Integrated BIM Approach to Design, Modelling and Asset Management of Water and Stormwater Infrastructure

Slavco Velickov, PhD. Global asset performance sales director

Bentley Advancing Infrastructure

Agenda

- BIM for Water Infrastructure
- Hydraulic modeling as a reliable decision-support tool for Sustainable Urban Drainage Systems
  - Design and rehabilitation
  - Engineering support of operation
  - Improved emergency response
- Some project examples from the *Be Inspired* Awards
- Conclusion and additional resources
- Q&As

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Bentley's mission is to provide ***innovative software and services*** for the enterprises and professionals who ***design, build, and operate*** the world's infrastructure – sustaining the global economy and environment for ***improved quality of life***.

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NAVIGATOR | MOBILE APPS: Bentley Map Mobile | ProjectWise WorkSite | Field Supervisor | Navigator Mobile | InspectTech Collector Mobile | ProjectWise Explorer Mobile | ...
BENTLEY'S PROJECT PLAYBOOKS
MINING
MineCycle
OpenPlant
AssetWise APM
Amulet
STAAD
Promis.e
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Descartes
Acute3D
InRoads
GEOPAK
gINT
CAMPUSES
Bentley Map
AECOsim
Descartes
RAM
STAAD
GEOPAK
InRoads
MXROAD
gINT
SITEOPS
WATER & WASTEWATER
WaterGEMS
SewerGEMS
OpenPlant
AutoPLANT
STAAD
RAM
OpenPlant Support Engineering
gINT
OpenUtilities
Subsurface Utilities Engineering
CITIES
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GEOPAK
Subsurface Utilities Engineering
SITEOPS
Acute3D
NUCLEAR POWER
AutoPIPE
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COMMUNICATIONS NETWORKS
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RM Bridge
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Subsurface Utilities Engineering
SITEOPS
SUBSURFACE UTILITIES
OpenUtilities
WaterGEMS
SewerGEMS
Exor
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RM Bridge
LEAP Bridge Steel
InspectTech
SUPERLOAD
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ProStructures
POWER PLANTS
OpenPlant
AutoPLANT
AutoPIPE
Promis.e
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ProStructures
OpenPlant Support Engineering
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Acute3D
GEOPAK
InRoads
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CONSTRUCTION
Navigator
ConstructSim
PW Construction Work Package Server
ProStructures
Field Supervisor App
AECOsim
Descartes
InRoads
UTILITY NETWORKS
OpenUtilities
Substation
WaterGEMS
SewerGEMS
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Descartes
AssetWise APM
Amulet
Acute3D
RAIL & TRANSIT
Bentley Rail Track
Optram
GEOPAK
InRoads
MXROAD
RM Bridge
LEAP Bridge Steel
gINT
Promis.e
WIND FARMS
SACS
MOSES
MAXSURF
ProSteel
OpenPlant
gINT
AssetWise APM
Amulet
Acute3D
OFFSHORE STRUCTURES
SACS
MOSES
MAXSURF
AutoPIPE
ProSteel
ConstructSim
OpenPlant
AssetWise APM
Acute3D
Amulet
PROCESS PLANTS
OpenPlant
AutoPLANT
AutoPIPE
OpenPlant Support Engineering
Promis.e
ProStructures
STAAD
AssetWise APM
Amulet
gINT
GEOPAK
InRoads
SITEOPS
Acute3D
BENTLEY'S COMMON PLATFORM: MICROSTATION | PROJECTWISE | ASSETWISE
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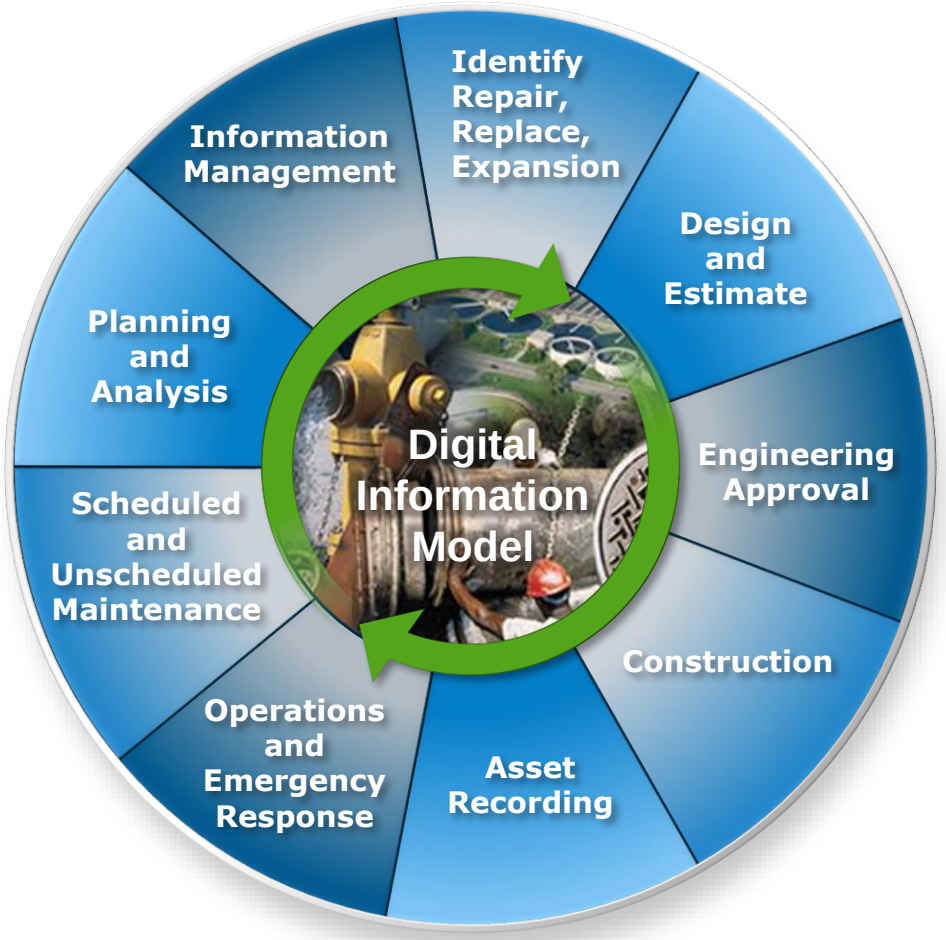
Water, Wastewater and StormWater Infrastructure Lifecycle



Bentley provides applications across the entire lifecycle

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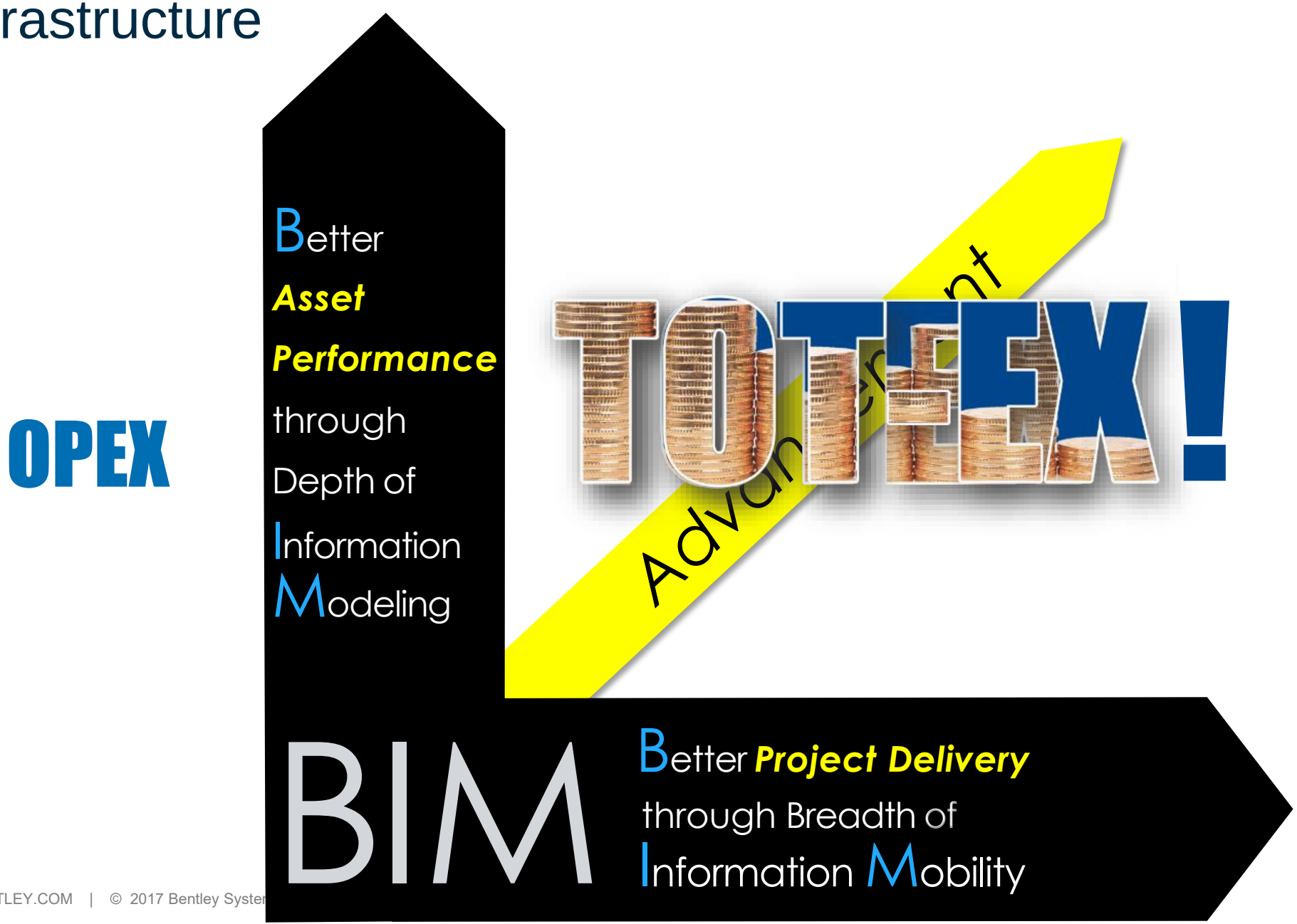
Why BIM (building information modelling) for StormWater Infrastructure



