

GEO-STORM: A tool for Floodplain and Watershed Management

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Prince George's County, MD

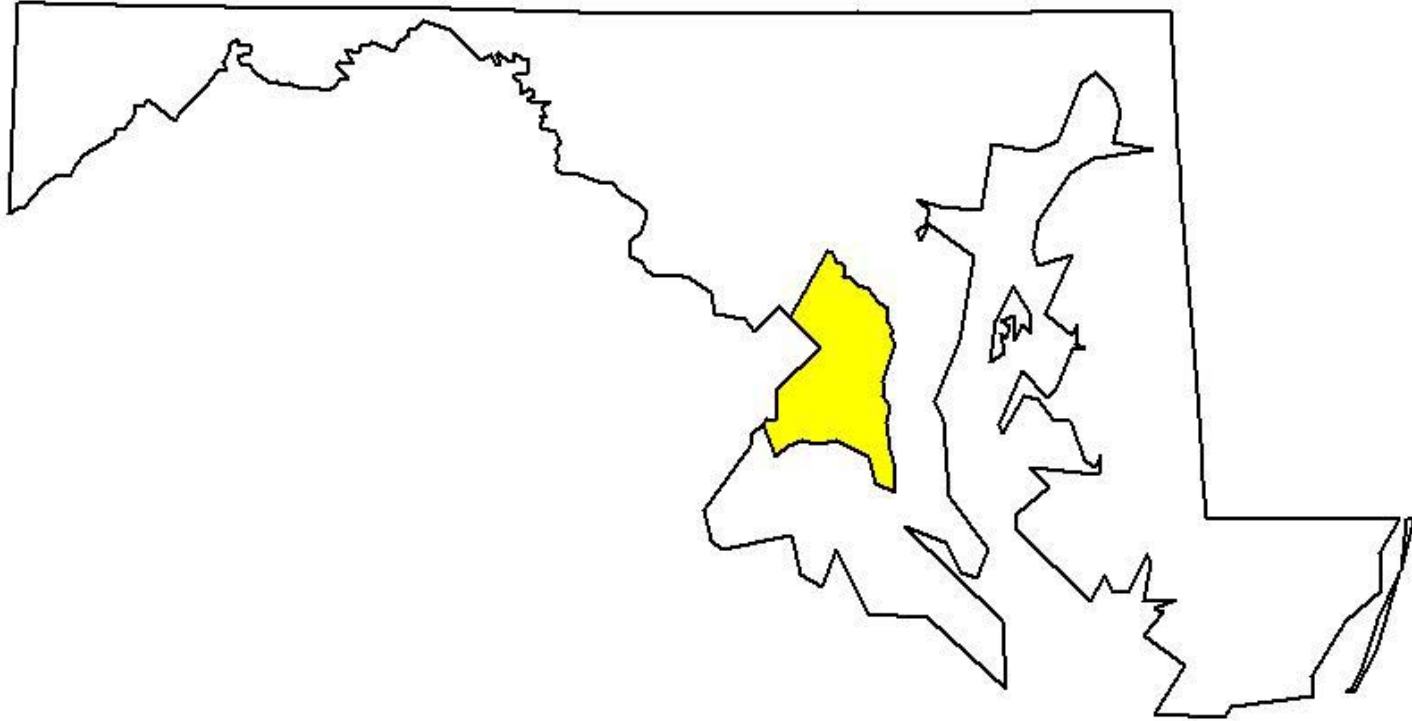


ABSTRACT

GEO-STORM: A tool for Floodplain and Watershed Management

Prince George's County provides floodplain studies for developers, engineers, and private citizens, as well as conducting FEMA projects such as watershed studies and floodplain delineations countywide. Geo-STORM is a tool that combines GIS with Hydrologic Models (TR-55 and TR-20) and Hydraulic Model (HEC-2) to complete floodplain and watershed management studies.

Geo-STORM incorporates GIS functionality with the models reducing the time needed to complete the studies. Some of the capabilities include: automatic calculations of drainage area, runoff curve numbers, flow path and regimes (sheet, shallow concentrated, or channel flow), and water surface elevations enabling automatic delineation of the floodplain.



Prince George's County, Maryland

Geo-Storm

A tool that combines:

- GIS
- Hydrologic Models
 - TR-55
 - TR-20
- Hydraulic Model
 - HEC-2

Geo-STORM
incorporates GIS
functionality with the
H&H models reducing
the time needed to
complete floodplain and
watershed
management studies.

**Geo-Storm was
developed for the
Prince George's
County in 1992.**

Platform

- **Unix**
 - **Solaris 7 & 8**
- **ArcInfo**
 - **Version 7.2.1 & 8.01**
 - **Grid, Tin, Networking**
 - **AML**

Need

- **Flood Management Watershed Study**
- **15 years Effort**
- **85% of the County**
- **Tedious, labor-Intensive Manual Methods**
- **Excellent Candidate for Automation**

Who are our customers?

- **Developers**
- **Engineers**
- **Private citizens**
- **Internal customers**
- **FEMA**

Geo-STORM Applications

- **Floodplain Studies**
- **Development Technical Review (including LOMR & LOMA)**
- **Design support**
- **Large area studies (Watershed Studies)**
- **FEMA's CTP Initiative**
- **Federal & State Grants**

GIS Data Development

- **Landuse**
 - Existing
 - Ultimate
- **Soil**
- **Topography**
- **Zoning**
- **property boundaries**
- **Stream Network**
- **Watersheds**
- **Storm drain inventory**
- **Councilmanic districts**

Data Needed for the Hydrologic and Hydraulic Analyses (TR-55, TR-20 and HEC-2)

- **Create 30ft and 5ft grids of the following:**
- **Land use / land cover information**
- **Hydrologic soil information**
- **Topographic information**
 - **2-ft topographic data**
 - **Bridge information**
 - **Stream characteristics**
- **Stream centerline information**



Jack E. Johnson
County Executive

Streams



 Streams.shp

Source: DEP, Programs and Planning Division, Technical Support Section, April 2004



Jack E. Johnson
County Executive

Landuse



- AGRICULTURE
- AGRICULTURE (RURAL)
- Open Space
- Woods
- Conservation
- Trails
- RECREATION
- Scenic/Forest
- Wetlands
- High Density Residential
- High Density Residential
- Medium Density Residential
- Low Density Residential
- Low Density Residential
- Medium Density Residential
- High Density Residential
- Special Use Land
- Conservation/Recreation Land
- Open Space
- Wetlands
- Wetlands
- Wetlands
- Wetlands

Source: DCR, Programs and Planning Division, Technical Support Section, April 2004

Development Approach

- **Three Stage Development Process**
 - **Hydrology/Single Subwatershed : TR-55**
 - **Stream Network with Multiple Subwatersheds: TR-20**
 - **Hydraulics: HEC-2**
- **“Mapcentric” Approach**
- **User-Friendly Interface**

Geo-Guide

- **Graphic User Interface to ARC/INFO**
- **“Point-and Click” window**
- **Enables Less-Experienced Users to use ArcInfo without learning command line**
- **Used by engineers with minimum GIS experience**

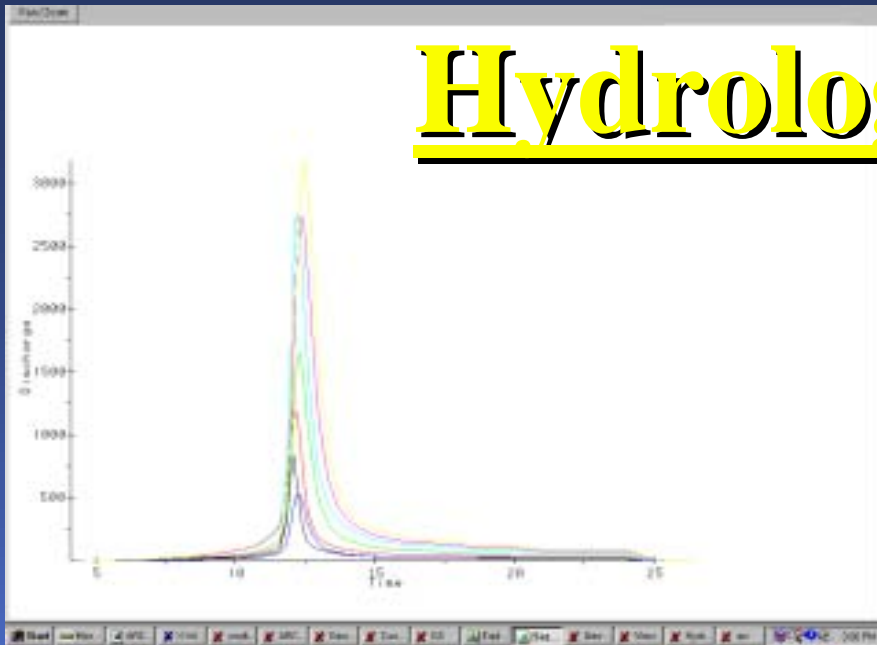
Geo-Storm Features:

- automatic calculations of drainage area
- runoff curve numbers
- flow path and regimes
 - sheet
 - shallow concentrated
 - channel flow
- water surface elevations
- automatic delineation of the floodplain

