



Ciclo de 20

MasterClass

AGUASRESIDUALES.INFO

AGUASRESIDUALES.INFO



Enrico Remigi

WEST Product Owner (DHI, Water in Cities)
Environmental Engineer

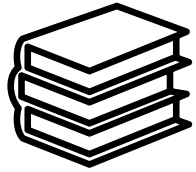
- Model Development
- Technical Support & Training
- Projects (30): process & energy optimization



Outline



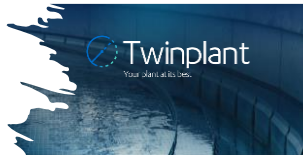
About DHI



Case studies



Offline Studies - WEST



Online Solutions

About DHI

- Independent, private and not-for-profit organisation
- Main office in DK and 30+ offices in countries worldwide with total staff of more than 1,100
- Software products for water modelling – the MIKE suite
- Custom-made digital solutions for the water sector










We support the UN **sustainable development goals.**



DHI is a **leading, innovative, global advisory** company, integrating deep **domain knowledge** and **technology** to enabling new ways to use, manage and live with **water** and to protect water-related ecosystems.



Wastewater Treatment Services

- Experts in analysing, modelling and optimising WWTPs
 - performance and energy audits » Feasibility Studies 
 - bottleneck identification & optimization » Advanced Process Modelling 
- We can help to:
 -  Improve effluent quality
 -  Increase plant capacity
 -  Become energy neutral
 -  Recover valuable resources » WRRFs
 -  Establish automated model- and data-driven operations

Wastewater Treatment Services

Operation (online)

- Implementation of **Digital Twins** (integration ↔ model)
- Implementation of **real-time DSS** for operators and process engineers
» to identify best operating strategy in dynamic conditions

Operation (offline)

- Optimization of operation **costs** (e.g. aeration, chem dosing, energy)
- Assessment and optimization of advanced **control solutions**
- Estimation of GHG emissions (e.g. N₂O)
- Operator training

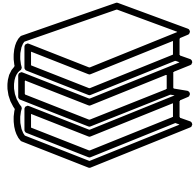
Design

- Evaluation of design alternatives and **design verification**
- Capacity assessment for different **scenarios** (e.g. peak load, population growth, new discharge, ..)
- Study **upgrade** solutions

Outline



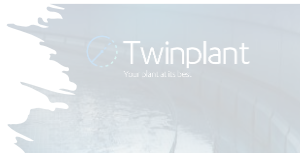
About DHI



Case studies



Offline Studies - WEST



Online Solutions

VIBY (DK)

CHALLENGE

- Insufficient capacity » unstable performance
- Short WWTP lifetime

SOLUTION

- Model-based process optimization & retrofitting
- Advanced control strategies (aeration, chemical dosing)

RESULT

- 30% capacity for < 2M Eur
- very limited interventions in new infrastructure

Client: Aarhus Vand

Partners: NIRAS, TechRas Miljø, EssDe GmbH



BJERGMARKEN (DK)

CHALLENGE

- High energy consumption due to excessive aeration

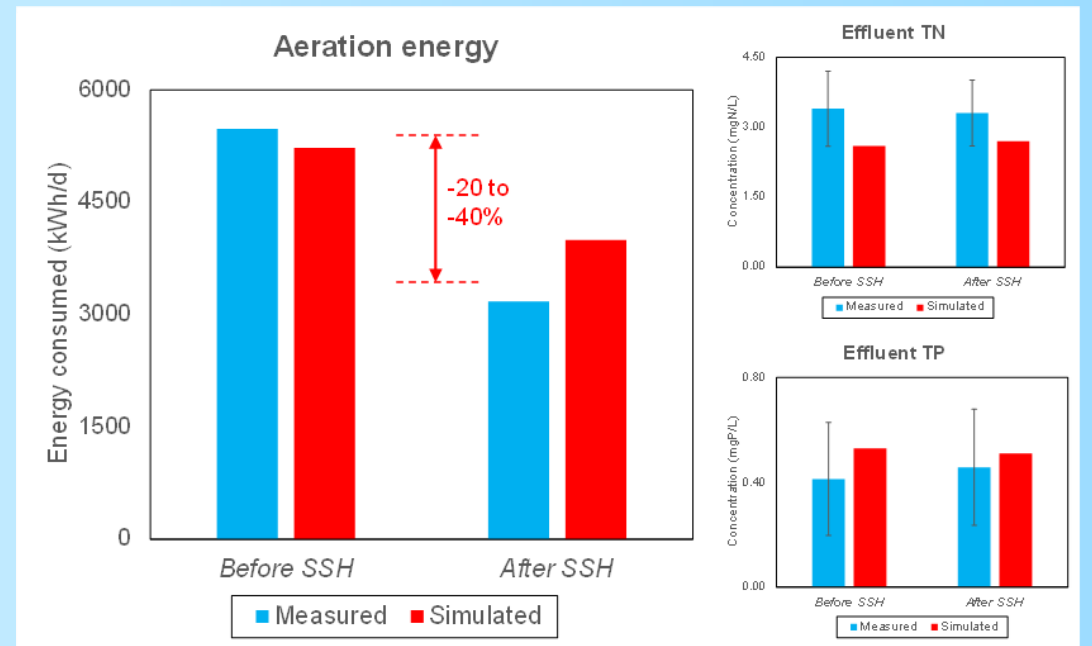
SOLUTION

- Model-based process retrofitting
- Conversion of ARP process to side-stream hydrolysis (SSH)

RESULT

- -20% reduction in aeration energy use
- Long-term treatment stability

Client: FORS A/S



WEST LAFAYETTE (US)

CHALLENGE

- Reduce C-footprint to fulfil climate action plan

SOLUTION

- Process modelling to identify optimization potential
- Advanced control strategies (aeration, anaerobic digestion)
- Carbon footprint calculator

RESULT

- 60% energy neutral operation achievable
- \$ 293,000 estimated yearly savings

Client: City of West Lafayette



BRESSO NIGUARDA (IT)

VISION

- Couple operator's experience, real-time data and model's predictive capability

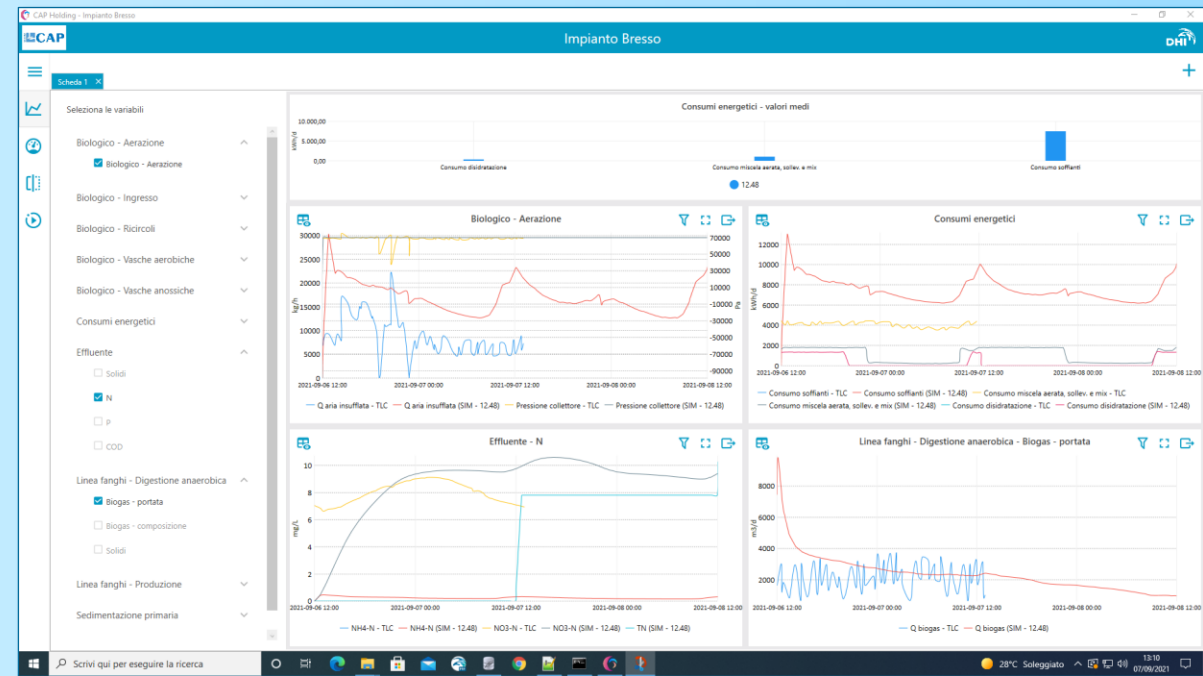
SOLUTION

- Digital Twin for plant monitoring, staff training and decision support
- Custom GUI, automatic data acquisition, WEST model, and scheduled execution of simulations

RESULT

- Running on premises

Client: Gruppo CAP



Outline



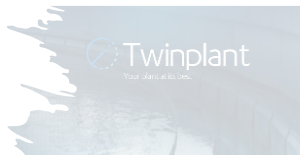
About DHI



Case studies



Offline Studies - WEST



Online Solutions

WEST

- **Dynamic** simulator for physical, chemical and biological processes
- Domains:
 - Municipal wastewater treatment plants (**WWTP**)
 - Transition WWTP » **WRRF** (Water Resource Recovery Facility)
 - Integrated Urban Water System (**IUWS**): catchment, sewer, plant, receiving water body
 - Other domains, e.g. (drinking) water treatment, industrial process water treatment, ..