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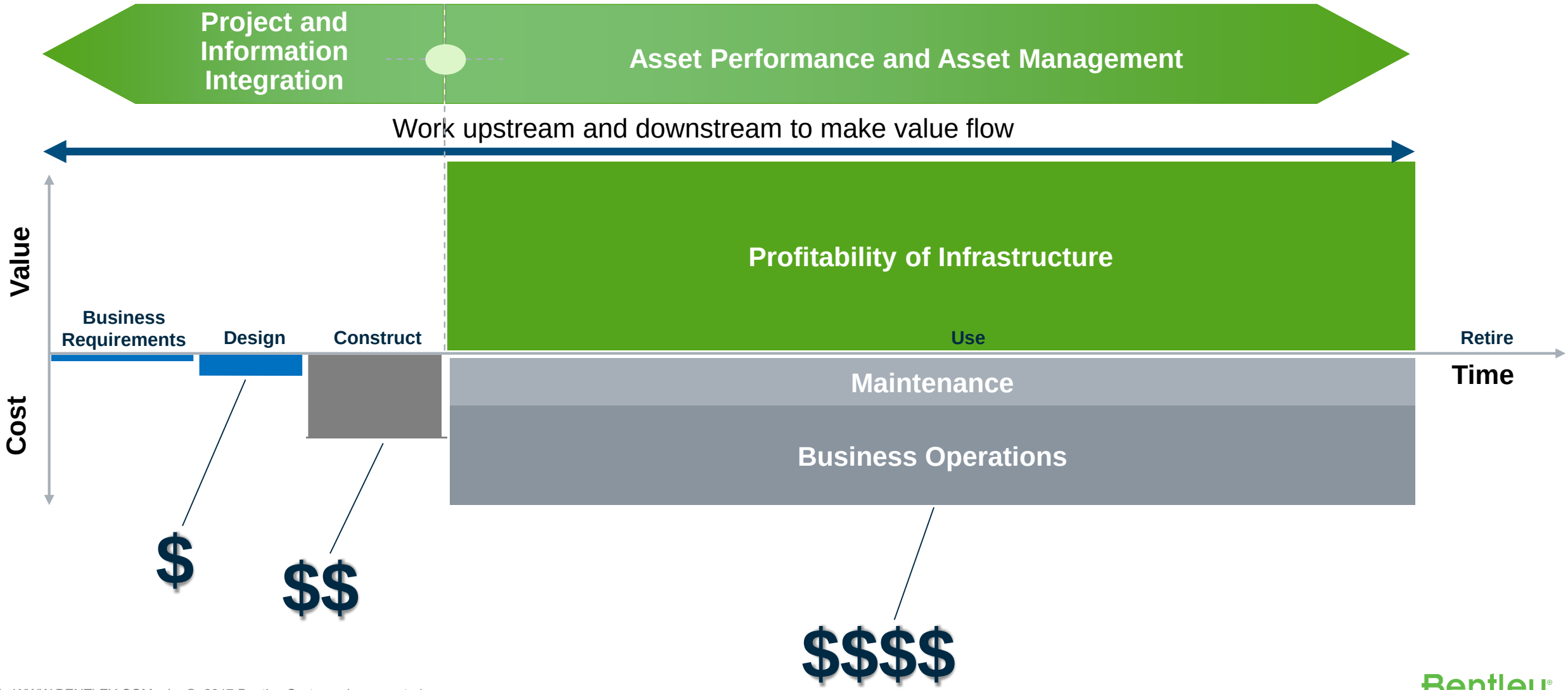
It is All about the - Whole Life Cycle of the Assets



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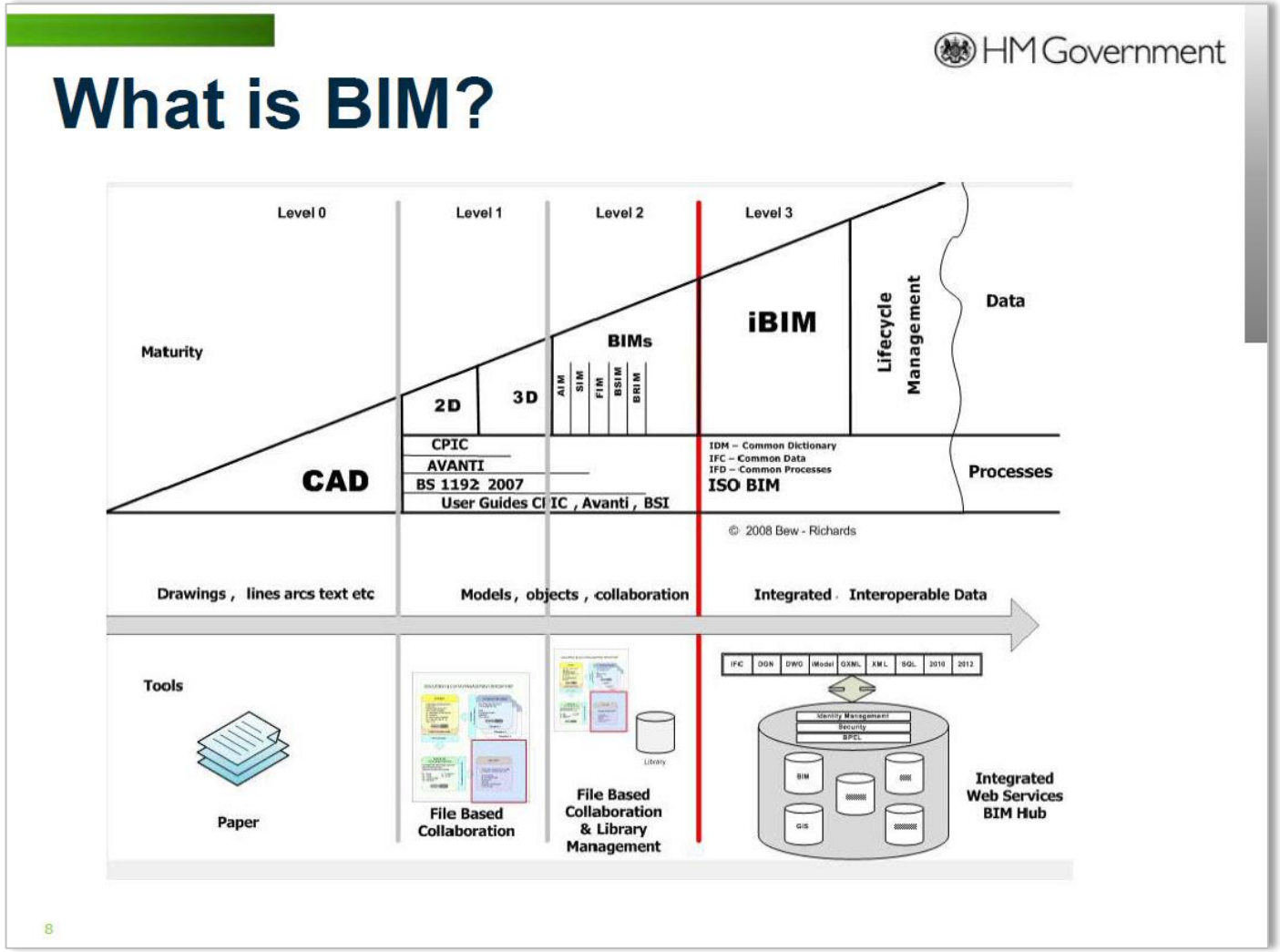
BIM Aligns with Asset Management Standards (ISO 55000, PAS55)

- **Ensures delivery of both: Physical Infrastructure & Digital Information Model**
- Drives asset performance throughout operable life
- Uses disciplined asset lifecycle information management



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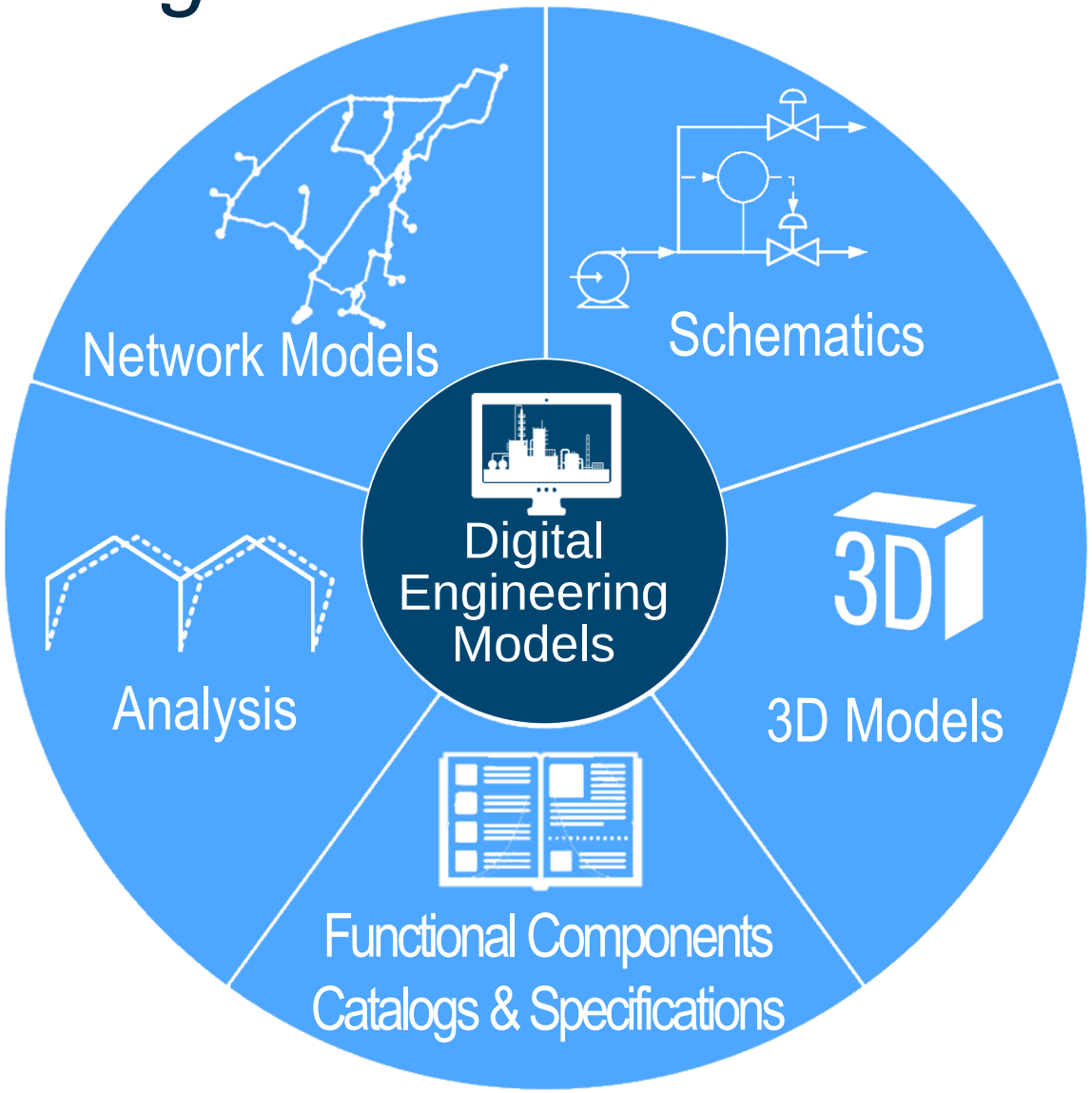
Digital Engineering Models…