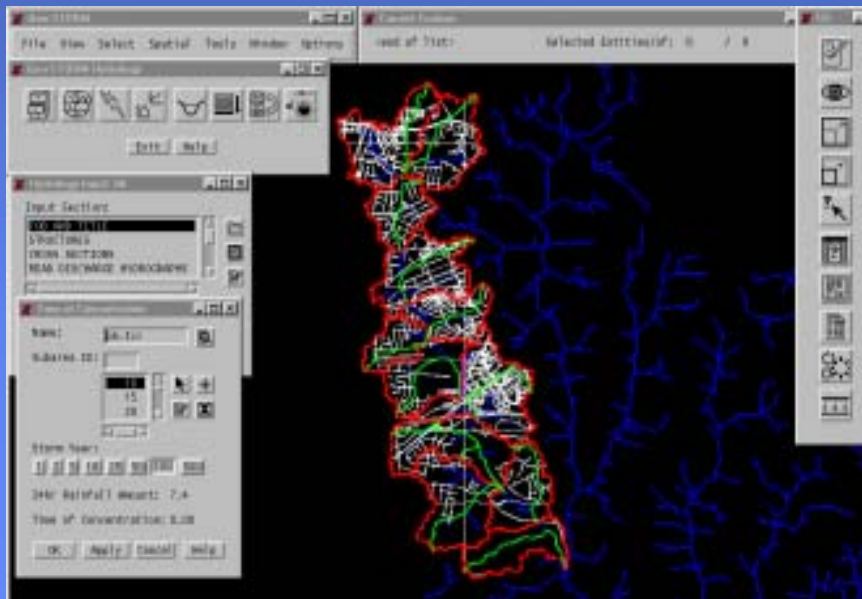
Geo-Storm Features:

- **Estimate Peak Discharge for Selected Flood Frequencies**
- **Identify Floodprone Structures/properties**
- **Evaluate Solutions to the Identified Flooding Problems**
- **Analyze Cumulative Impacts of All Developments in Stream Systems**

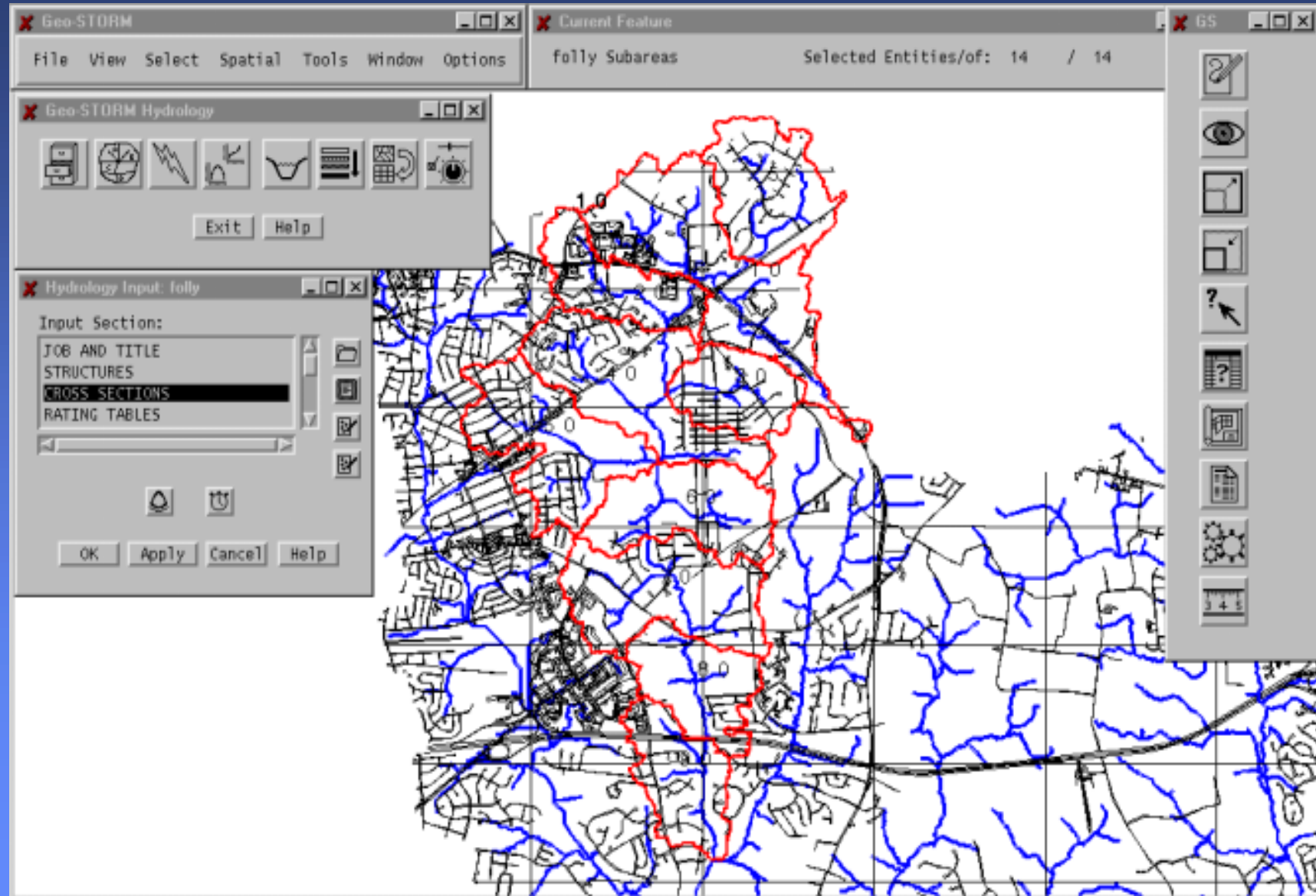
Hydrologic Analysis



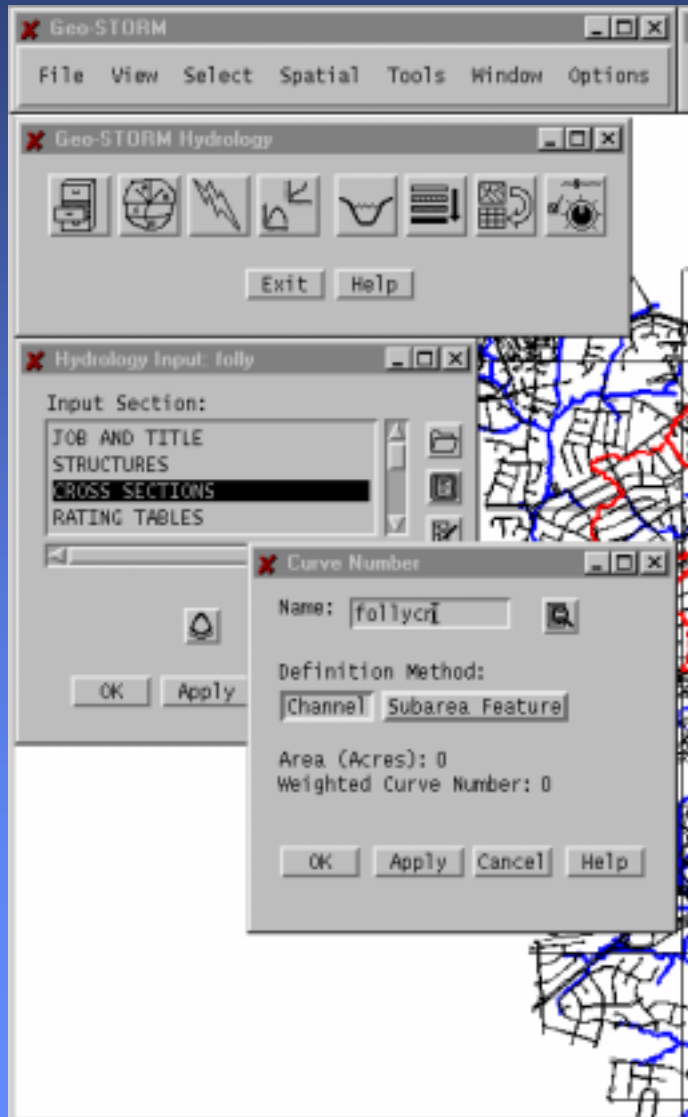
- **Graphic Interaction**
- **Automatically:**
 - **Divide Watersheds Into Subareas**
 - **Calculate DA, CN and Tc**
 - **Construct Model Input From GIS Database**
 - **Generate Hydrographs**
- **Improved Productivity**
- **Higher Quality/Accurate Modeling**
- **Cost and Time Savings**



Automatically Delineate Watershed Boundaries & Calculate Runoff Curve Numbers



Runoff Curve Number Report



07/27/99

PAGE 1

Runoff Curve Number Report for Subarea 5

HS	COVER DESCRIPTION	CURVE NUMBE	AREA acre	PRODUCT CN x Are
A	Residential-1 acre	51	56	2,849
A	Woods/grass combination; Good	32	2	52
B	Industrial	88	3	253
B	Residential-1 acre	68	3	174
B	Woods/grass combination; Good	58	1	85
C	Industrial	91	32	2,899
C	Residential-1 acre	79	210	16,584
C	Woods/grass combination; Good	72	33	2,344
D	Residential-1 acre	84	39	3,254
			377	28,493

