



Stormwater Management Software

A Comprehensive Guide to Selecting the Right Solution for You

- ▶ **StormCAD®**
Storm Sewer Modeling & Design
- ▶ **PondPack®**
Detention Pond Design & Urban Hydrology Modeling
- ▶ **CivilStorm®**
Fully-Dynamic Stormwater Analysis
- ▶ **CulvertMaster®**
Culvert Design & Analysis
- ▶ **FlowMaster®**
The Hydraulic Toolbox
- ▶ **HEC-Pack™**
Floodplain Hydrology & River Analysis



Contents

Stormwater Management

From site development and municipal projects to permitting and master planning, Haestad Methods stormwater products offer solutions for every aspect of stormwater management, including:

- ▶ Rainfall-runoff modeling of urban and rural watersheds
- ▶ Detention facility and appurtenance sizing
- ▶ Complete system master plans
- ▶ System evaluations based on U.S. and local regulations around the world
- ▶ Control strategy designs to minimize flooding and overflows
- ▶ Best Management Practices (BMP) evaluations



www.bentley.com

Site Development

For projects involving site development or detention and retention facility design, consider:

StormCAD® (Pages 4 & 5)

Design site drainage systems.

PondPack® (Pages 6 & 7)

Perform simple or complex detention pond designs.

CivilStorm™ (Pages 8 & 9)

Analyze interconnected pipe, pond, and open channel networks.

CulvertMaster® (Page 10)

Solve culvert hydraulics for outlet structures.

Urban Stormwater

For pursuing and completing municipal projects for cities, counties, or DOTs¹, apply:

StormCAD (Pages 4 & 5)

Design and analyze storm sewer systems.

CivilStorm (Pages 8 & 9)

Tackle any municipal project with this comprehensive solution.

CulvertMaster (Page 10)

Analyze and design culverts easily.

FlowMaster® (Page 11)

Handle preliminary and final designs of individual stormwater elements.





Agency Permitting

For projects involving permitting from FEMA², the National Flood Insurance Program, NPDES³, or any other agency, select:

StormCAD (Pages 4 & 5)

PondPack (Pages 6 & 7)

CivilStorm (Pages 8 & 9)

CulvertMaster (Page 10)

FlowMaster (Page 11)

HEC-Pack (Page 12)



Floodplain Modeling

For projects involving floodplain hydrology, floodplain mapping, river analyses, and GIS integration, HEC-Pack is the perfect solution.

HEC-Pack™ (Page 12)

HEC-Pack includes four programs developed by the USACE⁴ Hydrologic Engineering Center.

Graphical HEC-1 & HEC-HMS address floodplain hydrology.

HEC-RAS performs river analyses and floodplain mapping and design.

HEC-GIS (aka HEC-GeoRAS) integrates HEC-RAS with GIS.



Master Planning

For completing master plans and prioritizing future improvements, select:

StormCAD (Pages 4 & 5)

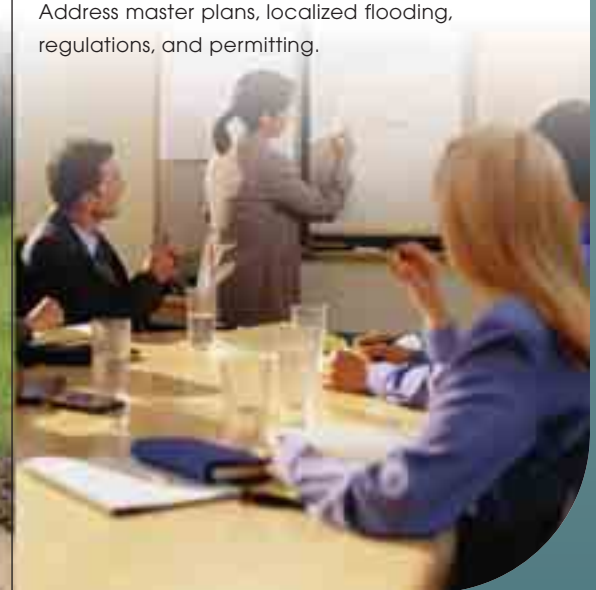
Simplify the exploration and assessment of “what-if” conditions with Scenario Manager.

