12d® Model

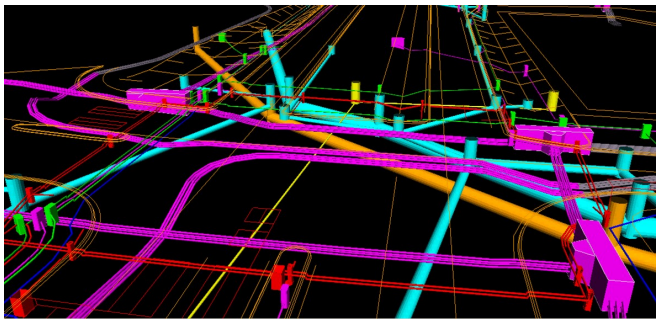
12d Synergy Enabled

Drainage & Utilities

12d Model's Drainage modules offer substantial benefits from conception to construction of piped drainage networks.

Drainage String for Network Design

The 12d Model Drainage String module allows the horizontal and vertical design of drainage networks using the drainage string, which consists of structures (manholes, pits, headwalls, *etc.*) joined by straight or curved conduits (pipes, culverts, channels). The module gives access to the Drainage Network Editor, which can be used to model almost any kind of service/utility network, whether gravity or non-gravity, wet or dry.



Users can design a complete drainage network and increase design quality through a holistic handling of design surfaces, other services, clash checking and trench quantities.

12d Model is the tool to create your drainage network. With inbuilt automated pipe grading functions, 12d can grade your drainage design with the click of a button.

12d Model handles whole projects, not just road or drainage requirements, enabling the management of all services, roads, and other surfaces in one system, reducing errors resulting from service clashes or design amendments.

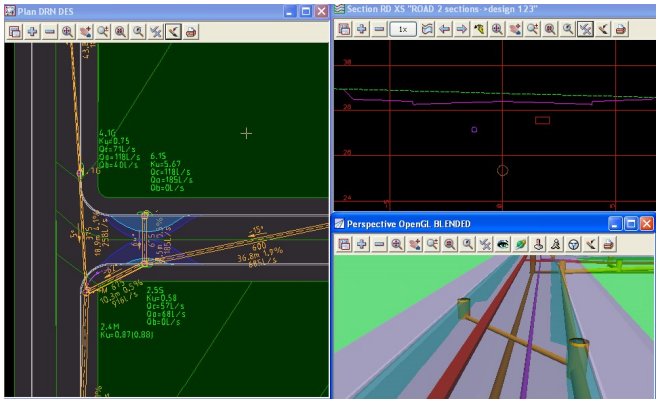
Drainage layout features include:

- Layout your complete drainage network inside 12d with invert levels set relative to finished design surface levels.
- Convert 2d CAD layouts to 3d drainage networks.
- Automatically set minimum pipe cover and grades with user defined settings.
- Powerful graphics to integrate network layout and vertical grading.
- Defines catchments with auto linking to inlets and labelling catchment plans
- Automatic service clash detection and reporting.
- Structure levels, invert levels and conduit grades can be set or modified graphically, parametrically, or by typed input.
- Structure and conduit types are user-definable; optionally you can change the thickness and connection points.
- Links to road design strings for set-out, road analysis and bypass.
- Links to catchment polygons for area, length and equal-area slope.
- Links to other service models to avoid whilst grading.
- Interfaces with external drainage packages such as Drains, PC Drain, XP-SWMM, RAT2000, RATHGL, Micro Drainage and spreadsheets.
- Drainage long-section and plan plots can be customised and output automatically.
- Drainage quantities and excavation volumes can be customised and output automatically.
- Automatic service clash detection and reporting.

Users can design a complete drainage network and increase design quality through a holistic handling of design surfaces, other services, clash checking and trench quantities.

Drainage Analysis

The Drainage Analysis module allows for Rational Method Hydrology to determine flow rates to each pit and within each conduit and essentially allows users to perform a hydraulic analysis of a drainage network.



Site specific rainfall data can be entered and stored in a rainfall file that can be utilised across many projects.

Using the Rational Method, catchments with variable runoff characteristics can be created and maintained, with time of concentrations calculated by typed input or automatically determined by graphical flow path creation.

Multiple catchments can be assigned to inlets in the drainage network. The hydraulic requirements of the drainage network are automatically calculated based on rainfall intensities and return periods from the rainfall file.

Pipes within the network, including culverts, are then sized and managed in the Network Editor with overland and

bypass flows able to be calculated and graphically represented.

Ku losses within pits and flow velocities are determined with hydraulic grade lines shown and plotted. The network can be designed and sized based on both flow depth or pressurised (freeboard) methods and hydrological and hydraulic reports automatically produced.

Flooded widths and roadway depths are shown graphically in 12d Model. 12d Model calculates the width of flow using normal depth calculations. For more detailed analysis, HEC RAS projects can be created with discharge results from the hydrology calculations. Flooding from drainage pits is difficult to conceptualise, so 12d Model displays where spill from the flooded area will occur.

