334  29.12679 0.001  0    0    .006   0.5334  0
G1  10351  10352  2    .6096  111.139 0.001  0    0    .006   0.6096  0
G1  10352  10351  2    .6096  113.0914 0.001  0    0    .006   0.6096  0
G1  10353  10354  2    .5334  116.6488 0.001  0    0    .006   0.5334  0
G1  10354  10353  2    .5334  110.9448 0.001  0    0    .006   0.5334  0
G1  10355  10354  2    .5334  51.46413 0.001  0    0    .006   0.5334  0
G1  10356  10355  2    .5334  61.2818 0.001  0    0    .006   0.5334  0
G1  10357  10356  2    .4572  113.4716 0.001  0    0    .006   0.4572  0
G1  10358  10357  2    .381   57.69375 0.001  0    0    .006   0.381   0
G1  10359  10358  2    .381   61.91652 0.001  0    0    .006   0.381   0
G1  10360  10359  2    .381   59.94394 0.001  0    0    .006   0.381   0
G1  10361  10360  2    .381   64.51801 0.001  0    0    .006   0.381   0
G1  10362  10363  2    .381   52.94779 0.001  0    0    .006   0.381   0
G1  10363  10364  2    .4572  39.88584 0.001  0    0    .006   0.4572  0
G1  10364  10365  2    .4572  44.43067 0.001  0    0    .006   0.4572  0
G1  10365  10366  2    .4572  39.04271 0.001  0    0    .006   0.4572  0
G1  10366  10367  2    .4572  26.86535 0.001  0    0    .006   0.4572  0
G1  102020 102021 2    .3048  22.27329 0.001  0    0    .006   0.3048  0
G1  102021 102022 2    .3048  40.48606 0.001  0    0    .006   0.3048  0
G1  10323  20281  2    .5334  12.00073 0.001  0    0    .006   0.5334  0
G1  10390  21461  2    .5334  12.27661 0.001  0    0    .006   0.5334  0
G1  10334  21471  2    .5334  11.01636 0.001  0    0    .006   0.5334  0
G1  10244  10252  2    .381   74.96085 0.001  0    0    .006   0.381   0
G1  10252  10259  2    .4572  80.93134 0.001  0    0    .006   0.4572  0
G1  10259  10267  2    .4572  74.47012 0.001  0    0    .006   0.4572  0
G1  10267  10275  2    .4572  74.20909 0.001  0    0    .006   0.4572  0
G1  10456  10457  2    .5334  66.6719 0.001  0    0    .006   0.5334  0
G1  10457  10458  2    .5334  68.46106 0.001  0    0    .006   0.5334  0
G1  10458  10459  2    .6096  110.0382 0.001  0    0    .006   0.6096  0
G1  10459  4601   2    .6096  7.543276 0.001  0    0    .006   0.6096  0
G1  10461  10462  2    .381   54.40551 0.001  0    0    .006   0.381   0
G1  10462  10463  2    .381   46.69942 0.001  0    0    .006   0.381   0
G1  10463  10464  2    .381   48.64994 0.001  0    0    .006   0.381   0
G1  10464  10465  2    .4572  55.29556 0.001  0    0    .006   0.4572  0
G1  10465  10466  2    .4572  57.68249 0.001  0    0    .006   0.4572  0
G1  10466  10467  2    .5334  105.7787 0.001  0    0    .006   0.5334  0
G1  10467  4681   2    .6096  12.84315 0.001  0    0    .006   0.6096  0
G1  10454  10456  2    .4572  57.24117 0.001  0    0    .006   0.4572  0
G1  10455  10456  2    .4572  65.77213 0.001  0    0    .006   0.4572  0
G1  10469  10466  2    .3048  54.34501 0.001  0    0    .006   0.3048  0
G1  10470  10467  2    .3048  52.90041 0.001  0    0    .006   0.3048  0
G1  10471  10472  2    .3048  45.85426 0.001  0    0    .006   0.3048  0
G1  10472  10473  2    .3048  49.32206 0.001  0    0    .006   0.3048  0
G1  10473  10474  2    .3048  53.37035 0.001  0    0    .006   0.3048  0
G1  10474  10475  2    .5334  57.3864 0.001  0    0    .006   0.5334  0
G1  10475  10476  2    .5334  48.71075 0.001  0    0    .006   0.5334  0
G1  10476  10477  2    .6096  26.53399 0.001  0    0    .006   0.6096  0
G1  10477  10478  2    .6096  85.22542 0.001  0    0    .006   0.6096  0
G1  10478  10479  2    .6858  104.1186 0.001  0    0    .006   0.6858  0
G1  10479  4801   2    .762   13.67074 0.001  0    0    .006   0.762   0
G1  10481  10482  2    .4572  43.43556 0.001  0    0    .006   0.4572  0
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G1  10483  10484  2    .3048  72.89657 0.001  0    0    .006   0.3048  0
G1  10484  10485  2    .381   61.36208 0.001  0    0    .006   0.381   0
G1  10485  10486  2    .381   52.0822 0.001  0    0    .006   0.381   0
G1  10486  10487  2    .4572  54.3838 0.001  0    0    .006   0.4572  0
G1  10487  10488  2    .4572  47.81627 0.001  0    0    .006   0.4572  0
G1  10488  4891   2    .6096  16.98665 0.001  0    0    .006   0.6096  0
G1  10490  10484  2    .3048  56.1904 0.001  0    0    .006   0.3048  0
G1  10491  10486  2    .3048  56.34818 0.001  0    0    .006   0.3048  0
G1  10492  10493  2    .381   58.27694 0.001  0    0    .006   0.381   0
G1  10493  10494  2    .381   51.18666 0.001  0    0    .006   0.381   0
G1  10494  10484  2    .3048  57.22567 0.001  0    0    .006   0.3048  0
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G1  10496  10493  2    .5334  16.63782 0.001  0    0    .006   0.5334  0
G1  10497  10498  2    .5334  87.34834 0.001  0    0    .006   0.5334  0
G1  10498  10499  2    .6096  26.62494 0.001  0    0    .006   0.6096  0
G1  10499  10500  2    .6096  62.07462 0.001  0    0    .006   0.6096  0
G1  10500  10501  2    .6096  15.89568 0.001  0    0    .006   0.6096  0
G1  10501  5021   2    .6858  11.26489 0.001  0    0    .006   0.6858  0
G1  10503  10498  2    .381   57.10222 0.001  0    0    .006   0.381   0
G1  10504  10498  2    .381   60.98351 0.001  0    0    .006   0.381   0
G1  10505  10501  2    .3048  56.07614 0.001  0    0    .006   0.3048  0
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G1  10506  10507  2    .4572  47.50134 0.001  0     0     .006   0.4572  0
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G1  10508  10509  2    .5334  53.34964 0.001  0     0     .006   0.5334  0
G1  10509  10510  2    .6096  54.63235 0.001  0     0     .006   0.6096  0
G1  10510  10511  2    .6096  49.5514 0.001  0     0     .006   0.6096  0
G1  10511  5121   2    .6096  11.16096 0.001  0     0     .006   0.6096  0
G1  10555  10556  2    .762   113.1158 0.001  0     0     .006   0.762   0
G1  10556  3091   2    .762   98.29546 0.001  0     0     .006   0.762   0
G1  101261 12221  2    .4572  72.77161 0.001  0     0     .006   0.4572  0
G1  101262 101263 2    .5334  110.151 0.001  0     0     .006   0.5334  0
G1  101263 101264 2    .5334  23.98679 0.001  0     0     .006   0.5334  0
G1  101264 12651  2    .5334  99.93493 0.001  0     0     .006   0.5334  0
G1  101266 101267 2    .381   55.18356 0.001  0     0     .006   0.381   0
G1  101267 101268 2    .381   49.14027 0.001  0     0     .006   0.381   0
G1  101268 101269 2    .4572  51.42685 0.001  0     0     .006   0.4572  0
G1  101269 12701  2    .4572  65.76525 0.001  0     0     .006   0.4572  0
G1  101271 101272 2    .4572  108.0619 0.001  0     0     .006   0.4572  0
G1  101272 101273 2    .6096  110.1381 0.001  0     0     .006   0.6096  0
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G1  101274 12751  2    .6858  14.55855 0.001  0     0     .006   0.6858  0
G1  101276 101277 2    .3048  49.50424 0.001  0     0     .006   0.3048  0
G1  101277 101278 2    .3048  48.35714 0.001  0     0     .006   0.3048  0
G1  10683  10684  2    .3048  35.16908 0.001  0     0     .006   0.3048  0
G1  10684  10685  2    .3048  57.08057 0.001  0     0     .006   0.3048  0
G1  10685  10686  2    .3048  33.71198 0.001  0     0     .006   0.3048  0
G1  10686  10680  2    .3048  57.76579 0.001  0     0     .006   0.3048  0
G1  10687  10688  2    .3048  35.84969 0.001  0     0     .006   0.3048  0
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G1  10690  10691  2    .4572  56.47763 0.001  0     0     .006   0.4572  0
G1  10691  10692  2    .4572  47.74345 0.001  0     0     .006   0.4572  0
G1  10692  10693  2    .5334  47.04314 0.001  0     0     .006   0.5334  0
G1  10693  10694  2    .5334  60.48435 0.001  0     0     .006   0.5334  0
G1  10694  10695  2    .5334  74.81501 0.001  0     0     .006   0.5334  0
G1  10695  10696  2    .5334  23.61201 0.001  0     0     .006   0.5334  0
G1  10696  6701   2    .6096  15.31831 0.001  0     0     .006   0.6096  0
G1  10697  10698  2    .3048  60.52402 0.001  0     0     .006   0.3048  0
G1  10699  10700  2    .3048  35.9906 0.001  0     0     .006   0.3048  0
G1  10700  10698  2    .3048  43.25  0.001  0     0     .006   0.3048  0
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G1  101470 1471   2    .762   48.21469 0.001  0     0     .006   0.762   0
G1  101511 101512 2    .3048  44.07371 0.001  0     0     .006   0.3048  0
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G1  101656 101657 2    .6096  24.8155 0.001  0     0     .006   0.6096  0
G1  101657 101658 2    .6096  54.20822 0.001  0     0     .006   0.6096  0
G1  101658 101582 2    .6096  14.50244 0.001  0     0     .006   0.6096  0
G1  101659 101582 2    .381   19.82093 0.001  0     0     .006   0.381   0
G1  101582 16661  2    .5334  6.470027 0.001  0     0     .006   0.5334  0
G1  101651 101660 2    .6096  19.43425 0.001  0     0     .006   0.6096  0
G1  101660 101661 2    .6096  40.10751 0.001  0     0     .006   0.6096  0
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G1  101663 101606 2    .6096  15.08609 0.001  0     0     .006   0.6096  0
G1  101664 101606 2    .381   20.00307 0.001  0     0     .006   0.381   0
G1  101606 16661  2    .6096  4.484697 0.001  0     0     .006   0.6096  0
G1  101668 101669 2    .3048  43.61348 0.001  0     0     .006   0.3048  0
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G1  101673 16741  2    .6096  13.35031 0.001  0     0     .006   0.6096  0
G1  101675 101673 2    .4572  32.95119 0.001  0     0     .006   0.4572  0
G1  10984  10985  2    .3048  50.65868 0.001  0     0     .006   0.3048  0
G1  10985  10986  2    .381   82.84503 0.001  0     0     .006   0.381   0
G1  10986  10987  2    .5334  63.06197 0.001  0     0     .006   0.5334  0
G1  10987  10988  2    .4572  62.62408 0.001  0     0     .006   0.4572  0
G1  10988  10989  2    .4572  66.56589 0.001  0     0     .006   0.4572  0
G1  10989  10990  2    .5334  82.59991 0.001  0     0     .006   0.5334  0
G1  10990  10991  2    .5334  88.25144 0.001  0     0     .006   0.5334  0
G1  10991  9281   2    .5334  23.08801 0.001  0     0     .006   0.5334  0
G1  101167 101156 2    .3048  52.13395 0.001  0     0     .006   0.3048  0
G1  101168 101169 2    .3048  22.446  0.001  0     0     .006   0.3048  0
G1  101169 101159 2    .3048  46.47615 0.001  0     0     .006   0.3048  0
G1  102422 102423 2    .254   41.71667 0.001  0     0     .006   0.254   0
G1  102511 102512 2    .3048  55.81221 0.001  0     0     .006   0.3048  0
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G1  102512  102513  2     .254    48.72718 0.001   0      0      .006    0.254   0
G1  102513  102337  2     .3048   47.39751 0.001   0      0      .006    0.3048  0
G1  10374   22881   2     .5334   76.90913 0.001   0      0      .006    0.5334  0
G1  10375   22881   2     .6096   23.56075 0.001   0      0      .006    0.6096  0
G1  102294  102295  2     .254    28.11018 0.001   0      0      .006    0.254   0
G1  102295  102296  2     .254    39.59248 0.001   0      0      .006    0.254   0
G1  102296  102297  2     .254    32.48967 0.001   0      0      .006    0.254   0
G1  102297  102298  2     .3048   31.22488 0.001   0      0      .006    0.3048  0
G1  102299  102298  2     .254    46.12889 0.001   0      0      .006    0.254   0
G1  102298  2300    2     .762    126.2046 0.001   0      0      .006    0.762   0
G1  101526  16741   2     .6096   5.778238 0.001   0      0      .006    0.6096  0
G1  101644  16971   2     1.524   5.752439 0.001   0      0      .006    1.524   0
G1  10777   10780   2     1.2192  17.75887 0.001   0      0      .006    1.2192  0
G1  10780   21091   2     1.2192  42.42891 0.001   0      0      .006    1.2192  0
G1  102309  10553   2     1.8288  297.3975 0.001   0      0      .006    1.8288  0
G1  102310  101332  2     .6096   243.0965 0.001   0      0      .006    0.6096  0
G1  10534   10535   2     .5334   71.76979 0.001   0      0      .006    0.5334  0
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G1  10537   10538   2     .381    64.07916 0.001   0      0      .006    0.381   0
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G1  10651   6501    2     .4572   24.26546 0.001   0      0      .006    0.4572  0
G1  101231  101232  2     .381    61.57619 0.001   0      0      .006    0.381   0
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G1  101240  101241  2     .5334   72.90723 0.001   0      0      .006    0.5334  0
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G1  101250  101251  2     .381    55.71324 0.001   0      0      .006    0.381   0
G1  101251  101252  2     .4572   66.17033 0.001   0      0      .006    0.4572  0
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G1  10903   10904   2     .3048   44.09776 0.001   0      0      .006    0.3048  0
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G1  10911   10912   2     .381    41.00006 0.001   0      0      .006    0.381   0
G1  10912   10913   2     .381    37.61991 0.001   0      0      .006    0.381   0
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G1  10914   10915   2     .3048   46.8955 0.001    0      0      .006    0.3048  0
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G1  101506  101507  2     .3048   45.77011 0.001   0      0      .006    0.3048  0
G1  101507  101508  2     .381    57.82526 0.001   0      0      .006    0.381   0
G1  101508  101509  2     .6096   37.45455 0.001   0      0      .006    0.6096  0
G1  101509  101478  2     .6096   41.02855 0.001   0      0      .006    0.6096  0
G1  101476  101477  2     .3048   39.95685 0.001   0      0      .006    0.3048  0
G1  101477  101478  2     .3048   41.53719 0.001   0      0      .006    0.3048  0
G1  101523  101502  2     .3048   51.11608 0.001   0      0      .006    0.3048  0
G1  101502  101503  2     .4572   40.62782 0.001   0      0      .006    0.4572  0
G1  101503  101504  2     .4572   41.56666 0.001   0      0      .006    0.4572  0
G1  101504  101478  2     .4572   41.27517 0.001   0      0      .006    0.4572  0
G1  101498  101499  2     .3048   51.0767 0.001    0      0      .006    0.3048  0
G1  101499  101500  2     .3048   54.63716 0.001   0      0      .006    0.3048  0
G1  101038  101039  2     .3048   56.4566 0.001    0      0      .006    0.3048  0
G1  101040  101041  2     .3048   57.0176 0.001    0      0      .006    0.3048  0
G1  101042  101043  2     .3048   66.13422 0.001   0      0      .006    0.3048  0
G1  101044  101045  2     .3048   65.06972 0.001   0      0      .006    0.3048  0
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G1  101046  101047  2     .3048   61.03893 0.001   0      0      .006    0.3048  0
G1  101048  101049  2     .3048   63.84132 0.001   0      0      .006    0.3048  0
G1  101050  101051  2     .3048   43.57411 0.001   0      0      .006    0.3048  0
G1  101052  101053  2     .3048   45.49424 0.001   0      0      .006    0.3048  0
G1  101054  101055  2     .3048   45.28819 0.001   0      0      .006    0.3048  0
G1  101056  101057  2     .3048   44.90104 0.001   0      0      .006    0.3048  0
G1  101521  101522  2     .381    36.11305 0.001   0      0      .006    0.381   0
G1  101522  101524  2     .4572   41.93339 0.001   0      0      .006    0.4572  0
G1  101524  101525  2     .4572   9.010679 0.001   0      0      .006    0.4572  0
G1  101525  101526  2     .6096   16.74287 0.001   0      0      .006    0.6096  0
G1  101527  101528  2     .3048   56.3742 0.001    0      0      .006    0.3048  0
G1  101528  101529  2     .3048   57.34515 0.001   0      0      .006    0.3048  0
G1  101529  101525  2     .381    42.19962 0.001   0      0      .006    0.381   0
G1  101530  101531  2     .3048   47.23945 0.001   0      0      .006    0.3048  0
G1  101532  101533  2     .3048   33.07034 0.001   0      0      .006    0.3048  0
G1  101533  101531  2     .3048   33.46744 0.001   0      0      .006    0.3048  0
G1  101531  101534  2     .381    47.92164 0.001   0      0      .006    0.381   0
G1  101534  101535  2     .381    43.67288 0.001   0      0      .006    0.381   0
G1  101497  101535  2     .3048   65.9101 0.001    0      0      .006    0.3048  0
G1  101535  101536  2     .4772   50.5654 0.001    0      0      .006    0.4772  0
G1  101536  101537  2     .5334   46.96453 0.001   0      0      .006    0.5334  0
G1  101537  101538  2     .5334   43.73294 0.001   0      0      .006    0.5334  0
G1  101538  15391   2     .5334   12.70177 0.001   0      0      .006    0.5334  0
G1  101489  101490  2     .3048   39.88014 0.001   0      0      .006    0.3048  0
G1  10929   10873   2     .3048   38.16106 0.001   0      0      .006    0.3048  0
G1  10930   10873   2     .3048   40.77006 0.001   0      0      .006    0.3048  0
G1  10931   10932   2     .3048   42.11956 0.001   0      0      .006    0.3048  0
G1  10932   10933   2     .3048   49.59176 0.001   0      0      .006    0.3048  0
G1  10933   10880   2     .0348   41.30955 0.001   0      0      .006    0.3048  0
G1  10950   10951   2     .254    45.09939 0.001   0      0      .006    0.254   0
G1  10951   10952   2     .3048   46.67121 0.001   0      0      .006    0.3048  0
G1  10702   10703   2     .5334   47.40769 0.001   0      0      .006    0.5334  0
G1  10703   10704   2     .5334   50.24372 0.001   0      0      .006    0.5334  0
G1  10704   10771   2     .6096   14.4026 0.001    0      0      .006    0.6096  0
G1  10705   10706   2     .3048   53.24296 0.001   0      0      .006    0.3048  0
G1  10706   10707   2     .381    53.15583 0.001   0      0      .006    0.381   0
G1  10707   10708   2     .381    51.0202 0.001    0      0      .006    0.381   0
G1  10708   10709   2     .4572   50.32273 0.001   0      0      .006    0.4572  0
G1  10709   10710   2     .4572   58.75879 0.001   0      0      .006    0.4572  0
G1  10710   10711   2     .5334   95.58134 0.001   0      0      .006    0.5334  0
G1  101316  101317  2     .3048   43.73374 0.001   0      0      .006    0.3048  0
G1  101317  101318  2     .3048   44.18972 0.001   0      0      .006    0.3048  0
G1  101318  101319  2     .381    56.69228 0.001   0      0      .006    0.381   0
G1  101319  101320  2     .381    52.01076 0.001   0      0      .006    0.381   0
G1  101320  101321  2     .4572   57.72017 0.001   0      0      .006    0.4572  0
G1  101321  101322  2     .4572   51.44237 0.001   0      0      .006    0.4572  0
G1  101062  101063  2     .5334   94.29314 0.001   0      0      .006    0.5334  0
G1  101063  1037111 2     .5334   72.47773 0.001   0      0      .006    0.5334  0
G1  101064  101065  2     .254    47.46057 0.001   0      0      .006    0.254   0
G1  101065  101066  2     .3048   51.70216 0.001   0      0      .006    0.3048  0
G1  101067  101068  2     .254    45.7792 0.001    0      0      .006    0.254   0
G1  101068  101069  2     .3048   50.34042 0.001   0      0      .006    0.3048  0
G1  101070  101071  2     .254    44.81168 0.001   0      0      .006    0.254   0
G1  101071  101072  2     .3048   53.46389 0.001   0      0      .006    0.3048  0
G1  101073  101074  2     .254    43.63948 0.001   0      0      .006    0.254   0
G1  101074  101075  2     .3048   53.38386 0.001   0      0      .006    0.3048  0
G1  101076  101077  2     .254    46.33234 0.001   0      0      .006    0.254   0
G1  101077  101078  2     .3048   52.50735 0.001   0      0      .006    0.3048  0
G1  101079  101080  2     .254    45.82004 0.001   0      0      .006    0.254   0
G1  101080  101081  2     .3048   53.31708 0.001   0      0      .006    0.3048  0
G1  101066  101069  2     .381    19.43384 0.001   0      0      .006    0.381   0
G1  101069  101072  2     .4572   87.06847 0.001   0      0      .006    0.4572  0
G1  101072  101075  2     .4572   7.224778 0.001   0      0      .006    0.4572  0
G1  101075  101078  2     .4572   82.617  0.001    0      0      .006    0.4572  0
G1  101078  101081  2     .5334   7.286161 0.001   0      0      .006    0.5334  0
G1  101081  101082  2     .5334   88.19672 0.001   0      0      .006    0.5334  0
G1  101082  101083  2     .5334   89.07805 0.001   0      0      .006    0.5334  0
G1  101083  101084  2     .5334   50.02091 0.001   0      0      .006    0.5334  0
G1  101553  101554  2     .6096   32.8175 0.001    0      0      .006    0.6096  0
G1  101554  101555  2     .6096   31.82383 0.001   0      0      .006    0.6096  0
G1  101555  101544  2     .6096   44.55031 0.001   0      0      .006    0.6096  0
G1  101557  101558  2     .3048   29.70848 0.001   0      0      .006    0.3048  0
G1  101558  101559  2     .3048   25.88796 0.001   0      0      .006    0.3048  0
G1  101337  1341    1     1.9558  235.1127 0.001   0      0      .006    3.0988  0
G1  101278  101279  2     .381    52.20311 0.001   0      0      .006    0.381   0
G1  101279  101280  2     .381    57.019  0.001    0      0      .006    0.381   0
G1  101280  101281  2     .4572   52.13394 0.001   0      0      .006    0.4572  0
G1  101281  101282  2     .4572   57.15245 0.001   0      0      .006    0.4572  0
G1  101282  101283  2     .5334   43.86798 0.001   0      0      .006    0.5334  0
G1  101283  101284  2     .6096   51.86409 0.001   0      0      .006    0.6096  0
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G1  101284  12851  2     .6096   18.35858 0.001   0      0      .006    0.6096  0
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G1  101287  101288 2     .3048   51.95676 0.001   0      0      .006    0.3048  0
G1  101288  101289 2     .381    56.302  0.001   0      0      .006    0.381   0
G1  101289  101290 2     .381    52.01076 0.001   0      0      .006    0.381   0
G1  101290  101291 2     .4572   53.55268 0.001   0      0      .006    0.4572  0
G1  101291  101292 2     .4572   56.63805 0.001   0      0      .006    0.4572  0
G1  101292  101293 2     .5334   44.37984 0.001   0      0      .006    0.5334  0
G1  101293  101294 2     .6096   49.9557 0.001   0      0      .006    0.6096  0
G1  101294  12951  2     .6096   15.64693 0.001   0      0      .006    0.6096  0
G1  101296  101297 2     .381    37.91332 0.001   0      0      .006    0.381   0
G1  101297  101298 2     .381    43.79787 0.001   0      0      .006    0.381   0
G1  101298  101299 2     .4572   55.27676 0.001   0      0      .006    0.4572  0
G1  101299  101300 2     .4572   54.52949 0.001   0      0      .006    0.4572  0
G1  101300  101301 2     .5334   54.52949 0.001   0      0      .006    0.5334  0
G1  101301  101302 2     .5334   53.8116 0.001   0      0      .006    0.5334  0
G1  101302  101303 2     .5334   47.185  0.001   0      0      .006    0.5334  0
G1  101303  101304 2     .6096   47.84315 0.001   0      0      .006    0.6096  0
G1  101304  13051  2     .6858   18.47468 0.001   0      0      .006    0.6858  0
G1  101084  1085111 2     .6858   24.08794 0.001   0      0      .006    0.6858  0
G1  101086  101087 2     .254    48.58827 0.001   0      0      .006    0.254   0
G1  101087  101088 2     .254    43.15302 0.001   0      0      .006    0.254   0
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G1  101090  101091 2     .254    50.15429 0.001   0      0      .006    0.254   0
G1  101091  101092 2     .254    44.90104 0.001   0      0      .006    0.254   0
G1  101092  101093 2     .3048   44.48049 0.001   0      0      .006    0.3048  0
G1  10723   10724  2     .6096   12.77572 0.001   0      0      .006    0.6096  0
G1  10724   10725  2     .6096   16.70116 0.001   0      0      .006    0.6096  0
G1  10725   10726  2     .6096   50.36712 0.001   0      0      .006    0.6096  0
G1  10726   10727  2     .6096   40.12284 0.001   0      0      .006    0.6096  0
G1  10727   6691   2     .6096   15.18695 0.001   0      0      .006    0.6096  0
G1  10728   10725  2     .381    51.42579 0.001   0      0      .006    0.381   0
G1  10729   10730  2     .4572   43.9599 0.001   0      0      .006    0.4572  0
G1  10730   10731  2     .381    45.4248 0.001   0      0      .006    0.381   0
G1  10731   10732  2     .381    62.10476 0.001   0      0      .006    0.381   0
G1  10732   10733  2     .381    44.36286 0.001   0      0      .006    0.381   0
G1  10733   10734  2     .5334   57.1695 0.001   0      0      .006    0.5334  0
G1  10734   10735  2     .5334   56.52304 0.001   0      0      .006    0.5334  0
G1  10735   10736  2     .5334   47.74345 0.001   0      0      .006    0.5334  0
G1  10736   10737  2     .5334   44.30872 0.001   0      0      .006    0.5334  0
G1  10737   6701   2     .6096   16.60756 0.001   0      0      .006    0.6096  0
G1  10738   10735  2     .381    55.18042 0.001   0      0      .006    0.381   0
G1  10739   10740  2     .381    49.91814 0.001   0      0      .006    0.381   0
G1  10740   10741  2     .381    43.28252 0.001   0      0      .006    0.381   0
G1  10741   6711   2     .6096   14.29432 0.001   0      0      .006    0.6096  0
G1  101579  101580 2     .5334   69.14005 0.001   0      0      .006    0.5334  0
G1  101580  101581 2     .5334   53.78804 0.001   0      0      .006    0.5334  0
G1  101581  101582 2     .5334   53.8354 0.001   0      0      .006    0.5334  0
G1  101583  101584 2     .381    87.64117 0.001   0      0      .006    0.381   0
G1  101584  101585 2     .4572   40.59899 0.001   0      0      .006    0.4572  0
G1  101585  101586 2     .4572   47.53599 0.001   0      0      .006    0.4572  0
G1  101586  101587 2     .4572   53.67418 0.001   0      0      .006    0.4572  0
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G1  101596  101597 2     .381    45.35269 0.001   0      0      .006    0.381   0
G1  101597  101598 2     .381    32.23381 0.001   0      0      .006    0.381   0
G1  101598  101599 2     .381    39.56322 0.001   0      0      .006    0.381   0
G1  101599  101600 2     .4572   22.51089 0.001   0      0      .006    0.4572  0
G1  101600  101545 2     .4572   23.48459 0.001   0      0      .006    0.4572  0
G1  10749   10750  2     .4572   42.10381 0.001   0      0      .006    0.4572  0
G1  10750   10751  2     .4572   59.35303 0.001   0      0      .006    0.4572  0
G1  10751   10733  2     .4572   57.94746 0.001   0      0      .006    0.4572  0
G1  10753   10754  2     .381    30.24217 0.001   0      0      .006    0.381   0
G1  10754   10755  2     .381    26.15333 0.001   0      0      .006    0.381   0
G1  10755   10750  2     .381    81.7782 0.001   0      0      .006    0.381   0
G1  10752   10753  2     .381    35.95148 0.001   0      0      .006    0.381   0
G1  10762   10763  2     .381    41.95522 0.001   0      0      .006    0.381   0
G1  10763   10758  2     .381    36.23309 0.001   0      0      .006    0.381   0
G1  10758   10759  2     .4572   55.96526 0.001   0      0      .006    0.4572  0
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G1  10760   10761  2     .5334   92.65912 0.001   0      0      .006    0.5334  0
G1  10761   6731   2     .6096   14.95928 0.001   0      0      .006    0.6096  0
G1  10765   10760  2     .381    60.17677 0.001   0      0      .006    0.381   0
G1  101123  101124 2     .381    63.84901 0.001   0      0      .006    0.381   0
G1  101124  101125 2     .4572   72.45948 0.001   0      0      .006    0.4572  0
G1  101125  101126 2     .5334   170.9594 0.001   0      0      .006    0.5334  0
G1  101126  939    2     .5334   22.46041 0.001   0      0      .006    0.5334  0
G1  101127  101128 2     .381    50.57412 0.001   0      0      .006    0.381   0
G1  101128  101129 2     .381    71.371  0.001   0      0      .006    0.381   0
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G1  101129  101130  2     .4572   62.70793 0.001   0      0      .006    0.4572  0
G1  101130  101131  2     .4572   68.41494 0.001   0      0      .006    0.4572  0
G1  101131  101132  2     .5334   94.40106 0.001   0      0      .006    0.5334  0
G1  101132  9401    2     .5334   97.70135 0.001   0      0      .006    0.5334  0
G1  104011  101133  2     .4572   46.43641 0.001   0      0      .006    0.4572  0
G1  101133  101134  2     .4572   44.20591 0.001   0      0      .006    0.4572  0
G1  101134  101135  2     .4572   43.21096 0.001   0      0      .006    0.4572  0
G1  101135  101136  2     .5334   68.21316 0.001   0      0      .006    0.5334  0
G1  101136  101137  2     .6096   19.51214 0.001   0      0      .006    0.6096  0
G1  101137  101138  2     .6096   17.75978 0.001   0      0      .006    0.6096  0
G1  101138  101139  2     .6096   88.88942 0.001   0      0      .006    0.6096  0
G1  101139  101140  2     .6096   88.31711 0.001   0      0      .006    0.6096  0
G1  101140  101141  2     .6858   87.23273 0.001   0      0      .006    0.6858  0
G1  101141  101142  2     .6858   90.63355 0.001   0      0      .006    0.6858  0
G1  10543   5401    2     .381    56.44619 0.001   0      0      .006    0.381   0
G1  10544   10545   2     .4572   62.27661 0.001   0      0      .006    0.4572  0
G1  10545   10546   2     .4572   53.22955 0.001   0      0      .006    0.4572  0
G1  10546   10547   2     .5334   48.48478 0.001   0      0      .006    0.5334  0
G1  10547   10548   2     .5334   55.27805 0.001   0      0      .006    0.5334  0
G1  10548   5491    2     .6096   11.20184 0.001   0      0      .006    0.6096  0
G1  10550   10546   2     .381    61.52428 0.001   0      0      .006    0.381   0
G1  10551   10548   2     .3048   60.81715 0.001   0      0      .006    0.3048  0
G1  10552   10553   2     .762    108.6304 0.001   0      0      .006    0.762   0
G1  10553   10554   2     .762    111.3951 0.001   0      0      .006    0.762   0
G1  10554   10555   2     .762    213.9441 0.001   0      0      .006    0.762   0
G1  10513   10507   2     .381    52.24574 0.001   0      0      .006    0.381   0
G1  10514   10509   2     .381    59.43823 0.001   0      0      .006    0.381   0
G1  10515   10511   2     .3048   59.06985 0.001   0      0      .006    0.3048  0
G1  10531   10532   2     .381    42.055  0.001   0      0      .006    0.381   0
G1  10532   10533   2     .381    37.86374 0.001   0      0      .006    0.381   0
G1  10533   10534   2     .4572   89.67911 0.001   0      0      .006    0.4572  0
G1  10662   10663   2     .381    54.30662 0.001   0      0      .006    0.381   0
G1  10663   10664   2     .6096   11.2101 0.001   0      0      .006    0.6096  0
G1  10664   6651    2     .6858   86.3872 0.001   0      0      .006    0.6858  0
G1  10676   10677   2     .3048   28.23908 0.001   0      0      .006    0.3048  0
G1  10677   10678   2     .381    50.64295 0.001   0      0      .006    0.381   0
G1  10678   10679   2     .4572   52.83851 0.001   0      0      .006    0.4572  0
G1  10679   10680   2     .4572   54.58991 0.001   0      0      .006    0.4572  0
G1  10680   10681   2     .5334   103.1723 0.001   0      0      .006    0.5334  0
G1  10681   10682   2     .6096   97.47991 0.001   0      0      .006    0.6096  0
G1  10682   6691    2     .6096   12.47108 0.001   0      0      .006    0.6096  0
G1  101439  14381   2     .5334   30.47704 0.001   0      0      .006    0.5334  0
G1  101450  101451  2     .6096   58.26389 0.001   0      0      .006    0.6096  0
G1  101451  14381   2     .6096   53.33907 0.001   0      0      .006    0.6096  0
G1  101449  101450  2     .4572   50.52559 0.001   0      0      .006    0.4572  0
G1  101462  101463  2     .6096   23.4627 0.001   0      0      .006    0.6096  0
G1  101463  101464  2     .6096   45.59583 0.001   0      0      .006    0.6096  0
G1  101464  101465  2     .6096   27.34739 0.001   0      0      .006    0.6096  0
G1  10915   10916   2     .4572   59.81704 0.001   0      0      .006    0.4572  0
G1  10916   10917   2     .4572   66.52245 0.001   0      0      .006    0.4572  0
G1  10873   10874   2     .4572   74.09903 0.001   0      0      .006    0.4572  0
G1  10879   10880   2     .381    67.98804 0.001   0      0      .006    0.381   0
G1  10880   10881   2     .381    71.69272 0.001   0      0      .006    0.381   0
G1  10886   10887   2     .3048   49.81592 0.001   0      0      .006    0.3048  0
G1  10887   10888   2     .3048   44.60627 0.001   0      0      .006    0.3048  0
G1  10888   10889   2     .381    57.07952 0.001   0      0      .006    0.381   0
G1  10895   10896   2     .381    61.45025 0.001   0      0      .006    0.381   0
G1  101012  101013  2     .381    64.35518 0.001   0      0      .006    0.381   0
G1  101013  101014  2     .381    52.44624 0.001   0      0      .006    0.381   0
G1  101014  101015  2     .4572   61.77645 0.001   0      0      .006    0.4572  0
G1  101015  101016  2     .381    56.4566 0.001   0      0      .006    0.381   0
G1  101017  101018  2     .254    59.91828 0.001   0      0      .006    0.254   0
G1  101018  101019  2     .254    64.91621 0.001   0      0      .006    0.254   0
G1  101020  101021  2     .254    60.47859 0.001   0      0      .006    0.254   0
G1  101021  101022  2     .3048   62.11134 0.001   0      0      .006    0.3048  0
G1  101023  101024  2     .254    54.13115 0.001   0      0      .006    0.254   0
G1  101024  101025  2     .3048   63.89339 0.001   0      0      .006    0.3048  0
G1  101026  101027  2     .254    54.16916 0.001   0      0      .006    0.254   0
G1  101027  101028  2     .3048   63.2332 0.001   0      0      .006    0.3048  0
G1  101029  101030  2     .254    55.94379 0.001   0      0      .006    0.254   0
G1  101030  101031  2     .3048   66.69455 0.001   0      0      .006    0.3048  0
G1  101032  101033  2     .254    56.50426 0.001   0      0      .006    0.254   0
G1  101033  101034  2     .3048   66.64467 0.001   0      0      .006    0.3048  0
G1  101019  101022  2     .381    20.85281 0.001   0      0      .006    0.381   0
G1  101022  101025  2     .4572   86.51632 0.001   0      0      .006    0.4572  0
G1  101025  101028  2     .4572   6.753219 0.001   0      0      .006    0.4572  0
G1  101028  101031  2     .4572   83.61036 0.001   0      0      .006    0.4572  0
G1  101031  101034  2     .5334   6.846371 0.001   0      0      .006    0.5334  0
G1  101034  101035  2     .5334   87.81526 0.001   0      0      .006    0.5334  0
G1  101035  101036  2     .5334   88.75693 0.001   0      0      .006    0.5334  0
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G1  101060  101061  2     .254    44.8673 0.001   0     0     .006   0.254   0
G1  101051  101053  2     .381    19.52985 0.001  0     0     .006   0.381   0
G1  101053  101055  2     .381    86.89643 0.001  0     0     .006   0.381   0
G1  101055  101057  2     .4572   6.76639 0.001   0     0     .006   0.4572  0
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G1  101061  101062  2     .5334   82.6946 0.001   0     0     .006   0.5334  0
G1  101500  101501  2     .381    37.29537 0.001  0     0     .006   0.381   0
G1  101501  101502  2     .381    45.27811 0.001  0     0     .006   0.381   0
G1  101478  101479  2     .6858   34.72228 0.001  0     0     .006   0.6858  0
G1  101479  101480  2     .6858   25.98916 0.001  0     0     .006   0.6858  0
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G1  101481  101482  2     .6858   43.70692 0.001  0     0     .006   0.6858  0
G1  101482  101483  2     .6858   46.7947 0.001   0     0     .006   0.6858  0
G1  101483  101484  2     .762    45.19688 0.001  0     0     .006   0.762   0
G1  101484  101485  2     .762    46.03695 0.001  0     0     .006   0.762   0
G1  101485  101486  2     .762    44.84513 0.001  0     0     .006   0.762   0
G1  101486  101487  2     .762    45.27811 0.001  0     0     .006   0.762   0
G1  101487  101488  2     .9144   44.31918 0.001  0     0     .006   0.9144  0
G1  101488  1471    2     .9144   24.20785 0.001  0     0     .006   0.9144  0
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G1  101493  101494  2     .3048   44.87634 0.001  0     0     .006   0.3048  0
G1  101494  101495  2     .381    40.79759 0.001  0     0     .006   0.381   0
G1  101495  101488  2     .381    39.79229 0.001  0     0     .006   0.381   0
G1  101490  101491  2     .381    33.27868 0.001  0     0     .006   0.381   0
G1  101491  101486  2     .381    37.13315 0.001  0     0     .006   0.381   0
G1  101516  101517  2     .3048   38.67052 0.001  0     0     .006   0.3048  0
G1  101517  101518  2     .3048   35.40843 0.001  0     0     .006   0.3048  0
G1  101518  101519  2     .3048   40.28396 0.001  0     0     .006   0.3048  0
G1  101520  101519  2     .3048   37.53855 0.001  0     0     .006   0.3048  0
G1  101519  101521  2     .381    38.45271 0.001  0     0     .006   0.381   0
G1  10711   6721    2     .6096   15.77174 0.001  0     0     .006   0.6096  0
G1  10712   10713   2     .381    63.35819 0.001  0     0     .006   0.381   0
G1  10713   10714   2     .6096   46.52656 0.001  0     0     .006   0.6096  0
G1  10714   10715   2     .6096   45.4248 0.001   0     0     .006   0.6096  0
G1  10715   6681    2     .6858   14.57876 0.001  0     0     .006   0.6858  0
G1  10716   10717   2     .3048   18.01714 0.001  0     0     .006   0.3048  0
G1  10717   10718   2     .4572   46.23389 0.001  0     0     .006   0.4572  0
G1  10718   10719   2     .4572   45.02032 0.001  0     0     .006   0.4572  0
G1  10719   10720   2     .5334   61.73851 0.001  0     0     .006   0.5334  0
G1  10720   10721   2     .5334   45.30986 0.001  0     0     .006   0.5334  0
G1  10721   10722   2     .6096   59.2693 0.001   0     0     .006   0.6096  0
G1  10722   10723   2     .6096   25.83813 0.001  0     0     .006   0.6096  0
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G1  101544  101545  2     .6858   32.0844 0.001   0     0     .006   0.6858  0
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G1  101307  101308  2     .381    45.4039 0.001   0     0     .006   0.381   0
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G1  101309  101310  2     .4572   55.78934 0.001  0     0     .006   0.4572  0
G1  101310  101311  2     .5334   52.01075 0.001  0     0     .006   0.5334  0
G1  101311  101312  2     .5334   56.17843 0.001  0     0     .006   0.5334  0
G1  101312  101313  2     .6096   48.19104 0.001  0     0     .006   0.6096  0
G1  101313  101314  2     .6096   44.31053 0.001  0     0     .006   0.6096  0
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G1  101562  101563  2     .3048   32.8175 0.001   0     0     .006   0.3048  0
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G1  101564  101565  2     .4572   55.85851 0.001  0     0     .006   0.4572  0
G1  101565  101566  2     .9144   46.27528 0.001  0     0     .006   0.9144  0
G1  101566  15671   2     .9144   12.36661 0.001  0     0     .006   0.9144  0
G1  101568  101569  2     .3048   50.88208 0.001  0     0     .006   0.3048  0
G1  101569  101570  2     .381    57.62243 0.001  0     0     .006   0.381   0
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G1  101578  101579  2     .5334   57.71378 0.001   0      0      .006    0.5334  0
G1  101322  101323  2     .5334   95.68629 0.001   0      0      .006    0.5334  0
G1  101323  13241   2     .6096   20.78271 0.001   0      0      .006    0.6096  0
G1  101325  101326  2     .6096   79.69853 0.001   0      0      .006    0.6096  0
G1  101326  101327  2     .6096   92.95747 0.001   0      0      .006    0.6096  0
G1  101327  101328  2     .6096   76.72544 0.001   0      0      .006    0.6096  0
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G1  101332  101333  2     .5334   81.96031 0.001   0      0      .006    0.5334  0
G1  101333  101334  2     .5334   94.41106 0.001   0      0      .006    0.5334  0
G1  101334  101335  2     .6096   73.55976 0.001   0      0      .006    0.6096  0
G1  101335  101336  2     .6096   80.33486 0.001   0      0      .006    0.6096  0
G1  101336  101337  2     .6096   20.24949 0.001   0      0      .006    0.6096  0
G1  101342  101331  1     1.9558  145.4986 0.001   0      0      .006    3.0988  0
G1  101331  101337  1     1.9558  49.36541 0.001   0      0      .006    3.0988  0
G1  101094  101095  2     .254    45.91326 0.001   0      0      .006    0.254   0
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G1  101097  101098  2     .254    45.28819 0.001   0      0      .006    0.254   0
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G1  101100  101101  2     .254    47.46057 0.001   0      0      .006    0.254   0
G1  101101  101102  2     .3048   44.39028 0.001   0      0      .006    0.3048  0
G1  101103  101104  2     .254    49.14242 0.001   0      0      .006    0.254   0
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G1  101093  101096  2     .4572   88.11993 0.001   0      0      .006    0.4572  0
G1  101096  101099  2     .4572   5.909065 0.001   0      0      .006    0.4572  0
G1  101099  101102  2     .4572   83.62007 0.001   0      0      .006    0.4572  0
G1  101359  101360  2     .9144   114.2773 0.001   0      0      .006    0.9144  0
G1  101360  101361  2     .9144   68.35244 0.001   0      0      .006    0.9144  0
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G1  101102  101105  2     .5334   7.175292 0.001   0      0      .006    0.5334  0
G1  101105  101106  2     .5334   88.50523 0.001   0      0      .006    0.5334  0
G1  101106  101107  2     .5334   88.74644 0.001   0      0      .006    0.5334  0
G1  101107  101108  2     .5334   50.31918 0.001   0      0      .006    0.5334  0
G1  101108  1085111 2     .6096   24.42577 0.001   0      0      .006    0.6096  0
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G1  101110  9441    2     .3048   54.36776 0.001   0      0      .006    0.3048  0
G1  101111  9451    2     .3048   56.42907 0.001   0      0      .006    0.3048  0
G1  101112  9461    2     .3048   56.19752 0.001   0      0      .006    0.3048  0
G1  101113  11141   2     .5334   21.85443 0.001   0      0      .006    0.5334  0
G1  101115  11161   2     .5334   22.06309 0.001   0      0      .006    0.5334  0
G1  101117  101118  2     .4572   76.50471 0.001   0      0      .006    0.4572  0
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G1  101119  101120  2     .6096   102.9079 0.001   0      0      .006    0.6096  0
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G1  101601  101602  2     .381    14.69361 0.001   0      0      .006    0.381   0
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G1  10952   10953   2     .4572   192.2958 0.001   0      0      .006    0.4572  0
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G1  101371  101372  1     .9144   50.647  0.001   0      0      .006    0.5842  0
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G1  101373  101374  2     .381    32.17245 0.001   0      0      .006    0.381   0
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G1  101378  101371  1     .762    51.42275 0.001   0      0      .006    0.4636  0
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G1  10744  10745  2    .4572  52.48359 0.001  0     0     .006   0.4572 0
G1  10745  10746  2    .4572  45.7154 0.001   0     0     .006   0.4572 0
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G1  10748  10749  2    .381   40.81616 0.001  0     0     .006   0.381  0
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G1  101390 101391 2    .4572  51.50914 0.001  0     0     .006   0.4572 0
G1  101391 101392 2    .4572  30.59386 0.001  0     0     .006   0.4572 0
G1  101392 101393 2    .5334  30.37162 0.001  0     0     .006   0.5334 0
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G1  101402 14011  2    .5334  72.21735 0.001  0     0     .006   0.5334 0
G1  101605 101606 2    .6096  80.64185 0.001  0     0     .006   0.6096 0
G1  101611 101612 2    .381   74.81332 0.001  0     0     .006   0.381  0
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G1  102033  102034  2     .4572   48.27608 0.001   0      0      .006    0.4572  0
G1  102034  102035  2     .5334   97.47092 0.001   0      0      .006    0.5334  0
G1  101744  101745  2     .381    32.09375 0.001   0      0      .006    0.381   0
G1  101745  101746  2     .4572   47.33346 0.001   0      0      .006    0.4572  0
G1  101746  101747  2     .4572   57.47648 0.001   0      0      .006    0.4572  0
G1  101747  101748  2     .5334   100.357 0.001    0      0      .006    0.5334  0
G1  101748  17491   2     .5334   108.3436 0.001   0      0      .006    0.5334  0
G1  101750  101751  2     .3048   47.61852 0.001   0      0      .006    0.3048  0
G1  101751  101752  2     .381    52.03936 0.001   0      0      .006    0.381   0
G1  101752  101753  2     .4572   49.32469 0.001   0      0      .006    0.4572  0
G1  101753  101754  2     .4572   55.31004 0.001   0      0      .006    0.4575  0
G1  101754  101755  2     .5334   50.89261 0.001   0      0      .006    0.5334  0
G1  101755  17561   2     .5334   62.74822 0.001   0      0      .006    0.5334  0
G1  101757  101758  2     .381    38.14937 0.001   0      0      .006    0.381   0
G1  101758  101759  2     .381    49.98135 0.001   0      0      .006    0.381   0
G1  101759  101760  2     .381    51.78113 0.001   0      0      .006    0.381   0
G1  101760  101761  2     .4572   51.92323 0.001   0      0      .006    0.4572  0
G1  101761  101762  2     .4572   51.09905 0.001   0      0      .006    0.4572  0
G1  101762  101763  2     .5334   96.27962 0.001   0      0      .006    0.5334  0
G1  101763  17641   2     .5334   97.64023 0.001   0      0      .006    0.5334  0
G1  101765  101766  2     .381    43.95275 0.001   0      0      .006    0.381   0
G1  101766  101767  2     .381    37.48448 0.001   0      0      .006    0.381   0
G1  101767  101768  2     .381    40.26982 0.001   0      0      .006    0.381   0
G1  101768  101769  2     .5334   89.95273 0.001   0      0      .006    0.5334  0
G1  101769  101770  2     .5334   91.96129 0.001   0      0      .006    0.5334  0
G1  101770  101771  2     .6096   62.41687 0.001   0      0      .006    0.6096  0
G1  101771  17721   2     .6096   68.9241 0.001    0      0      .006    0.6096  0
G1  101773  101774  2     3048    62.53871 0.001   0      0      .006    0.3048  0
G1  101774  101768  2     .381    93.64703 0.001   0      0      .006    0.381   0
G1  101775  101776  2     .3048   30.57755 0.001   0      0      .006    0.3048  0
G1  101776  101777  2     .381    53.17457 0.001   0      0      .006    0.381   0
G1  101814  101815  2     .4572   49.95745 0.001   0      0      .006    0.4572  0
G1  101815  101816  2     .6858   37.67682 0.001   0      0      .006    0.6858  0
G1  101816  18171   2     .6858   74.92393 0.001   0      0      .006    0.6858  0
G1  101818  101819  2     .3048   22.47286 0.001   0      0      .006    0.3048  0
G1  101819  101811  2     .3048   50.66182 0.001   0      0      .006    0.3048  0
G1  101820  101821  2     .381    51.56565 0.001   0      0      .006    0.381   0
G1  101821  101822  2     .381    88.695  0.001    0      0      .006    0.381   0
G1  101822  101823  2     .4572   56.79783 0.001   0      0      .006    0.4572  0
G1  101823  101824  2     .4572   21.78487 0.001   0      0      .006    0.4572  0
G1  101824  101825  2     .4572   19.71   0.001    0      0      .006    0.4572  0
G1  101825  101816  2     .5334   49.96796 0.001   0      0      .006    0.5334  0
G1  101826  101827  2     .5334   50.66182 0.001   0      0      .006    0.5334  0
G1  101827  101828  2     .5334   49.56712 0.001   0      0      .006    0.5334  0
G1  101828  101829  2     .5334   49.56712 0.001   0      0      .006    0.5334  0
G1  101829  101830  2     .6096   76.42242 0.001   0      0      .006    0.6096  0
G1  101830  101831  2     .6096   102.6977 0.001   0      0      .006    0.6096  0
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G1  10855   10856   2     .5334   52.02929 0.001   0      0      .006    0.5334  0
G1  10856   10857   2     .6096   113.2256 0.001   0      0      .006    0.6096  0
G1  10857   10858   2     .6858   111.4246 0.001   0      0      .006    0.6858  0
G1  10853   10852   2     .3048   59.65693 0.001   0      0      .006    0.3048  0
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G1  10864   10825   2     .3048   55.35948 0.001   0      0      .006    0.3048  0
G1  10865   10817   2     .3048   85.02551 0.001   0      0      .006    0.3048  0
G1  10866   10821   2     .3048   52.12358 0.001   0      0      .006    0.3048  0
G1  10867   10816   2     .3048   82.79774 0.001   0      0      .006    0.3048  0
G1  10868   10820   2     .3048   44.18174 0.001   0      0      .006    0.3048  0
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G1  10870   10871   2     .3048   49.5698 0.001    0      0      .006    0.3048  0
G1  101452  101453  2     .3048   60.7242 0.001    0      0      .006    0.3048  0
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G1  101455  101431  2     .5334   77.25558 0.001   0      0      .006    0.5334  0
G1  101440  101441  2     .3048   54.63235 0.001   0      0      .006    0.3048  0
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G1  101443  101455  2     .381    74.74189 0.001   0      0      .006    0.381   0
G1  101431  101432  2     .3048   29.5244 0.001    0      0      .006    0.3048  0
G1  101432  101433  2     .3048   31.89219 0.001   0      0      .006    0.3048  0
G1  101433  101434  2     .3048   45.85096 0.001   0      0      .006    0.3048  0
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G1  101437  14381   2     .4572   48.17098 0.001  0      0      .006    0.4572  0
G1  101642  101639  2     .381    24.87252 0.001  0      0      .006    0.381   0
G1  101639  101643  2     .381    30.19238 0.001  0      0      .006    0.381   0
G1  101643  101638  2     .381    61.10522 0.001  0      0      .006    0.381   0
G1  101630  101631  2     .381    43.69381 0.001  0      0      .006    0.381   0
G1  101631  101632  2     .381    65.93673 0.001  0      0      .006    0.381   0
G1  101632  101633  2     .4572   50.66712 0.001  0      0      .006    0.4572  0
G1  101633  101634  2     .4572   54.4316 0.001   0      0      .006    0.4572  0
G1  101634  101635  2     .762    56.40002 0.001  0      0      .006    0.762   0
G1  101635  101629  2     .762    26.73479 0.001  0      0      .006    0.762   0
G1  101629  101644  1     1.0668  9.008411 0.001  0      0      .006    1.1684  0
G1  101626  101627  2     .381    62.4579 0.001   0      0      .006    0.381   0
G1  101627  101628  2     .5334   68.96251 0.001  0      0      .006    0.5334  0
G1  101628  101629  2     .6858   56.32393 0.001  0      0      .006    0.6858  0
G1  101645  101588  2     1.8288  45.08827 0.001  0      0      .006    1.8288  0
G1  101588  14731   2     .6096   7.035886 0.001  0      0      .006    0.6096  0
G1  101646  101556  2     .6096   46.07292 0.001  0      0      .006    0.6096  0
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G1  101647  101648  2     .6096   6.988835 0.001  0      0      .006    0.6096  0
G1  101156  101157  2     .4572   34.8988 0.001   0      0      .006    0.4572  0
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G1  101158  101159  2     .5334   6.445082 0.001  0      0      .006    0.5334  0
G1  101159  101160  2     .5334   85.08051 0.001  0      0      .006    0.5334  0
G1  101160  101161  2     .5334   90.39162 0.001  0      0      .006    0.5334  0
G1  101161  101162  2     .5334   46.60309 0.001  0      0      .006    0.5334  0
G1  101162  11631   2     .6858   24.92469 0.001  0      0      .006    0.6858  0
G1  101164  101152  2     .3048   50.15399 0.001  0      0      .006    0.3048  0
G1  101165  101153  2     .3048   48.8732 0.001   0      0      .006    0.3048  0
G1  101166  101155  2     .3048   50.49334 0.001  0      0      .006    0.3048  0
G1  101649  101650  2     .6096   6.72614 0.001   0      0      .006    0.6096  0
G1  101650  101593  2     .6096   7.677135 0.001  0      0      .006    0.6096  0
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G1  101652  101654  2     .6096   16.89278 0.001  0      0      .006    0.6096  0
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G1  101655  101656  2     .6096   27.33481 0.001  0      0      .006    0.6096  0
G1  101170  101171  2     .254    46.97621 0.001  0      0      .006    0.254   0
G1  101171  101172  2     .254    45.37379 0.001  0      0      .006    0.254   0
G1  101172  101173  2     .3048   52.37386 0.001  0      0      .006    0.3048  0
G1  101173  101174  2     .381    18.45747 0.001  0      0      .006    0.381   0
G1  101174  101175  2     .4572   52.90815 0.001  0      0      .006    0.4572  0
G1  101175  101176  2     .4572   40.10593 0.001  0      0      .006    0.4572  0
G1  101176  101177  2     .4572   7.002799 0.001  0      0      .006    0.4572  0
G1  101177  101178  2     .4572   85.29425 0.001  0      0      .006    0.4572  0
G1  101178  101179  2     .5334   89.089  0.001   0      0      .006    0.5334  0
G1  101179  101180  2     .5334   90.10478 0.001  0      0      .006    0.5334  0
G1  101180  101181  2     .6096   47.24562 0.001  0      0      .006    0.6096  0
G1  101181  11821   2     .6858   23.78406 0.001  0      0      .006    0.6858  0
G1  101183  101184  2     .254    45.57361 0.001  0      0      .006    0.254   0
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G1  101185  101174  2     .3048   50.09068 0.001  0      0      .006    0.3048  0
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G1  101187  101176  2     .3048   52.76894 0.001  0      0      .006    0.3048  0
G1  101207  101208  2     .6096   119.8144 0.001  0      0      .006    0.6096  0
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G1  10804   21341   2     .6096   16.06128 0.001  0      0      .006    0.6096  0
G1  10994   10995   2     .5334   68.36107 0.001  0      0      .006    0.5334  0
G1  10997   10998   2     .6096   63.81499 0.001  0      0      .006    0.6096  0
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G1  10999   9381    2     .6096   66.16283 0.001  0      0      .006    0.6096  0
G1  10992   10993   2     .6096   68.87157 0.001  0      0      .006    0.6096  0
G1  10993   10994   2     .4572   75.5104 0.001   0      0      .006    0.4572  0
G1  10995   10996   2     .5334   62.19283 0.001  0      0      .006    0.5334  0
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G1  101000  101001  2     .4572   63.79417 0.001  0      0      .006    0.4572  0
G1  101001  101002  2     .4572   62.15976 0.001  0      0      .006    0.4572  0
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G1  101003  101004  2     .5334   84.68491 0.001  0      0      .006    0.5334  0
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G1  101005  939     2     .5334   25.57085 0.001  0      0      .006    0.5334  0
G1  101006  101007  2     .381    51.46174 0.001  0      0      .006    0.381   0
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G1  101009  101010  2     .5334   64.31333 0.001  0      0      .006    0.5334  0
G1  101010  101011  2     .5334   59.91828 0.001  0      0      .006    0.5334  0
G1  101011  9401    2     .5334   71.57565 0.001  0      0      .006    0.5334  0
G1  101676  101675  2     .381    43.08536 0.001  0      0      .006    0.381   0
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G1  101684  16851   2     .6096   17.8358  0.001   0      0      .006    0.6096  0
G1  10807   6741    2     .3048   17.26661 0.001   0      0      .006    0.3048  0
G1  10810   10811   2     .381    32.10164 0.001   0      0      .006    0.381   0
G1  10811   10812   2     .4572   34.57461 0.001   0      0      .006    0.4572  0
G1  10812   10813   2     .4572   18.87073 0.001   0      0      .006    0.4572  0
G1  10814   10815   2     .4572   39.49295 0.001   0      0      .006    0.4572  0
G1  10815   10816   2     .5334   111.0747 0.001   0      0      .006    0.5334  0
G1  10816   10817   2     .6096   114.8097 0.001   0      0      .006    0.6096  0
G1  10817   10818   2     .6858   110.5322 0.001   0      0      .006    0.6858  0
G1  10819   10820   2     .5334   112.1748 0.001   0      0      .006    0.5334  0
G1  10820   10821   2     .6096   114.2756 0.001   0      0      .006    0.6096  0
G1  10821   10822   2     .6858   110.5322 0.001   0      0      .006    0.6858  0
G1  10823   10824   2     .5334   58.04185 0.001   0      0      .006    0.5334  0
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G1  10829   10830   2     .4572   51.42052 0.001   0      0      .006    0.4572  0
G1  101940  101941  2     .6096   36.56031 0.001   0      0      .006    0.6096  0
G1  101941  101942  2     .6096   38.24632 0.001   0      0      .006    0.6096  0
G1  101944  101945  2     .6858   71.51868 0.001   0      0      .006    0.6858  0
G1  101945  17721   2     .9144   77.75317 0.001   0      0      .006    0.9144  0
G1  101942  101943  2     .6096   38.71935 0.001   0      0      .006    0.6096  0
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G1  101708  101709  2     .5334   53.1375  0.001   0      0      .006    0.5334  0
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G1  101711  101712  2     .3048   48.26636 0.001   0      0      .006    0.3048  0
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G1  101717  101718  2     .3048   46.3626  0.001   0      0      .006    0.3048  0
G1  101718  101719  2     .381    49.53841 0.001   0      0      .006    0.381   0
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G1  101982  101983  2     .4572   53.43684 0.001   0      0      .006    0.4572  0
G1  101983  101984  2     .4572   49.73302 0.001   0      0      .006    0.4572  0
G1  101984  101985  2     .5334   45.01411 0.001   0      0      .006    0.5334  0
G1  101985  101986  2     .5334   53.34602 0.001   0      0      .006    0.5334  0
G1  101986  18011   2     .5334   41.82689 0.001   0      0      .006    0.5334  0
G1  101987  101988  2     .381    49.82572 0.001   0      0      .006    0.381   0
G1  101988  101989  2     .381    51.80878 0.001   0      0      .006    0.381   0
G1  101989  101990  2     .381    76.30806 0.001   0      0      .006    0.381   0
G1  101990  101991  2     .5334   76.52372 0.001   0      0      .006    0.5334  0
G1  101991  101992  2     .5334   39.77533 0.001   0      0      .006    0.5334  0
G1  101992  101993  2     .6096   74.75822 0.001   0      0      .006    0.6096  0
G1  101993  101994  2     .6096   73.18591 0.001   0      0      .006    0.6096  0
G1  101994  18091   2     .6858   72.73542 0.001   0      0      .006    0.6858  0
G1  101995  101996  2     .381    47.10946 0.001   0      0      .006    0.381   0
G1  101996  101997  2     .4572   39.12228 0.001   0      0      .006    0.4572  0
G1  101997  101998  2     .4572   48.73406 0.001   0      0      .006    0.4572  0
G1  101998  102002  2     .4572   42.12969 0.001   0      0      .006    0.4572  0
G1  102002  102003  2     .5334   26.18621 0.001   0      0      .006    0.5334  0
G1  102003  102004  2     .6096   60.69854 0.001   0      0      .006    0.6096  0
G1  102004  102005  2     .6096   37.03291 0.001   0      0      .006    0.6096  0
G1  102005  102006  2     .6858   138.9821 0.001   0      0      .006    0.6858  0
G1  102006  18171   2     .762    71.22776 0.001   0      0      .006    0.762   0
G1  101740  17411   2     .5334   96.64755 0.001   0      0      .006    0.5334  0
G1  101742  101743  2     .381    58.48145 0.001   0      0      .006    0.381   0
G1  101743  101744  2     .381    33.3573  0.001   0      0      .006    0.381   0
G1  10830   10831   2     .5334   54.2174  0.001   0      0      .006    0.5334  0
G1  10831   10832   2     .5334   54.57103 0.001   0      0      .006    0.5334  0
G1  10832   10833   2     .381    46.37247 0.001   0      0      .006    0.381   0
G1  10833   10834   2     .381    48.07005 0.001   0      0      .006    0.381   0
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G1  10834  10835  2    .381   35.86229 0.001  0     0     .006   0.381  0
G1  10835  10836  2    .4572  26.25515 0.001  0     0     .006   0.4572 0
G1  10836  10837  2    .4572  62.90566 0.001  0     0     .006   0.4572 0
G1  10837  10838  2    .4572  48.41211 0.001  0     0     .006   0.4572 0
G1  10838  10839  2    .5334  69.69473 0.001  0     0     .006   0.5334 0
G1  10839  10840  2    .5334  43.0918 0.001  0     0     .006   0.5334 0
G1  10840  10841  2    .6096  52.70518 0.001  0     0     .006   0.6096 0
G1  10841  10842  2    .6096  59.09784 0.001  0     0     .006   0.6096 0
G1  10843  10844  2    .381   62.11255 0.001  0     0     .006   0.381  0
G1  10844  10845  2    .4572  27.61895 0.001  0     0     .006   0.4572 0
G1  10845  10846  2    .4572  82.02038 0.001  0     0     .006   0.4572 0
G1  10846  10847  2    .5334  65.46333 0.001  0     0     .006   0.5334 0
G1  10847  10848  2    .5334  49.27332 0.001  0     0     .006   0.5334 0
G1  10848  10849  2    .6096  53.37536 0.001  0     0     .006   0.6096 0
G1  10849  18501  2    .6096  58.44264 0.001  0     0     .006   0.6096 0
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G1  102013 102014 2    .3048  13.66649 0.001  0     0     .006   0.3048 0
G1  102022 102023 2    .4572  66.30784 0.001  0     0     .006   0.4572 0
G1  102023 102024 2    .5334  76.84077 0.001  0     0     .006   0.5334 0
G1  102024 102025 2    .5334  12.77041 0.001  0     0     .006   0.5334 0
G1  102025 102026 2    .5334  18.89965 0.001  0     0     .006   0.5334 0
G1  102026 102027 2    .5334  86.06795 0.001  0     0     .006   0.5334 0
G1  102027 4481   2    .6096  24.84333 0.001  0     0     .006   0.6096 0
G1  10389  20291  2    .5334  10.30686 0.001  0     0     .006   0.5334 0
G1  1020321 1020331 2    .4572  60.81142 0.001  0     0     .006   0.4572 0
G1  1020331 102023  2    .4572  48.07505 0.001  0     0     .006   0.4572 0
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G1  101778 101779  2    .381   51.16192 0.001  0     0     .006   0.381  0
G1  101779 101780  2    .4572  50.61517 0.001  0     0     .006   0.4572 0
G1  101780 101781  2    .5334  54.34155 0.001  0     0     .006   0.5334 0
G1  101781 101782  2    .5334  54.6258 0.001  0     0     .006   0.5334 0
G1  101782 17831   2    .5334  56.79782 0.001  0     0     .006   0.5334 0
G1  101784 101778  2    .3048  43.35837 0.001  0     0     .006   0.3048 0
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G1  101786 101787  2    .381   58.02316 0.001  0     0     .006   0.381  0
G1  101787 101788  2    .4572  53.95374 0.001  0     0     .006   0.4572 0
G1  101788 101789  2    .4572  50.45415 0.001  0     0     .006   0.4572 0
G1  101789 101790  2    .5334  50.45935 0.001  0     0     .006   0.5334 0
G1  101790 101791  2    .5334  52.6138 0.001  0     0     .006   0.5334 0
G1  101791 17921   2    .5334  47.9576 0.001  0     0     .006   0.5334 0
G1  101793 101794  2    .3048  33.24274 0.001  0     0     .006   0.3048 0
G1  101794 101795  2    .381   39.37336 0.001  0     0     .006   0.381  0
G1  101795 101796  2    .381   57.53251 0.001  0     0     .006   0.381  0
G1  101796 101797  2    .4572  50.66182 0.001  0     0     .006   0.4572 0
G1  101797 101798  2    .4572  53.28798 0.001  0     0     .006   0.4572 0
G1  101798 101799  2    .5334  51.69276 0.001  0     0     .006   0.5334 0
G1  101799 101800  2    .5334  48.43685 0.001  0     0     .006   0.5334 0
G1  101800 18011   2    .5334  45.04489 0.001  0     0     .006   0.5334 0
G1  101802 101803  2    .3048  20.62117 0.001  0     0     .006   0.3048 0
G1  101803 101804  2    .3048  50.66182 0.001  0     0     .006   0.3048 0
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G1  101806 101807  2    .4572  74.5446 0.001  0     0     .006   0.4572 0
G1  101807 101808  2    .4572  48.59376 0.001  0     0     .006   0.4572 0
G1  101808 18091   2    .5334  91.89276 0.001  0     0     .006   0.5334 0
G1  101810 101811  2    .3048  55.0375 0.001  0     0     .006   0.3048 0
G1  101811 101812  2    .381   33.24274 0.001  0     0     .006   0.381  0
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G1  10871  10872   2    .3048  46.87141 0.001  0     0     .006   0.3048 0
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G1  101831 18171   2    .6858  153.313 0.001  0     0     .006   0.6858 0
G1  101836 101837  2    .254   25.65996 0.001  0     0     .006   0.254  0
G1  102077 102078  2    .3048  52.20406 0.001  0     0     .006   0.3048 0
G1  102078 102079  2    .6858  12.46166 0.001  0     0     .006   0.6858 0
G1  102081 102082  2    .381   53.73601 0.001  0     0     .006   0.381  0
G1  102082 102083  2    .381   58.23765 0.001  0     0     .006   0.381  0
G1  102083 102084  2    .4572  56.48175 0.001  0     0     .006   0.4572 0
G1  102084 102085  2    .5334  99.74753 0.001  0     0     .006   0.5334 0
G1  102085 102086  2    .762   10.21652 0.001  0     0     .006   0.762  0
G1  102080 102081  2    .381   52.57156 0.001  0     0     .006   0.381  0
G1  102087 102088  2    .381   47.43917 0.001  0     0     .006   0.381  0
G1  102088 102089  2    .381   62.87011 0.001  0     0     .006   0.381  0
G1  102089 102090  2    .4572  109.0505 0.001  0     0     .006   0.4572 0
G1  102090 102091  2    .5334  50.70744 0.001  0     0     .006   0.5334 0
G1  102094 102095  2    .381   49.69319 0.001  0     0     .006   0.381  0
G1  102095 102096  2    .4572  60.4549 0.001  0     0     .006   0.4572 0
G1  102096 102097  2    .5334  71.2593 0.001  0     0     .006   0.5334 0
G1  102097 102107  2    .6096  9.606497 0.001  0     0     .006   0.6096 0
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G1  102098  102099  2     .3048   47.79004 0.001   0      0      .006    0.3048  0
G1  102099  102096  2     .3048   57.31231 0.001   0      0      .006    0.3048  0
G1  102100  102101  2     .254    59.3392 0.001   0      0      .006    0.254   0
G1  102101  102102  2     .254    53.99299 0.001   0      0      .006    0.254   0
G1  102102  102097  2     .3048   66.36662 0.001   0      0      .006    0.3048  0
G1  102103  102104  2     .254    43.64498 0.001   0      0      .006    0.254   0
G1  101838  101837  2     .254    22.7024 0.001   0      0      .006    0.254   0
G1  101837  101840  2     .3048   8.308732 0.001   0      0      .006    0.3048  0
G1  101839  101840  2     .254    25.03032 0.001   0      0      .006    0.254   0
G1  101840  101841  2     .4572   111.5349 0.001   0      0      .006    0.4572  0
G1  101842  101843  2     .3048   25.47503 0.001   0      0      .006    0.3048  0
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G1  101844  101843  2     .4572   141.1062 0.001   0      0      .006    0.4572  0
G1  101845  101846  2     .3048   110.3136 0.001   0      0      .006    0.3048  0
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G1  101841  101848  2     .9144   171.4662 0.001   0      0      .006    0.9144  0
G1  101848  101849  2     .9144   11.44454 0.001   0      0      .006    0.9144  0
G1  101849  18501   2     .9144   68.28054 0.001   0      0      .006    0.9144  0
G1  101846  101847  2     .381    59.82827 0.001   0      0      .006    0.381   0
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G1  101854  101855  2     .4572   58.38639 0.001   0      0      .006    0.4572  0
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G1  101856  101849  2     .6096   64.25312 0.001   0      0      .006    0.6096  0
G1  101857  101858  2     .381    54.81448 0.001   0      0      .006    0.381   0
G1  101858  101859  2     .4572   82.48674 0.001   0      0      .006    0.4572  0
G1  102079  5421    2     1.2192  9.615314 0.001   0      0      .006    1.2192  0
G1  10237   21161   2     .6096   12.73483 0.001   0      0      .006    0.6096  0
G1  10183   21161   2     .6096   12.0719 0.001   0      0      .006    0.6096  0
G1  10186   21151   2     .762    13.43056 0.001   0      0      .006    0.762   0
G1  101859  101860  2     .4572   16.68864 0.001   0      0      .006    0.4572  0
G1  101860  101848  2     .6096   81.00922 0.001   0      0      .006    0.6096  0
G1  101861  101862  2     .3048   57.9818 0.001   0      0      .006    0.3048  0
G1  101862  101863  2     .4572   48.85451 0.001   0      0      .006    0.4572  0
G1  101863  101864  2     .4572   49.20009 0.001   0      0      .006    0.4572  0
G1  101864  101865  2     .5334   95.85005 0.001   0      0      .006    0.5334  0
G1  101865  101866  2     .5334   90.46802 0.001   0      0      .006    0.5334  0
G1  101866  101867  2     .6096   23.2273 0.001   0      0      .006    0.6096  0
G1  101867  101868  2     .6096   17.2323 0.001   0      0      .006    0.6096  0
G1  101868  101869  2     .6096   56.44262 0.001   0      0      .006    0.6096  0
G1  101869  17101   2     .9144   75.74652 0.001   0      0      .006    0.9144  0
G1  101874  101877  2     .381    49.87069 0.001   0      0      .006    0.381   0
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G1  101900  17321   2     .6096   46.68414 0.001   0      0      .006    0.6096  0
G1  101901  101903  2     .3048   50.56764 0.001   0      0      .006    0.3048  0
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G1  101904  101905  2     .381    23.77703 0.001   0      0      .006    0.381   0
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G1  101906  101907  2     .4572   29.58405 0.001   0      0      .006    0.4572  0
G1  101907  101908  2     .4572   29.71324 0.001   0      0      .006    0.4572  0
G1  101908  101909  2     .4572   29.06156 0.001   0      0      .006    0.4572  0
G1  101909  101910  2     .4572   27.48324 0.001   0      0      .006    0.4572  0
G1  101910  101911  2     .5334   98.0899 0.001   0      0      .006    0.5334  0
G1  101911  101912  2     .5334   99.91792 0.001   0      0      .006    0.5334  0
G1  101912  17411   2     .6096   27.3217 0.001   0      0      .006    0.6096  0
G1  101913  101914  2     .3048   37.11989 0.001   0      0      .006    0.3048  0
G1  101914  101915  2     .381    48.02099 0.001   0      0      .006    0.381   0
G1  101915  101916  2     .381    54.31095 0.001   0      0      .006    0.381   0
G1  101916  101917  2     .4572   49.96892 0.001   0      0      .006    0.4572  0
G1  101917  101918  2     .4572   53.14237 0.001   0      0      .006    0.4572  0
G1  101918  101919  2     .5334   83.37288 0.001   0      0      .006    0.5334  0
G1  102037  102038  2     .3048   27.32092 0.001   0      0      .006    0.3048  0
G1  102038  102039  2     .381    60.5113 0.001   0      0      .006    0.381   0
G1  102039  102040  2     .4572   55.82524 0.001   0      0      .006    0.4572  0
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G1  102042  102043  2     .5334   53.88932 0.001   0      0      .006    0.5334  0
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G1  102044  4521    2     .9144   10.45407 0.001   0      0      .006    0.9144  0
G1  102045  102046  2     .381    56.73618 0.001   0      0      .006    0.381   0
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G1  102047  102048  2     .4572   52.10586 0.001   0      0      .006    0.4572  0
G1  102048  102049  2     .4572   26.67533 0.001   0      0      .006    0.4572  0
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G1  102051  102052  2     .6096   50.78659 0.001   0      0      .006    0.6096  0
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G1  102061  102057  2     .5334   52.78643 0.001   0      0      .006    0.5334  0
G1  101919  17561   2     .5334   89.43861 0.001   0      0      .006    0.5334  0
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G1  101921  101922  2     .381    21.39711 0.001   0      0      .006    0.381   0
G1  101922  101923  2     .381    20.29909 0.001   0      0      .006    0.381   0
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G1  101925  101926  2     .54334  115.8941 0.001   0      0      .006    0.5334  0
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G1  101927  101928  2     .4572   52.17722 0.001   0      0      .006    0.4572  0
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G1  101933  101934  2     .6096   42.20595 0.001   0      0      .006    0.6096  0
G1  101934  101935  2     .6096   69.01126 0.001   0      0      .006    0.6096  0
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G1  101939  101940  2     .6096   28.28274 0.001   0      0      .006    0.6096  0
G1  102057  102058  2     .6096   57.44327 0.001   0      0      .006    0.6096  0
G1  102058  102059  2     .6096   44.0645  0.001   0      0      .006    0.6096  0
G1  102059  102060  2     .6096   69.23596 0.001   0      0      .006    0.6096  0
G1  102060  102062  2     .6858   43.3736  0.001   0      0      .006    0.6858  0
G1  102062  9341    2     .6858   74.64255 0.001   0      0      .006    0.6858  0
G1  10138   21611   2     .5334   6.493268 0.001   0      0      .006    0.5334  0
G1  10245   21621   2     .4572   14.9306  0.001   0      0      .006    0.4572  0
G1  10148   21641   2     .5334   10.45418 0.001   0      0      .006    0.5334  0
G1  10238   21631   2     .6096   15.60094 0.001   0      0      .006    0.6096  0
G1  102173  102174  2     .381    51.64548 0.001   0      0      .006    0.381   0
G1  102174  102175  2     .381    33.77734 0.001   0      0      .006    0.381   0
G1  102176  102175  2     .381    54.46663 0.001   0      0      .006    0.381   0
G1  102175  102177  2     .381    83.69469 0.001   0      0      .006    0.381   0
G1  102177  102178  2     .381    78.53517 0.001   0      0      .006    0.381   0
G1  102178  102179  2     .4572   46.68591 0.001   0      0      .006    0.4572  0
G1  102179  102180  2     .4572   48.32607 0.001   0      0      .006    0.4572  0
G1  102180  102181  2     .4572   51.76855 0.001   0      0      .006    0.4572  0
G1  102181  102182  2     .4572   35.641   0.001   0      0      .006    0.4572  0
G1  102182  102183  2     .4572   18.54243 0.001   0      0      .006    0.4572  0
G1  102183  102184  2     .4572   67.10696 0.001   0      0      .006    0.4572  0
G1  102184  102185  2     .4572   45.41765 0.001   0      0      .006    0.4572  0
G1  102185  102186  2     .5334   78.36652 0.001   0      0      .006    0.5334  0
G1  101016  101039  2     .6096   89.49604 0.001   0      0      .006    0.6096  0
G1  101039  101041  2     .6096   20.29089 0.001   0      0      .006    0.6096  0
G1  101041  101043  2     .6096   88.53363 0.001   0      0      .006    0.6096  0
G1  101043  101045  2     .6858   7.898822 0.001   0      0      .006    0.6858  0
G1  101045  101047  2     .6858   81.2747  0.001   0      0      .006    0.6858  0
G1  101047  101049  2     .762    7.337596 0.001   0      0      .006    0.762   0
G1  101049  21291   2     .762    253.6398 0.001   0      0      .006    0.762   0
G1  102186  102187  2     .5334   89.17367 0.001   0      0      .006    0.5334  0
G1  102187  101016  2     .5334   91.84428 0.001   0      0      .006    0.5334  0
G1  102239  102233  2     .6096   98.04813 0.001   0      0      .006    0.6096  0
G1  102233  2227    2     .6096   99.68857 0.001   0      0      .006    0.6096  0
G1  102240  102241  2     .381    38.75257 0.001   0      0      .006    0.381   0
G1  102241  102242  2     .4572   93.26247 0.001   0      0      .006    0.4572  0
G1  102242  102243  2     .5334   94.32773 0.001   0      0      .006    0.5334  0
G1  102243  102244  2     .6096   92.68416 0.001   0      0      .006    0.6096  0
G1  102244  2245    2     .6096   98.57341 0.001   0      0      .006    0.6096  0
G1  102246  102247  2     .381    73.38288 0.001   0      0      .006    0.381   0
G1  102247  102244  2     .381    32.92723 0.001   0      0      .006    0.381   0
G1  102248  102249  2     .3048   66.51426 0.001   0      0      .006    0.3048  0
G1  102249  102243  2     .381    39.88573 0.001   0      0      .006    0.381   0
G1  102250  102242  2     .381    37.09898 0.001   0      0      .006    0.381   0
G1  102251  102252  2     .381    37.38203 0.001   0      0      .006    0.381   0
G1  102252  102253  2     .4572   56.62637 0.001   0      0      .006    0.4572  0
G1  102212  102216  2     .5334   89.09778 0.001   0      0      .006    0.5334  0
G1  102216  102220  2     .5334   88.45422 0.001   0      0      .006    0.5334  0
G1  102220  102224  2     .6096   90.89599 0.001   0      0      .006    0.6096  0
G1  102224  2225    2     .6096   100.6014 0.001   0      0      .006    0.6096  0
G1  102262  102258  2     .5334   86.27535 0.001   0      0      .006    0.5334  0
G1  102258  102253  2     .6096   83.51773 0.001   0      0      .006    0.6096  0
G1  102253  102263  2     .6858   85.70778 0.001   0      0      .006    0.6858  0
```

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G1  102263 102264 2    .9144  92.03487 0.001  0     0     .006   0.9144 0
G1  102264 22651  2    .9144  15.71487 0.001  0     0     .006   0.9144 0
G1  102278 102273 2    .5334  95.45908 0.001  0     0     .006   0.5334 0
G1  102273 102239 2    .5334  80.1669 0.001   0     0     .006   0.5334 0
G1  10166  21171  2    .4572  17.58212 0.001  0     0     .006   0.4572 0
G1  102282 102283 2    .3048  46.78179 0.001  0     0     .006   0.3048 0
G1  102283 102284 2    .381   67.13734 0.001  0     0     .006   0.381  0
G1  1022841 102026 2   .4572  72.85058 0.001  0     0     .006   0.4572 0
G1  102279 102280 2    .381   64.58674 0.001  0     0     .006   0.381  0
G1  102280 102025 2    .381   71.21324 0.001  0     0     .006   0.381  0
G1  102281 102034 2    .3048  53.29282 0.001  0     0     .006   0.3048 0
G1  102284 102053 2    .4572  55.65065 0.001  0     0     .006   0.4572 0
G1  102285 10410  2    .3048  21.99201 0.001  0     0     .006   0.3048 0
G1  103312 10552  2    .762   111.0212 0.001  0     0     .006   0.762  0
G1  102317 102316 2    .4572  91.52644 0.001  0     0     .006   0.4572 0
G1  102316 102315 2    .4572  95.10573 0.001  0     0     .006   0.4572 0
G1  102315 102314 2    .6858  91.16555 0.001  0     0     .006   0.6858 0
G1  102313 102314 2    .254   64.67997 0.001  0     0     .006   0.254  0
G1  102314 102318 2    .6858  26.67549 0.001  0     0     .006   0.6858 0
G1  102354 102355 2    .254   43.54232 0.001  0     0     .006   0.254  0
G1  102355 102356 2    .3048  79.9929 0.001   0     0     .006   0.3048 0
G1  102356 102345 2    .3048  92.89307 0.001  0     0     .006   0.3048 0
G1  102357 102327 2    .254   76.15276 0.001  0     0     .006   0.254  0
G1  102358 102327 2    .254   73.50081 0.001  0     0     .006   0.254  0
G1  102359 102360 2    .3048  53.66087 0.001  0     0     .006   0.3048 0
G1  102360 102361 2    .381   61.13755 0.001  0     0     .006   0.381  0
G1  102361 102346 2    .4572  61.98196 0.001  0     0     .006   0.4572 0
G1  102362 102363 2    .3048  50.40545 0.001  0     0     .006   0.3048 0
G1  102363 102364 2    .381   63.75119 0.001  0     0     .006   0.381  0
G1  102364 102347 2    .4572  60.35164 0.001  0     0     .006   0.4572 0
G1  102365 102366 2    .254   16.92876 0.001  0     0     .006   0.254  0
G1  102366 102328 2    .254   33.78311 0.001  0     0     .006   0.254  0
G1  102367 102368 2    .254   12.95964 0.001  0     0     .006   0.254  0
G1  102368 102328 2    .254   33.85115 0.001  0     0     .006   0.254  0
G1  102390 102391 2    .4572  70.70683 0.001  0     0     .006   0.4572 0
G1  102391 102392 2    .6096  90.27894 0.001  0     0     .006   0.6096 0
G1  102392 102393 2    .6096  77.64124 0.001  0     0     .006   0.6096 0
G1  102393 102394 2    .6096  54.79447 0.001  0     0     .006   0.6096 0
G1  102394 102395 2    .9144  32.62026 0.001  0     0     .006   0.9144 0
G1  102395 102396 2    .9144  32.11603 0.001  0     0     .006   0.9144 0
G1  102396 102397 2    .9144  26.99007 0.001  0     0     .006   0.9144 0
G1  102397 2308   2    .9144  16.12689 0.001  0     0     .006   0.9144 0
G1  102398 102399 2    .254   39.4864 0.001   0     0     .006   0.254  0
G1  102399 102400 2    .3048  61.60769 0.001  0     0     .006   0.3048 0
G1  102400 102401 2    .381   101.9648 0.001  0     0     .006   0.381  0
G1  102401 2305   2    .4572  15.84416 0.001  0     0     .006   0.4572 0
G1  102402 102403 2    .254   45.90253 0.001  0     0     .006   0.254  0
G1  102403 102404 2    .381   87.24819 0.001  0     0     .006   0.381  0
G1  102404 102405 2    .4572  80.26804 0.001  0     0     .006   0.4572 0
G1  102405 2305   2    .5334  16.64433 0.001  0     0     .006   0.5334 0
G1  102407 102408 2    .3048  45.24949 0.001  0     0     .006   0.3048 0
G1  102408 102409 2    .381   32.73714 0.001  0     0     .006   0.381  0
G1  102409 2304   1    .9144  14.38574 0.001  0     0     .006   1.016  0
G1  102410 102411 2    .6096  77.90051 0.001  0     0     .006   0.6096 0
G1  102411 102412 2    .6096  82.86566 0.001  0     0     .006   0.6096 0
G1  102412 102413 2    .6858  90.33194 0.001  0     0     .006   0.6858 0
G1  102413 102414 2    .6858  45.06478 0.001  0     0     .006   0.6858 0
G1  102414 102337 2    .762   11.03018 0.001  0     0     .006   0.762  0
G1  102406 102414 2    .254   42.44796 0.001  0     0     .006   0.254  0
G1  102415 102416 2    .254   40.43519 0.001  0     0     .006   0.254  0
G1  102416 102417 2    .5334  49.89717 0.001  0     0     .006   0.5334 0
G1  102417 102418 2    .5334  33.92396 0.001  0     0     .006   0.5334 0
G1  102418 102419 2    .5334  49.51068 0.001  0     0     .006   0.5334 0
G1  102419 102420 2    .6096  22.75494 0.001  0     0     .006   0.6096 0
G1  102420 102421 1    .9144  51.22816 0.001  0     0     .006   1.016  0
G1  102421 102409 1    .9144  36.13208 0.001  0     0     .006   1.016  0
G1  102423 102424 2    .5334  65.1744 0.001   0     0     .006   0.5334 0
G1  102424 102425 2    .5334  20.48694 0.001  0     0     .006   0.5334 0
G1  102425 102426 2    .6096  20.86592 0.001  0     0     .006   0.6096 0
G1  102426 102420 2    .6096  53.09262 0.001  0     0     .006   0.6096 0
G1  102427 102429 2    .381   84.26236 0.001  0     0     .006   0.381  0
G1  102429 102423 2    .4572  83.78104 0.001  0     0     .006   0.4572 0
G1  102428 102430 2    .381   82.79624 0.001  0     0     .006   0.381  0
G1  102430 102423 2    .4572  81.25703 0.001  0     0     .006   0.4572 0
G1  102458 102428 2    .254   61.82169 0.001  0     0     .006   0.254  0
G1  102459 102428 2    .254   62.5058 0.001   0     0     .006   0.254  0
G1  102471 102463 2    .6858  76.0011 0.001   0     0     .006   0.6858 0
G1  102463 102420 2    .9144  83.6512 0.001   0     0     .006   0.9144 0
G1  102485 102486 2    .254   37.43765 0.001  0     0     .006   0.254  0
G1  102486 102487 2    .5334  72.1679 0.001   0     0     .006   0.5334 0
```