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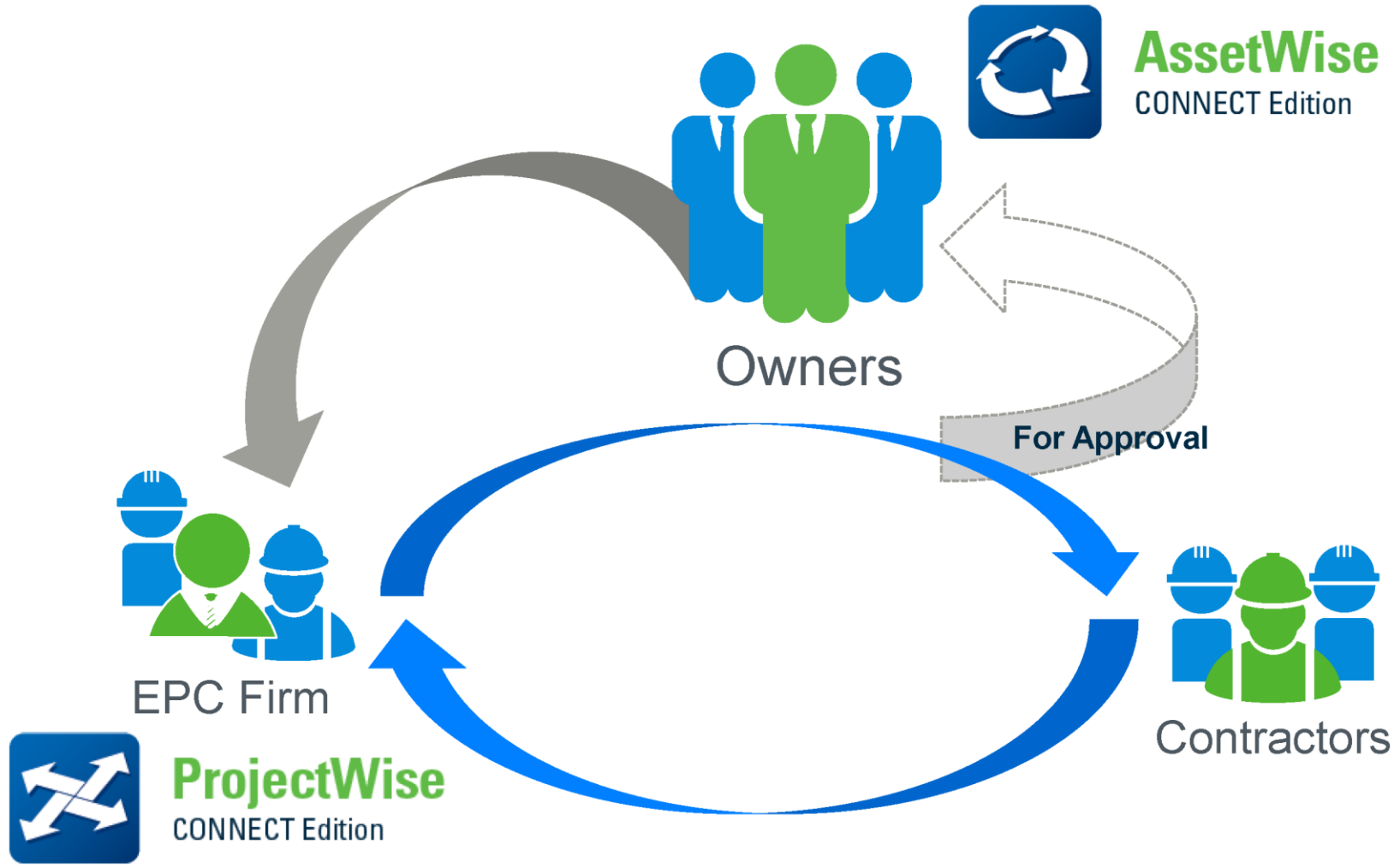
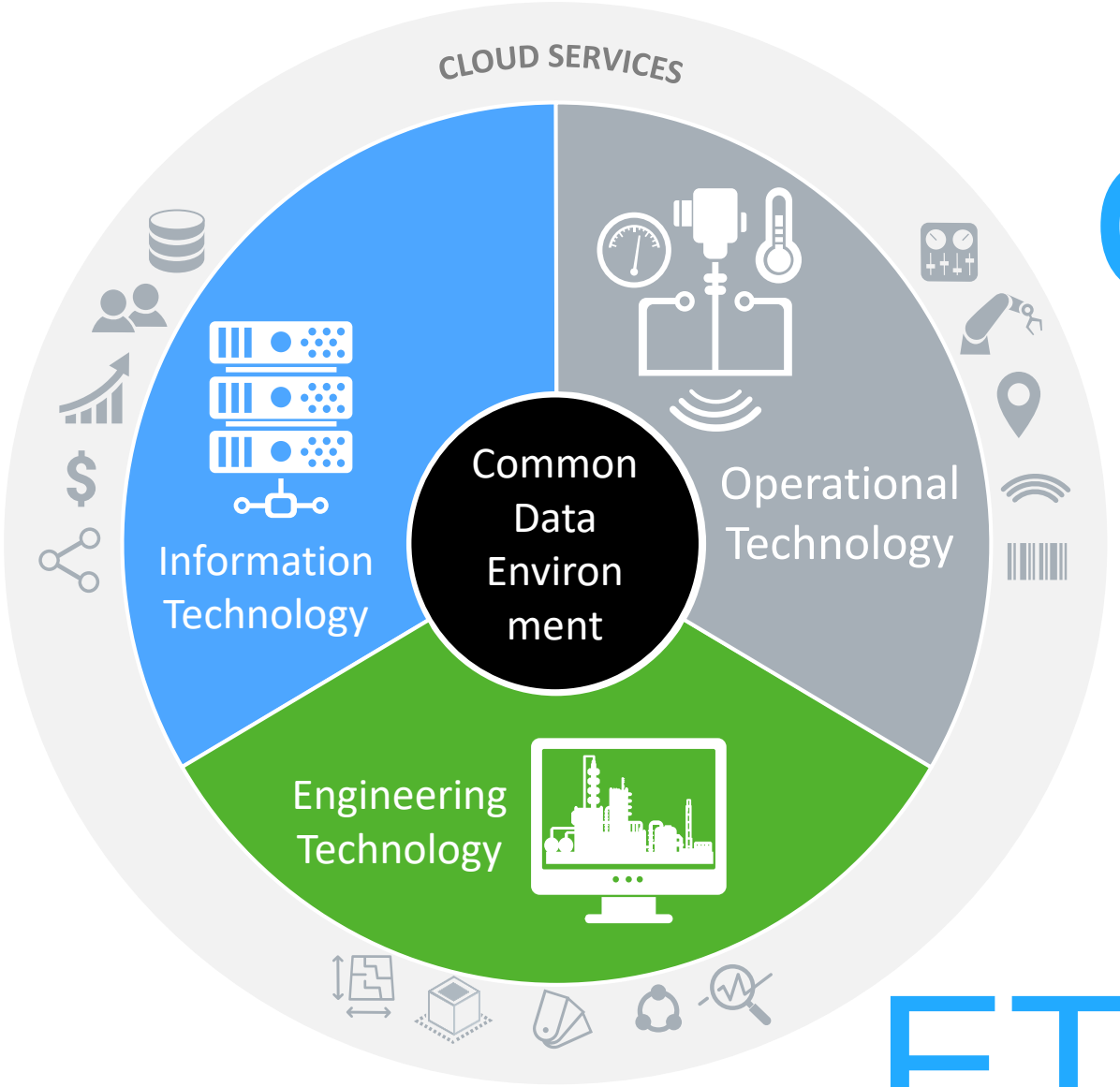
Data Driven Digital Workflow



Asset Information and Data Management for Smart Infrastructure
In the Cloud

IT

OT



ET

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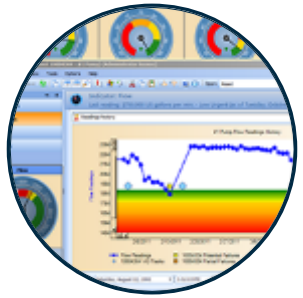
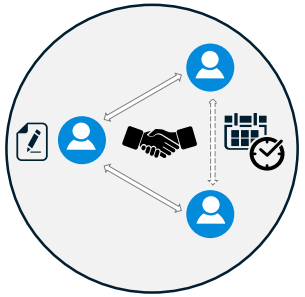
AssetWise CONNECT Edition

