Hydranautics – Nitto

DESIGN SOFTWARE and SUPPORTING TOOL

SEMINARIO

WATER TREATMENT – L'impiego della Tecnologia delle Membrane nel Trattamento e Riciclo delle Acque Reflue

Genova - TICASS · 21 ottobre 2016

Solutions You Need. Technologies You Trust.

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Hydranautics- Nitto Proprietary Design Sofware

http://membranes.com/solutions/software/

- ✓ **IMSDesign-2016:** (Integrated Membrane Solutions Design) is the latest version of Hydranautics **RO** membrane projection software
- ✓ **RODataXL**: **normalization** program tracking your RO system performance by inputing reference and operational data. Graphs of operational and normalized parameters automatically updated with each input.
- ✓ **HYDRAcap MAX web simulator**: **UF** membrane simulator is Hydranautics' first web based program to fully design the operation and the control logics of a new system
- ✓ **HYDRAsub system design:** an easy tool for Hydranautics **MBR** membrane system projection

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Before: ….
Review of Project Specs Requirements

- Permeate capacity
- Filtrate / Permeate quality (NTU, TDS ..)
- Specifications
- Recovery rate
- Max Feed Pressure
- Average permeate flux rate
- Membrane type
- Size of trains or Number of units
- Qualifications (equipment, OEM)
- Pilot unit verification
- Technical support
- Delivery schedule
- Performance warranty
- Penalties

Feed Water Infos

- Source
- Salinity and composition of individual ions and possibly specific contaminants
- pH
- Temperature (min, max)
- Turbidity (NTU)
- Suspended solids concentration
- Silt density index (SDI)
- Total organic carbon (TOC)
- Bacterial count

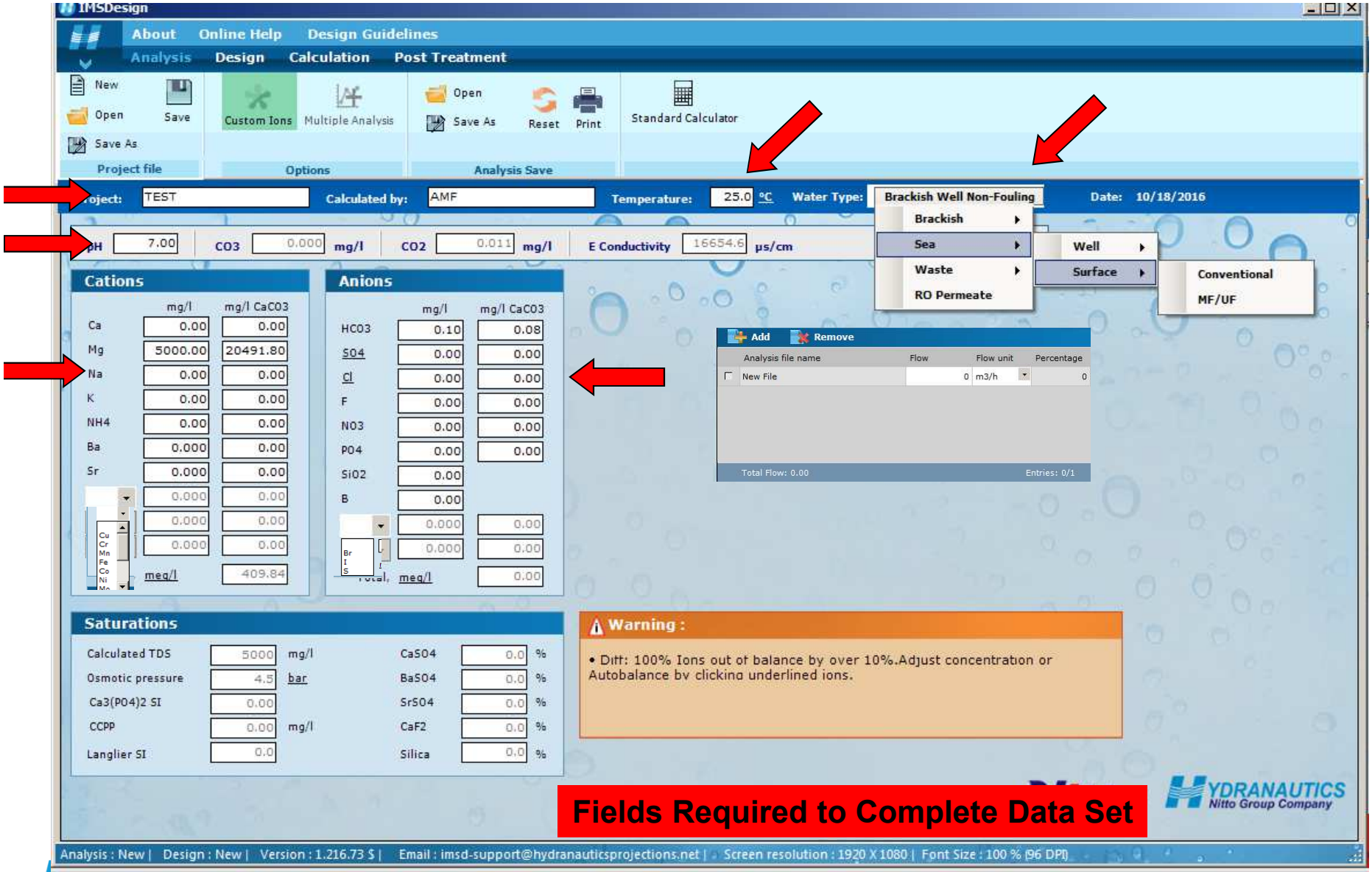
→

- Calcium
- Magnesium
- Sodium
- Potassium
- Barium
- Strontium
- Bicarbonate
- Chloride
- Sulphate
- Nitrate
- Fluoride
- Boron
- Silica
- Hydrogen sulfide
- …

