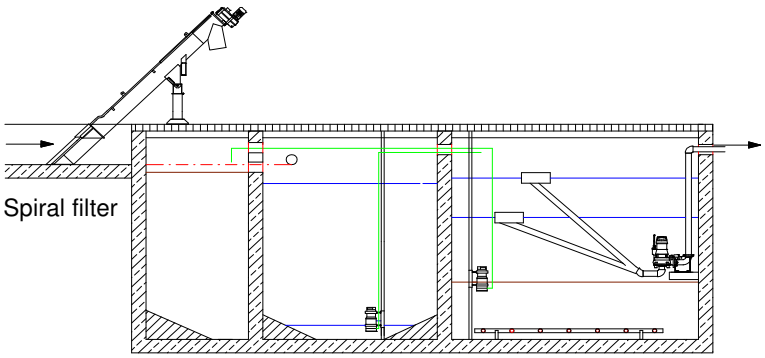
SBR sewage treatment plant Clear Water



Mode of operation

The sewage treatment plant consists of a spiral filter, the buffer tank, the SBR reactor and the sludge storage tank. In the first stage, domestic waste water flows through the spiral filter, where solid matter > 3mm is filtered out of the water. The pre-treated water then flows into the buffer tank. The SBR sewage treatment plant works in impound mode. First, the intake water is stored in the buffer tank. It is then pumped into the SBR reactor. Here, the waste water is treated in the following five phases.

1. Filling: the SBR Reactor is filled with waste water from the buffer tank.
2. Aeration: a diaphragm pipe aerator blows oxygen into the water. This creates activated sludge which consists of microorganisms and bacteria. In this phase, impurities in the waste water are biologically decomposed.
3. Settling phase: during the settling phase, the water is no longer aerated. The activated sludge settles on the tank floor due to the cessation of turbulence. Since the sludge settles completely on the tank floor, the upper part of the clarified water is of extremely good quality.
4. Clarified water removal: in this phase, the clarified water is pumped out using the clarified water pump.
5. Excess sludge removal: since new activated sludge is formed during every aeration process, excess sludge is pumped to the sludge storage tank during this phase so that the reactor always contains the optimum amount of sludge.

Works

· System proposal
· Technical dimensioning
· Construction & implementation plans
· Mechanical system installation
· Commissioning
· Technical training
· Technical documentation

Benefits

· high purification performance
· robust engineering
· simple installation
· easy to maintain and to repair
· electronic fault reporting
· remote monitoring
· refitting existing tanks possible

Range

We offer the CLEAR WATER sewage treatment plant in construction sizes from 50 PE to 5.000 PE.
The following system variants are available:
· ring construction in concrete
· compact construction in concrete or synthetics
· rectangular construction in concrete
· container construction in stainless steel.
If the customer already has a tank or wishes to construct one himself, we can supply the necessary technical equipment.

Scope of application

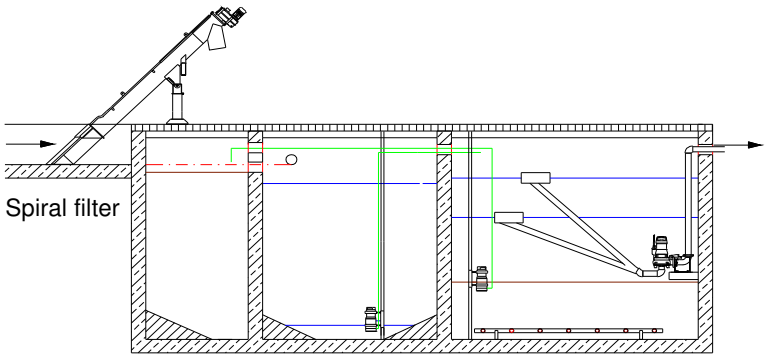
The Clear Water waste water treatment system is dimensioned according to the purification performance required. A sewage treatment calculation for this is provided.
We propose the following treatment stages for you:
· C-elimination
· Nitri-/ denitrification
· Desinfection
The functioning of the waste water treatment system is assured even during high load fluctuations, because the height adjustability of the pumps make it possible to adapt the volumetric loading to the actual loading at all times.

Construction project

SBR sewage treatment plant
Clear Water CW 10000-S
with C-elimination, nitrification and denitrification
Project:
No.: I00343

Contact

CLEAR WATER CW 10000-S



Volume	Pre-treatment 1	Pre-treatment tot.		SBR reactor 1	SBR reactor 2	SBR reactor 3	SBR reactor tot.	
Safety reserve:	0,0	0,0	m³	0,2	0,2	0,2	0,7	m³
Buffer:	875,0	875,0	m³	125,0	125,0	125,0	375,0	m³
Sedimentation:	-	-	m³	384,5	384,5	384,5	1153,4	m³
Sludge:	-	-	m³	339,6	339,6	339,6	1018,9	m³
Volume total:	875,0	875,0	m³	849,3	849,3	849,3	2548,0	m³