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G1  102487  102488  2     .6096   83.19064 0.001   0      0      .006    0.6096  0
G1  102488  102489  2     .6858   39.57751 0.001   0      0      .006    0.6858  0
G1  102489  102490  2     .6858   61.83088 0.001   0      0      .006    0.6858  0
G1  102490  102491  2     .762    37.76536 0.001   0      0      .006    0.762   0
G1  102491  102492  2     .762    31.63973 0.001   0      0      .006    0.762   0
G1  102318  102505  2     .9144   58.77201 0.001   0      0      .006    0.9144  0
G1  102506  102507  2     .9144   39.97071 0.001   0      0      .006    0.9144  0
G1  102507  2300    2     .9144   105.9454 0.001   0      0      .006    0.9144  0
G1  10275   4491    2     .245    91.33702 0.001   0      0      .006    0.245   0
G1  102035  2036    2     .6096   17.20007 0.001   0      0      .006    0.6096  0
G1  1039    10148   2     .4572   508.3458 0.001   0      0      .006    0.4572  0     784531.286540836 3322785.68066538
G1  1028    10138   2     .4572   483.4206 0.001   0      0      .006    0.4572  0     784625.268806254 3323030.48477426
G1  1049    10159   2     .4572   479.2232 0.001   0      0      .006    0.4572  0     784736.134115056 3322799.74986724
G1  1068    21561   2     .4572   395.6656 0.001   0      0      .006    0.4572  0     784518.624262624 3323166.88567919
G1  10243   10238   2     .4572   383.2299 0.001   0      0      .006    0.4572  0
G1  10251   10245   2     .4572   383.0072 0.001   0      0      .006    0.4572  0
G1  10258   10253   2     .4572   383.4547 0.001   0      0      .006    0.4572  0
G1  10266   10260   2     .4572   383.9651 0.001   0      0      .006    0.4572  0
G1  10274   10268   2     .4572   383.7386 0.001   0      0      .006    0.4572  0
G1  10966   9101    2     .508    538.249 0.001    0      0      .006    0.508   0
G1  10975   9211    2     .508    541.1147 0.001   0      0      .006    0.508   0
G1  10281   10276   2     .4572   456.8105 0.001   0      0      .006    0.4572  0
G1  10287   10282   2     .4572   459.1131 0.001   0      0      .006    0.4572  0
G1  10294   10288   2     .4572   455.4045 0.001   0      0      .006    0.4572  0
G1  10302   10295   2     .4572   458.5126 0.001   0      0      .006    0.4572  0
G1  10341   10334   2     .4572   455.8594 0.001   0      0      .006    0.4572  0
G1  10397   4021    2     .4572   356.0292 0.001   0      0      .006    0.4572  0
G1  10874   8781    2     .5334   330.3378 0.001   0      0      .006    0.5334  0
G1  10881   8851    2     .5334   333.8718 0.001   0      0      .006    0.5334  0
G1  10889   8941    2     .5334   467.6741 0.001   0      0      .006    0.5334  0
G1  10897   9021    2     .5334   346.2768 0.001   0      0      .006    0.5334  0
G1  10906   9101    2     .5334   398.5333 0.001   0      0      .006    0.5334  0
G1  10917   9211    2     .5334   398.1237 0.001   0      0      .006    0.5334  0
G1  10922   9281    2     .5334   506.5614 0.001   0      0      .006    0.5334  0
G1  102369  102486  2     .4572   802.0358 0.001   0      0      .006    0.4572  0
G1  102476  102471  2     .4572   444.1278 0.001   0      0      .006    0.4572  0
G1  101394  14011   2     .762    326.1819 0.001   0      0      .006    0.762   0
G1  103311  13561   1     .7874   763.4443 0.001   0      0      .006    1.2954  0
G1  101379  13561   2     .6096   336.1833 0.001   0      0      .006    0.6096  0
G1  101875  101876  2     .5334   69.63069 0.001   0      0      .006    0.5334  0
G1  101876  101873  2     .5334   71.46043 0.001   0      0      .006    0.5334  0
G1  101873  101877  2     .6096   84.5526 0.001    0      0      .006    0.6096  0
G1  101877  101878  2     .6096   21.37804 0.001   0      0      .006    0.6096  0
G1  101878  101879  2     .6096   40.7539 0.001    0      0      .006    0.6096  0
G1  101879  101880  2     .6096   40.17542 0.001   0      0      .006    0.6096  0
G1  101880  101881  2     .6858   94.6305 0.001    0      0      .006    0.6858  0
G1  101881  101869  2     .6858   96.27706 0.001   0      0      .006    0.6858  0
G1  101882  101883  2     .5334   42.53129 0.001   0      0      .006    0.5334  0
G1  101883  101884  2     .5334   95.05361 0.001   0      0      .006    0.5334  0
G1  101884  101885  2     .6096   108.2065 0.001   0      0      .006    0.6096  0
G1  101885  101886  2     .6096   51.31165 0.001   0      0      .006    0.6096  0
G1  101886  101887  2     .6096   27.77341 0.001   0      0      .006    0.6096  0
G1  101887  101888  2     .6858   89.14738 0.001   0      0      .006    0.6858  0
G1  101888  101889  2     .6858   91.55804 0.001   0      0      .006    0.6858  0
G1  101889  17241   2     .762    83.8713 0.001    0      0      .006    0.762   0
G1  101890  101891  2     .3048   49.89663 0.001   0      0      .006    0.3048  0
G1  101891  101892  2     .381    44.82159 0.001   0      0      .006    0.381   0
G1  101892  101893  2     .381    39.9173 0.001    0      0      .006    0.381   0
G1  101893  101894  2     .4572   37.13349 0.001   0      0      .006    0.4572  0
G1  101894  101895  2     .4572   21.37641 0.001   0      0      .006    0.4572  0
G1  101895  101896  2     .4572   25.51755 0.001   0      0      .006    0.4572  0
G1  101896  101897  2     .4572   22.82359 0.001   0      0      .006    0.4572  0
G1  101897  101898  2     .5334   25.07847 0.001   0      0      .006    0.5334  0
G1  101898  101899  2     .6858   77.63821 0.001   0      0      .006    0.6858  0
G1  101899  101900  2     .5334   94.11425 0.001   0      0      .006    0.5334  0
G1  102104  102105  2     .254    69.69476 0.001   0      0      .006    0.254   0
G1  102105  102106  2     .3048   62.56568 0.001   0      0      .006    0.3048  0
G1  102106  102107  2     .381    7.672764 0.001   0      0      .006    0.381   0
G1  102092  102093  2     .254    47.77115 0.001   0      0      .006    0.254   0
G1  102093  10361   2     .254    53.51381 0.001   0      0      .006    0.254   0
G1  102108  102096  2     .3048   63.0046 0.001    0      0      .006    0.3048  0
G1  101221  21311   2     .5334   14.7666 0.001    0      0      .006    0.5334  0
G1  102063  102064  2     .381    59.82119 0.001   0      0      .006    0.381   0
G1  102064  9361    2     .381    59.93803 0.001   0      0      .006    0.381   0
G1  102065  102066  2     .4572   45.93172 0.001   0      0      .006    0.4572  0
G1  102066  4891    2     .4572   57.56323 0.001   0      0      .006    0.4572  0
G1  102067  102068  2     .381    54.51474 0.001   0      0      .006    0.381   0
G1  102068  5021    2     .381    57.55459 0.001   0      0      .006    0.381   0
G1  102069  102070  2     .381    44.30429 0.001   0      0      .006    0.381   0
G1  102070  5121    2     .381    59.60261 0.001   0      0      .006    0.381   0
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G1  102076  102071  2     .381   39.07758 0.001  0     0     .006   0.381  0
G1  102071  102072  2     .4572  41.70485 0.001  0     0     .006   0.4572 0
G1  102072  102073  2     .4572  73.72871 0.001  0     0     .006   0.4572 0
G1  102073  102074  2     .4572  50.58116 0.001  0     0     .006   0.4572 0
G1  102074  102075  2     .4572  59.99451 0.001  0     0     .006   0.4572 0
G1  102075  5491    2     .5334  100.8788 0.001  0     0     .006   0.5334 0
G1  10813   21361   2     .5334  7.454737 0.001  0     0     .006   0.5334 0
G1  10850   850     2     .6858  15.00494 0.001  0     0     .006   0.6858 0
G1  10842   21401   2     .6858  13.90283 0.001  0     0     .006   0.6858 0
G1  10827   21411   2     .5334  11.57942 0.001  0     0     .006   0.5334 0
G1  10822   21421   2     .5334  14.59149 0.001  0     0     .006   0.5334 0
G1  10801   21431   2     .5334  6.091064 0.001  0     0     .006   0.5334 0
G1  10818   21451   2     .5334  15.6648 0.001   0     0     .006   0.5334 0
G1  10796   21441   2     .6093  5.64563 0.001   0     0     .006   0.6096 0
G1  10308   21491   2     .5334  10.71731 0.001  0     0     .006   0.5334 0
G1  10295   21481   2     .5334  12.22071 0.001  0     0     .006   0.5334 0
G1  10225   21501   2     .534   6.572006 0.001  0     0     .006   0.5334 0
G1  10288   21511   2     .5334  12.82964 0.001  0     0     .006   0.5334 0
G1  10282   21521   2     .4572  9.53402 0.001   0     0     .006   0.4572 0
G1  10219   21531   2     .5334  5.082324 0.001  0     0     .006   0.5334 0
G1  10213   21541   2     .6096  6.446483 0.001  0     0     .006   0.6096 0
G1  10276   21551   2     .4572  11.52227 0.001  0     0     .006   0.4572 0
G1  10268   21571   2     .4572  13.32114 0.001  0     0     .006   0.4572 0
G1  10260   215811  2     .4572  14.2022 0.001   0     0     .006   0.4572 0
G1  10159   21591   2     .5334  8.509995 0.001  0     0     .006   0.5334 0
G1  10253   21601   2     .4572  13.96518 0.001  0     0     .006   0.4572 0
G1  102319  102320  2     .4572  67.00784 0.001  0     0     .006   0.4572 0
G1  102320  102321  2     .4572  61.38831 0.001  0     0     .006   0.4572 0
G1  102321  102322  2     .5334  85.93817 0.001  0     0     .006   0.5334 0
G1  102322  102318  2     .5334  86.17411 0.001  0     0     .006   0.5334 0
G1  102323  102324  2     .254   61.05635 0.001  0     0     .006   0.254  0
G1  102324  102325  2     .254   27.6194 0.001   0     0     .006   0.254  0
G1  102325  102326  2     .3048  22.29571 0.001  0     0     .006   0.3048 0
G1  102326  102327  2     .381   58.54109 0.001  0     0     .006   0.381  0
G1  102327  102328  2     .4572  87.53098 0.001  0     0     .006   0.4572 0
G1  102328  102329  2     .5334  50.43967 0.001  0     0     .006   0.5334 0
G1  102329  102330  2     .5334  24.64818 0.001  0     0     .006   0.5334 0
G1  102330  102331  2     .5334  29.68942 0.001  0     0     .006   0.5334 0
G1  102331  102332  2     .6096  66.37023 0.001  0     0     .006   0.6096 0
G1  102332  102333  2     .6096  65.32201 0.001  0     0     .006   0.6096 0
G1  102333  102334  2     .9144  6.751508 0.001  0     0     .006   0.9144 0
G1  102334  102335  2     .9144  80.91338 0.001  0     0     .006   0.9144 0
G1  102335  102336  2     .9144  7.63131 0.001   0     0     .006   0.9144 0
G1  102336  102337  2     .9144  102.8702 0.001  0     0     .006   0.9144 0
G1  102337  2303    2     .9144  16.73352 0.001  0     0     .006   0.9144 0
G1  102342  102344  2     .254   40.51795 0.001  0     0     .006   0.254  0
G1  102344  102345  2     .4572  6.992154 0.001  0     0     .006   0.4572 0
G1  102345  102346  2     .4572  75.44706 0.001  0     0     .006   0.4572 0
G1  102346  102347  2     .6096  6.961236 0.001  0     0     .006   0.6096 0
G1  102347  102333  2     .6858  77.42053 0.001  0     0     .006   0.6858 0
G1  102338  102339  2     .254   41.36266 0.001  0     0     .006   0.254  0
G1  102339  102340  2     .3048  6.961239 0.001  0     0     .006   0.3048 0
G1  102340  102341  2     .4572  76.05355 0.001  0     0     .006   0.4572 0
G1  102341  102334  2     .4572  82.68447 0.001  0     0     .006   0.4572 0
G1  102348  102349  2     .254   19.84937 0.001  0     0     .006   0.254  0
G1  102349  102350  2     .254   44.74271 0.001  0     0     .006   0.254  0
G1  102350  102351  2     .3048  78.70261 0.001  0     0     .006   0.3048 0
G1  102351  102344  2     .381   91.50344 0.001  0     0     .006   0.381  0
G1  102352  102354  2     .254   15.82235 0.001  0     0     .006   0.254  0
G1  102492  2304    2     .9144  15.79804 0.001  0     0     .006   0.9144 0
G1  102432  102390  2     .3048  95.97163 0.001  0     0     .006   0.3048 0
G1  102433  102405  2     .254   41.84674 0.001  0     0     .006   0.254  0
G1  102434  102435  2     .254   40.15292 0.001  0     0     .006   0.254  0
G1  102435  102436  2     .3048  56.38163 0.001  0     0     .006   0.3048 0
G1  102436  102437  2     .381   45.67205 0.001  0     0     .006   0.381  0
G1  102437  102438  2     .4572  46.44584 0.001  0     0     .006   0.4572 0
G1  102438  102439  2     .4572  37.25999 0.001  0     0     .006   0.4572 0
G1  102439  2307    2     .5334  16.04126 0.001  0     0     .006   0.5334 0
G1  102440  102441  2     .381   30.86328 0.001  0     0     .006   0.381  0
G1  102441  102442  2     .381   57.87818 0.001  0     0     .006   0.381  0
G1  102442  102443  2     .4572  36.837  0.001   0     0     .006   0.4572 0
G1  102443  102444  2     .4572  32.54548 0.001  0     0     .006   0.4572 0
G1  102444  2307    2     .5334  14.16137 0.001  0     0     .006   0.5334 0
G1  102445  102446  2     .381   34.1819 0.001   0     0     .006   0.381  0
G1  102446  102447  2     .381   38.76446 0.001  0     0     .006   0.381  0
G1  102447  102448  2     .4572  57.4222 0.001   0     0     .006   0.4572 0
G1  102448  102449  2     .4572  45.34853 0.001  0     0     .006   0.4572 0
G1  102449  102450  2     .5334  64.9977 0.001   0     0     .006   0.5334 0
G1  102451  102452  2     .3048  35.57869 0.001  0     0     .006   0.3048 0
G1  102452  102453  2     .381   55.39569 0.001  0     0     .006   0.381  0
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G1  102453  102454  2     .4572   56.30537 0.001  0     0     .006   0.4572  0
G1  102454  102455  2     .4572   53.42128 0.001  0     0     .006   0.4572  0
G1  102455  102450  2     .5334   65.65932 0.001  0     0     .006   0.5334  0
G1  102450  102395  2     .6858   110.3357 0.001  0     0     .006   0.6858  0
G1  102498  102499  2     .254    40.95069 0.001  0     0     .006   0.254   0
G1  102499  102339  2     .254    56.687  0.001   0     0     .006   0.254   0
G1  102500  102340  2     .254    62.14934 0.001  0     0     .006   0.254   0
G1  102501  102502  2     .254    42.72445 0.001  0     0     .006   0.254   0
G1  102502  102335  2     .3048   80.91006 0.001  0     0     .006   0.3048  0
G1  102503  102504  2     .254    32.02918 0.001  0     0     .006   0.254   0
G1  102504  102505  2     .3048   61.42049 0.001  0     0     .006   0.3048  0
G1  102505  102336  2     .381    63.47039 0.001  0     0     .006   0.381   0
G1  101444  101449  2     .4572   274.1893 0.001  0     0     .006   0.4572  0
G1  101456  101450  2     .4572   237.9069 0.001  0     0     .006   0.4572  0
G1  102229  102233  2     .4572   246.6304 0.001  0     0     .006   0.4572  0
G1  102234  102239  2     .4572   265.8362 0.001  0     0     .006   0.4572  0
G1  102269  102273  2     .4572   225.5225 0.001  0     0     .006   0.4572  0
G1  102274  102278  2     .4572   248.912 0.001   0     0     .006   0.4572  0
G1  102221  102224  2     .381    131.8487 0.001  0     0     .006   0.381   0
G1  102217  102220  2     .381    127.5669 0.001  0     0     .006   0.381   0
G1  102213  102216  2     .4572   138.2125 0.001  0     0     .006   0.4572  0
G1  102209  102212  2     .4572   140.0182 0.001  0     0     .006   0.4572  0
G1  102203  2208    2     .4572   244.5877 0.001  0     0     .006   0.4572  0
G1  102196  22021   2     .4572   241.6137 0.001  0     0     .006   0.4572  0
G1  102188  21951   2     .4572   234.7297 0.001  0     0     .006   0.4572  0
G1  102254  102258  2     .4572   180.0534 0.001  0     0     .006   0.4572  0
G1  102259  102262  2     .381    179.8506 0.001  0     0     .006   0.381   0
G1  102493  102391  2     .4572   170.4737 0.001  0     0     .006   0.4572  0
G1  1001    21151   2     .6858   410.5678 0.001  0     0     .006   0.6858  0     784333.754955736 3323073.25514468
G1  104999  22891   2     .6858   323.1138 0.001  0     0     .006   0.6858  0
G1  102467  102471  2     .4572   160.243 0.001   0     0     .006   0.4572  0
G1  10516   5241    2     .6096   478.829 0.001   0     0     .006   0.6096  0
G1  10525   5241    2     .5334   472.6049 0.001  0     0     .006   0.5334  0
G1  10411   10415   2     .5334   310.5819 0.001  0     0     .006   0.5334  0
G1  10415   4481    2     .6858   373.1002 0.001  0     0     .006   0.6858  0
G1  10416   4531    2     .5334   372.4319 0.001  0     0     .006   0.5334  0
G1  10435   4521    2     .6096   278.0393 0.001  0     0     .006   0.6096  0
G1  10577   13411   1     .9144   447.0933 0.001  0     0     .006   1.016   0
G1  10607   6561    1     1.2192  194.4876 0.001  0     0     .006   1.3272  0
G1  102456  102463  2     .381    142.1628 0.001  0     0     .006   0.381   0
G1  101404  101407  2     .381    144.778 0.001   0     0     .006   0.381   0
G1  101386  101390  2     .381    184.0636 0.001  0     0     .006   0.381   0
G1  102052  9351    2     .6096   680     .001    0     0     .006   .381    0
*   JK      NAMEW   NGTO    Width   WAREA   %IMPERV WSLOPE IMPER N  PERV N WSTORE1 WSTORE2 INFIL1 INFIL2  DECAY  RMAXINF
H1  1       11982   101982  674     2.516226 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11973   101973  677     2.591432 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11965   101965  683     2.775875 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11979   101979  86      1.575952 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11970   101970  49      2.270631 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11772   17721   97      .9708661 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11952   101952  271     .4931755 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11960   101960  335     .8032489 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11941   101941  504     1.196297 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11947   101947  391     1.988267 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11956   101956  419     1.851826 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11939   101939  367     2.731136 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11164   101164  119     .3601646 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11145   101145  300     .6198039 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11490   101490  257     1.403718 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11333   101333  813     11.50819 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11937   101937  212     3.349415 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11933   101933  797     1.568487 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11916   101916  907     2.605847 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11921   101921  795     2.901302 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11905   101905  824     3.191427 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11893   101893  838     3.410155 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11885   101885  889     2.335317 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11869   101869  166     .1379829 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11878   101878  695     1.677972 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11864   101864  746     2.91392 0       0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11861   101861  128     .8380157 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11873   101873  244     .4738666 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11883   101883  511     4.536775 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11876   101876  403     4.121478 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11845   101845  284     1.086602 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11844   101844  333     3.077842 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11837   101837  105     2.183175 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11840   101840  244     1.12962 0       0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11847   101847  67      .1452085 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
H1  1       11841   101841  584     1.015875 0      0.001   0.025   0.1     1       5       12      3       0.001   12.5    0       0       0       0
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H1	1	11852	101852	74	2.219451	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11851	101851	71	1.031303	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11849	101849	182	.2021968	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11860	101860	143	.3673998	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11857	101857	287	1.95937	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11853	101853	434	2.642751	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11474	101474	127	.5625407	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11468	101468	597	5.710394	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11421	101421	185	1.696403	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11438	14381	448	1.12053	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11434	101434	448	3.326044	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11471	14711	765	4.610395	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11494	101494	883	3.004538	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11579	101579	592	2.788516	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11666	16661	368	8.949391E-02	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11568	101568	180	.4683247	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11584	101584	503	2.403507	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11588	101588	153	.216363	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1160	1060	51	.2667301	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1161	1061	112	.4883667	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1162	1062	76	.1901155	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1163	1063	100	.1795728	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1167	1067	182	.6613167	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1187	1087	558	1.849906	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1174	1074	147	.7577798	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1176	1076	151	.726372	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1178	1078	156	.5835162	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1181	1081	218	.7198764	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12042	102042	251	1.460648	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1936	9361	255	1.571025	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12064	102064	231	1.490668	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12065	102065	106	1.417359	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12067	102067	124	1.280539	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12069	102069	104	1.263097	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12074	102074	229	1.366791	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1215	10215	422	2.271234	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1218	10218	776	3.165759	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	120321	1020321	583	1.379418	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12032	102032	198	1.252513	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12041	102041	194	1.155368	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12046	102046	554	3.321777	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1186	10186	600	2.003234	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1184	1084	883	1.477953	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11032	101032	426	1.493747	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1322	10322	372	.8156367	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1387	10387	289	1.013238	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1388	10388	417	1.081285	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1391	10391	488	1.187357	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1392	10392	327	1.030299	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1393	10393	309	.9472848	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1394	10394	255	1.009183	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1683	10683	397	1.33836	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1685	10685	400	1.363941	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1687	10687	398	1.323259	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1662	10662	298	1.115075	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1727	10727	595	1.425024	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1737	10737	486	1.413264	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1735	10735	315	1.334335	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1730	10730	298	1.310731	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11063	101063	251	.4764367	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11035	101035	178	1.527277	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11036	101036	318	.7985405	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11113	101113	219	.8158892	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11115	101115	458	1.266871	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11359	101359	455	3.703401	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11363	101363	268	3.057696	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11365	101365	232	.8252434	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11368	101368	292	1.249765	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11370	101370	181	1.067399	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11371	101371	101	.5835388	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11377	101377	172	.8229802	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11379	101379	824	10.28881	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1082	101082	257	1.736325	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12289	22891	608	39.07889	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12309	102309	518	28.54273	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12310	102310	334	35.06153	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	103312	103312	147	29.35991	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11062	101062	263	.7739368	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11718	101718	950	2.35544	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11726	101726	988	3.437802	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0

