


*Supply and Delivery of Bioreactor Aeration Equipment for The West End Water  
Pollution Control Centre BNR Upgrade (WEWPCC) Project  
Bid Opportunity No. 602- 2005  
ABS ref#: CA-179-05*

**Technical Details**

**Appendixes**

	<b>NOPOL<sup>®</sup> DDS</b> <b>Disc Diffuser Systems</b>	41- 31001 /2	1/3
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## SYSTEM DESCRIPTION

In fine bubble aeration systems compressed air is distributed through pipework to the aeration device, called diffusers. Compressed air is dispersed into fine bubbles and oxygen is transferred into the surrounding fluid. The grids of pipes with diffusers installed, called an aeration group, cover the basin bottom. The pipework is fixed to the basin bottom. Even distribution of diffusers gives equal dissolved oxygen concentration and uniform mixing energy distribution throughout the tank.

NOPOL<sup>®</sup> DDS systems consist of one or several aeration groups. Each group is made up of diffusers, air distribution pipes, pipe expansion joints and bottom mounting brackets. The NOPOL<sup>®</sup> DDS system is complete including all necessary accessories for installation. The prefabricated modular elements make installation easy and fast. An aeration group and its main components are shown in the drawings LD 3950 and LD 5462.

## COMPONENTS OF THE SYSTEM

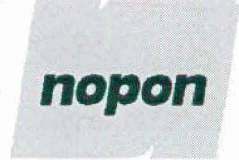
There are five kinds of NOPOL<sup>®</sup> DDS systems for various applications. The HKLE, MKLE, KKIE, and PIKEV systems have different disc diffusers, but they are all made of similar pipework and components. The PIKE system can be used with many kinds of pipework and the components are different from the other systems.

Table 1. NOPOL<sup>®</sup> DDS systems and diffusers

System name	Diffuser type	Diffuser disc
HKLE	HKL 215	Porous HDPE, fine bubble, Ø 200 mm
MKLE	MKL 215	Porous HDPE, medium bubble, Ø 200 mm
KKIE	KKI 215	Elastic membrane, Ø 200 mm
PRKE	PRK 300	Elastic membrane, Ø 300 mm
PIKEV	PIK 300	Elastic membrane, Ø 300 mm
PIKE	PIK 300	Elastic membrane, Ø 300 mm

The HKL 215, MKL 215, KKI 215, and PRK 300 diffusers are designed for mounting on a PVC or stainless steel pipe by a wedge piece attachment. The PIK 300 diffusers are designed for mounting on a PP, PVC or stainless steel pipe by a wedge piece attachment. No solvent welding is required at site. Details of the diffusers and its components, materials and performance are described in the respective technical specifications.

Preassembled diffuser elements are made of O.D. 90 mm uPVC or PP pipes, cut in length up to 5 m, to hold the diffusers and to form lateral rows spanning the whole group. Characteristics for the pipe are given in the PVC (41-31012) and PP pipe specifications (41-51012).

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Connection sleeves HSY 90 - 90 and PSY 90 are used to connect the pipe elements and the construction allows thermal expansion of the pipe, see drawings LD 3965 and LD 4571.

The elements are fixed to the basin bottom. The whole system has to be level. This is easily achieved by use of bottom mounting brackets, HPK 210 or PPK 90. The adjustable bracket overcomes the unevenness of the basin bottom by adjustment to within a range of 105-120 mm by using extension pieces. See drawings LD 3967 and LD 4073. The PP system uses also fixed bottom mounting brackets: PKL 90 and TKK 90. See drawings LD 5553, LD 5555 and LD 6452.

Air is conducted via distribution headers from the blower through a dropleg pipe into the zone headers, which in turn distribute it further into the lateral rows of diffuser elements (headers). Zone headers have a flange on a vertical pipe extension for connection of dropleg and lateral branches to connect the diffuser elements. Zone headers are made of uPVC, PP or stainless steel (AISI 316). The diameter of the zone header is defined by air velocity.


The OD 90 mm PVC zone header has a loose flange, either DN80, DN100 or DN125. The OD 160 mm PVC zone header has a loose flange, DN150. The drillings of the flanges are according to DIN 2501, PN 10, see drawing LD 3947. Wall thickness of the Ø 90 pipes is 3,5 mm and Ø 160 pipes 4,0 mm. The PVC zone headers are anchored to the tank bottom and levelled by bottom mounting brackets, HPK 210 or TPK 150.