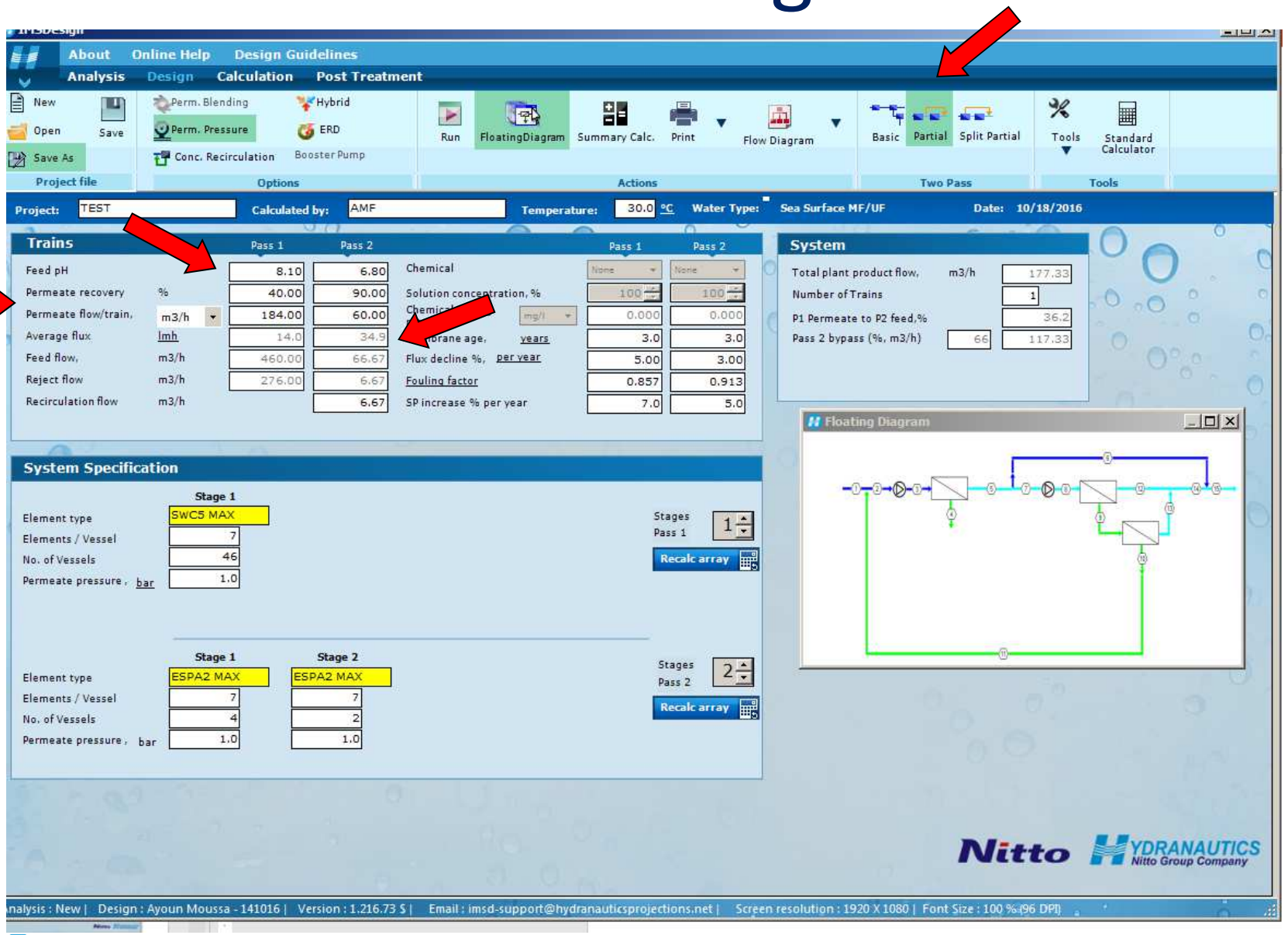
IMS Design Features

- Detailed Water Analysis – including Custom Ions, Multiple Analysis, Saturations
- Chemical Pre-treatment – pH adjustment
- RO Design - system configuration (number of stages, passes, recirculation, ERD, booster ..) and membrane selection
- Preliminary Calculation Results
- Full System Printount
- Additional features
  - Flow diagrams
  - Summary Calculation (easy Graphs of output vs operating parameters)
- Custom Flow Diagram
- Summary Calculation
- Chemical Post-treatment – Degasser, LSI adjustment
- Power Calculations – pumping specific energy kwh/m3
- Cost Calculations

Water Analysis



RO Design



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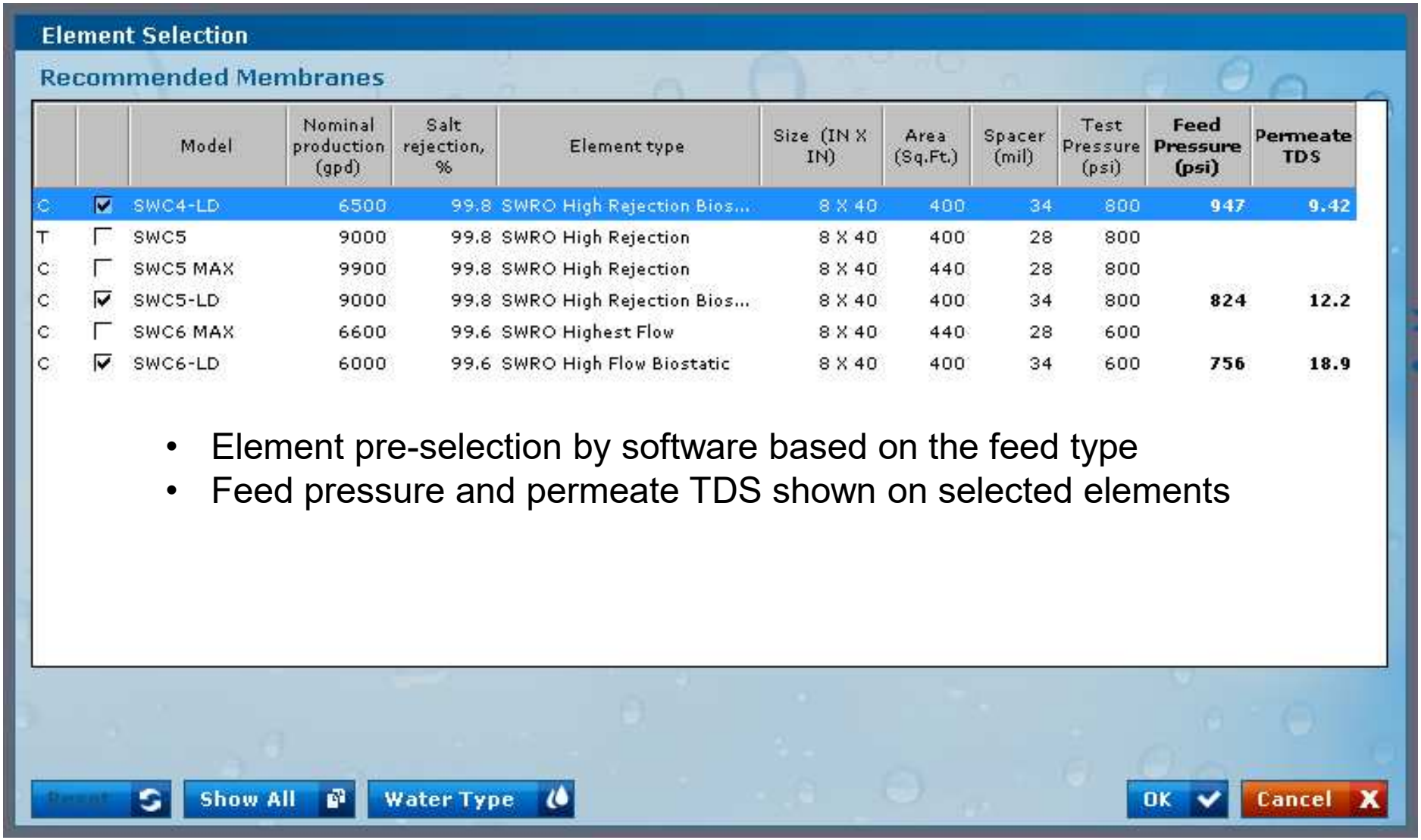
Element Selection