H1	1	11734	101734	980	3.648236	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11743	101743	145	1.025423	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11745	101745	727	2.612158	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11752	101752	635	2.419289	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11760	101760	872	1.829298	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11766	101766	242	.6926762	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11769	101769	872	3.288771	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11779	101779	936	3.712043	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11773	101773	123	1.155898	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11776	101776	267	1.350399	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11785	101785	901	3.140197	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11794	101794	907	2.919765	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11803	101803	117	.2516506	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11804	101804	491	1.050314	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11808	101808	242	.4069047	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11818	101818	286	.8327121	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11813	101813	470	.9324155	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11821	101821	448	1.652487	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11816	101816	227	.3479144	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11817	18171	386	1.121582	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11827	101827	748	4.034427	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11171	101171	301	1.080408	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12018	102018	359	1.762593	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12008	102008	426	1.309468	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12005	102005	294	.593737	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12016	102016	344	1.348911	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12000	102000	519	2.001878	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11996	101996	209	2.586683	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11993	101993	425	.8761544	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11988	101988	603	.9631839	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1751	10751	442	1.345374	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1748	10748	276	1.219292	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1747	10747	210	1.224922	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1704	10704	460	1.341663	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1711	10711	483	1.446863	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1792	10792	475	1.379528	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1674	674	398	.8702447	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1809	10809	462	.7371651	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1841	10841	394	.9178807	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1839	10839	307	.8048223	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1837	10837	299	.7679644	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1834	10834	224	.4391064	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1904	10904	364	.8158011	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1959	10959	466	1.640276	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1962	10962	469	1.745225	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11373	101373	456	2.691908	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11386	101386	452	7.480078	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11404	101404	289	2.547052	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11408	101408	358	2.003137	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1222	10222	419	2.403871	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1224	10224	636	1.386895	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12030	102030	104	1.032157	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12021	102021	184	.8250873	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1343	10343	544	1.415755	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1345	10345	299	1.042921	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1317	10317	116	.7741856	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1319	10319	116	.3970987	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1376	10376	225	.8799161	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1379	10379	300	.9808402	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1381	10381	250	1.032132	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1383	10383	135	.9589478	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1320	10320	88	.3042691	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1304	10304	89	.2638848	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1306	10306	225	.6634202	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1321	10321	225	.7727323	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1307	10307	359	.7279585	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1512	101512	454	2.139929	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11518	101518	412	1.307	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1553	10553	1195	3.231246	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12035	102035	764	2.34027	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1452	4521	357	1.164143	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1258	10258	1259	3.702457	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1266	10266	1214	3.622695	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1689	10689	179	1.304631	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1706	10706	213	1.614536	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1987	10987	389	1.639802	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1888	10888	444	1.377741	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1896	10896	294	.7957874	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1879	10879	435	1.100485	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0