Volumes pre-treatment

	selected		necessary		Capacity
Safety reserve:	0,0	m³	0,0	m³	
Buffer:	875,0	m³	875,0	m³	100%
Sedimentation:	-	m³	-	m³	
Sludge:	-	m³	-	m³	
Total:	875,0	m³	875,0	m³	100%

Waste water parameters

		Intake	Outlet	
COD	≤	800	90	mg/l
BOD5	≤	400	20	mg/l
NH4-N	≤	-	10	mg/l
Ntot.	≤	73	18	mg/l

SBR volume

	selected		necessary		Capacity
Safety reserve:	0,7	m³	0,0	m³	
Buffer:	375,0	m³	375,0	m³	100%
Sedimentation:	1.153,4	m³	1.153,4	m³	100%
Sludge:	1.018,9	m³	1.018,9	m³	100%
Total:	2.548,0	m³	2.547,3	m³	100%

Sludge disposal

Annual sludge amount	3.908	m³/a
Disposal frequency	2,0	Months

Pumps / compressors

Number of pumps	21	No.
Number of compressors	6	No.
Annual energy consumption	315.700	kWh/a

Data

Type:			CW 10000-	S
Design capacity			10.000	PE
Daily water flow per PE			150	l/(PE*d)
Daily inflow capacity	Q_d	=	1500,0	m³/d
RW Daily inflow capacity	$Q_{d,max}$	=	1500,0	m³/d
Peak hourly flow	Q_{max}	=	150,0	m³/h
Daily BOD5 load	B_d	=	600,0	kg BOD5/d
Metering temperature	T_{min}	=	12	°C

Version

Technical equipment	x
Concrete ring construction	
Monolithic concrete	
Buoyancy protection	
Rectangular construction	x
Intake with free fall	x
Relief manhole/pumping station	
Spiral filter in the intake	x
Number of buttom-diagonals	

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Project:
No.: I00343

Contact

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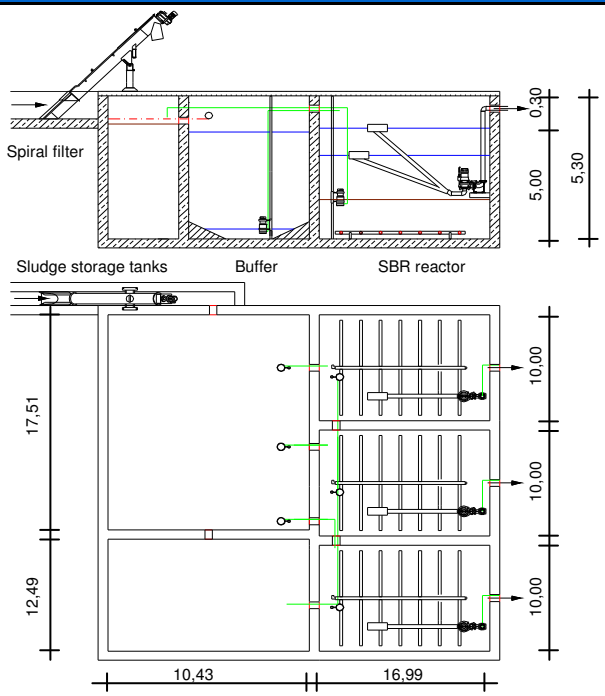
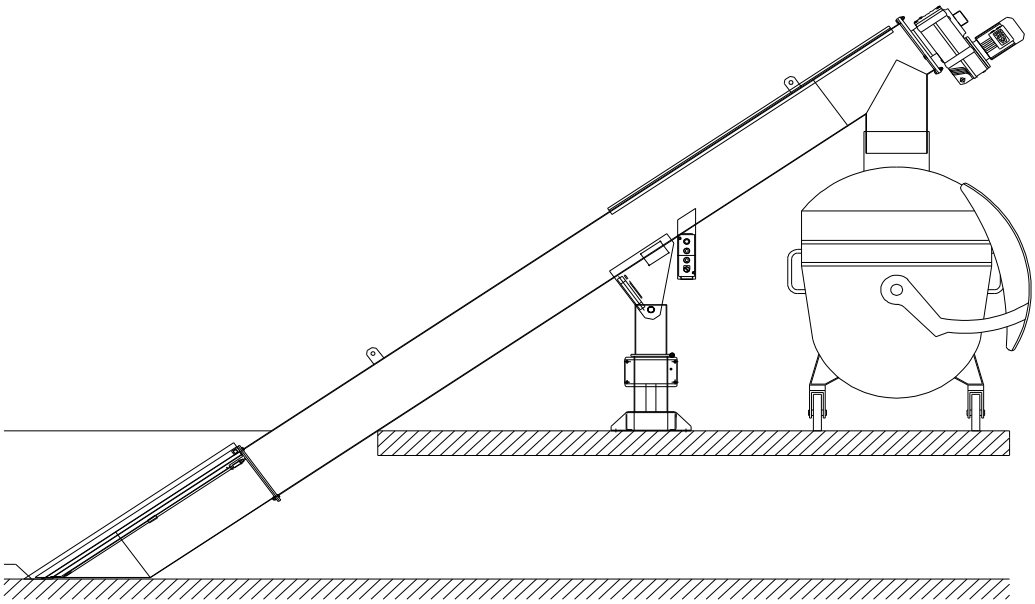
Dimensions



