Numerical Models Accepted by FEMA for NFIP Usage

(Nationally Accepted Models)

TYPE	PROGRAM	DEVELOPED BY	AVAILABLE FROM	COMMENTS
Coastal Models:				
Coastal Storm Surges	FEMA Surge (1988)	Tetra Tech, Inc.; Engineering Methods & Applications; Greenhorne & O'Mara; Camp, Dresser & McKee, Inc.	Dewberry & Davis LLC, METS Division 8401 Arlington Blvd. Fairfax, VA 22031	Incorporates modified NWS-23 model for hurricanes and Joint Probability Method. Reportedly more accurate for water elevations than water currents.
	ODISTIM (1975)	Coastal Consultants, Inc.	Dewberry & Davis LLC, METS Division 8401 Arlington Blvd. Fairfax, VA 22031	Computes wind-driven surges propagating in estuaries or rivers described by one-dimensional elements, but only for northeasters since wind direction is fixed.
	Northeaster Model (1978)	Stone & Webster Engineering Corp.	Dewberry & Davis LLC, METS Division 8401 Arlington Blvd. Fairfax, VA 22031	Accommodates asymmetrical geometry for extratropical storms but requires separate program to compute resultant coastal surge for winds and pressures.
	FLOW2D (1975)[1]	Resource Analysis, Inc.	Camp, Dresser, & McKee, Inc. Ten Cambridge Center Cambridge, MA 02142	Unsteady flood flow for estuaries and floodplains, but no direct wind effects are considered.
	TABS RMA2 v. 4.3 (October 1996)	U.S. Army Corps of Engineers	Coastal Engineering Research Center Department of the Army Waterways Experiment Station Corps of Engineers 3909 Halls Ferry Road Vicksburg, MS 39180-6199	Two-dimensional steady/unsteady flow model, for water levels and velocities. Computes finite element solution of the Reynolds form of the Navier-Stokes equations for turbulent flows.
	MIKE 21 HD/NHD	DHI Water and Environment	DHI Inc. Eight Neshaminy Interplex Suite 219 Trevose, PA 19053	Solves the non-linear depth-averaged equations of continuity and conservation of momentum. Computes water levels and flows based on a variety of forcing functions. Can include wave-driven currents and setup. Uses a finite difference grid with dynamic nesting grid capabilities. Directly resolving small scale features such as narrow inland channels may result in a large computational costs.
	DYNLET	U.S. Army Corps of Engineers	Coastal and Hydraulics Laboratory Engineering Research and Development Center 3909 Halls Ferry Road Vicksburg, MS 39180-6199	One-dimensional model of dynamic behavior of tidal flow at inlets. Can be used to predict tide dominated velocities and water level fluctuations at an inlet and interior back bay system. DYNLET solves the full one-dimensional shallow water equations using an implicit finite difference solution.
Coastal Wave Heights	WHAFIS 3.0 (1988)	Dames & Moore, revised by Greenhorne & O'Mara	Dewberry & Davis LLC, METS Division 8401 Arlington Blvd. Fairfax, VA 22031	Defines wave heights associated with 100-year flood in coastal areas using modern wave action treatment; incorporates 1977 NAS recommendations on basic approximations for wind speeds, wave breaking criterion, and controlling wave height.
	WHAFIS 3.0 GL (1993)	Dames & Moore, Greenhorne & O'Mara, Dewberry & Davis LLC	Dewberry & Davis LLC, METS Division 8401 Arlington Blvd. Fairfax, VA 22031	Identical wave treatments as WHAFIS 3.0, but with programmed reduction of wind speeds for U.S. shorelines of the Great Lakes.

[1]This model is acceptable for coastal storm surge applications only.