Generic platform for process modelling and simulation

The Model Library

Screening, grit removal

Buffer tanks: equalisation, storm,

Activated sludge, oxidation ditch

Biofilm: MBBR, IFAS

Alternated process: SBR, CFID, CFCD

Membrane: MBR, external membrane

Primary & Secondary Settling tanks

Sand- and trickling filters

Sludge dewatering units

Chemical dosage units

Aerobic and anaerobic digesters

Heat losses, sludge pre-heating, gas turbine

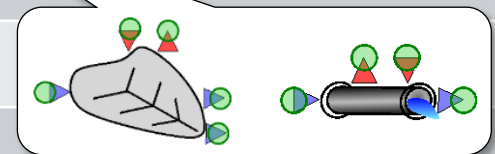
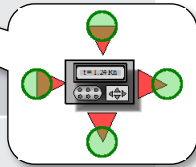
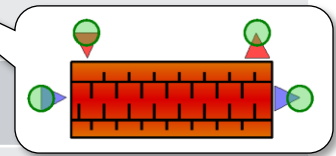
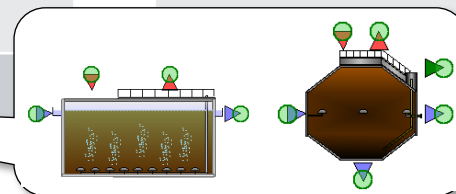
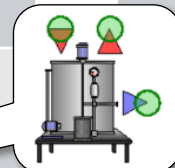
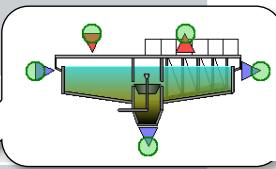
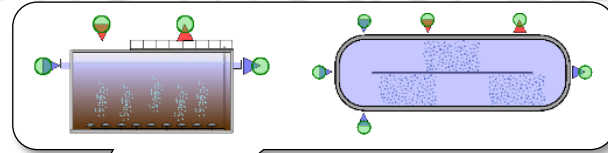
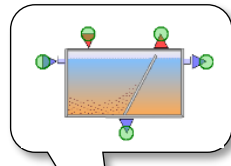
Disinfection

Sensors, controllers, timers

Aerators and Blowers

Pumps

Catchment, Pipes, CSO, River



The Workflow in WEST



The Workflow in WEST

Demo_WEST_PitStop - WEST+ 2021 (64-bit)

Home Project Layout Dashboard Code View Tools

Paste Cut Copy Redo Undo Select All WEST Forum Support Help

Clipboard Help

Block Library

- Input and Output
- Flow
- Blowers and Pumps
- Pre-treatment
- Retention
- > Biological Treatment
 - Activated Sludge Tank
 - Oxidation ditch
 - SBR
 - Biofilter
 - MBR
 - MBBR
 - Granular SBR
- Separation
- Sludge Treatment
- Dosing
- Aeration
- Controllers, Timers
- Sensors
- Tertiary
- Energy
- Misc
- NRM

Logging Layout Top-level Items

Control Center

Steady State Dynamic

Start	Current	Stop	Unit
0	0	100	d

Block Details : <Root>

Parameters Variables Description

Name	Value	Unit
------	-------	------

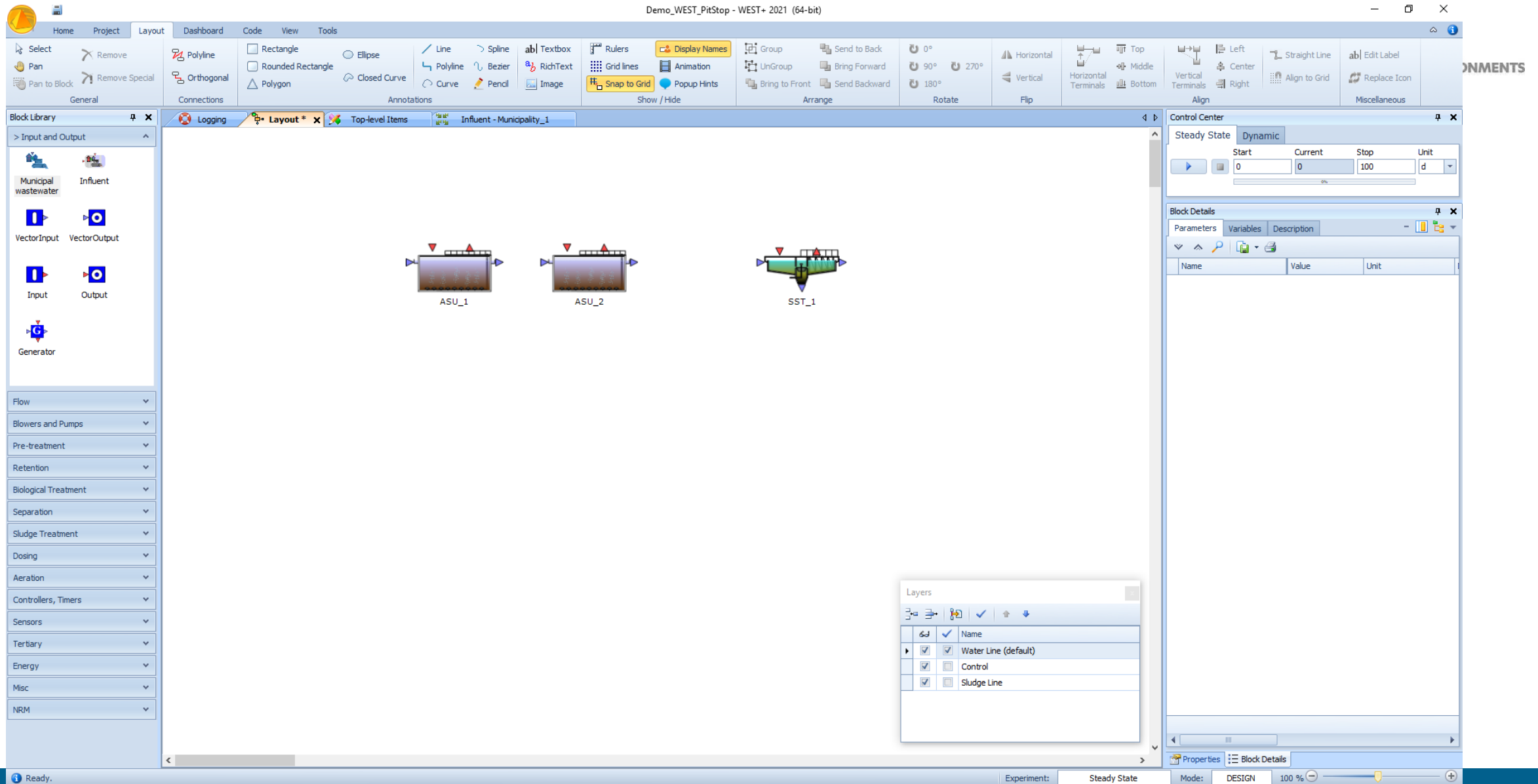
Layers

Name	Value	Unit
<input checked="" type="checkbox"/> Name		
<input checked="" type="checkbox"/> Water Line (default)		
<input checked="" type="checkbox"/> Control		
<input checked="" type="checkbox"/> Sludge Line		

Ready. Experiment: Steady State Mode: DESIGN 100%

The Workflow in WEST

Demo_WEST_PitStop - WEST+ 2021 (64-bit)



The screenshot displays the WEST software interface in 'Layout' mode. The main workspace shows a wastewater treatment plant layout with three main blocks: ASU_1, ASU_2, and SST_1. The ASU blocks are rectangular with a brown top and a blue bottom, while the SST block is a more complex structure with a green top and a blue bottom. The interface includes a top menu bar with options like Home, Project, Layout, Dashboard, Code, View, and Tools. Below the menu is a toolbar with various drawing and editing tools. On the left, there is a 'Block Library' panel with categories like 'Input and Output', 'Flow', 'Blowers and Pumps', etc. On the right, there are panels for 'Control Center' and 'Block Details'. The 'Control Center' panel shows a 'Steady State' tab with a table for parameters:

Start	Current	Stop	Unit
0	0	100	d

The 'Block Details' panel shows a table for parameters:

Name	Value	Unit

A 'Layers' dialog box is also visible, showing a list of layers with checkboxes:

Layer Name	Checked
Name	<input checked="" type="checkbox"/>
Water Line (default)	<input checked="" type="checkbox"/>
Control	<input type="checkbox"/>
Sludge Line	<input checked="" type="checkbox"/>

The bottom status bar shows 'Ready.', 'Experiment: Steady State', 'Mode: DESIGN', and '100%' zoom.

The Workflow in WEST

Demo_WEST_PitStop - WEST+ 2021 (64-bit)

Home Project Layout Dashboard Code View Tools

Select Remove Polyline Rectangle Ellipse Line Spline ab| Textbox Rulers Display Names Group Send to Back 0° Horizontal Top Left Straight Line ab| Edit Label
 Pan Pan to Block Remove Special Orthogonal Rounded Rectangle Polyline Bezier RichText Grid lines Animation UnGroup Bring Forward 90° 270° Vertical Middle Left Center Right Vertical Terminals Right Vertical Terminals Left Center Right Straight Line ab| Edit Label
 Pan to Block Remove Special Orthogonal Polygon Closed Curve Curve Pencil Image Snap to Grid Popup Hints Bring to Front Send Backward 180° Horizontal Bottom Vertical Terminals Bottom Vertical Terminals Right Center Right Straight Line ab| Edit Label
 General Connections Annotations Show / Hide Arrange Rotate Flip Horizontal Middle Bottom Vertical Terminals Right Center Right Straight Line ab| Edit Label
 Miscellaneous

Block Library

- Input and Output
 - Municipal wastewater
 - Influent
 - VectorInput
 - VectorOutput
 - Input
 - Output
 - Generator
- Flow
- Blowers and Pumps
- Pre-treatment
- Retention
- Biological Treatment
- Separation
- Sludge Treatment
- Dosing
- Aeration
- Controllers, Timers
- Sensors
- Tertiary
- Energy
- Misc
- NRM

Logging Layout * x Top-level Items Influent - Municipality_1

Well_1 ASU_1 ASU_2 FS_1 SST_1 FS_2

Control Center

Steady State Dynamic

Start	Current	Stop	Unit
0	0	100	d

Block Details: <Root>

Name	Value	Unit

Layers

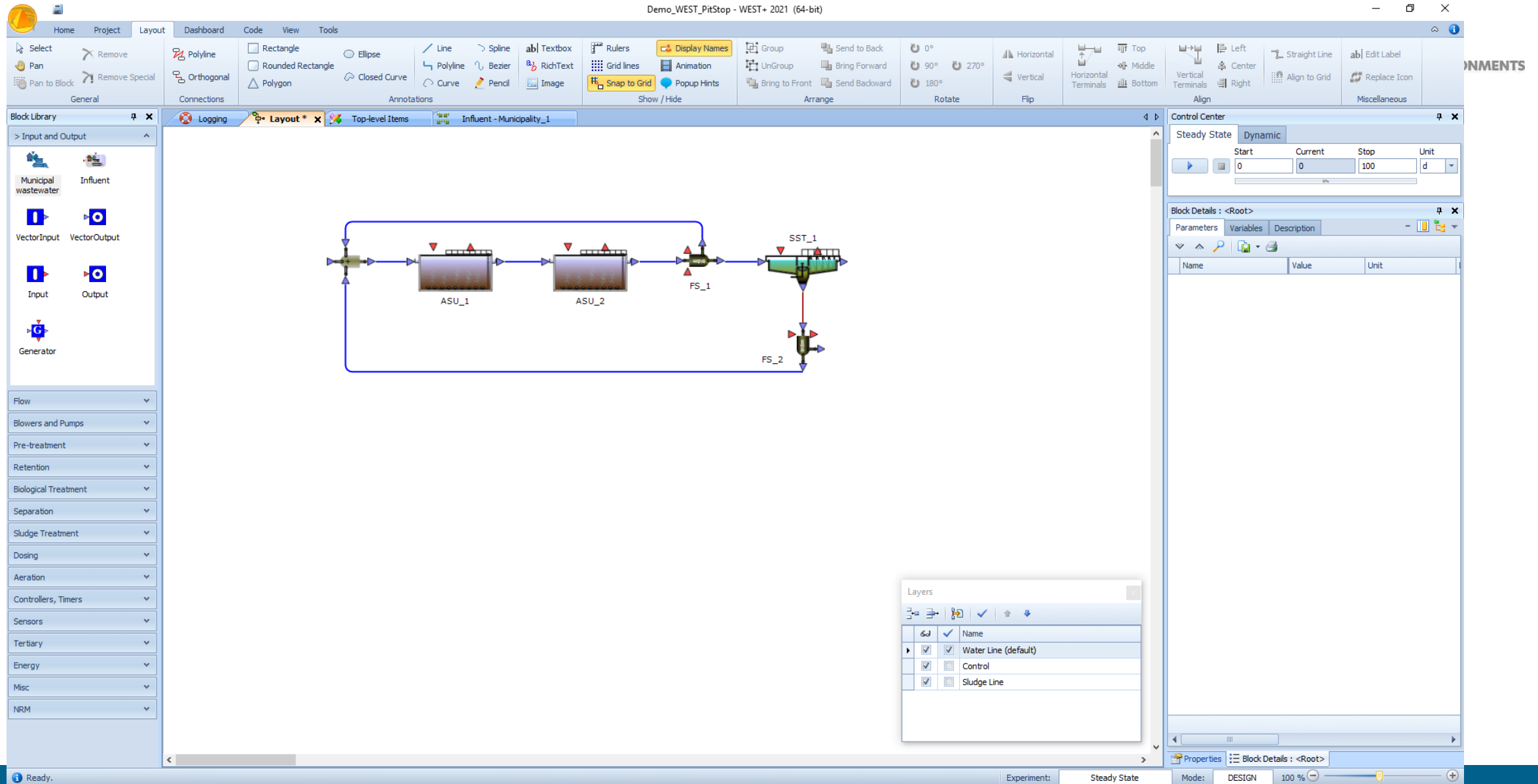
Name	Visible
Water Line (default)	<input checked="" type="checkbox"/>
Control	<input checked="" type="checkbox"/>
Sludge Line	<input checked="" type="checkbox"/>

