



SewerGEMS®

Urban Sanitary and Combined Sewer Modeling

From urban sewer planning to overflow remediation analysis to optimized best management practices designs, SewerGEMS provides an easy-to-use environment for engineers to analyze, design, and operate sanitary or combined conveyance sewer systems, using built-in hydraulic and hydrology tools, and a variety of wet-weather calibration methods.

Superior Interoperability

With SewerGEMS, utilities and consultants can choose to model from within four platforms, while accessing a single, shared, project data source. These platforms include:

- Windows stand alone for ease of use, accessibility, and performance
- ArcGIS for GIS integration, thematic mapping, and publishing
- MicroStation for bridging geospatial planning and engineering design environments
- AutoCAD for convenient CAD layout and drafting

Modeling teams can leverage the skills of engineers from different departments, and engineers can flatten learning curves by choosing the environment they already know and provide results that can be visualized on multiple platforms.

Streamlined Model Building

Engineers can leverage geospatial data, CAD drawings, SCADA data, databases, and spreadsheets to jumpstart the model building process. SewerGEMS provides synchronized database connections, geospatial links, and advanced model-building modules that connect with virtually any digital data format. SewerGEMS also provides drawing and connectivity review tools to guarantee a hydraulically coherent model.

Wastewater and Stormwater Loading Allocation and Estimation

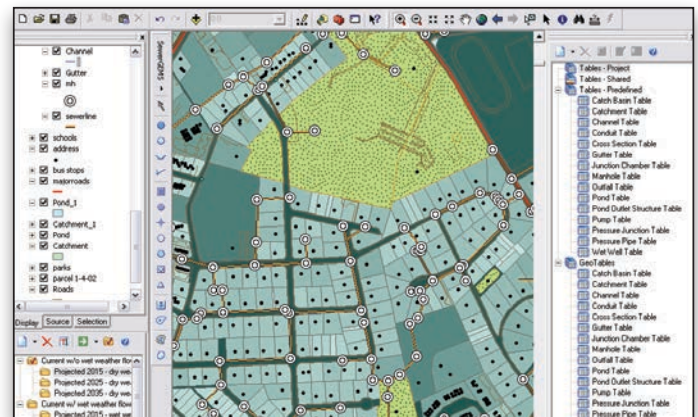
The included LoadBuilder module helps modelers allocate sewer loads based on a variety of GIS-based sources such as customer water use billing data, area-wide flow measurement, or polygons with known population or land use. Sewer loading can also be applied as user-defined hydrographs, pattern-based loads, and unit loads. Engineers can access and customize the comprehensive unit (dry weather) load engineering library with numerous typical unit loads based on population, area, count, and discharge.

SewerGEMS also allows users to input and save an unlimited number of flow patterns, to accurately model flow changes over the course of a day. Engineers can also load models with wet weather runoff flows derived from precipitation, using SewerGEMS built-in rainfall distributions, or user-defined rainfall events.

Runoff flows are modeled and calibrated using a choice of hydrograph methods, including RTK, SCS, Modified Rational, EPA-SWMM, or user-defined generic unit hydrographs.

Easy Model Management with Scenarios

With SewerGEMS scenario management center, users can configure, evaluate, visualize, and compare an unlimited number of scenarios within a single file.



SewerGEMS can be used from within MicroStation, AutoCAD, ArcGIS, or as a stand-alone application.

Engineers can evaluate design, operational, sanitary loading, and network topology strategies for better decision-making support.

Advanced Analysis

SewerGEMS can model the effect that low impact development controls have in retaining runoff before it enters the sewer system. With SewerGEMS, users can also model hydrogen sulfide formation, with a view to decreasing the risk of pipe damage from H₂S formation, preventing odor complaints, and improving workers' safety.

Multiple Solvers

Modelers can easily switch among multiple solvers, according to the type of system they are analyzing:

- To solve the Saint Venant equations, users can choose between SewerGEMS' explicit EPA SWMM solver and the implicit dynamic wave engine. These two dynamic engines account for storage effects within structures and quantify overflows should they occur.
- The convex/gradually varied flow solver uses convex routing to determine gravity sewer flows and gradually varied flow (backwater analysis) to determine hydraulic properties once the flow is known. Pressurized flows and pumping calculations are especially stable when using this solver option. Use steady-state analysis for extreme flow conditions and to automatically design sanitary sewers, or extended period simulations to analyze how the sanitary sewer system behaves over time.
- With the rational/gradually varied flow solver, peak flows in the storm sewer system are calculated using the rational method. Use this solver to analyze peak flow conditions, or to automatically design storm sewers.

For more information about the solvers supported by SewerGEMS, download *What Is the Right Way to Analyze Collection System Hydraulics?* from www.bentley.com/SewerStormPaper.

System Requirements

Refer to the 'Installation Requirements' section of the SewerGEMS ReadMe file:

www.bentley.com/SewerGEMS-Spec

Platform pre-requirements:

SewerGEMS runs without platform restrictions as a stand-alone application.

It also runs from within ArcGIS, AutoCAD, and MicroStation. The requirements are also available in SewerGEMS' ReadMe file.

