Jacobs Challenging today. Reinventing tomorrow.

Duff WTP Dynamic Operations Model

May 3, 2024

Agenda

- Introductions
- Duff WTP Introduction
- Problem Statement
- What's a Digital Twin?
- Solution
- Next Steps

INTRODUCTION

Jackson Corley

Digital Solutions Technologist

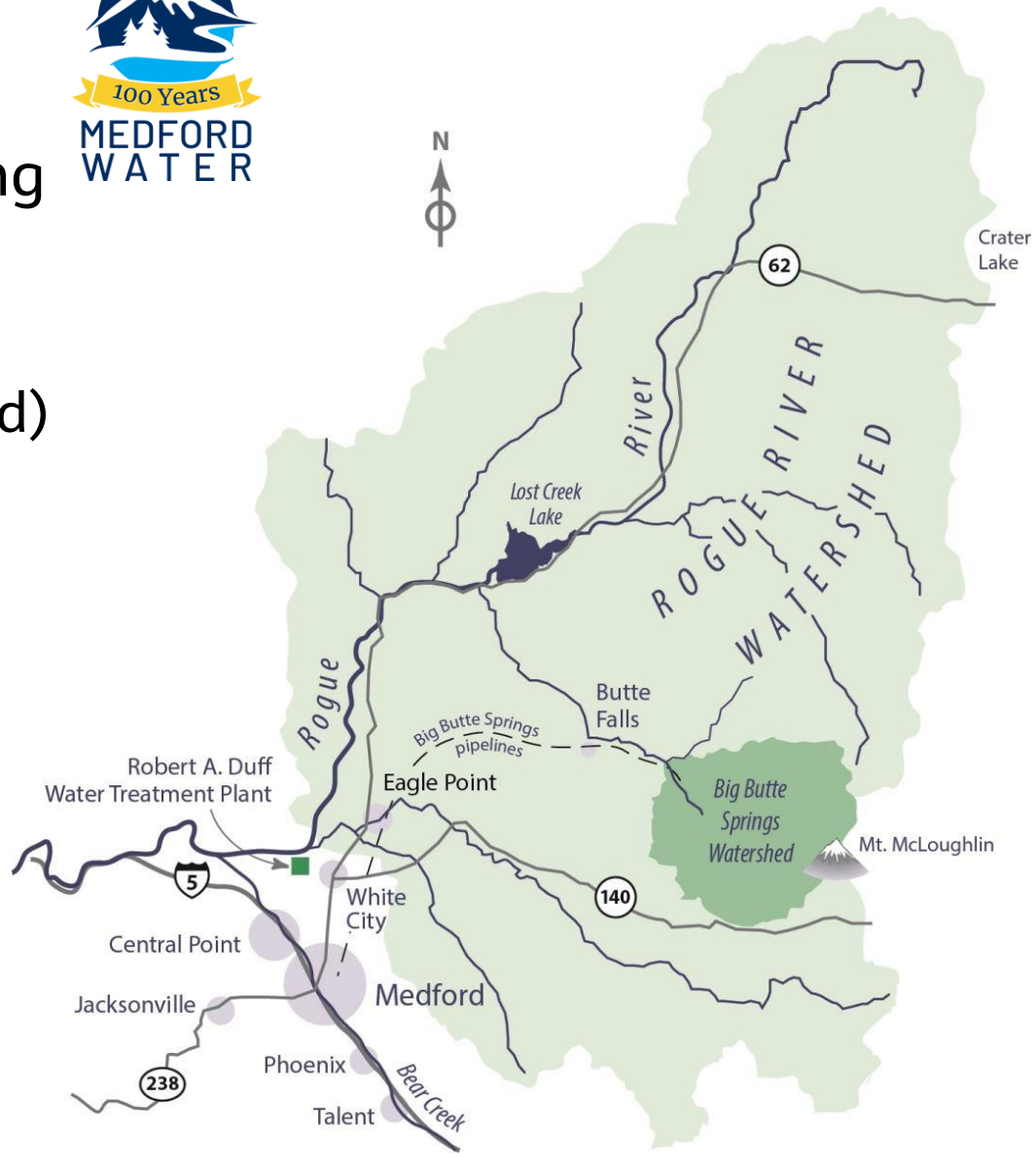
Joshua Kennedy

Project Manager and Water Treatment Department Manager

Duff WTP Project Background

Background - Medford Water

- 140,000 customers in Medford and surrounding communities
- Two sources:
  - Duff Water Treatment Plant, Rogue River (45 mgd)
  - Big Butte Springs (26.4 mgd)
- Capacity: 71.4 mgd nominal



Background - Duff Water Treatment

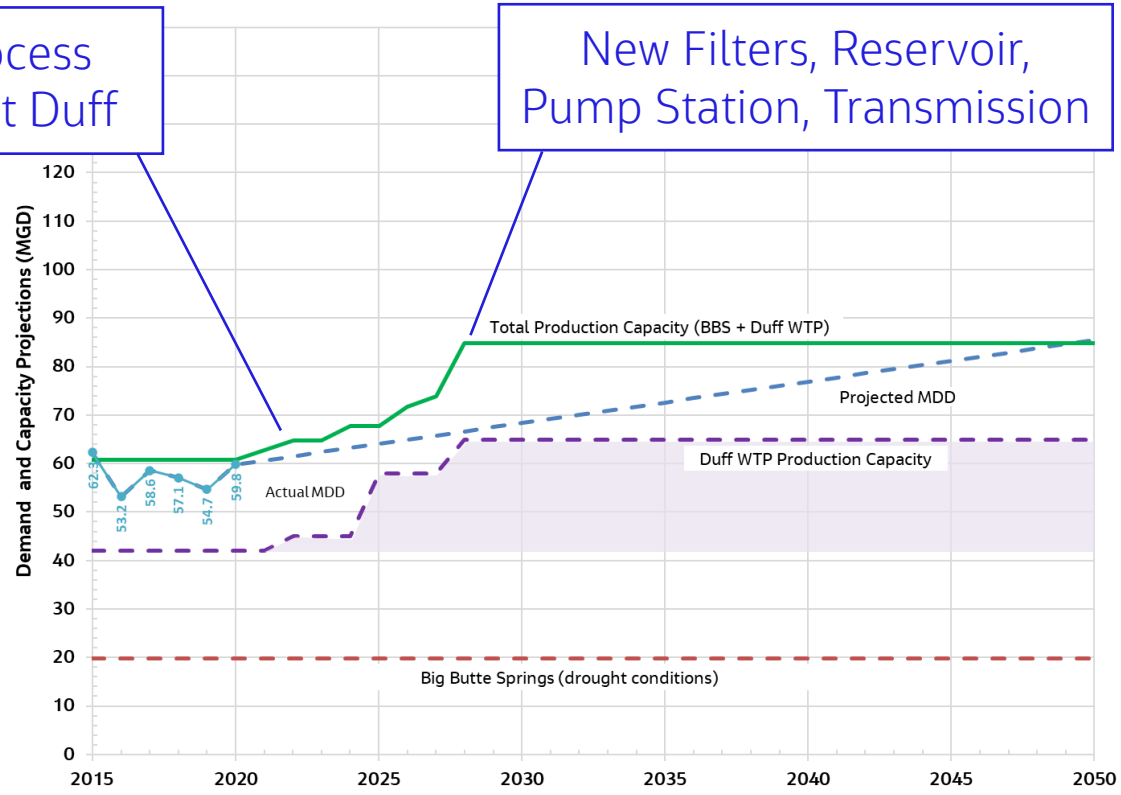
- History and capacity:
  - 1968 15 mgd
  - 1964 30 mgd
  - 1999 45 mgd
  - 2017 65 mgd