PondPack (Pages 6 & 7)

Prepare comprehensive reports using the automated Report Builder.

CivilStorm (Pages 8 & 9)

Address master plans, localized flooding, regulations, and permitting.



StormCAD®

StormCAD offers a complete approach to storm sewer design and analysis, from rainfall to outlet. Its simple, elegant interface, computational strength, and support of industry-standard methodologies make it the intelligent choice for your storm sewer modeling needs.

Who Uses StormCAD?

The diverse ability of StormCAD to design and analyze storm sewer systems makes it ideal for:

- ▶ Commercial & industrial site designers
- ▶ Land developers
- ▶ Roadway/transportation designers
- ▶ Stormwater master planners
- ▶ Plan reviewers

“StormCAD helped us automate our storm sewer design process. It has allowed us to look at more alternatives and helped make our entire process more efficient.”

—City of Chippewa Falls Public Works (USA)

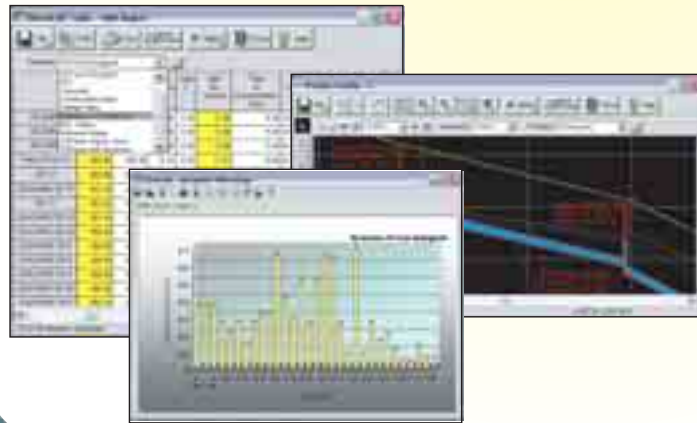
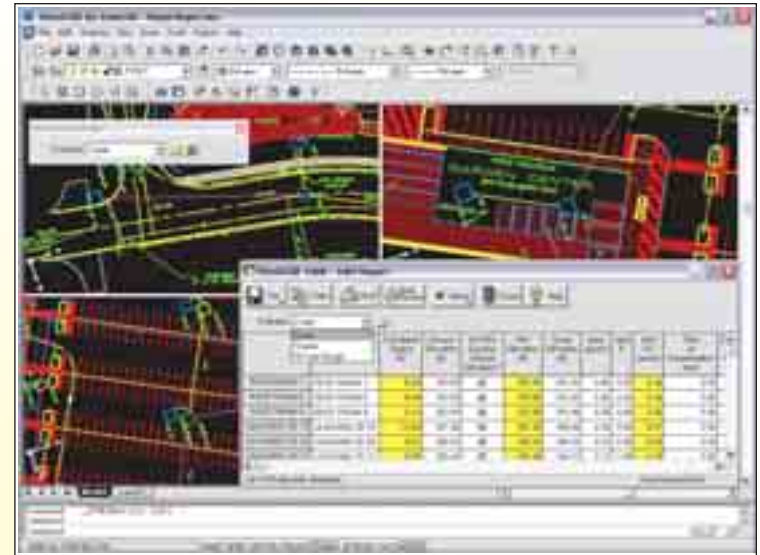
www.bentley.com/stormcad

Model Within Multiple Interfaces

Analyze storm sewer system performance, including HGLs, gutter spread and depth, and inlet capture within a **Stand-Alone, MicroStation, or AutoCAD** interface.

Automate System Design

Design new storm sewers or system improvements using the automated, constraint-based feature.