The OD 90 mm PP zone header has a loose flange, DN 80. The wall thickness of the pipe is 4,5 mm. The zone header is anchored to the tank bottom and levelled by bottom mounting brackets PPK 90, HPK 210 or TKK 90.

The stainless steel zone headers have a fixed flange, either DN125, DN150, DN200, DN250, DN300 or DN350. The drillings of the flanges are according to DIN 2501, PN 10. Wall thickness of the pipes is 2,0...2,5 mm. See drawings LD 3948 and LD 3998. The stainless steel zone headers are anchored to the tank bottom and levelled by bottom mounting brackets, TPK, see drawing LD 3966. All materials are AISI 316.

Water collection pipe, with a water drainage connection (see drawings LD 3949 and LD 4681) connects the lateral branches of diffuser elements. In a closed loop pipework the pressure in the aeration group is equalised and a uniform air distribution to the diffusers is achieved. In special aeration groups in round or ring shape basins or in smaller aeration groups, where the length of the Header pipes is small, the water collection pipe is not needed and the water drainage connections are mounted to the zone header. Water drainage connection is usually located in the OD 160 PVC zone headers as well (see drawing LD 4855 B).



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### SYSTEM FLEXIBILITY

The same main body HSA 215 is the base for HKL 215, MKL 215, KKI 215 and PRK 300 diffusers. The PRF 300 retrofit can be installed on the same main body. Thus these diffusers are interchangeable. This enables modification of existing system. System capacity and efficiency of HKLE, MKLE, and KKIE systems can easily be increased by installing the PRF 300 retrofit. Continuous processes can be made intermittent by changing to membrane diffusers.

The wedge piece attachment makes the aeration system flexible. More diffusers can be added later as conditions change. Diffuser positions can be changed as well. To achieve an optimal dissolved oxygen profile the disc distribution along the basin can simply be changed.

	<p style="text-align: center;"><b>NOPOL<sup>®</sup> PIK 300 Membrane Disc Diffuser</b></p>	<p style="text-align: center;">51- 31044 / 2</p>	<p style="text-align: center;">1/3</p>
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## DESCRIPTION

The NOPOL<sup>®</sup> PIK 300 Membrane Disc Diffuser has an elastomeric membrane with slits. The slits open during aeration by the pressure of compressed air and close when not aerated. Air is then spread into small bubbles, the size is between 1 - 3 mm when released through the membrane.

The membrane is fixed by a bayonet type screw-on ring (PKR 300) to a main body (PSA 300). Between the screw-on ring and the membrane there is the PVR 300 sliding ring which is antifriction material (POM) thus ensuring free expansion and contraction of the membrane without any mechanical friction. The edge of the membrane is formed like an O-ring sealing the construction when pressed by the sliding ring against the saddle piece. The main body distributes the air evenly over the entire surface of the membrane.

Inside the main body there is the non-return valve which is operating both as a control orifice and automatically closing non-return valve. The orifice ensures even pressure loss between diffusers and thus even air distribution. The non-return valve protects the system from clogging.

Between the main body of the diffuser and the pipe there is a seal which seals the attachment tightly. PLT 15/4 SIL flat seal is used for PP piping, PLT 15/5 flat seal for OD 88.9 mm steel piping and PLT 15/4 flat seal for OD 90 mm PVC piping.

The diffuser is mechanically attached to pipe by a rigid PSK 90 wedge piece without any glue or solvent welding. The requested diameter of the hole to be drilled in the pipe is  $\varnothing$  15 mm.

The PIK 300 preassembled diffuser includes the screw-on ring, sliding ring, membrane disc, main body, non-return valve, seal and the separate wedge piece. All the materials of the NOPOL<sup>®</sup> PIK 300 diffuser are recyclable.

The diffuser construction is shown in the exploded views and drawings LD 5173, LD 5637 and LD 5636.

## APPLICATIONS

The NOPOL<sup>®</sup> PIK 300 diffuser is suitable for normal continuous aeration systems as well as where intermittent aeration is required, e.g. biological nutrient removal and SBR processes.

Due to its non-clogging nature the PIK 300 rubber membrane diffuser is also suitable for industrial effluents.