H1	1	1396	10396	174	.3613159	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1872	10872	383	.6563895	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1953	10953	294	2.374316	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1957	10957	166	1.997507	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1954	10954	463	3.816343	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1995	10995	394	1.776122	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11001	101001	386	1.678764	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11006	101006	294	1.719362	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1501	10501	452	1.24279	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1786	10786	205	1.241019	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1692	10692	218	.7019072	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1509	10509	290	.9469993	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1511	10511	568	1.294758	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1546	10546	316	1.066921	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1515	10515	593	1.392638	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1550	10550	396	1.072304	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1551	10551	579	1.419328	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1537	10537	268	1.645121	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12086	102086	350	2.000364	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12125	102125	587	2.027955	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12104	102104	393	1.523292	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12101	102101	445	.5303058	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12098	102098	348	.9808527	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12122	102122	255	1.380028	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12084	102084	222	3.172754	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12092	102092	510	2.691967	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12108	102108	116	.9952505	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1315	10315	216	.6121292	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1227	10227	725	3.133683	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1193	1093	553	1.543627	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1199	1099	550	1.715203	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1205	10205	562	2.037579	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1777	10777	508	2.638542	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1783	10783	417	1.044097	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1779	10779	126	.1566631	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12109	21091	1011	3.499275	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12039	102039	291	2.806379	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1934	9341	134	.4263455	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1350	3501	195	.7433937	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12062	102062	233	1.254486	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12059	102059	227	1.175589	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12057	102057	219	1.147733	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	12056	102056	331	1.195527	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1357	10357	232	3.770465	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1347	10347	127	.3535163	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1349	10349	320	.4039317	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1799	10799	716	3.464933	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1818	10818	425	1.082727	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1822	10822	581	1.430831	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1826	10826	638	1.289464	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1816	10816	294	.914629	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1820	10820	222	1.205654	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1825	10825	219	1.13957	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1815	10815	310	.921367	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1819	10819	316	1.281679	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1824	10824	427	1.223922	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1814	10814	80	.4635284	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1829	10829	635	2.102578	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1990	10990	383	1.641574	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1998	10998	381	1.761099	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11004	101004	384	1.61185	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11011	101011	384	1.723471	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11120	101120	580	1.792623	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11125	101125	572	1.81297	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11131	101131	581	1.722286	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11118	101118	399	1.723282	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1916	10916	375	.8094122	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1911	10911	61	.9656575	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1845	10845	227	.7652341	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1843	10843	124	.5123579	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1855	10855	225	.9839128	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1848	10848	378	.8092777	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1847	10847	222	.6921899	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1856	10856	223	1.01302	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1765	10765	342	1.245522	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1764	10764	316	1.122421	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1852	10852	342	.8816075	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11192	101192	412	2.341789	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1810	10810	481	1.258103	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1857	10857	461	1.280417	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0

