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SUSTAINABLE WATERS WaterMan

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WaterMan partner meeting

Saldus. Latvia (1-3/04/2025)

Jerzy Butkiewicz & Magdalena Gajewska & Krzysztof Czerwionka

[Source: geoportal.gov.pl]

Location:

Łąkowa 1 Street. **Braniewo**. Poland

[Source:mos.braniewo.pl]

Municipal Sports Center „Zatoka”

↳ Recreation & Rehabilitation Complex „Healthy Braniewo”

Infrastructure:

- **Indoor pool complex:**
  - sport swimming pool
  - leisure pool with wading pool
  - SPA bath

- **Wellness facilities:**
  - sauna rooms (x2)
  - gym
  - massage parlour
  - rest zone
  - tanning beds

Reuse of pool waters – technical data

Indoor pool complex:

- **Water purification technology:**

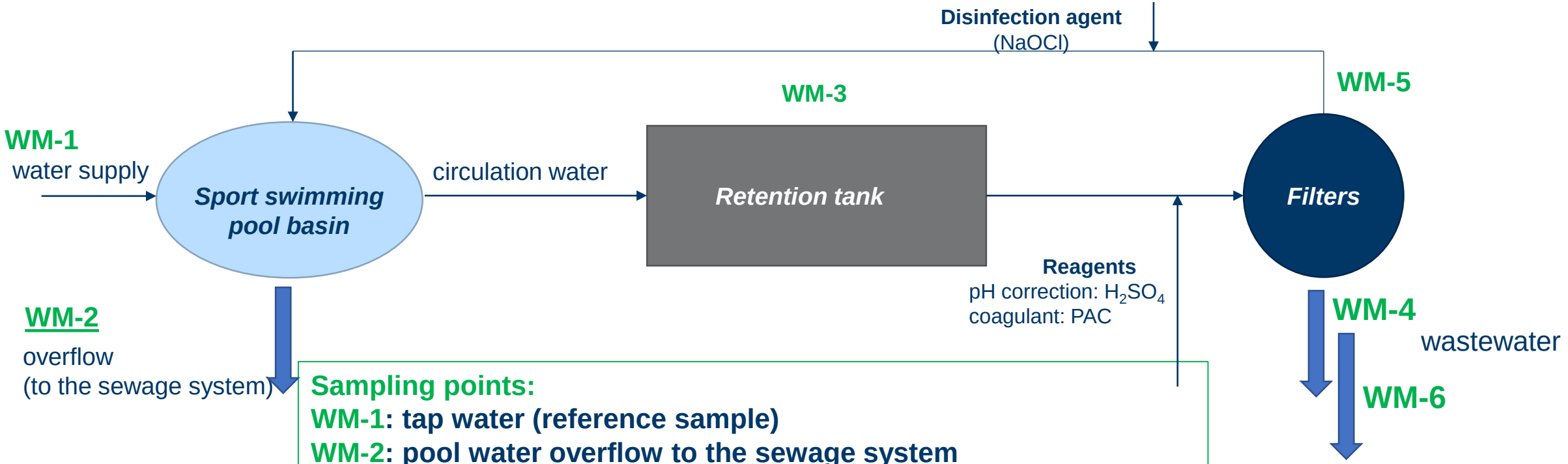
coagulation ⇨ filtration ⇨ chlorination (NaOCl)

- **3 separate water treatment circuits**
  - sport swimming pool
  - leisure pool with wading pool
  - SPA bath

POTENTIALLY FOR REUSE:
- **rinse water from filters**
- **used water discharged from pools**

[Source:mos.braniewo.pl]

Reuse of pool waters – monitoring campaign (2023)



Sampling points:

WM-1: tap water (reference sample)

WM-2: pool water overflow to the sewage system

WM-3: pool water + sediment (mixture)

WM-4: filter rinsing wastewater (from sport swimming pool); first stream

WM-5: water after filtration (to sport swimming pool)