	Sludge	Pre-treatment	SBR reactor			
Height dimensions from above	1	1	1	2	3	
Freeboard:	0,30 m	0,30	m	0,30	0,30	0,30	m
Water level max.:	0,00 m	0,00	m	0,00	0,00	0,00	m
Buffer max.:	- m	0,00	m	0,00	0,00	0,00	m
Sedimentation max:	- m	5,00	m	0,74	0,74	0,74	m
Sludge max.:	0,00 m	5,00	m	3,00	3,00	3,00	m
Tank floor:	5,00 m	5,00	m	5,00	5,00	5,00	m
Volumen						
Safety reserve:	0,0 m³	0,0	m³	0,2	0,2	0,2	m³
Buffer:	- m³	875,0	m³	125,0	125,0	125,0	m³
Sedimentation:	- m³	-	m³	384,5	384,5	384,5	m³
Sludge:	651,4 m³	-	m³	339,6	339,6	339,6	m³
Total:	651,4 m³	875,0	m³	849,3	849,3	849,3	m³
Intake / outlet						
Intake	0,00 m	0,00	m	0,00	0,00	0,00	m
Outlet	0,00 m	0,00	m	0,00	0,00	0,00	m
Dimensions						
Length	10,43 m	10,43	m	16,99	16,99	16,99	m
Width	12,49 m	17,51	m	10,00	10,00	10,00	m

Construction project	Contact
SBR sewage treatment plant Clear Water CW 10000-S with C-elimination, nitrification and denitrification Project: No.: I00343	

Spiral filter



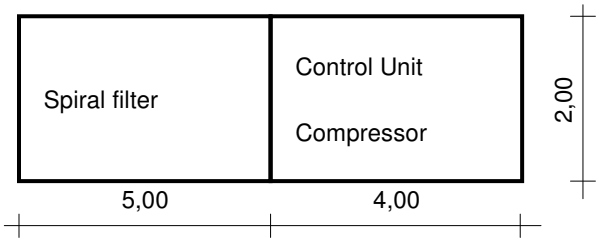
Spiral filter

Type:	Spiral filter in the channel NSI 500 (80 l/s)	
Max water flow	80,0	l/s
Voltage:	400	V
Frequency:	50	Hz
Output:	1,10	kW
Total:	1	No.

Screenings

Amount of screenings per E	6,0	kg/(E*a)
Volume of screenings per E	5,5	l/(E*a)
Amount of screenings per year	60,0	t/a
Volume of screenings per year	54,5	m^3/a

Size of plant building



Specification

Through the spiral sive foreign materials are removed from the waste water. So pumps and diffusers are protected against plugging and damage.
The sewage sludge from the biological treatment is free of foreign material and it is further usable.
The screenings arel pressed and dewaterrd in a pressing zone. After that the screening thrown out in a screeining container.
A waste managing for screeningsis necessary.

System design

The spiral sive is avaible for channel installation or as compact station inside a case. Creterias of the sive are:
- case complete in stainlees steel
- integrated campacting and dewatering zone
- Self-cleaning of sieving zone by means of a spiral brush
- Hygienic encapsulation for pressed screenings available

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SBR sewage treatment plant
Clear Water CW 10000-S
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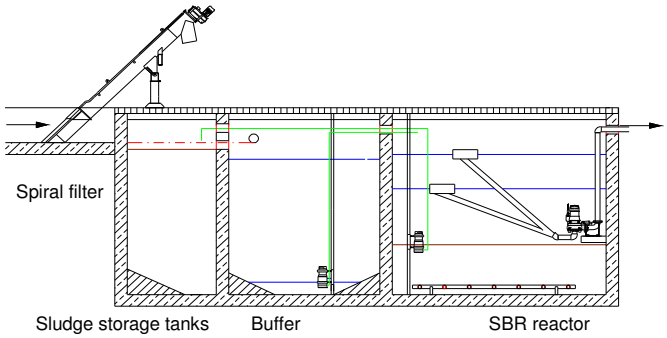
Project:
No.: I00343

Contact

Buffer



Water level heights		
Safety reserve:	0,00	m
Buffer:	5,00	m
Sedimentation:	-	m
Sludge:	-	m
Total:	5,00	m

Volume		
Safety reserve:	0,0	m³
Buffer:	875,0	m³
Sedimentation:	-	m³
Sludge:	-	m³
Total:	875,0	m³

Version	
Technical equipment	x
Rectangular construction	x
Buoyancy protection	
Floor slope 15°	x
Sludge suction device	
sludge pump	
Pressure sensor	1