Customize Results Presentation

Document your results for project reports and plan sets using customizable reports, plan and profile drawings in DGN, DWG, or DXF format, and graphs.



Develop Models Easily

Manage your system data input and transfer using **User-Defined Attributes, Shapefile and Database Connections, and model conversions** from MicroStation and AutoCAD drawings.

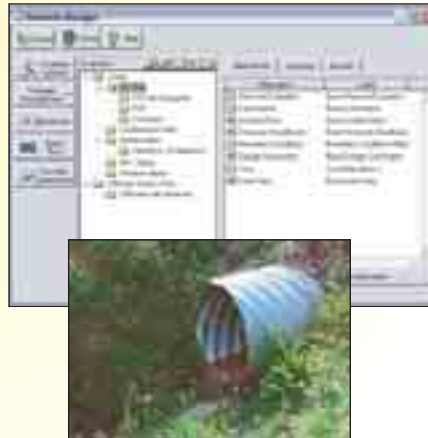
Prioritize System Improvements

Compare alternative designs or a variety of system conditions to prioritize capital improvements or develop system master plans.



Perform Project Cost Analyses

Compute project costs using your own unit cost data and adjustment factors to determine the financial impact of proposed improvements.



See Pages 14 & 15 for product details and SELECT information.

Reducing Overflows

User: *Aguas de Manizales (Colombia)*

Problem: In Colombia, over half of the City of Manizales' combined sewer system contains pipes at slopes greater than 10%, and in some cases, in excess of 50%. This topology plus Colombia's heaviest rainfall intensities and frequent seismic activity challenges engineers to look for innovative solutions. Aguas de Manizales and the National University of Colombia developed a StormCAD model to evaluate rehabilitation strategies to reduce constant overflows and failing pipes in the system.

Solution: Andres Hoyos built a StormCAD model of the San Luis Creek basin using StormCAD's shapefile connection utility and calibrated the model under various loading conditions using a wealth of available field data. The calibration resulted in "excellent agreement between modeled and observed results" that allowed the City to make sound decisions from the model.

Once the problem areas were defined, scenarios were developed to compare various solutions. Special constraints were created in StormCAD's automated design utility to maintain the existing depths and slopes. "The flexibility of StormCAD allowed us to investigate a wide range of alternatives, thus guaranteeing the most economic option for the rehabilitation," remarked Hoyos.

PondPack®

PondPack allows engineers to model any project from basic site designs to complex drainage studies. The robust calculation engine simplifies detention pond design while handling the complexity of interconnected pond modeling.

Who Uses PondPack?

PondPack is an intuitive and powerful solution that will increase workflow efficiencies for the following users:

- ▶ Detention & retention facility designers
- ▶ Land developers
- ▶ Stormwater master planners
- ▶ Site designers
- ▶ Regional drainage planners
- ▶ Regulatory reviewers
- ▶ BMP designers and reviewers

“PondPack is a wonderful tool for the design and analysis of SWM facilities. It certainly reduced our design time since we began using it.”

—Joyce Engineering Corporation

www.bentley.com/pondpack



Perform Complete System Analyses

- ▶ **Model** rainfall runoff from urban and rural watersheds to **design** detention and retention facilities, outlet structures, and channels.

Track Project History

- ▶ **Track** the design history of a project file and revert to previous designs with the click of a button.

Build Customized Reports

Document your results for system master plans and drainage studies by building customized reports and graphs. ▶