WM-6: filter rinsing wastewater after aeration

Water quality control: BASIC PARAMETERS

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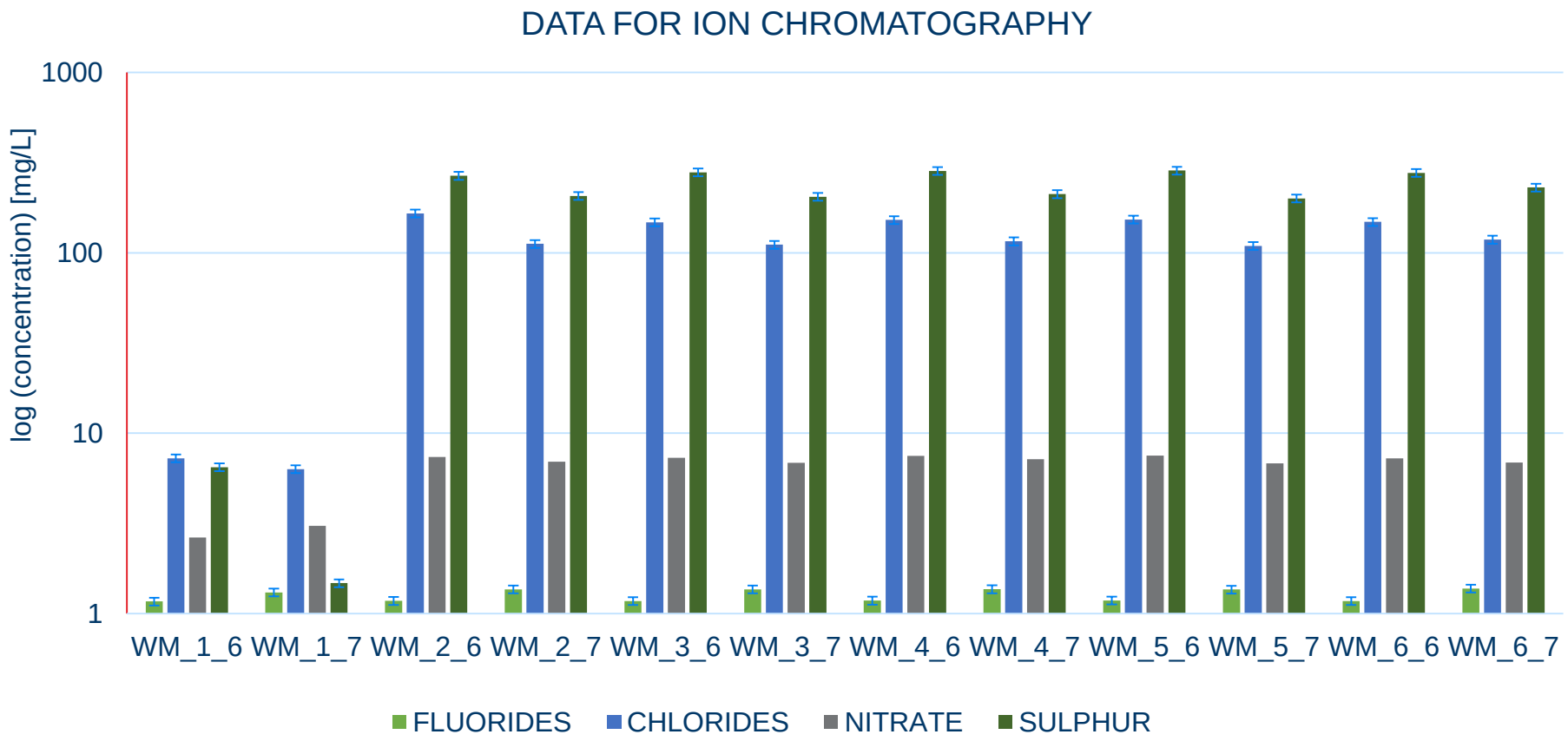
PARAMETERS		SAMPLE					
		WM-1	WM-2	WM-3	WM-4	WM-5	WM-6
Turbidity	mg/L	15.5	15.1	14.6	9.9	0	4.9
Color	mgPt/L	8.1	2.0	1.2	108.7	2.6	66.2
Conductivity	µS/cm	489	1083	1083	1078	1025	1081
Suspended solids	mg/L	1.375	0.625	0.625	16.75	1.0	13.5
Total Cl_2	mg/L	0	0.9	0.8	0.9	0.7	1.0
Free Cl_2	mg/L	0	0.4	0.4	0.2	0.1	0.2
TN	mg/L	1.41	2.98	3.15	2.82	2.34	2.55
COD	mgO_2/L	15.9	17.3	11.3	5.23	10.23	10.1

NO BROMIDES. NITRITES. PHOSPHATES

but…

One-way ANOVA (α 0.05)
There no significant difference between groups. p=0.88



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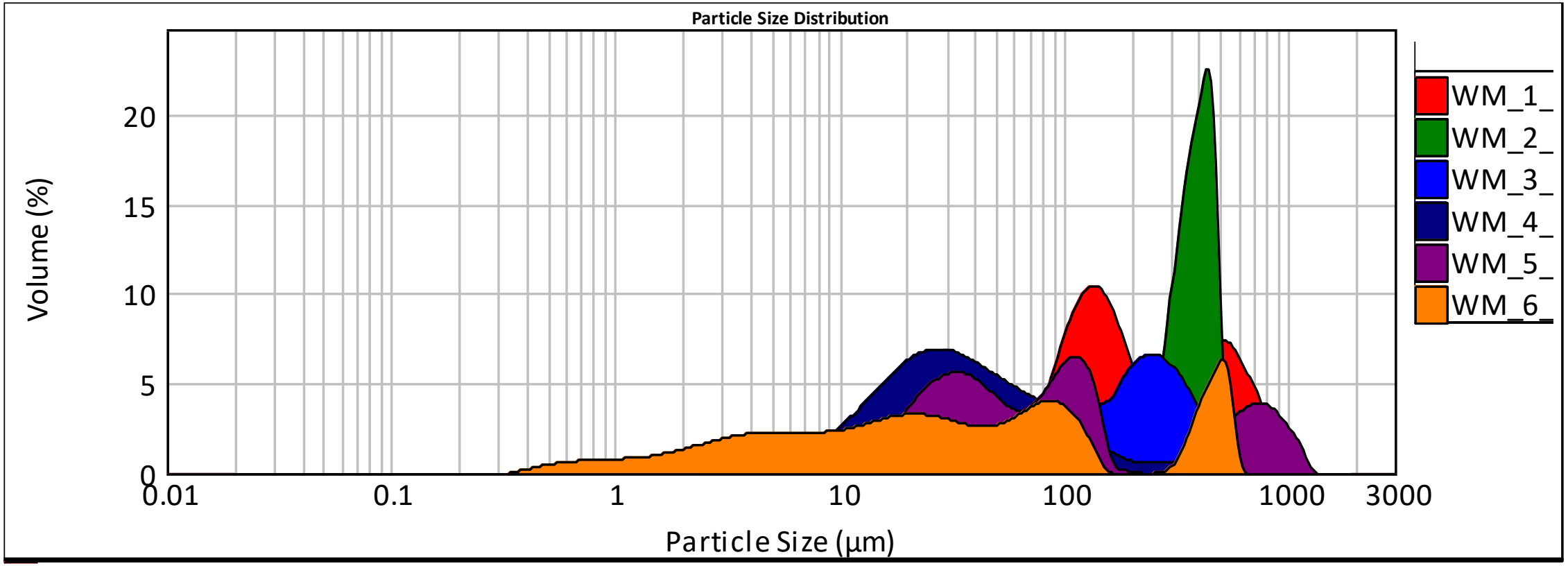
GRANULOMETRY analyze
(water without sample preparation)