Numerical Models Accepted by FEMA for NFIP Usage

(Nationally Accepted Models)

TYPE	PROGRAM	DEVELOPED BY	AVAILABLE FROM	COMMENTS
Coastal Models (cont'd):				
Coastal Wave Heights	RCPWAVE (1986)	U.S. Army Corps of Engineers	Coastal Engineering Research Center Department of the Army Waterways Experiment Station Corps of Engineers 3909 Halls Ferry Road Vicksburg, MS 39180-6199	Treats linear, monochromatic waves propagating over grid giving coastal bathymetry, providing nearshore wave heights pertinent to proper spacing between transects or to magnitudes of wave setup.
	CHAMP 1.0 (2001)	Dewberry & Davis LLC	Dewberry & Davis LLC, METS Division 8401 Arlington Blvd. Fairfax, VA 22031 http://www.fema.gov/mit/tsd/frm_soft.htm	Coastal Hazard Analysis Modeling Program (CHAMP) is a Windows-based program used for wave height analyses (enhances WHAFIS 3.0) and provides summary tables and graphics for mapping.
	MIKE 21 Offshore Spectral Wave Model (OSW)	DHI Water and Environment	DHI Inc. Eight Neshaminy Interplex Suite 219 Trevose, PA 19053	Two-dimensional dynamic wind-wave growth model. Discretizes spectrum in frequency and direction. Does not include breaking. Appropriate for providing regional wave conditions in deep and intermediate depths, providing boundary data for nearshore modeling or basic analysis.
	MIKE 21 Nearshore Spectral Wave Model (NSW)	DHI Water and Environment	DHI Inc. Eight Neshaminy Interplex Suite 219 Trevose, PA 19053	Two-dimensional stationary model for propagation of waves into the nearshore zone (refraction, shoaling, breaking, bed friction, and wind-wave growth). Based on the conservation equation for the spectral wave action density; similar to HISWA model. Obstructions not directly resolvable in the grid, must be modeled with grid bed roughness coefficients.
Coastal Wave Effects	RUNUP 2.0 (1990)	Stone & Webster Engineering Corp., revised by Dewberry & Davis	Dewberry & Davis LLC, METS Division 8401 Arlington Blvd. Fairfax, VA 22031	Executes 1978 guidance by USACE defining wave runup on shore barrier with specified approach and storm conditions; mean wave description determines mean runup elevation.
	GLWRM (1992)	U.S. Army Corps of Engineers	Department of the Army Detroit District, Corps of Engineers 477 Michigan Avenue Detroit, MI 48266	Developed particularly to analyze wave runup for the three types of situations most frequently encountered on U.S. shorelines of the Great Lakes: sand beach, sloping riprap revetment, and vertical wall.
	EROSION (1988)	Dewberry & Davis LLC	Dewberry & Davis LLC, METS Division 8401 Arlington Blvd. Fairfax, VA 22031	Compares sand dune cross section to 540 ft^2 rule and computes eroded geometry for 100-year flood as either duneface retreat or dune removal by optional methods. Presently needs revisions to improve model and to provide graphics.
	ACES 1.07 (1992)	U.S. Army Corps of Engineers	Coastal Engineering Research Center Department of the Army Waterways Experiment Station Corps of Engineers 3909 Halls Ferry Road Vicksburg, MS 39180-6199	Used for restricted fetch wave growth analysis and runup on vertical structures or revetments.
	CHAMP 1.0 (2001)	Dewberry & Davis LLC	Dewberry & Davis LLC, METS Division 8401 Arlington Blvd. Fairfax, VA 22031 http://www.fema.gov/mit/tsd/frm_soft.htm	CHAMP is a Windows-based program used for storm-induced erosion treatments (enhances EROSION) and wave runup analyses (enhances RUNUP 2.0), and provides summary tables and graphics for mapping.

Numerical Models Accepted by FEMA for NFIP Usage

(Nationally Accepted Models)

