An introduction to MicroDrainage – the UK & Ireland's most widely used drainage design software.

Presented by: Rajan Sanhotra & Max Anderson
Ask Questions! Type queries into the Question Field in the GoToWebinar interface.

The webinar will be recorded and posted on innovyze.com along with the PowerPoint and Q&A document.

All registrants will receive a link to these files.
Today’s Presenter

Max Anderson
Product Manager (MicroDrainage)
Innovyze
Scope

• Background to MicroDrainage

• Overview of Drainage Design Fundamentals

• How MicroDrainage can help perform some typical tasks:
  • Optimising a Pipe Network
  • Designing a Pond
  • Testing and approving a design

• Further Resources
• Upcoming Events & Training
Poll Question 1

How would you describe your current level of understanding of MicroDrainage?
**MicroDrainage - Background**

- ‘De Facto’ Industry Standard Drainage Design software with the UK → Why?
  - First launched in 1983 – Developed alongside the needs of design engineers and approving authorities
  - Seen as being a proponent of industry thinking and innovation
  - International mode allows for applicability worldwide

- Optimised Storm & Foul Network Design & Analysis
  - Utilises latest hydrology theories and methodologies

- Modular system allowing for a range of tailored functionality to suit your needs
  - Integrated capability with the popular AutoCAD Civil3D CAD package.
MicroDrainage - Applications

- New Residential Developments
- Highways Drainage
- Lead Local Flood Authorities
- Planning & Submission Approval
- National Level Infrastructure Projects:
  - High Speed 2 Rail Link
  - Queen Elizabeth Olympic Park
  - Channel Tunnel
  - Smart Motorways Programme
Module Selector

Network
Increase productivity by running the network build modules together

System 1
Design & schedule optimised Storm and Foul networks

Simulation
Model and analyse fully integrated drainage systems

DrawNet
Enables for live, fully interactive graphical interface

QuoST
Tools to complete taking off, billing and pricing the job

MDSuDS
SuDS design with hydraulic and water quality analysis

Channel
Determine water levels in Open Channels using a Backwater Step Method

APT
Enables Existing Networks and advanced modelling options inc. Terrain Models.

CASDef
Allows for Pipe Sizing, Control Sizing and Storage Design.

FloodFlow
Full 2D overland flow analysis

MDSuDS (Plugin)
Allows MDSuDS data to be combined within the network design

Source Control
Design SuDS systems, Ponds and calculate Rural Runoff

Pliuvius
A rainfall management and analysis tool built around Met Office rainfall gauges

Innovyzr®
Aims & Principles of Drainage Design

• Understand current and future behaviour of site hydrology and response to typical events.
• Design a system to convey, control and cleanse discharge to a suitable point of outfall.
• Ensure a minimum level of service is provided by the system.
• Ensure that the design adheres to a variety of hydraulic performance and construction standards and that approval can be granted quickly.
• Design in a cost-effective manner without compromising performance.
• Produce outputs and records of the design to enable construction, auditing, maintenance and asset management and a greater understanding of future flood risk.
C Surface Water

C3 Layout and Access

C3.1.1 Limit flood risk with layout of drains and sewers

C3.1.10 Minimum depth of cover;
  a) 0.35m in gardens & pathways with no vehicular access
  b) 0.5m domestic where <7.5t gross vehicle weight
  c) 0.9m domestic & mews where >7.5t gross vehicle wt
  d) 0.9m in POS & agricultural land
  e) 1.2m in highways & parking areas >7.5t gross vehicle wt

C3.2.13 Manhole Diameters – must be designed to ensure suitable access.

C4 Reliability

C3.4.1 Minimum pipe size for SW sewer 150mm

C3.4.2 Minimum pipe size for SW lateral 100mm

C3.4.9 Minimum velocity 1 m/s at pipe full, or
  a) 150mm @ minimum 1 in 150
  b) 100mm @ minimum 1 in 100
C5 Hydraulic Design

C5.1 Surface Water on Site

C5.1.1 Appropriate flow simulation method based on the Wallingford Procedure
C5.1.2 Design under pipe full to accept the following design storm without surcharging:

- Sites with average ground slopes >1% 1 year
- Sites with average ground slopes <1% 2 year
- Sites where consequences of flood are severe 5 year

C5.1.3 Runoff from roofs, roads & paved areas @ 100% impermeability

C5.1.4 Roughness value \( (k_s) \) for surface water to be 0.6mm

C5.2 Protection Against Flooding

C5.2.1 No flooding for 1:30 year return period
C5.2.2 Underground storage to attenuate 1:30 year return period
C5.2.3 Locate storage tank for a free-flowing discharge
C5.2.4 Demonstrate flow paths and identify the flood routes

Often also required to demonstrate performance in 100yr +CC% (i.e. Exceedance Rainfall events)
Sustainable goals & pressures

• Mimic natural hydrological processes → Provide betterment where possible

• **Control the quantity** of runoff to support the management of flood risk and maintain & protect the natural water cycle.