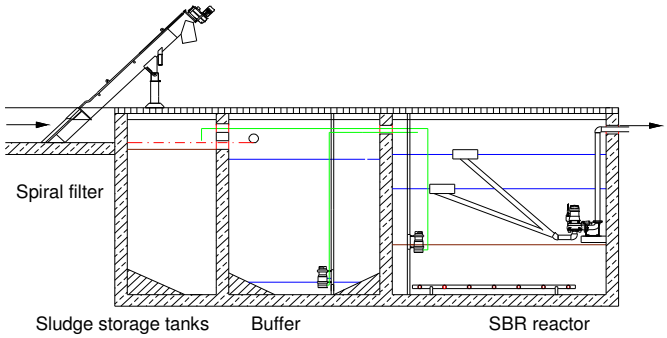
Height dimensions from above		
Water level max.:	0,00	m
Buffer max.:	0,00	m
Sedimentation max:	5,00	m
Sludge max.:	5,00	m
Tank floor:	5,00	m

Dimensions		
Length	10,43	m
Width	17,51	m

Pumps		
Type:	Amarex	
Pump power output:	70,0	m³/h
Head:	4,00	m
Voltage:	400	V
Frequency:	50	Hz
Output:	2,56	kW
Total:	9	No.

Construction project	Contact
SBR sewage treatment plant Clear Water CW 10000-S with C-elimination, nitrification and denitrification Project: No.: I00343	

SBR reactor



Water level heights

Safety reserve:	0,00	m
Buffer:	0,74	m
Sedimentation:	2,26	m
Sludge:	2,00	m
Total:	5,00	m

Volume

Safety reserve:	0,7	m³
Buffer:	375,0	m³
Sedimentation:	1.153,4	m³
Sludge:	1.018,9	m³
Total:	2.548,0	m³

Version

Number of SBR tanks	3
Technical equipment	x
Rectangular construction	x
Buoyancy protection	
Pressure sensor	3
O2-sonde	3
Sample removal shaft	

Height dimensions from above

Water level max.:	0,00	m
Buffer max.:	0,00	m
Sedimentation max:	0,74	m
Sludge max.:	3,00	m
Tank floor:	5,00	m

Dimensions

Length	16,99	m
Width	10,00	m

Compressor

Type:	SAH 505	
Pump power output:	2.020	m³/h
Pressure:	560	mbar
Voltage:	400	V
Frequency:	50	Hz
Output:	15,00	kW
Number per tank:	2	No.

Clear water pump

Type:	Amarex	
Pump power output:	70,0	m³/h
Head:	4,0	m
Voltage:	400	V
Frequency:	50	Hz
Output:	2,56	kW
Number per tank:	3	No.

Excess sludge pump

Type:	Ama-Porter 502	
Pump power output:	24,0	m³/h
Head:	4,0	m
Voltage:	400	V
Frequency:	50	Hz
Output:	1,50	kW
Number per tank:	1	No.

Tube diffusers

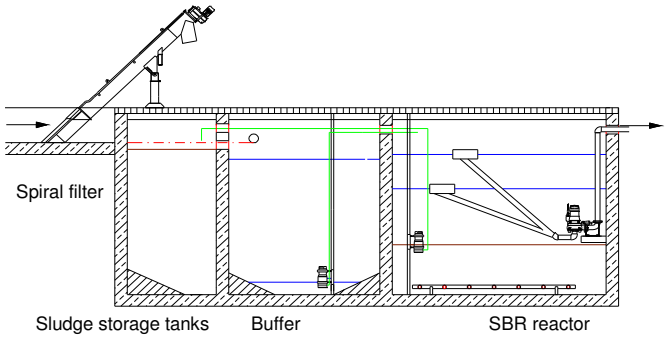
Number per tank:	256	No.
Slit image:	M 34	
Length per aerator:	1,00	m
Diffuser length total	256,00	m
Diffuser density	1,51	m/m²

Construction project

SBR sewage treatment plant
Clear Water CW 10000-S
with C-elimination, nitrification and denitrification
Project:
No.: I00343

Contact

Sludge storage tanks



Dimensions		
Water depth:	5,00	m
Volume:	651,4	m³

Dimensions		
Length	10,43	m
Width	12,49	m

Height dimensions from above		
Water level max.:	0,00	m
Tank floor:	5,00	m

Volume		
Volume per tank	651,4	m³
Number of tanks	1	No.
Total volume	651,4	m³

Sludge outfeed		
Sludge accumulation per PE	391	l/(PE*a)
Annual sludge amount	3.908	m³/a
Disposal frequency	2,0	Months
Disposal frequency	60	d

Version	
Number of sludge storage tanks	1
Technical equipment	x
Rectangular construction	x
Buoyancy protection	
Floor slope 15°	x
Sludge suction device	
sludge pump	

Construction project	Contact
SBR sewage treatment plant Clear Water CW 10000-S with C-elimination, nitrification and denitrification Project: No.: I00343	

Sewage treatment calculation

CLEAR WATER CW 10000-S **Design capacity** **10.000 PE**

Intake		Population-specific		Freight		Concentrations	
Waste water accumulation	$Q_{d,E}$	150	l/(PE*d)	1.500,00	m^3/d		
BOD5 load	B_d	0,060	kg/(PE x d)	600,00	kg/d	400	mg/l
BOD5 load after PT	$B_{d,\ VK}$	0,060	kg/(PE x d)	600,00	kg/d	400	mg/l
Total solids after pre-treatment	$X_{TS,ZB}$	0,070	kg/(PE*d)	700,00	kg/d	467	mg/l
TKN load after PT	$S_{TKN,ZB}$	0,011	kg/(PE*d)	110,00	kg/d	73	mg/l
Nitrate after pre-treatment	$S_{NO3,ZB}$	0,000	kg/(PE*d)	0,00	kg/d	0	mg/l