Ready. Experiment: Steady State Mode: DESIGN 100 %

ONMENTS

The Workflow in WEST

Demo_WEST_PitStop - WEST+ 2021 (64-bit)



Block Library

- Input and Output
 - Municipal wastewater
 - Influent
 - VectorInput
 - VectorOutput
 - Input
 - Output
 - Generator
- Flow
- Blowers and Pumps
- Pre-treatment
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- NRM

Control Center

Steady State | Dynamic

Start	Current	Stop	Unit
0	0	100	d

Block Details : <Root>

Name	Value	Unit
------	-------	------

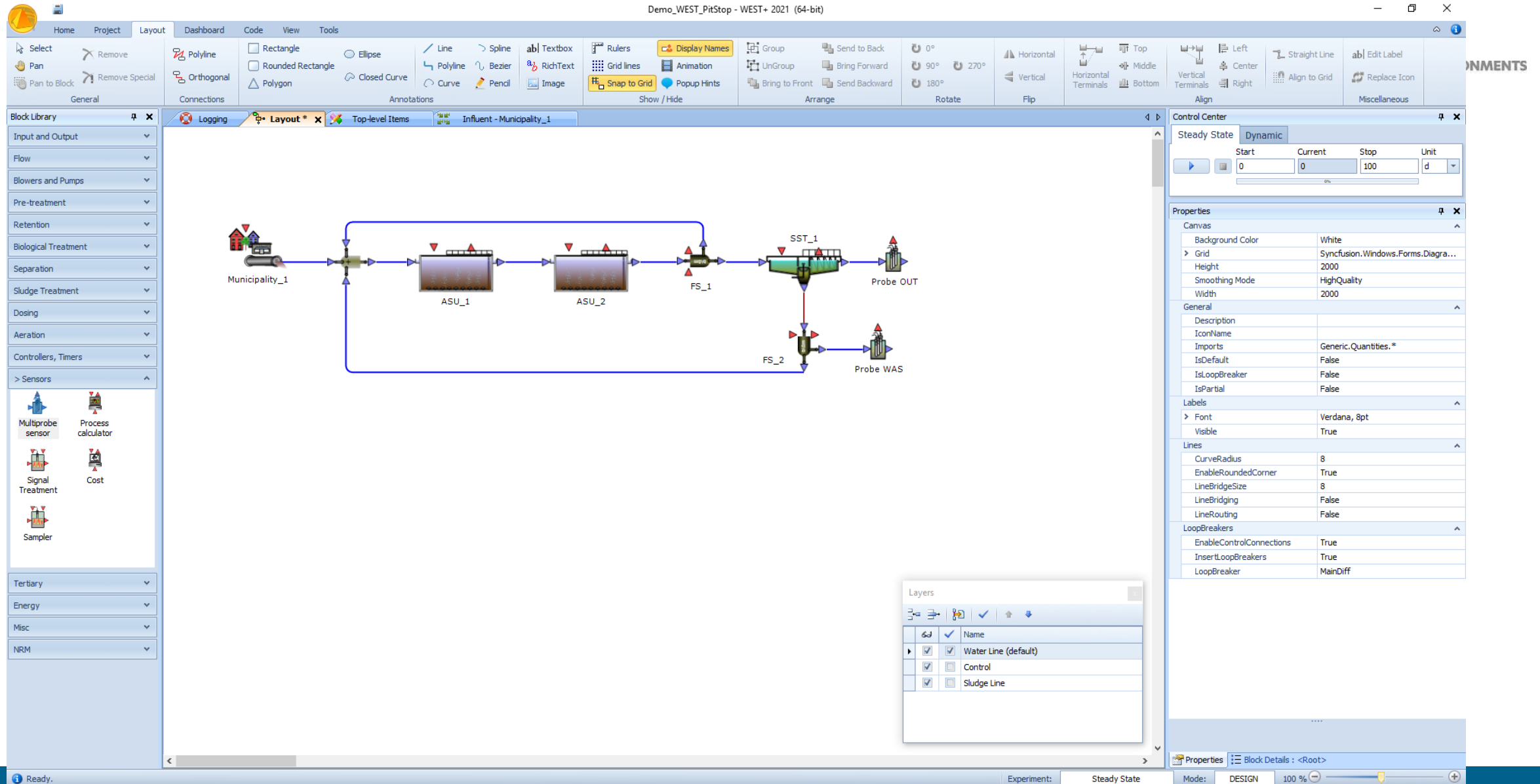
Layers

Name	Visible
Water Line (default)	<input checked="" type="checkbox"/>
Control	<input type="checkbox"/>
Sludge Line	<input type="checkbox"/>

Ready. Experiment: Steady State Mode: DESIGN 100%

The Workflow in WEST

Demo_WEST_PitStop - WEST+ 2021 (64-bit)



The screenshot displays the WEST software interface for a wastewater treatment plant simulation. The main workspace shows a process flow diagram with the following components and connections:

- Municipality_1**: The starting point of the process flow.
- ASU_1** and **ASU_2**: Aeration Sludge Units connected in series.
- FS_1**: A flow splitter receiving input from ASU_2.
- SST_1**: A Secondary Settling Tank receiving input from FS_1.
- Probe OUT**: A flow probe located at the outlet of SST_1.
- FS_2**: A flow splitter receiving input from SST_1.
- Probe WAS**: A flow probe located at the outlet of FS_2.

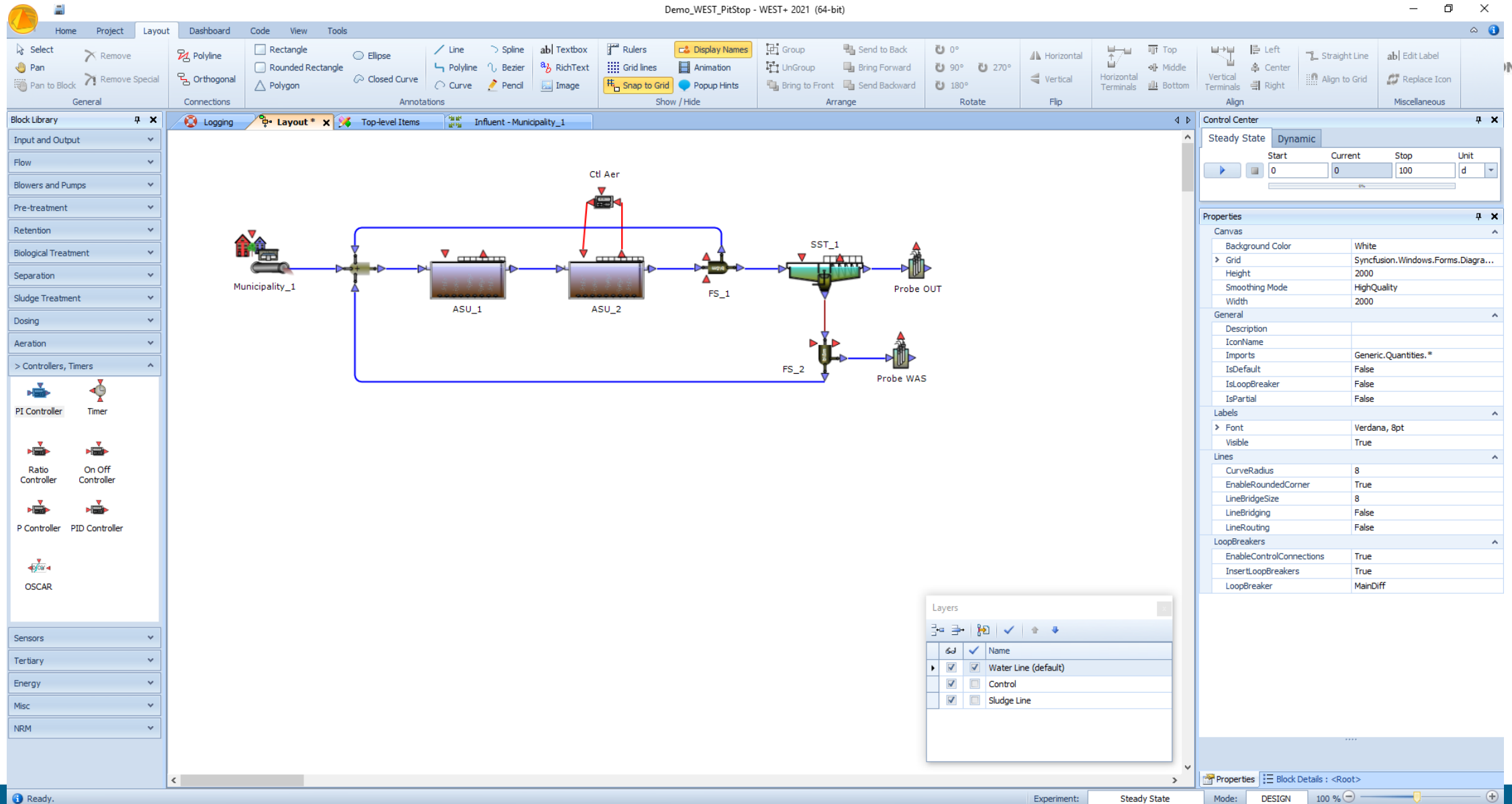
The interface includes a top menu bar (Home, Project, Layout, Dashboard, Code, View, Tools), a ribbon with various drawing and editing tools, and several panels on the right:

- Control Center**: Shows simulation parameters for Steady State and Dynamic modes, including Start, Current, Stop, and Unit values.
- Properties**: A detailed list of object properties such as Background Color, Grid, Height, Smoothing Mode, and General settings.
- Layers**: A panel for managing the visibility of different layers like Name, Water Line (default), Control, and Sludge Line.