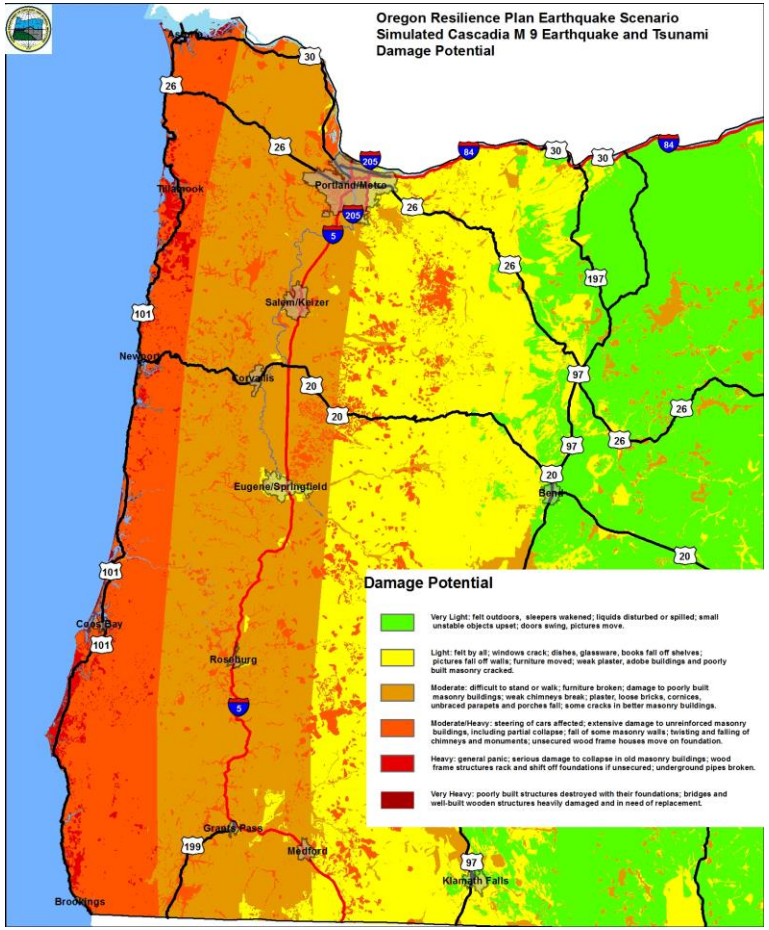
Project Goals

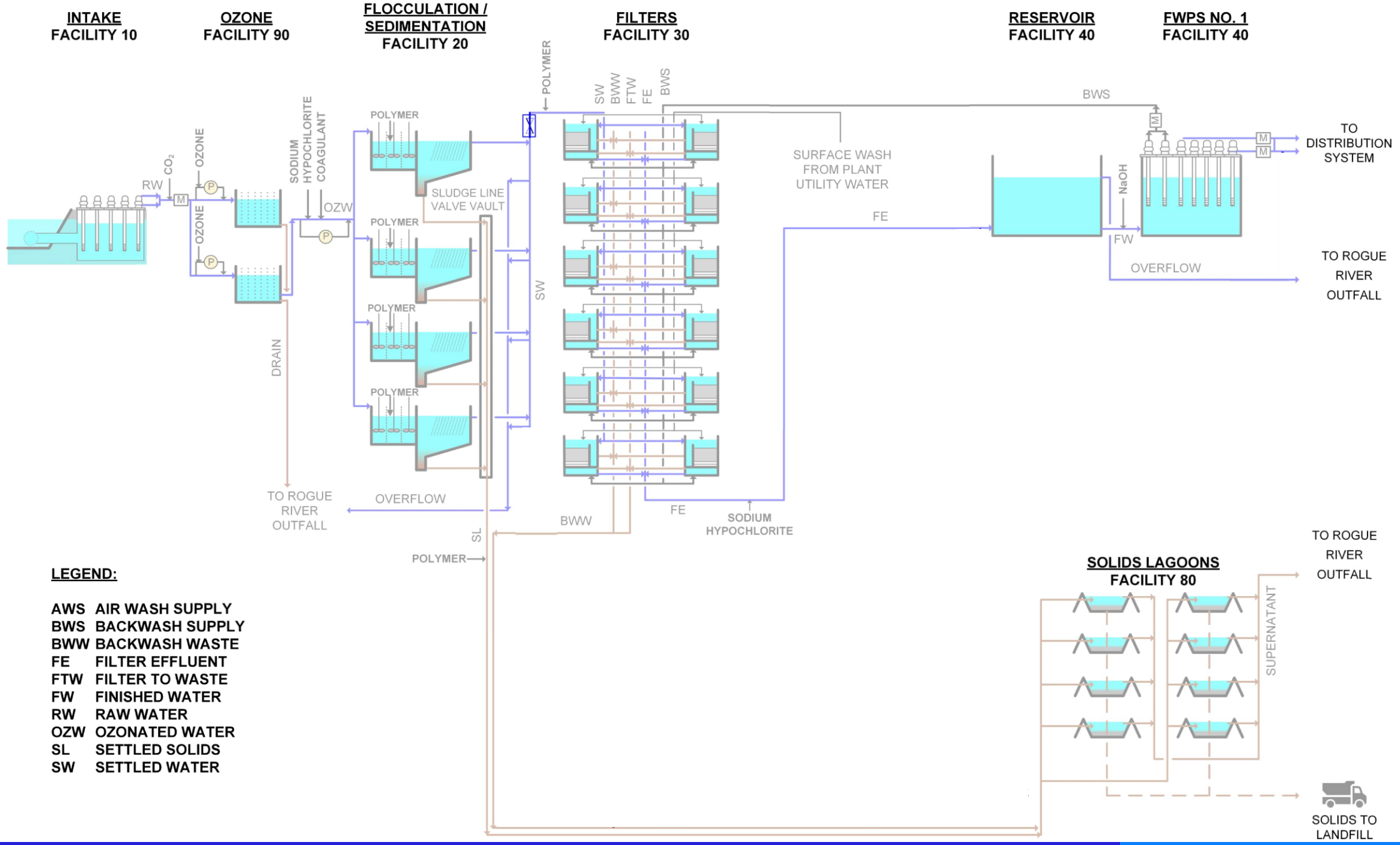
- Expand from 45 to 65 mgd
- Provide 23 mgd seismically resilient capacity

Short-term Process Improvements at Duff

New Filters, Reservoir, Pump Station, Transmission

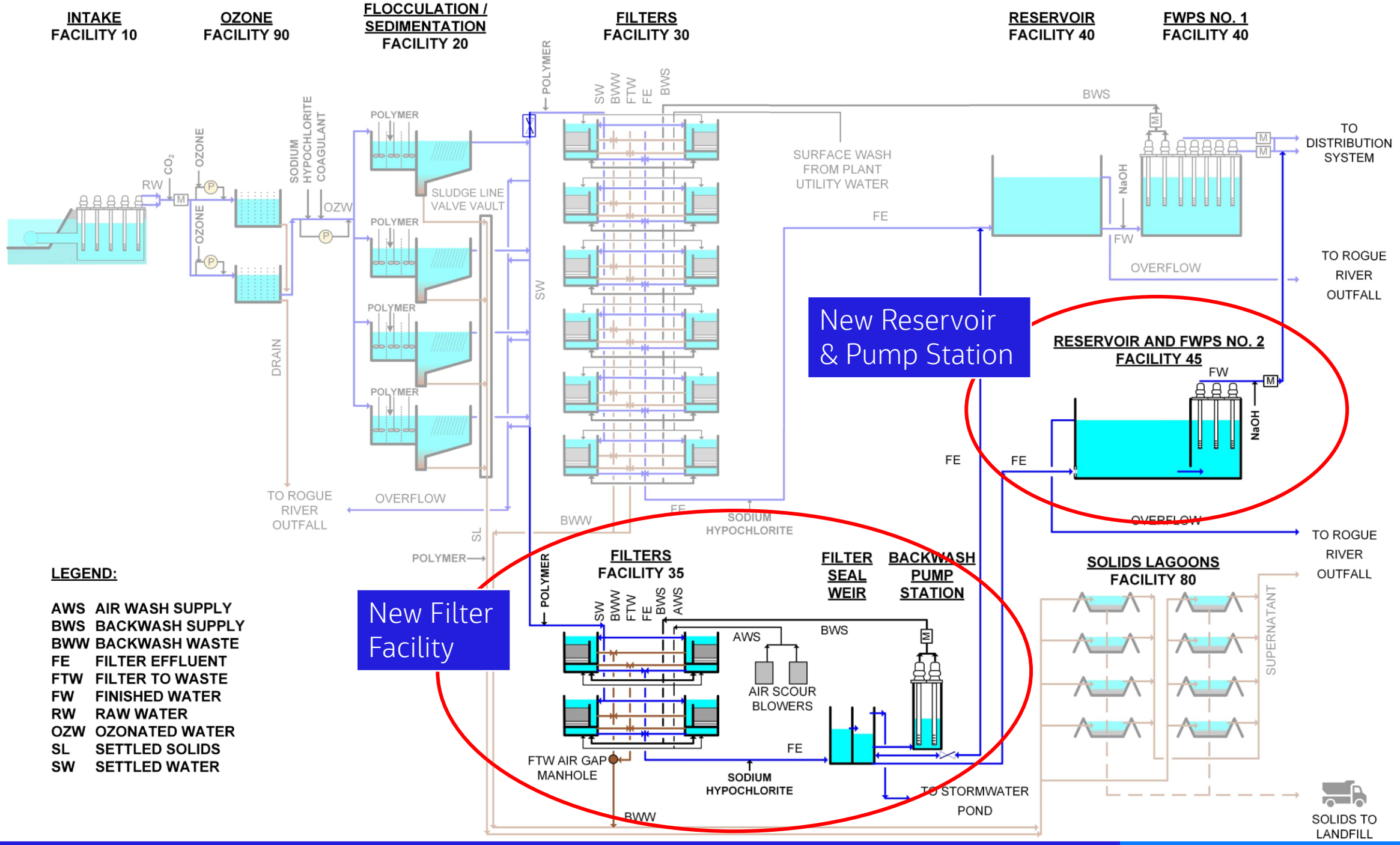




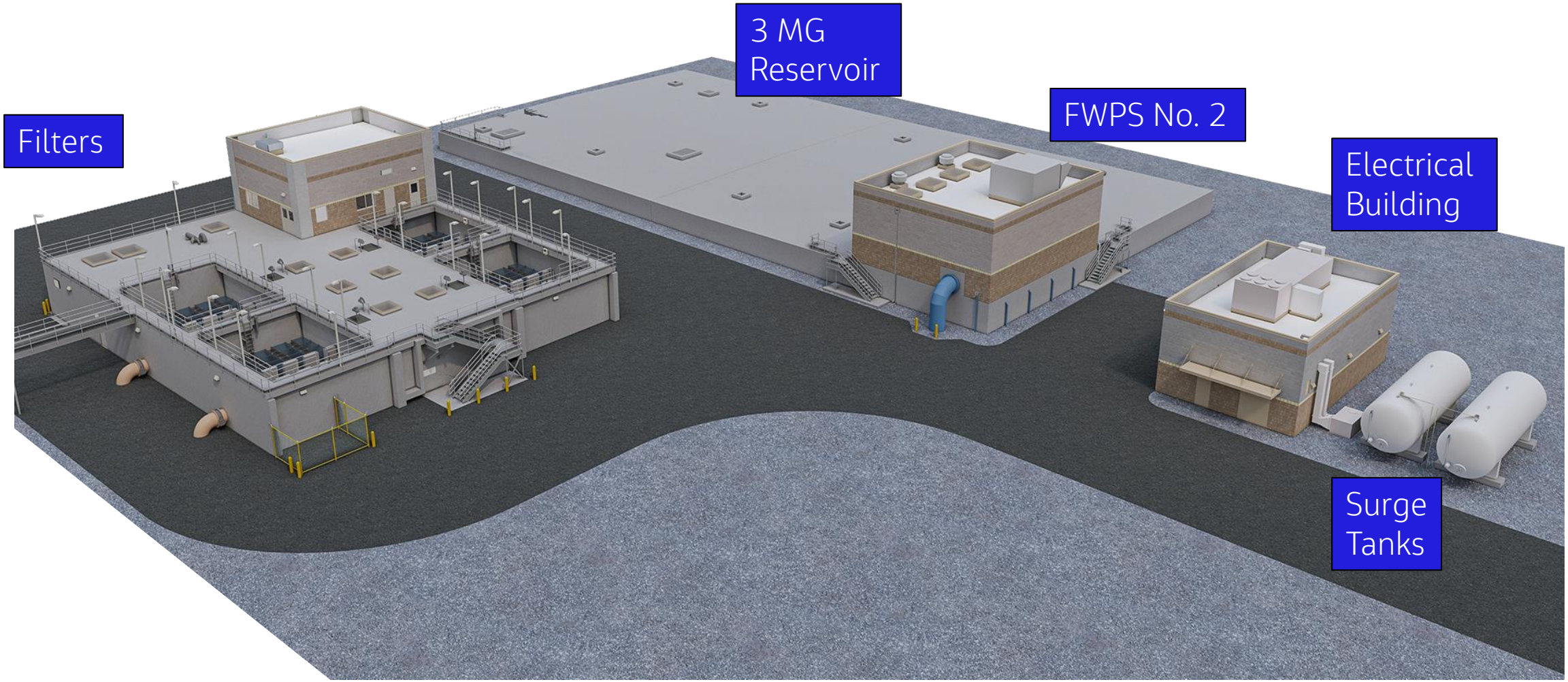


LEGEND:

AWS	AIR WASH SUPPLY
BWS	BACKWASH SUPPLY
BWW	BACKWASH WASTE
FE	FILTER EFFLUENT
FTW	FILTER TO WASTE
FW	FINISHED WATER
RW	RAW WATER
OZW	OZONATED WATER
SL	SETTLED SOLIDS
SW	SETTLED WATER