Converging IT, OT, and ET information for superior asset performance

CONNECTED ASSET PERFORMANCE

Asset Lifecycle Info Mmgt	Asset Reliability	Compliance & Safety	Operational Analytics	Network Design & Analysis	Enterprise Interoperability
					

COMMON DATA ENVIRONMENT

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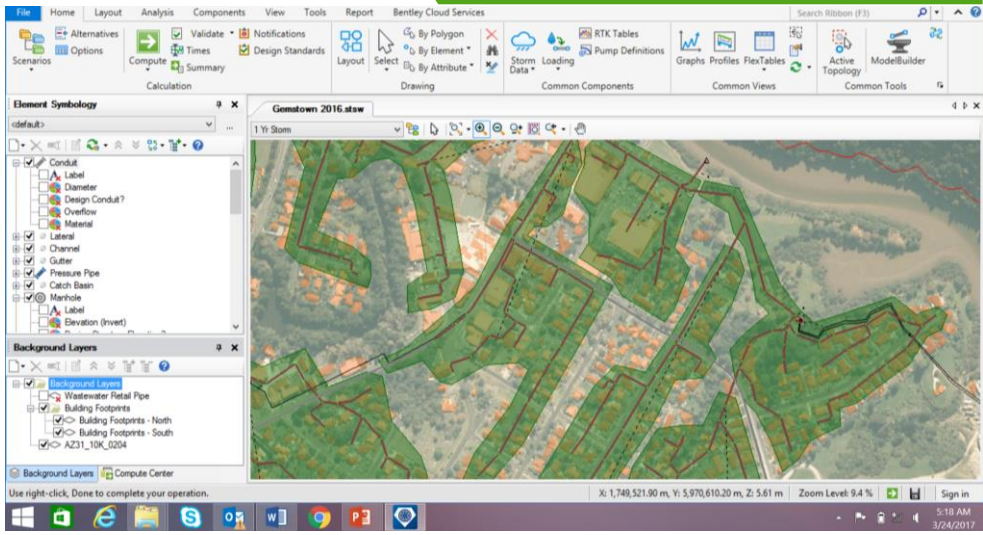
BIM Level 1

Design



Information Modeling

Visualization

Design Modeling

Information Mobility

Design

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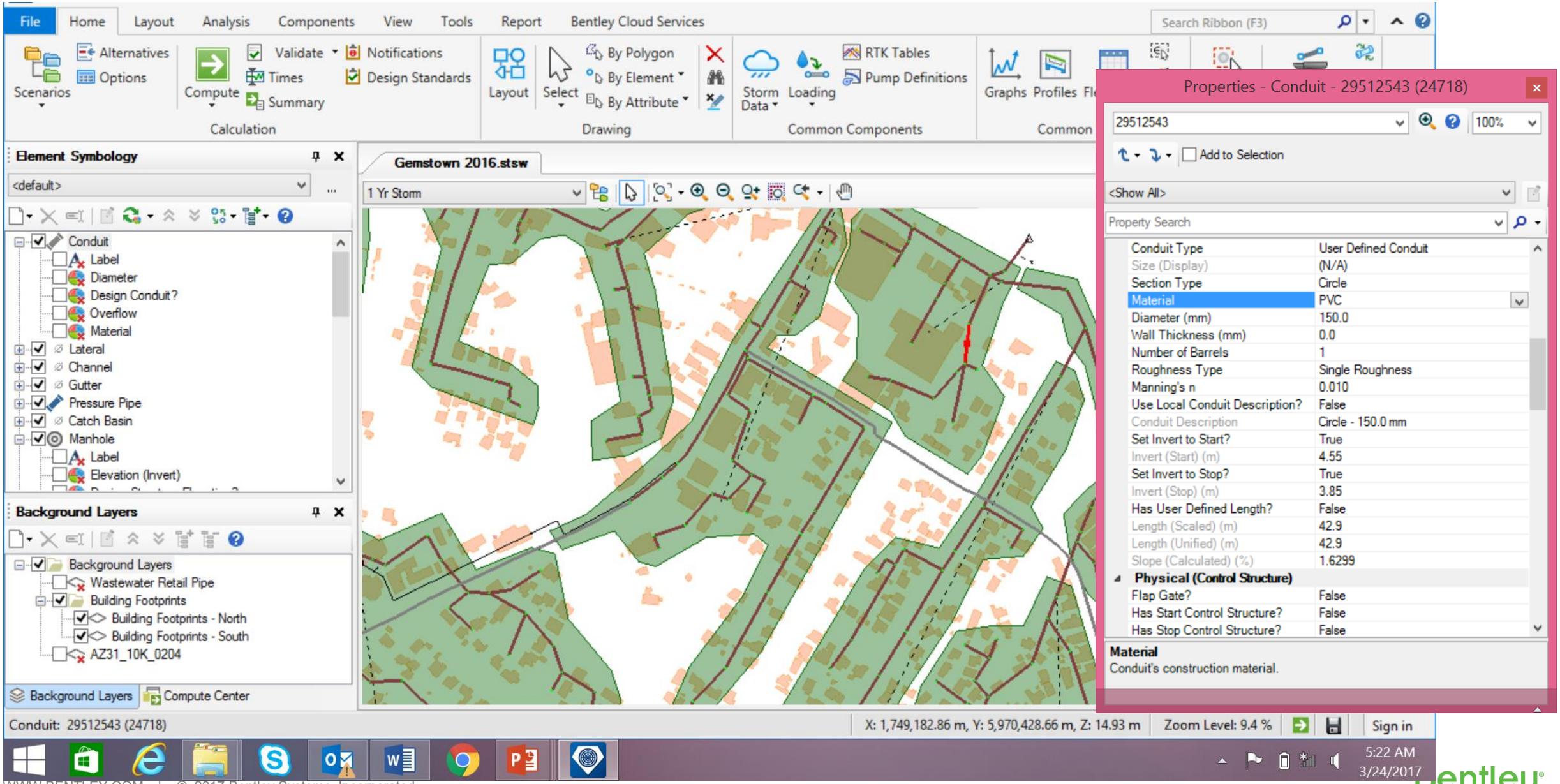
2D: Storm Drainage Networks – SewerGEMS

Design



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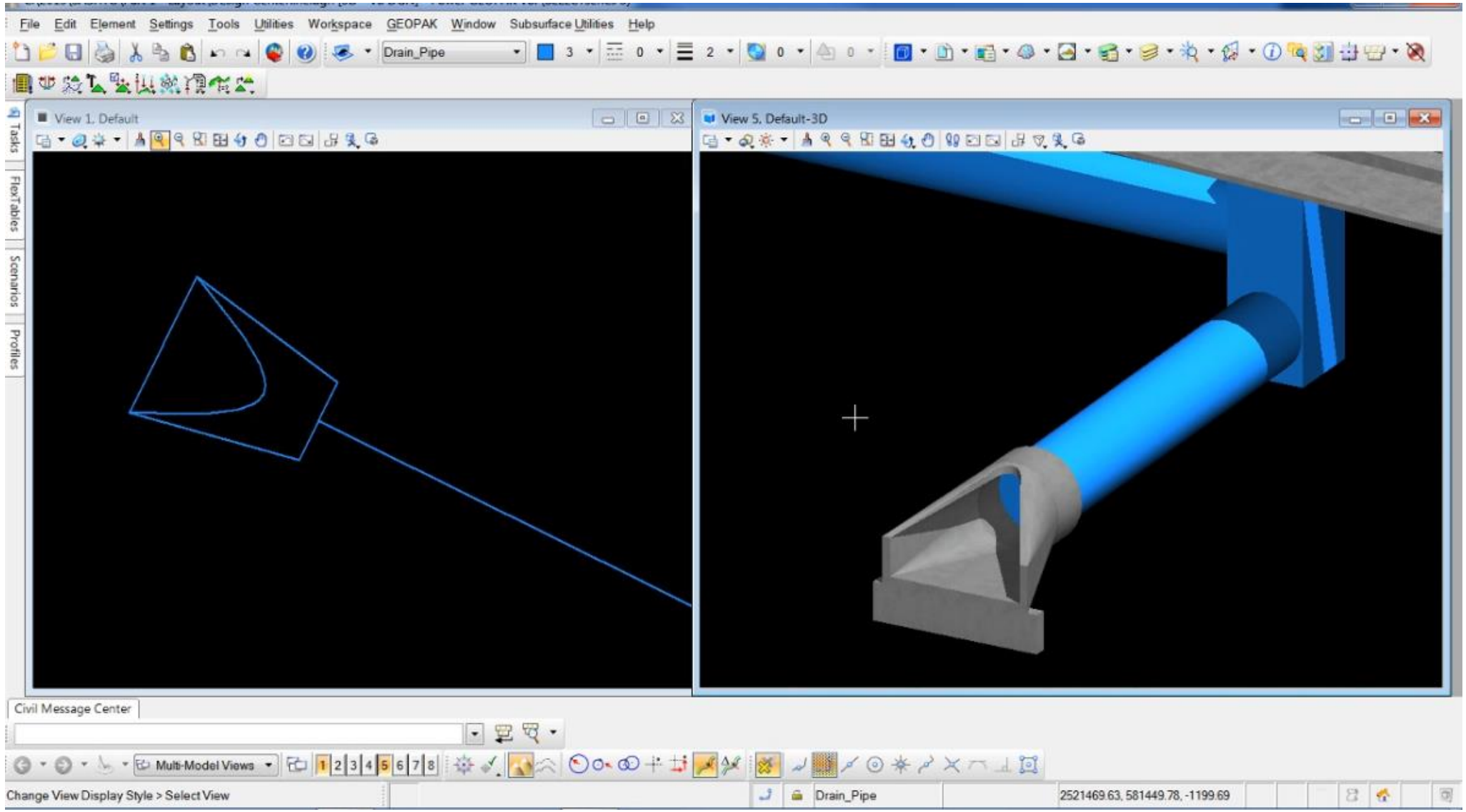
3D: Intelligent Storm Drainage Models - SUE