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H1 1 11231 101231 223 1.211987 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11233 101233 204 1.137093 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11273 101273 207 1.234097 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
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H1 1 11266 101266 92 .7184831 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11267 101267 209 .8377899 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11258 101258 243 2.155625 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11262 101262 232 1.994042 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11316 101316 184 .8165415 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11319 101319 217 .8372874 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0

H1	1	11321	101321	219	.8607838	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11322	101322	202	.7777875	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11306	101306	160	1.27543	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11308	101308	217	1.242428	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11310	101310	219	1.235094	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11313	101313	206	1.116819	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11575	101575	298	1.235608	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11572	101572	428	1.115549	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11590	101590	320	.9119158	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11594	101594	139	1.103489	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11236	101236	83	.892318	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11237	101237	330	1.566348	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11213	101213	219	1.191462	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11218	101218	108	.8703526	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11241	101241	163	1.021857	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	112432	101242	300	.5723106	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11238	101238	238	.6012126	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11234	101234	170	.3207714	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1757	10757	286	1.271864	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1802	10802	340	1.168231	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1755	10755	104	.5656989	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	1753	10753	137	1.088712	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11249	101249	456	2.094093	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11252	101252	397	1.304755	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11256	101256	95	.9009109	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11245	101245	764	4.677301	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11271	101271	210	2.423959	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11272	101272	220	1.334741	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11552	101552	319	.8154845	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11550	101550	238	.7072953	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11547	101547	139	.7958147	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11557	101557	148	1.23109	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11562	101562	56	.6426532	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11560	101560	132	.7038828	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11639	101639	221	1.239557	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11497	101497	120	1.4638	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11532	101532	121	.5681448	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11503	101503	125	.6151696	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11523	101523	223	1.001223	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11499	101499	265	1.671191	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11630	101630	413	1.260344	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11626	101626	248	.9836939	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11482	101482	608	2.640107	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11477	101477	154	.7699739	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11504	101504	334	.6122117	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11510	101510	81	.9230387	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11314	101314	285	.647477	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11294	101294	340	.5864116	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11284	101284	278	.6257517	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	14011	104011	161	.313387	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11134	101134	189	.346288	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11136	101136	85	.1984562	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11121	101121	113	.7090417	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11123	101123	391	1.817893	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11127	101127	112	.6993449	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11129	101129	390	1.706	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11180	101180	420	1.385227	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11179	101179	179	1.224799	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11178	101178	178	1.15327	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11177	101177	316	1.087375	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11174	101174	482	1.317629	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11184	101184	162	.722555	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11190	101190	152	.5715117	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11191	101191	150	1.019125	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11505	101505	542	1.732088	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11531	101531	566	1.134093	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11527	101527	297	.5755833	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11246	101246	566	1.969973	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11902	101902	115	.7391648	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11913	101913	80	.6307948	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11928	101928	370	2.285909	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11473	14731	548	1.02065	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11090	101090	398	1.106711	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11119	101119	103	.3048876	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11110	101110	103	.3983294	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11094	101094	261	.4849034	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11097	101097	275	.5549664	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11100	101100	267	.4614296	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0
H1	1	11103	101103	289	.5137949	0	0.001	0.025	0.1	1	5	12	3	0.001	12.5	0	0	0	0

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H1 1 11064 101064 217 .660332 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
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H1 1 1341 10341 900 3.172406 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 1397 10397 712 1.833039 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 1874 1087 660 2.76367 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 1881 10881 668 3.650289 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 1894 8941 934 3.431291 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 1897 10897 692.54 3.422734 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 1906 10906 797 2.338245 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 1917 10917 796 2.178845 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 1922 10922 1012 4.617228 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 12369 102369 802 1.946349 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 12476 102476 444 1.493655 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11394 101394 652 8.326627 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 1323 101323 100 2.452332 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11372 101372 147 1.39845 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11402 101402 1208 16.40163 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11264 101264 246 2.422758 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11240 101240 146 2.362379 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11141 101141 180 .9817188 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 1946 9461 1262 11.55479 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 12052 102052 217 2.352857 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11269 101269 130 2.6613 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11615 101615 432 1.298428 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11296 101296 157 1.236724 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11298 101298 217 1.222727 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11300 101300 219 1.278593 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11302 101302 208 1.25259 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11286 101286 187 .6981544 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11288 101288 221 .6787336 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11290 101290 214 .6298897 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11293 101293 209 .5572231 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11277 101277 191 .9320231 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11278 101278 221 .8877899 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11280 101280 214 .8587003 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11282 101282 209 .8766871 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 1717 10717 225 1.443039 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 1720 10720 212 1.379709 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 1722 10722 126 .7242562 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 1723 10723 396 1.260917 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 1767 10767 745 4.88978 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11165 101165 211 .4270328 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11166 1166 200 .3470719 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11167 101167 205 .3830723 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11168 101168 301 .7127289 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11147 101147 316 .7134249 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11148 101148 292 .5291996 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 11150 101150 305 .5796697 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 12416 102416 568 .9192315 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 12423 102423 550 .8185356 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 12458 102458 235 .3169521 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 12459 102459 86 .4033567 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 12363 102363 307 .6742448 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0
H1 1 12367 102367 143 .1303286 0 0.001 0.025 0.1 1 5 12 3 0.001 12.5 0 0 0 0

```
H1  1    12359  102359 311   .6921236 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    12365  102365 192   .340291 0     0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    12354  102354 422   .8368569 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    12358  102358 240   .3475556 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    12350  102350 430   1.130108 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    11067  101067 311   .6836547 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    11071  101071 279   .5434051 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    11074  101074 289   .6013004 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    11076  101076 281   .5355105 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    11050  101050 106   .4032656 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    11052  101052 207   .4199572 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    11054  101054 176   .3240848 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    11056  101056 194   .3517467 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    11058  101058 171   .2763854 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    11017  101017 270   .864289 0     0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    11020  101020 361   .9245899 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    11023  101023 321   .6771294 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    11026  101026 339   .8549176 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    11029  101029 320   .5937077 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    11038  101038 220   .5115274 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    11040  101040 240   .5939157 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    11042  101042 211   .3899214 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    11044  101044 237   .5226004 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    12341  102341 358   .5942548 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    12346  102346 406   .3450347 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    12498  102498 285   .5551367 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    12500  102500 172   .1736422 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    12342  102342 218   .19432  0     0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    12297  102297 368   2.352163 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    1385   10385  203   .8359373 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    11161  101161 460   1.532165 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    11160  101160 269   2.604761 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    12224  102224 345   2.281781 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    12221  102221 419   1.801643 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    12217  102217 425   1.535194 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    12213  102213 506   1.402801 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    12233  102233 686   3.777563 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    1966   10966  538   3.497625 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    1975   10975  541   3.709969 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    1139   1039   1016  4.857168 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    1128   1028   966   3.742678 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    1149   1049   958   3.836273 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    13311  103311 1526  64.84811 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    12188  102188 468   5.380873 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    12493  102493 340   1.810099 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    12432  102432 240   1.455325 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    1101   1001   820   7.543356 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    12467  102467 320   1.618589 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    12463  102463 284   1.783552 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    1516   10516  956   6.020854 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    1525   10525  944   9.154639 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    1411   10411  1261  8.738706 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    1416   10416  620   3.417571 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    1435   10435  556   4.446223 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    1577   10577  894   11.60555 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    1607   10607  400   17.30745 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    12433  102433 84    .4970956 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    1212   10212  543   5.972795 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    1209   10209  414   3.835334 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    1274   10274  767   8.314312 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
H1  1    1712   10712  127   2.495755 0    0.001  0.025  0.1   1    5    12    3    0.001  12.5  0    0    0    0
*
* NPRNT INTERV
M1  4      1
* NDET STARTP1 STOPPR1
M2  1      0      0
* IPRNT...
M3  10411  10415  10416  10435
*
$ENDPROGRAM
```