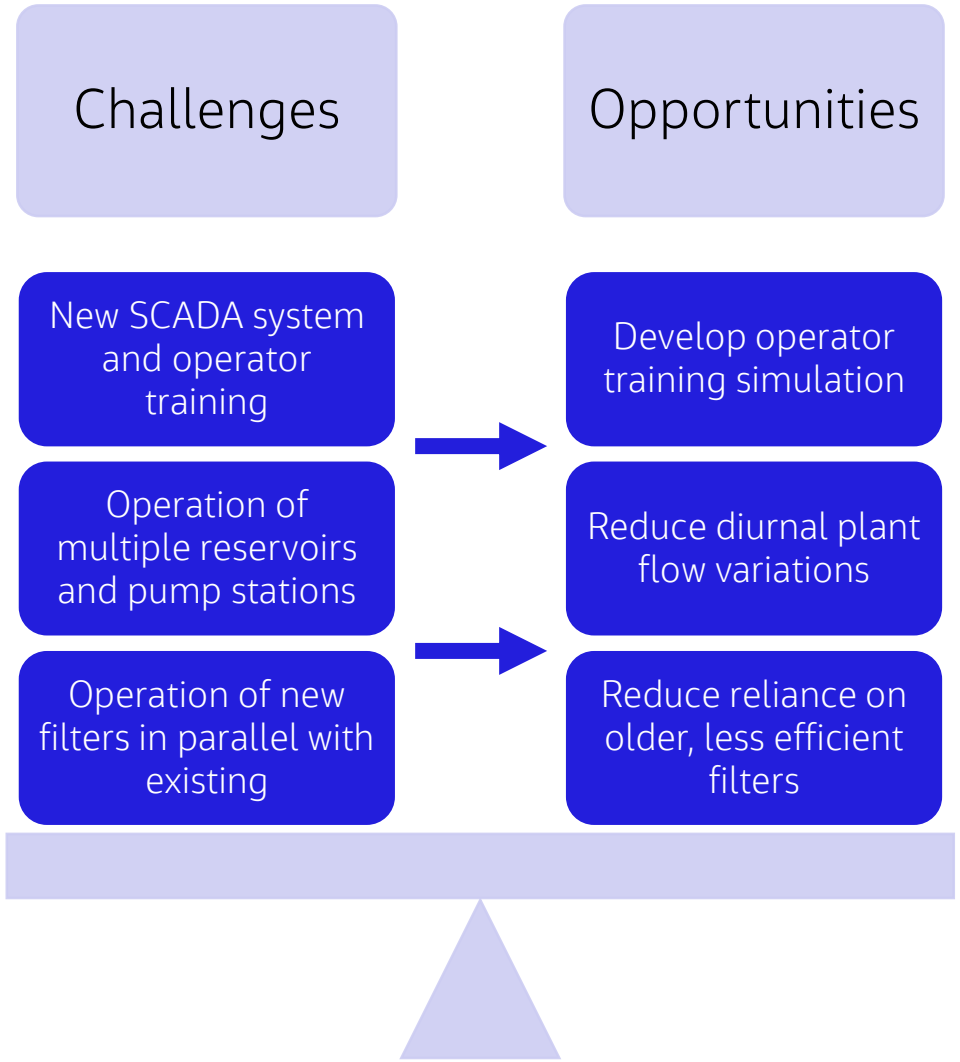

INTAKE
FACILITY 10
OZONE
FACILITY 90
FLOCCULATION / SEDIMENTATION
FACILITY 20
FILTERS
FACILITY 30
RESERVOIR
FACILITY 40
FWPS NO. 1
FACILITY 40
RW
CO2
OZONE
SODIUM HYPOCHLORITE
COAGULANT
OZW
POLYMER
SLUDGE LINE VALVE VAULT
DRAIN
TO ROGUE RIVER OUTFALL
OVERFLOW
SW
BWW
FTW
FE
BWS
SURFACE WASH FROM PLANT UTILITY WATER
NaOH
FW
TO DISTRIBUTION SYSTEM
TO ROGUE RIVER OUTFALL
SODIUM HYPOCHLORITE
SL
New Reservoir & Pump Station
RESERVOIR AND FWPS NO. 2
FACILITY 45
New Filter Facility
FILTERS
FACILITY 35
AWS
FILTER SEAL WEIR
BACKWASH PUMP STATION
AIR SCOUR BLOWERS
FTW AIR GAP MANHOLE
TO STORMWATER POND
SOLIDS LAGOONS
FACILITY 80
SUPERNATANT
SOLIDS TO LANDFILL
LEGEND:
AWS AIR WASH SUPPLY
BWS BACKWASH SUPPLY
BWW BACKWASH WASTE
FE FILTER EFFLUENT
FTW FILTER TO WASTE
FW FINISHED WATER
RW RAW WATER
OZW OZONATED WATER
SL SETTLED SOLIDS
SW SETTLED WATER