Calculation assumptions				Freight		Concentrations	
Minimum temperature	T_{min}	12	°C				
Maximum temperature	T_{max}	20	°C				
Nitrogen effluent values							
Organic nitrogen	C_{orgN}			3,00	kg/d	2,00	mg/l
Ammonium nitrogen	S_{NH4}			1,50	kg/d	1,00	mg/l
Nitrate nitrogen	S_{NO3}			18,00	kg/d	12,00	mg/l
Nitrogen tot.	ΣN_{ab}			22,50	kg/d	15,00	mg/l
Nitrogen bonded to EF sludge	$N_{ÜS}$			30,00	kg/d	20,00	mg/l
Denitrifying nitrogen	NO_3-N_D			57,50	kg/d	38,33	mg/l

Determination of denitrification fraction				
Req´d. denitrification capacity	S_{NO3}/C_{BSB}	0,10	kg/kg	Required denitrification volumes in accordance
VD / VBB		0,30		with ATV-DVWK A 131 Table 3
VD / VBB selected		0,30		

Metering sludge age			
Safety factor for nitri.	SF	1,8	
Sludge age	$t_{TS,Bem}$	11,7	d
selected sludge age	$t_{TS,Bem}$	11,7	d

Excess sludge production			
$X_{TS,ZB}/C_{BSB,ZB}$		1,17	
EF sludge production from C eliminate	$ÜS_{d,C}$	647,46	kg/d
EF sludge production from P eliminate	$ÜS_{d,P}$	3,90	kg/d
EF sludge production	$ÜS_d$	651,36	kg/d

Required aeration tank volume			
Required mass TS	$M_{TS,BB}$	7.641,9	kg
Selected total solids	TS_{BB}	4,0	kg/m³
Aeration tank volume	V_{BB}	1.910,5	m³

Required SBR reactor volume			
Cycles per day		4,0	
Sedimentation phase	t_{Sed}	1,50	h
Denitrification phase	t_D	1,35	h
Nitrification phase tN	t_N	3,15	h
SBR reactor volume	V_R	**2.547,3**	m³

Selected SBR volumes/characteristic values			
SBR reactor volume	V_R	**2.548,0**	m³
SBR volume per PE		255	l/PE
BOD5 volumetric loading		0,31	kg/(m³ *d)
BOD5 sludge loading		0,08	kg/(kg*d)

Construction project	Contact
SBR sewage treatment plant Clear Water CW 10000-S with C-elimination, nitrification and denitrification Project: No.: I00343	

Aeration calculation

Assumptions

Sludge age	$t_{TS,Bem,gew}$	11,7	d
Minimum temperature	T_{min}	12	°C
Maximum temperature	T_{max}	20	°C
Temperature factor	$F_{T,min}$	0,8	
Temperature factor	$F_{T,max}$	1,4	
BOD5 load after PT		600,0	kg/d
NO3 to be denitrified	$S_{NO3,D}$	38,3	mg/l
Nitrate in intake	$S_{NO3,ZB}$	0,0	mg/l
Nitrate in effluent	$S_{NO3,AN}$	12,0	mg/l

Loading case 1 C decomposition and nitrification Tmin

Oxygen consumption	$OV_{d,C}$	663,27	kgO_2/d
	$OV_{d,N}$	324,65	kgO_2/d
	fc	1,00	
	OV_h	78,41	kgO_2/h

Loading case 2 denitrification at Tmax

Oxygen consumption	$OV_{d,C}$	726,95	kgO_2/d
	$OV_{d,N}$	324,65	kgO_2/d
	$OV_{d,D}$	166,75	kgO_2/d
	fc	1,00	
	OV_h	70,23	kgO_2/h

