



Mine Water Software Solution

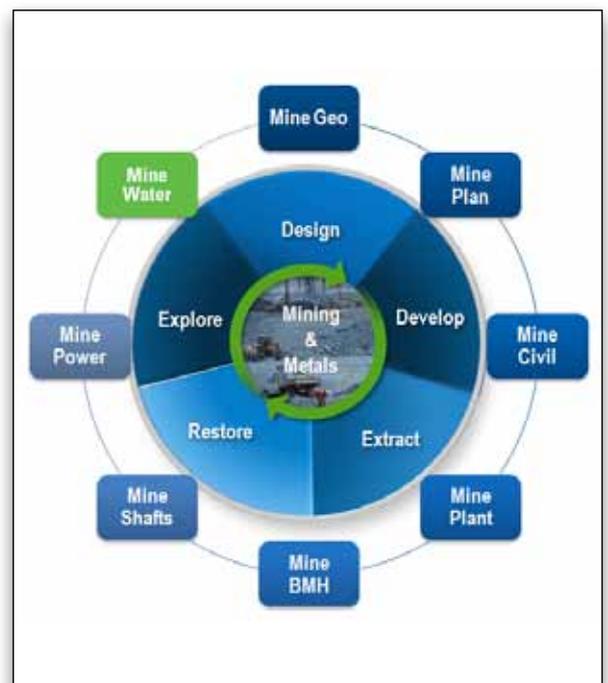
Integrated Water, Wastewater, and Stormwater Systems Modeling Solution for the Mining Sector

Bentley® enables mine owner-operators to successfully provide sustainable water and wastewater systems with a comprehensive set of software tools to design, build, and operate water and wastewater infrastructure that is easily deployed to serve the challenging needs of mining operations.

Water is essential to mining operations, as well as to the mining community, facility, and township. Therefore, it is imperative that the water and wastewater systems servicing each of these always be managed effectively and sustainably. Bentley's mine water solution is a subset of its overall mining and metals solution. The products and services that comprise it intraoperate with other Bentley tools, such as those for geotechnical, plant, and civil engineering. The Bentley mine water solution encompasses software for stormwater systems, potable water distribution, and wastewater collection, the technology behind their innovative capabilities has made Bentley the acknowledged world leader in water, wastewater, and stormwater modeling and analysis.

The mine water products support the needs of individual engineers and modelers, and work seamlessly with the ProjectWise® collaboration platform that enables multidiscipline project teams to easily manage, find, share, and visualize geospatial and CAD content, other project data, and Microsoft Office documents. The products can be cost-effectively deployed by mine owner-operators, engineering/procurement/construction (EPC) contractors, and other consulting engineers that work with and support the mining industry.

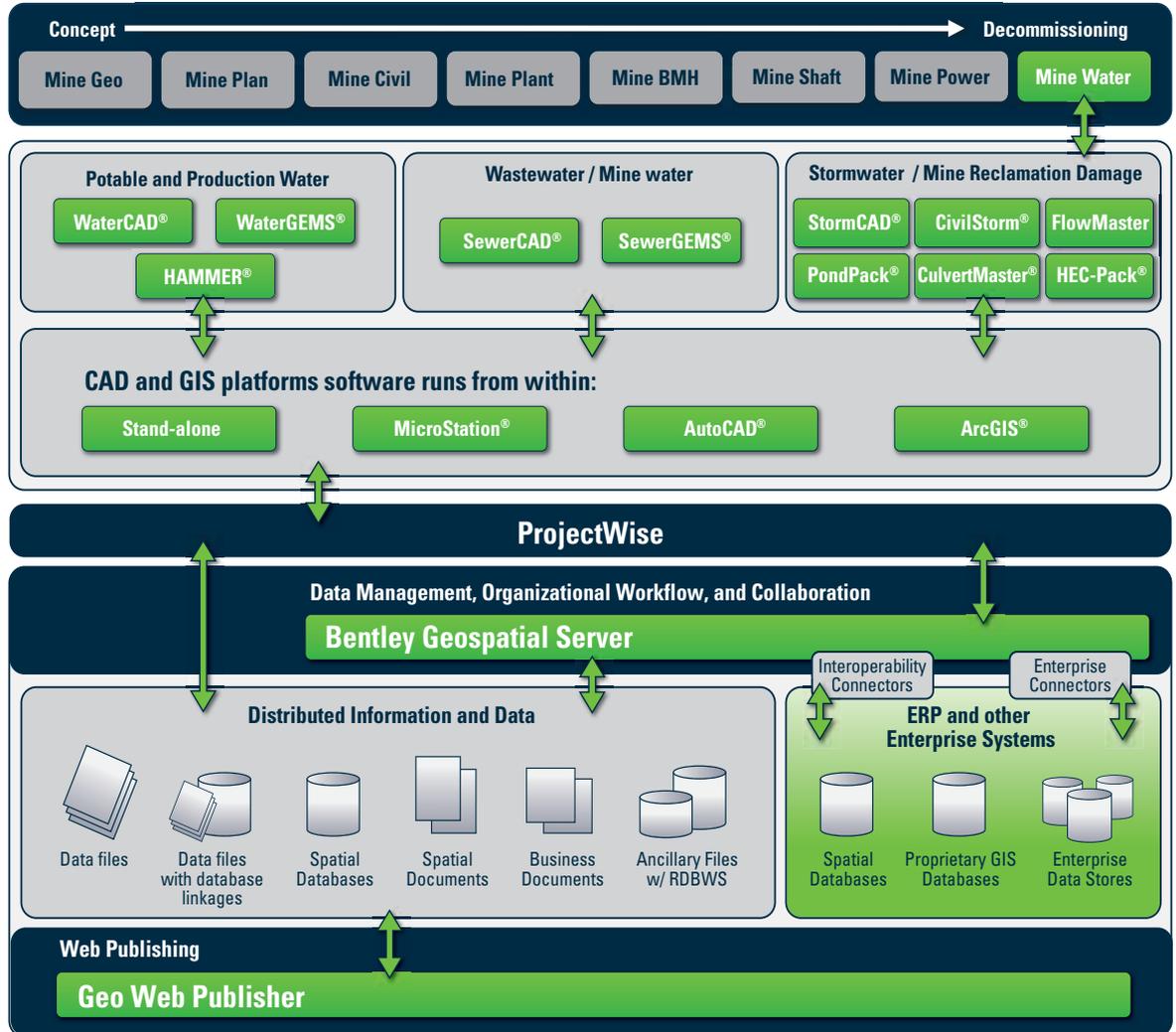
Major mining organizations such as International Power, BHP Billiton Mitsubishi Alliance, and LGL Gold rely on Bentley water products every day.