Duff WTP Expansion to 65 MGD

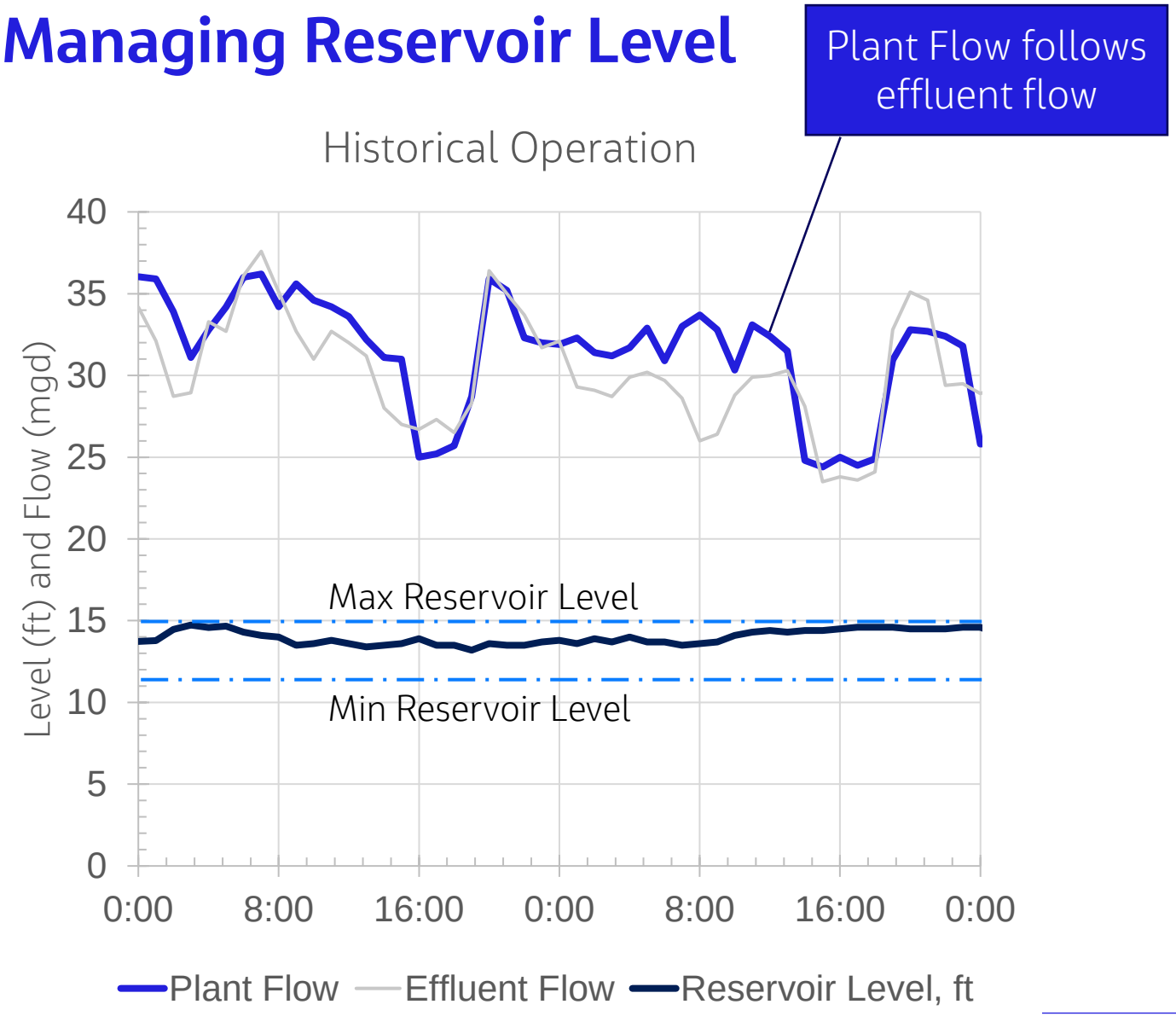


Construction Progress

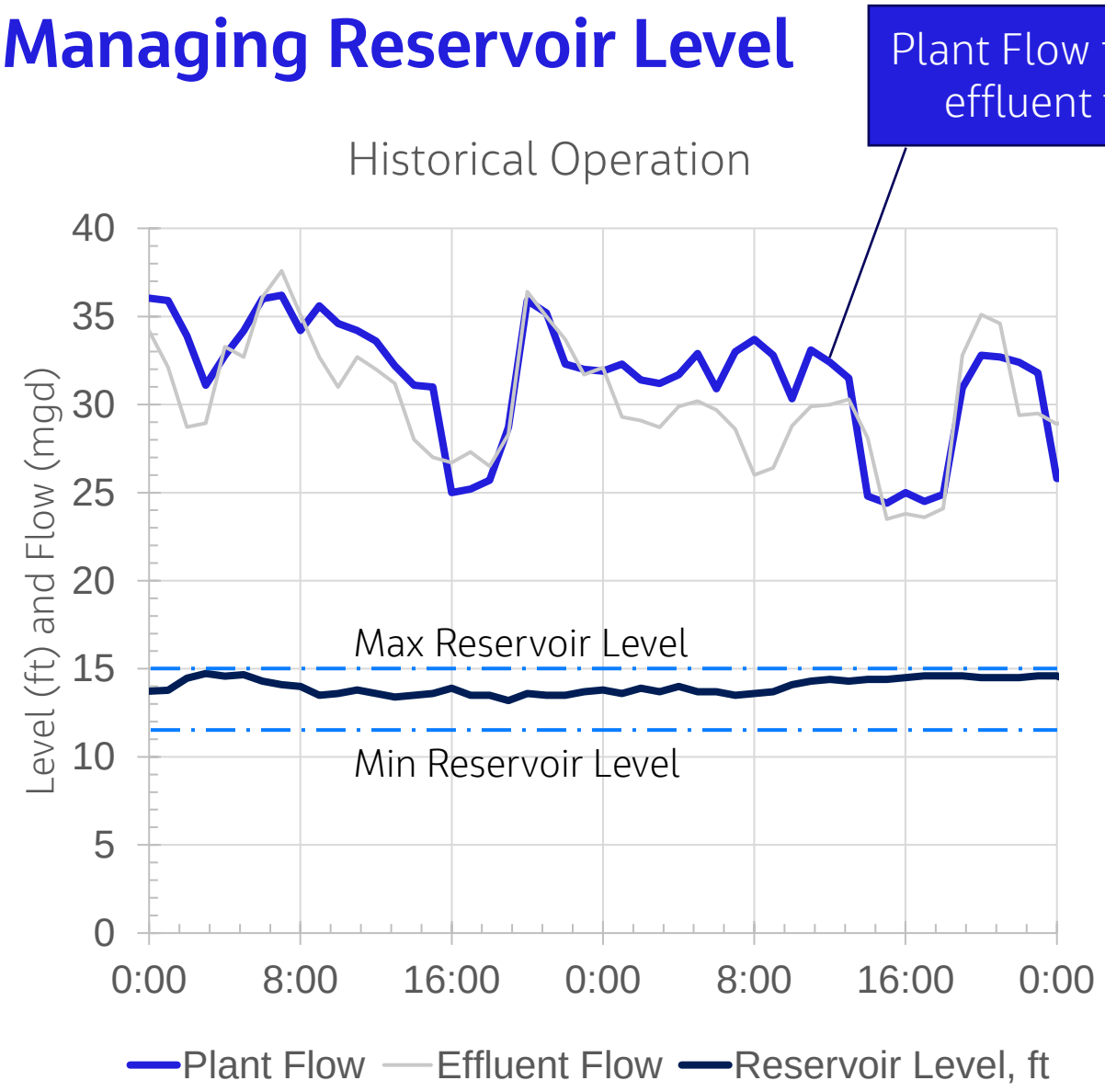
Key Challenges and Opportunities

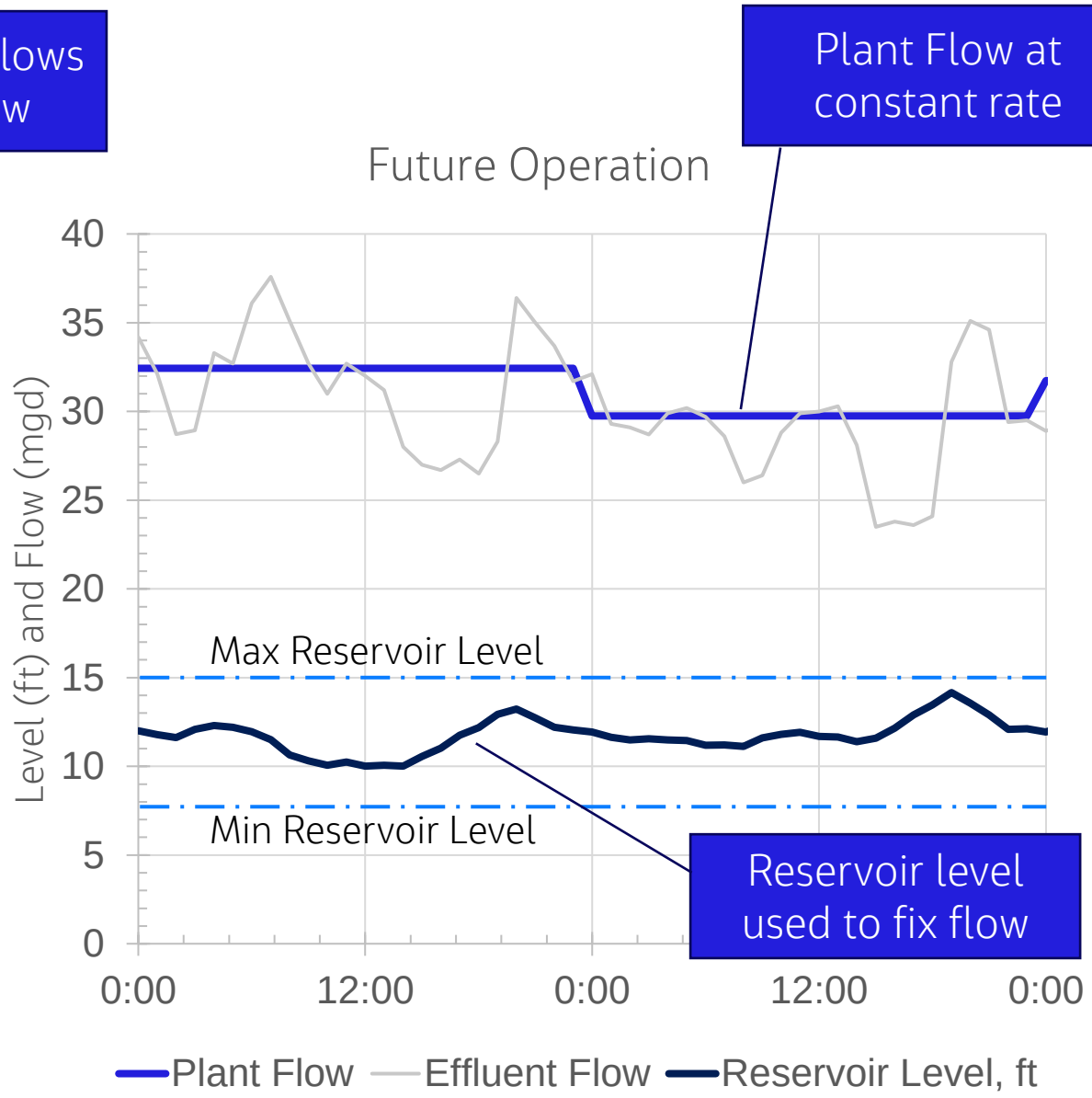


Managing Reservoir Level



Managing Reservoir Level



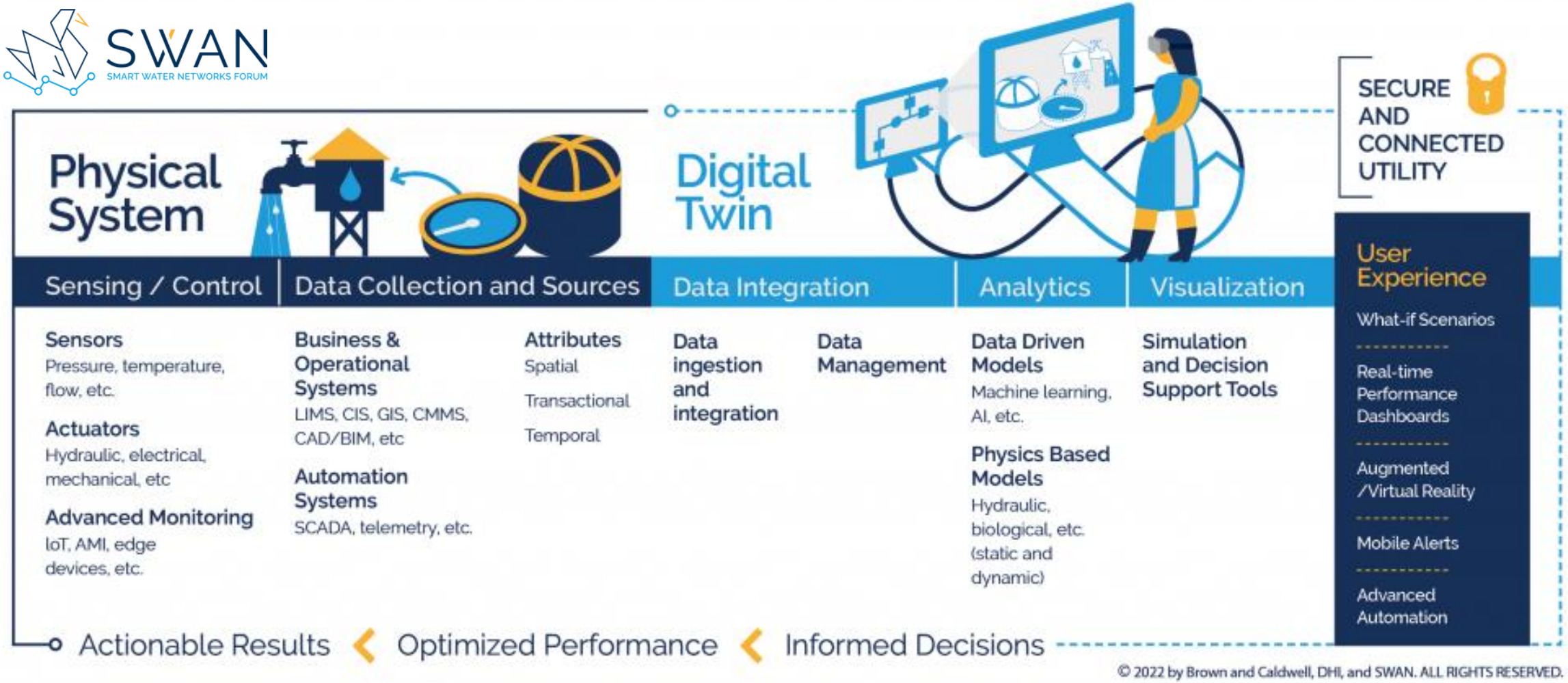


Digital Twin

Is Every Model a Digital Twin?

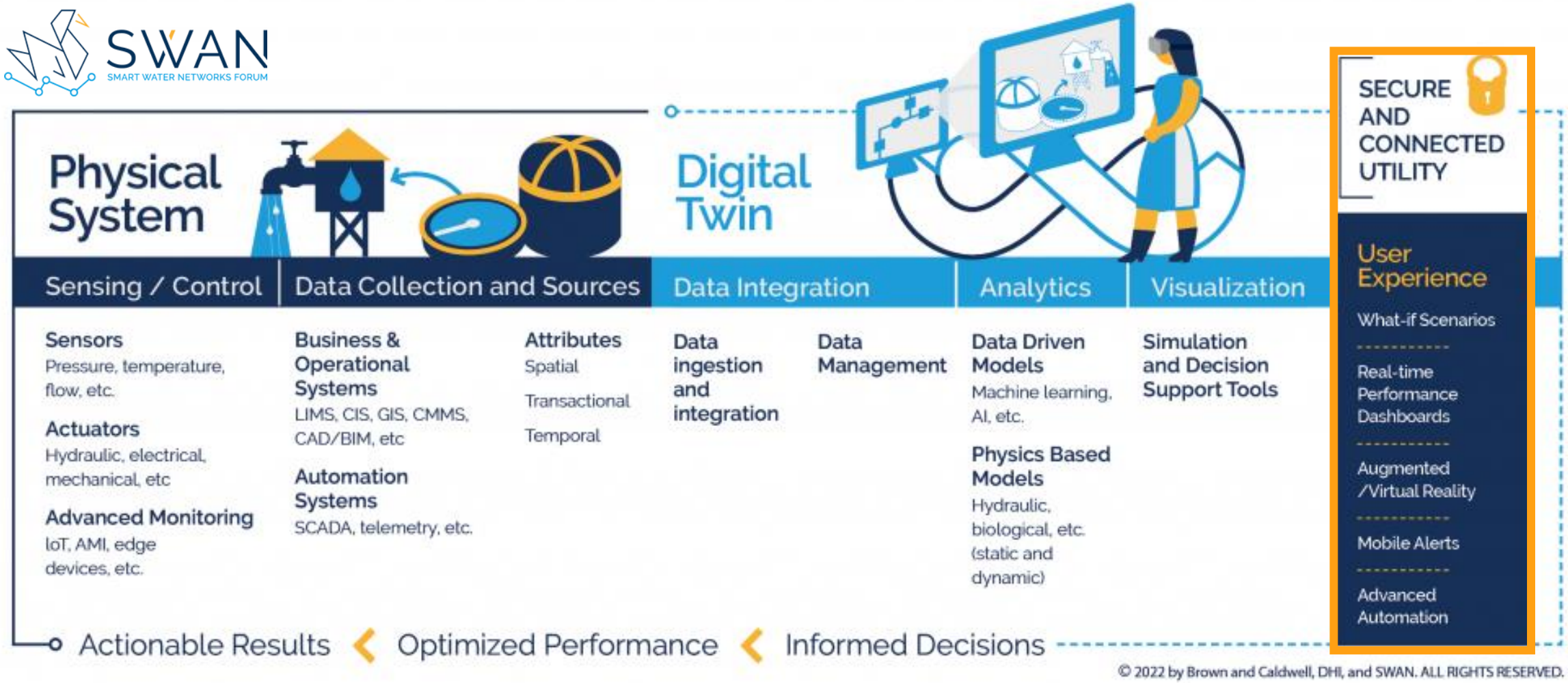
Defining a Digital Twin

A digital twin is a dynamic digital representation of real-world entities and their behaviors using models with static and dynamic data that enable insights and interactions to drive actionable and improved outcomes.