		Model	Nominal production (gpd)	Salt rejection, %	Element type	Size (IN X IN)	Area (Sq.Ft.)	Spacer (mil)	Test Pressure (psi)	Feed Pressure (psi)	Permeate TDS
C	☑	SWC4-LD	6500	99.8	SWRO High Rejection Bios...	8 X 40	400	34	800	947	9.42
T	☐	SWC5	9000	99.8	SWRO High Rejection	8 X 40	400	28	800		
C	☐	SWC5 MAX	9900	99.8	SWRO High Rejection	8 X 40	440	28	800		
C	☑	SWC5-LD	9000	99.8	SWRO High Rejection Bios...	8 X 40	400	34	800	824	12.2
C	☐	SWC6 MAX	6600	99.6	SWRO Highest Flow	8 X 40	440	28	600		
C	☑	SWC6-LD	6000	99.6	SWRO High Flow Biostatic	8 X 40	400	34	600	756	18.9

- Element pre-selection by software based on the feed type
- Feed pressure and permeate TDS shown on selected elements

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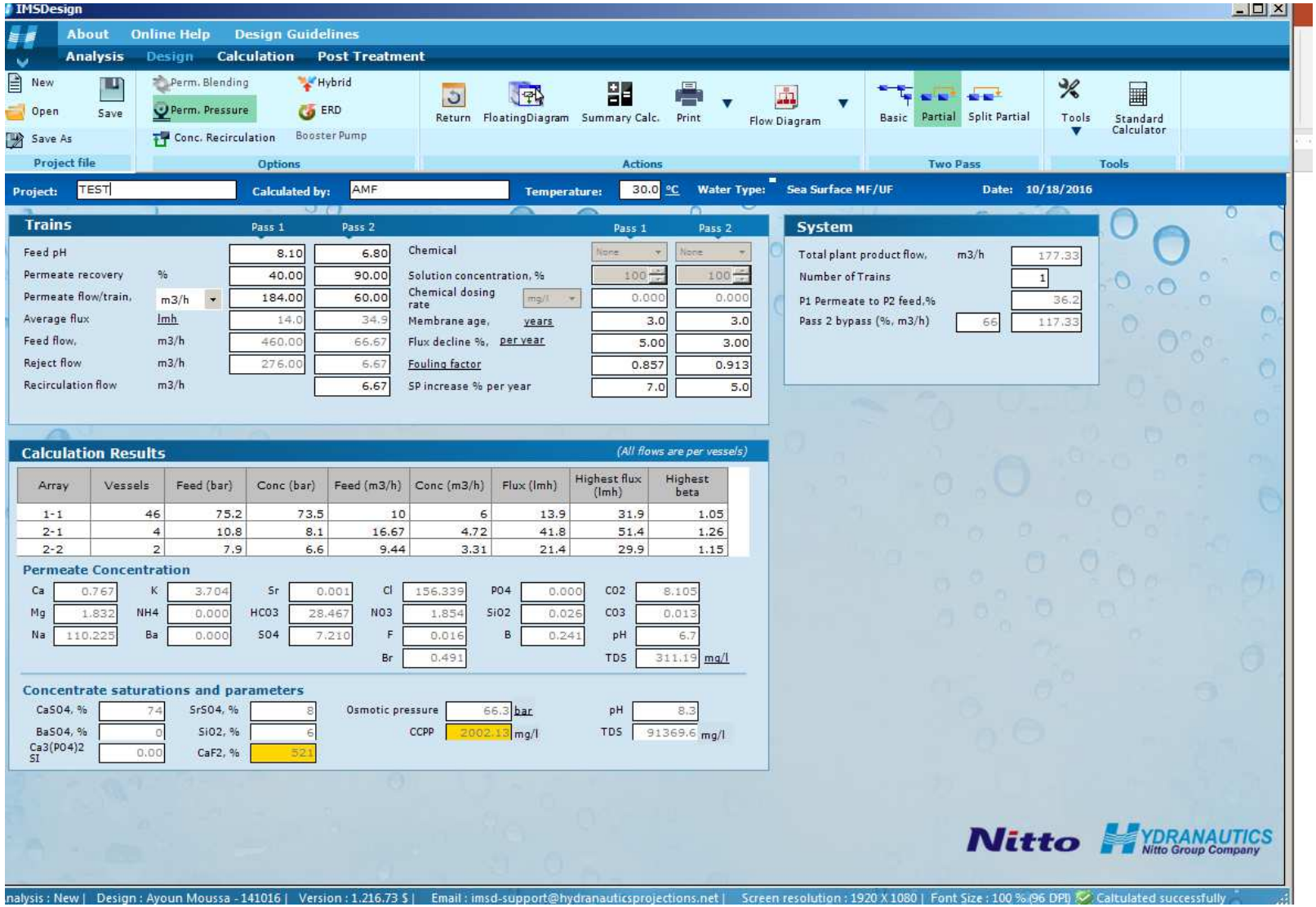
RUN and Preliminary Results