TYPE	PROGRAM	DEVELOPED BY	AVAILABLE FROM	COMMENTS
Hydrologic Models: Determination of Flood Hydrographs				
Single Event	HEC-1 4.0.1 and up[2] (May 1991)	U.S. Army Corps of Engineers	Water Resources Support Center[3] Corps of Engineers Hydrologic Engineering Center (HEC) 609 Second Street Davis, CA 95616-4687	Flood hydrographs at different locations along streams. Calibration runs preferred to determine model parameters.
	HEC-HMS 1.1 and up (March 1998)	U.S. Army Corps of Engineers	U.S. Army Corps of Engineers Hydrologic Engineering Center 609 Second Street Davis, CA 95616-4687 http://www.hec.usace.army.mil/	The Hydrologic Modeling System provides a variety of options for simulating precipitation-runoff processes. It has a capability to use gridded rainfall data to simulate runoff. It does not provide snowmelt and snowfall functions; it cannot be used for areas where snowmelt is an important flood hazard source and must be considered in estimation of flood discharges.
	TR-20 (February 1992)	U.S. Department of Agriculture, Natural Resources Conservation Service	U.S. Department of Commerce National Technical Information Service 5285 Port Royal Road Springfield, VA 22161	Flood hydrographs at different locations along streams. Calibration runs preferred to determine model parameters.
	TR-55 (June 1986)	U.S. Department of Agriculture, Natural Resources Conservation Service	U.S. Department of Commerce National Technical Information Service 5285 Port Royal Road Springfield, VA 22161 http://www.wcc.nrcs.usda.gov/water/quality/common/tr55/tr55.html	Peak discharges and flood hydrographs at a single location.
	SWMM (RUNOFF) 4.30 (May 1994), and 4.31 (January 1997)	U.S. Environmental Protection Agency and Oregon State University	Center for Exposure Assessment Modeling U.S. Environmental Protection Agency Office of Research and Development Environmental Research Laboratory 960 College Station Road Athens, GA 30605-2720 http://www.epa.gov/ceampubl/softwdos.htm Department of Civil, Construction, and Environmental Engineering Oregon State University 202 Apperson Hall Corvallis, OR 97331-2302 http://www.ccee.orst.edu/swmm/ ftp://ftp.engr.orst.edu/pub/swmm/pc	Calibration or verification to the actual flood events highly recommended.

[2]The enhancement of these programs in editing and graphical presentation can be obtained from several private companies.
[3]Program is typically distributed by vendors and may not be available through HEC. A list of vendors may be obtained through HEC.

Numerical Models Accepted by FEMA for NFIP Usage

(Nationally Accepted Models)

TYPE	PROGRAM	DEVELOPED BY	AVAILABLE FROM	COMMENTS
Hydrologic Models: Determination of Flood Hydrographs (cont'd)				
Single Event	MIKE 11 UHM (June 1999)	DHI Water and Environment	DHI Inc. Eight Neshaminy Interplex Suite 219 Trevose, PA 19053	Simulates flood hydrographs at different locations along streams using unit hydrograph techniques. Three methods are available for calculating infiltration losses and three methods for converting rainfall excess to runoff. The web page is at: http://www.dhi.dk
	DBRM 3.0 (1993)	Bernard L. Golding, P.E. Consulting Water Resources Engineer Orlando, FL	Center for Microcomputers in Transportation (McTrans) University of Florida 512 Weil Hall Gainesville, FL 32611-6585	Flood hydrographs at different locations along streams. Calibration runs preferred to determine model parameters.
	HYMO	U.S. Department of Agriculture, Natural Resources Conservation Service	U.S. Department of Commerce National Technical Information Service 5285 Port Royal Road Springfield, VA 22161	Flood hydrographs at different locations along streams. Calibration runs preferred to determine model parameters.

Numerical Models Accepted by FEMA for NFIP Usage

(Nationally Accepted Models)

