

### Summary

World leading, field proven dynamic simulation program. Combining hydraulics, controls, and process modeling to create a realistic, dynamic system behavior. Coordinated facility modeling that covers the entire life cycle of a facility including; design and planning, controls programming, pre-tuning, and testing, facility startup, operator training, and operations optimization.

### Business Value

Understand and optimize the dynamic challenges of designing and operating a facility, sustainably and economically.

Simulate all aspects of a process system allowing for more in depth knowledge and exploration leading to cutting-edge ideas and more informed decision making.

Reduce project risk during the commissioning phase through a thoroughly integrated analysis of process control system testing.

User friendly interface for model operation and linkage to SCADA HMI for “flight simulator” operator training.

## REPLICA

Practical dynamic Simulation for Water and Wastewater Engineering Solutions

### ROBUST, INNOVATIVE, AND EFFICIENT SOLUTIONS

The water and wastewater industries face ever increasing challenges to meet water supply demands and treatment regulations, while needing to provide sustainable, effective, and economical solutions.

CH2M HILL's REPLICA dynamic simulation provides a world leading, unique method for modeling a realistic system behavior. REPLICA integrates hydraulics, instrumentation, controls, and process treatment allowing for improved design discipline coordination, more effective and efficient design solutions, improved system understanding and optimization of operations.

REPLICA has been built from over 30 years of hydraulic modeling, process design, and process controls knowledge, in a fashion that is both flexible and complies with industry standard calculations, and can be customized for a specific application. REPLICA has been used on over 100 projects of varying size around the world consisting of: water conveyance and distribution, water treatment, wastewater treatment, and wastewater collection.

### BENEFITS SUMMARY

- Thorough analysis of complete system leads to improved system understanding leading to more robust solutions
- Develop and verify process control strategies early on to reduce operational risk during non-typical events
- Pre-tune and test control logic against the model prior to field installation to reduce startup risk and schedule
- Optimize operations to increase facility performance efficiency
- Provides a “flight simulator” environment for operator training, with linkage to actual facility SCADA HMI

# REPLICA

## DYNAMIC SIMULATION

### MODELING CAPABILITIES

- Compressible and Non-compressible Hydraulics
- Process Instrumentation and Control Logic
- Water Chemistry
- Wastewater Treatment Process
- Water Treatment Process
- Energy and Chemical Usage
- Advanced Optimization

### MODELING APPLICATIONS

REPLICA can be applied at various phases of a project, which can start with a theoretical model during design and be calibrated during the operations phase.

#### Design

REPLICA can be used during the design phase of a project to confirm equipment sizing and selection, evaluate system pressure and gravity hydraulics, develop fundamental control strategies and preliminary control setpoints. In addition, REPLICA can be linked to CH2M HILL's Advanced Optimization Algorithms to optimize the project design for various parameters including operating costs, power consumption, chemical usage, water loss, and process control tuning setpoints.

#### Commissioning

REPLICA can be used during the commissioning phase of a project to perform control system testing and operator training. The process control logic programmed in the actual Programmable Logic Controllers (PLCs) being installed in the field are tested and tuned against the REPLICA model prior to field installation to minimize programming changes in the field. REPLICA can also be linked to the SCADA HMI software to provide a realistic "flight simulator" of the system for operator training, providing operators insight in operating the system prior to actual system operations.

#### Operations

REPLICA can be used after a project has been in operation to evaluate and optimize operations, capture operations knowledge, provide operator training, and to be used by operators as a "what if" scenario tool.

### MODELING DELIVERY

Run-time model versions of REPLICA dynamic simulation projects are provided as a deliverable, and are customized for each specific project. Model user guides are prepared so that Engineers and Clients can use the dynamic simulation model to evaluate the system.



# REPLICA

## DYNAMIC SIMULATION

### MODELING COMPONENTS

#### Non-Compressible Hydraulics

Tanks  
Pipes  
Valves  
Pumps  
Fittings  
Orifices  
Weirs  
Screens  
Equipment  
Open Channels  
Flumes  
Source  
Sink

#### Compressible Hydraulics

Tanks  
Pipes  
Valves  
Blowers  
Equipment (Diffusers)

#### Instrumentation

Flow Measurement  
Indicator Transmitters  
Process analyzers  
Limit Switch  
Actuator  
Motor

#### Process Controls

Math Functions  
Logical Functions  
ASD Sequencer  
PID Controller  
Chemical Dosage  
Cycle Timer  
Duty Controller  
Units Controller  
Gap Action Level Controller  
Group Sequencer  
Lead Lag Block  
Lead Standby Block  
Most Open Valve  
Pump Transitions  
Ramp Block

### UNIT PROCESS MODULES

#### Water Treatment

Flow Control  
Rapid Mix  
Flocculation  
Sedimentation  
Actiflo  
High Rate Clarification  
Dissolved Air Flotation  
Ozone Contractor and Generation  
Conventional Filtration  
Pressure filtration  
Pressure Membranes  
Cartridge Filtration  
Reverse Osmosis  
Equalization Basin  
Gravity Thickening  
Solids Drying Beds  
Deskins Filtration  
Storage and Clearwells  
Liquid & Dry Chemicals

#### Wastewater Treatment

Screening and Grit  
Splitter Structure  
Primary Clarification  
Bioreactor  
Secondary Clarification  
Membrane Bioreactor  
Fluidized Bed Reactor  
Aeration Blowers  
Submerged Membranes  
Moving Bed Biofilm Reactor  
Oxidation Ditch  
Actiflo  
LPHO Ultra Violet  
Chlorine Contact Basin  
Cloth disc Filtration  
WAS Storage  
Gravity Belt Thickener  
Centrifuges  
Digesters

#### Conveyance

Pressure Reducing Station  
Submersible Pump Station  
Horizontal Centrifugal Pump Station  
Vertical Turbine Pump Station  
Well Pump Station  
Chopper Pump Station  
RAS / WAS Pump Station  
Backwash Supply Pump Station

### LINKAGE

Microsoft Excel  
CH2M HILL Pro 2D  
EPA Net

OPC  
CH2M HILL Source  
Rockwell Automation

Digital Linked Library  
Infoworks  
Siemens



CH2MHILL® **Replica** SIMULATION TECHNOLOGY