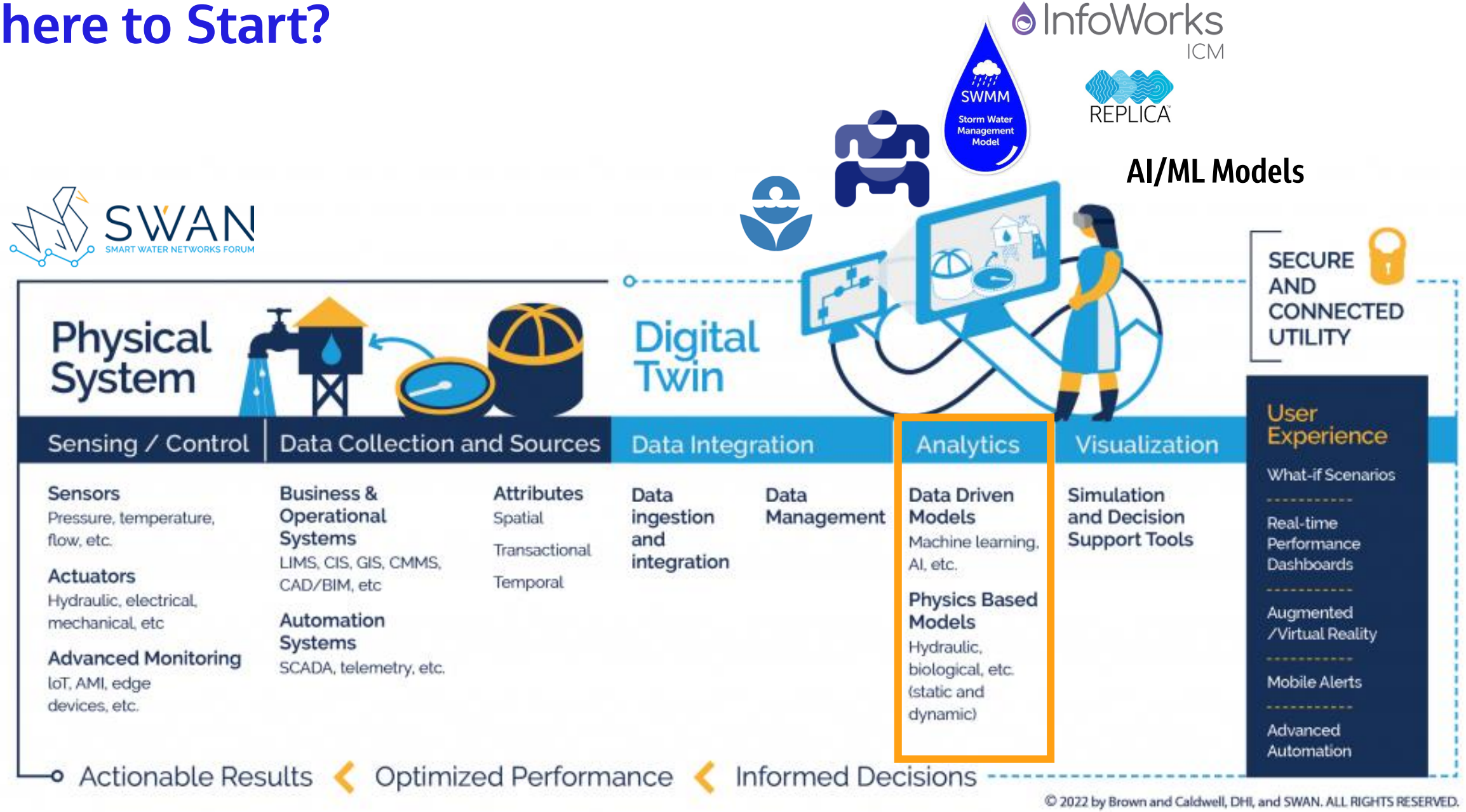


Defining a Digital Twin

Two core digital twin focuses: (1) operational/behavioral support and (2) physical/asset representation for construction/utilization optimization



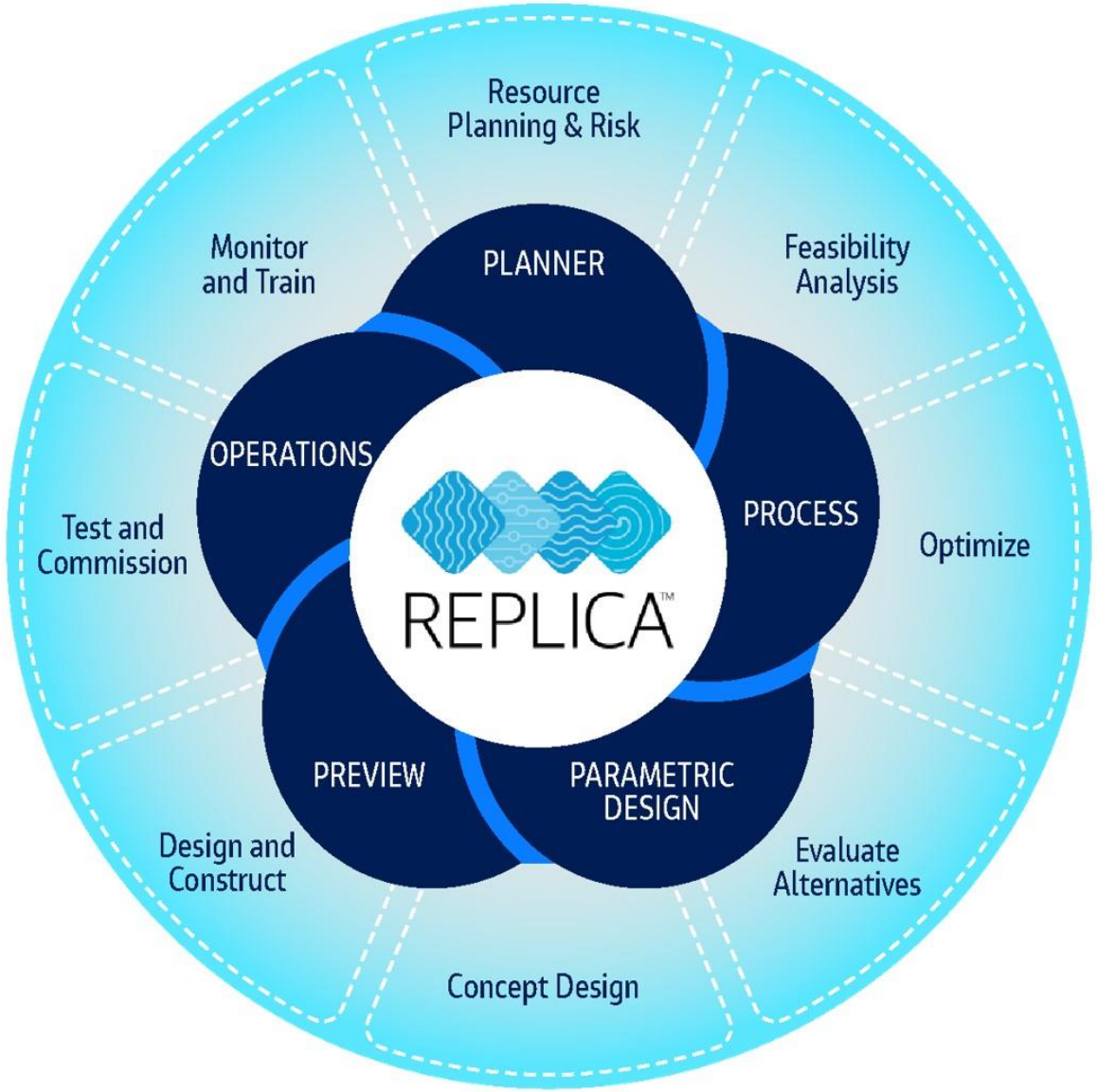
Where to Start?



The Solution

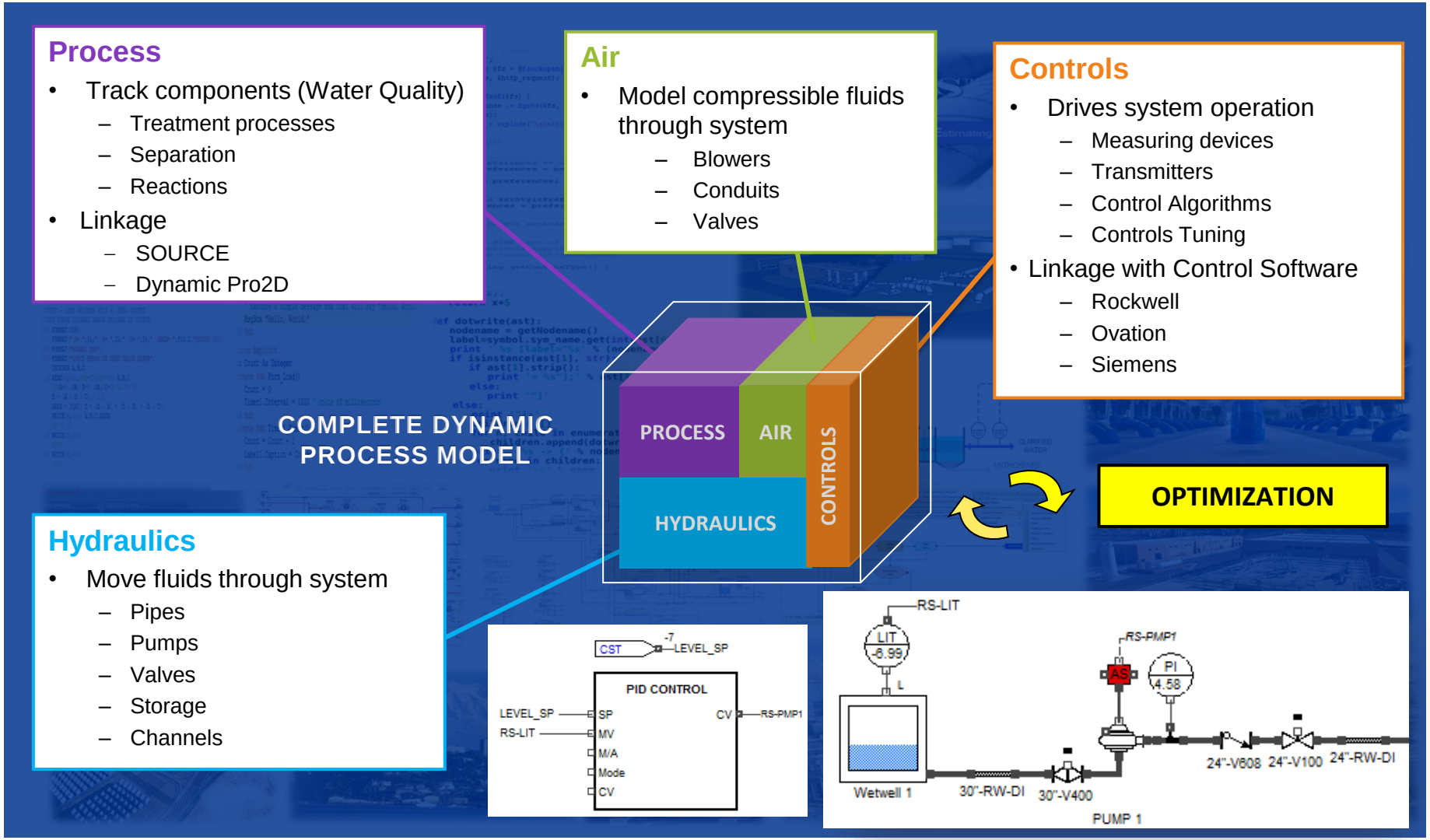
REPLICA is Jacobs' suite of software for digital twins

- Developed for >20 years
- Capabilities across the project lifecycle
- Built on a foundation of domain knowledge, computational power, data connectivity, and intuitive interfaces