CN(Weighted) = Total Product / Total Area

76

07/27/99

PAGE 1

Runoff Curve Number Report for Subarea 10

HS	COVER DESCRIPTION	CURVE NUMBE	AREA acre	PRODUCT CN x Are
A	Industrial	81	8	651
A	Residential-1 acre	51	36	1,847
A	Woods/grass combination; Good	32	2	58
B	Commercial and business	92	10	890
B	Industrial	88	85	7,513
B	Residential-1/8 acre or less	85	3	258
B	Residential-1/4 acre	75	2	157
B	Residential-1 acre	68	112	7,645
B	Woods/grass combination; Good	58	35	2,030
C	Commercial and business	94	37	3,513
C	Industrial	91	112	10,162
C	Residential-1 acre	79	123	9,722
C	Woods/grass combination; Good	72	16	1,177
D	Commercial and business	95	16	1,503
D	Industrial	93	7	667
D	Residential-1 acre	84	64	5,356
D	Woods/grass combination; Good	79	14	1,123
			683	54,272

Automatically Determine Time of Concentration and Flow Paths

The screenshot displays the Geo-STORM software interface with several windows open. The main window shows a map with a network of flow paths in red, green, and blue. The 'Current Feature' window at the top right shows 'fully Subareas' with 'Selected Entities/of: 14 / 14'. The 'Geo-STORM Hydrology' window contains various tool icons and 'Exit' and 'Help' buttons. The 'Hydrology Input: folly' window lists 'Input Sections' including 'JOB AND TITLE', 'STRUCTURES', 'CROSS SECTIONS', and 'RATING TABLES'. The 'Time of Concentration' window is the primary focus, showing the following data:

- Name: folly.tcr
- Subarea ID: [empty]
- Storm Year: 1 | 2 | 5 | 10 | 25 | 50 | 100 | 500
- 24hr Rainfall Amount: 7.4
- Time of Concentration: 0.00

Buttons for 'OK', 'Apply', 'Cancel', and 'Help' are visible at the bottom of the 'Time of Concentration' window.

Time of Concentration Report

Geo-STORM
File View Select Spatial Tools Window Options

Geo-STORM Hydrology

Hydrology Input: folly
Input Section:
JOB AND TITLE
STRUCTURES
CROSS SECTIONS
RATING TABLES

Time of Concentration
Name: folly.tcr
Subarea ID:
5
10
20
Storm Year: 1 2 5 10 25 50 100 500
24hr Rainfall Amount: 7.4
Time of Concentration: 0.00
OK Apply Cancel Help

arc

Sheet Flow Calculation

SURFACE LAND DESCRIPTION SLOPE(ft/ft)	MANNING COEFFICIENT	FLOW 100 YEAR LENGTH(ft)	STORM(in)
Residential-1 acre 0.02	0.150	60.00	7.4
		<u>60.00</u>	

Computed travel time for sheet flow
0.08

Shallow Concentrated Flow Calculation

SURFACE DESCRIPTION	FLOW LENGTH(ft)	WATERCOURSE SLOPE(ft/ft)	AVERAGE VELOCITY(ft/s)
Residential-1 acre	<u>1,805.51</u>	0.01	1.94
	1,805.51		

Computed travel time for shallow concentrated flow
0.26

Channel Flow Calculation

CROSS SECTION FLOW LENGTH(ft)	WETTED PERIMETER(ft)	HYDRAULIC RADIUS(ft)	CHANNEL SLOPE(ft/ft)	MANNING COEFFICIENT	VELOCITY (ft/s)
5465.00	20	24	0.83	0.01	0.03
					4.40

Computed travel time for channel flow
0.34

Obtain Rating Tables for Channel Routing from GIS Files

The screenshot displays the Geo-STORM software interface. The main window shows a map of a watershed with a routing path highlighted in red and green. The path starts at a point labeled '10' and flows through the watershed. The map also shows a network of blue lines representing channels and black lines representing roads and buildings.

The 'Cross Section Rating Table' dialog box is open, showing the following information:

X-Section ID: 10
Description:
Drainage Area:
Bankfull Elevation:

Elevation	Discharge	End Area
<input type="text" value="132.00"/>	<input type="text" value="1150.00"/>	<input type="text" value="750.00"/>

Values:

<input type="text" value="125.96"/>	<input type="text" value="354.00"/>	<input type="text" value="187.00"/>
<input type="text" value="127.08"/>	<input type="text" value="564.00"/>	<input type="text" value="257.00"/>
<input type="text" value="128.70"/>	<input type="text" value="798.00"/>	<input type="text" value="378.00"/>
<input type="text" value="129.57"/>	<input type="text" value="902.00"/>	<input type="text" value="460.00"/>

Automatically Develop Channel “Network” (Standard Control)

The screenshot displays the Geo-STORM software interface. The main window shows a map of a channel network with various colored lines (red, green, blue) representing different channels. Overlaid on the map are several dialog boxes:

- Geo-STORM Hydrology**: A toolbar with icons for various hydrology functions and buttons for 'Exit' and 'Help'.
- Hydrology Input: folly**: A dialog box with a list of input sections: DIVERSIONS, STANDARD CONTROL (selected), EXECUTIVE CONTROL, and RAIN TABLE. It includes 'OK', 'Apply', 'Cancel', and 'Help' buttons.
- Standard Control**: A dialog box for configuring channel control parameters. It includes tabs for 'X-Section' and 'Structure', and fields for 'X-SectionID'. It also has sections for 'Data Values', 'Hydrograph Numbers', 'Output Options', and 'Statements'.

The **Standard Control** dialog box contains the following configuration details:

Operation:

Position: X-SectionID:

Data Values: Field 1: Field 2: Field 3:

Hydrograph Numbers: Input1: Input2: Output:

Output Options:

- Peak Data
- Hydrograph
- Elevation
- Volume
- Discharge File
- Summary

Reach statements for tributaries within a subarea
Minimum tributary length:

Use only downstream most rating tables

Alias downstream most rating tables with X-Section IDs

Statements:

1	6	RUNOFF	1	005	1	0.5098	76.0
2	6	REACH	3	011	1	2	2171.7300
3	6	RUNOFF	1	010	3	1.0673	80.0
4	6	ADDHYD	4	010	2	3	4

Select Study Storm Events (Executive Control)

The screenshot displays the Geo-STORM software interface. The main window shows a map of a watershed with various features highlighted in red, green, and blue. Overlaid on the map are several dialog boxes:

- Geo-STORM Hydrology**: A toolbar with icons for various hydrology functions and buttons for 'Exit' and 'Help'.
- Hydrology Input: folly**: A dialog box with a list of input sections: 'DIVERSIONS', 'STANDARD CONTROL', 'EXECUTIVE CONTROL' (highlighted), and 'RAIN TABLE'. It includes 'OK', 'Apply', 'Cancel', and 'Help' buttons.
- Executive Control**: A dialog box for configuring storm event operations. It includes a 'Statements' list and several input fields.

The **Executive Control** dialog box contains the following configuration:

Operation: **LIST** | BASFLO | INCREM | COMPUT | ENDCMP | ENDJOB

From Position: X-Section | Structure | X-SectionID:

Through Position: X-Section | Structure | X-SectionID:

Data Values: Rain Table:
Field 1: AMC:
Field 2: Alternate:
Field 3: Storm:

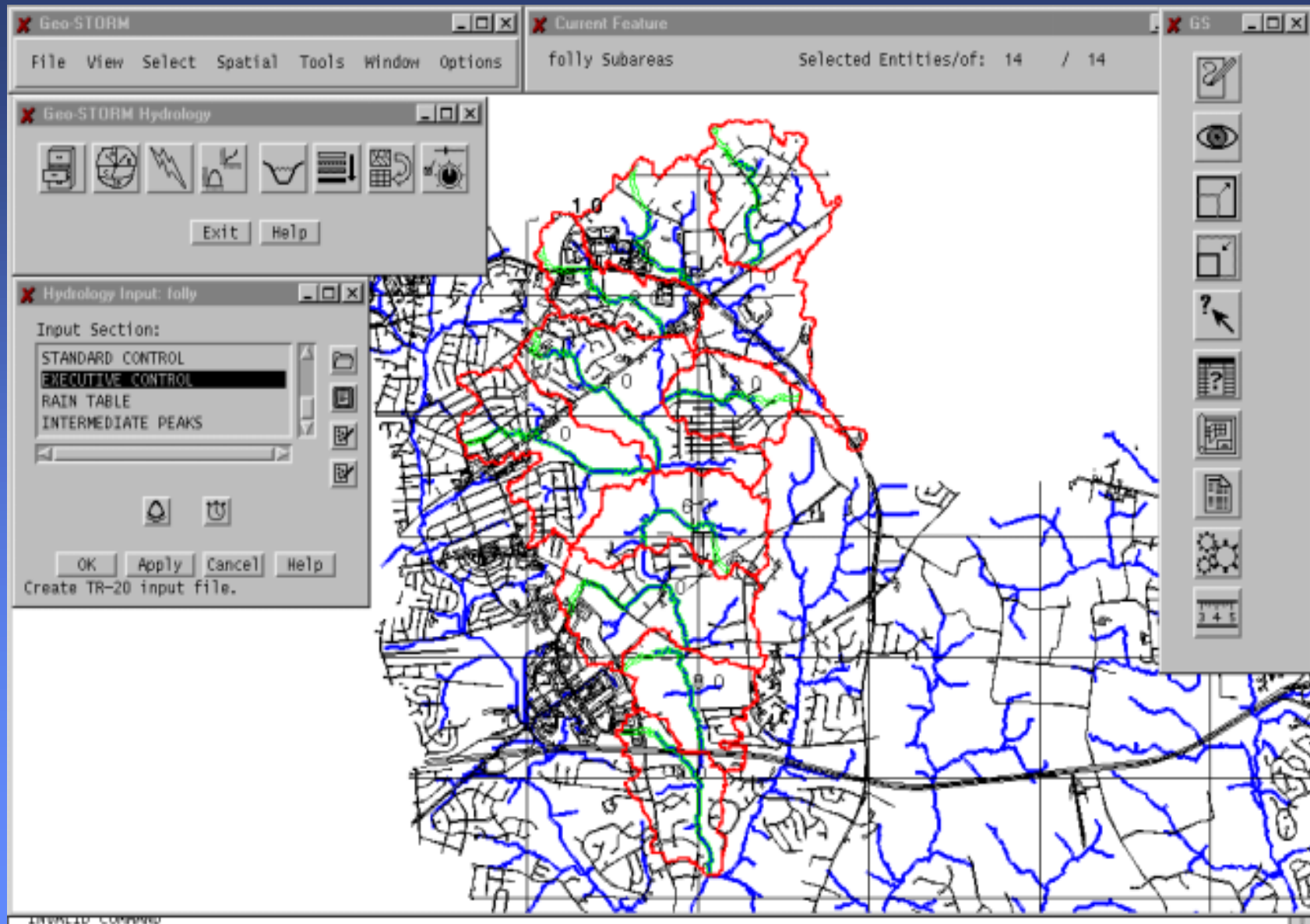
Default:

Statements:

1	7 LIST			
2	7 INCREM 6		0.1	
3	7 COMPUT 7 005 090		0.0	
4	ENDCMP 1			

Buttons:

Automatically Create TR-20 Input File



View TR-20 Input File and Execute the TR-20 Program

The screenshot displays the Geo-STORM software interface. The main window shows a hydrology map with a network of blue lines representing waterways. Overlaid on the map are three dialog boxes:

- Geo-STORM Hydrology:** Contains various tool icons for map manipulation and navigation, along with 'Exit' and 'Help' buttons.
- Run TR-20: folly:** A dialog box for running the TR-20 model. The 'Input File' field contains 'folly.inp'. Below it, there are icons for file operations and 'Model Output' options. Buttons for 'OK', 'Apply', 'Cancel', and 'Help' are at the bottom.
- arc:** A text window displaying the TR-20 input file content. The title is 'JOB TR-20' and the subtitle is 'Folly Branch watershed study'. The main content is a table of data for a 100-year ultimate landuse conditions study.

The TR-20 input file content is as follows:

```
JOB TR-20
TITLE Folly Branch watershed study
TITLE 100-year ultimate landuse conditions
2 XSECTN 010 1.00
8 121.00 0.00 0.00
8 122.00 60.00 45.00
8 124.21 156.00 97.00
8 125.96 354.00 187.00
8 127.08 564.00 257.00
8 128.70 798.00 378.00
8 129.57 902.00 460.00
8 131.37 1047.00 660.00
8 132.00 1150.00 750.00
8 135.00 1525.00 1350.00
9 ENDTBL
2 XSECTN 020 1.00
8 123.90 0.00 0.00
8 124.90 120.00 188.00
8 125.90 420.00 420.00
8 126.90 899.00 686.00
8 127.90 1563.00 989.00
8 128.90 2450.00 1324.00
8 129.00 3050.00 1650.00
9 ENDTBL
2 XSECTN 040 1.00
8 112.00 0.00 0.00
8 113.00 18.00 42.00
8 114.00 112.00 165.00
8 115.00 360.00 340.00
8 116.00 725.00 533.00
8 117.00 1217.00 747.00
8 118.00 1825.00 976.00
8 119.50 2975.00 1375.00
9 ENDTBL
2 XSECTN 060 1.00
8 107.88 0.00 0.00
8 109.00 100.00 75.00
8 111.00 300.00 200.00
8 112.87 617.00 336.00
8 114.85 1626.00 679.00
8 117.89 2855.00 1476.00
8 120.02 3847.00 2149.00
8 121.00 4200.00 2550.00
9 ENDTBL
2 XSECTN 070 1.00
8 107.00 0.00 0.00
8 108.00 130.00 110.00
8 109.30 354.00 344.00
8 111.66 1042.00 1170.00
8 113.40 1919.00 1851.00
8 114.29 2611.00 2219.00
```

View TR-20 output File

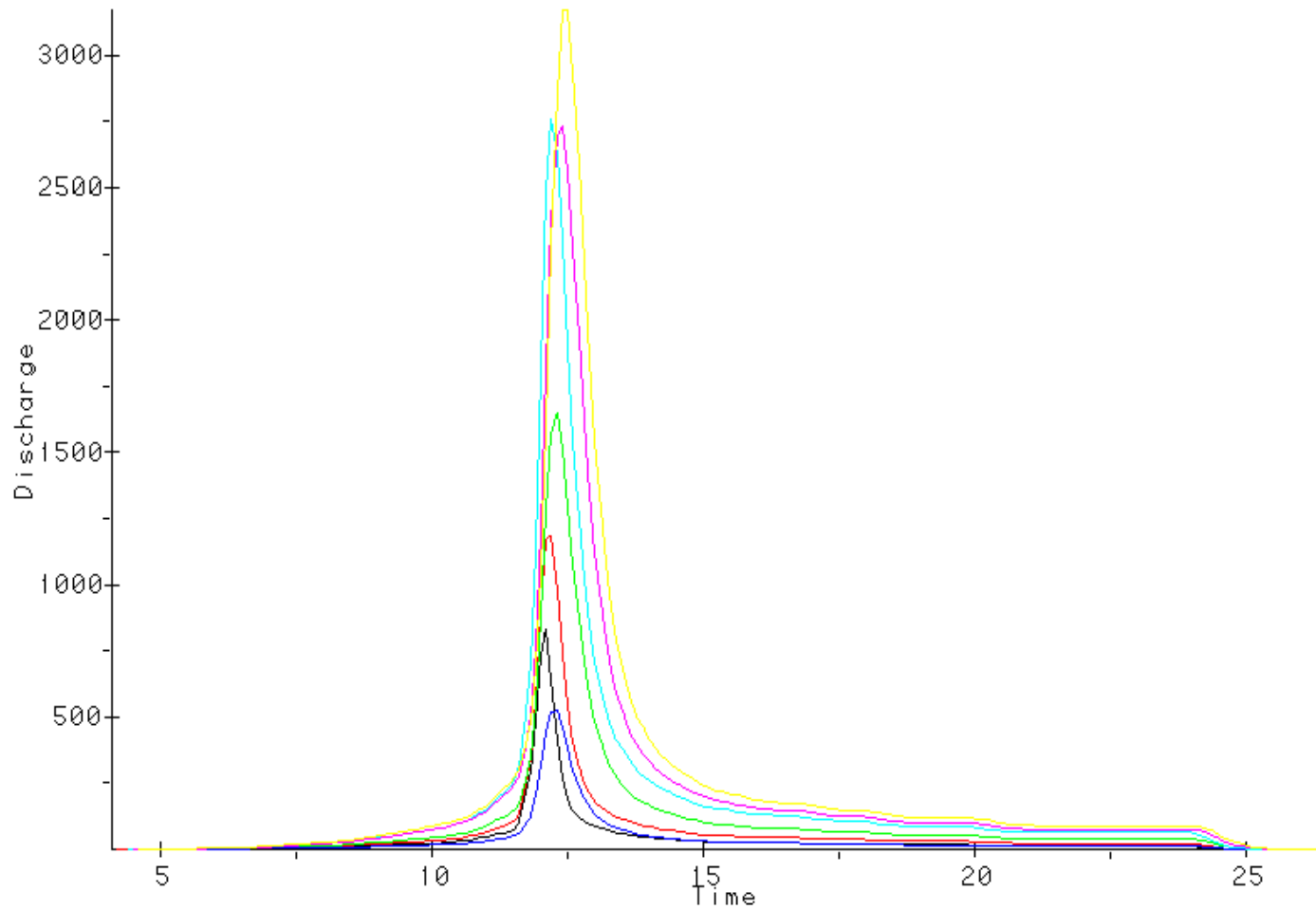
The screenshot displays the Geo-STORM software interface. On the left, there are three windows: 'Geo-STORM Hydrology' with various tool icons and 'Run TR-20: folly' with an input file 'Folly.inp'. The main area shows a map of a watershed with a network of blue and red lines representing waterways. On the right, a text window displays 'SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES'. The table lists XSECTION/STRUCTURE ID, DRAINAGE AREA (SQ MI), and discharge values for storm 1. The table is as follows:

XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 1
0 STRUCTURE 4	5.87	
+ ALTERNATE 1		2143.60
0 STRUCTURE 3	5.40	
+ ALTERNATE 1		2117.66
0 STRUCTURE 2	2.11	
+ ALTERNATE 1		870.30
0 STRUCTURE 1	1.66	
+ ALTERNATE 1		3200.50
0 XSECTION 5	0.59	
+ ALTERNATE 1		1176.47
0 XSECTION 10	1.66	
+ ALTERNATE 1		3259.30
0 XSECTION 20	2.11	
+ ALTERNATE 1		3476.65
0 XSECTION 30	0.39	
+ ALTERNATE 1		957.61
0 XSECTION 40	3.30	
+ ALTERNATE 1		2382.99
0 XSECTION 50	4.03	
+ ALTERNATE 1		3808.31
0 XSECTION 60	4.62	
+ ALTERNATE 1		3523.55
0 XSECTION 70	5.40	
+ ALTERNATE 1		2623.58
0 XSECTION 80	5.87	
+ ALTERNATE 1		2155.54
0 XSECTION 90	6.33	
+ ALTERNATE 1		2182.99

1END OF 1 JOBS IN THIS RUN

ENTER COMMAND > 0 STOP

View Hydrographs



Hydrologic Summary

- **Graphic Interaction**
- **Automatically:**
 - **Divide Watersheds Into Subareas**
 - **Calculate DA, CN and Tc**
 - **Construct Model Input From GIS Database**
 - **Generate Hydrographs**
- **“What IF” Analysis**
- **Easy Data Import**

Hydraulics Analysis

- **Graphic Interaction**
- **Automatically:**
 - **Derive Station and Elevation Values from GIS Database**
 - **Measure Channel, Left, and Right Overbank Reach Lengths**
 - **Build Model Input for Bridges and Culverts**
 - **Build Input file for the HEC-2 Model**
- **Delineate Continuous, Interpolated Flood Plain Boundaries**
- **Major cost and Time savings**

Define Starting Conditions

The screenshot displays the Geo-STORM software interface. The main window shows a topographic map with contour lines and a network of red and blue lines representing a water system. A dialog box titled "J1 - Starting Conditions" is open in the foreground, allowing the user to define the starting conditions for a hydraulic profile.

Geo-STORM
File View Select Spatial Tools Window Options

Current Feature
Mataroads Selected Entities/of: 2124 / 2124

Hydraulics Input: fps990023

J1 - Starting Conditions

Profile Number: 1

REQUIRED VALUES:

- Discharge Field (INQ):
- Discharge Value (Q):
- Water Surface Elevation (WSEL):

OPTIONAL VALUES:

- Print NC - EJ Data Records (ICHECK)
- Compute Manning's n (NINV)

Flow Type (IDIR):

Start Computations Using (STRT):

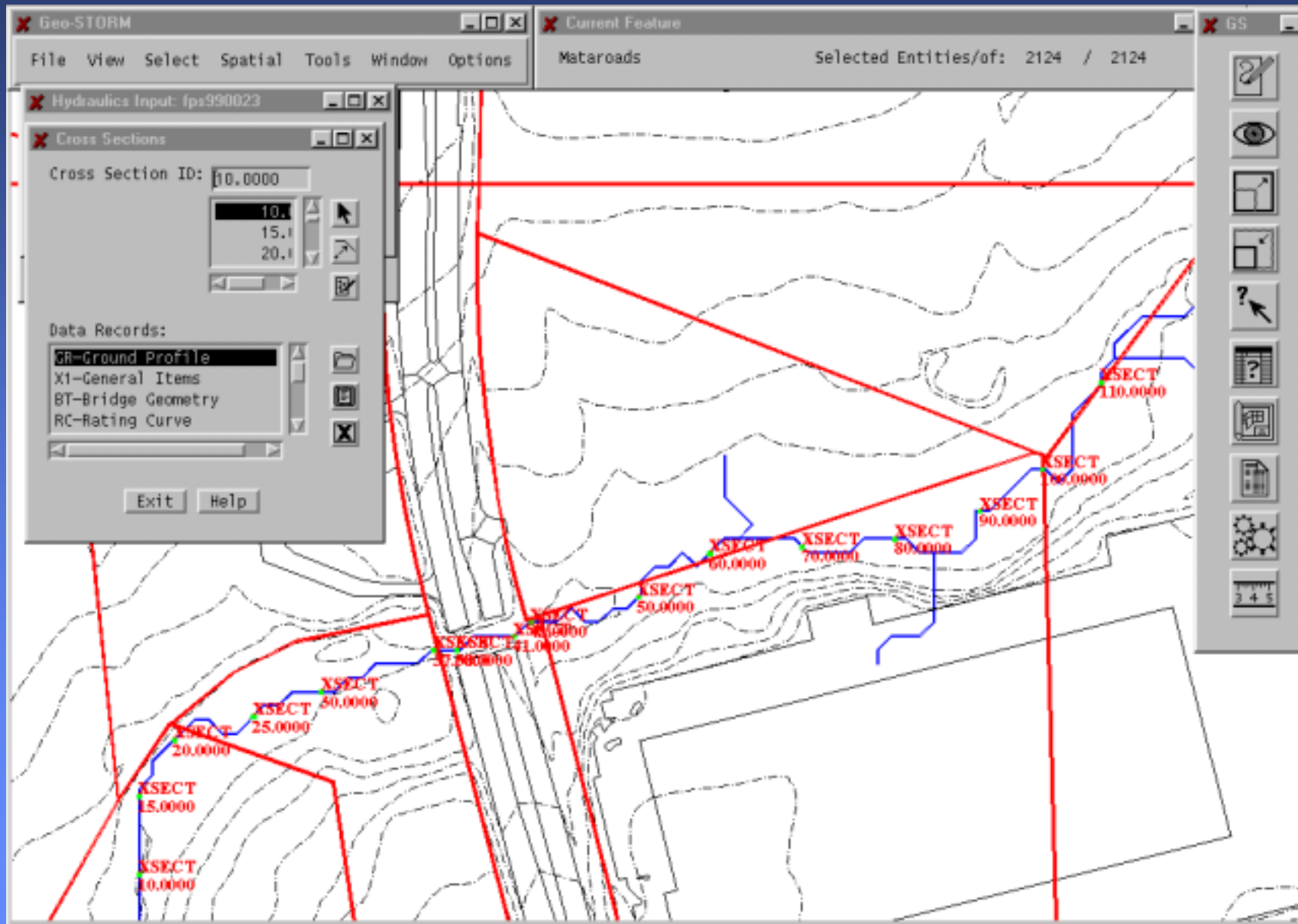
- Critical Depth
- Known water surface elevation
- Energy Slope:
- Rating Curve Pairs:

Units (METRIC):

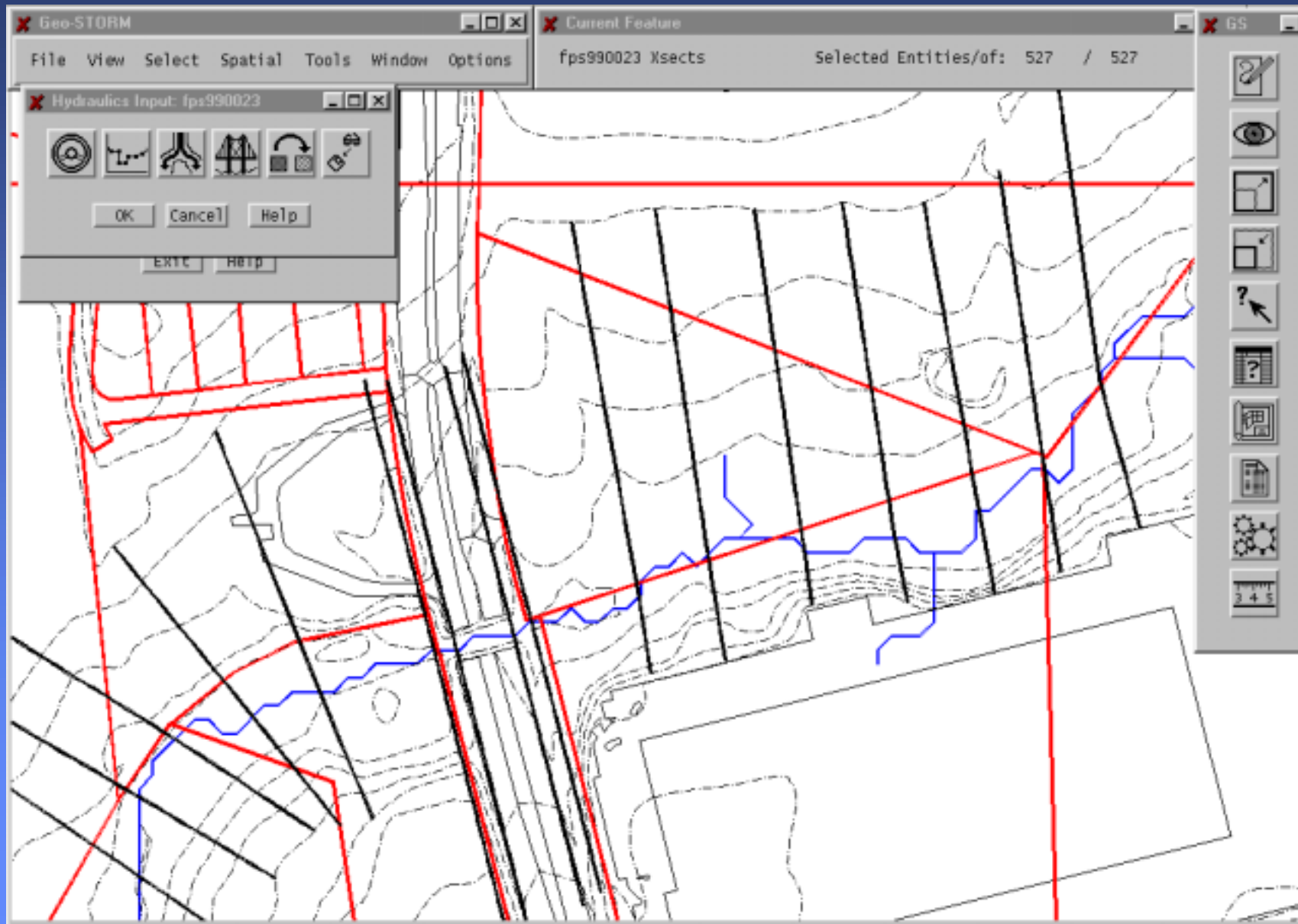
Max Change in Velocity (HVINS):