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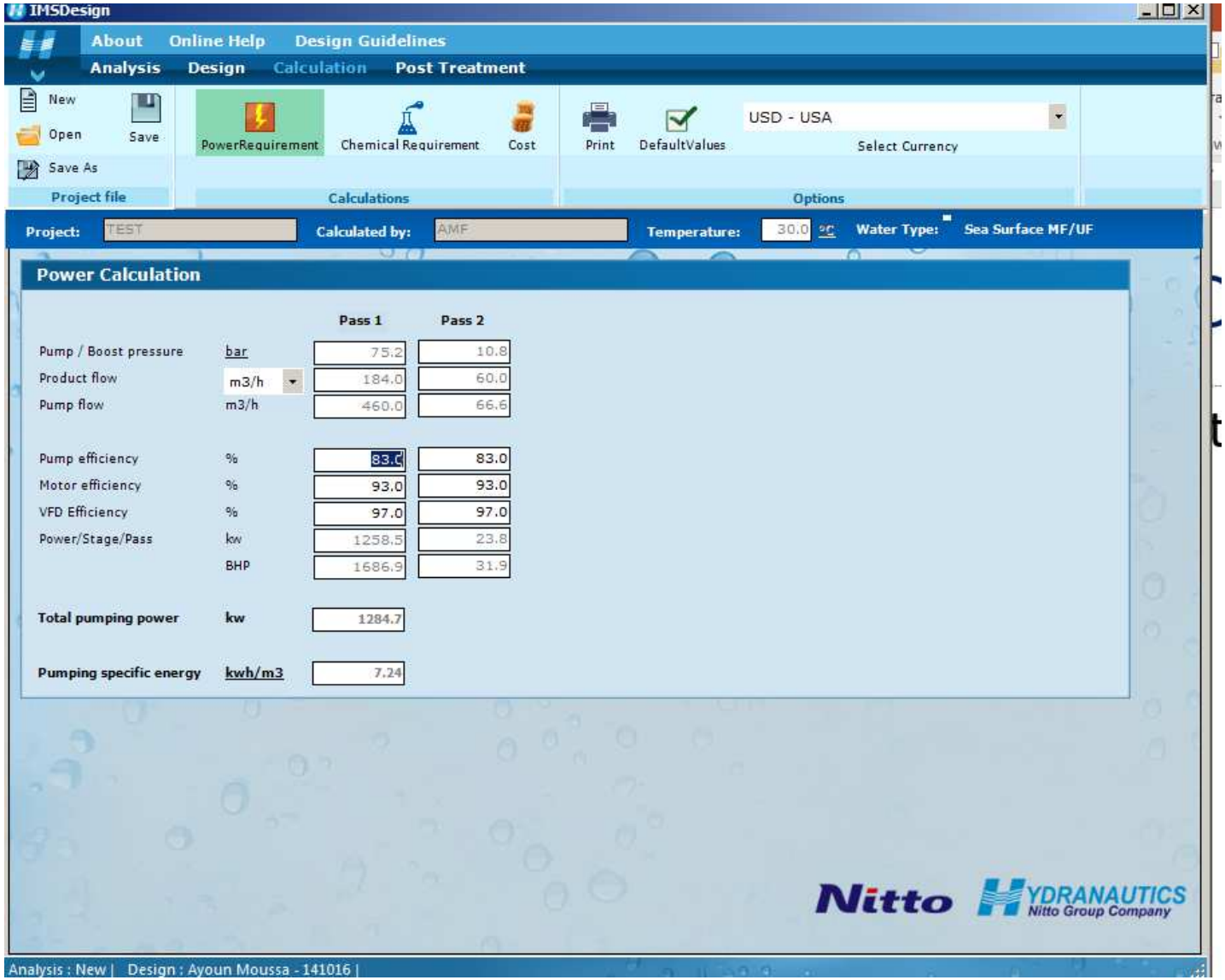
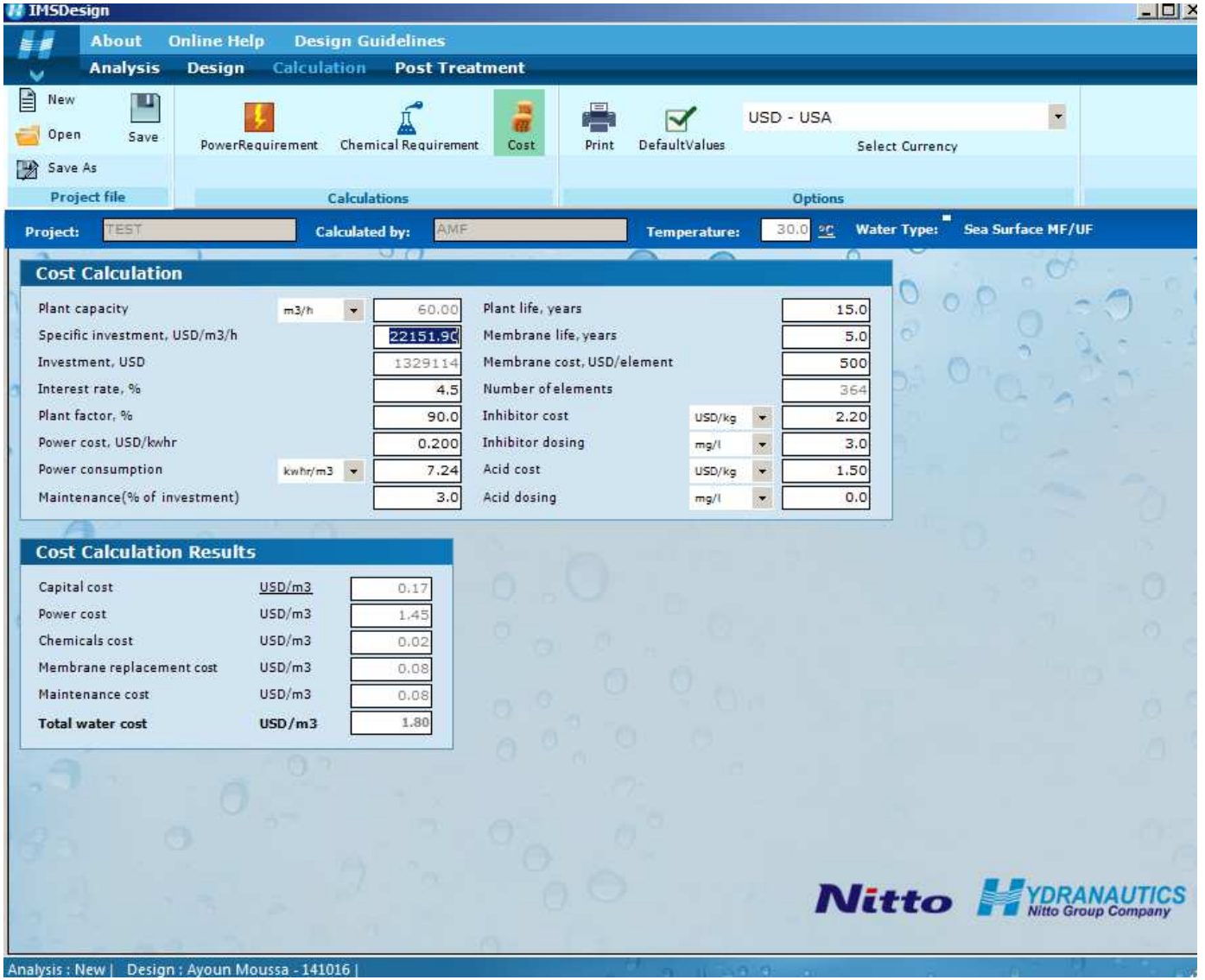
Chemical Post Treatment

Power Calculations



Chemical Requirement

COST Calculation



ROData - normalization tool

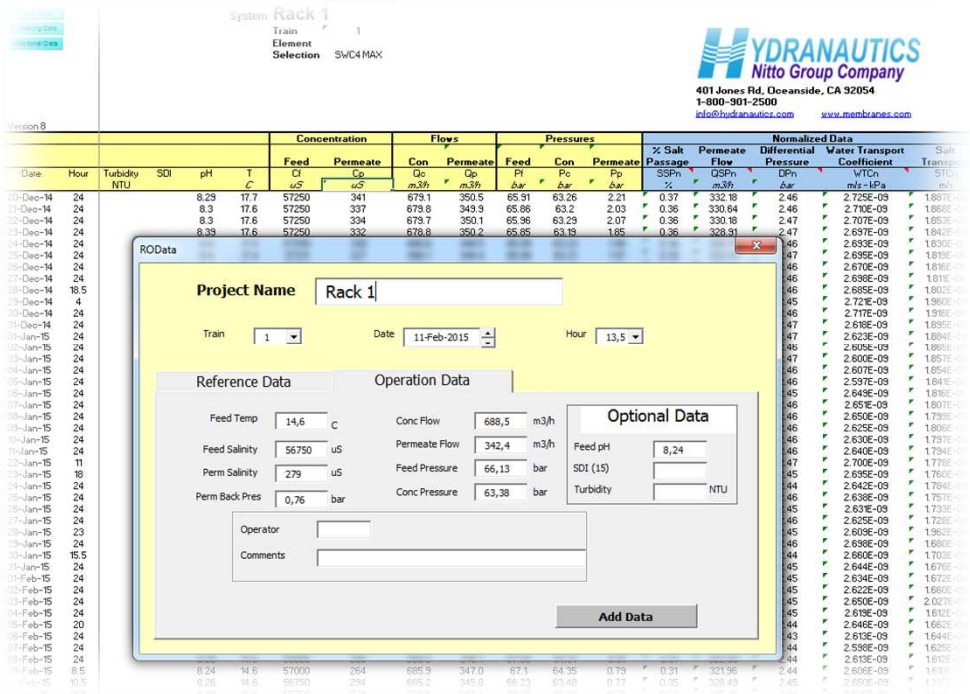
- ✓ Data log sheet

  Collect daily operating data (At least one set of data per shift)

- ✓ Normalization to a given reference performance

  to identify the effects of fouling and membrane degradation vs. normal changes in plant performance