Oxygen feed

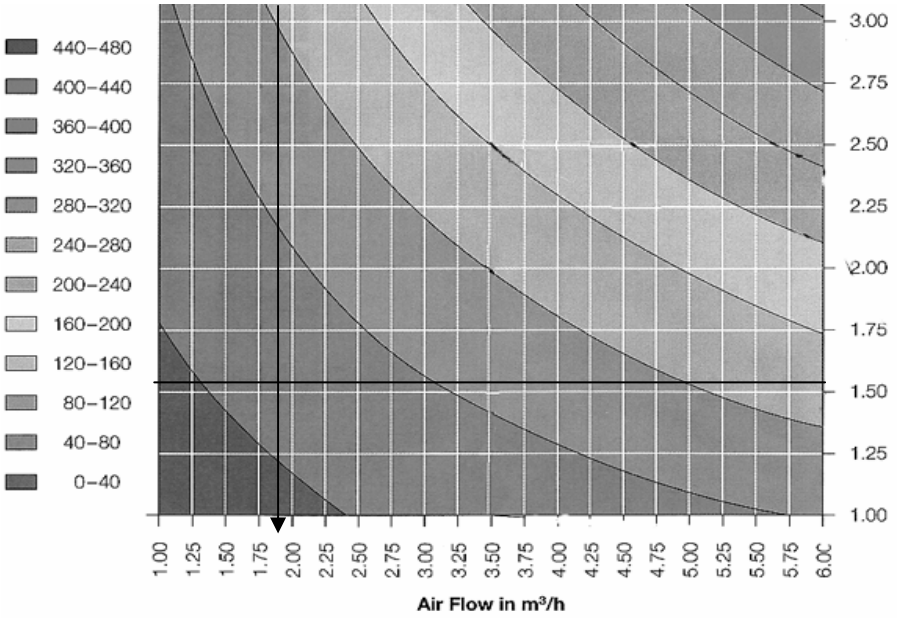
Definitive loading case	OV_h	78,41	kgO_2/h
Max. temperature	T	20	°C
O2 saturated vapour pressure	$C_{ss,T}$	9,09	mg O_2/l
Aeration depth	h_E	5,00	m
Atmospheric pressure	p	1.013	hPa
O2 saturation concentration	C_s	11,29	mg O_2/l
Intended concentration	C_x	2,00	
	erf. αOC	95,29	kg O_2/h
	α	0,70	
Oxygen consumption	OV	136,1	kg O_2/h
Volume SBR reactor		2.548,0	m^3
Oxygen consumption	OV	**53,4**	$gO_2/(m^3*h)$

Diffuser density

Surface	A	509,6	m^2
Diffuser length total		768	m
Diffuser density	L/A	**1,51**	m/m^2

Oxygen consumption
OV [gO2/(m³*h)]

Diffuser density
L/A [1/m²]



Air Flow

1,85 m³/h

Air content Q

1420,8 m³/h

Max. water depth

5,00 m

Water pressure

560 mbar

Compressor type

6 x SAH 505 (15)

Compressor

2.019,6 m³/h

Motor output

15,00 kW

Intake capacity

18,29 kW

Construction project

SBR sewage treatment plant
Clear Water CW 10000-S
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Project:
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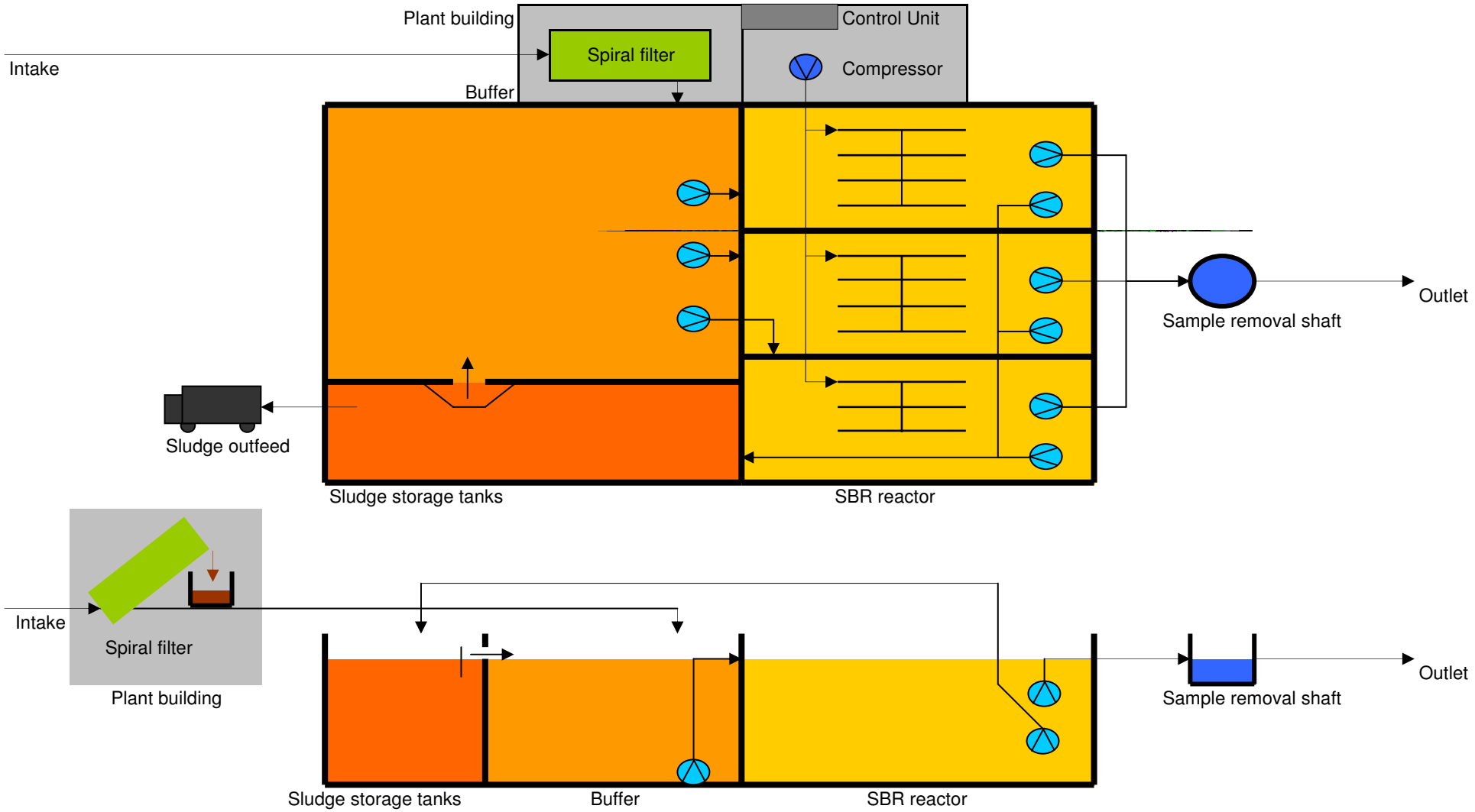
Water layout