TYPE	PROGRAM	DEVELOPED BY	AVAILABLE FROM	COMMENTS
Hydrologic Models: Determination of Flood Hydrographs (cont'd)				
Continuous Event	DR3M (October 1993)	U.S. Geological Survey	U.S. Geological Survey National Center 12201 Sunrise Valley Drive Reston, VA 22092	Calibration to actual flood events required. The web page is at: http://water.usgs.gov/software/surface_water.html
	HSPF 10.10 and up (December 1993)	U.S. Environmental Protection Agency, U.S. Geological Survey	Center for Exposure Assessment Modeling U.S. Environmental Protection Agency Office of Research and Development Environmental Research Laboratory 960 College Station Road Athens, GA 30605-2720	Calibration to actual flood events required. The web page is at: http://water.usgs.gov/software/surface_water.html
	MIKE 11 RR (June 1999)	DHI Water and Environment	DHI Inc. Eight Neshaminy Interplex Suite 219 Trevose, PA 19053	The Rainfall-Runoff Module (RR, formerly NAM) is a lumped-parameter hydrologic model capable of continuously accounting for water storage in surface and sub-surface zones. Flood hydrographs are estimated at different locations along streams. Calibration to actual flood events is required. The web page is at: http://www.dhi.dk
Interior Drainage Analysis	HEC-IFH 1.03 and up	U.S. Army Corps of Engineers	U.S. Army Corps of Engineers Hydrologic Engineering Center 609 Second Street Davis, CA 95616-4687	Provides both continuous simulation and hypothetical event analyses. Coincidence frequency analysis (not included in the model) may be needed for some cases. Supporting documentation is available at: http://www.fema.gov/mit/tsd/dl_ifh.htm
Statistical Models:				
	HEC FFA 3.1 (February 1995)	U.S. Army Corps of Engineers	Water Resources Support Center[3] Corps of Engineers Hydrologic Engineering Center 609 Second Street Davis, CA 95616-4687	Performs flood frequency analyses following *Bulletin 17B, Guidelines for Determining Flood Flow Frequency*, prepared by the Interagency Advisory Committee on Water Data (1982). Supersedes HECWRC.
	PEAKFQ 2.4 and up (April 1998)	U.S. Geological Survey	U.S. Geological Survey Hydrologic Analysis Software Support Team 437 National Center Reston, VA 20192 http://water.usgs.gov/software/surface_water.html	Performs flood frequency analyses following *Bulletin 17B, Guidelines for Determining Flood Flow Frequency*, prepared by the Interagency Advisory Committee on Water Data (1982).
	FAN	FEMA	Michael Baker, Jr., Inc. 3601 Eisenhower Avenue, Suite 600 Alexandria, VA 22304	Determines depth and velocity zones over alluvial fans.

[3]Program is typically distributed by vendors and may not be available through HEC. A list of vendors may be obtained through HEC.

Numerical Models Accepted by FEMA for NFIP Usage

January 11, 2002

(Nationally Accepted Models)

TYPE	PROGRAM	DEVELOPED BY	AVAILABLE FROM	COMMENTS
Hydraulic Models: Determination of Water-surface Elevations for Riverine Analysis				
One-dimensional Steady Flow Models	HEC-RAS 2.2 (September 1998)	U.S. Army Corps of Engineers	Water Resources Support Center Corps of Engineers Hydrologic Engineering Center (HEC) 609 Second Street Davis, CA 95616-4687 http://www.hec.usace.army.mil/	A HEC-2 file can be imported into HEC-RAS; the user must change the conveyance computations in HEC-RAS and make the necessary modifications to the bridge modeling before running HEC-RAS to duplicate the results obtained using HEC-2. The use of HEC-RAS for restudying a stream previously studied using HEC-2 is encouraged, as long as one of the following conditions is met: 1) the entire stream is rerun using HEC-RAS; or 2) the stream reach remodeled using HEC-RAS is hydraulically independent from the rest of the stream. The WSPRO bridge analysis is recom- mended for constricted floodplains under subcritical flow conditions. In addition, HEC-RAS version 2.2 that performs the steady flow water-surface profile calculations (SNET) has been updated to version 2.2.1; it should be used for NFIP studies.