→ Early detection of performance upset



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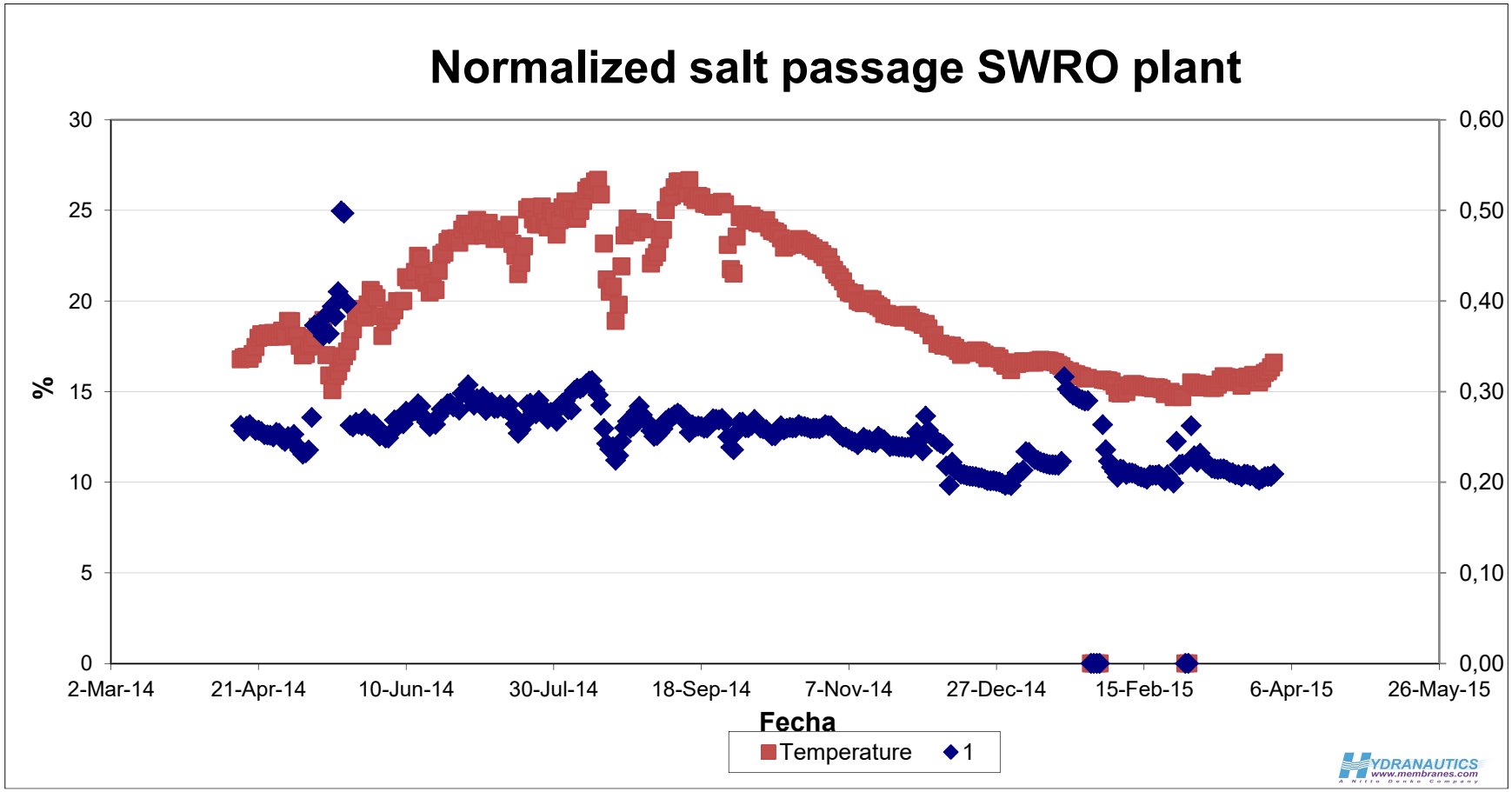
Normalized salt passage



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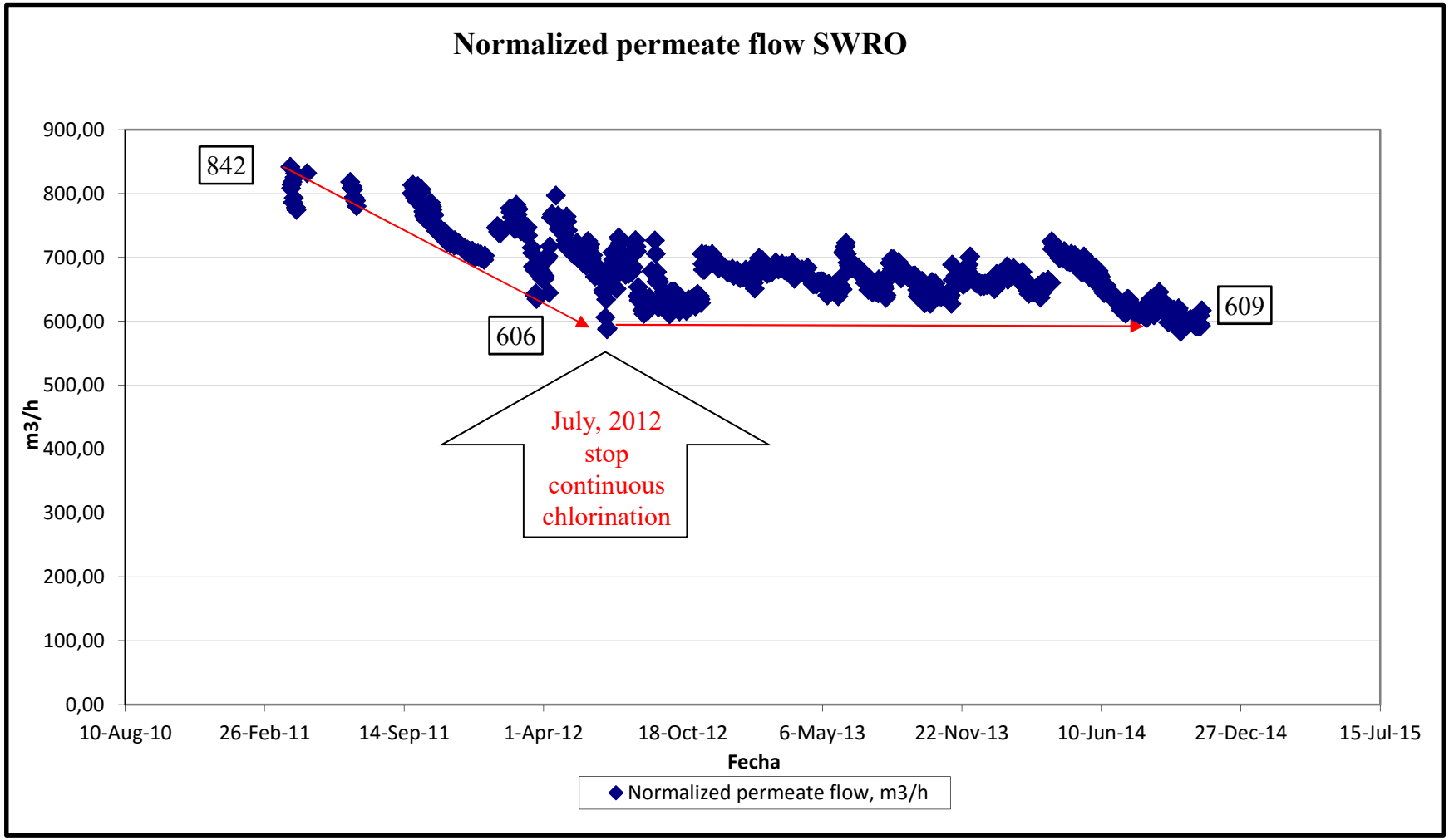
Normalized permeate flow