Automate Pond & Outlet Design

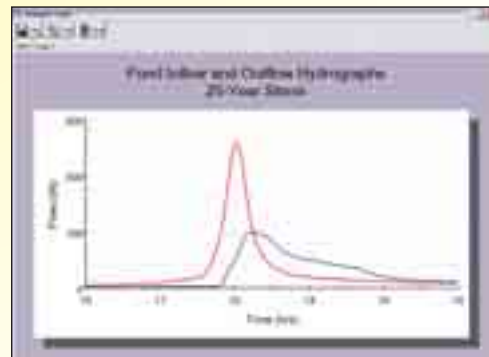
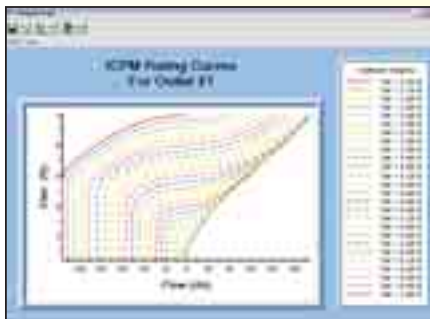
- Compare alternative designs for ponds and outlet structures for use in master plans, drainage studies, and BMP submittals.

Account for Travel Time & T_c

- Attenuate flows and account for travel time by routing hydrographs and calculating time of concentration quickly and accurately.

Model Interconnected Ponds

- Evaluate simple to complex hydrologic networks for existing or proposed conditions, including Interconnected Ponds, and calculate first-flush volumes to meet BMP requirements.



See Pages 14 & 15 for product details and SELECT information.

From Hand-Calcs to High-Tech

Users: Sullivan, Donahoe & Ingalls (SDI), (USA)

Problem: Zeke Moore, of SDI in Virginia, was faced with bringing an old, unfinished project into compliance with current regulations. The task involved making the design comply with the Chesapeake Bay Preservation Act and new water quality requirements and included three interconnected ponds with multiple split-flow considerations.

Moore performed numerous hand calculations to develop an outflow hydrograph to simulate the pond interconnections. Because of the hand calculations, the split-flow conditions could not be accounted for, resulting in a very conservative design.

Solution: Tired of the tedious process, Moore turned to PondPack for its ability to quickly and accurately route complex, interconnected pond and outlet designs.

The owner of an adjacent golf course approached SDI to provide additional water sources for their sprinkler system. Using PondPack, Moore modified the original design and completed the model in six hours.

PondPack has allowed SDI to create innovative solutions for stormwater management problems, while maintaining the firm's design integrity and its ability to meet regulatory requirements.

CivilStorm is a **fully-dynamic** hydraulic model developed for the analysis of complex stormwater systems. It is unprecedented in its coupling of vast computational ability with a straightforward, feature-rich interface.

Why Use CivilStorm?

CivilStorm assists both engineers working on complex land development projects and municipal engineers involved with large-scale stormwater management studies by providing a solution to:

- ▶ Analyze drainage and detention facilities for systems with hydraulically-connected elements
- ▶ Develop stormwater master plans
- ▶ Perform water quality studies
- ▶ Prioritize the rehabilitation of an existing system
- ▶ Evaluate systems with stormwater pumping

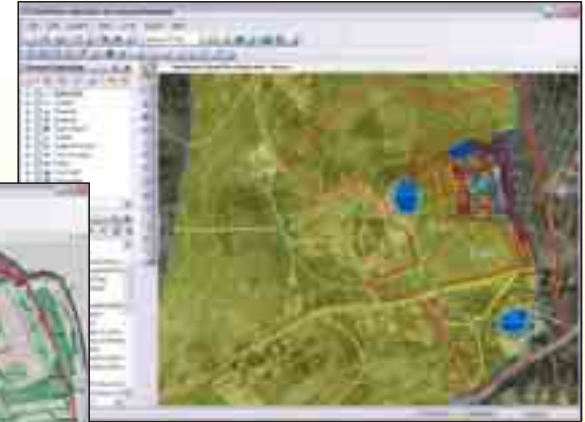
“As with all Haestad Methods products, the state-of-the-art CivilStorm software is the ultimate modeling software for stormwater modeling.”

—City of Tucson, Arizona (USA)

www.bentley.com/civilstorm

Model in Geospatial Environments

Map and **model** your systems in a scaled environment whether you work in the **Stand-Alone**, **MicroStation**, or **AutoCAD** interface.