Additional feature information:

- May be used to set the sizes of the conduits, based on the calculated HGL.
- Supports industry methods to calculate Tc, I and C values.
- Supports partial-area effects, bypass flows, surcharge flows and user-defined inlet capacity.
- Flooded width and sag-pond extents calculated and shown graphically, based on the finished-surface design.
- Hydraulic analysis applies a backwater solution to the Darcy-Weisbach and Gradually Varied Flow equations.
- Pit-loss factors calculated automatically.
- Support for circular, rectangular, vee and trapezoid conduits shapes, and multiple parallel conduits.
- Culverts are tested under conditions of inlet and outlet control.
- Detention basin sizes can be estimated for preliminary design.
- Requires no external drainage package.

Schedules/Results and Presentation

12d Model allows user customisation of results to achieve the highest standard for company and client presentation.

Schedules/results and presentation include:

- User defined construction setout tables, northing/easting or road centreline chainage/offset.
- Automatic network quantity schedules (pipes and manholes by depth range) for pricing.
- Earthwork trench excavation volumes based on custom templates that vary with depth and pipe size.
- Automatic service clash detection and reporting.
- Produces finished/CAD quality drawings complete with hydraulic data, drawing sheets and title blocks.

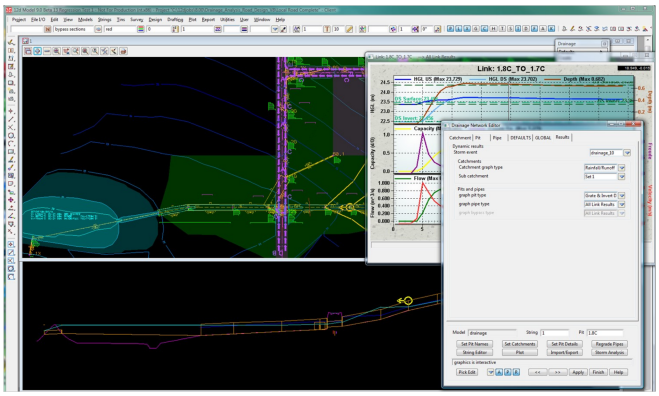
Dynamic Drainage using the full St Venant equation

The 12d Model Dynamic Drainage module allows detailed hydrological and hydraulic modelling based on volumetric hydrograph methods and hydraulic analysis based on the St Venant equation.

Dynamic Drainage looks at the use of detention basins in storm-water management to reduce peak flows that damage property and the environment.

Basin elevation-area curves are extracted from the design TIN and outlet structures are created from a mix of culverts, weirs and orifices.

The transition from a Rational Method based design to 12d Model Dynamic Drainage is extremely quick.



Features include:

- 100% integration with civil design
- Storm-water basin design
- Integrates with 12d Model Visualisation! (Note: Visualisation is a separate module)
- Inlet capacities, bypass flow, dynamic pit loss calculation (Ku/Kw)
- Graphical results showing elevations, flows, velocity & other hydraulic parameters
- Includes time-area hydrology methods i.e. Australian (AR&R including ILSAX) & NZ SCS hydrology methods
- Uses all the terms of the St Venant equations
- Customisable & region specific outputs
- Pit loss factors calculated automatically at each time-step
- Detention basin performance can be properly analysed for final design and verification.
- Also supports user-defined channel shapes, adverse grades, diversions, loops, reverse flows, pumps, weirs, orifices, storage tanks, tidal effects, historical storms.

- Requires no external drainage package

Complex hydraulic situations including adverse grades, flow reversal, tidal outfall, flap gates and fixed backwater can be modelled within the network due to the introduction of Dynamic Wave calculations.

Many types of conduit configurations can be included in the drainage network such as natural/irregular rectangular and trapezoidal conduits, as well as weir and orifice configurations.

The inclusion of hydrograph methodology allows the design of basins such as dry retarding, wet detention and interconnected basins to be properly supported. Hydrograph methods already implemented within the software are ILSAX and NZ SCS.

Reporting and analysis of the dynamic network can be complemented with a range of time series graphs navigated from within 12d that can be saved and exported into other documents. These graphs include depth, elevation, volumes and inflows/outflows.

Dynamic Water Supply

The Dynamic Water Supply module performs hydraulic analysis and models the water behaviour in pressurised pipe networks. Networks can consist of pipes, junctions, pumps, valves, storage tanks and reservoirs.

Not only can the flow of water, pressure, and height of water in tanks be tracked but also the concentration of chemicals such as chlorine, and water age.

Very large network sizes can be analysed, and system operation can use both simple tank levels or time controls as well as more complex rule based controls.

Multiple demands with their own time patterns (*e.g.* house connections) and pressure dependent demands such as sprinkler heads are allowed.

Any of the time series results can be presented as graphs to help clarify the workings of the system.

The Dynamic Water Supply is an exciting addition (in 12d Model 12) to the existing 12d Model modules which now cover the ‘Three Waters’ trilogy of Water Supply, Stormwater and Waste Water.

Hydrology/Hydraulic Design or Interface

The Drainage module interfaces with MicroDrainage, Info Works, Drains, ILSAX, PC Drain, RAT 2000, Spreadsheets, XP-SWMM, and XP-STORM. This combines the “real world” power of 12d’s terrain modelling and pipe grading capabilities with other specialised hydraulic design packages.