Find out about Bentley at: www.bentley.com

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SewerGEMS At-A-Glance

Interface and Graphical Editing

- Stand-alone Windows interface included
- Ability to run within ArcGIS (ArcMap license required)
- Ability to run within MicroStation (MicroStation license required)
- Ability to run within AutoCAD (AutoCAD license required)
- Unlimited undo/redo of layout and editing
- Element morphing, splitting, and reconnection
- Merge nodes in close proximity tool
- Automatic element labeling
- Scaled, schematic, and hybrid environments
- Element prototypes (one-click setup)
- Dynamic zooming
- Multiple background file support
- Image, CAD, and GIS background layer support
- Automatic input and result fields filtering (based on solver used)

Interoperability and Model Building

- Single set of model files for four compatible interfaces
- Import/export of InRoads® Storm and Sanitary files
- Import of MX Drainage files
- Shapefile, Geodatabase, Geometric Network, and SDE support
- Polyline-to-pipe conversion from DXF and DWG files
- Oracle Locator/spatial data connection
- GIS-ID property (to maintain associations between records in source file and elements in model)
- SCADACONnect for live data connections (from SCADA systems)
- Seed files (new models template)
- Spreadsheet, database, Shapefile, and ODBC connections
- Automated assignment of elevation data to manhole elements
- Unified file format with SewerCAD, CivilStorm, and StormCAD

Hydraulics and Operations

- Two engines for solving the full set of St. Venant equations included
- Implicit dynamic engine included
- Explicit dynamic engine included (EPA-SWMM)
- Gradually varied flow-convex engine included (SewerCAD's engine)
- Extended period simulations
- Steady-state simulations
- Automatic constraint-based design for sanitary and storm sewers
- Gradually varied flow-rational engine included (StormCAD's engine)
- Peak flow simulations
- Evaporation definition
- Long-term continuous simulation
- HEC-22 inlet capacity calculations
- HEC-22 node headloss calculations
- Support for V-shaped and parabolic gutters
- Support for culvert headwalls and endwalls
- Aquifer simulation
- Control structures (weirs, orifices, depth-flow curve)
- Rule-based controls
- Pollution analysis with optional definition of land use categories and land surface characteristics
- Variable-speed pumping
- Flow profile methods: capacity and backwater analysis
- Totalizing flow meters
- Air valves for high points in force mains
- Complex manifolded pump stations/force mains
- SCADA element
- Low impact development control analysis
- Hydrogen sulfide formation modeling

Results Presentation

- Direct ArcMap visualization and mapping
- Thematic mapping
- Dynamic, multi-parameter, and multi-scenario graphing
- Advanced dynamic profiling
- Advanced tabular reporting with FlexTables®
- Property-based color coding and symbology
- Property-based annotation
- Publishing of i-models in 2D or 3D, including to Bentley Map Mobile

Model Management

- Custom data fields (with user-assigned or formula-based values)
- Unlimited scenarios and alternatives
- Comprehensive scenario management
- Scenario comparison
- Tabular reports global editing
- Sorting and persistent filtering on tabular reports
- Statistical analysis from tabular reports
- Customizable engineering libraries
- Dynamic and static selection sets
- Global engineering units management
- Drawing review tools for connectivity consistency
- Automatic topology review
- Orphaned node and dead-end pipe queries
- Sub-model management
- Surface water flow direction displayed across any terrain
- ProjectWise® and ProjectWise® Geospatial Management support

Sanitary Load Allocation and Estimation

- Automatic sanitary load allocation from geospatial data
- Geospatial load allocation from billing meters
- Load allocation using flow monitoring distribution
- Land use-based load distribution
- Sewer load assignment based on phased land use projections and population projections
- Dry-weather load assignment using hydrographs, unit loads, and pattern-based loads
- Customizable area-, count-, discharge-, and population-based unit sanitary loading library
- Inflow and infiltration calibration using RTK tables

Stormwater Load Allocation and Estimation

- Runoff methods: SCS Unit Hydrograph, Modified Rational Method, EPA SWMM, RTK Unit Hydrograph, generic Unit Hydrograph, Time-Area Method, ILSAX and user-defined hydrograph
- Time of concentration methods: User-defined, Carter, Eagleson, Espey/ Winslow, Federal Aviation Agency, Kerby/Hathaway, Kirpich (PA and TN), Length and Velocity, SCS Lag, TR-55 Sheet Flow, TR-55 Shallow Concentrated Flow, TR-55 Channel Flow, Friend, Kinematic Wave, Bransby-Williams, and UK standard
- Loss Methods: Constant loss rate, Green and Ampt, Horton, Initial Loss and Constant Fraction, Initial Loss and Constant Loss Rate, SCS Curve Number

PondMaker: Pond Outlet Design

- Automatic update of worksheet containing design data for multiple design trials of a single pond
- Multiple pond designs possible
- Maximum outflow rates establishment (user-defined or pre-development flows)
- Post-development pond inflows computation
- Pond size requirements estimation
- Pond geometry design (grading plan or underground storage)
- Outlet structure design
- Pre- and post-development peak flow and volume comparison
- Hydrograph routing through ponds