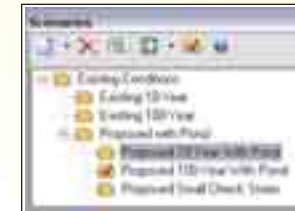
Analyze Complex Systems

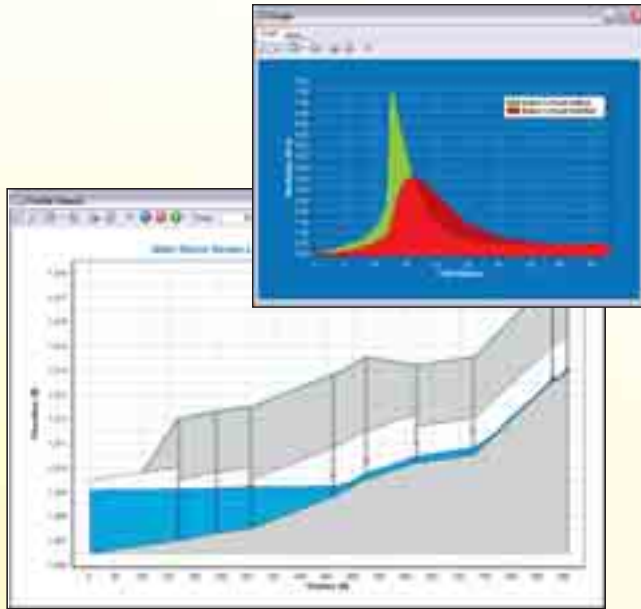
Perform **comprehensive analyses** of all aspects of your system: rainfall, runoff, inlet capture and bypass, gravity and pressure piping, ponds, outlet structures, open channels, culverts, and more.



Optimize System Performance

Compare alternative designs or proposed rehabilitation methods for a variety of system conditions (including pre- and post-development).





Present Comprehensive Results

- Develop comprehensive reports, including tables, dynamic graphs, profiles, maps, and more, for use with **system master plans** or studies and project plan sets.



Fully-dynamic modeling of systems with:

- **Inlets**
- **Storm Sewers**
- **Open Channels**
- **Streams**
- **Culverts**
- **Pump Stations**
- **Control Structures**
- **Overflows**
- **Detention Ponds**

Experience the Dynamic Calculation Engine

Calculate your model with the new fully-dynamic engine, which solves using either the **Saint Venant equations** or the globally-accepted **SWMM algorithm**.

See Pages 14 & 15 for product details and SELECT information.

Applying CivilStorm

Analyze Complex Systems

Drainage designs can be tricky, even for small sites. A storm sewer may discharge to a detention facility whose water surface elevation creates a tailwater condition on the upstream sewer, affecting its capacity. Additionally, the engineer may consider hydrograph attenuation due to storage. CivilStorm handles these complex issues with ease, preventing the inadvertent overdesigning that often accompanies less sophisticated analysis approaches.

Design for System Rehabilitation

In rehabilitating existing systems, engineers must find the most feasible and cost-effective solutions that maximize benefits. System flooding and overflows are a major concern. To alleviate the problems, engineers may consider measures such as parallel storm sewers or overflow channels. CivilStorm is the perfect solution for these types of challenges.

Simulate Pumping Systems

Pump stations are an integral part of many stormwater systems, especially in regions with low-lying or flat topography. CivilStorm integrates wet wells and pumps directly into the overall system model and allows for the review and development of pump operational strategies to improve efficiency.

CulvertMaster is the best tool available for solving culvert hydraulics. The results are fast, report-ready, and stress-free. Incredibly flexible, it builds on the input you have while providing what you are missing.

Why Use CulvertMaster?

CulvertMaster is a powerful, yet easy-to-use solution for the design and analysis of culverts and is capable of:

- ▶ Quickly calculating hydraulics for simple culverts with known characteristics
- ▶ Analyzing more complex systems with multiple barrels, different shapes and sizes, and roadway overtopping
- ▶ Developing and comparing several proposed design options
- ▶ Handling backwater and drawdown conditions and free-surface, pressure, or transitional flow

“CulvertMaster really helps us to reduce schedules in order to meet the client’s requirements.”