The status bar at the bottom indicates the current mode is DESIGN and the simulation is in Steady State.

The Workflow in WEST

Demo_WEST_PitStop - WEST+ 2021 (64-bit)



Control Center

Steady State | Dynamic

Start	Current	Stop	Unit
0	0	100	d

Properties

Canvas

Background Color	White
Grid	Syncfusion.Windows.Forms.Diagra...
Height	2000
Smoothing Mode	HighQuality
Width	2000

General

Description	
IconName	
Imports	Generic.Quantities.*
IsDefault	False
IsLoopBreaker	False
IsPartial	False

Labels

Font	Verdana, 8pt
Visible	True

Lines

CurveRadius	8
EnableRoundedCorner	True
LineBridgeSize	8
LineBridging	False
LineRouting	False

LoopBreakers

EnableControlConnections	True
InsertLoopBreakers	True
LoopBreaker	MainDiff

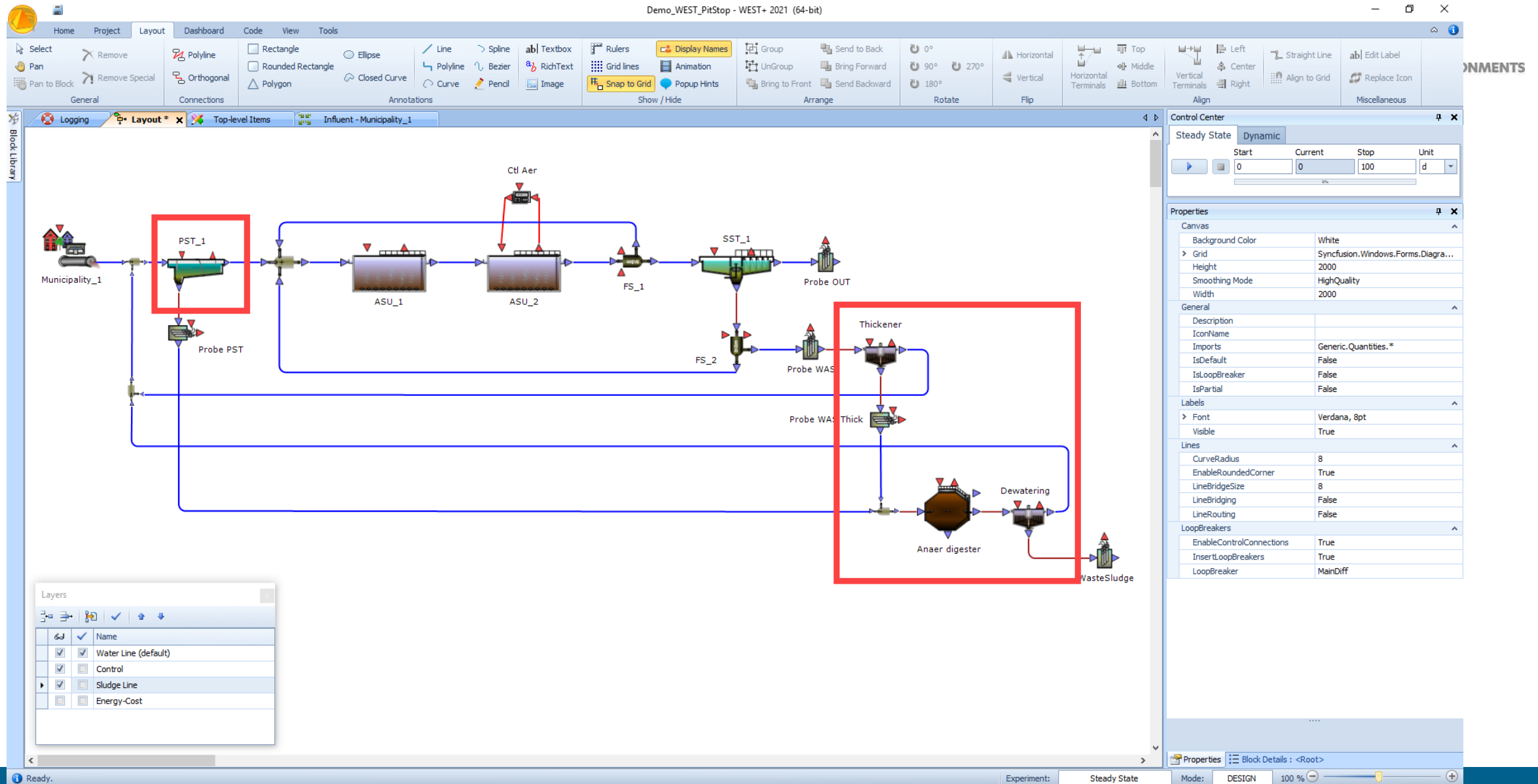
Layers

Visible	Name
<input checked="" type="checkbox"/>	Water Line (default)
<input checked="" type="checkbox"/>	Control
<input checked="" type="checkbox"/>	Sludge Line

Ready. Experiment: Steady State Mode: DESIGN 100 %

The Workflow in WEST

Demo_WEST_PitStop - WEST+ 2021 (64-bit)



Control Center

Steady State | Dynamic

Start	Current	Stop	Unit
0	0	100	d

Properties

Canvas

Background Color	White
Grid	Syncfusion.Windows.Forms.Diagra...
Height	2000
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LoopBreakers

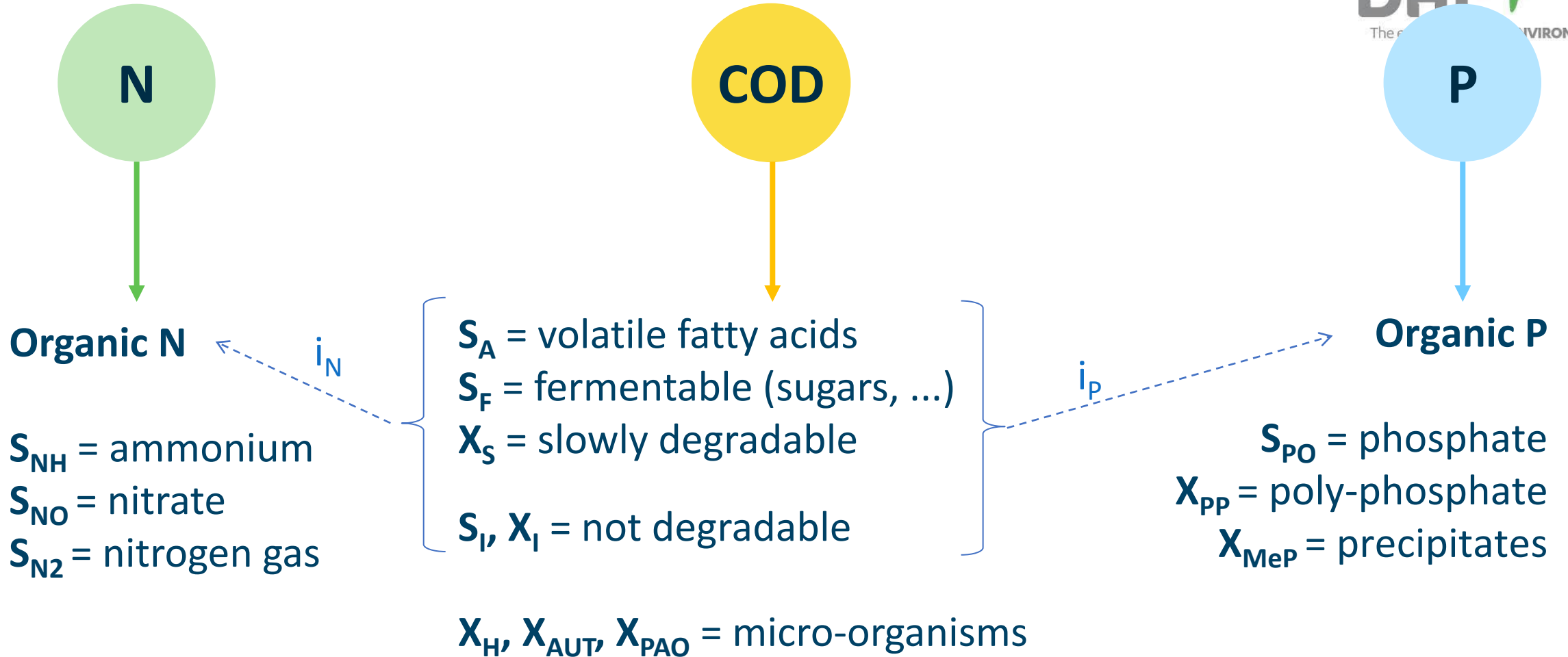
EnableControlConnections	True
InsertLoopBreakers	True
LoopBreaker	MainDiff

Layers

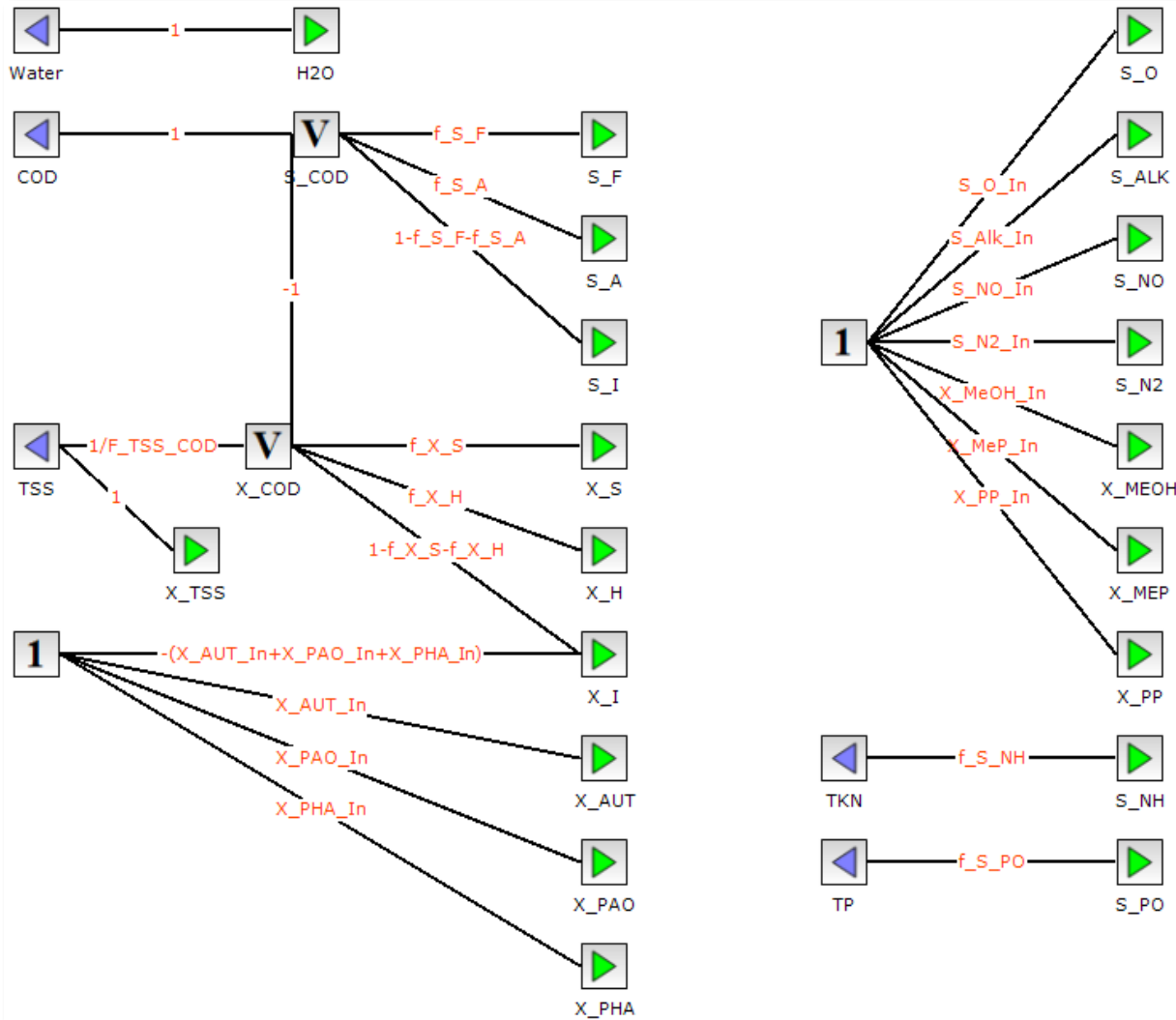
Visible	Name
<input checked="" type="checkbox"/>	Water Line (default)
<input checked="" type="checkbox"/>	Control
<input checked="" type="checkbox"/>	Sludge Line
<input type="checkbox"/>	Energy-Cost