30 m³/d

water supply from the municipal network

Before implementation of the WaterMan pilot solution:

wastewater *from showers and toilets*

pool water ***overflow***

filter rinsing ***wastewater***

15 m³/d | 4÷5 m³/d | 10÷11 m³/d

discharge into the sewage system (100%):
30 m³/d

1. ***Wastewater*** *from showers and toilets and pool water* ***overflow*** *are combined within the Basin and discharged through a* ***common sewage system*** *- directing the pool water overflow to the pilot requires reconstruction of the sewage system in the swimming pool building*

2. Filter rinsing wastewater *is discharged from the swimming pool building by a* ***separate sanitary collector*** *- it can be easily directed to the pilot*

30 m³/d

water supply from the municipal network

After implementation of the WaterMan pilot solution:

Reuse of treated wastewater:

- *flushing the sewer system in Braniewo: ap. 3 m³/d (all year round)*
- *watering urban greenery (vegetation period)*
- *watering of plants by residents (vegetation period)*
- *…… (in the process of arrangements)*

wastewater *from showers and toilets*

pool water ***overflow***

filter rinsing ***wastewater***

15 m³/d

4÷5 m³/d

4÷6 m³/d

4÷5 m³/d

discharge into the sewage system

- ✓ 40-50% **reduction** in filter rinsing wastewater
- ✓ 15% **reduction** in sewage discharge
- ✓ **5m3/d savings** on tap water for different purposes

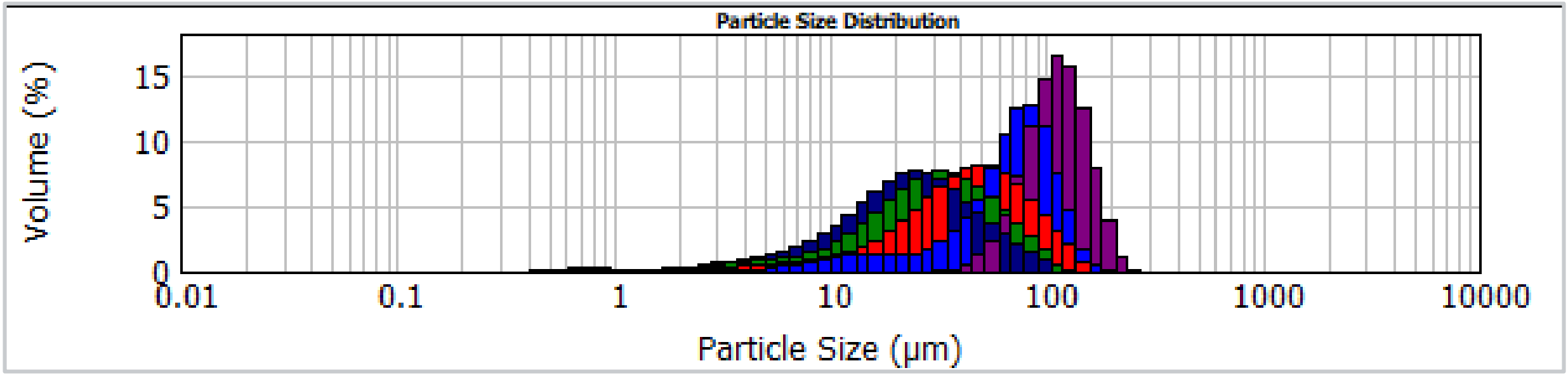
Technological research on wastewater treatment from filter rinsing

- **Three series of tests were carried out on the effectiveness of removing contaminants from filter rinsing wastewater (leisure pool with wading pool):**
  - technical aluminum sulfate was used
  - aluminum ion dose: 0.5-10 mg Al/l
  - intensive mixing time (mixing the coagulant with the wastewater) - 10 min
  - polyelectrolytes (anionic polymer) during slow mixing: 1mg/l
  - slow mixing time (flocculation process) - 20 min
  - sedimentation time of suspensions (without mixing) - 2 (3) hours
  - analysis of the quality of raw and treated wastewater

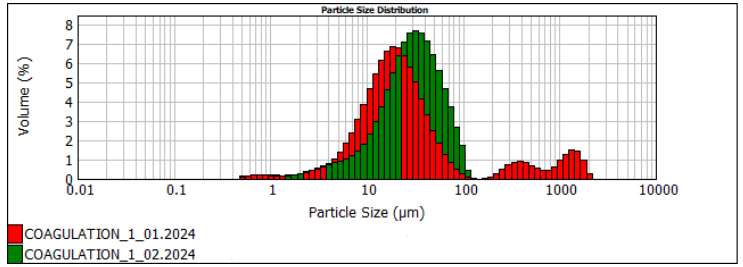
Water quality control: BASIC PARAMETERS

PARAMETERS		SAMPLE	
		Wastewater	**Coagulation 1.0 mg/L**
pH	[-]	6.31	6.85
Turbidity	mg/L	28.9	**2.2**
Color	mgPt/L	94.5	**6.8**
Conductivity	µS/cm	991	992
Suspended solids	mg/L	37.6	**4.4**
Total Cl_2	mg/L	2.58	**0.085**
Free Cl_2 (method 1)	mg/L	0.4	**0.18**
Free Cl_2 (method 2)	mg/L	0.397	**0.164**
TN	mg/L	3.97	**2.53**
N-NH_4	mg/L	0.116	**0.084**
P-PO_3	mg/L	1.41	**0.069**
COD	mgO2/L	65.7	**23.1**