—Walsh Peru S.A. (PERU)

www.bentley.com/culvertmaster

Modify & Compare Designs

Design and analyze culvert hydraulics using industry-standard FHWA HDS-5 methodologies.



Review Data Quickly

Easily manage your data within tabbed dialog worksheets and FlexTables.



Calculate Flows

Evaluate flows using the Rational Method or SCS Graphical Peak Method.



Customize Presentations

Document your results by building customized reports and graphs for project submittals.



See Pages 14 & 15 for product details and SELECT information.



FlowMaster is a complete hydraulic toolbox for the design and analysis of pipes, ditches, open channels, weirs, orifices, and inlets. It will be the easiest model you will ever use, but so powerful you will be solving flow problems in minutes.

Why Use FlowMaster?

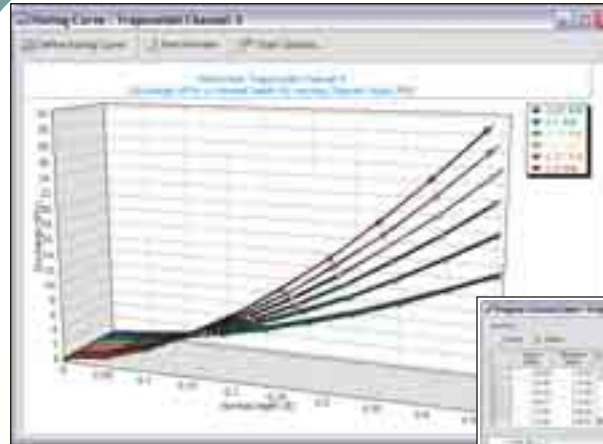
With FlowMaster, perform preliminary and final designs for roadway drainage and permitting purposes quickly and efficiently by:

- ▶ Managing and comparing multiple designs
- ▶ Computing gradually-varied flows for any free-surface flow element
- ▶ Quickly calculating various pressure pipe parameters
- ▶ Designing hydraulic elements using industry-standard methodologies

“FlowMaster has been a very effective tool for modeling highway and land development drainage.”

—McCormick Taylor, Inc.

www.bentley.com/flowmaster



Calculate Structure Hydraulics

Design and analyze any type of hydraulic structure for preliminary and final designs all within one program.



Build Graphs & Reports

Document your results by building customized reports and graphs for project submittals.



Enter Data Only Once

Transfer data between projects and other Haestad Methods applications and easily manage data with the Project Explorer.



See Pages 14 & 15 for product details and SELECT information.



HEC-Pack includes Graphical HEC-1® and HEC-HMS for performing floodplain hydrologic analyses, HEC-RAS for performing water surface profile analyses, and HEC-GIS (HEC-GeoRAS) for leveraging geospatial tools with HEC-RAS.

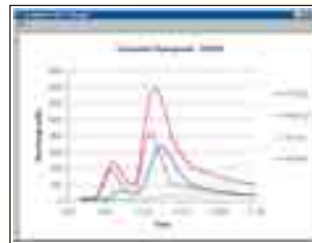
Why Use HEC-Pack?

HEC-Pack is a suite of software designed to model and map the hydrologic and hydraulic characteristics of floodplains and rivers and is ideal for:

- ▶ Graphical layout of watersheds and floodplain systems
- ▶ Transforming precipitation data into runoff hydrographs for routing through watersheds
- ▶ Evaluating floodway encroachments for floodplain management and insurance studies
- ▶ Viewing results in 3D with X-Y-Z perspective plots and standard reports