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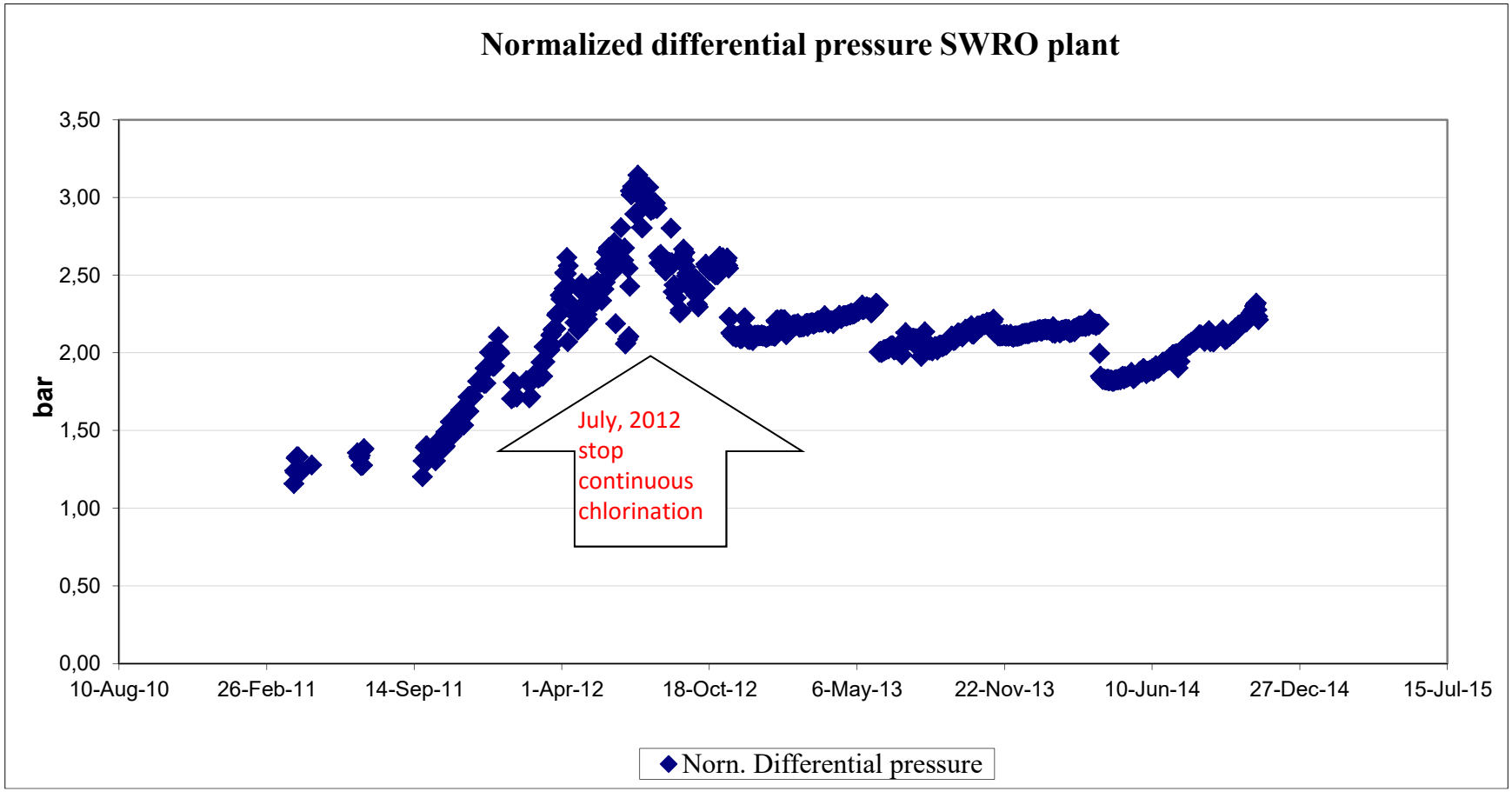
Normalized differential pressure



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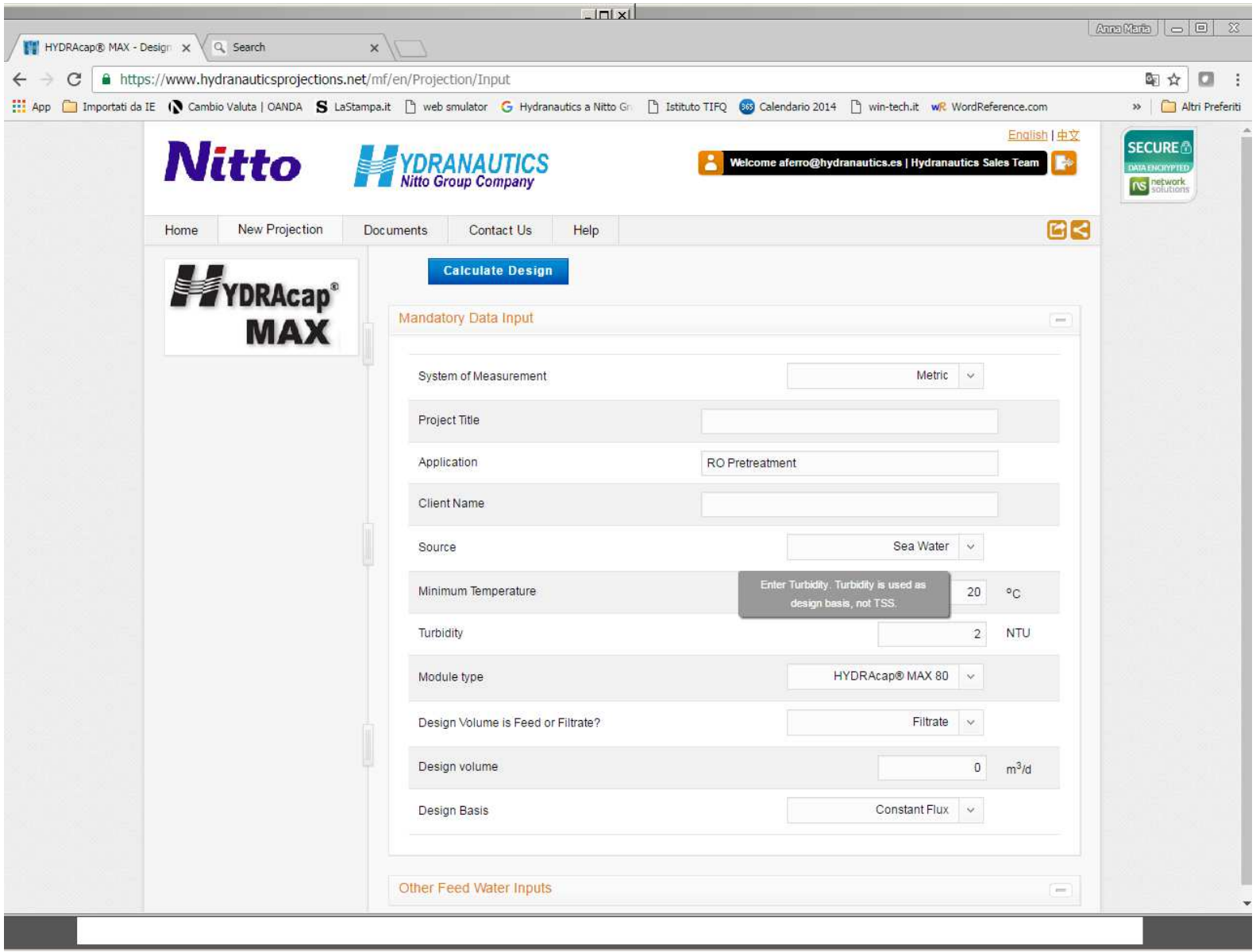
HYDRAcap® MAX – Web simulator