Water quality control: GRANULOMETRY



WASTEWATER_02.2024
COAGULATION_1_02.2024
COAGULATION_2_02.2024
COAGULATION_5_02.2024
COAGULATION_10_02.2024



Grass tolerance to salinity

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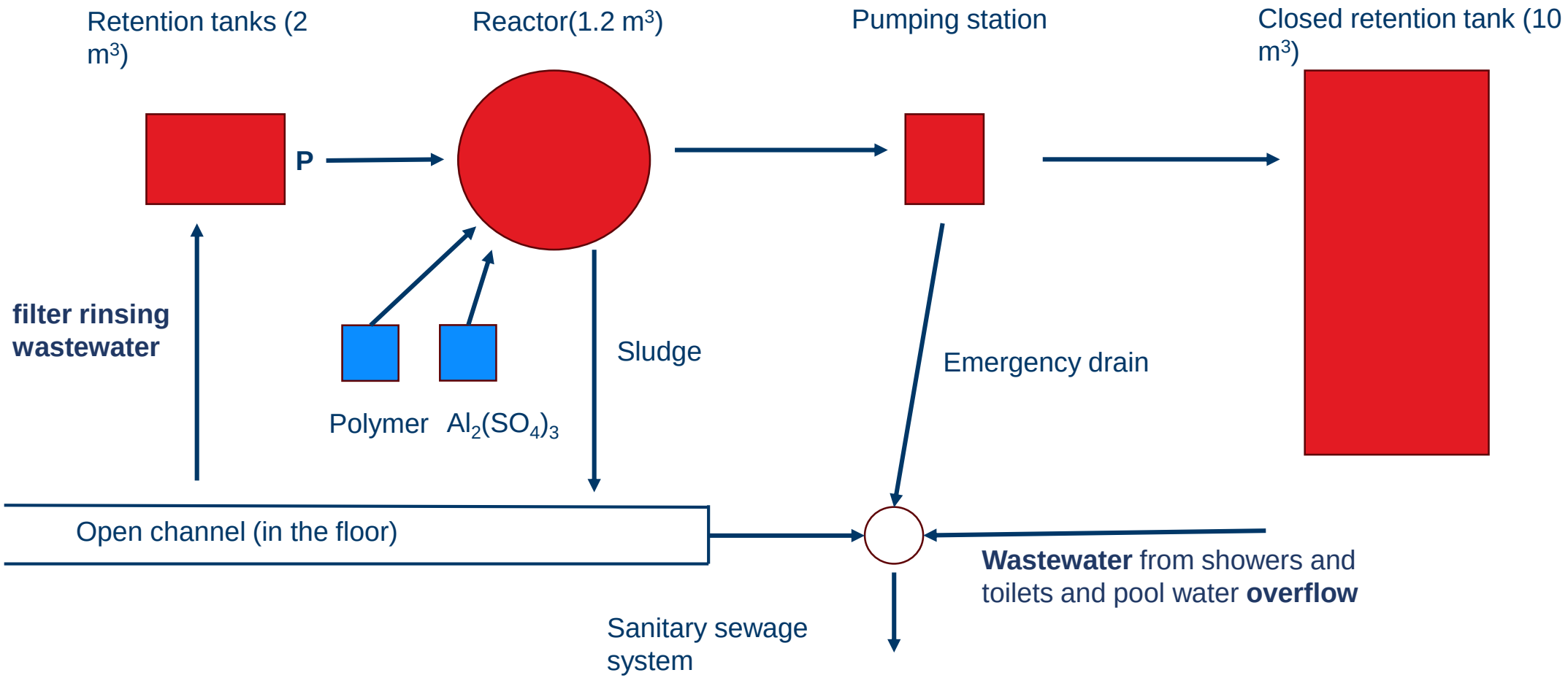
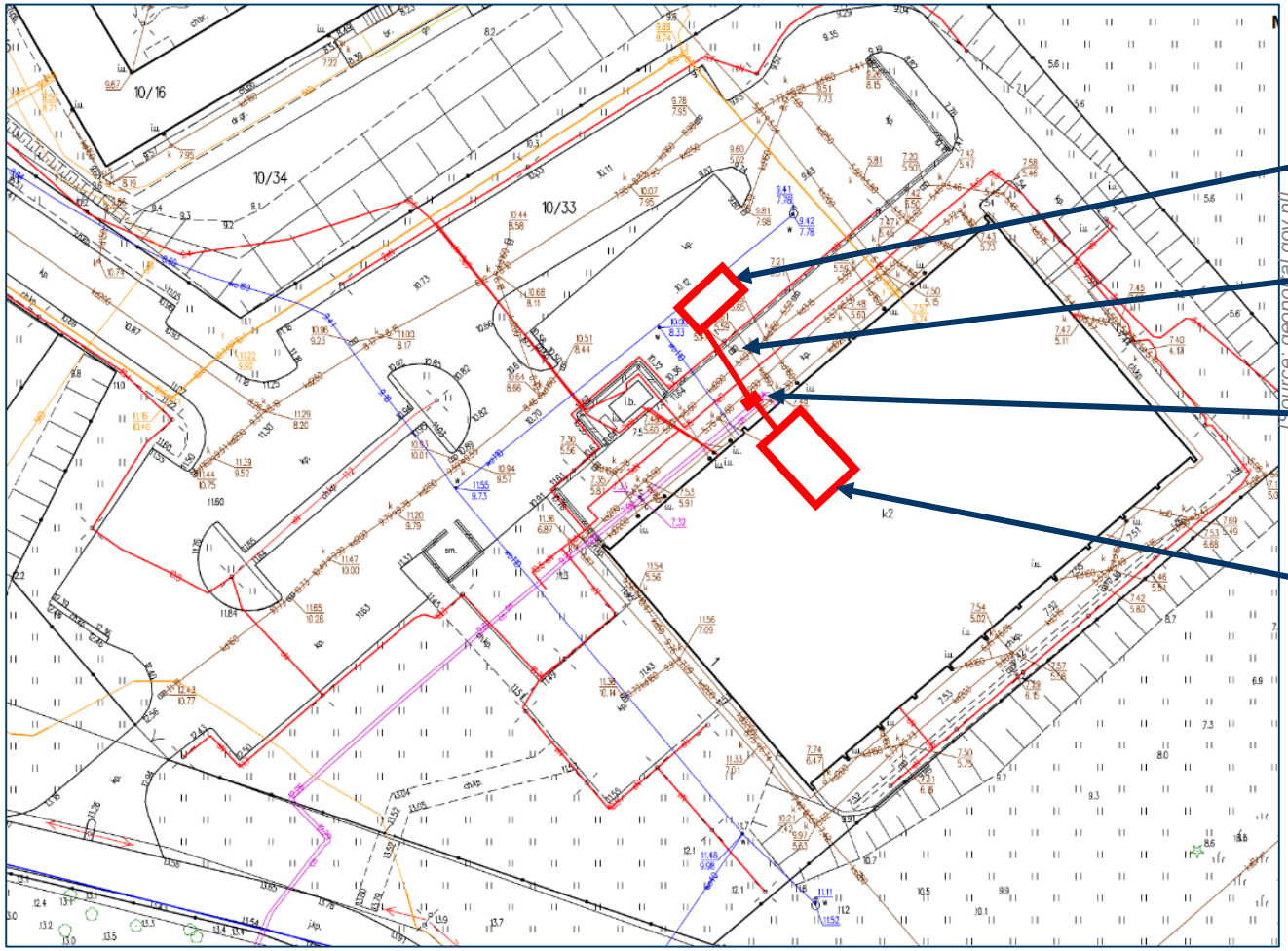
EC irrigation water (dS/m)	Grass species	Tolerance
3 – 8	*Synodon dactylon*	**Tolerant**
	Zoysia spp.	
	Agrostisstolonifera	
	Festuca arundinacea	
	Lolium perene	
	Festuca rubra var. tricophilla	
0.7 – 3	*Festuca rubra var. rubra*	**Moderately tolerant**
	Festuca rubra var. commutata	
	Festuca ovina	
	Agrophirum smithii	
0.7	*Poa pratensis*	**Sensitive**
	Poa trivialis	