SBR sewage treatment plant
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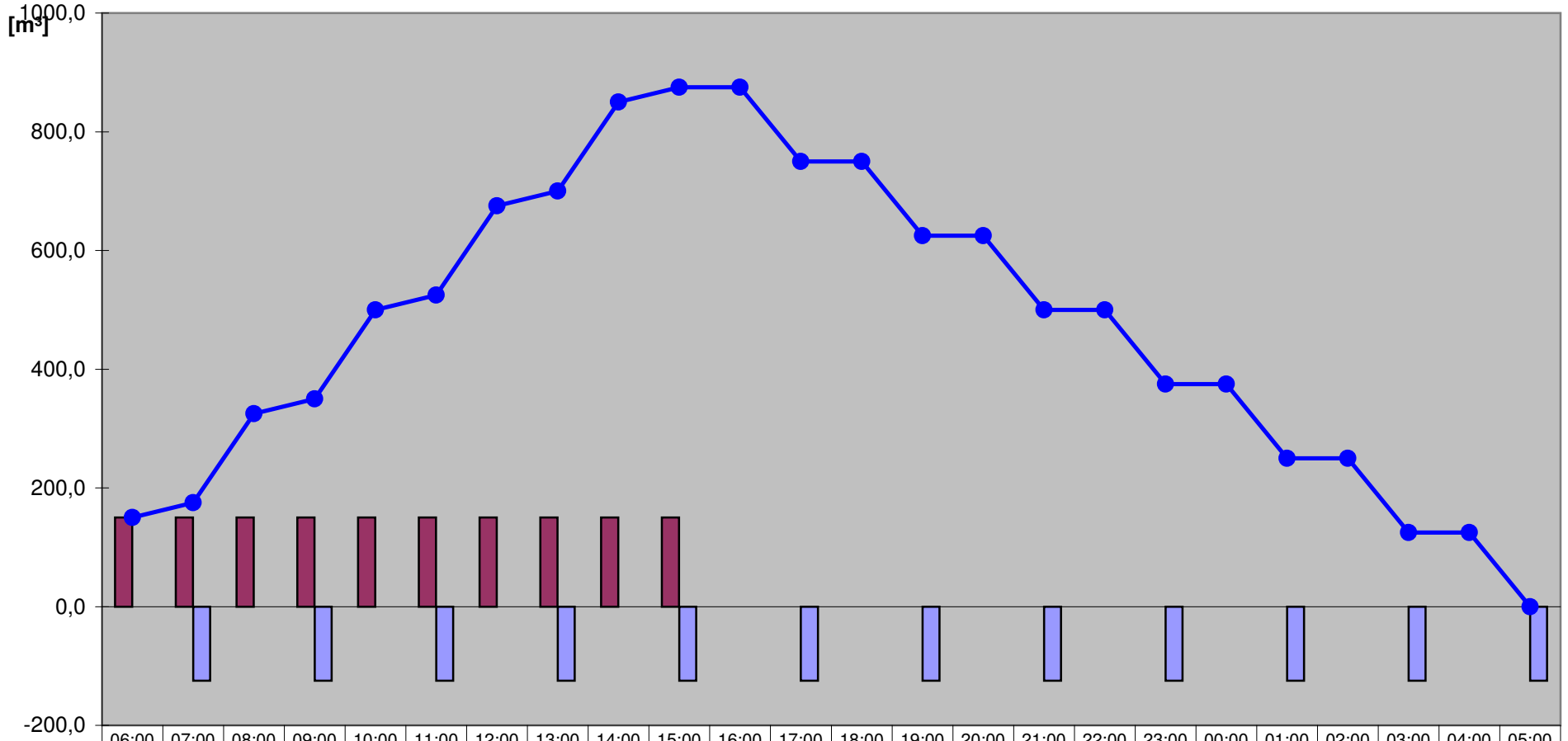
calculation curve