	<b>NOPOL<sup>®</sup> PIK 300</b> <b>Membrane Disc Diffuser</b>	51- 31044 / 2	2/3
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## SPECIFIC DATA OF THE PIK 300 DIFFUSER

Table 1. Diffuser specification

Design air flow range	0,5 - 8,0 m <sup>3</sup> /h/diffuser (+20 °C; 1 013 mbar)
Membrane diameter	304 mm
Membrane surface area	0,060 m <sup>2</sup>
Size of bubbles	1 - 3 mm
Diffuser weight	0,795 kg
Air temperature, max	+ 100°C in operation conditions
Max/min interval, c/c	1,2 / 0,450 m
Diffuser level	250 mm above tank bottom ( standard )
Performance (SOTE)	5,5...8 %/m water depth; see graph 41-31045 / 2
Pressure loss	2,0...6,0 kPa, see graph 41-31045 / 2

## COMPONENTS AND MATERIALS

Table 2. Components and materials

PKR 300	Screw-on Ring	polypropylene
PVR 300	Sliding Ring	POM (polyacetal)
HIK 300	Membrane Disc	EPDM rubber
PTV 15	Non-return Valve	polypropylene
	Ball	stainless steel AISI 420
	O-ring	VITON
PSA 300	Main Body	polypropylene
PLT 15/4 SIL	Flat Seal	silicon
PLT 15/5	Flat Seal	EPDM rubber
PLT 15/4	Flat Seal	EPDM rubber
PSK 90	Wedge Piece	polypropylene



	<p style="text-align: center;"><b>NOPOL<sup>®</sup> PIK 300 Membrane Disc Diffuser</b></p>	<p style="text-align: center;">51- 31044 / 2</p>	<p style="text-align: center;">3/3</p>
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## ATTACHMENT ALTERNATIVES

The PIK 300 D90 diffuser is fitted to an OD 90 mm PP pipe (outer diameter 90,25 mm  $\pm$  0,05 mm) with a wedge piece PSK 90 and sealed with a flat seal PLT 15/4 SIL.

The PIK 300 V D90 diffuser is fitted to an OD 90 mm PVC pipe (outer diameter 90,25 mm  $\pm$  0,05 mm) with a wedge piece PSK 90 and sealed with a flat seal PLT 15/4.

The PIK 300 S D88.9 diffuser is fitted to an OD 88,9 mm stainless steel pipe (outer diameter 88,9 mm  $\pm$  0,75 %) or PVC pipe (NS 3": 88,9 mm  $\pm$  0,20 mm) with a wedge piece PSK 90 and sealed with PLT 15/5 flat seal.

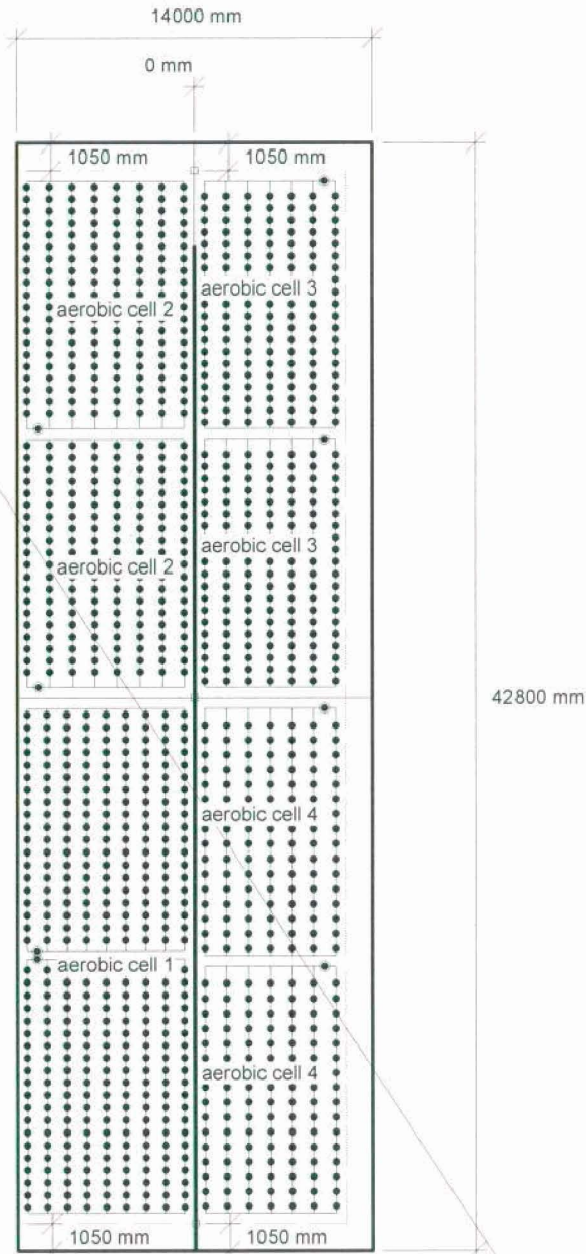
The PIK 300 4" diffuser is fitted to an OD 114,3 mm pipe (NS 4") with a wedge piece PSK 4 and sealed with PLT 15/4 flat seal.