Multiplier Factor (FQ):

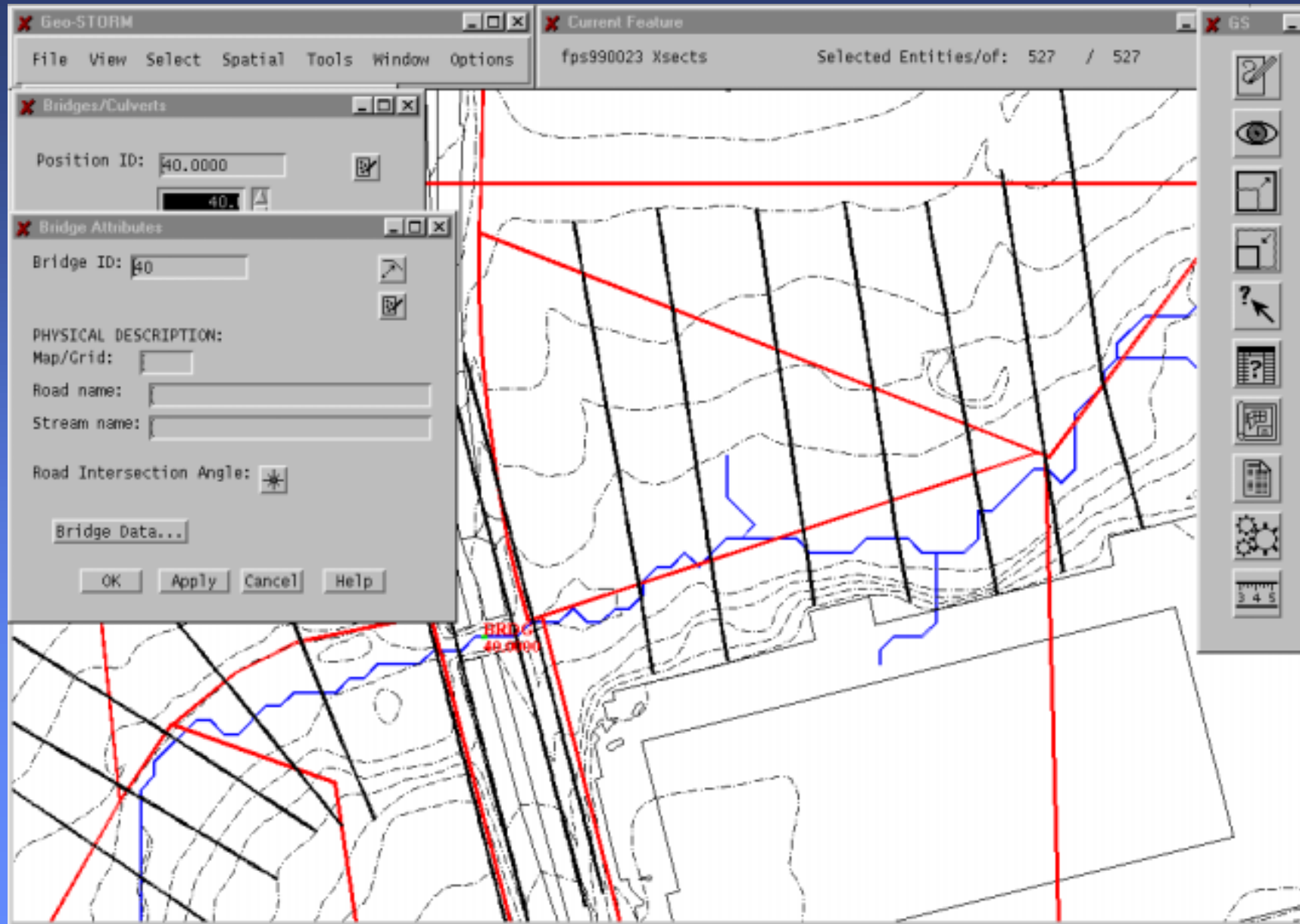
Locate HEC-2 Cross-Sections



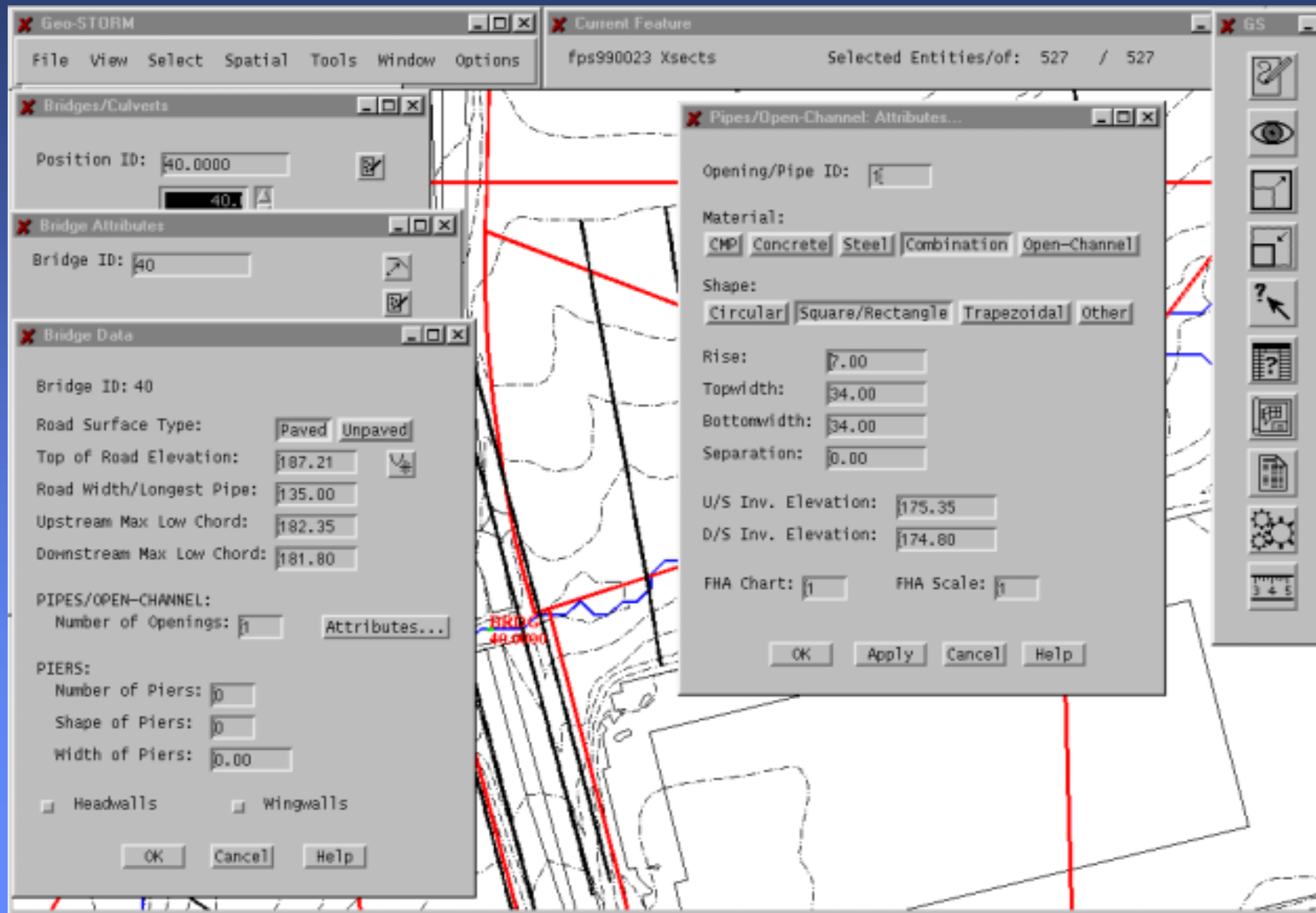
Automatically Develop Cross-Sections



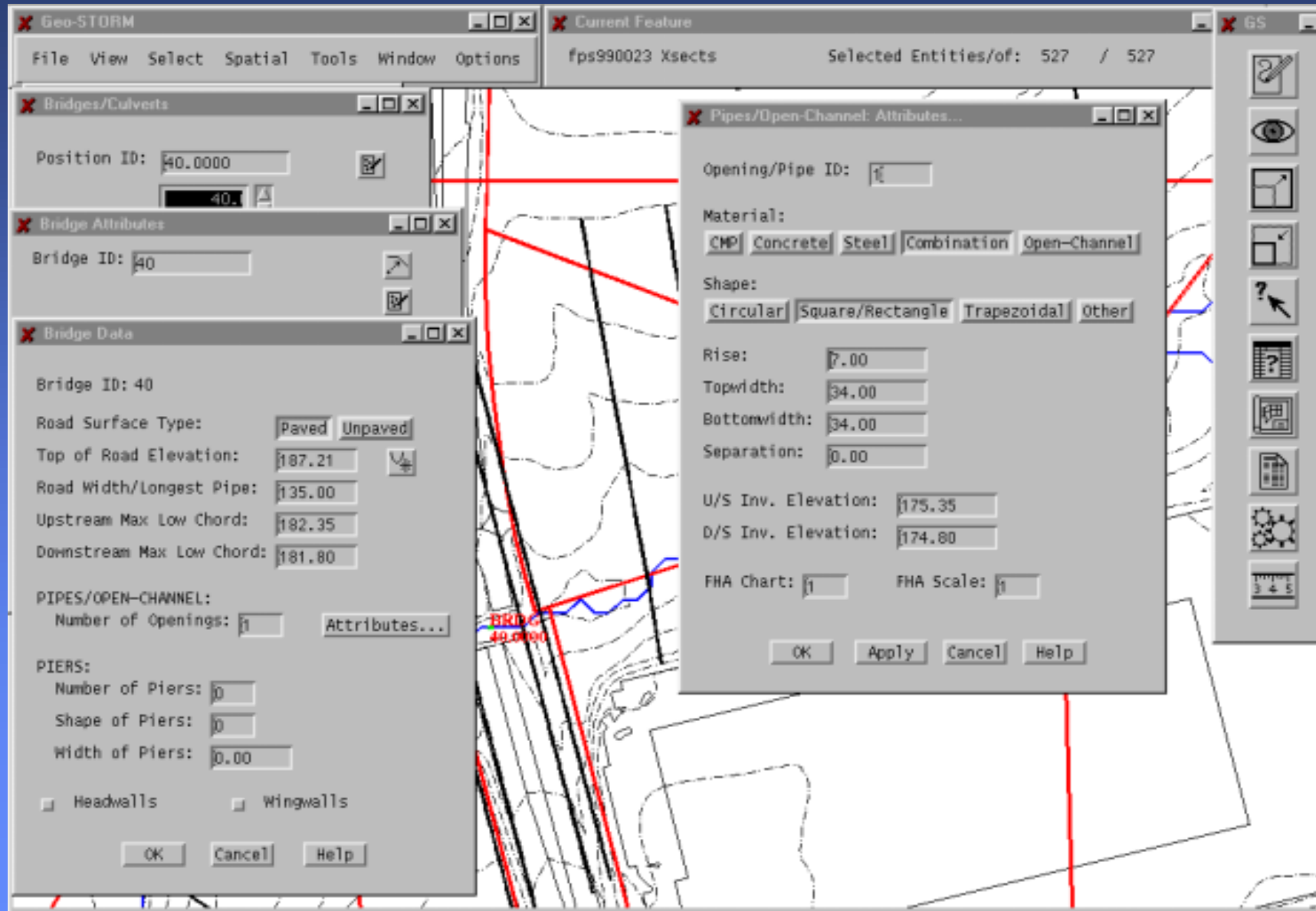
Bridge Location & Window



Automatically Retrieve Bridge Attributes from Files



Automatically Develop the Appropriate Bridge HEC-2 Cross-Sections



Input Manning "n" Values

The screenshot displays the Geo-STORM software interface. The main window shows a map with a cross-section line (red) and a channel (blue). The 'Change Data' dialog is open, showing the 'Cross Section ID' as 10.0000. Below it, a list of 'Data Records' includes 'NC-Starting Mannings Values'. The 'NC - Starting Mannings n and Shock Losses' dialog is also open, showing the following values:

MANNING'S N		
Left n (XNL):	Right n (XNR):	Channel n (XNCH):
0.085	0.085	0.044

Below the Manning's n values, the 'SHOCK LOSSES' section shows:

SHOCK LOSSES	
Contraction Coefficient (CCHV):	Expansion Coefficient (CEHV):
0.10	0.30

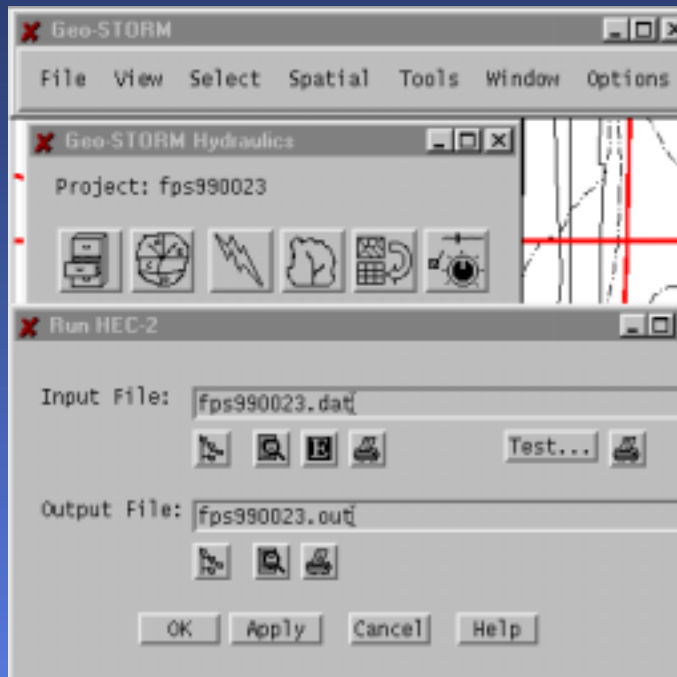
The dialog has 'OK', 'Cancel', and 'Help' buttons at the bottom.

Automatically Prepare Input File & Execute the HEC-2 Program

The screenshot displays the Geo-STORM software interface. The 'Run HEC-2' dialog box is open, showing the input file 'fps990023.dat' and an empty output file field. The background shows a map with a red line representing a stream or channel. To the right, a data table is visible, titled 'T1 This is a GIS-Based HEC-2 run using project fps990023.'.

T1 This is a GIS-Based HEC-2 run using project fps990023.										
J1	0	0	0	0.005	0	0	3232	174.6	0	0
J3	150									
NC	0.085	0.085	0.06	0.1	0.3					
X1	10	30	270	330	0	0	0	0	0	0
GR189.68	0	188.82	30	188.82	60	186.73	90	184.96	120	
GR 181.6	150	179.06	180	175.39	210	175.28	240	172.21	270	
GR169.64	298	169.64	300	172.84	330	174.8	360	176.71	390	
GR177.97	420	179.79	450	180.1	480	180.93	510	181.36	540	
GR182.12	570	182.7	600	184.21	630	185.7	660	185.46	690	
GR185.55	720	185.55	750	187.08	780	187.68	810	190.19	827	