- First web based program always updated and easy to share
- Please contact us to receive a key to access the web simulator
- Full membrane system design and operation, including
  - Membrane system details
  - Chemicals consumptions
  - Ancillary Equipment Sizing (pumps, blowers, tanks, …)
  - Sequence Tables
- Mozilla or Chrome are preferred Internet browser

Input Section



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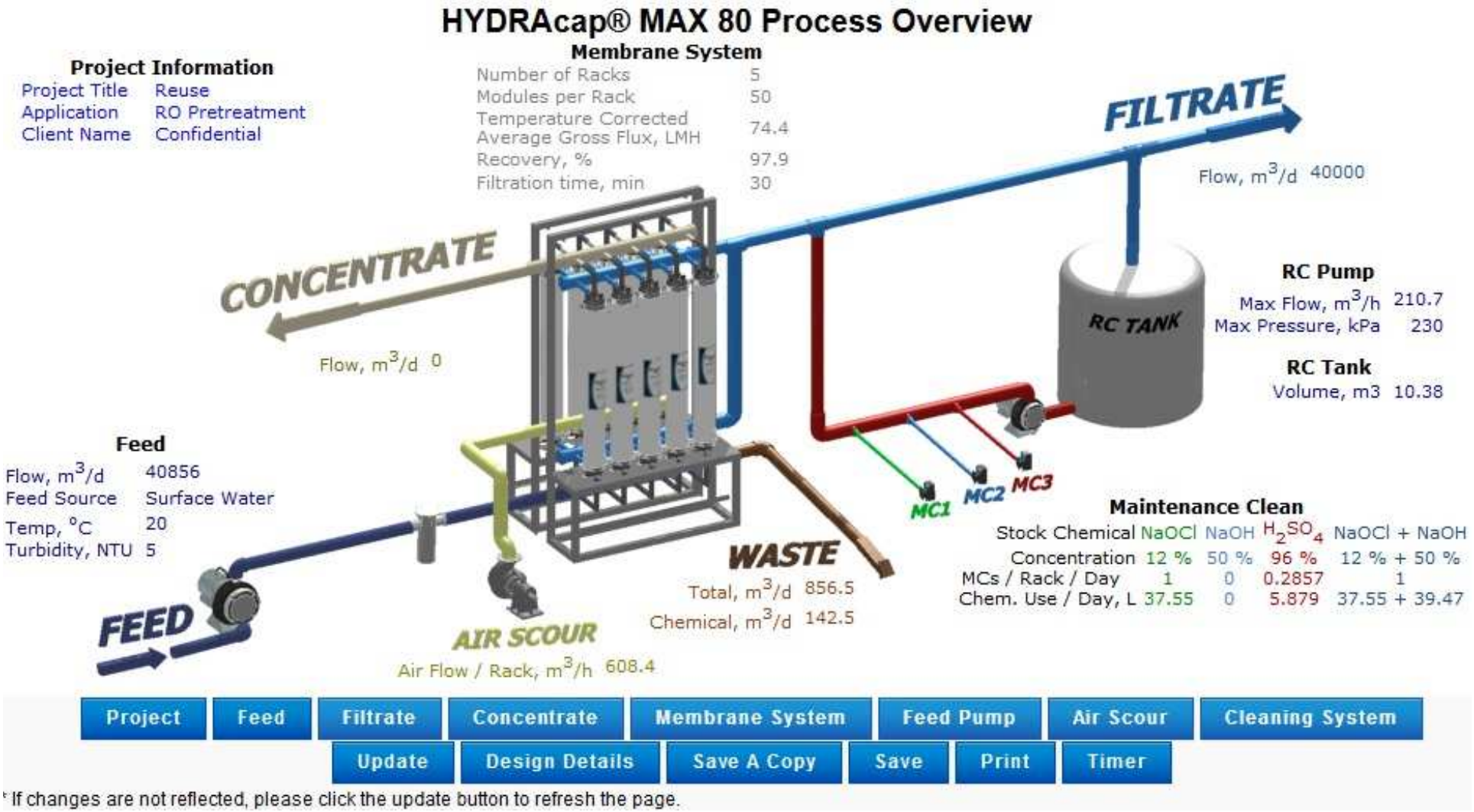
DESIGN SUMMARY