The PIK 300 T 3" diffuser is fitted to an OD 88,9 mm stainless steel pipe (outer diameter 88,9 mm  $\pm$  0,75 %) or PVC pipe (NS 3": 88,9 mm  $\pm$  0,20 mm) with a wedge piece PSK 3 and sealed with PLT 15/4 flat seal.

## MAINTENANCE AND INSTALLATION TOOLS

Due to the self-cleaning properties of the diffuser membrane no extra cleaning method is normally required. However, if needed due to process conditions, the whole aeration system can be cleaned during operation by using the bumping system (mechanical shock given by shortly increasing air flow rate) or using the patented NOPOL<sup>®</sup> CLEAN method. The cleaning liquid, formic acid, is fed into the air supply to remove materials such as lime and iron deposits from the membrane disc.

Special tools requested for installation and maintenance are delivered with the diffusers.



Project:  
WEWPCC\_tender 1 basin\_final

Zones, Groups, Diff.type, count  
4, 7, PIK300, 1175

**NOPOL®Aeration System**

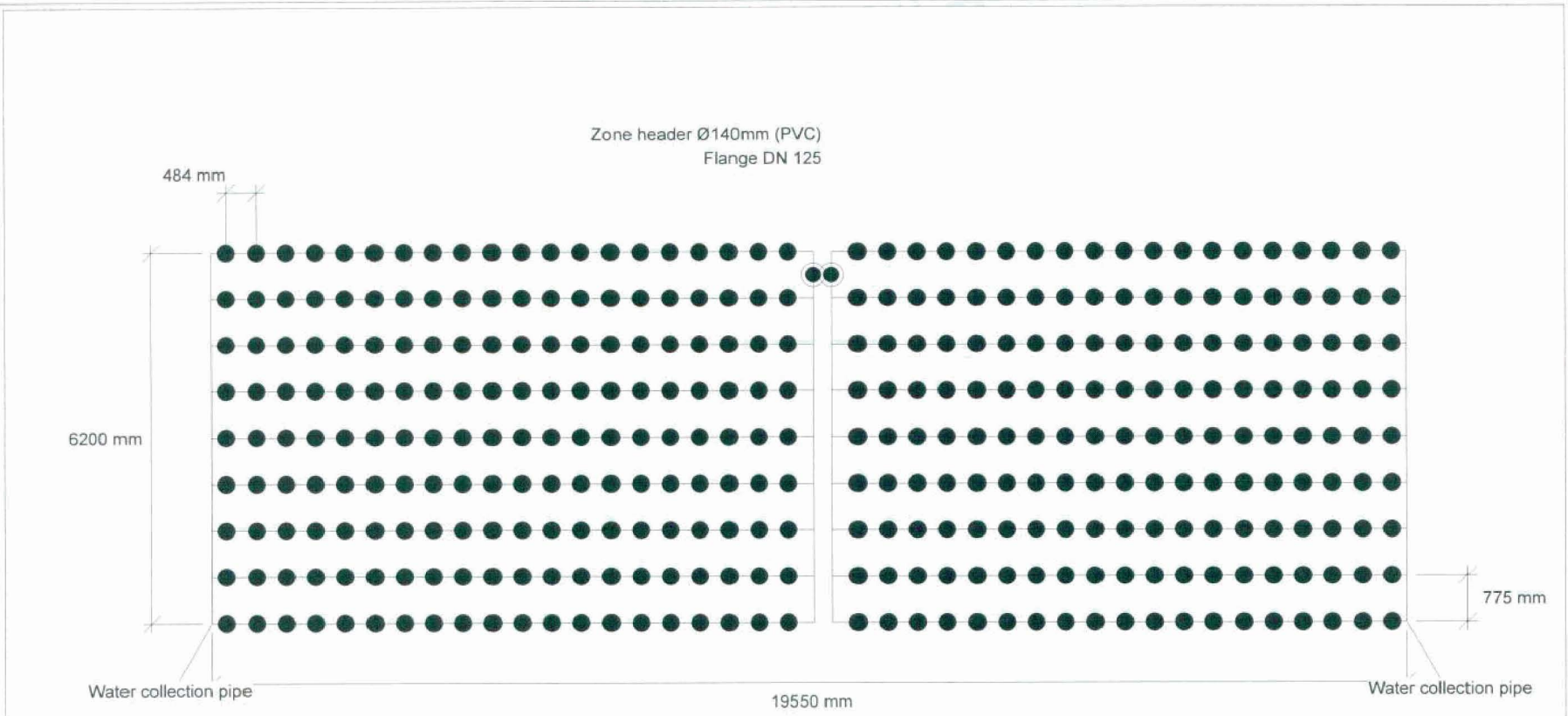
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Rev:  
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Rev date:  
24/11/2005