Ready. Experiment: Steady State Mode: DESIGN 100 %

The Workflow in WEST

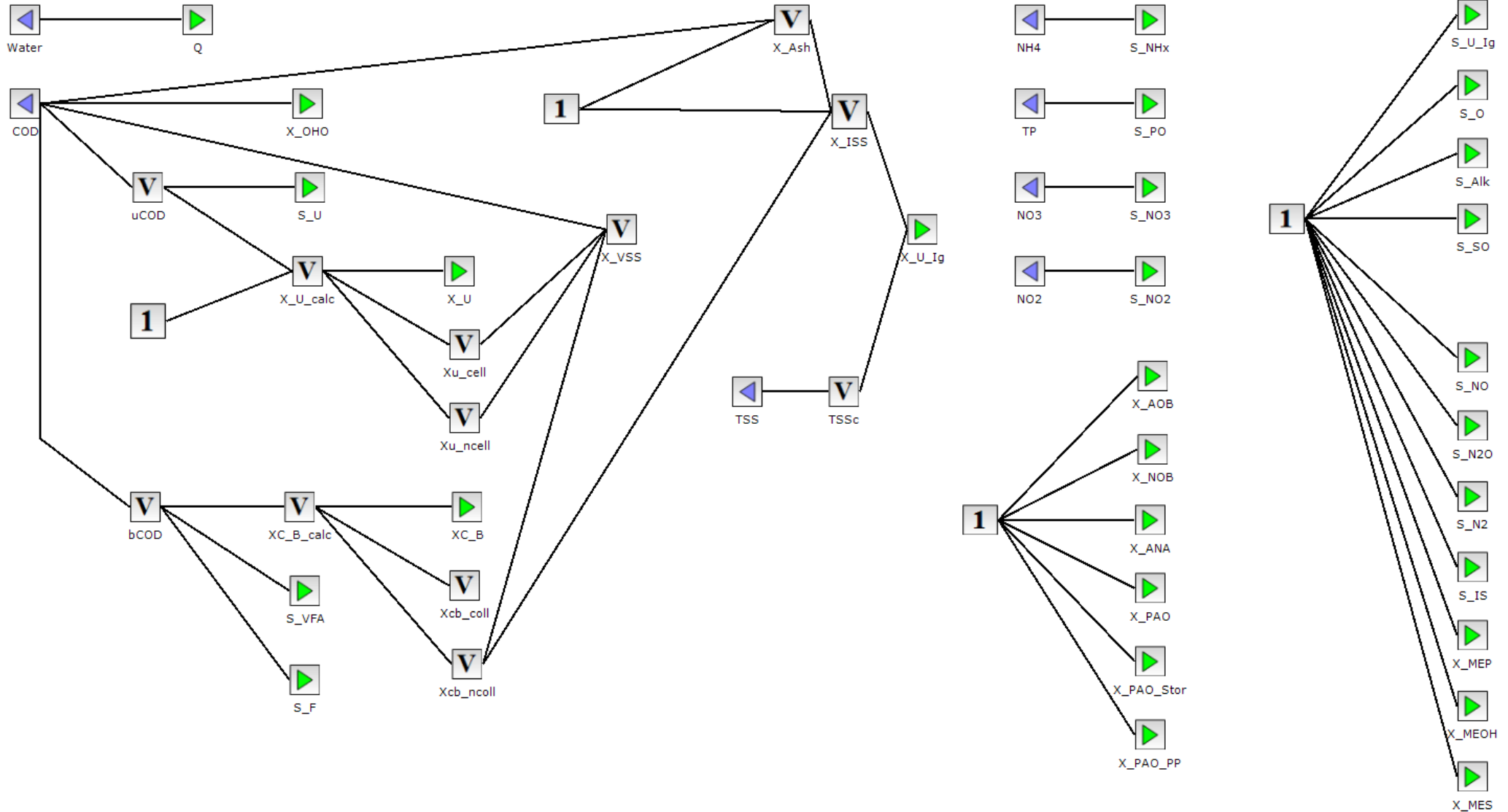


Influent Fractionation



f_{S_F}	0.375
f_{S_A}	0.25
f_{X_S}	0.69
f_{X_H}	0.17
$f_{S_{NH}}$	0.6
$f_{S_{PO}}$	0.6
F_{TSS_COD}	0.75

Influent Fractionation



Process Parameters

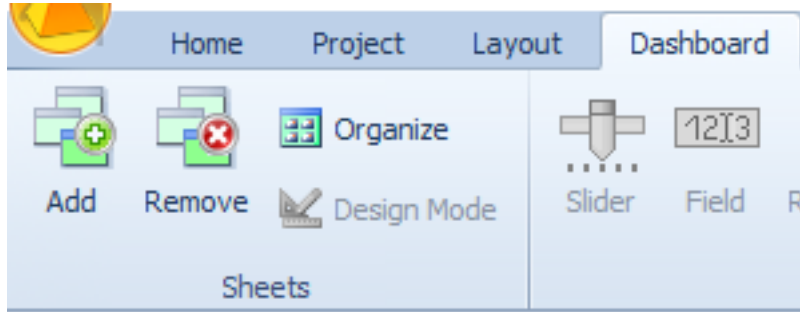


Blocco	Blocco	From	To
Ctl kLa	Aerata	DO	y_M
		u	kLa
Eta del fango	Anossica	V_ASU	V_01
		TSS	TSS_01
	Aerata	V_ASU	V_01
		TSS	TSS_01
	S-Effluente	y_Q	Q_Out
		y_TSS	TSS_Out
	S-Fango Supero	y_Q	Q_Waste1
		y_TSS	TSS_Waste1
Cost_1	Aerata	AerationPower	AerationPower1
	R-ML	PumpingPower	PumpingPower1
	Sed Secondario	PumpingPower	PumpingPower2

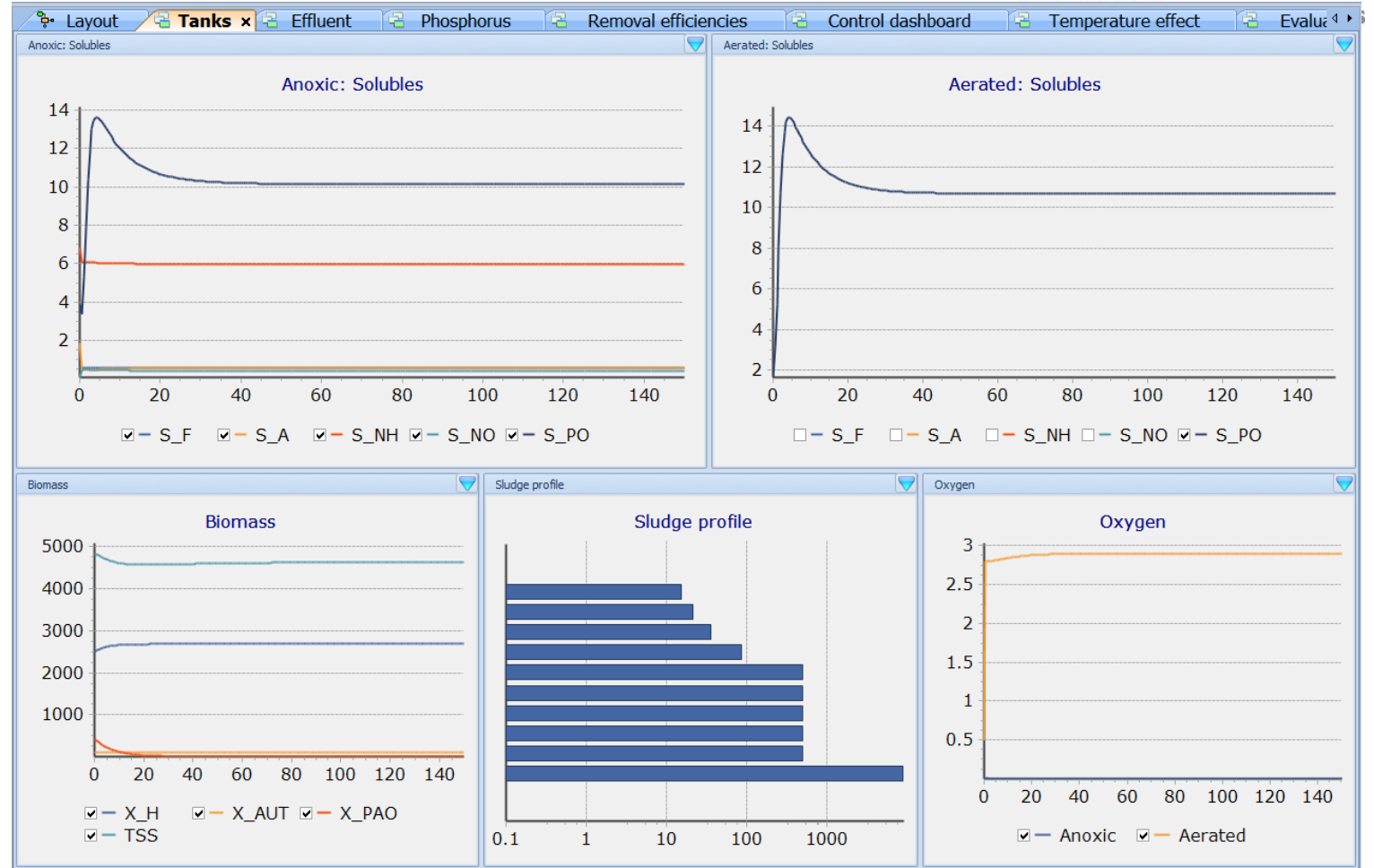
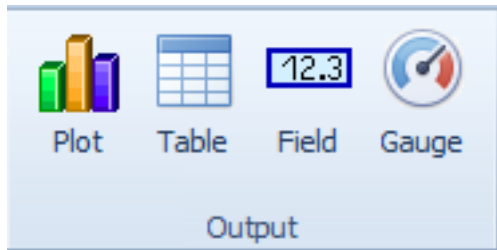
Influente	$f_{S_A} = 0.25$ $f_{S_F} = 0.375$ $F_{TSS_COD} = 0.75$
Anossica	Temp = 20 °C $kLa = 1 \text{ 1/d}$ Vol = 5,000 m ³
Aerato	Temp = 20 °C $kLa = \text{controllata}$ Vol = 10,000 m ³
Controllore PI	$y_S = 2 \text{ (g/m}^3\text{)}$
Ricircolo ML	$Q_{Out2} = 77,000 \text{ m}^3\text{/d}$
Ricircolo RAS	$Q_{Under} = 22,000 \text{ m}^3\text{/d}$
Fango di supero	$Q_{Out2} = 385 \text{ m}^3\text{/d}$

Dashboards for plots, tables, ..