Wastewater after coagulation: ap. 1000 µS/cm = 1 dS/m

Swimming pool water reuse technology – **Proposed wastewater treatment system**



Swimming pool water reuse technology – **pilot location**



[Source: geoportal.gov.pl]

Closed retention tank (in the parking)

New section of sanitary sewage system

Pumping station

Pilot instalation (in the filter room)

Pilot system parameters

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Assumed operating parameters:

- flow rate – 4.0-4.8 m3/d
- Operation in a system of 4 cycles per day including:
  - 0.5 h filling.
  - 0.5 h total fast (5-10 min) and slow (20-25 min) mixing.
  - 3 h sedimentation.
  - 2 h pumping out (treated sewage and sludge)

- total time 6 hours/cycle

Reagents:

- Coagulant dosing (preliminarily selected aluminium sulphate as Kemipol ALS preparation)
  - Dose 1 mg Al/l (23.61 mg aluminium sulphate/l)
  - ALS density – 1300 mg/l
  - Volumetric dose – 0.0182 cm^3/l (18.2 cm^3/m^3)
  - Volume dosed per 1 cycle for 1100 +50 = 1150 l = approx. 21 cm^3
- Polyelectrolyte dosing (preliminarily selected Kemipol A110 preparation)
  - Dose 1 g/m^3 (1 mg/l)
  - 3% solution – 3 g/100 cm^3 = 30 g/l
  - Volumetric dose – 33.3 cm^3/m^3
  - Dosing volume per cycle for 1100 +50 = 1150 l = approx. 38 cm^3

Pilot set components:

I - Raw material storage (filter rinsing wastewater)

- sewage feed pump
- mechanical mixer
- filling measurement

II - Reaction tank with accessories

- mechanical mixer with speed control filling
- pump with pipelines and solenoid valve
- purified water discharge pump
- sludge drain
- reagent tanks with dosing pumps

III - Control system

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2.3 Pilot measure / reuse of treated water:
Reuse of public swimming pool water

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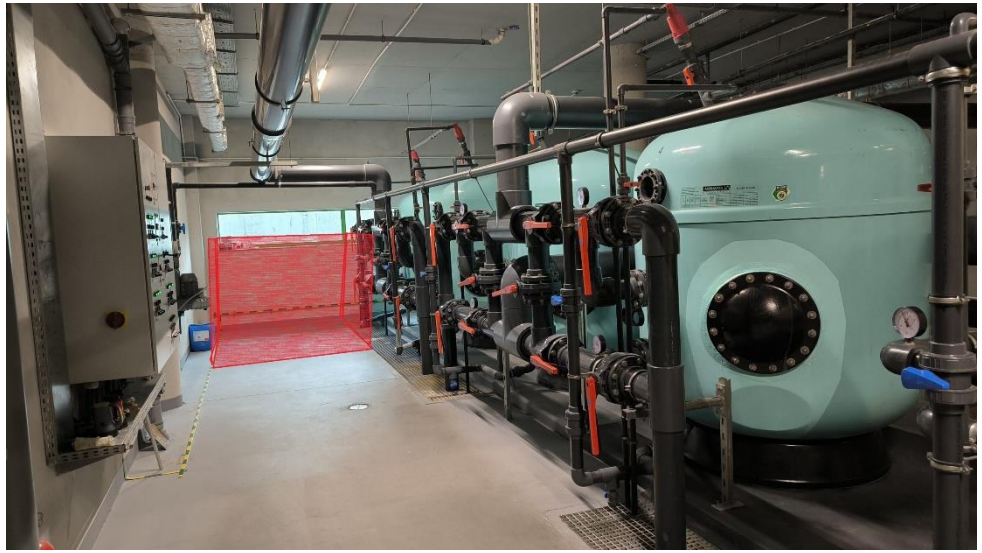