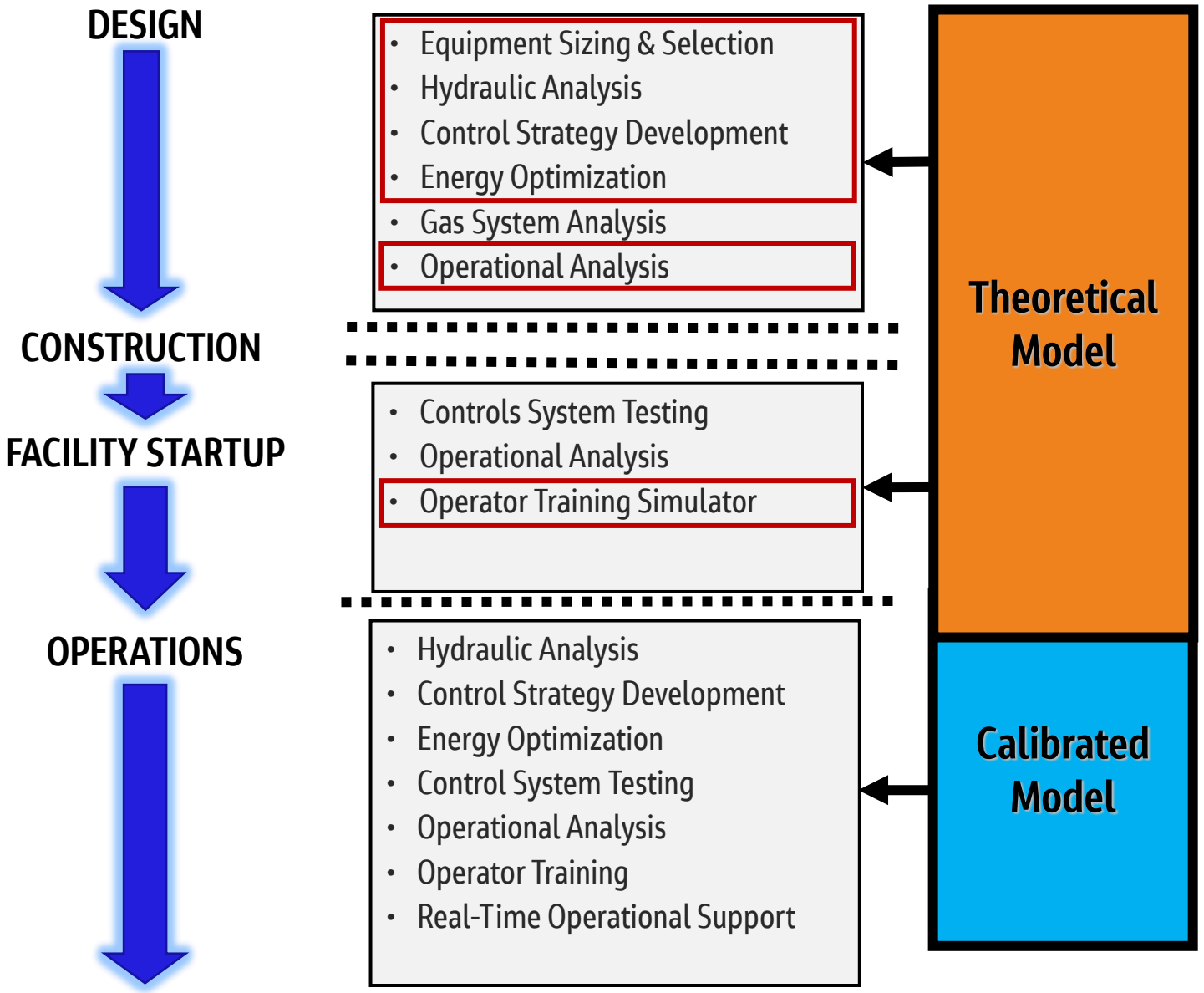


https://www.jacobs.com/insights/digital-twin-technologies

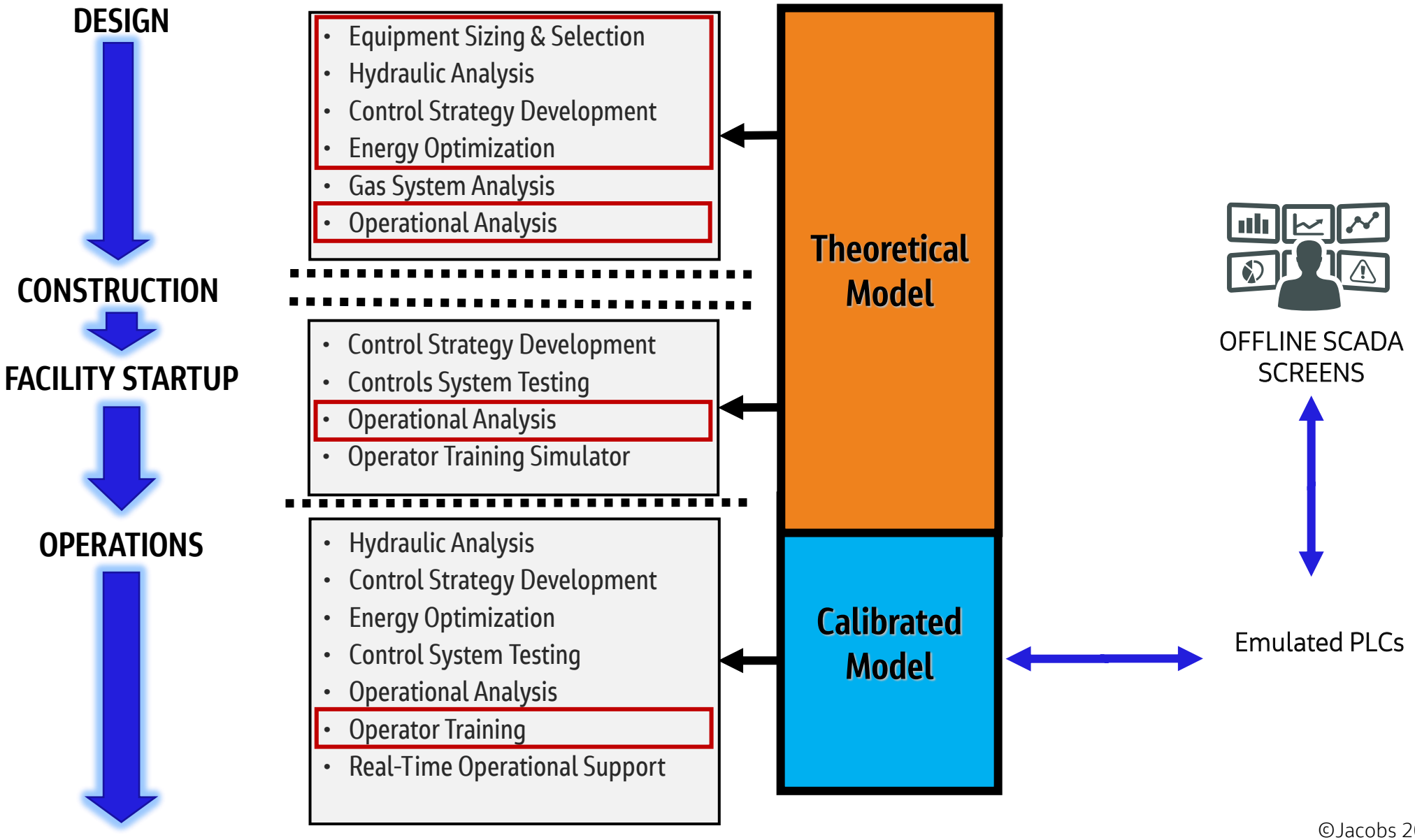
Replica Operations



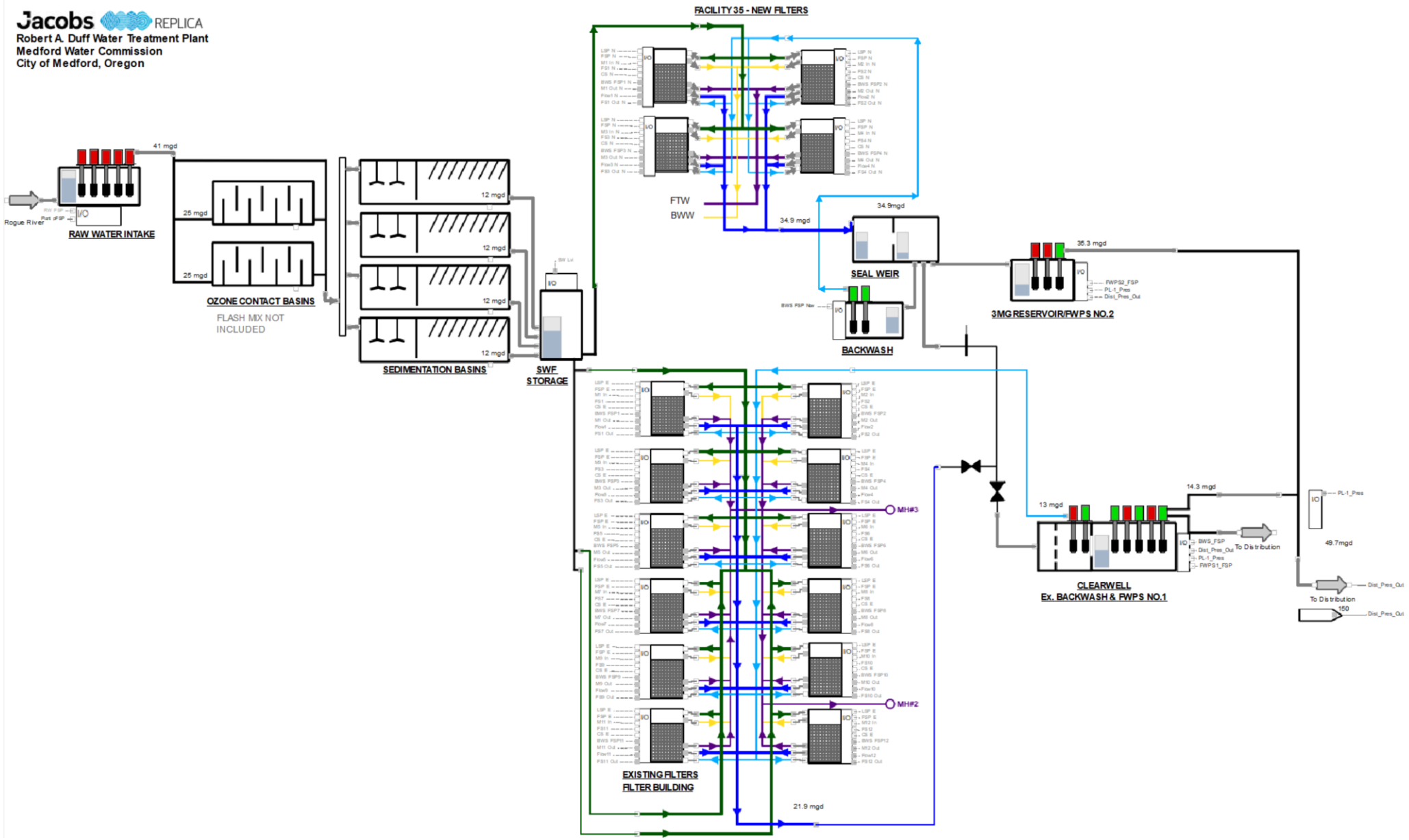
How Was the Replica Model Used?