A.2 EXTRAN Input Data

```
$EXTRAN
*   Title Lines
A1   'May 8 1995'
*   ISOL    KSUPER  KREDO   TOLCS1  QLOWCS  TOLCS2
B0  4       0       0       0       0       0
*   NTCYC   DELT    TZERO   NSTART  INTER   JNTER   REDO    IDATZ
B1   86000  1       0       0       30      30      0       19950508
*   METRIC  NEQUAL  AMEN    ITMAX   SURTOL
B2  1       3       0.0     35      0.02
*   NHPRT   NQPRT   NPLT    LPLT    NJSW
B3  6       7       0       0       1
*   PRINT HEADS
B4  2168    2167    2164    2268    2166    3002
*   PRINT FLOWS
B5  102167  102165  102303  102164  102227  103001  102168
*   CONDUIT DATA
*   NCOND   NJUNC1  NJUNC2  QO      NKLASS  AFULL   DEEP    WIDE    LEN     ZP(1)   ZP(2)   ROUGH   STHETA  SPHI    ENTK    EXITK
OTHERK
C1   102202  2202    2195    0       2       0       2.835   4.877   190.1525 0      0       .015    0       0       0       0       0       0
C1   102195  2195    2166    0       1       0       3       3       147.8846 0      0       .015    0       0       0       0       0       0
C1   10524   524     536     0       1       0       1.2192  1.2192  95.61778 0      0       .015    0       0       0       0       0       0
C1   10536   536     539     0       1       0       1.524   1.524   43.03012 0      0       .015    0       0       0       0       0       0
C1   10539   539     540     0       1       0       1.524   1.524   33.55107 0      0       .015    0       0       0       0       0       0
C1   10540   540     541     0       1       0       1.524   1.524   97.93176 0      0       .015    0       0       0       0       0       0
C1   10541   541     542     0       1       0       1.524   1.524   12.58094 0      0       .015    0       0       0       0       0       0
C1   10665   665     666     0       1       0       0.762   0.762   32.31611 0      0       .015    0       0       0       0       0       0
C1   10666   666     667     0       1       0       0.762   0.762   14.2801 0       0       .015    0       0       0       0       0       0
C1   10667   667     668     0       2       0       1.016   0.9144  82.23927 0      0       .015    0       0       0       0       0       0
C1   10669   669     670     0       2       0       1.016   0.9144  36.63408 0      0       .015    0       0       0       0       0       0
C1   10670   670     671     0       1       0       1.524   1.524   111.0754 0      0       .015    0       0       0       0       0       0
C1   10671   671     672     0       1       0       1.524   1.524   112.0339 0      0       .015    0       0       0       0       0       0
C1   10672   672     673     0       1       0       1.8288  1.8288  115.194 0       0       .015    0       0       0       0       0       0
C1   10673   673     674     0       1       0       1.8288  1.8288  107.4631 0      0       .015    0       0       0       0       0       0
C1   10674   674     675     0       1       0       1.9812  1.9812  95.72192 0      0       .015    0       0       0       0       0       0
C1   10647   647     648     0       1       0       2.4384  2.4384  7.088018 0      0       .015    0       0       0       0       0       0
C1   10648   648     649     0       1       0       2.4384  2.4384  51.60398 0      0       .015    0       0       0       0       0       0
C1   10649   649     650     0       1       0       2.4384  2.4384  109.5437 0      0       .015    0       0       0       0       0       0
C1   10650   650     652     0       1       0       2.4384  2.4384  37.60325 0      0       .015    0       0       0       0       0       0
C1   10652   652     653     0       1       0       2.4384  2.4384  32.21735 0      0       .015    0       0       0       0       0       0
C1   10653   653     654     0       1       0       2.4384  2.4384  31.70253 0      0       .015    0       0       0       0       0       0
C1   10654   654     655     0       1       0       2.4384  2.4384  84.63134 0      0       .015    0       0       0       0       0       0
C1   10655   655     656     0       1       0       2.4384  2.4384  105.4234 0      0       .015    0       0       0       0       0       0
C1   10656   656     657     0       1       0       2.4384  2.4384  108.7219 0      0       .015    0       0       0       0       0       0
C1   10657   657     658     0       1       0       2.4384  2.4384  91.56994 0      0       .015    0       0       0       0       0       0
C1   10659   659     660     0       1       0       2.4384  2.4384  23.95812 0      0       .015    0       0       0       0       0       0
C1   102289  2289    2290    0       1       0       1.3716  1.3716  23.91172 0      0       .015    0       0       0       0       0       0
C1   102290  2290    2291    0       1       0       1.3716  1.3716  81.4112 0       0       .015    0       0       0       0       0       0
C1   102291  2291    2292    0       2       0       1.3716  0.889   81.32844 0      0       .015    0       0       0       0       0       0
C1   101471  1471    1472    0       2       0       1.0668  1.1684  412.2856 0      0       .015    0       0       0       0       0       0
C1   101472  1472    1473    0       2       0       1.8288  1.8288  23.00706 0      0       .015    0       0       0       0       0       0
C1   10885   885     894     0       2       0       0.9144  1.016   84.80229 0      0       .015    0       0       0       0       0       0
C1   10878   878     885     0       2       0       0.9144  1.016   88.11791 0      0       .015    0       0       0       0       0       0
C1   104021  402     878     0       2       0       0.9144  1.016   52.55932 0      0       .015    0       0       0       0       0       0
C1   10402   402     350     0       1       0       0.9144  0.9144  42.69095 0      0       .015    0       0       0       0       0       0
C1   10350   350     934     0       2       0       1.524   1.524   107.9207 0      0       .015    0       0       0       0       0       0
C1   101338  1338    1339    0       2       0       3.0988  1.9558  180.6293 0      0       .015    0       0       0       0       0       0
C1   101339  1339    1340    0       2       0       3.0988  1.9558  280.4498 0      0       .015    0       0       0       0       0       0
C1   101340  1340    1341    0       2       0       3.0988  1.9558  154.1122 0      0       .015    0       0       0       0       0       0
C1   101356  1356    1357    0       1       0       2.032   2.032   123.7113 0      0       .015    0       0       0       0       0       0
C1   101357  1357    1358    0       1       0       1.5224  1.5224  109.6875 0      0       .015    0       0       0       0       0       0
C1   101358  1358    1295    0       1       0       1.5224  1.5224  100.6622 0      0       .015    0       0       0       0       0       0
C1   10934   934     935     0       1       0       1.524   1.524   107.627 0       0       .015    0       0       0       0       0       0
C1   10935   935     936     0       1       0       1.524   1.524   109.3216 0      0       .015    0       0       0       0       0       0
C1   10936   936     937     0       1       0       1.524   1.524   108.3578 0      0       .015    0       0       0       0       0       0
C1   10902   902     910     0       2       0       0.9144  1.0668  90.57555 0      0       .015    0       0       0       0       0       0
C1   10910   910     921     0       2       0       0.9144  1.10668 17.1751 0      0       .015    0       0       0       0       0       0
C1   10921   921     928     0       2       0       0.9144  1.0668  89.21513 0      0       .015    0       0       0       0       0       0
C1   10928   928     938     0       2       0       1.3208  1.2192  87.77702 0      0       .015    0       0       0       0       0       0
C1   10938   938     939     0       2       0       1.3208  1.2192  93.7084 0       0       .015    0       0       0       0       0       0
C1   10939   939     940     0       2       0       1.3208  1.2192  84.55349 0      0       .015    0       0       0       0       0       0
C1   10940   940     941     0       2       0       1.3208  1.2192  85.41051 0      0       .015    0       0       0       0       0       0
C1   10941   941     942     0       2       0       1.3208  1.2192  20.65407 0      0       .015    0       0       0       0       0       0
C1   10942   942     943     0       1       0       1.8288  1.8288  85.41051 0      0       .015    0       0       0       0       0       0
C1   10943   943     944     0       1       0       1.8288  1.8288  6.562009 0      0       .015    0       0       0       0       0       0
C1   10944   944     945     0       1       0       1.8288  1.8288  82.1296 0       0       .015    0       0       0       0       0       0
C1   10945   945     946     0       1       0       1.8288  1.8288  7.745127 0      0       .015    0       0       0       0       0       0
```

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C1  10946  946   947   0   1   0   1.8288  1.8288  83.58828 0   0   .015  0   0   0   0   0   0
C1  10947  947   948   0   1   0   1.8288  1.8288  86.85085 0   0   .015  0   0   0   0   0   0
C1  10948  948   949   0   1   0   1.8288  1.8288  75.42523 0   0   .015  0   0   0   0   0   0
C1  101473 1473  1653  0   1   0   1.8288  1.8288  90.75165 0   0   .015  0   0   0   0   0   0
C1  101653 1653  1665  0   1   0   1.8288  1.8288  98.9203 0   0   .015  0   0   0   0   0   0
C1  101665 1665  1666  0   1   0   1.8288  1.8288  94.18615 0   0   .015  0   0   0   0   0   0
C1  101666 1666  1667  0   1   0   1.8288  1.8288  102.2401 0   0   .015  0   0   0   0   0   0
C1  101817 1817  1809  0   2   0   1.1684  1.0668  12.65379 0   0   .015  0   0   0   0   0   0
C1  101809 1809  1801  0   2   0   1.3272  1.2192  78.20486 0   0   .015  0   0   0   0   0   0
C1  101801 1801  1792  0   2   0   1.3272  1.2192  66.50521 0   0   .015  0   0   0   0   0   0
C1  101792 1792  1783  0   1   0   1.524   1.524   81.6788 0   0   .015  0   0   0   0   0   0
C1  101783 1783  1772  0   1   0   1.524   1.524   225.5738 0   0   .015  0   0   0   0   0   0
C1  101772 1772  1764  0   1   0   1.524   1.524   11.89573 0   0   .015  0   0   0   0   0   0
C1  101764 1764  1756  0   1   0   1.8288  1.8288  72.46528 0   0   .015  0   0   0   0   0   0
C1  101756 1756  1749  0   1   0   1.8288  1.8288  78.06145 0   0   .015  0   0   0   0   0   0
C1  101749 1749  1741  0   1   0   1.8288  1.8288  74.55896 0   0   .015  0   0   0   0   0   0
C1  101741 1741  1732  0   1   0   1.8288  1.8288  78.56547 0   0   .015  0   0   0   0   0   0
C1  101732 1732  1724  0   1   0   1.8288  1.8288  77.356  0   0   .015  0   0   0   0   0   0
C1  101724 1724  1710  0   1   0   1.8288  1.8288  23.18131 0   0   .015  0   0   0   0   0   0
C1  101710 1710  1832  0   1   0   2.4384  2.4384  153.865 0   0   .015  0   0   0   0   0   0
C1  101832 1832  1833  0   1   0   2.4384  2.4384  12.96122 0   0   .015  0   0   0   0   0   0
C1  101833 1833  1834  0   1   0   2.4384  2.4384  115.3043 0   0   .015  0   0   0   0   0   0
C1  101834 1834  1835  0   1   0   2.4384  2.4384  46.46759 0   0   .015  0   0   0   0   0   0
C1  101835 1835  949   0   1   0   2.4384  2.4384  64.7379 0   0   .015  0   0   0   0   0   0
C1  10661  661   2109  0   1   0   3.048   3.048   200.3364 0   0   .015  0   0   0   0   0   0
C1  102109 2109  2110  0   1   0   3.048   3.048   124.4754 0   0   .015  0   0   0   0   0   0
C1  102110 2110  2111  0   1   0   3.048   3.048   83.84151 0   0   .015  0   0   0   0   0   0
C1  102111 2111  2112  0   1   0   3.048   3.048   32.75831 0   0   .015  0   0   0   0   0   0
C1  102112 2112  2113  0   1   0   3.048   3.048   32.56769 0   0   .015  0   0   0   0   0   0
C1  102113 2113  2114  0   2   0   2.835   4.877   158.3601 0   0   .015  0   0   0   0   0   0
C1  102114 2114  2115  0   2   0   2.835   4.877   12.84503 0   0   .015  0   0   0   0   0   0
C1  102115 2115  2116  0   2   0   2.835   4.877   30.20167 0   0   .015  0   0   0   0   0   0
C1  102116 2116  2117  0   2   0   2.835   4.877   118.5181 0   0   .015  0   0   0   0   0   0
C1  102117 2117  2118  0   2   0   2.835   4.877   145.754 0   0   .015  0   0   0   0   0   0
C1  102118 2118  2119  0   2   0   2.835   4.877   18.71674 0   0   .015  0   0   0   0   0   0
C1  102119 2119  2120  0   2   0   2.835   4.877   258.6857 0   0   .015  0   0   0   0   0   0
C1  102126 2126  2127  0   1   0   3.048   3.048   136.5714 0   0   .015  0   0   0   0   0   0
C1  10449  449   2126  0   1   0   3.048   3.048   106.0857 0   0   .015  0   0   0   0   0   0
C1  10448  448   449   0   1   0   3.048   3.048   26.40626 0   0   .015  0   0   0   0   0   0
C1  102036 2036  448   0   1   0   3.048   3.048   206.7357 0   0   .015  0   0   0   0   0   0
C1  10542  542   549   0   1   0   2.4384  2.4384  113.1578 0   0   .015  0   0   0   0   0   0
C1  10549  549   512   0   1   0   2.4384  2.4384  116.3388 0   0   .015  0   0   0   0   0   0
C1  10512  512   502   0   1   0   2.4384  2.4384  112.51  0   0   .015  0   0   0   0   0   0
C1  10502  502   489   0   1   0   2.4384  2.4384  116.7422 0   0   .015  0   0   0   0   0   0
C1  10489  489   480   0   1   0   2.4384  2.4384  100.748 0   0   .015  0   0   0   0   0   0
C1  10452  452   2036  0   1   0   3.048   3.048   122.3142 0   0   .015  0   0   0   0   0   0
C1  10453  453   452   0   1   0   3.048   3.048   10.73572 0   0   .015  0   0   0   0   0   0
C1  10460  460   453   0   1   0   3.048   3.048   108.7471 0   0   .015  0   0   0   0   0   0
C1  10937  937   460   0   1   0   3.048   3.048   12.0571 0   0   .015  0   0   0   0   0   0
C1  10468  468   937   0   1   0   3.0485  3.048   13.29044 0   0   .015  0   0   0   0   0   0
C1  10480  480   468   0   1   0   2.4384  2.4384  111.818 0   0   .015  0   0   0   0   0   0
C1  102120 2120  2121  0   2   0   2.835   4.877   14.27431 0   0   .015  0   0   0   0   0   0
C1  102127 2127  2128  0   2   0   3.048   3.048   226.2126 0   0   .015  0   0   0   0   0   0
C1  102129 2129  2130  0   2   0   2.835   4.877   7.488911 0   0   .015  0   0   0   0   0   0
C1  102130 2130  1116  0   2   0   2.835   4.877   114.0015 0   0   .015  0   0   0   0   0   0
C1  101116 1116  1114  0   2   0   2.835   4.877   89.53085 0   0   .015  0   0   0   0   0   0
C1  101114 1114  1037  0   2   0   2.835   4.877   94.43153 0   0   .015  0   0   0   0   0   0
C1  101037 1037  1850  0   2   0   2.835   4.877   102.0746 0   0   .015  0   0   0   0   0   0
C1  101850 1850  1085  0   2   0   2.835   4.877   92.98374 0   0   .015  0   0   0   0   0   0
C1  101085 1085  949   0   2   0   2.835   4.877   197.4164 0   0   .015  0   0   0   0   0   0
C1  10949  949   1163  0   2   0   2.835   4.877   194.9659 0   0   .015  0   0   0   0   0   0
C1  101163 1163  1182  0   2   0   2.835   4.877   193.7418 0   0   .015  0   0   0   0   0   0
C1  101182 1182  2169  0   2   0   2.835   4.877   36.08308 0   0   .015  0   0   0   0   0   0
C1  102169 2169  1143  0   2   0   2.835   4.877   54.63431 0   0   .015  0   0   0   0   0   0
C1  101143 1143  2170  0   2   0   2.835   4.877   60.56656 0   0   .015  0   0   0   0   0   0
C1  102170 2170  1235  0   2   0   2.835   4.877   66.1237 0   0   .015  0   0   0   0   0   0
C1  101235 1235  1239  0   2   0   2.835   4.877   115.1334 0   0   .015  0   0   0   0   0   0
C1  101239 1239  1243  0   2   0   2.835   4.877   106.3246 0   0   .015  0   0   0   0   0   0
C1  101243 1243  1667  0   2   0   2.835   4.877   134.8761 0   0   .015  0   0   0   0   0   0
C1  10675  675   2139  0   1   0   1.9812  1.9812  13.95114 0   0   .015  0   0   0   0   0   0
C1  102163 2163  2165  0   2   0   2.835   6.096   29.24588 0   0   .015  0   0   0   0   0   0
C1  102165 2165  2166  0   2   0   2.835   10.2672 6.096426 0   0   .015  0   0   0   0   0   0
C1  102167 2167  2168  0   2   0   3       18      100     0   0   .06   0   0   0   0   0   0
C1  102164 2164  2165  0   2   0   2.835   4.2672  37.35199 0   0   .015  0   0   0   0   0   0
C1  102171 2171  1324  0   1   0   2.4384  2.4384  102.75  0   0   .015  0   0   0   0   0   0
C1  101324 1324  1315  0   1   0   2.4384  2.4384  100.005 0   0   .015  0   0   0   0   0   0
C1  101315 1315  1305  0   1   0   2.4384  2.4384  109.3967 0   0   .015  0   0   0   0   0   0
C1  101305 1305  1295  0   1   0   2.4384  2.4384  116.6942 0   0   .015  0   0   0   0   0   0
C1  101295 1295  1285  0   1   0   2.4384  2.4384  21.70123 0   0   .015  0   0   0   0   0   0
C1  101285 1285  1275  0   1   0   3.048   3.048   120.1919 0   0   .015  0   0   0   0   0   0
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C1  101275 1275  1270  0  1  0  3.048  3.048  114.0378 0  0  .015  0  0  0  0  0  0
C1  101270 1270  1667  0  1  0  3.048  3.048  353.9178 0  0  .015  0  0  0  0  0  0
C1  101667 1667  2172  0  2  0  2.835  4.2672  11.74163 0  0  .015  0  0  0  0  0  0
C1  102172 2172  2131  0  2  0  3.048  3.048  213.5204 0  0  .015  0  0  0  0  0  0
C1  1021721 2172  1265  0  2  0  2.835  5.4864  99.90859 0  0  .015  0  0  0  0  0  0
C1  102132 2132  1211  0  1  0  3.048  3.048  95.32085 0  0  .015  0  0  0  0  0  0
C1  101211 1211  1206  0  1  0  3.048  3.048  34.96638 0  0  .015  0  0  0  0  0  0
C1  101206 1206  2133  0  1  0  3.048  3.048  88.32278 0  0  .015  0  0  0  0  0  0
C1  102133 2133  1229  0  1  0  3.048  3.048  119.4906 0  0  .015  0  0  0  0  0  0
C1  101229 1229  2135  0  1  0  3.048  3.048  89.96946 0  0  .015  0  0  0  0  0  0
C1  102135 2135  2137  0  1  0  3.048  3.048  98.90236 0  0  .015  0  0  0  0  0  0
C1  102137 2137  2140  0  1  0  3.048  3.048  28.71177 0  0  .015  0  0  0  0  0  0
C1  102140 2140  2141  0  2  0  2.835  4.2672  98.69731 0  0  .015  0  0  0  0  0  0
C1  102141 2141  2142  0  2  0  2.835  4.2672  105.1873 0  0  .015  0  0  0  0  0  0
C1  102142 2142  2145  0  2  0  2.835  4.2672  107.716 0  0  .015  0  0  0  0  0  0
C1  102145 2145  2146  0  2  0  2.835  4.2672  103.1325 0  0  .015  0  0  0  0  0  0
C1  102146 2146  2147  0  2  0  2.835  4.2672  48.16325 0  0  .015  0  0  0  0  0  0
C1  102147 2147  2148  0  2  0  2.835  4.2672  81.92706 0  0  .015  0  0  0  0  0  0
C1  102148 2148  2151  0  2  0  2.835  4.2672  28.94772 0  0  .015  0  0  0  0  0  0
C1  102151 2151  2152  0  2  0  2.835  4.2672  109.5694 0  0  .015  0  0  0  0  0  0
C1  102152 2152  2155  0  2  0  2.835  4.2672  81.35469 0  0  .015  0  0  0  0  0  0
C1  102155 2155  2128  0  2  0  2.835  4.2672  132.6576 0  0  .015  0  0  0  0  0  0
C1  102128 2128  2157  0  2  0  2.835  4.2672  89.10941 0  0  .015  0  0  0  0  0  0
C1  102157 2157  21581  0  2  0  2.835  6.096  80.96234 0  0  .015  0  0  0  0  0  0
C1  1021581 21581  2160  0  2  0  2.835  6.096  66.51827 0  0  .015  0  0  0  0  0  0
C1  102160 2160  2162  0  2  0  2.835  6.096  76.58202 0  0  .015  0  0  0  0  0  0
C1  102162 2162  2163  0  2  0  2.835  6.096  69.52062 0  0  .015  0  0  0  0  0  0
C1  101222 1222  1217  0  2  0  2.835  4.2672  112.2721 0  0  .015  0  0  0  0  0  0
C1  101217 1217  1200  0  2  0  2.835  4.2672  218.8817 0  0  .015  0  0  0  0  0  0
C1  101200 1200  2134  0  2  0  2.835  4.2672  119.1528 0  0  .015  0  0  0  0  0  0
C1  102134 2134  2136  0  2  0  2.835  4.2672  91.679  0  0  .015  0  0  0  0  0  0
C1  102136 2136  2138  0  2  0  2.835  4.2672  92.30486 0  0  .015  0  0  0  0  0  0
C1  102138 2138  2139  0  2  0  2.835  4.2672  27.40472 0  0  .015  0  0  0  0  0  0
C1  102139 2139  2143  0  2  0  2.835  4.2672  209.2242 0  0  .015  0  0  0  0  0  0
C1  101265 1265  1222  0  2  0  2.835  4.2672  115.1356 0  0  .015  0  0  0  0  0  0
C1  102131 2131  2132  0  1  0  3.048  3.048  113.5665 0  0  .015  0  0  0  0  0  0
C1  102143 2143  2144  0  2  0  2.835  4.2672  108.107 0  0  .015  0  0  0  0  0  0
C1  102144 2144  2029  0  2  0  2.835  4.2672  102.8642 0  0  .015  0  0  0  0  0  0
C1  102029 2029  2028  0  2  0  2.835  4.2672  49.3608 0  0  .015  0  0  0  0  0  0
C1  102028 2028  2149  0  2  0  2.835  4.2672  81.73107 0  0  .015  0  0  0  0  0  0
C1  102149 2149  2150  0  2  0  2.835  4.2672  29.64929 0  0  .015  0  0  0  0  0  0
C1  102150 2150  2153  0  2  0  2.835  4.2672  106.464 0  0  .015  0  0  0  0  0  0
C1  102153 2153  2154  0  2  0  2.835  4.2672  83.49916 0  0  .015  0  0  0  0  0  0
C1  102154 2154  2121  0  2  0  2.835  4.2672  138.4894 0  0  .015  0  0  0  0  0  0
C1  102121 2121  2156  0  2  0  2.835  4.2672  82.50185 0  0  .015  0  0  0  0  0  0
C1  102156 2156  2159  0  2  0  2.835  4.2672  137.5603 0  0  .015  0  0  0  0  0  0
C1  102159 2159  2161  0  2  0  2.835  4.2672  86.02077 0  0  .015  0  0  0  0  0  0
C1  102161 2161  2164  0  2  0  2.835  4.2672  65.29695 0  0  .015  0  0  0  0  0  0
C1  102228 2228  2208  0  2  0  2.835  4.877  101.0205 0  0  .015  0  0  0  0  0  0
C1  102208 2208  2202  0  2  0  2.835  4.877  90.59143 0  0  .015  0  0  0  0  0  0
C1  102225 2225  2226  0  2  0  3.2766  3.81  84.52033 0  0  .015  0  0  0  0  0  0
C1  102226 2226  2227  0  2  0  3.2766  3.81  90.39076 0  0  .015  0  0  0  0  0  0
C1  102227 2227  2228  0  2  0  3.2766  3.81  291.9487 0  0  .015  0  0  0  0  0  0
C1  102265 2265  2266  0  1  0  3.048  3.048  110.7768 0  0  .015  0  0  0  0  0  0
C1  102266 2266  2245  0  1  0  3.048  3.048  177.4194 0  0  .015  0  0  0  0  0  0
C1  102245 2245  2267  0  1  0  3.048  3.048  95.45908 0  0  .015  0  0  0  0  0  0
C1  102267 2267  2268  0  1  0  3.048  3.048  85.89877 0  0  .015  0  0  0  0  0  0
C1  102268 2268  2228  0  1  0  3.048  3.048  107.0487 0  0  .015  0  0  0  0  0  0
C1  101341 1341  647  0  1  0  2.4384  2.4384  8.84503 0  0  .015  0  0  0  0  0  0
C1  10660  660  309  0  1  0  2.4384  2.4384  12.30359 0  0  .015  0  0  0  0  0  0
C1  10309  309  661  0  1  0  2.4384  2.4384  9.317988 0  0  .015  0  0  0  0  0  0
C1  10658  658  2288  0  1  0  2.4384  2.4384  9.335032 0  0  .015  0  0  0  0  0  0
C1  102288 2288  659  0  1  0  2.4384  2.4384  23.01304 0  0  .015  0  0  0  0  0  0
C1  102292 2292  2293  0  2  0  1.3716  0.9144  80.30807 0  0  .015  0  0  0  0  0  0
C1  102293 2293  2112  0  2  0  1.524  1.016  88.30586 0  0  .015  0  0  0  0  0  0
C1  102300 2300  2301  0  2  0  1.3272  1.2192  98.43372 0  0  .015  0  0  0  0  0  0
C1  102301 2301  2302  0  2  0  1.3272  1.2192  43.22448 0  0  .015  0  0  0  0  0  0
C1  102302 2302  2303  0  2  0  1.3272  1.2192  53.35244 0  0  .015  0  0  0  0  0  0
C1  102286 2286  2287  0  1  0  0.9144  0.9144  136.1131 0  0  .015  0  0  0  0  0  0
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*
*  JUN   GRELEV Z     QINST  YO
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D1  4021  -.816  -2.36  0   0   783617.499534931 3323323.85091584 0   0
D1  309   -0.9144 -4.61  0   0   783402.359344655 3325091.51346558 0   0
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E1 654 0.3 -0.195 5
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E1 655 0.3 -1.68 5
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E1 661 -0.3 -1.033 5
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E1 667 -0.61 -0.328 5
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E1 11821 1.83 -7.822 5
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E1 12061 -0.91 -3.625 5
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E1 12391 1.83 -3 5
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E1  13561  5.49   -75.332 5
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E1  13571  1.83   -14.302 5
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E1  14381  0      -14.945 5
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E1  14711  0      -25.765 5
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E1  1472   -1.22  -2.655  5
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E1  15391  -0.91  -4.63   5
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E1  1665   -1.52  -0.118  5
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E1  1667   1.83   -1.252  5
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E1  16741  0      -5.552  5
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E1  16851  -0.91  -0.994  5
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E1  16971  -0.91  -8.152  5
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E2 0.005 0 0.005 3.49 0.28 3.80 4.14 4.1 4.9 6.23
E1 2165 1.22 -0.245 5
E2 0.005 0 0.005 2.84 0.1 3.09 0.11 5.08 0.24 6.6
E1 2169 2.13 -0.255 5
E2 0.005 0 0.005 3.5 0.17 3.81 0.22 4.11 0.25 6.85
E1 2170 1.83 -0.375 5
E2 0.005 0 0.005 3.24 0.28 3.54 0.33 4.76 0.37 6.59
E1 2171 1.83 -1.444 5
E2 0.005 0 0.005 2.53 0.28 2.83 1.19 3.23 1.44 5.06
E1 2172 1.83 -1.274 5
E2 0.005 0 0.005 3.7 0.28 4.01 1.19 5.53 1.27 6.75
E1 21951 1.52 -5.286 5
E2 0.005 0 0.005 3.27 0.28 3.58 5.19 3.88 5.29 6.01
E1 22021 -1.22 -2.56 5
E2 0.005 0 0.005 3.04 0.28 3.34 2.555 3.36 2.56 3.65
E1 2208 -1.22 -2.845 5
E2 0.005 0 0.005 3.08 0.28 3.38 2.835 3.4 2.84 3.69
E1 2225 0.3 -6.439 5
E2 0.005 0 0.005 3.55 0.28 3.85 6.37 4.12 6.44 5.03
E1 2226 -0.91 -1.071 5
E2 0.005 0 0.005 3.5 0.28 3.81 1.06 3.83 1.07 4.11
E1 2227 0 -13.852 5
E2 0.005 0 0.005 3.48 0.28 3.79 13.79 4.09 13.85 4.7
E1 2228 -0.91 -2.484 5
E2 0.005 0 0.005 3.73 0.28 4.03 2.475 4.05 2.48 4.34
E1 2245 -0.3 -7.13 5
E2 0.005 0 0.005 3.36 0.28 3.67 7.12 3.97 7.13 4.28
E1 22651 0.91 -7.7 5
E2 0.005 0 0.005 3.62 0.28 3.92 7.56 4.23 7.7 5.44
E1 2266 -0.91 -1.805 5
E2 0.005 0 0.005 3.05 0.28 3.35 1.71 3.38 1.81 3.64
E1 2267 -0.91 -1.234 5
E2 0.005 0 0.005 3.38 0.28 3.69 1.225 3.71 1.23 3.99
E1 2268 -0.91 -1.053 5
E2 0.005 0 0.005 3.4 0.28 3.71 1.04 3.73 1.05 4.01
E1 2286 -0.61 -2.669 5
E2 0.005 0 0.005 1.46 0.28 1.77 2.54 2.02 2.67 2.63
E1 2287 -0.3 -13.721 5
E2 0.005 0 0.005 1.33 0.28 1.63 13.31 1.82 13.72 3.04

```
E1  22881  2.13   -6.952  5
E2  0.005  0      0.005  3.67   0.024  3.97   3.18   4.28   6.95   6.71
E1  22891  1.83   -29    5
E2  0.005  0      0.005  3.03   0.28   3.33   13.52  3.64   29     4.86
E1  2290   0.61   -1.943  5
E2  0.005  0      0.005  2.57   0.28   2.88   1.53   3.18   1.94   3.79
E1  2291   0.91   -2.683  5
E2  0.005  0      0.005  2.19   0.28   2.50   2.13   3.71   2.68   4.32
E1  2292   1.52   -2.843  5
E2  0.005  0      0.005  2.39   0.28   2.70   1.9    3.91   2.84   5.13
E1  2293   1.52   -2.638  5
E2  0.005  0      0.005  2.57   0.28   2.88   1.12   3.79   2.64   5.31
E1  2300   5.18   -11.166 5
E2  0.005  0      0.005  5.3    0.28   5.61   6.69   5.91   11.17  9.57
E1  2301   1.22   -0.139  5
E2  0.005  0      0.005  5.63   0.28   5.93   0.135  5.95   0.14   6.24
E1  2302   0.91   -0.067  5
E2  0.005  0      0.005  5.33   0.28   5.64   0.065  5.66   0.07   5.94
E1  2303   2.74   -12.112 5
E2  0.005  0      0.005  5.04   0.28   5.34   6.45   5.65   12.11  7.17
E1  2304   3.35   -12.479 5
E2  0.005  0      0.005  4.47   0.28   4.77   7.35   5.08   12.48  7.82
E1  2305   0.61   -1.984  5
E2  0.005  0      0.005  4.48   0.28   4.78   1.66   4.8    1.98   5.09
E1  2306   0.3    -0.148  5
E2  0.005  0      0.005  4.5    0.28   4.80   0.145  4.82   0.15   5.11
E1  2307   0.61   -2.237  5
E2  0.005  0      0.005  4.5    0.28   4.80   2.23   4.82   2.24   5.11
E1  2308   1.52   -8.482  5
E2  0.005  0      0.005  3.94   0.28   4.25   6.5    4.52   8.48   6.04
E1  215811 -3.05  -2.969  5
E2  0.005  0      0.005  3.45   0.28   3.76   2.89   3.78   2.97   4.06
E1  2167   6      2500
E1  2168   6      2500
G1  21601  2160   1      3.42   3.72   0.5    1.5    0      2
G1  3091   309    1      3.6456 3.94   0.5    1.5    0      2
G1  3501   350    1      1.474  1.774  0.5    1.5    0      2
G1  4481   448    1      2.998  3.298  0.5    1.5    0      2
G1  4491   449    1      5.822  5.522  0.5    1.5    0      2
G1  4021   402    1      1.494  1.794  0.5    1.5    0      2
G1  4521   452    1      2.998  3.298  0.5    1.5    0      2
G1  4531   453    1      2.998  3.298  0.5    1.5    0      2
G1  4601   460    1      2.998  3.298  0.5    1.5    0      2
G1  4681   468    1      2.9985 3.2985 0.5    1.5    0      2
G1  4801   480    1      2.7804 3.0804 0.5    1.5    0      2
G1  4891   489    1      3.0052 3.3052 0.5    1.5    0      2
G1  5021   502    1      2.6104 2.9104 0.5    1.5    0      2
G1  5401   540    1      2.1004 2.4004 0.5    1.5    0      2
G1  5421   542    1      2.95   3.25   0.5    1.5    0      2
G1  5491   549    1      2.7352 3.0352 0.5    1.5    0      2
G1  5121   512    1      2.8252 3.1252 0.5    1.5    0      2
G1  5241   524    1      1.7104 2.0104 0.5    1.5    0      2
G1  5361   536    1      1.9304 2.2304 0.5    1.5    0      2
G1  6651   665    1      1.7212 2.0212 0.5    1.5    0      2
G1  6681   668    1      1.6464 1.9464 0.5    1.5    0      2
G1  6691   669    1      2.1412 2.4412 0.5    1.5    0      2
G1  6701   670    1      2.516  2.816  0.5    1.5    0      2
G1  6721   672    1      2.6112 2.9112 0.5    1.5    0      2
G1  6731   673    1      2.8112 3.1112 0.5    1.5    0      2
G1  6741   674    1      3.0012 3.3012 0.5    1.5    0      2
G1  6501   650    1      3.9552 4.2552 0.5    1.5    0      2
G1  6561   656    1      3.2008 3.5008 0.5    1.5    0      2
G1  8781   878    1      1.4156 1.7156 0.5    1.5    0      2
G1  8851   885    1      1.4456 1.7456 0.5    1.5    0      2
G1  8941   894    1      1.7904 2.0904 0.5    1.5    0      2
G1  9021   902    1      1.5056 1.8056 0.5    1.5    0      2
G1  9101   910    1      1.5356 1.8356 0.5    1.5    0      2
G1  9211   921    1      1.5356 1.8356 0.5    1.5    0      2
G1  9281   928    1      1.5656 1.8356 0.5    1.5    0      2
G1  9341   934    1      1.774  2.074  0.5    1.5    0      2
G1  9351   935    1      1.9756 2.2756 0.5    1.5    0      2
G1  9361   936    1      2.2856 2.5856 0.5    1.5    0      2
G1  12651  1265   1      3.0612 3.3612 0.5    1.5    0      2
G1  12701  1270   1      3.0960 3.3960 0.5    1.5    0      2
G1  12751  1275   1      3.0160 3.3160 0.5    1.5    0      2
G1  1037111 1037  1      3.1408 3.4408 0.5    1.5    0      2
G1  12851  1285   1      2.9980 3.2980 0.5    1.5    0      2
G1  12951  1295   1      2.5260 2.8260 0.5    1.5    0      2
G1  13051  1305   1      2.3884 2.6884 0.5    1.5    0      2
G1  13151  1315   1      2.3884 2.6884 0.5    1.5    0      2
```