1. Add a Sheet

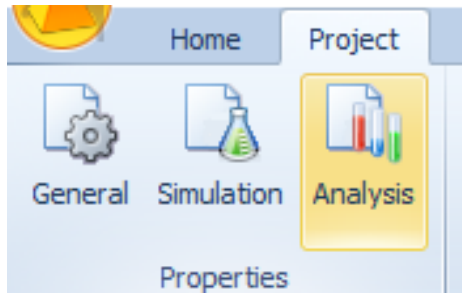


2. Add plot, table, field, ..



Stats and Objective Functions

Criteria



Analysis Properties

Objective Function Run

Variables Data files General

Submodel	Name
Calc_SRT	SRT_Tot
Cost_1	TotalAerationPower
Cost_1	TotalPumpingPower
ProbeOut	y_COD
ProbeOut	y_NH
ProbeOut	y_NO
ProbeOut	y_TN
ProbeOut	y_TP
ProbeOut	y_TSS

General Time series Criteria

Name	Enabled	Desired Value	Lower bound	Upper bound	Weight	Value
Aggregation						
Minimum	<input type="checkbox"/>	0	-INF	+INF	1	
Maximum	<input type="checkbox"/>	0	-INF	+INF	1	
Mean	<input checked="" type="checkbox"/>	0	-INF	+INF	1	0
Mean Weighted	<input type="checkbox"/>	0	-INF	+INF	1	
Standard Deviation	<input checked="" type="checkbox"/>	0	-INF	+INF	1	0
Standard Deviation Weighted	<input type="checkbox"/>	0	-INF	+INF	1	
Median	<input type="checkbox"/>	0	-INF	+INF	1	
Lower Percentile	<input checked="" type="checkbox"/>	0	-INF	+INF	1	0
Upper Percentile	<input checked="" type="checkbox"/>	0	-INF	+INF	1	0
Lower Percentile 2	<input type="checkbox"/>	0	-INF	+INF	1	
Upper Percentile 2	<input type="checkbox"/>	0	-INF	+INF	1	
Skewness	<input type="checkbox"/>	0	-INF	+INF	1	

Properties

Percentage: 0 10 20 30 40 50 60 70 80 90 100

Percentage 2: 0 10 20 30 40 50 60 70 80 90 100

Sample: Standard: Order: 3

Specify Number of Time points: Number of Time points: 100

Time: 0

Lower bound: -1.79769313486... Upper bound: 1.79769313486...

Difference Criterion: AbsSquared

Time Weighted Difference: Compute Root of Mean Difference: Difference Interpolated: Difference Extrapolated:

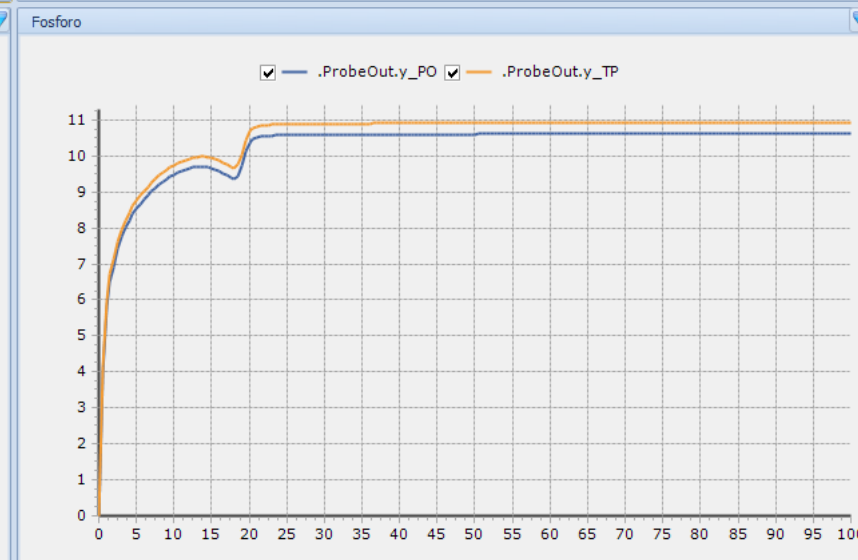
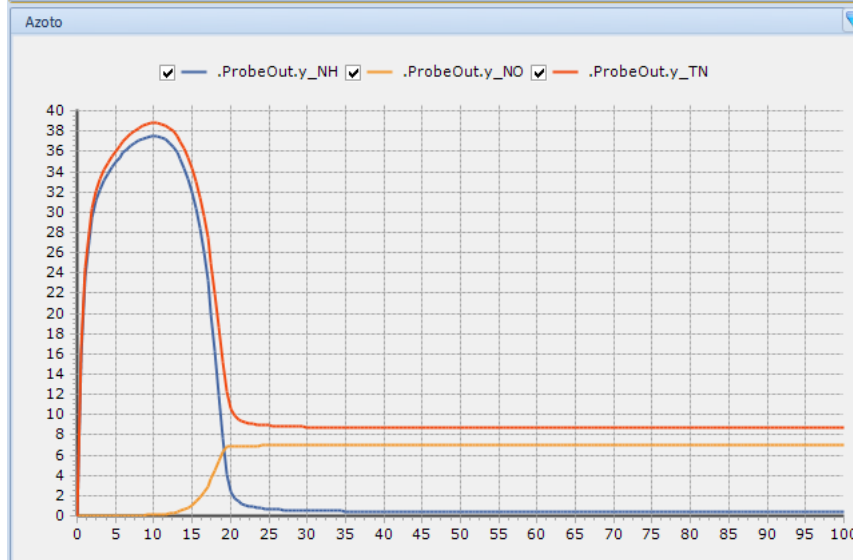
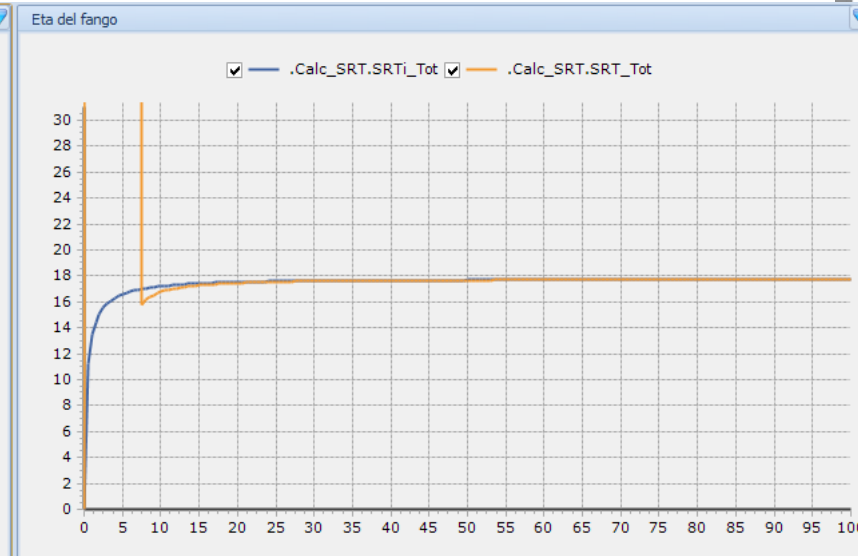
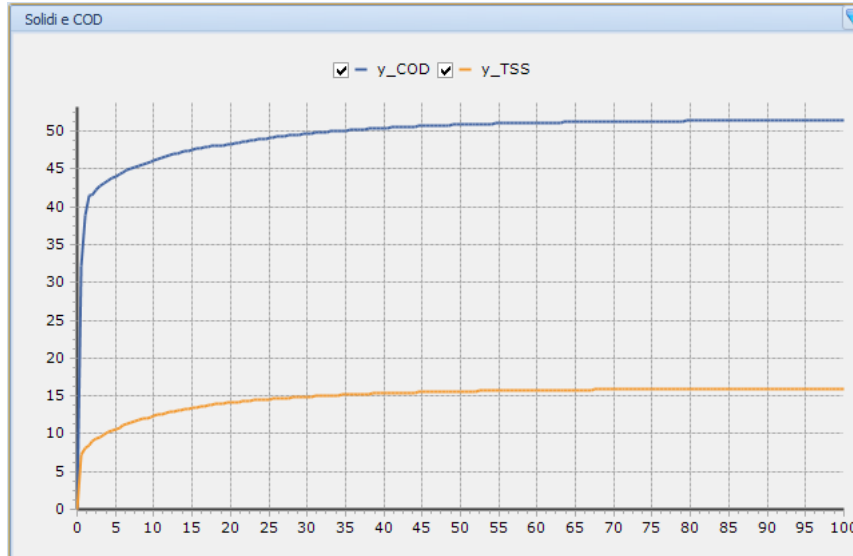
Weight Variable:

*** independent for steady-state and dynamic simulations

Variables

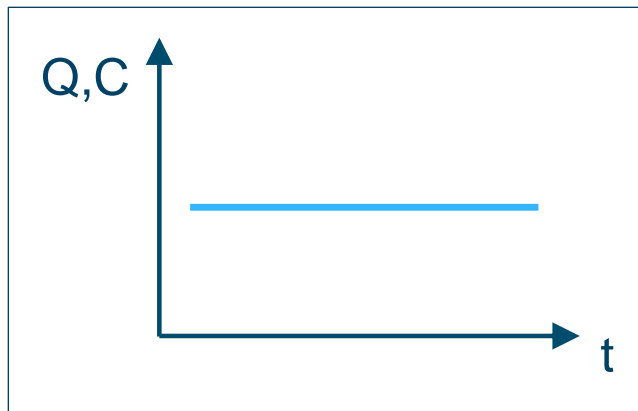
Statistics
 Sub-objectives

Steady-state Simulation



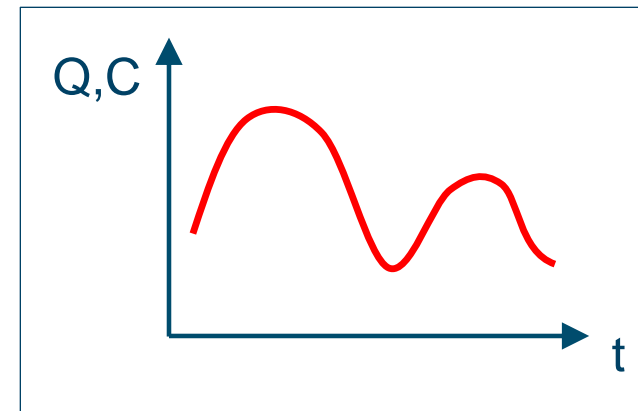
Steady-state → Dynamic

- Steady-state simulation
 - » Initial conditions for the system
 - » Baseline calibration