Analysis results can be brought back into 12d Model with drainage networks updated automatically.

Sewer - Waste Water Reticulation

The Sewer module is an extension of the Drainage module and supports the design of gravity operated waste water reticulation systems, typically those required for new land sub-divisions and development projects.

The user enters proposed manholes, pipelines and end of line points. Obstructions which pass over, under or parallel to the design lines within a user specified corridor about the design line will be shown on long and cross section views.

The user enters proposed manholes, pipelines and end of line points. Obstructions which pass over, under or parallel to the design lines within a user specified corridor about the design line will be shown on long and cross section views.

When satisfied with the design invert levels, connections from the design line to the individual house blocks can be added and reported on. Earthwork volumes for trenches can be calculated along the selected design line.

The special waste water reticulation longitudinal plots show existing surface, manholes, design pipelines, pipe grades, property connection points and all obstructions.

Pipeline

This module is used to support the design of major pipelines of any diameter (*e.g.* 2000mm) and any length.

Pipeline allows for the extraction of long sections and cross sections against the digital terrain model for the proposed route, plus all the obstructions that run parallel to or cross a corridor of user given width on either side of the centre line of the route. The joint deflection for pipes of a user nominated length is calculated and interactively displayed along the pipeline.

Earthwork volumes for trenches can be calculated along the selected design line. The special pipeline longitudinal plots show the existing surface, design pipeline, depth of cut or fill to pipe invert, percentage grades and vertical curve data or deflection angles, and all obstructions.

Roads and Highways

12d Model's design option is the smarter solution for the design, modification and maintenance of Road and Highway projects.

Enjoy advanced 3D tools to design local and major roads, intersections, roundabouts, highways, interchanges and much more.

Ports and Dredging

12d Model is the solution for port infrastructure and dredging, easily managing the very large datasets and complex volume calculations often required by these projects.

A complete range of flexible and customisable volume calculation tools allow teams to extract and present the information quickly and easily.

Land Development

12d Model is the most versatile solution for the creation of sustainable land development projects, including residential, commercial and industrial developments, recreational areas, landfills, and agriculture projects.

Easily manage all aspects of your land development project from earthwork quantities, road design utilities and drainage design.

Airport Infrastructure

12d Model provides a solution for the design, construction and analysis of new airports, as well as the upgrade and maintenance of existing runways and airport infrastructure.

Easily manage large airport infrastructure projects and share data across multi-disciplinary teams.

Rail

12d Track has been specifically designed for the survey, design and construction of light, heavy and high speed rail projects.

Extensive railway tools in 12d Track allow the rail designer to quickly and easily design their projects. These options are built on the existing 3D modelling and design tools available in 12d Model.

Mining Infrastructure

12d Model's powerful set of exploration, site investigation, survey and analysis tools are crucial for the initial design, construction and ongoing operation of mining projects.

Comprehensive tools for the survey, design and construction of access roads, railways, earthworks and services allow for the coordinated design and management of mining infrastructure from within 12d Model.

Drainage, Sewer and Utilities

12d Model provides comprehensive tools for the design, analysis and optimisation of stormwater and sewer projects using rational, dynamic (hydrograph) and 2d drainage methods.

Powerful clash detection management allows for efficient 3D modelling of service networks such as gas, electricity, telecommunications and water prior to construction.

Surveying

12d Model is a complete surveying package providing the tools to manage all facets of surveyed data including LIDAR, topographical, as-built, conformance, traversing, geodetics, data mapping, labelling and much more.

The 12d Field option runs on a ruggedized tablet and gives the user access to full 12d Model functionality, allowing you to take the entire project into the field with the most comprehensive pick-up and set-out tools.

Oil and Gas

12d Model assists with the design, construction and mapping of oil and gas pipelines, original site exploration and the wide range of infrastructure required for oil and gas projects.

Accurate 3D modelling and the ability to share data between users allow teams to quickly and easily coordinate designs.

Construction

12d Model is the ultimate software for construction with powerful set-out options, direct interfaces to machine control and detailed conformance reporting and auditing.

Manage 3D data and control volumes, quantities and progress claims with 12d Model. Set-out your project and undertake conformance and as-built surveys live on-site using 12d Field.

Rivers, Dams and Hydrology

12d Model handles very large datasets and interfaces with a wide range of analysis packages, making it perfect for flood studies and the management of rivers and dams.

12d has partnered with industry leading analysis software, allowing users to apply 2D drainage analysis from within 12d Model.

Environmental

12d Model's ability to handle very large datasets combined with flexible and comprehensive 3D analysis and modeling tools make it perfect for a wide variety of environmental projects.

Existing workflows can adopt 12d Model easily as it allows users to directly interface with GIS systems and most software packages and file formats.

Why Choose 12d?

- **Powerful data processing & intelligent functionality.**
- **Modular, easy to update & completely customisable.**
- **Seamless integration with major industry software and hardware.**
- **Used in over 55 countries worldwide.**
- **Friendly support & training from industry experts.**

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