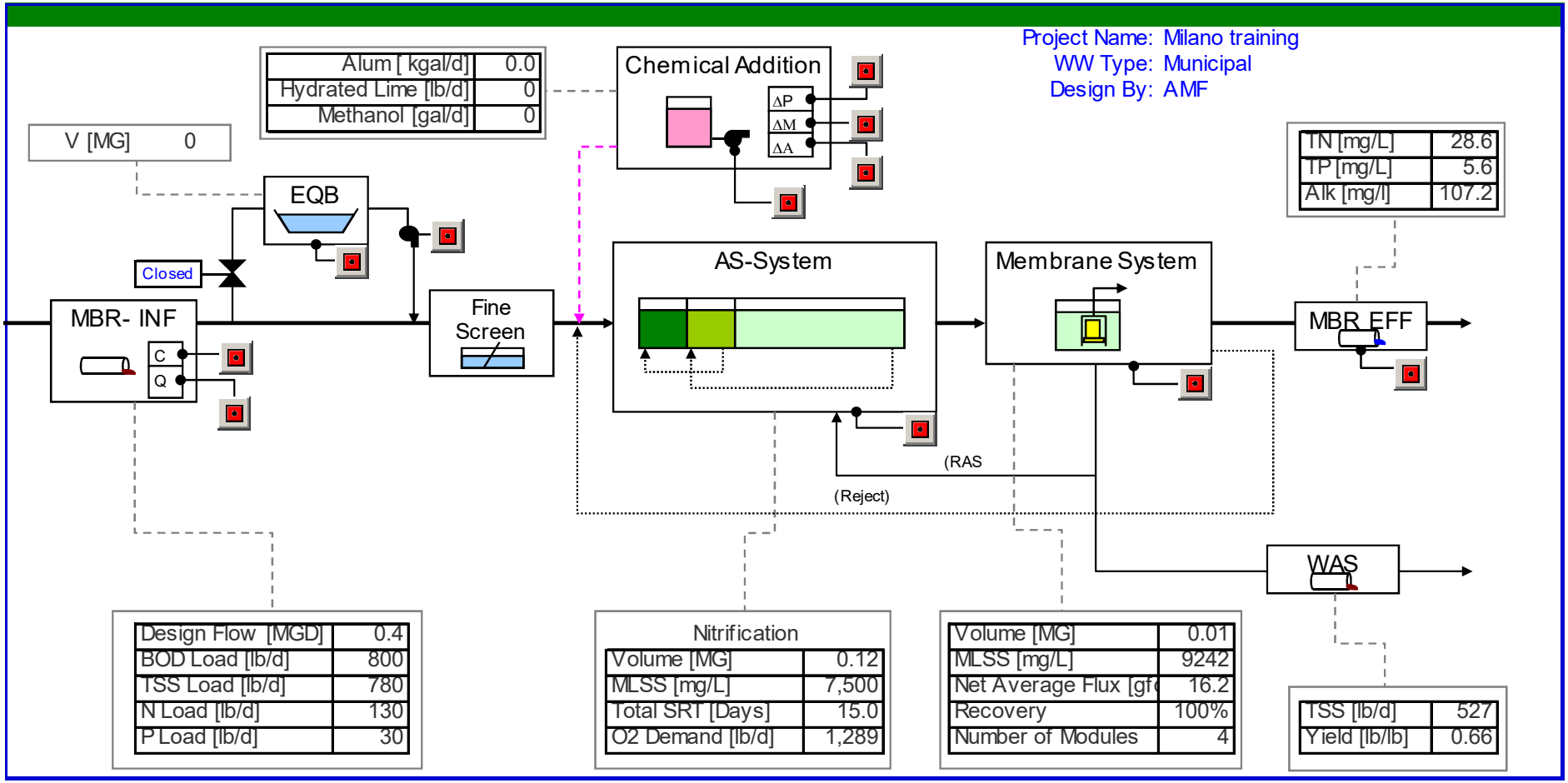


Online: http://hydranauticsprojections.net/Account/Login

HYDRAsub® – Simulator

- Easy Design software for MBR Membrane System
- Full membrane system and ancillary equipment design (no Biological process design)

HYDRAsub® System Design



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HYDRAsub® System Design

HYDRAsub®

Simulator Version: Model 04 3 rev 11FEB14
Design By: AMF
WW Type: Municipal

Milano training MBR Membrane System Design Summary

Influent Flows

Average Day	m³/day	1320
Maximum Month	m³/day	1470

Maximum Day	m³/day	1499
Peak Hour	m³/day	2400

Membrane Design

Net Peak Flux	lmh	50.0
Net Max Daily Flux[1]	lmh	31.2
Net Max Monthly Flux	lmh	30.6
Net Average Flux	lmh	27.5
Net Average Flux at N-1 Trains[2]	lmh	55.0

Min Temperature	°C	20
Filtration Time	min	7.0
Soak Time	min	1.0
Installed Membrane Surface	m²	2000
Redundency Required		No

No. of Cells in Membrane Tank	-	2
No. of Trains per Cell (x-direction)	-	1

Selected Module Class	HSM	500-ES
Membrane Area per Module	m²	500
Required Modules (min)	-	4

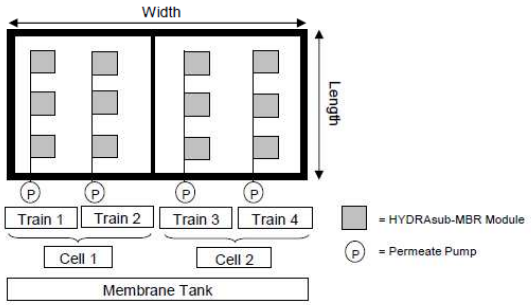
Number of Modules Installed	-	4
Number of Modules per Cell	-	2
Number of Modules per Train	-	2

Cell Width	m	1.8
Cell Length	m	2.9
Cell Volume (Total)	m³	16.7

Tank Depth	m	3.20
Tank Water Level	m	2.70
Total MT Length (x-direction)	m	5.80
Total MT Width (a-direction)	m	1.80
Membrane Tank Volume (Total)	m³	32.67
Min Tank Surface (Total)	m²	10.20

Permeate Production	m³/day	1469.7

Membrane Tank Configuration Example:



[1] For a maximum of 24 hours in any seven day period
[2] During a maintenance (CEB) or recovery (CIP) cleaning or other maintenance period for a duration of less than 4 hours

Equipment Summary

Equipment sizing is based on a number of assumptions, which may not be accurate to the specific project.

Conveyance Pumps		Backwash (CIP/CEB) Pumps	Membrane Pumps
Design Flow (Total)	m³/hr	4.2	114.3
Design Flow (per pump)	m³/hr	2.1	57.2
Assumed Static Head Loss	m		
TDH (Design Q)	m	8.3	9.3
Pump Efficiency	%	0.8	0.8
Motor Efficiency	%	0.9	0.9
NPSH Required	m		3.9
Horse Power (Design Q)	HP	0.26	5.8
Horse Power per Pump	HP	0.20	5.00
Number of Pumps	-	3	3
Number of Duty Pumps	-	2	2

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HYDRAsub® System Design

Chemical Pumps		Citric Acid Pump	Sodium Hypochlorite Pump
Min Injection Flow	L/min	2.3146	0.1630
Max Injection Flow	L/min	4.6292	2.7164
Stock Concentration	%	30%	12.5%
Redundancy Required	-	No	No
Number of Feed Pumps	-	1.0	1.0
Number of Duty Pumps	-	1.0	1.0
Safety Factor	-	1.2	1.2
Design Flow	L/min	5.55	3.26
Turndown Rate	%	58%	95%

Scour Air

Max Specific Air Flow	$m^3/(m^2\ hr)$	0.35
Total Maximum Air Flow (Design)	m^3/hr	701.1
Total Blower Horse Power	HP	12.18
Number of Duty Blowers	-	3
Blower HP (Each)	HP	5.00
Maximum Air Flow per Module	m^3/hr	175.3
Nominal Air Flow per Module	m^3/hr	146.1

Annual Operation Cost Summary

Power Consumption

Backwash (CIP/CEB) Pumps	MWh	0.004
Membrane Pumps	MWh	10.3
Scour Air	MWh	66
Membrane System Power (Total)	MWh	77
Power Unit Cost	$/kWh	$ 0.11
Membrane System Power Cost	$/yr	$ 8,429

Chemical Consumption

Citric Acid	L	83.4
Sodium Hypochlorite	L	848.7

	unit cost	
Citric Acid Cost	$ 4.0	$ 330
Sodium Hypochlorite	$ 0.2	$ 168
Total Chemical Cost		$ 499

Key Process and Cost Indicators

Annual Scour Air Power	kWh/m^3 pmt	0.12
Annual Membrane System Power	kWh/m^3 pmt	0.14
Scour Air	m^3 air/m^3 pmt	11.45
Membrane Chemicals	$/$m^3$ pmt	0.0009

QC Summary

	Unit	Model	Min	Max
Net Peak Flux	lmh	50.0	0.0	50.8
Net Max Daily Flux[1]	lmh	31.2	0.0	40.0
Net Max Monthly Flux	lmh	30.6	0.0	33.3
Net Average Flux	lmh	27.5	0.0	33.3
Net Average Flux at N-1 Trains[2]	lmh	55.0	0.0	50.8

[1] For a maximum of 24 hours in any seven day period

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Thank you

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