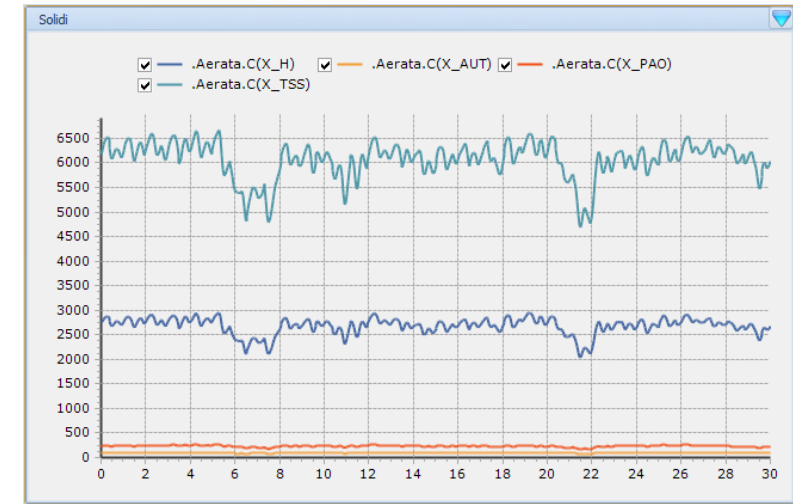
- » Costant conditions (flow rate, concentrations) / long-term

- Dynamic simulation



- » **Dynamic** conditions (flow rate, concentrations) / relevant time window

Dynamic Simulation



	COD	NH	NO	TN	TP	TSS	Aerat	Pumping	
Udine_01b-dyn	g/m3	g/m3	g/m3	g/m3	g/m3	g/m3	kWh/d	kWh/d	
Mean	38.79	0.53	6.57	8.02	8.64	13.40	6962	3960	10922
Standard Deviation	4.32	0.47	1.30	1.62	2.82	3.83			
Lower Percentile	30.95	0.17	4.17	5.14	4.76	8.71			
Upper Percentile	44.70	1.54	8.69	10.69	13.63	20.48			

Control & Automation

TwoASU - WEST+ 2021 (64-bit)

Home Project Layout Dashboard Code View Tools

Logging Layout * ASU Tanks Effluent and Sludge



Control Center

Steady State Dynamic

Start	Current	Stop	Unit
0	30	30	d

Dashboard

Aeration ctrl Fix DO Improved

Analysis Properties

Objective Function Run

Variable	Criterion	Desired Value	Lower bound	Upper bound	Weight	Value	Value after Difference Criterion
.Cost_1.AerationPower1	AbsSquared				1		7709.355
	Mean	0	-INF	+INF	1	7709.355	59434154.516025
.ProbeOut.y_TN	AbsSquared				1		13.82048
	Mean	0	-INF	+INF	1	13.82048	191.0056674304
Overall							3861.5877

Sheet 3

Nitrate, g/m3

Fix DO sp Improved

Total N, g/m3

Fix DO sp Improved

Ammonia, g/m3

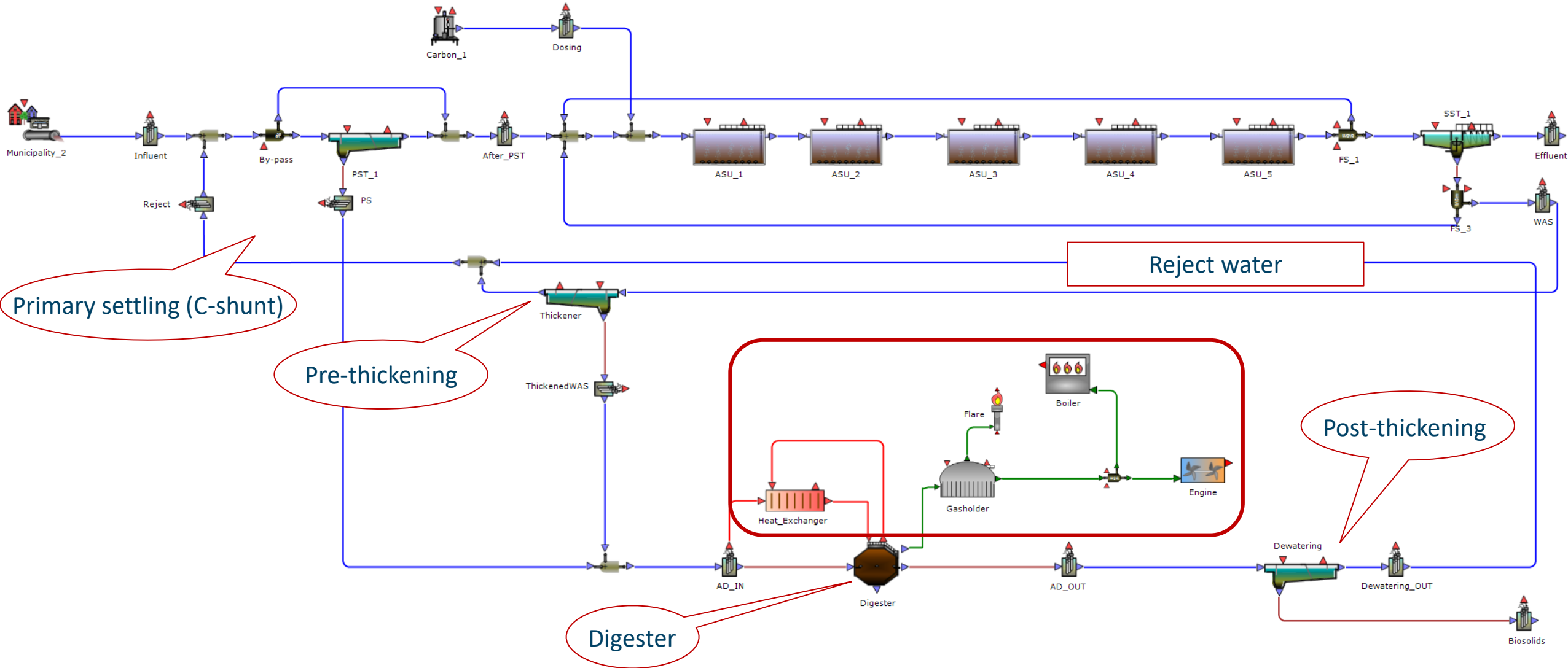
Fix DO sp Improved

Plot

Fix DO sp Improved

Experiment: Dynamic Mode: RUN 80%

Sludge line and biogas production



Energy Layer



mBSM2_Biogas - WEST+ 2022 (64-bit)

Home Project Layout Dashboard Code View Tools

General Simulation Analysis Setup Refresh Notes Reports Workbook Extensions Top-level Items Calculator Variables Build Simulation Run Log Initialize Simulation Advanced Local Sensitivity Analysis Global Sensitivity Analysis Parameter Estimation Scenario Analysis Uncertainty Analysis Remove

Properties Block Library Miscellaneous Advanced Experiments

Logging Layout Water line Sludge line Biogas

Block Library

- > Input and Output
- Flow
- Blowers and Pumps
- Pre-treatment
- Retention
- Biological Treatment
- Separation
- Sludge Treatment
- Dosing
- Aeration
- Controllers, Timers
- Sensors
- Tertiary
- Energy
- Misc
- NRM

Control Center

Steady State Dynamic

Start	Current	Stop	Unit
200	201,03004	230	d

Layers

Name
<input checked="" type="checkbox"/> Water Line (default)
<input checked="" type="checkbox"/> Sludge Line
<input checked="" type="checkbox"/> Control
<input type="checkbox"/> Calculator
<input type="checkbox"/> Data
<input checked="" type="checkbox"/> Biogas Line

Properties Layers Block Details : Biosolids : Dewatering:...

Model Explorer

- <Root>
 - AD_IN
 - AD_OUT
 - After_PST
 - ASU_1
 - ASU_2
 - ASU_3
 - ASU_4
 - ASU_5
 - Biosolids
 - Boiler
 - By_pass
 - Carbon_1
 - Dewatering
 - Dewatering_OUT
 - Digester
 - Tank
 - TransIn
 - TransOut
 - Dosing
 - Effluent
 - Engine
 - Flare
 - FS_1
 - FS_3

Experiment: Dynamic Mode: RUN 60%

Types of Experiments in WEST

- Base Experiment = Objective Evaluation
 - Steady-state (SS) & Dynamic (DYN) simulations combined
 - Assessment of custom objective functions
- Advanced Experiments
 - To quantify the impact of change to a set of parameters, on a set of variables

Types of Experiments in WEST

Local Sensitivity Analysis	Sensitivity of a set of variables on a set of parameters Analytical method
Global Sensitivity Analysis	Sensitivity of a set of variables on a set of parameters Statistical method
Parameter Estimation	Minimise the objective function, by varying a set of parameters Goal: a) Compare measurements vs. model output » Calibration b) Combination of variables » Optimization
Scenario Analysis	Compare scenarios (variables) for different sets of parameters values
Uncertainty Analysis	Quantify how the uncertainty on the model parameters (input) propagates to the model variables (output)

Automatic Model Calibration

OUR_MSL - WEST+ 2021 (64-bit)

Home Project Layout Dashboard Code View Tools

Add Remove Design Mode Slider Field Radiobutton Combobox Checkbox Plot Table Field Gauge Clear All Series Data Refresh