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G1  13241  1324   1     2.3884  2.6884  0.5    1.5    0     2
G1  15391  1539   1     1.4740  1.7740  0.5    1.5    0     2
G1  6711   671    1     2.4112  2.7112  0.5    1.5    0     2
G1  9341   934    1     1.774   2.074   0.5    1.5    0     2
G1  9351   935    1     1.9756  2.2756  0.5    1.5    0     2
G1  9361   936    1     2.2856  2.5856  0.5    1.5    0     2
G1  9381   938    1     1.998   2.298   0.5    1.5    0     2
G1  9391   939    1     1.9204  2.2204  0.5    1.5    0     2
G1  9401   940    1     1.9404  2.2404  0.5    1.5    0     2
G1  9411   941    1     1.6556  1.9556  0.5    1.5    0     2
G1  9421   942    1     2.3552  2.6552  0.5    1.5    0     2
G1  9431   943    1     2.4204  2.7204  0.5    1.5    0     2
G1  9441   944    1     2.4504  2.7504  0.5    1.5    0     2
G1  9451   945    1     2.8104  3.1104  0.5    1.5    0     2
G1  9461   946    1     2.5356  2.8356  0.5    1.5    0     2
G1  1085111 1085  1     3.2108  3.5108  0.5    1.5    0     2
G1  11141  1114   1     3.1008  3.4008  0.5    1.5    0     2
G1  11161  1116   1     4.2900  4.5900  0.5    1.5    0     2
G1  11431  1143   1     2.7850  3.0850  0.5    1.5    0     2
G1  11631  1163   1     3.3608  3.6608  0.5    1.5    0     2
G1  11821  1182   1     3.4408  3.7408  0.5    1.5    0     2
G1  12001  1200   1     3.1412  3.4412  0.5    1.5    0     2
G1  12061  1206   1     3.4360  3.7360  0.5    1.5    0     2
G1  12111  1211   1     3.1212  3.4212  0.5    1.5    0     2
G1  12171  1217   1     3.1012  3.4012  0.5    1.5    0     2
G1  12221  1222   1     3.0812  3.3812  0.5    1.5    0     2
G1  12291  1229   1     3.4660  3.7660  0.5    1.5    0     2
G1  12351  1235   1     3.2160  3.5160  0.5    1.5    0     2
G1  12391  1239   1     3.2560  3.5560  0.5    1.5    0     2
G1  12431  1243   1     3.2960  3.5960  0.5    1.5    0     2
G1  12851  1285   1     2.9980  3.2980  0.5    1.5    0     2
G1  12951  1295   1     2.5260  2.8260  0.5    1.5    0     2
G1  13051  1305   1     2.3884  2.6884  0.5    1.5    0     2
G1  13151  1315   1     2.3884  2.6884  0.5    1.5    0     2
G1  13241  1324   1     2.3884  2.6884  0.5    1.5    0     2
G1  13411  1341   1     3.0500  3.3500  0.5    1.5    0     2
G1  13561  1356   1     1.9820  2.2820  0.5    1.5    0     2
G1  13571  1357   1     1.9820  2.2820  0.5    1.5    0     2
G1  14011  1401   1     1.3512  1.6512  0.5    1.5    0     2
G1  14381  1438   1     1.3812  1.6812  0.5    1.5    0     2
G1  14711  1471   1     1.0312  1.3312  0.5    1.5    0     2
G1  14731  1473   1     2.0212  2.3212  0.5    1.5    0     2
G1  15671  1567   1     1.4740  1.7740  0.5    1.5    0     2
G1  16161  1616   1     1.4740  1.7740  0.5    1.5    0     2
G1  16661  1666   1     2.1412  2.4412  0.5    1.5    0     2
G1  16741  1674   1     1.7360  2.0360  0.5    1.5    0     2
G1  16851  1685   1     1.8760  1.8760  0.5    1.5    0     2
G1  16971  1697   1     2.4606  2.7608  0.5    1.5    0     2
G1  17101  1710   1     3.4256  3.7256  0.5    1.5    0     2
G1  17241  1724   1     3.3556  3.6556  0.5    1.5    0     2
G1  17321  1732   1     3.3256  3.6256  0.5    1.5    0     2
G1  17411  1741   1     3.2856  3.5856  0.5    1.5    0     2
G1  17491  1749   1     3.2556  3.5556  0.5    1.5    0     2
G1  17561  1756   1     3.2256  3.5256  0.5    1.5    0     2
G1  17641  1764   1     3.1956  3.4956  0.5    1.5    0     2
G1  17721  1772   1     3.0856  3.3856  0.5    1.5    0     2
G1  17831  1783   1     3.0856  3.3856  0.5    1.5    0     2
G1  17921  1792   1     3.0556  3.3556  0.5    1.5    0     2
G1  18011  1801   1     2.7156  3.0156  0.5    1.5    0     2
G1  18091  1809   1     2.0108  2.3108  0.5    1.5    0     2
G1  18171  1817   1     2.3056  2.6056  0.5    1.5    0     2
G1  18501  1850   1     3.1808  3.4808  0.5    1.5    0     2
G1  20281  2028   1     3.2912  3.5912  0.5    1.5    0     2
G1  20291  2029   1     3.2812  3.5812  0.5    1.5    0     2
G1  21091  2109   1     3.1260  3.4260  0.5    1.5    0     2
G1  21151  2115   1     3.0312  3.3312  0.5    1.5    0     2
G1  21161  2116   1     3.3560  3.6560  0.5    1.5    0     2
G1  21171  2117   1     3.1112  3.4112  0.5    1.5    0     2
G1  21291  2129   1     3.5904  3.8904  0.5    1.5    0     2
G1  21311  2131   1     3.0812  3.3812  0.5    1.5    0     2
G1  21321  2132   1     3.1012  3.4012  0.5    1.5    0     2
G1  21331  2133   1     3.4460  3.7460  0.5    1.5    0     2
G1  21341  2134   1     3.1612  3.4612  0.5    1.5    0     2
G1  21351  2135   1     3.4860  3.7860  0.5    1.5    0     2
G1  21361  2136   1     2.8764  3.1764  0.5    1.5    0     2
G1  21371  2137   1     3.2012  3.5012  0.5    1.5    0     2
G1  21401  2140   1     3.2012  3.5012  0.5    1.5    0     2
G1  21411  2141   1     3.5260  3.8260  0.5    1.5    0     2
G1  21421  2142   1     3.5460  3.8460  0.5    1.5    0     2
G1  21431  2143   1     3.2412  3.5412  0.5    1.5    0     2
```

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G1   21441   2144    1      3.2612  3.5612  0.5     1.5     0       2
G1   21451   2145    1      3.2612  3.5612  0.5     1.5     0       2
G1   21461   2146    1      3.2812  3.5812  0.5     1.5     0       2
G1   21471   2147    1      3.2912  3.5912  0.5     1.5     0       2
G1   21481   2148    1      3.6060  3.9060  0.5     1.5     0       2
G1   21491   2149    1      3.6060  3.9060  0.5     1.5     0       2
G1   21501   2150    1      3.6160  3.9160  0.5     1.5     0       2
G1   21511   2151    1      3.6160  3.9160  0.5     1.5     0       2
G1   21521   2152    1      3.6360  3.9360  0.5     1.5     0       2
G1   21531   2153    1      3.3312  3.6312  0.5     1.5     0       2
G1   21541   2154    1      3.3412  3.6412  0.5     1.5     0       2
G1   21551   2155    1      3.6460  3.9460  0.5     1.5     0       2
G1   21561   2156    1      3.3812  3.6812  0.5     1.5     0       2
G1   21571   2157    1      3.6860  3.9860  0.5     1.5     0       2
G1   21591   2159    1      3.4112  3.7112  0.5     1.5     0       2
G1   21601   2160    1      3.4112  3.7112  0.5     1.5     0       2
G1   21611   2161    1      3.4212  3.7212  0.5     1.5     0       2
G1   21621   2162    1      3.4212  3.7212  0.5     1.5     0       2
G1   21631   2163    1      3.7460  4.0460  0.5     1.5     0       2
G1   21641   2164    1      3.4412  3.7412  0.5     1.5     0       2
G1   21951   2195    1      3.2208  3.5208  0.5     1.5     0       2
G1   22021   2202    1      2.9860  3.2860  0.5     1.5     0       2
*G1   22081   2208    1      3.0260  3.3260  0.5     1.5     0       2
*G1   22251   2225    1      3.4608  3.7608  0.1     1.5     0       2       0       0
*G1   22271   2227    1      3.4308  3.7308  0.1     1.5     0       2       0       0
*G1   22451   2245    1      3.3108  3.6108  0.1     1.5     0       2       0       0
G1   22651   2265    1      3.5656  3.8656  0.5     1.5     0       2
G1   22881   2288    1      3.6156  3.9156  0.5     1.5     0       2
G1   22891   2289    1      2.9800  3.2800  0.5     1.5     0       2
*G1   23001   2300    1      5.2544  5.5544  0       1.5     0       2       0       0
*G1   23031   2303    1      4.9896  5.2896  0.5     1.5     0       2
*G1   23041   2304    1      4.4200  4.7200  0.1     1.5     0       2       0       0
*G1   23051   2305    1      4.4300  4.7300  0.1     1.5     0       2       0       0
*G1   23071   2307    1      4.4500  4.7500  0.1     1.5     0       2       0       0
*G1   23081   2308    1      3.8604  4.1604  0.1     1.5     0       2       0       0
G1   215811  21581   1      3.4012  3.7012  0.5     1.5     0       2
*    ==============
*  PUMPS Pump at Senac St.
*=============================================================================================
*IP  TYP    NJUNC1  NJUNC2  NPRATE  PRATE(1) PRATe(2)PRATE(3) VRATE1  VRATE2 VRATE3  VWELL   PON     POFF
H1   3      2166    2167    3       28.32   84.95   113.27  7.32    4.42    1.68    2.13    2.13
*    JFREE   NBCF
I1   3002    1
*    NTIDE
J1   2
J2   0.35
*hydrograph
K1   1       0       0
K2   3001
K3   0       0
K3   3.4     .06
K3   3.6     25.7
K3   4.26    27
K3   5.3     24.8
K3   7       16.9
K3   8.1     21.2
K3   24.0    1.
*
$ENDPROGRAM
```