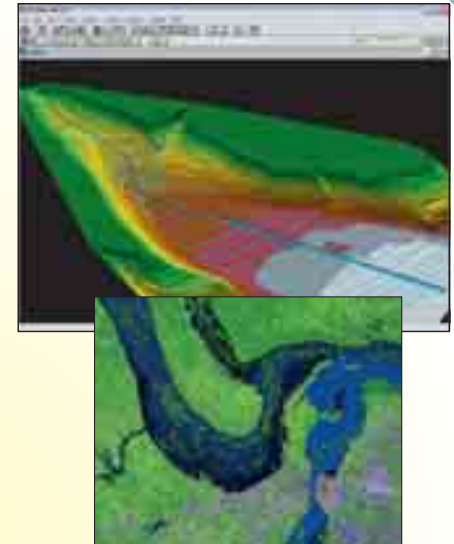
Integrate with GIS

Import geometric data from existing DTMs and import HEC-RAS water surface profiles into HEC-GIS to perform additional spatial analyses and mappings. ▶



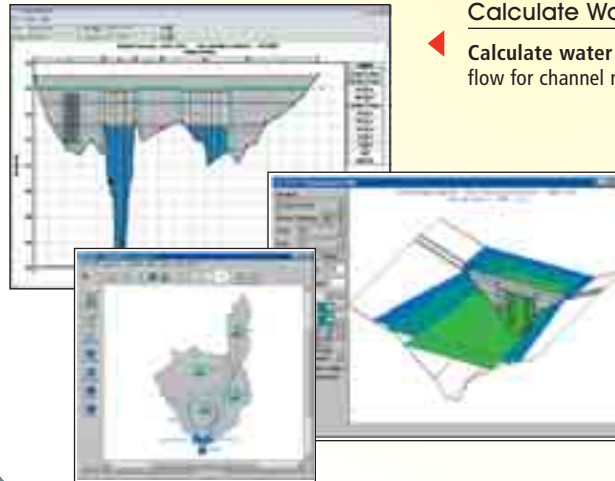
Generate Runoff Hydrographs

◀ Generate and route runoff hydrographs using methods such as SCS, Clark, Kinematic Wave, and Modified Puls.



Evaluate Bridge Scour

Compute bridge scour based on the routines outlined in HEC-18. ▼



Calculate Water Surface Profiles

◀ Calculate water surface profiles based on steady, gradually-varied flow for channel networks, dendritic systems, or a single river reach.

Model Bridges, Levees, & Culverts

◀ Determine changes in water surface profiles due to levees, bridges, and culverts.

See Page 15 for SELECT information.



Comprehensive reference books were developed by compiling the knowledge of modeling experts from around the world to bridge the gap between water resources theory and practice by:

- ▶ Explaining model development
- ▶ Teaching calibration techniques
- ▶ Discussing real-world applications
- ▶ Revealing modeling tips and tricks

www.bentley.com/library

STORMWATER MANAGEMENT BOOKS



***Stormwater Conveyance Modeling and Design* (7.5 CEUs)**

A comprehensive guide for planning, designing, and implementing stormwater conveyance systems.



***Floodplain Modeling Using HEC-RAS* (7.5 CEUs)**

Learn how to model floodways, bridges, and culverts, analyze bridge scour, and much more.

OTHER BOOKS FROM BENTLEY INSTITUTE PRESS

- *Wastewater Collection System Modeling and Design* (8.0 CEUs)
- *Advanced Water Distribution Modeling and Management* (11.0 CEUs)
- *Water Security Summit Proceedings*

Training

Enhance Your Modeling Experience



Maximize the benefits of your modeling investment with professional training from the Bentley Institute. With several courses offered in stormwater modeling, you will learn a mix of theory, software, and practical application from expert instructors.