Design



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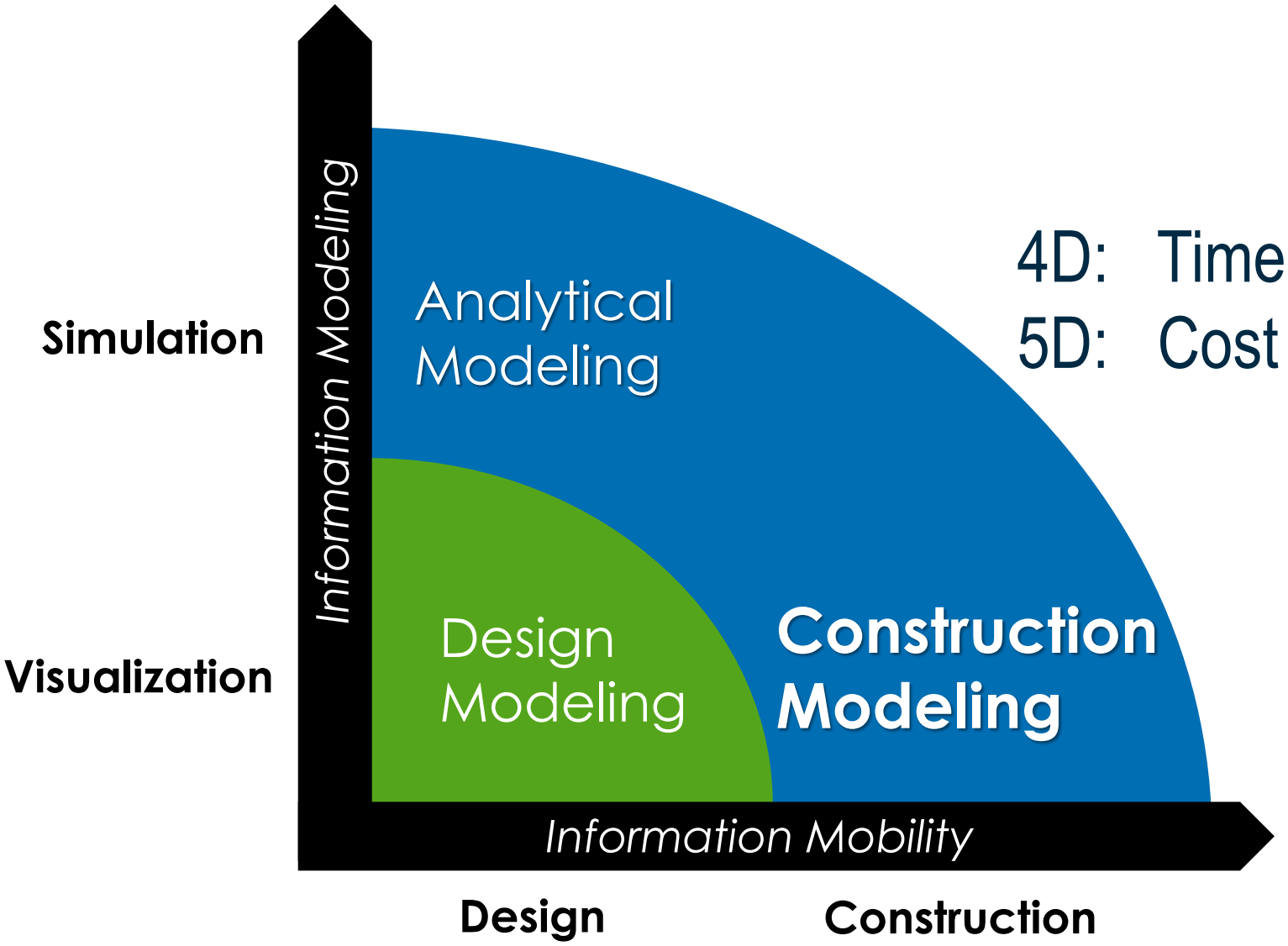
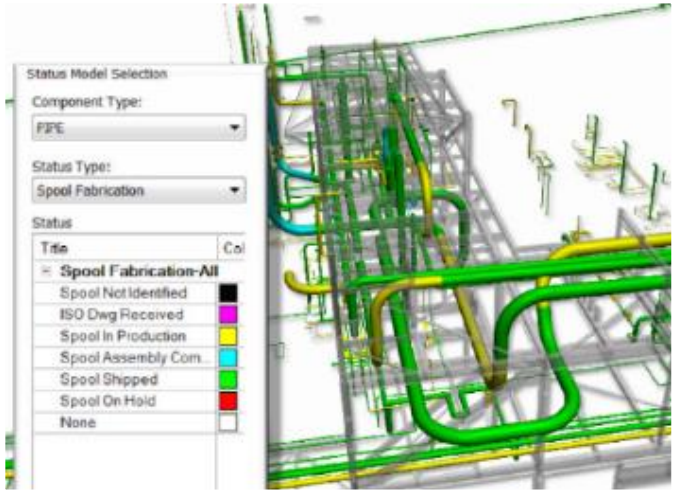
BIM Level 2





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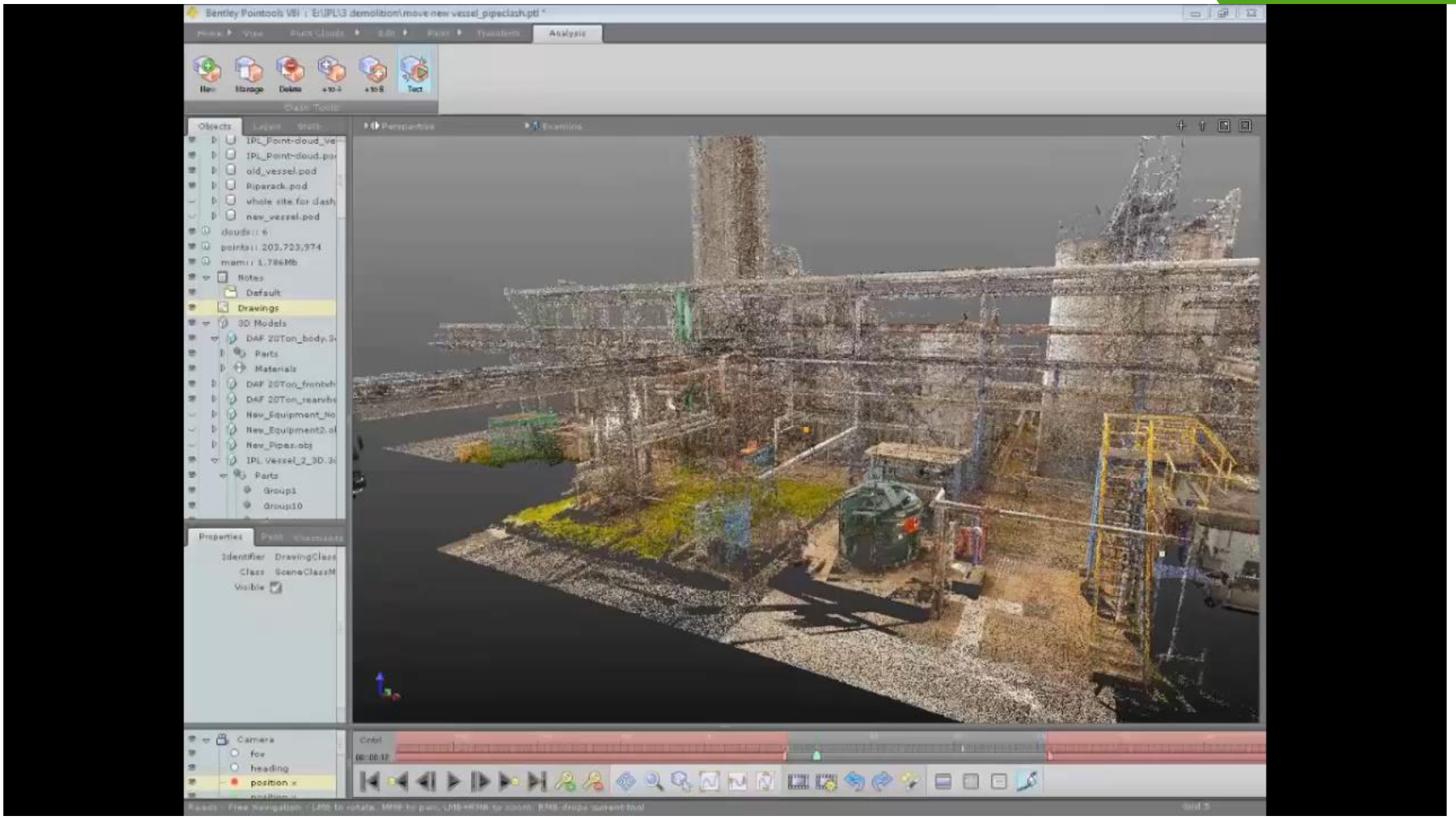