APPENDIX B

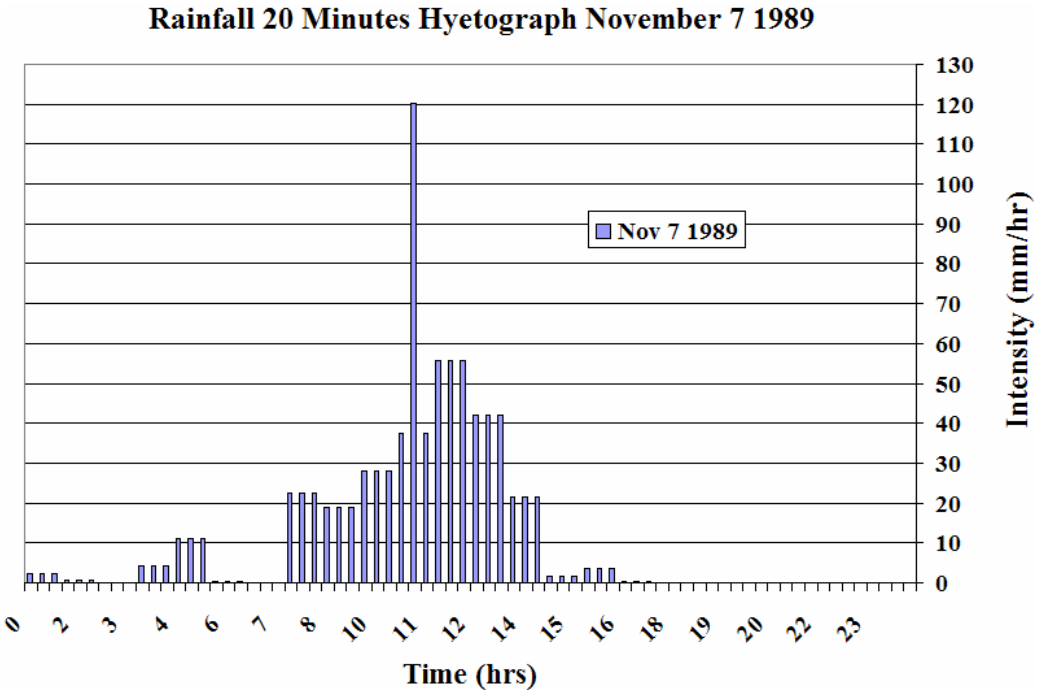

Figure B.1 Input Rainfall Hyetograph for the Storm of Nov 7 1989

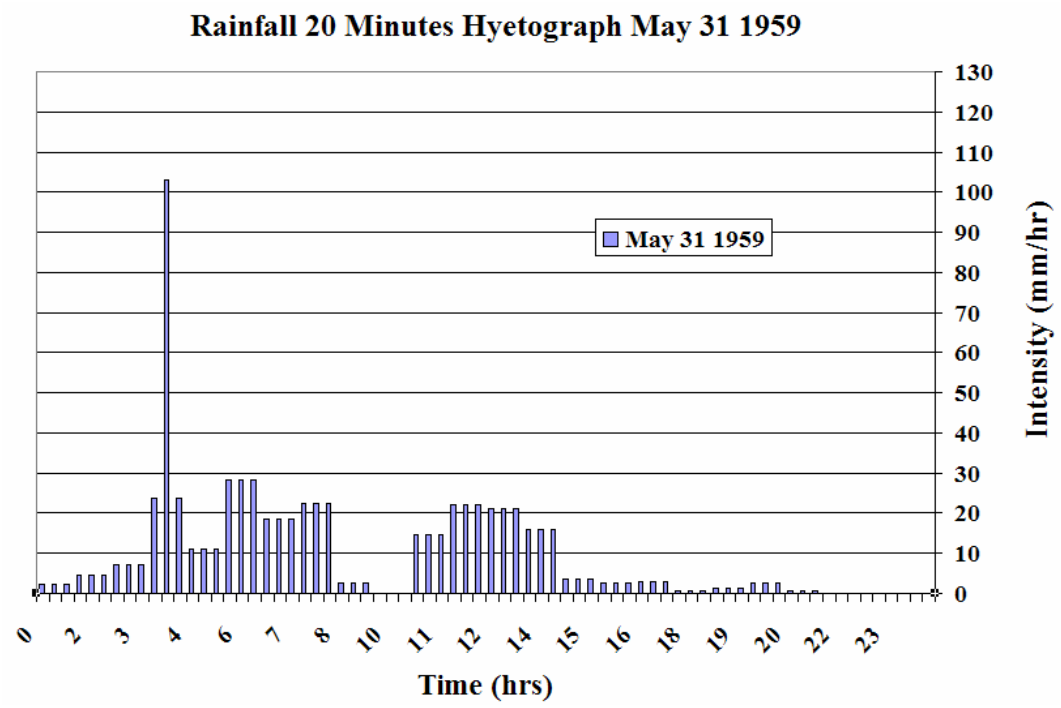

Figure B.2 Input Rainfall Hyetograph for the Storm of May 31 1959

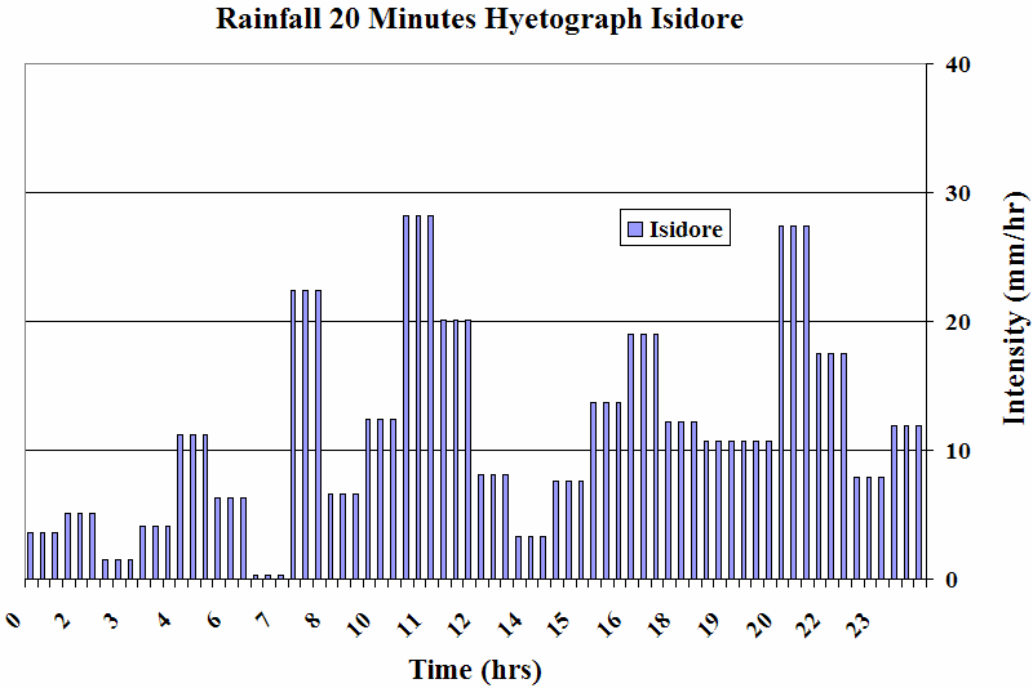

Figure B.3 Input Rainfall Hyetograph for the Tropical Storm Isidore

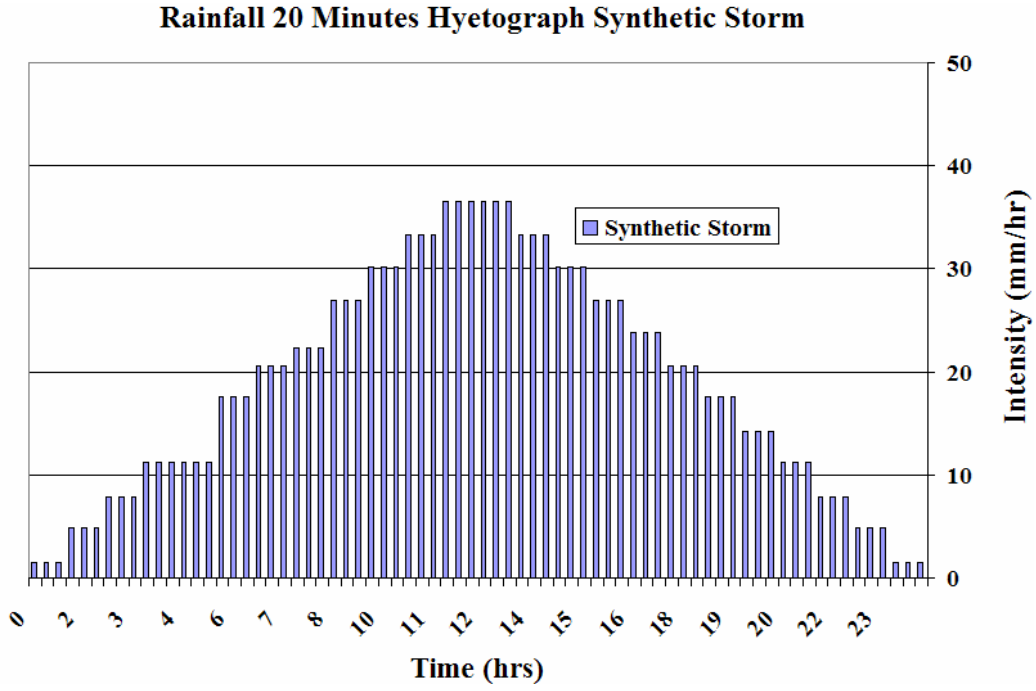

Figure B.4 Input Rainfall Hyetograph for the Synthetic Storm

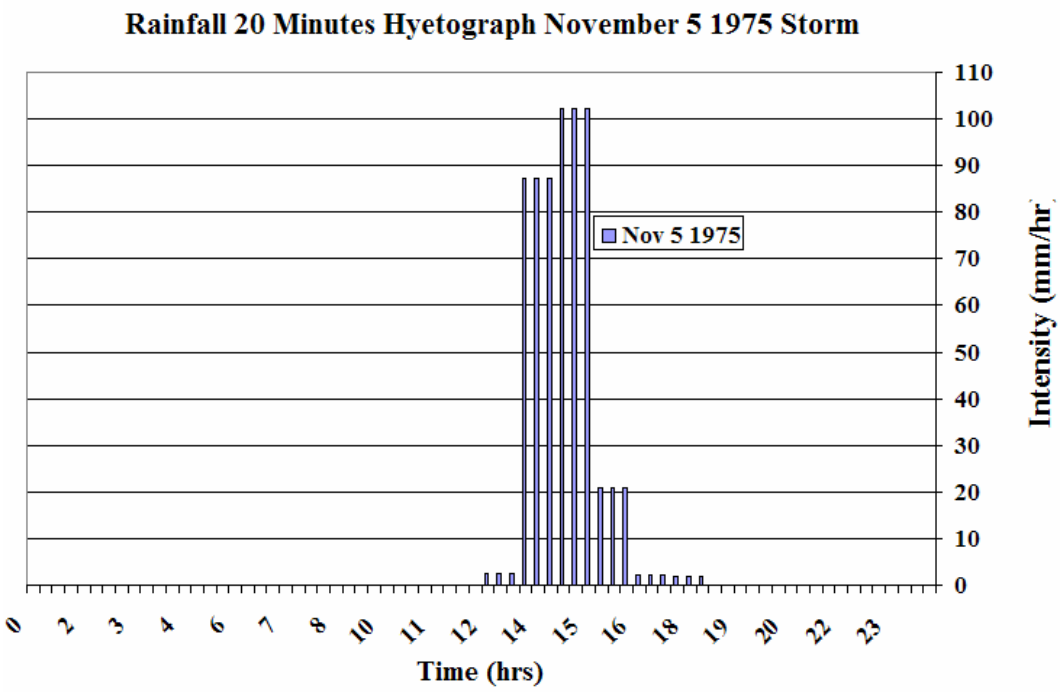

Figure B.5 Input Rainfall Hyetograph for the Storm of November 5 1975

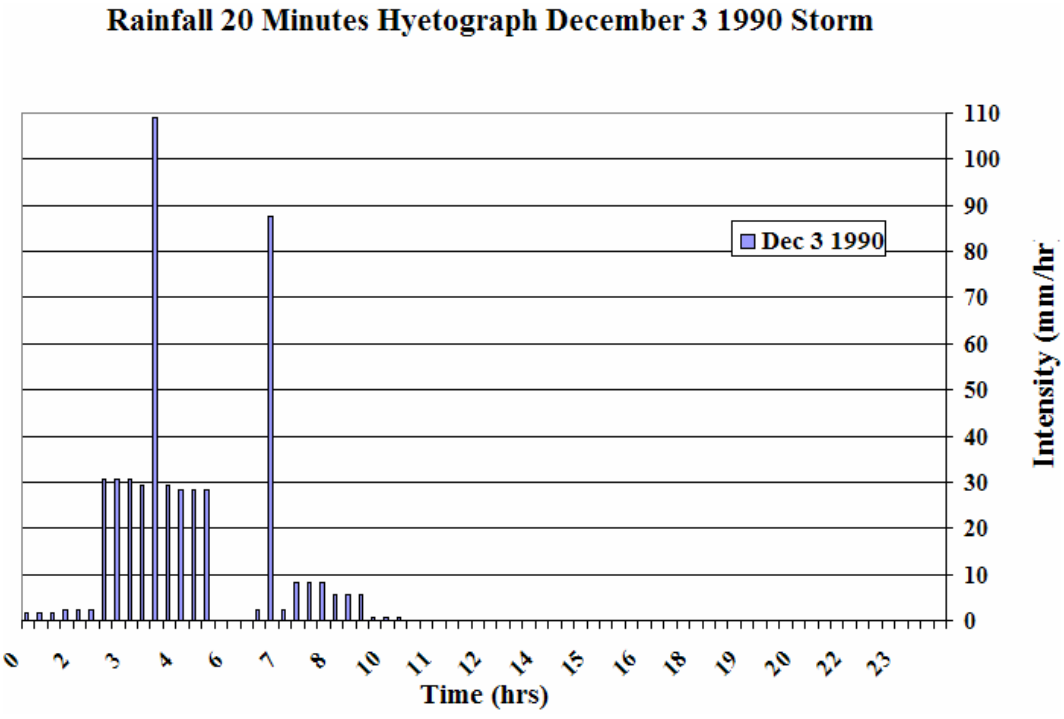

Figure B.6 Input Rainfall Hyetograph for the Storm of December 3 1990

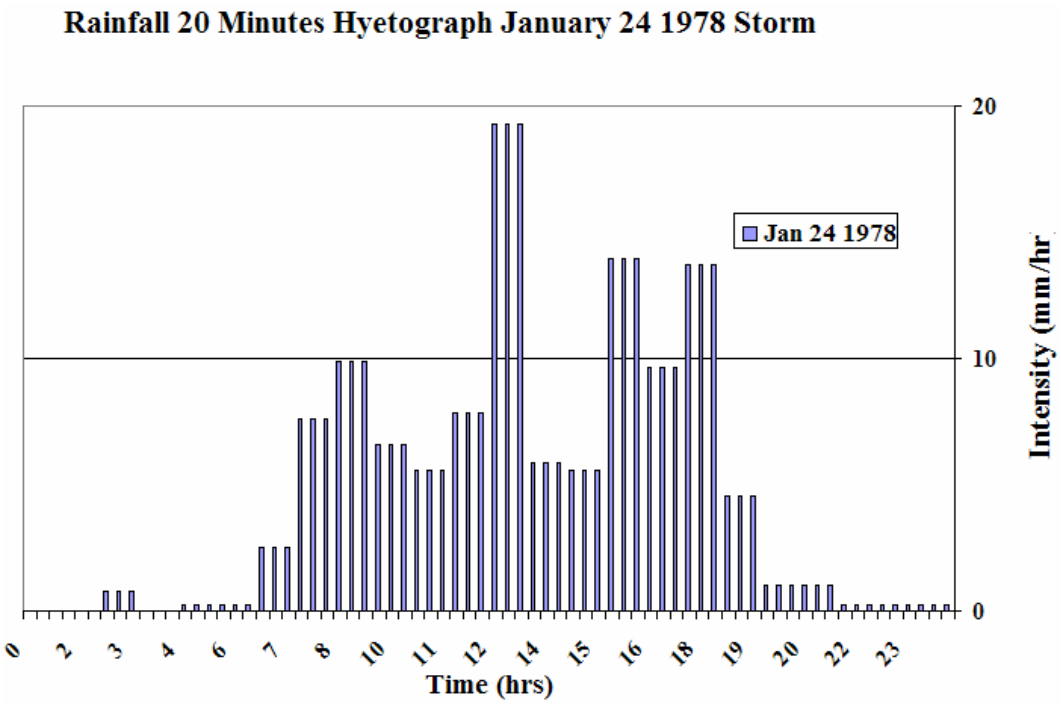

Figure B.7 Input Rainfall Hyetograph for the Storm of January 24 1978

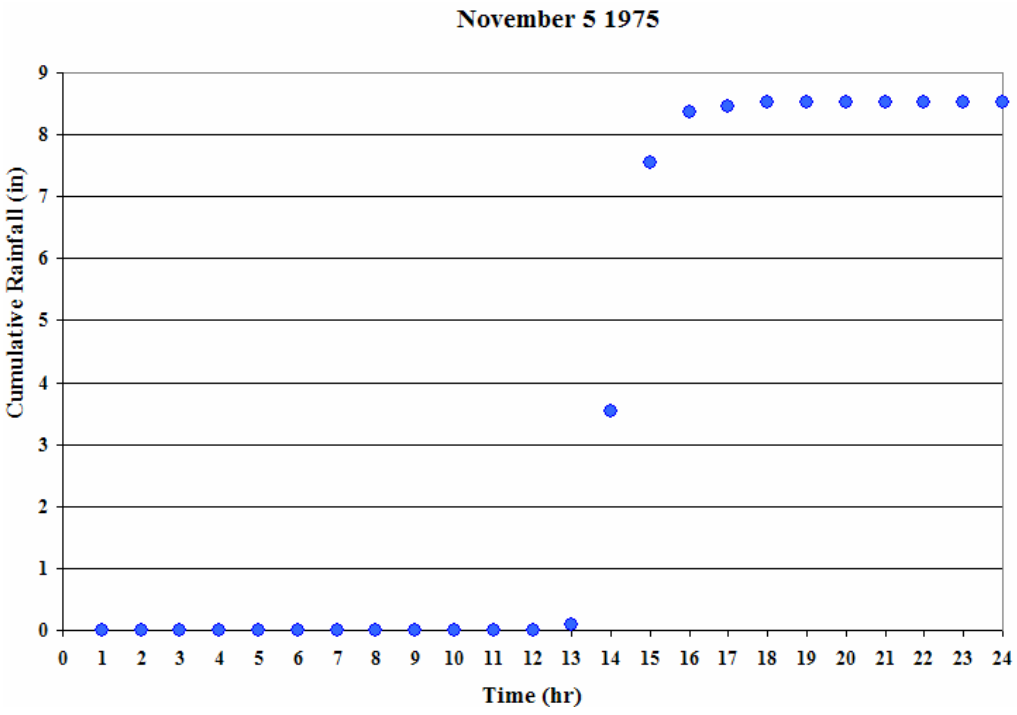

Figure B.8 Cumulative Rainfall versus Time for the Storm of November 5 1975

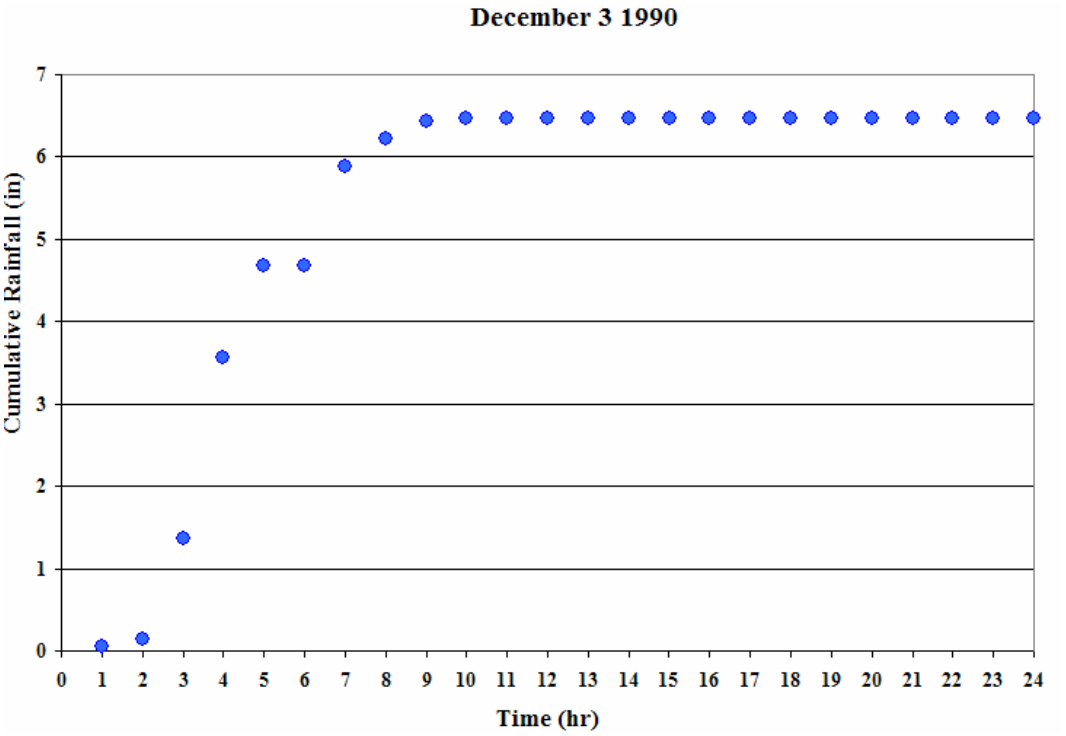

Figure B.9 Cumulative Rainfall versus Time for the Storm of December 3 1990

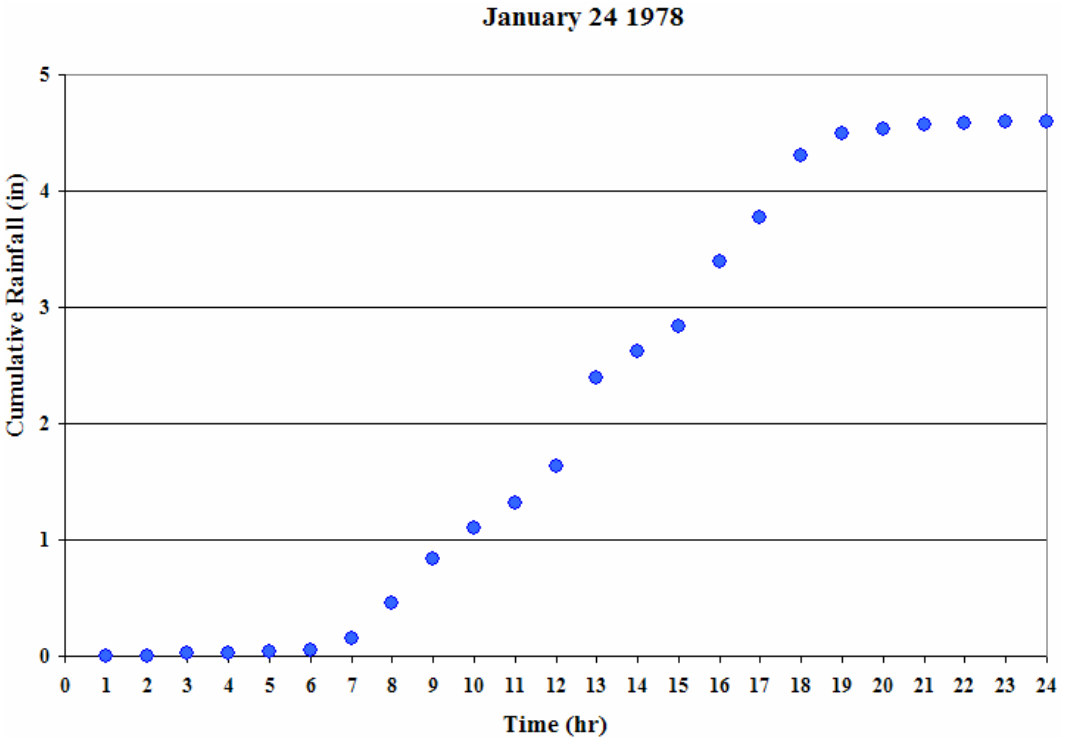

Figure B.10 Cumulative Rainfall versus Time for the Storm of January 24 1978

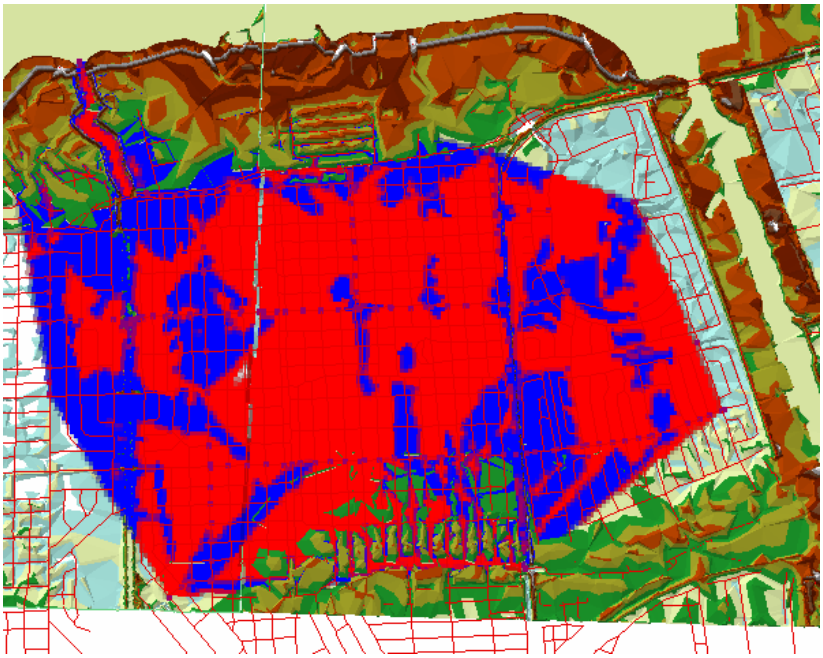

Figure B.11 November 5 1975 Storm Flood Volume Surface

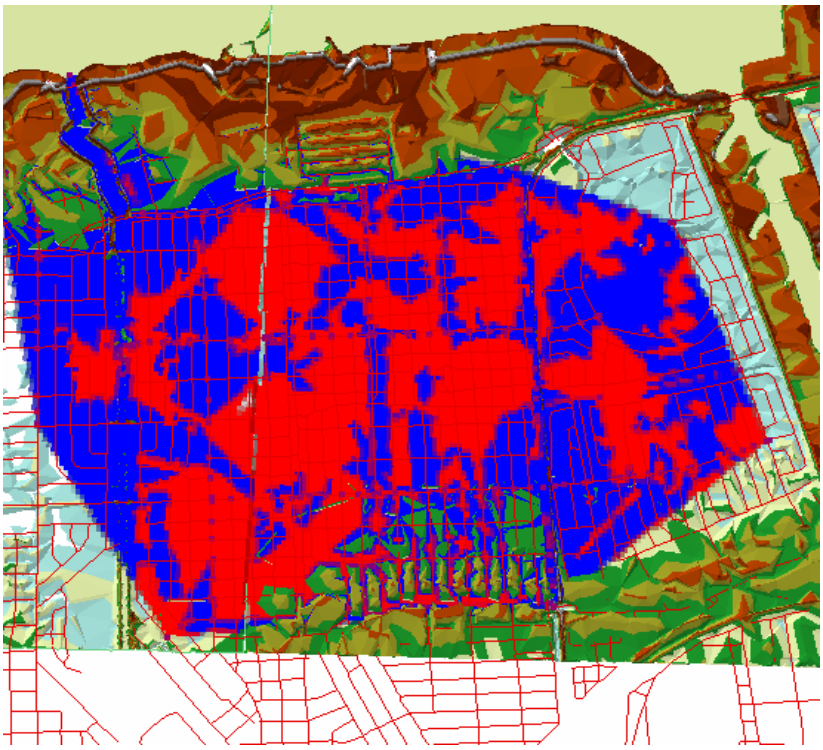

Figure B.12 January 24 1978 Storm Flood Volume Surface

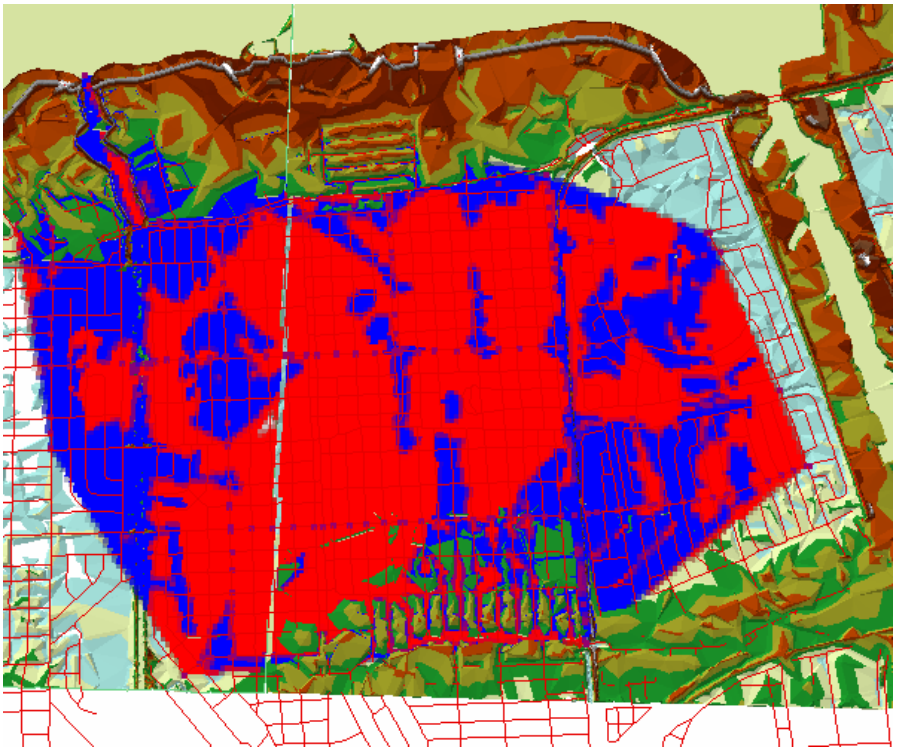

Figure B.13 December 3 1990 Storm Flood Volume Surface

VITA

Efrain Giron was born in Tegucigalpa, Honduras, on July 12, 1975. In June 1994, he graduated from High School at The Mayan School in Tegucigalpa. He obtained a Bachelor of Science in Civil Engineering from Universidad Nacional Autonoma de Honduras (UNAH), in May 2000.

In the spring of 2001 Efrain Giron started his graduate studies at the University of New Orleans in the Department of Civil and Environmental Engineering, working as a Graduated Research Assistant for Dr. J. Alex McCorquodale. He graduated with an overall GPA of 4.0. In the fall 2002, the author started to pursue his PhD. in the same institution as, finalizing his studies on May 2005. The author completed his doctoral studies with an overall GPA of 3.942. His academic emphasis has been in the area of Water Resources, Drinking Water and Waste Water Treatment. Currently he is working for the Engineering firm Parsons Brinckerhoff Quade & Douglas Inc.