X1	15	28	300	360	153.74	125.3	168.84	0	0	0
GR190.23	0	189.22	30	187.24	60	184.81	90	181.22	120	
GR 178.9	150	176.59	180	175.03	210	173.62	240	173.21	270	
CR172.77	300	170.36	330	170.36	339	177.82	360	177.82	390	
GR178.24	420	180.14	450	181.29	480	182.19	510	183.39	540	
GR184.19	570	184.68	600	185.54	630	187.35	660	189.28	690	
GR193.69	720	195.25	750	195.25	752					
X1	20	30	330	390	140.3	158.35	152.82	0	0	0
GR190.47	0	187.37	30	186.72	60	184.57	90	183.84	120	
GR179.69	150	179.69	180	174.98	210	174.1	240	172.58	270	
GR174.01	300	173.69	330	171.12	359	171.12	360	174.45	390	
GR 180	420	180.68	450	181.35	480	181.27	510	182.7	540	
GR 182.7	570	184.29	600	185.38	630	187.91	660	189.92	690	
GR192.46	720	192.46	750	191.97	780	191.2	810	193.16	836	
X1	25	28	270	390	124.11	254.59	217	0	0	0
GR192.03	0	190.96	30	188.52	60	188.01	90	183.56	120	
GR181.51	150	178.33	180	175.13	210	174.15	240	174.15	270	
GR171.16	300	171.16	303	172.26	330	172.9	360	176.46	390	
GR176.46	420	181.18	450	183.04	480	184.05	510	184.46	540	
GR185.66	570	186.37	600	188.01	630	189.09	660	190.83	690	
GR 193.3	720	193.75	750	195.31	774					
X1	30	32	270	360	121.46	255.27	166.25	0	0	0
GR197.12	0	190.67	30	188.06	60	184.78	90	181.3	120	
GR 181.3	150	175.89	180	175.24	210	174.66	240	173.76	270	
CR173.05	293	173.05	300	173.08	330	174.36	360	174	390	
GR177.05	420	181.39	450	185.72	480	187	510	186.97	540	
GR186.97	570	186.94	600	187.02	630	187.77	660	188.18	690	
GR188.41	720	189.5	750	190.24	780	190.99	810	192.79	840	
CR193.58	870	196.04	899							
X1	37	41	570	630	311.68	309.13	279.9	0	0	0
GR 202.8	0	206.04	30	205.57	60	204.52	90	204.43	120	
GR204.43	150	203.5	180	204.3	210	203.63	240	199.27	270	
GR195.95	300	197.58	330	190.93	360	184.2	390	182.1	420	
GR 177.6	450	177.5	480	177.65	510	177.09	540	177.26	570	
GR174.17	600	175.94	630	177.06	660	180.3	690	185.71	720	
GR185.98	750	185.55	780	185.55	810	185.55	840	185.55	870	
GR185.55	900	185.55	930	185.55	960	185.55	990	187.35	1020	
GR187.14	1050	187.14	1080	190.43	1110	192.3	1140	191.82	1170	
CR192.84	1200									
NC				0.3	0.5					
X1	38	19	583	617	50	50	50	0	0	0