	HEC-RAS 3.0.1	U.S. Army Corps of Engineers	Water Resources Support Center Corps of Engineers Hydrologic Engineering Center 609 Second Street Davis, CA 95616-4687	Under rare circumstances, for bridges with low flow, and weir flow on the overbanks, HEC-RAS 3.0.1 may not be able to balance the flow using weir flow equation and low flow bridge analysis methods. HEC-RAS 3.0.1 will then use the energy method, and the computed energy grade elevations and water-surface elevations may be on the high side.
	HEC-2 4.6.2[2] (May 1991)	U.S. Army Corps of Engineers	Water Resources Support Center[3] Corps of Engineers Hydrologic Engineering Center 609 Second Street Davis, CA 95616-4687	Includes culvert analysis and floodway options.
	WSPRO (June 1988 and up)	U.S. Geological Survey, Federal Highway Administration (FHWA)	Federal Highway Administration (FHWA) web page at: http://www.fhwa.dot.gov/bridge/hyddescr.htm	Floodway option is available in June 1998 version. 1988 version is available on the USGS web page at: http://water.usgs.gov/software/surface_water.html
	FLDWY (May 1989)	U.S. Department of Agriculture, Natural Resources Conservation Service	U.S. Department of Commerce National Technical Information Service 5285 Port Royal Road Springfield, VA 22161	Determines the encroachment stations from equal conveyance reduction method; used in conjunction with WSP2. Encroachment stations developed using this model must be re-entered in WSP2 model to properly develop floodway.
	QUICK-2 1.0 and up (January 1995)	FEMA	Federal Emergency Management Agency Hazard Identification Branch Mitigation Directorate 500 C Street, SW Washington, DC 20472	Intended for use in areas studied by approximate methods (Zone A) only. May be used to develop water-surface elevations at one cross section or a series of cross sections. May not be used to develop a floodway.
	HY8 4.1 and up (November 1992)	U.S. Department of Transportation, Federal Highway Administration (FHWA)	Federal Highway Administration (FHWA) web page at: http://www.fhwa.dot.gov/bridge/hyddescr.htm	Computes water-surface elevations for flow through multiple parallel culverts and over the road embankment. Software and related publication are available from Center for Microcomputers in Transportation (McTrans), University of Florida, 512 Weil Hall, Gainesville, FL 32611-6585; and on the web at: http://www-mctrans.ce.ufl.edu/
	WSPGW 12.96 (October 2000)	Los Angeles Flood Control District and Joseph E. Bonadiman & Associates, Inc.	Joseph E. Bonadiman & Associates, Inc. 588 West 6th Street San Bernardino, CA 92410 http://www.bonadiman.com	Windows version of WSPG. Computes water-surface profiles and pressure gradients for open channels and closed conduits. Can analyze multiple parallel pipes. Road overtopping cannot be computed. Open channels are analyzed using the standard step method but roughness coefficient can not vary across the channel. Overbank analyses cannot be done. Multiple parallel pipe analysis assumes equal distribution between pipes so pipes must be of similar material, geometry, slope, and inlet configuration. Floodway function is not available. Demo version available from: http://www.civildesign.com