Sheets Input Output Miscellaneous

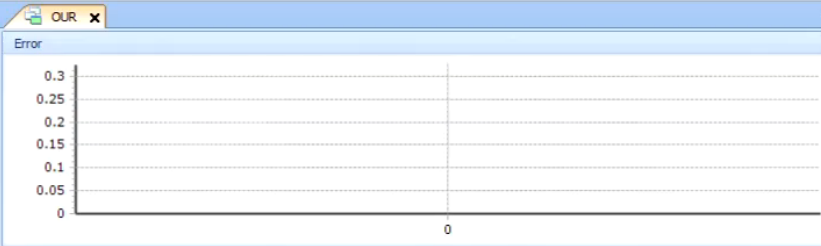
Analysis Properties

Submodel	Name
OUR_1	Ks
OUR_1	mumax
OUR_1	s
OUR_1	tau

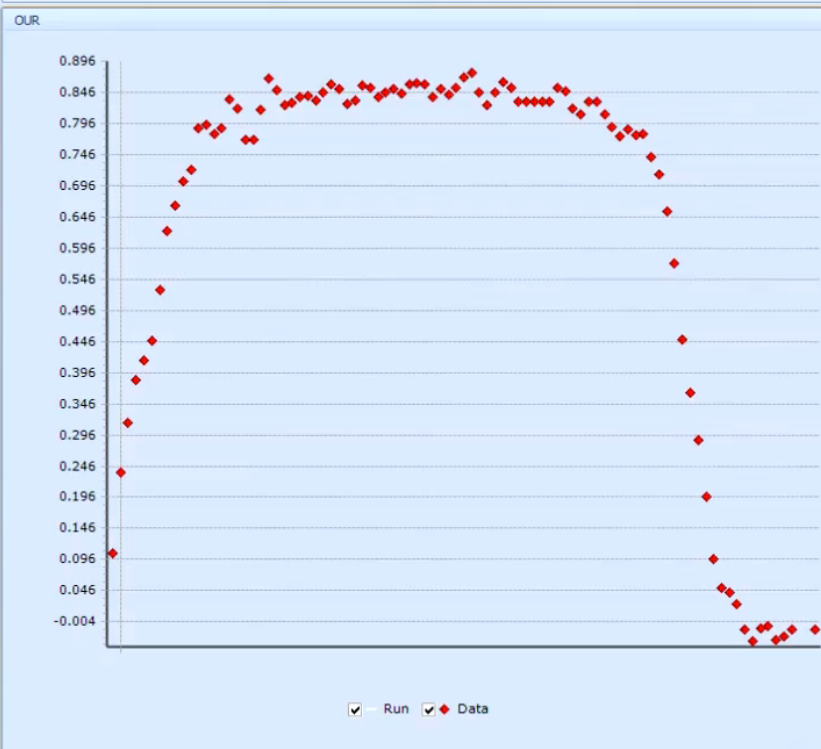
Settings: .OUR_1.Ks

Initial Value: 2
Lower bound: 0
Upper bound: 10
Step size: 1
Scaling: 2
Auto-scale:

Error



OUR



Block Details : .OUR_1

Name	Value	Unit	Default Value	Low
Category: Parameters				
Group:				
Ks	0		0	
Y	0.66		0.66	
mumax	0		0	
tau	1		1	
x	4000		4000	

Logging Layout ObjValue

OUR

OUR_1

Properties Block Details : .OUR_1

Control Center

Parameter Estimation Simulation

Run no.	Info
263	

Ready. Experiment: Parameter Estimation Mode: RUN 100%

Outline



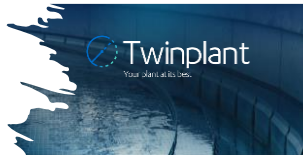
About DHI



Case studies



Offline Studies - WEST



Online Solutions

From offline ...

WWTP
performance

Status in
process units

Response to
changing
conditions

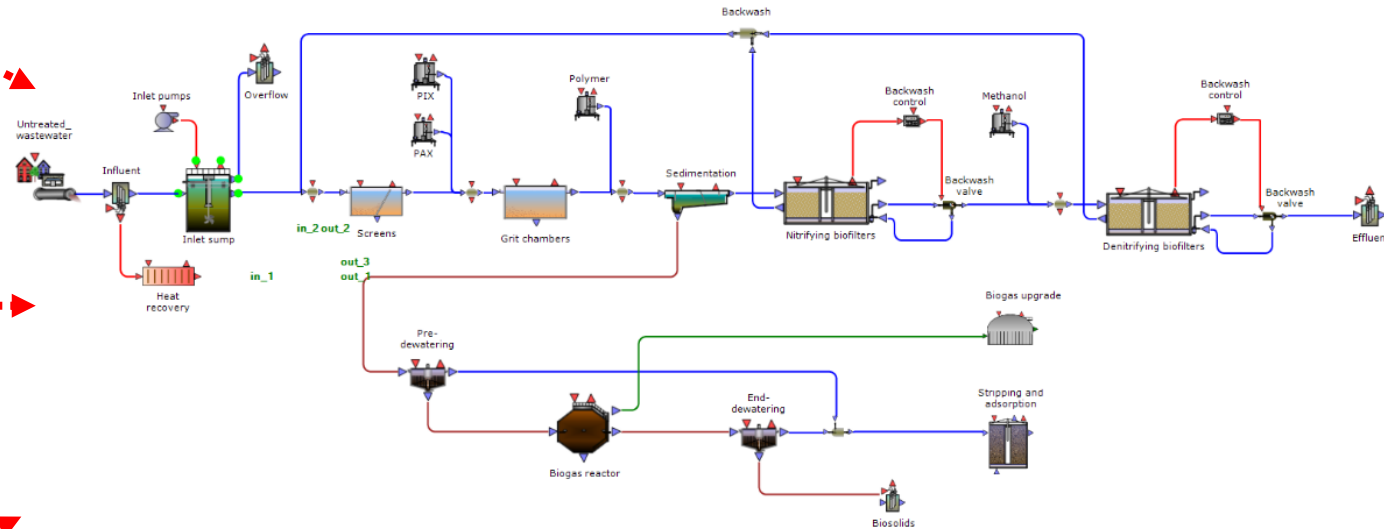
Output

Laboratory
measurements

Sensor data
(historical)

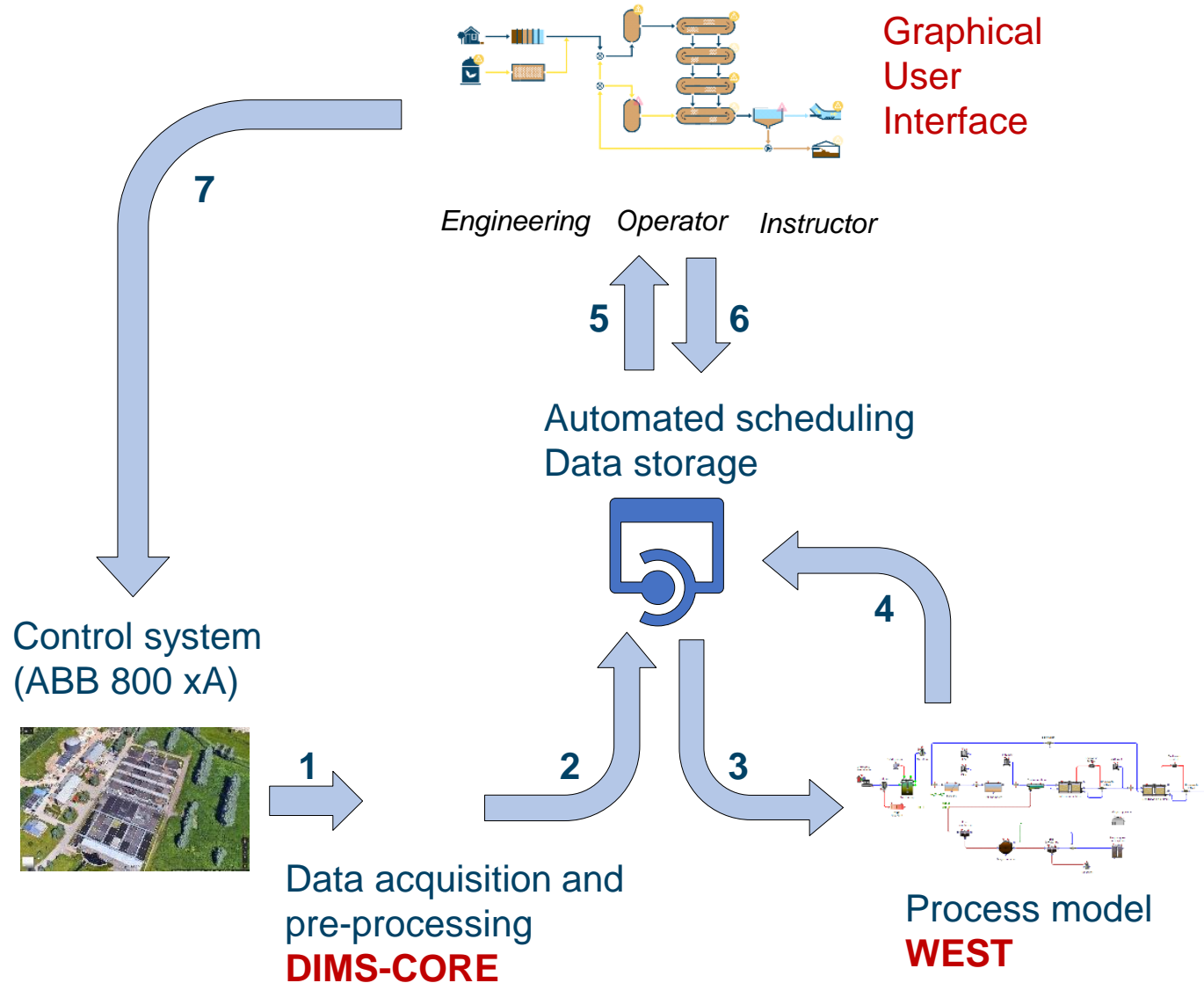
Boundary
conditions

Input



Process model of a WWTP (WEST)

... to online



1. Online data acquisition from data historian
2. Transfer of pre-processed online data to data storage
3. Data input to process simulator and execution of simulations
4. Transfer of simulation output to data storage
5. Consultation of simulation results and online data through GUI, data export and report generation
6. Set up and execution of what-if scenarios, induced equipment faults
7. Implementation of tested operational alternatives (manual / automated)

The Digital Twin idea

- A **Digital Twin** is a digital **replica** of a physical entity, with its properties and characteristics that can be used for multiple goals (IWA, 2021):
 - The virtual entity (model) operates **simultaneously** with the physical entity (plant) » **Connectivity**
 - The interface between physical and virtual world is possible through **continuous exchange of data** » **Real time**
 - Service: from offline to **online (real-time & prediction)**





Name
Drivers
Inputs
Outputs
Type

Fully automated plant

Bidirectional data connect.

(DigTwinOptim)



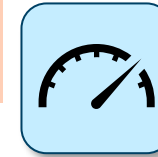
ONLINE

Calibrated WEST model
(optional) data intelligence
Custom GUI
Data layer
Fully customised features
(eg alarms, report, ..)

Operation support (DSS)

Bidirectional data connect.

DigDSS



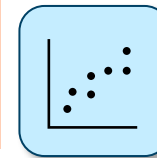
ONLINE

Calibrated WEST model
Custom (desktop/web) GUI
Data layer
History, Scenarios
(optional) Optimiser

Demonstration
Operator training

Long-term historical data
Detail controllers
(optional) data connection

PlantSimulator



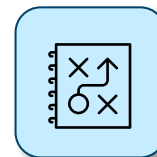
OFFLINE

Calibrated WEST model
(optional) Custom GUI
(optional) DIMS data layer

Troubleshooting
Upgrade

Plant visit
Design (steady state) data
Historical data
Controllers

Supervision



OFFLINE

Mass balance
Report / suggestions
Baseline process model
Scenarios

Conclusions

- When are process models used?
 - Different stages: project / upgrade / optimization / management
 - Offline vs. Online
- Workflow in WEST
 - Graphical setup of a process layout
 - Layout fractionation
 - Execution of the simulation: steady-state, dynamic and “advanced” experiments
- Model-based Solutions

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**Muchas gracias
por su atención.**

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