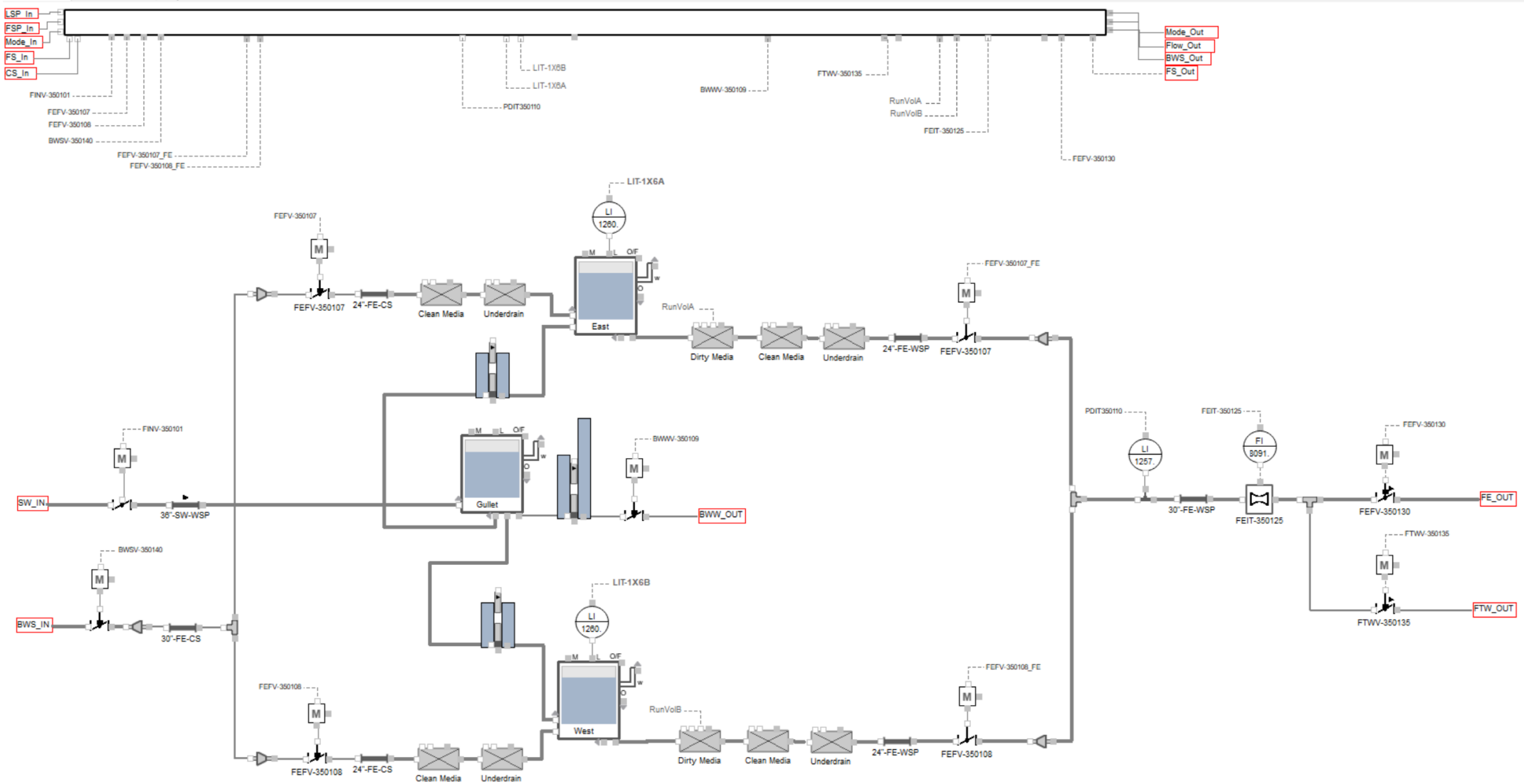
Transition from Model to Digital Twin



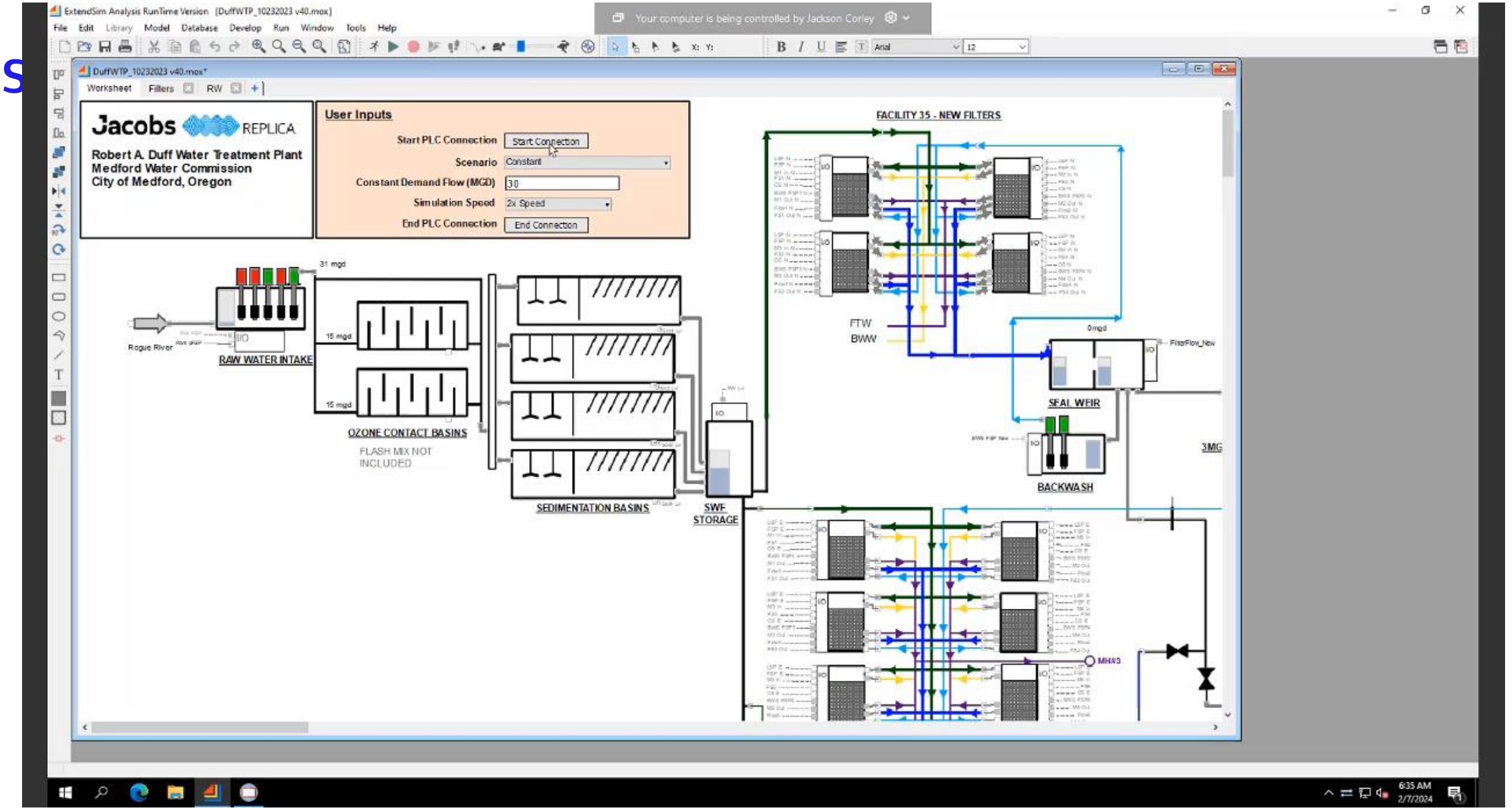
Model Overview – Main Interface



Model Overview – Hydraulics Filter Example

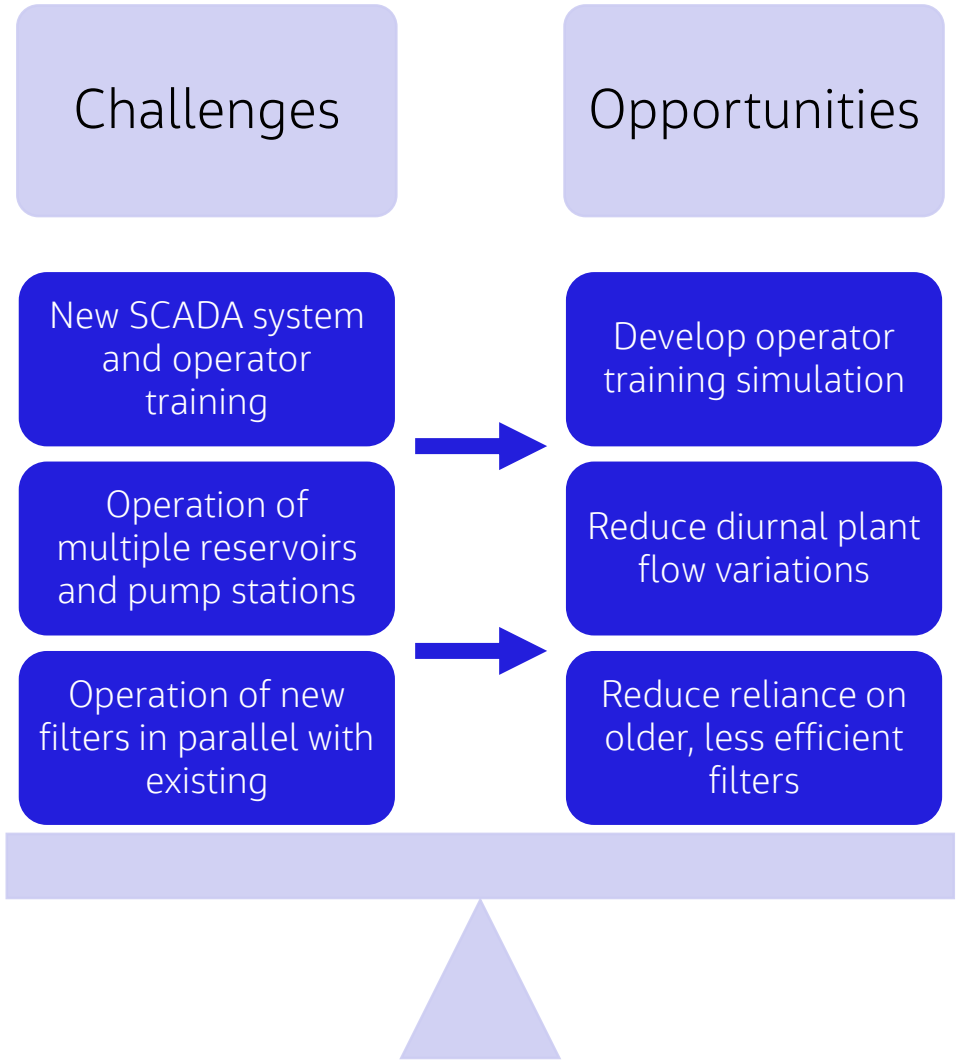


Operator Training Tool Example


ExtendSim Analysis RunTime Version [DuffWTP_10232023 v40.mox]
File Edit Library Model Database Develop Run Window Tools Help
Your computer is being controlled by Jackson Corley
DuffWTP_10232023 v40.mox*
Worksheet Filters RW
Jacobs REPLICA
Robert A. Duff Water Treatment Plant
Medford Water Commission
City of Medford, Oregon
User Inputs
Start PLC Connection
Start Connection
Scenario
Constant
Constant Demand Flow (MGD)
30
Simulation Speed
2x Speed
End PLC Connection
End Connection
FACILITY 35 - NEW FILTERS
31 mgd
15 mgd
15 mgd
Rogue River
RAW WATER INTAKE
OZONE CONTACT BASINS
FLASH MIX NOT INCLUDED
SEDIMENTATION BASINS
SWF STORAGE
FTW
BWW
0mgd
FilterFlow_New
SEAL WEIR
3MG
BACKWASH
MH#3
6:35 AM
2/7/2024

Next Steps

Key Challenges and Opportunities



Next Steps

Commissioning Summer 2025 and 2026	• Train operators on new filter facility (2025) and with new reservoir/FWPS (2026)
Updates to the model	• Incorporate distribution elements to model the entire system
Consider other uses for the tool	• Demand projection