[2]The enhancement of these programs in editing and graphical presentation can be obtained from several private companies.
[3]Program is typically distributed by vendors and may not be available through HEC. A list of vendors may be obtained through HEC.

Numerical Models Accepted by FEMA for NFIP Usage

January 11, 2002

(Nationally Accepted Models)

TYPE	PROGRAM	DEVELOPED BY	AVAILABLE FROM	COMMENTS
Hydraulic Models: Determination of Water-surface Elevations for Riverine Analysis (cont'd)				
One-dimensional Unsteady Flow Models	FEQ 8.92 and FEQUTL 4.68 (1997, both)	Delbert D. Franz, Linsley, Kraeger Associates; and Charles S. Melching, USGS	U.S. Geological Survey 221 North Broadway Avenue Urbana, IL 61801 http://water.usgs.gov/software/surface_water.html and technical support available at http://www-il.usgs.gov/proj/feq/	The FEQ model is a computer program for the solution of full, dynamic equations of motion for one-dimensional unsteady flow in open channels and control structures. The hydraulic characteristics for the floodplain (including the channel, overbanks, and all control structures affecting the movement of flow) are computed by its companion program FEQUTL and used by the FEQ program. Calibration or verification to the actual flood events highly recommended. Type 5 culvert flow computations of FEQUTL need verification with results obtained using methodology or models accepted for NFIP use. Floodway concept formulation is unavailable.
	Advanced ICPR 2.20 (October 2000)	Streamline Technologies, Inc.	Streamline Technologies, Inc. 6961 University Boulevard Winter Park, FL 32792	Previous versions of the model are not acceptable. Calibration or verification to the actual flood events highly recommended. Floodway concept formulation unavailable.
	SWMM 4.30 (May 1994), and 4.31 (January 1997)	U.S. Environmental Protection Agency and Oregon State University	Center for Exposure Assessment Modeling U.S. Environmental Protection Agency Office of Research and Development Environmental Research Laboratory 960 College Station Road Athens, GA 30605-2720 http://www.epa.gov/ceampubl/softwdos.htm Department of Civil, Construction, and Environmental Engineering Oregon State University 202 Apperson Hall Corvallis, OR 97331-2302 http://www.ccee.orst.edu/swmm/ ftp://ftp.engr.orst.edu/pub/swmm/pc	Calibration or verification to the actual flood events highly recommended. Structural loss calculations unavailable and must be accommodated via roughness factor manipulation. Floodway concept formulation unavailable. Preferably, for NFIP purposes, head losses at bridges should be verified using WSPRO; losses at culverts should be verified using the U.S. Geological Survey's six equations for culvert analysis. Losses at storm sewer junctions should also be verified with separate calculations; contact FEMA for guidance with these calculations. Supporting documentation for floodway calculations is available at: http://www.fema.gov/mit/tsd/dl_swmm.htm
	UNET 4.0 (April 2001)	U.S. Army Corps of Engineers	Water Resources Support Center Corps of Engineers Hydrologic Engineering Center (HEC) 609 Second Street Davis, CA 95616-4687	Calibration or verification to the actual flood events highly recommended. Comparison of bridge and culvert modeling to other numerical models reveals significant differences in results; these differences may be investigated in the near future. Floodway option is not accepted for NFIP usage.
	FLDWAV (November 1998)	National Weather Service	Hydrologic Research Laboratory Office of Hydrology National Weather Service, NOAA 1345 East-West Highway Silver Spring, MD 20910	Includes all the features of DAMBRK and DWOPER plus additional capabilities. It is a computer program for the solution of the fully dynamic equations of motion for one-dimensional flow in open channels and control structures. Floodway concept formulation is unavailable. Calibration to actual flood events required. This model has the capability to model sediment transport. Program is supported by NWS. Supporting documentation is available at: http://www.fema.gov/mit/tsd/dl_fdwv.htm
	MIKE 11 HD (June 1999)	DHI Water and Environment	DHI Inc. Eight Neshaminy Interplex Suite 219 Trevose, PA 19053	Hydrodynamic model for the solution of the fully dynamic equations of motion for one-dimensional flow in open channels and control structures. The floodplain can be modeled separately from the main channel. Bridge flow computations need verification with results obtained using methodologies or models accepted for NFIP usage. Calibration to actual flood events required. Floodway concept formulation is unavailable. This model has the capability to model sediment transport. The web page is at: http://www.dhi.dk
	FLO-2D v. 2000.11 (December 2000)	Jimmy S. O'Brien, Ph.D., P.E.	FLO-2D Software, Inc. Tetra Tech, ISG P.O. Box 66 Nutrioso, AZ 85932	Hydrodynamic model for the solution of the fully dynamic equations of motion for one- dimensional flow in open channels and two-dimensional flow in the floodplain. Bridge or culvert computations must be accomplished external to FLO-2D using methodologies or models accepted for NFIP usage. Calibration to actual flood events required. Floodway computation is unavailable.

Numerical Models Accepted by FEMA for NFIP Usage

(Nationally Accepted Models)

TYPE	PROGRAM	DEVELOPED BY	AVAILABLE FROM	COMMENTS
Hydraulic Models: Determination of Water-surface Elevations for Riverine Analysis (cont'd)				
Two-dimensional Steady/Unsteady Flow Models	TABS –RMA2 v. 4.3 (October 1996) –RMA4 v. 4.5 (July 2000)	U.S. Army Corps of Engineers	Coastal Engineering Research Center Department of the Army Waterways Experiment Station Corps of Engineers 3909 Halls Ferry Road Vicksburg, MS 39180-6199	Limitations on split flows. Floodway concept formulation unavailable. More review anticipated for treatment of structures.
	FESWMS 2DH 1.1 and up (June 1995)	U.S. Geological Survey	U.S. Geological Survey National Center 12201 Sunrise Valley Drive Reston, VA 22092 http://water.usgs.gov/software/surface_water.html	Region 10 has conducted study in Oregon. Floodway concept formulation unavailable. This model has the capability to model sediment transport.
	FLO-2D v. 2000.11 (December 2000)	Jimmy S. O'Brien, Ph.D., P.E.	FLO-2D Software, Inc. Tetra Tech, ISG P.O. Box 66 Nutrioso, AZ 85932	Hydrodynamic model that has the capabilities of modeling unconfined flows, complex channels, sediment transport, and mud and debris flows. It can be used for alluvial fan modeling.
Floodway Analysis	SFD	U.S. Army Corps of Engineers/FEMA	Federal Emergency Management Agency Hazard Identification Branch Mitigation Directorate 500 C Street, SW Washington, DC 20472	Simplified floodway procedure for streams with no regulatory floodway limits.
	PSUPRO	Pennsylvania State University/ U.S. Army Corps of Engineers/FEMA	Federal Emergency Management Agency Hazard Identification Branch Mitigation Directorate 500 C Street, SW Washington, DC 20472	Encroachment analysis for streams with no regulatory floodway limits.