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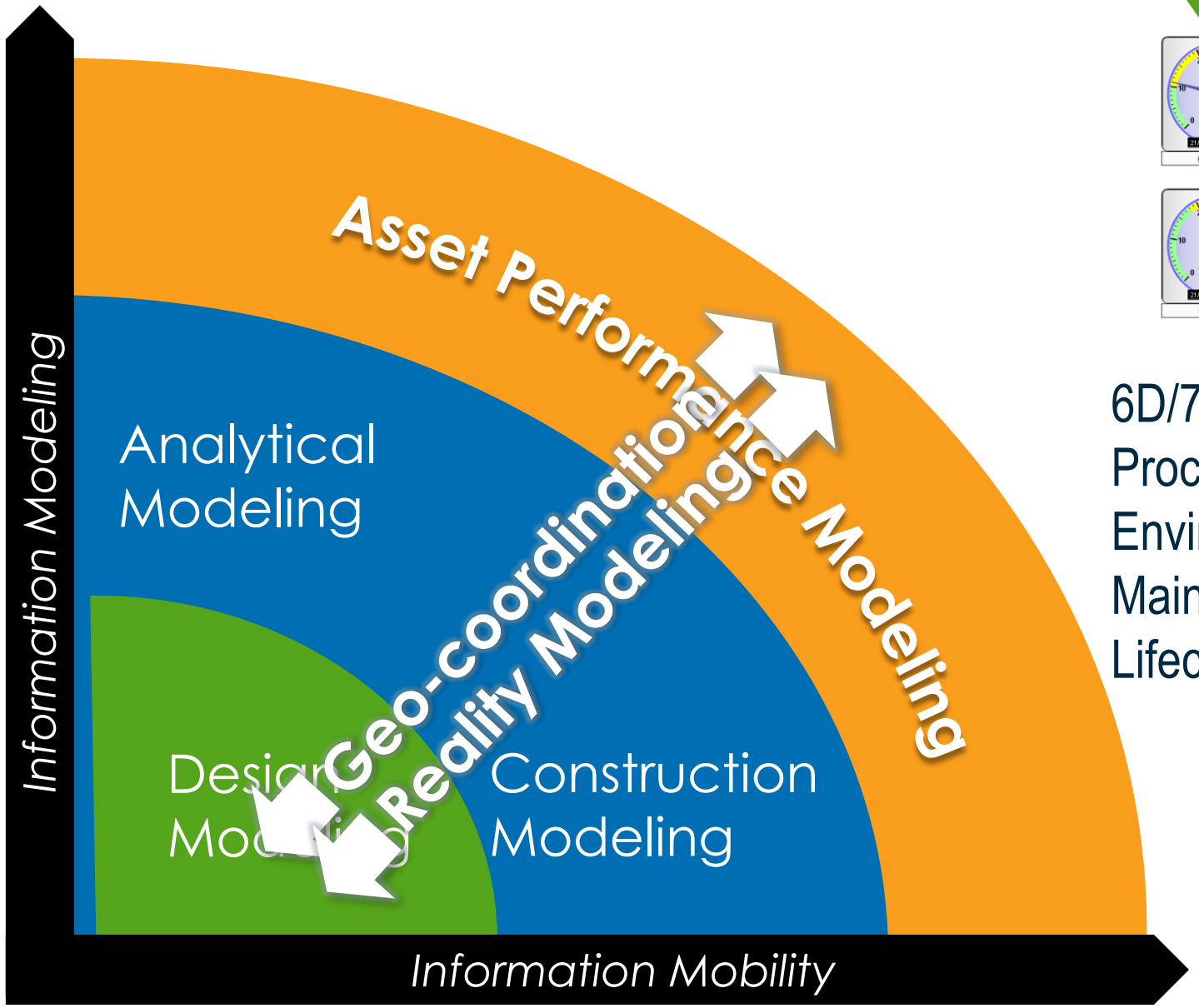
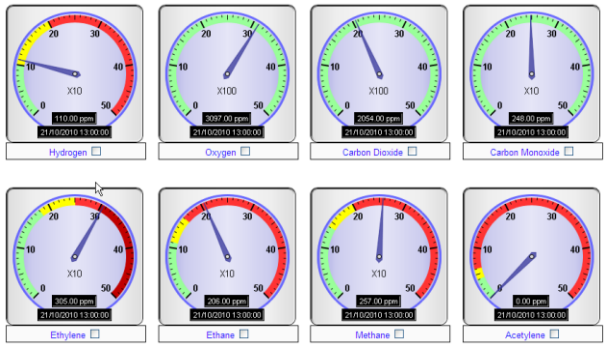
BIM Level 3



Operations



6D/7D:
Procurement
Environmental Sustainability
Maintenance & Operations
Lifecycle Engineering

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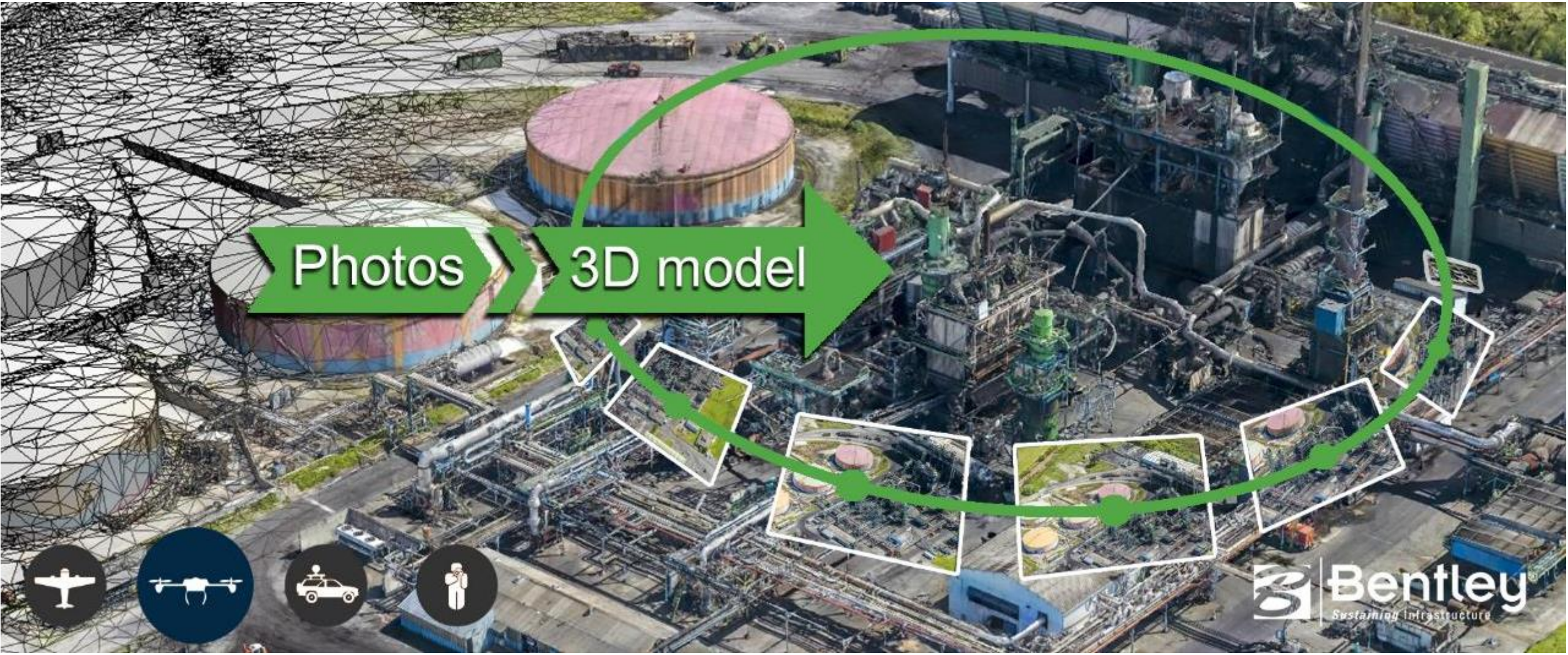
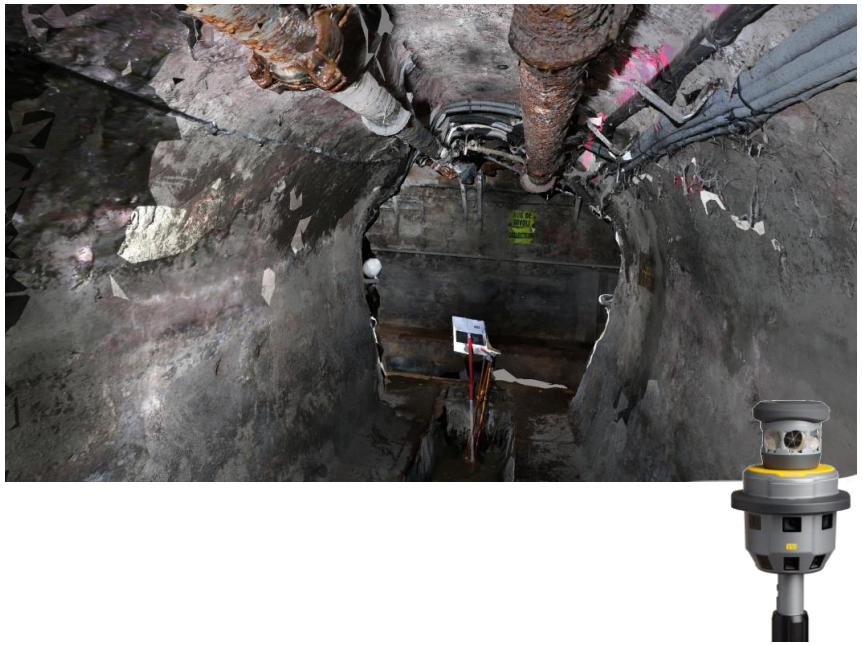
“Context Capture”…



Example: Paris 500 km of sewers mains



REQUIREMENT

- Model and refresh a sewer infrastructure (500km long) including pipes, cables and other equipment

SOLUTION

- Multi-directional camera system (like Trimble v10) + specific lighting system + Smart3DCapture Ultimate

RESULT

- Photorealistic 3D model, helping users to detect and extract structure components from the mesh and point cloud

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Why Use Storm Water and Sewer System Models?