Mine Water is part of Bentley's comprehensive solution for mine owner-operators



The Solution Architecture:



Stormwater Systems

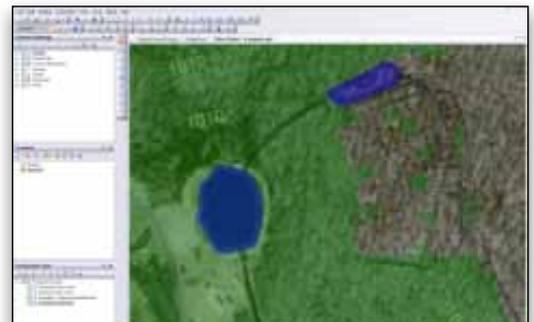
Mine planners and engineers must ensure proper stormwater drainage of explored areas to prevent the mine from flooding. At the same time, they must protect areas surrounding the mine to prevent extracted materials from being washed away and area dams from overflowing. These drainage goals are driven by not only safety concerns, but also regulatory compliance.

Bentley's stormwater modeling products help solve many stormwater-related challenges during and after exploration, including:

- Site design – for projects involving site development or detention and retention facility design,
- Urban stormwater – for pursuing and completing municipal projects for mining township developments,
- Master planning – for completing master plans and prioritizing future improvements,
- Floodplain modeling – for projects involving floodplain hydrology and mapping.

Stormwater system design and analysis products in Bentley's Mine Water solution include the following:

- **StormCAD** – comprehensive modeling software for the design and analysis of storm sewer systems. This software helps mining planners and engineers design mining site drainage systems, from rainfall to outlet.



Design detention and retention facilities, outlet structures, and channels, with PondPack.

“Water is an integral part of all operations – no mine operates without managing water. Risks and opportunities must be managed at both corporate and site level.”

Source: Leading Practice Sustainable Development Program for the Mining Industry

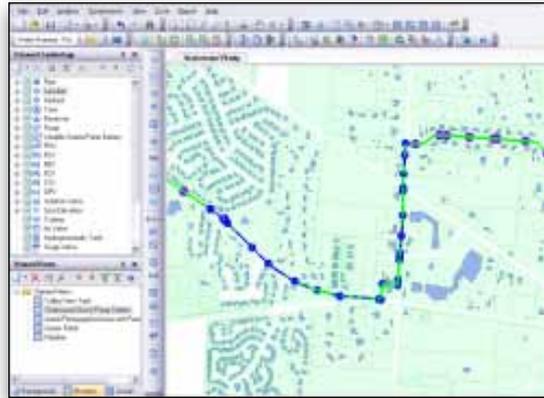


- **PondPack** – to help mining planners and engineers perform design and analysis for simple or complex detention and retention facilities, outlet structures, and channels.
- **CivilStorm** – for the analysis of complex stormwater systems. Engineers can use it to model inlets, storm sewers, open channels, streams, culverts, pump stations, control structures, detention ponds, and overflows. CivilStorm can be used 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, and evaluate systems with stormwater pumping.
- **CulvertMaster** – to solve culvert hydraulics. The results are obtained quickly and easily and are report ready.
- **FlowMaster** – for the design and analysis of pipes, ditches, open channels, weirs, orifices, and inlets. The software features an easy-to-use interface and can solve problems in minutes.
- **HEC-Pack** is a suite of software designed to model and map the hydrologic and hydraulic characteristics of floodplains and rivers. It is ideal for a variety of modeling tasks, from floodplain hydrology and mapping to river analysis and GIS integration.