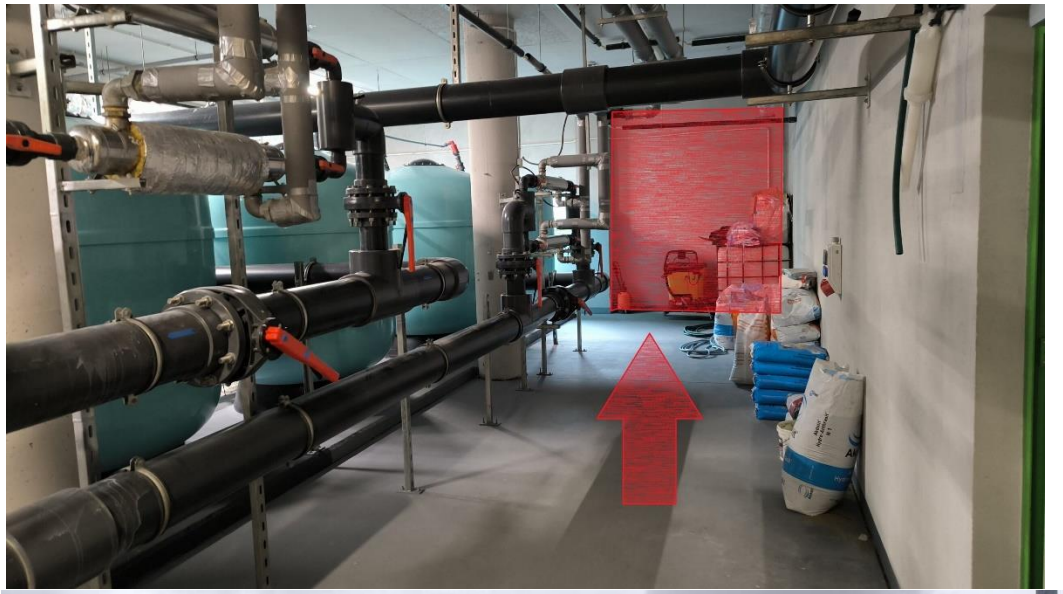

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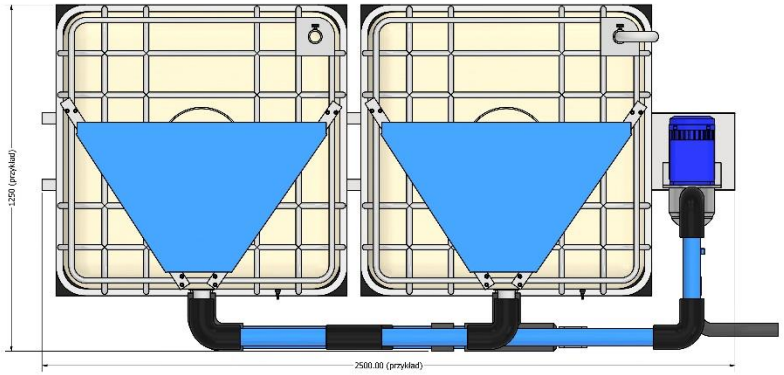