Bentley Playbook: StormCAD, CivilStorm, SewerGEMS, Open Utilities, Mohid 2d/3d, PowerCivil, ContextCapture, LumenRT

- Master planning
- Subdivision design
- Capacity evaluation
- Pump station design
- Force mains
- Pump selection
- Pressure sewer design
- Flood risk analysis
- Overflows
- I&I studies
- Pump operation
- System extensions
- Energy efficiency
- Rehabilitation
- Hydraulic flows in WWTP
- Delivery of BIM-ready models

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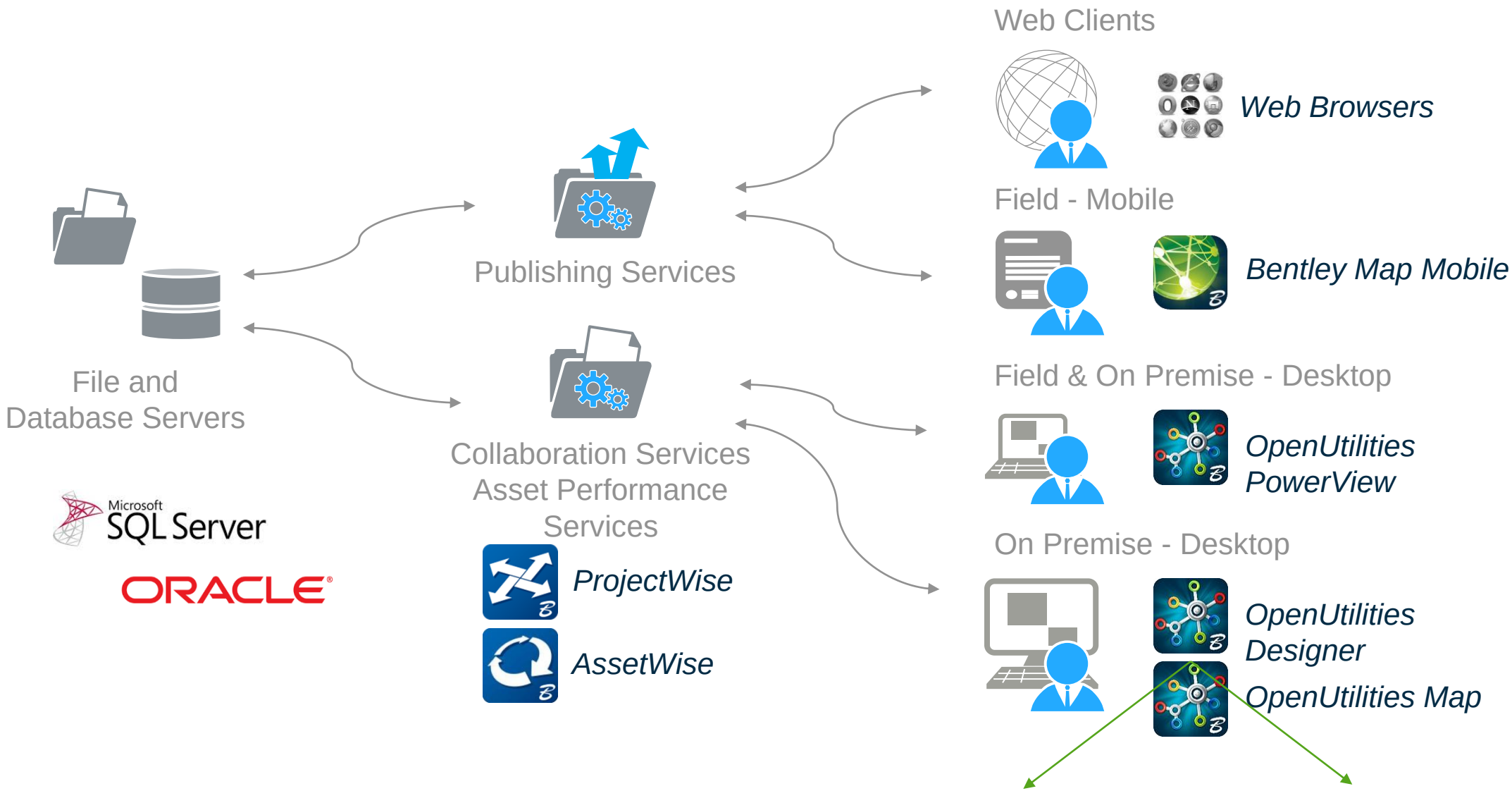
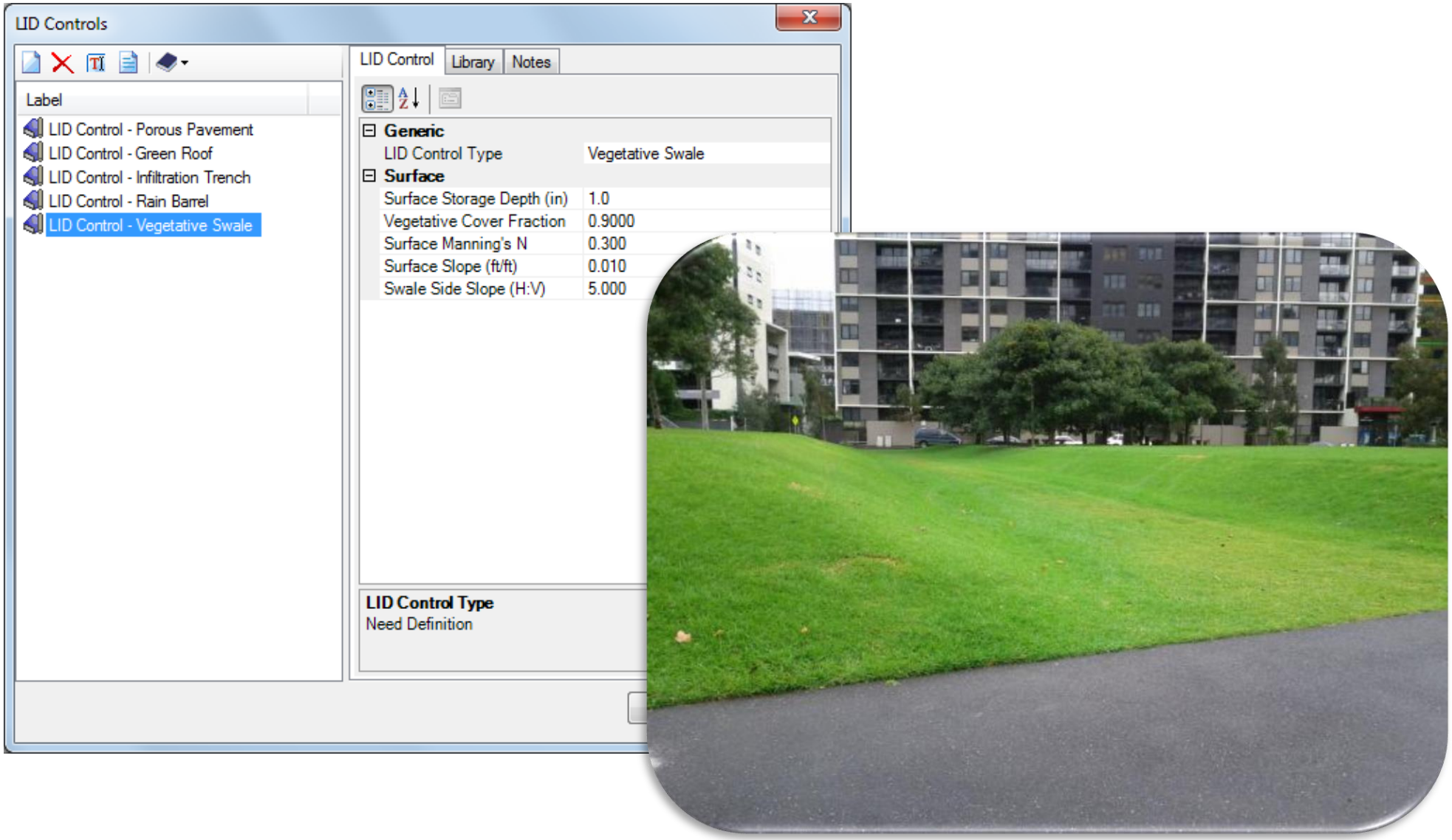
Bentley OpenUtilities: Multi-utility GIS for mapping, design and analysis of storm / sewer and other utilities infrastructure



New in CivilStorm & SewerGEMS: Low Impact Development (LID)



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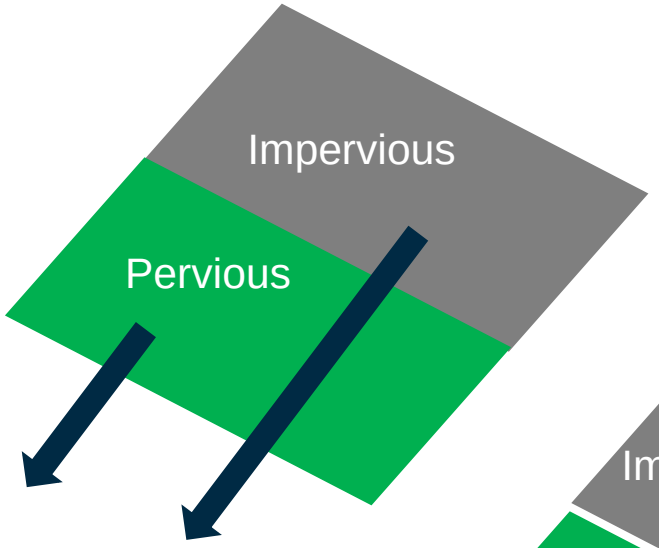
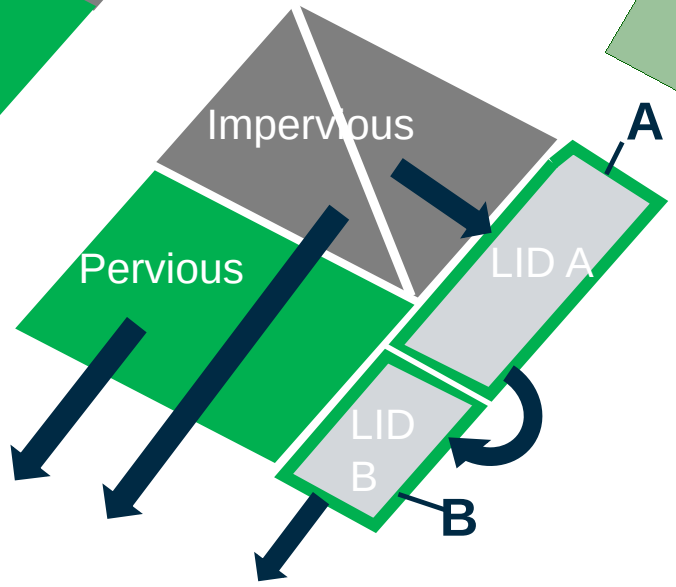
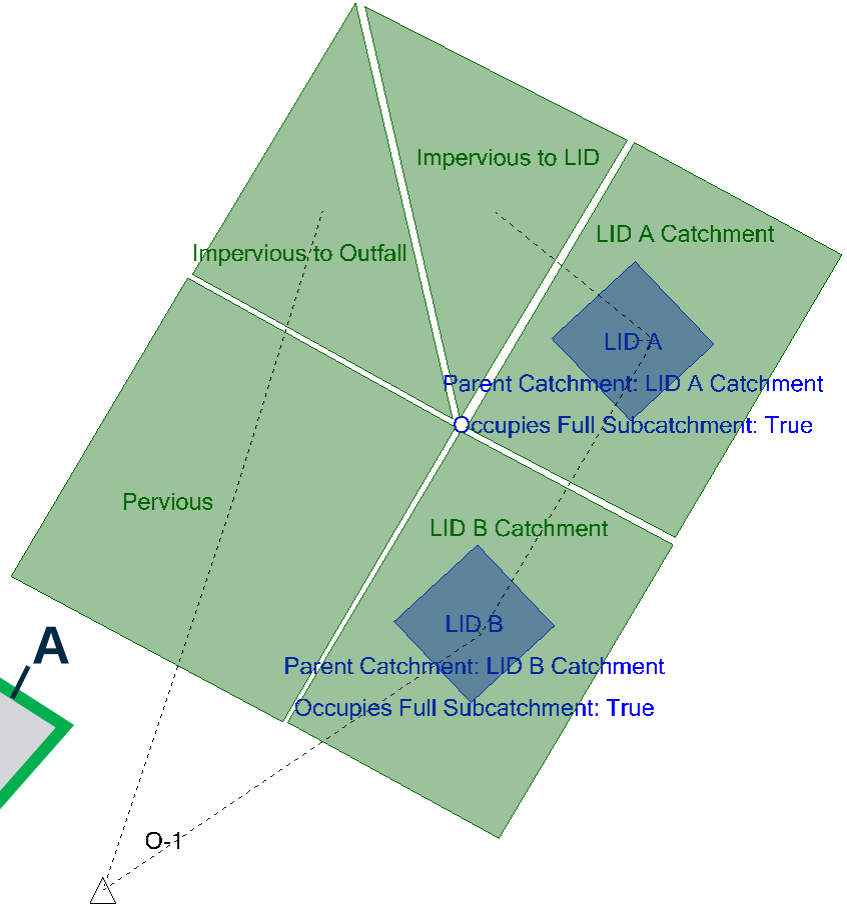
Flexible LID Modeling