Numerical Models Accepted by FEMA for NFIP Usage

(Locally Accepted Models)

TYPE	PROGRAM	DEVELOPED BY	AVAILABLE FROM	COMMENTS
Hydrologic Models: Determination of Flood Hydrographs				
Single Event	AHYMO 97 (August 1997)	Albuquerque Metropolitan Arroyo Flood Control Authority, Anderson-Hydro	Anderson-Hydro 13537 Terragon Drive, NE Albuquerque, NM 87112	Flood hydrographs at different locations along streams. **Only accepted for usage and the default parameters in the model applicable within New Mexico.**
	Colorado Urban Hydrograph Procedure (CUHPF/PC) (May 1996)	Denver Urban Drainage and Flood Control District	Denver Urban Drainage and Flood Control District 2480 West 26th Avenue, Suite 156-B Denver, CO 80211	Flood hydrographs at different locations along streams. Hydrographs are routed using UDSWM2-PC (a modified version of the Runoff Block of EPA's SWMM). **Only accepted for usage and the default parameters in the model applicable within the Denver, Colorado, metro area.**
Hydraulic Models: Determination of Water-surface Elevations for Riverine Analysis				
One-dimensional Unsteady Flow Models	HCSWMM 4.31B (August 2000)	Stormwater Management Section Public Works Department Hillsborough County, Florida	Stormwater Management Section Public Works Department Hillsborough County, Florida 601 E. Kennedy Boulevard, 21st Floor P.O. Box 1110 Tampa, FL 33601	Modified version of EPA SWMM 4.31. The major modifications are: integrated the SCS-CN method into the model to calculate the rainfall-runoff process; allow up to 21 different Manning's coefficients for each cross-section; added 4 more fields to C1 line to calculate the exit, entrance, and other minor losses, and to stretch the pipe based on stability condition automatically create an ASCII file, HYDROG.DAT, containing hydrograph for each subbasin generated after each run. **Only accepted for usage and applicable within Hillsborough County, Florida.** The web page is at: http://www.hillsboroughcounty.org/publicworks/engineering/home.html
Two-dimensional Unsteady Flow Models	SHEET2D 9 (July 2000)	Tomasello Consulting Engineers, Inc.	Tomasello Consulting Engineers, Inc. 5906 Center Street Jupiter, FL 33458	DOS program applied to a grid network presenting the topography and hydrologic parameters of the watershed. Computes runoff for applied rainfall distribution for each grid based on SCS formula and input soil and depression storage. Routes overland flow via two-dimensional dynamic equations. Channel routings performed with special grids with assigned HEC-2 type cross sections. Sheetflow barriers used to represent dikes and roads separating sheetflow grids. Special grids are used to define cascading water management systems with stage/storage and hydrologic parameter inputs that connect to the sheetflow regime via structures described in input. Outputs include high water elevation, discharge from structures, sheetflow hydrographs, and stage hydrographs for any point in the model. **Only accepted for usage within Big Cypress Basin, Florida.**
Two-dimensional Steady/Unsteady Flow Models	DHM 21 (August 1987)	Theodore V. Hromadka II, Ph.D., Ph.D., P.E., P.H.	Department of Mathematics, Geology, and Environmental Studies California State University, Fullerton Fullerton, CA 92958-9020 thromadka@fail.com	Diffusion flow model which can route unconfined surface and open channel flows. Can be used to model alluvial flooding. Rainfall-runoff output can be used for hydrologic studies. Kinematic routing optional. Floodway concept formulation unavailable. **Only accepted for usage within the San Bernardino County Flood Control District, California.**