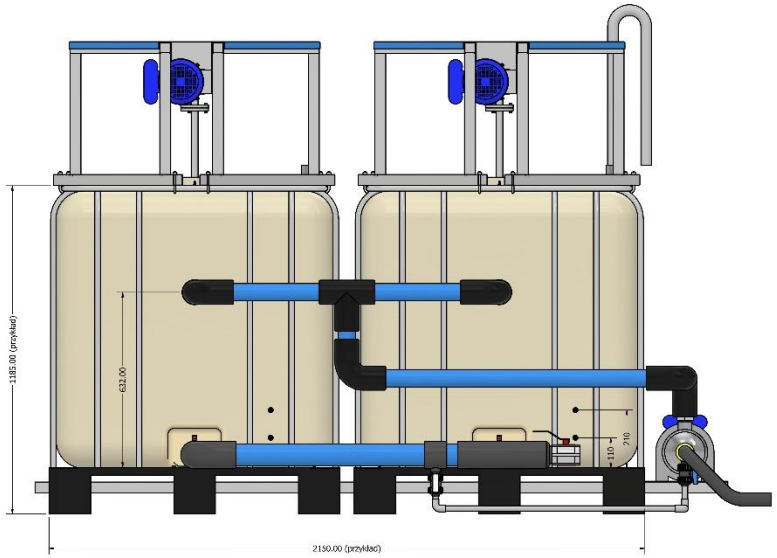
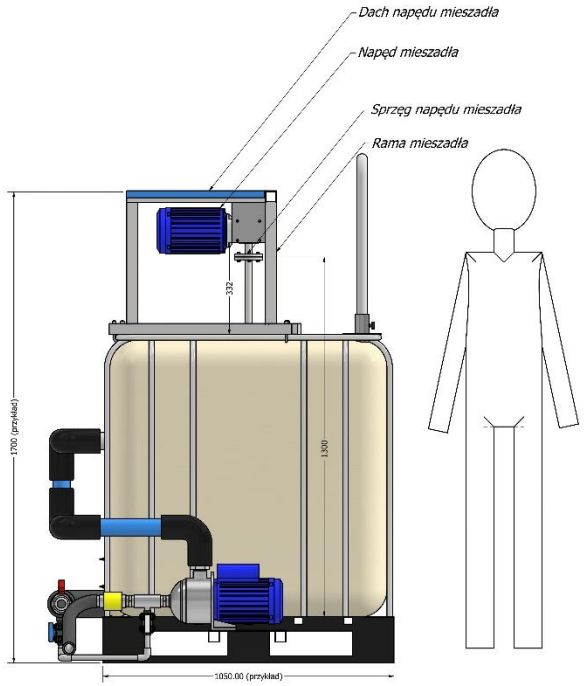
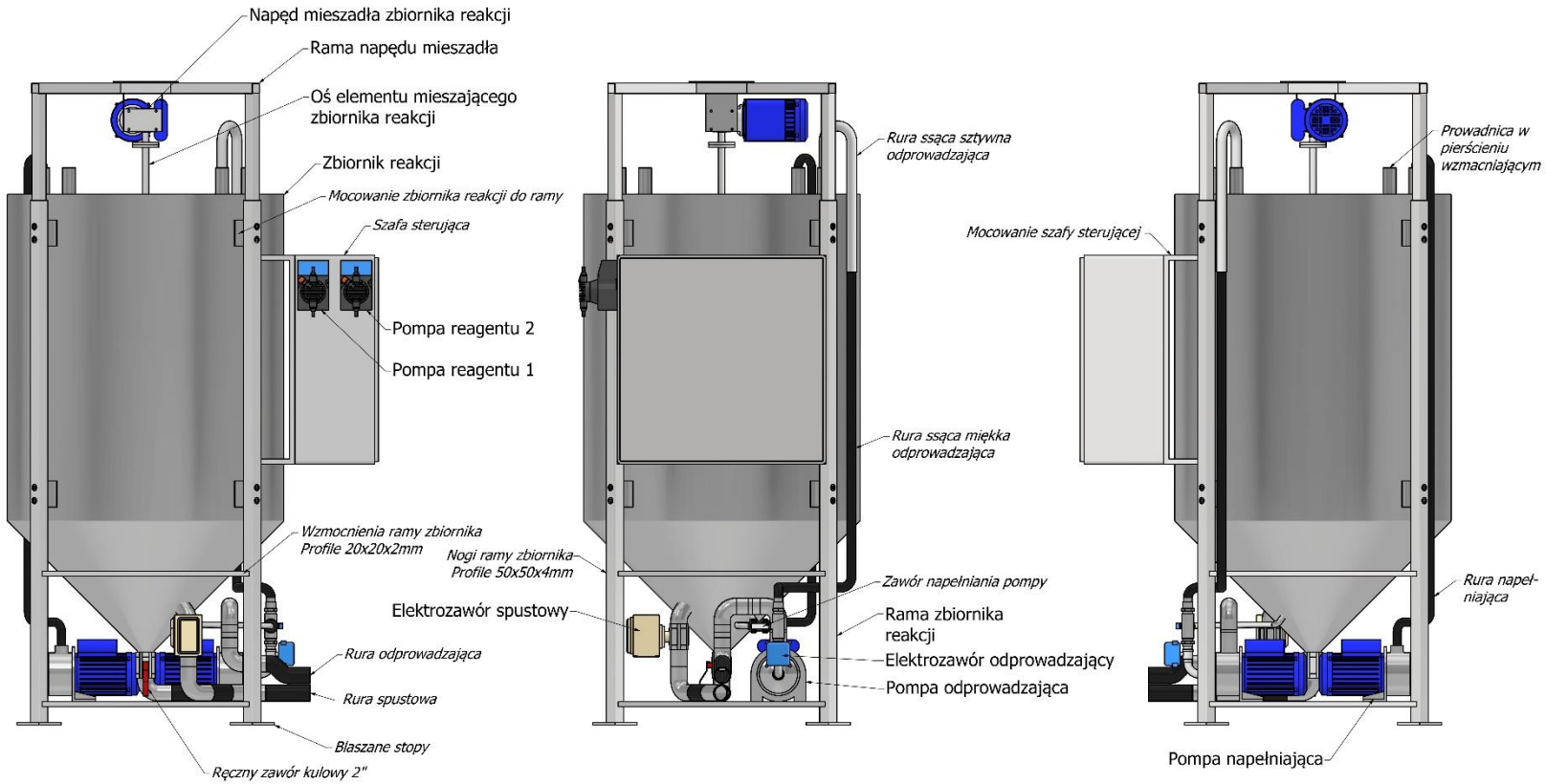
Raw material storage (filter rinsing wastewater)