• Manage the **water quality** to prevent pollution

• Growing need to provide greater detail / design validation earlier in the design process

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1 CIRIA SuDS Manual, 4 pillars of SuDS design
Poll Question 2

Which criteria do you consider the most challenging in drainage design?
**Drainage Networks**

**Traditional:**
- Large Storage volumes
- Significant control restrictions
- Increased expense
- Poor Water Quality Improvement

**SuDS:**
- Reduced storage volumes
- Utilises natural processes
- Water Quality Improvement
- Increased Biodiversity & Amenity
Key Terms

Ground / Cover Level

Backdrop

Cover

Soffit

Invert
Using ‘Design Rainfall’

• We need to ensure our networks can achieve a level of service
  • Laid out in standards such as:
    • Sewers for Adoption
    • Design Manual for Roads & Bridges

• We use rainfall theories to help design and assess network performance
  • Based on combinations of observed data & statistics
  • Geographic Variation
Design Storms

- Variation in peakedness of storms
  - Rainfall does not fall at a uniform rate
  - 5% of summer storms peak at >11 times their average rate

Wallingford procedure storms have 50% ‘Peakedness’

- peak at less than 4 times their average
- typically 50% of storms will have peaks greater
- than this, the rest will have less
Using ‘Design Rainfall’

- We need to test multiple durations of storms to identify critical behaviour.

For same return periods:
- Shorter storms have higher ‘peak’ intensities → Think ‘flash flooding’ / sudden inundation
- Longer storms have greater volumes of water → Greater volumes may require greater amounts of storage
Consider the case where we want to design a pipe to be able to transmit a peak flow of 500l/s (0.5m³/s), we want to lay the pipe with a gradient of 1:100 but need to determine what diameter of concrete pipe (n = 0.012) we be able to convey the flow.

\[ D = 8 \sqrt[3]{\left( \frac{4^5 Q n}{\pi \sqrt{S}} \right)} \]

With values:

\[ D = 8 \sqrt[3]{\left( \frac{4^5 \times 0.5 \times 0.012}{\pi \sqrt{0.01}} \right)} = 0.54229m \approx 543mm \]

For any practical purpose whilst we know that this would be the exact diameter required it would be far easier (and cheaper!) to instead select an industry standard sized pipe in this case a 600mm pipe.
Demo in MicroDrainage
Demo in MicroDrainage
Simulation Criteria

Software shown:

- Synthetic Rainfall
  - Return Period (years): 30
  - Region: England and Wales
  - Map: M5-60 (mm)
  - Ratio R: 0.400
  - Storm Duration (mins): 30
  - Profile: Summer
- Additional Settings
  - Areal Reduction Factor: 1.000
  - Hot Start (mins): 0
  - Hot Start Level (mm): 0
  - Manhole Headloss Coefficient (Global): 0.500
  - Foul Sewage per hectare l/s: 1.000
  - Additional Flow - % of Total Flow: 15.000
  - MADO Factor - 10m3/ha Storage: 2.000
  - Inlet Coefficient (Global): 0.800
  - Flow per person per day l/pc/day: 0.600
- Runoff
  - Volumetric Runoff Coefficient: 0.750
- Output Details
  - Run Time (mins): 0
  - Output Interval (mins): 0

Enter Return Period between 1 and 1000

Software logo: Innovyze®
Poll Question 3

Which methods of output are most important to you?
MicroDrainage Outputs

- Simulation Results
- Network Schedules
- Customisable reports
- 3D model – Basic linework or Intelligent Civil3D networks
- Longsections
- 3D Video playback & visualisation of results
Demo in MicroDrainage
Further Resources

susdrain – Industry body for the promotion of Sustainable Drainage

www.susdrain.org

• Case Studies
• Briefing Notes
• SuDS Manual

Innovyze YouTube Channel
Training Courses

MicroDrainage Two Day Introduction Course:
4th – 5th December 2018
15th – 16th January 2018

Further MicroDrainage Courses 11th – 13th December 2018

http://innovyze.com/education/training_schedule/
Upcoming Events

- NCE Flood Management Forum, London, November 21-22nd
- Pollutec, Lyon, France, November 27th-30th

Upcoming Webinar:
“Your hands-on guide to approving MicroDrainage designs”, 11th December

Interactive Session where YOU will be doing some of the Auditing!
Thanks for joining us

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