Other Topics Include:

- ▶ Modeling Watershed Hydrology
- ▶ Modeling for Flood Insurance Studies
- ▶ NPDES Phase II Permitting
- ▶ Navigating the FEMA Approval Process

COURSE TOPICS

- ▶ **Storm Sewer Design and Modeling** (1.6 CEUs)
Apply StormCAD to analyze and design inlet networks and storm sewer systems. Apply FlowMaster and CulvertMaster for open channel and culvert design.
- ▶ **Stormwater System Design and Modeling** (4.0 CEUs)
Use PondPack to learn detention pond modeling and design techniques. Use CivilStorm to analyze fully-integrated systems of stormwater elements.
- ▶ **Water Surface Profiles** (4.0 CEUs)
Apply HEC-RAS to model open channels and establish floodplain boundaries. Exercises include channel modification, culverts, and advanced bridge modeling.

Visit www.bentley.com/training/haestad for training schedules and pricing.



HAESTAD METHODS STORMWATER SOLUTIONS FEATURE COMPARISON

Type of Work	Product				
	StormCAD	PondPack	CivilStorm	CulvertMaster	FlowMaster
Storm Sewer Design	✓				
Storm Sewer Analysis	✓		✓		
Inlet Design	✓				✓
Inlet Analysis	✓		✓		✓
Pond Design		✓			
Pond Analysis		✓	✓		
Culvert Design				✓	
Culvert Analysis		As Pond Outlets	✓	✓	
Open Channel Design					✓
Open Channel Analysis (Normal Depth)		✓		As Tailwater Condition	✓
Open Channel Analysis (Gradually-Varied Flow)			✓		Prismatic Only
Weir Structures		✓	✓	✓	✓
Orifice Structures		✓	✓		✓
Comprehensive Analysis			✓		
Stand-Alone Interface	✓	✓	✓	✓	✓
MicroStation® and AutoCAD® Integration	✓		✓		
Background Image Support	✓		✓		
Accepted by FEMA	✓	✓	Pending	✓	✓



Bentley SELECT is our premier service and technology subscription program. With SELECT, you get the latest advancements in technology delivered right to your desktop, and unlimited, around-the-clock access to a wide range of support services.

Why Choose SELECT?

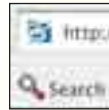
- ▶ **Exclusive** licensing privileges
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- ▶ **Comprehensive** technical support
- ▶ **Online** account management
- ▶ **Special** discounts and programs
- ▶ **Increased** user productivity
- ▶ **Maximized** return on investment

THE BENEFITS OF SELECT



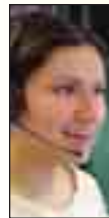
Exclusive Licensing Privileges

- ▶ **Network Licensing** allows you to install your products on an unlimited number of computers on a local area network for no additional charge.
- ▶ **Evaluation Licenses** offer a 30-day expiring license to try out our software products.
- ▶ **Home-Use Licensing** extends the use of Bentley products to the comfort of your home.
- ▶ **Bentley Redline** and **Bentley View** are tools for viewing, printing, and redlining DGN, DWG, and raster files.



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- ▶ Communicate interactively with the technical support group via e-mail, news-groups, Internet chat, and **analyst-driven desktop support**.



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“We've been using Haestad Methods software for many years and they have the best technical support and civil engineering software of any we've ever dealt with. Keep up the great work!”

—Hatch-Mott MacDonald (USA)

“Haestad Methods products remind me of Santa; capable of turning dreams into reality and making the use of each software program a joyful experience.”

—Dar Al-Handasah Shair (EGYPT)

“Haestad Methods software has been great to work with, easy to learn, and very useful in my everyday design tasks. I would recommend this software to any firm involved in storm, water, and wastewater system design.”

—Olson & Morris (USA)



“Haestad Methods software not only focuses on results, but also on ease of use so that a part-time modeler can obtain results that are presentable.”

—Gwinnett County, Georgia (USA)

“Your products are consistently of excellent quality and have rapidly become the go-to software of choice for most problems.”

—CH2M Hill (USA)

“Haestad Methods software is excellent for solving most hydraulic problems. In Mexico, it is becoming more and more known in private engineering firms and its use is now accepted by most government agencies, municipal, state, and federal.”

—Mega Tecnologias De Mexico (MEXICO)