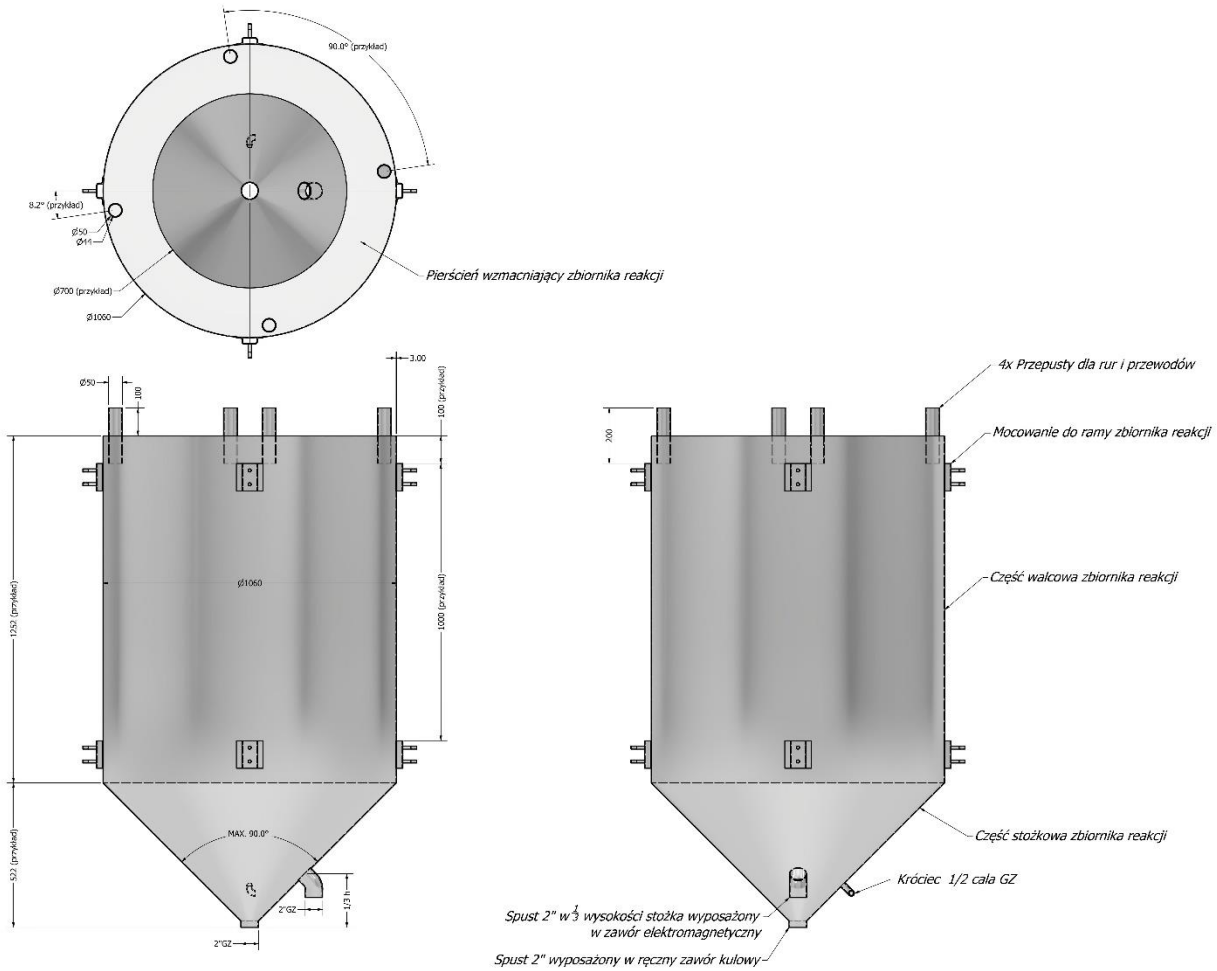




Reaction tank



Reaction tank



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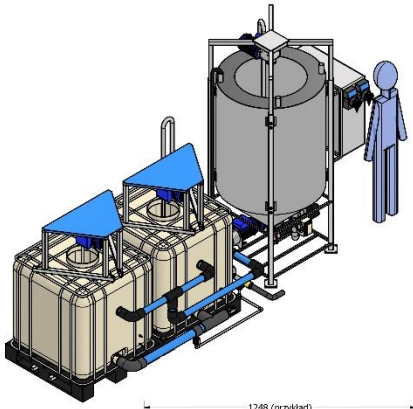
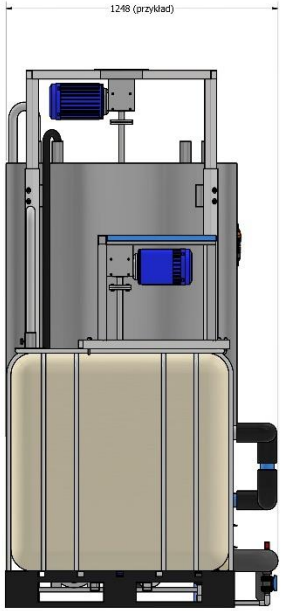
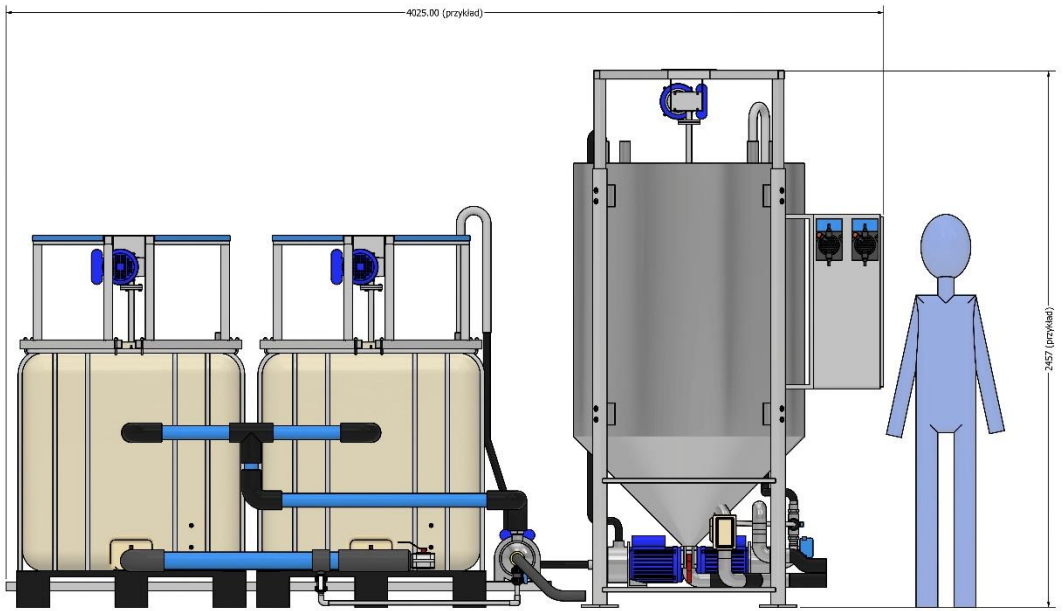
Pilot instalation





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