HEC-2 Output File



arc

SUMMARY PRINTOUT TABLE 150

XLCH	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFWNS	TOPWID
0.00	10.000	3232.00	177.47	0.00	0.00	2.87	215.11
168.84	15.000	3232.00	178.35	0.00	0.88	0.00	264.55
152.82	20.000	3232.00	178.86	0.00	0.51	0.00	228.56
217.00	25.000	3232.00	179.24	0.00	0.38	0.00	266.27
166.25	30.000	3232.00	179.51	0.00	0.27	0.00	277.03
+ 279.90	37.000	3232.00	180.20	0.00	0.70	0.00	256.47
50.00	38.000	3232.00	180.54	0.00	0.34	0.00	225.71
+ 135.00	41.000	3232.00	188.08	0.00	7.54	0.00	709.26
49.00	43.000	3232.00	188.09	0.00	0.01	0.00	822.95
277.60	50.000	3232.00	188.11	0.00	0.02	0.00	638.64
234.99	60.000	3232.00	188.12	0.00	0.01	0.00	517.78
218.90	70.000	3232.00	188.13	0.00	0.02	0.00	563.25
217.58	80.000	3232.00	188.15	0.00	0.02	0.00	594.93
267.48	90.000	3232.00	188.17	0.00	0.02	0.00	566.68
171.53	100.000	3232.00	188.19	0.00	0.02	0.00	550.31

Hydraulics Summary

- **Graphic Interaction**
- **Automatically:**
 - **Derive Station and Elevation Values from GIS Database**
 - **Measure Channel, Left, and Right Overbank Reach Lengths**
 - **Build Model Input for Bridges and Culverts**
 - **Build the HEC-2 Input file & Execute it**
- **Delineate Continuous, Interpolated Floodplain Boundaries**
- **Import Standard HEC-2 Projects**



Jack E. Johnson
Deputy Director

Flood Prone Structures per Councilmanic Districts

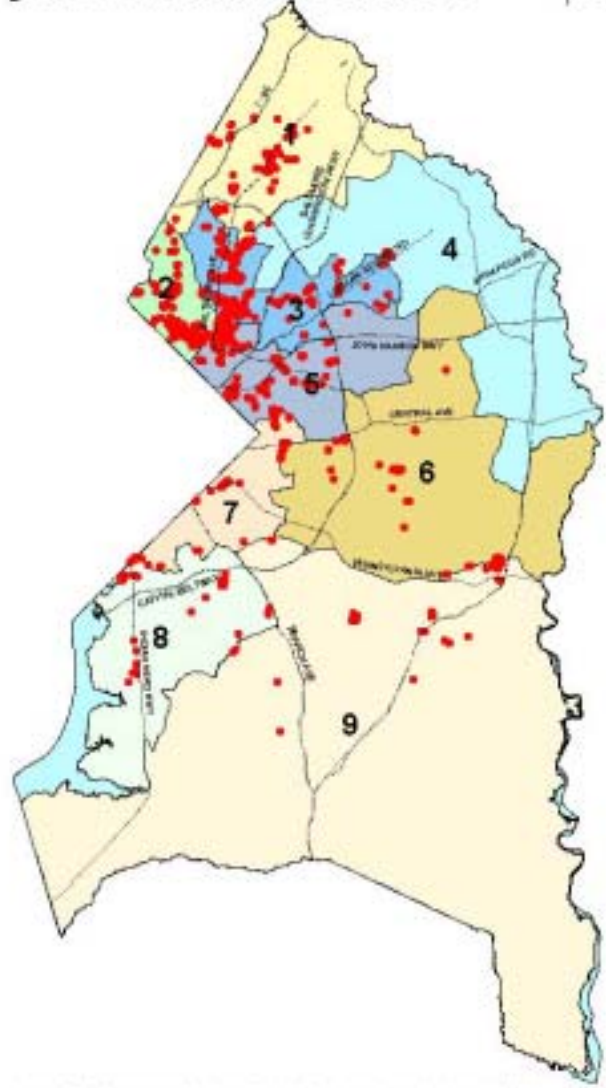


Legend

- Flood Prone Structures
- Major Road

Council Members

	Thomas R. Smith District 1, Councilor 313-960-3811
	Paul A. Smith Councilor 313-960-4108
	Thomas R. Smith District 2, Councilor 313-960-3811
	Timothy J.J. Ford District 3, Councilor 313-960-3811
	Jack Berggren District 4, Councilor 313-960-3811
	Samuel R. Jones District 5, Councilor 313-960-3811
	Charles Smith District 6, Councilor 313-960-3811
	Tom Smith District 7, Councilor 313-960-3811
	Robert Smith District 8, Councilor 313-960-3811

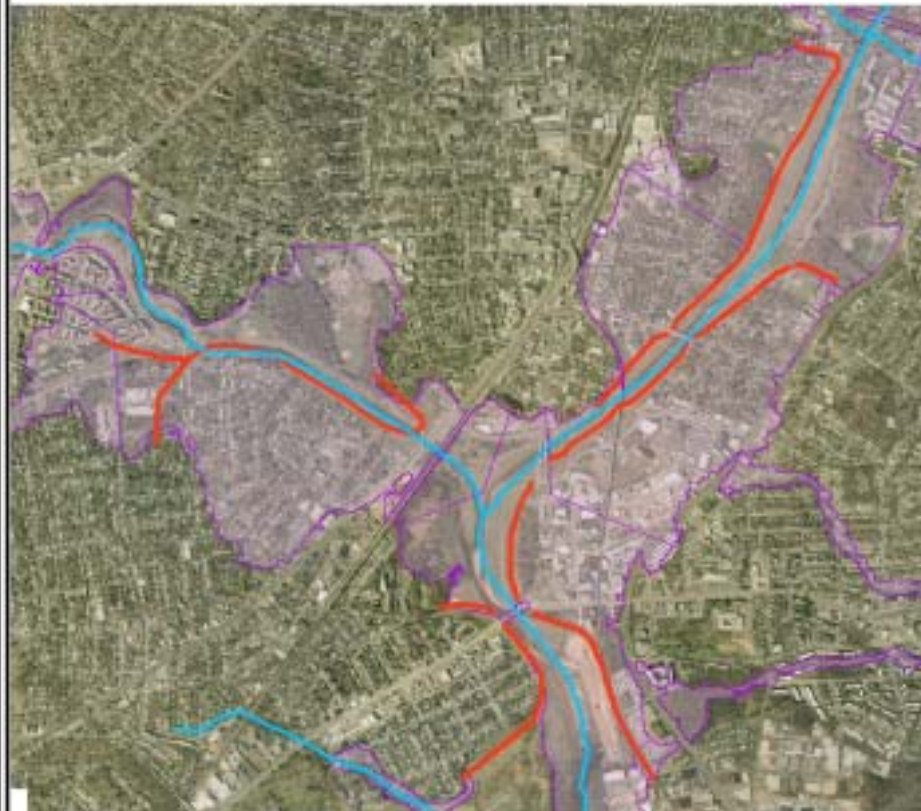


Source: DPR, Program and Planning Division, Technical Support Section, May 2003



Jack B. Johnson
County Executive

Anacostia Levees & Floodplain



-  Levees
-  Streams
-  100yr Flood Plain



Source: DER, Programs and Planning Division, Technical Support Section, April 2004

Geo-STORM Results

- **Improved Productivity**
- **Higher Quality/Accurate Modeling**
- **Cost Savings**
- **Generate Revenue & Grants**
- **Awards/Recognition**
 - **URSA**
 - **PTI**
 - **NACo**
 - **Ford Foundation**

Generated Revenue

- **Conduct Floodplain Studies for Developers**
- **Development Technical Review (County Permits)**
- **Floodplain Information Inquire**

Related Grants

- **Federal Emergency Management Agency's Cooperative Digital Flood Mapping Program**
- **Federal Emergency Management Agency's Cooperating Technical Partner (CTP) Program**

Conclusions

- **A successful and valuable tool**
- **Significant cost and time savings**
- **High degree of accuracy and consistent modeling results**
- **Generate enough revenue to self-support itself and more**
- **Streamline permit process**

Future plans

- **Upgrade application**
- **Move to Windows platform**
- **ArcGIS**
- **Geodatabase**
- **Include Hec-Ras**

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