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water amount	150,0	150,0	150,0	150,0	150,0	150,0	150,0	150,0	150,0	150,0	0,0	0,0	0,0	0,0	0,0	0,0								
pump volume	0,0	-125,0	0,0	-125,0	0,0	-125,0	0,0	-125,0	0,0	-125,0	0,0	-125,0	0,0	-125,0	0,0	-125,0	0,0	-125,0	0,0	-125,0	0,0	-125,0	0,0	-125,0
filling level	150,0	175,0	325,0	350,0	500,0	525,0	675,0	700,0	850,0	875,0	875,0	750,0	750,0	625,0	625,0	500,0	500,0	375,0	375,0	250,0	250,0	125,0	125,0	0,0

[m³]

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Project:
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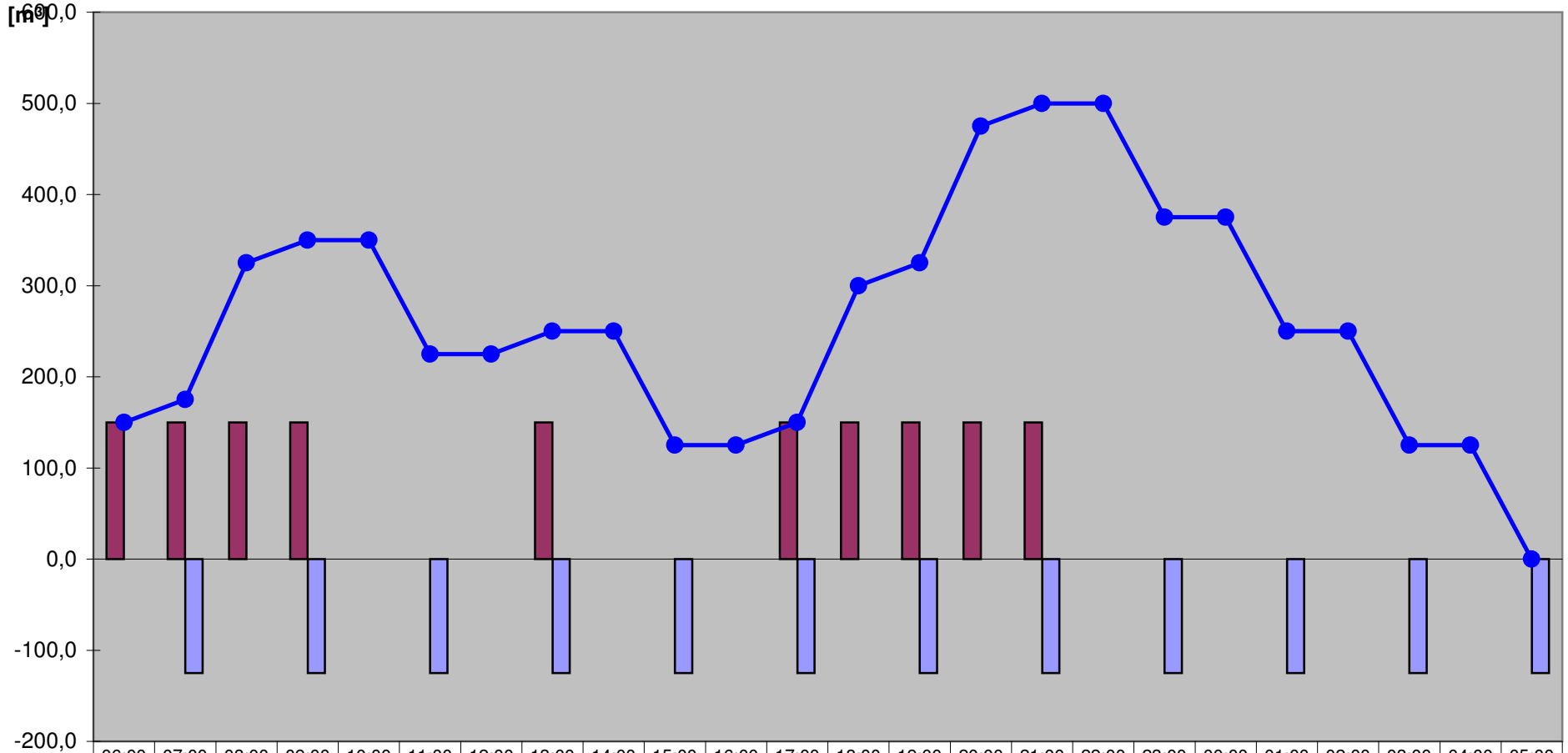
experience curve



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water amount	150,0	150,0	150,0	150,0				150,0				150,0	150,0	150,0	150,0	150,0								
pump volume	0,0	-125,0	0,0	-125,0	0,0	-125,0	0,0	-125,0	0,0	-125,0	0,0	-125,0	0,0	-125,0	0,0	-125,0	0,0	-125,0	0,0	-125,0	0,0	-125,0	0,0	-125,0
filling level	150,0	175,0	325,0	350,0	350,0	225,0	225,0	250,0	250,0	125,0	125,0	150,0	300,0	325,0	475,0	500,0	500,0	375,0	375,0	250,0	250,0	125,0	125,0	0,0

[m³]

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