a. Before LID Controls



b. With two LID controls in series





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Storage Tanks

- Manufactured tanks
- Usually underground
- New pond volume type
- Library available

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Cost-Effective Design and Rehabilitati

Objectives	
Deliver designs that meet regulatory requirements	Reduce modeling time, in order to focus on engineering decisions

Outcomes	
Optimal design - Minimized capital investment	High quality projects

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Design

New Infrastructure

Automated constraint-based design

Minimize design costs and capital investments

Maximize performance

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Rehabilitation

Existing Infrastructure

Evaluation of capacity

Assessing the risk of flooding

Find/fix bottlenecks

Improve overall system

Reduce capital investments

File Edit Element Settings Tools Utilities Workspace GEOPAK Window Subsurface Utility Help

Default

Tasks

Element Selection

View 1, Default

1084.150

167°31'22.2"

View 5, Default-3D

Properties - Catch Basin - 28 (236)

Project Explorer

Civil Message Center

Multi-Model Views

1 2 3 4 5 6 7 8

X 2516947.036

Y 585123.899

Element Selection > Identify element to add to set

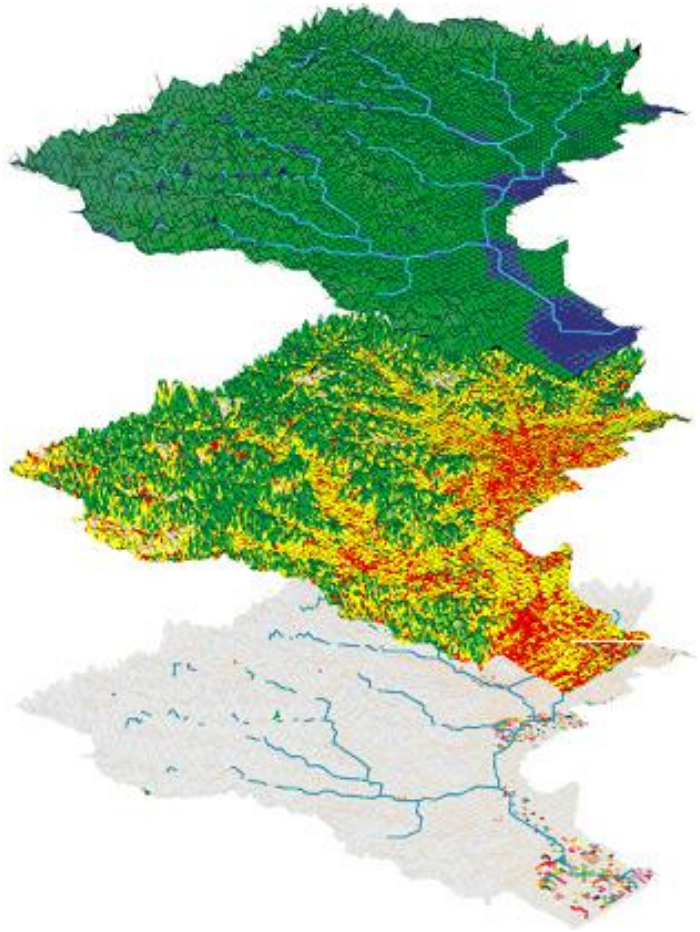
Node: 28, Level: Drainage-StormSewer

Default

:1

Flood Risk Analysis of Storm Drainage Systems

Flood risk = probability (flood hazard) x consequences (damage)



Flood hazard map (flood probability) based on capacity assessment / modelling using hydrologic inputs and hydrodynamic simulation models SwerGEMS / CivilStorm / HEC – Pack, Mohid 2D/3D

flood damage map showing the exposure and damage potential (consequences of flooding), based on available GIS data

flood risk map representing the direct damage (monetary value). Derived with GIS spatial analysis (Bentley Map)

32

LumenRT flood visualization (results from flood simulation and Map)

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Take Away Message

- Bentley's integrated solution cover the complete life-cycle of the Water, Stormwater, Sewer and any other Infrastructure
- Haestad modelling products are the back-bone of this solution to improve the Asset Performance of the infrastructure
- Delivery of BIM-ready digital information models is the way forward to ensure Sustainable Water Infrastructure

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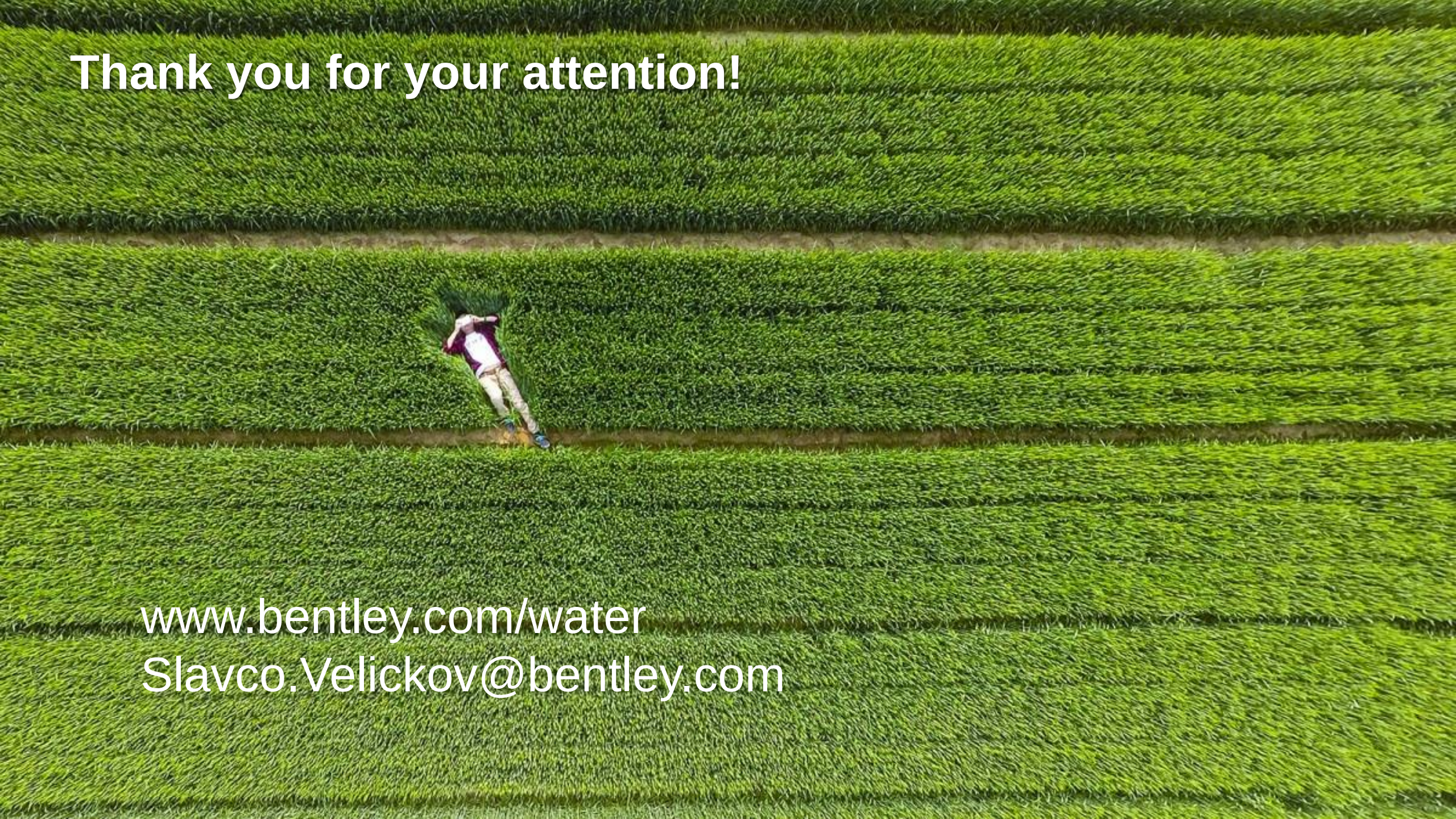
Thank you for your attention!



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