Thank You

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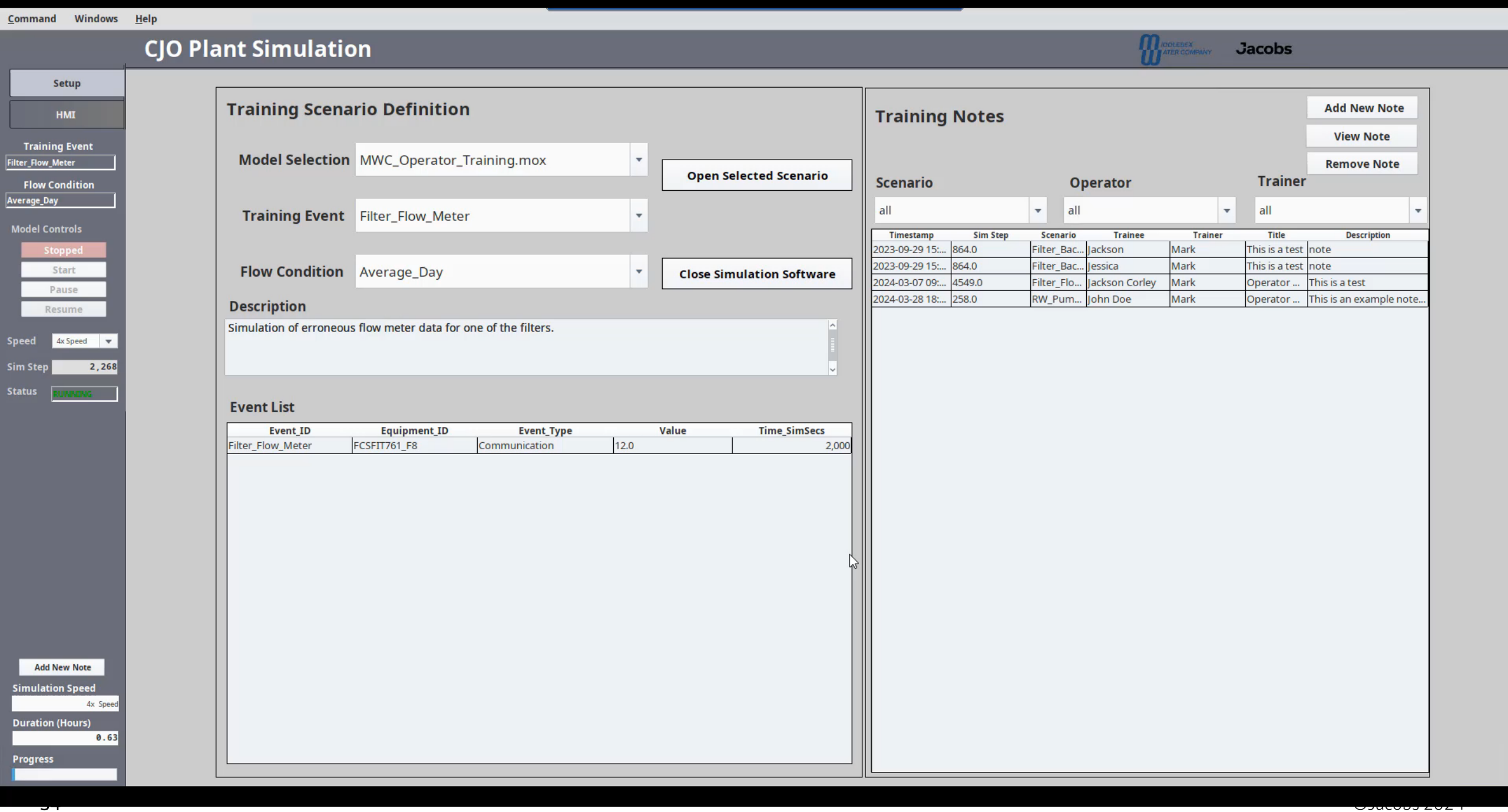
Medford Water
Slayden Constructors
Pacific Electrical Contractors

Operator Training Case Study

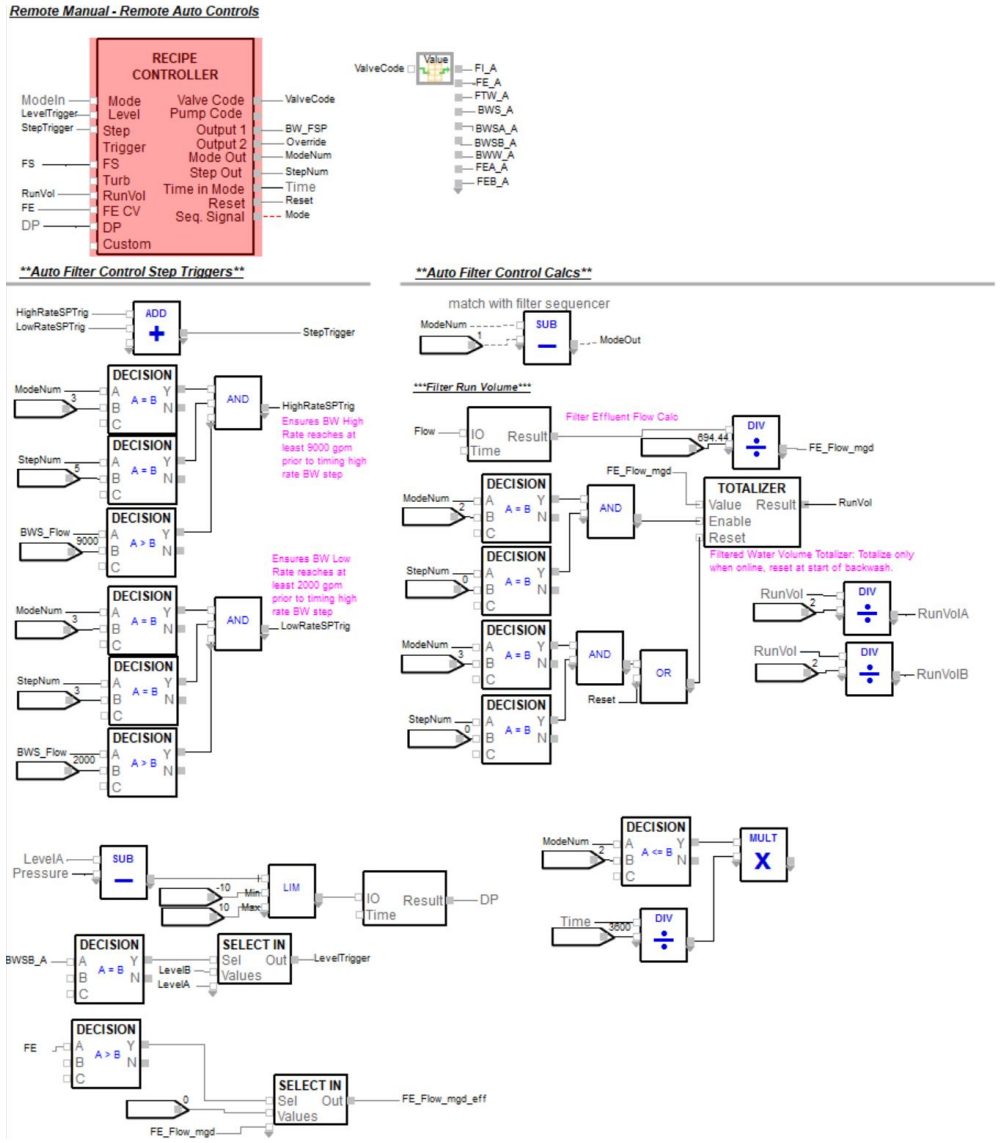

Command
Windows
Help
CJO Plant Simulation
Jacobs
Setup
HMI
Training Event
Filter_Flow_Meter
Flow Condition
Average_Day
Model Controls
Stopped
Start
Pause
Resume
Speed
4x Speed
Sim Step
2,268
Status
RUNNING
Add New Note
Simulation Speed
4x Speed
Duration (Hours)
0.63
Progress
Training Scenario Definition
Model Selection
MWC_Operator_Training.mox
Open Selected Scenario
Training Event
Filter_Flow_Meter
Flow Condition
Average_Day
Close Simulation Software
Description
Simulation of erroneous flow meter data for one of the filters.
Event List
Event_ID
Equipment_ID
Event_Type
Value
Time_SimSecs
Filter_Flow_Meter
FCSFIT761_F8
Communication
12.0
2,000
Training Notes
Add New Note
View Note
Remove Note
Scenario
all
Operator
all
Trainer
all
Timestamp
Sim Step
Scenario
Trainee
Trainer
Title
Description
2023-09-29 15:...
864.0
Filter_Bac...
Jackson
Mark
This is a test
note
2023-09-29 15:...
864.0
Filter_Bac...
Jessica
Mark
This is a test
note
2024-03-07 09:...
4549.0
Filter_Flo...
Jackson Corley
Mark
Operator ...
This is a test
2024-03-28 18:...
258.0
RW_Pum...
John Doe
Mark
Operator ...
This is an example note...

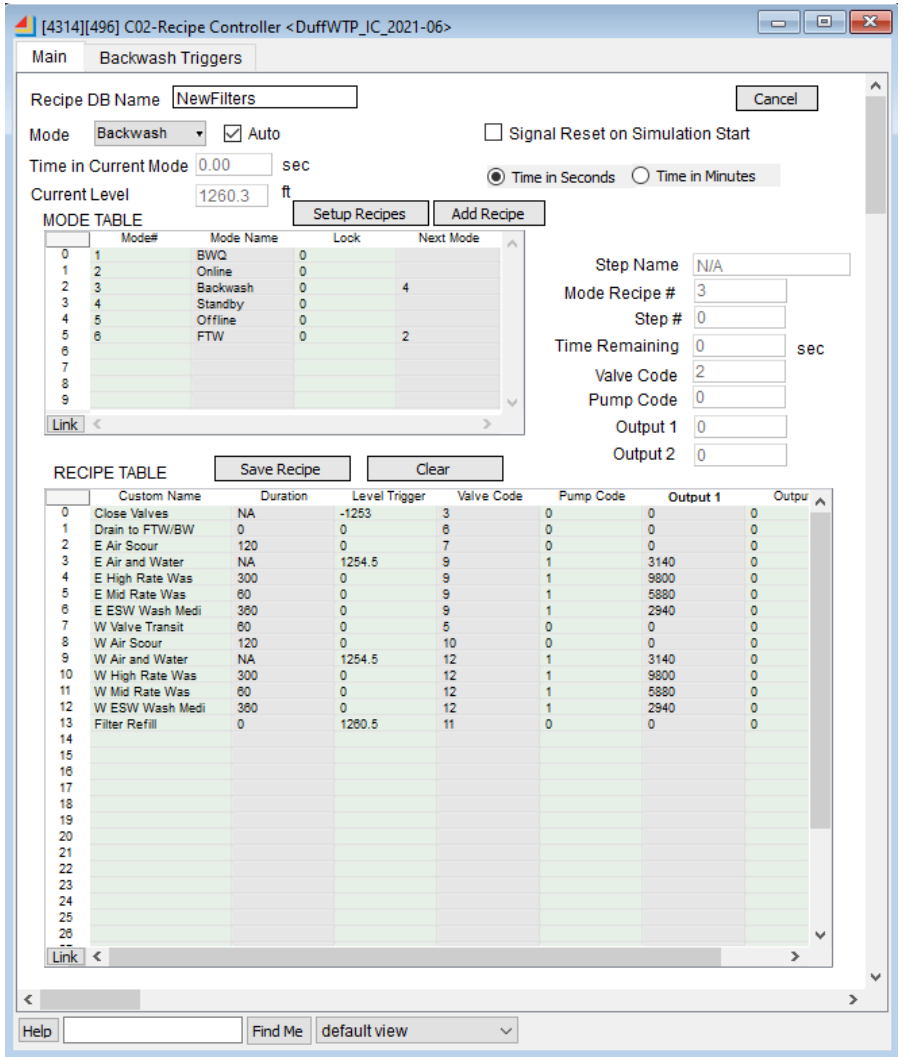
Extra Slides

Summary of Scenarios

Scenario Number	Description	Historical Flow Date	Total CFE Flow Range	Total FW Flow Range	Purpose
1	Shoulder Season, New	April 14, 2020	17.5 MGD (constant)	14 – 21 MGD	Demonstrate new operation of a shoulder season day flow. **Filter flow can be constant while FW flow varies.** Only new filters needed.
2	Current Peak Day, Historical	July 22, 2020	36 – 44 MGD	36 – 44 MGD	Demonstrate historical operation of a peak day flow. Filter flow matches FW flow.
3	Current Peak Day, New	July 22, 2020	41.4 MGD (constant)	36 – 44 MGD	Demonstrate new operation of a peak day flow. **Filter flow can be constant while FW flow varies.**
4	Future Peak Day	NA	67 MGD (constant)	54 – 76 MGD	Demonstrate maximum flow scenario. **Filter flow can be constant while FW flow varies.** Show impact of backwash while four new filters online.

Model Overview – Controls Filter Example





Start Up Benefits

- Prevent on site re-programming as control strategies have already been tested
- Streamline PID tuning using model provided tuning parameters
- Easily evaluate hydraulics or controls questions that arise during start up