Potable Water Distribution

Bentley provides design and analysis tools for potable water distribution. Among them are **WaterGEMS** and **WaterCAD** for the analysis and design of water distribution systems in mining townships. WaterGEMS and WaterCAD support automated fire flow analyses to ensure fire protection, water quality, criticality and flushing studies, and the automation of pipe design and model calibration using genetic algorithms. Energy cost analysis and pump scheduling optimization in WaterGEMS and WaterCAD help engineers achieve significant energy savings operating these water systems.

HAMMER helps mining engineers determine appropriate surge control strategies and reduce transients in pipelines. It uses the method of characteristics, the benchmark standard, and the most rigorous and robust algorithm for transient analyses. Engineers can run both transient and steady-state (for initial condition calculation) analyses in HAMMER, and choose to use it as a stand-alone product or with WaterCAD or WaterGEMS.



Identify, manage, and mitigate the risks associated with transients, with HAMMER.

Wastewater Collection

For wastewater collection, Bentley offers **SewerGEMS** and **SewerCAD** for system design and analysis. From overflow remediation and water quality analysis to mining township sewer planning and detailed network design, SewerGEMS and SewerCAD give users more engineering time. They also allow mining engineers to detect system bottlenecks easily, improve capacity, and limit sewer overflow, enabling mining companies to comply with sewer regulations set by regulatory agencies. Engineers can analyze sanitary or combined conveyance systems accurately with

Applications for mine planners, engineers, and operators of water systems, include:

Mining Infrastructure Planning

- ✓ Demand projections
- ✓ Capacity analysis
- ✓ Surge protection
- ✓ Disinfection
- ✓ Pressure regulation
- ✓ Repair/Replace decision support
- ✓ Storage and pump design
- ✓ Fire flow analysis
- ✓ Minimizing pumping costs and energy consumption

Operations

- ✓ Source blending
- ✓ Controlling non-revenue water (leakage)
- ✓ Asset registry maintenance
- ✓ Flushing schedules
- ✓ Operator training
- ✓ Pump energy cost analysis
- ✓ Trace analysis
- ✓ Failure analysis
- ✓ Contaminant intrusion
- ✓ Real-time operations decision support

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built-in hydrology tools, a variety of wet-weather calibration methods, and sewer loading allocation tools.



Design and rehabilitate sanitary sewers effortlessly with SewerCAD.

The Bentley Advantage

A commitment to interoperability – Bentley's mine water solution allows mining professionals to work with an entire suite of interoperable Bentley products that access Oracle Spatial, Esri ArcGIS data, and DGNs stored in a relational database management system (RDBMS). Or, they can leverage AutoCAD or ArcGIS data directly from the modeling products. The interoperability of Bentley products with users' existing technologies (including ArcGIS, AutoCAD, and MicroStation) extends the value of their current technologies and training investments.

More time engineering for increased productivity – Bentley water products use modern technology that maximizes return on investment. This technology allows users to spend more time solving engineering problems and less time modeling.

Support for the entire water lifecycle – Bentley's mine water solution meets the needs of mining and water

infrastructure professionals by covering the entire design, build, and operate lifecycle, and providing a comprehensive mapping, modeling, and engineering design environment.

Superior Hydraulic and Hydrology Technology

- Automated constraint-based design of water distribution systems, sanitary and storm sewers, and pond and outlet – for new designs or system improvements;
- Advanced scenario management to prioritize system improvements by comparing alternative designs or a variety of system conditions – for use in master plans, or drainage studies;
- Interconnected pond modeling to simulate tidal and tail-water effects in interconnected ponds – for an accurate understanding of real-world situations;
- Operating cost and energy usage minimization by:
 - » Analyzing when to use variable speed vs. constant speed pumping;
 - » Determining energy costs for different operating rules to find the best operational strategy;
 - » Finding optimal pump operation schedules;
- Water safety and security: Prevent, detect, and respond to emergencies and customer complaints by modeling emergency planning scenarios, real-time operations, and forensic analyses.
- Interoperability to run hydraulic and hydrology products stand alone or in up to four platforms: MicroStation, AutoCAD, ArcGIS, and PowerCivil; no other modeling software product lets users share models across different software platforms within a single product.