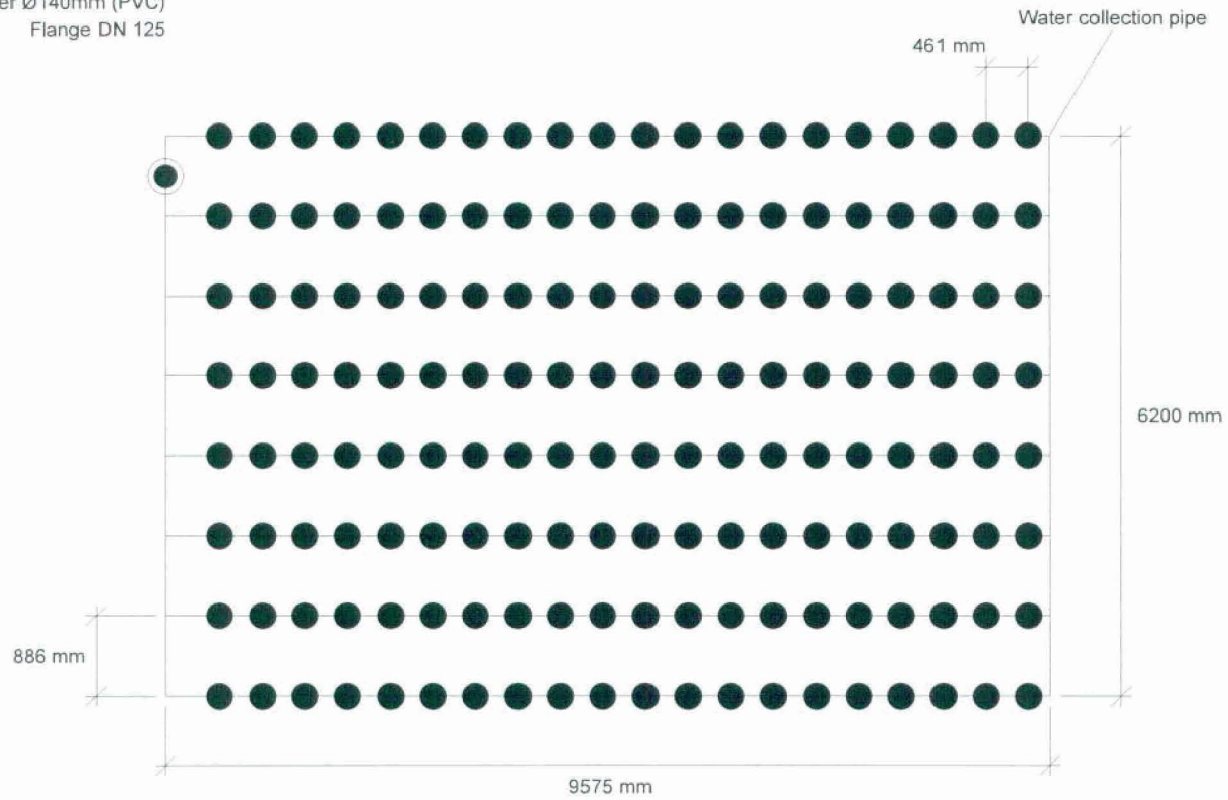
Designer:  
Itnsael





  <b>NOPOL®Aeration System</b>	Project: WEWPC_ tender 1 basin_final	Zone, Group, Diff.type, count 1, aerobic cell 1, PIK300, 35		
	Number:	Rev: 0	Rev date: 24/11/2005	Designer: Itnsael

Zone header Ø140mm (PVC)  
Flange DN 125



**ABS** **nopon**  
QUALITY EFFICIENT PUMPING

**NOPOL®**Aeration System

Project:  
WEWPCC\_tender 1 basin\_final

Number:

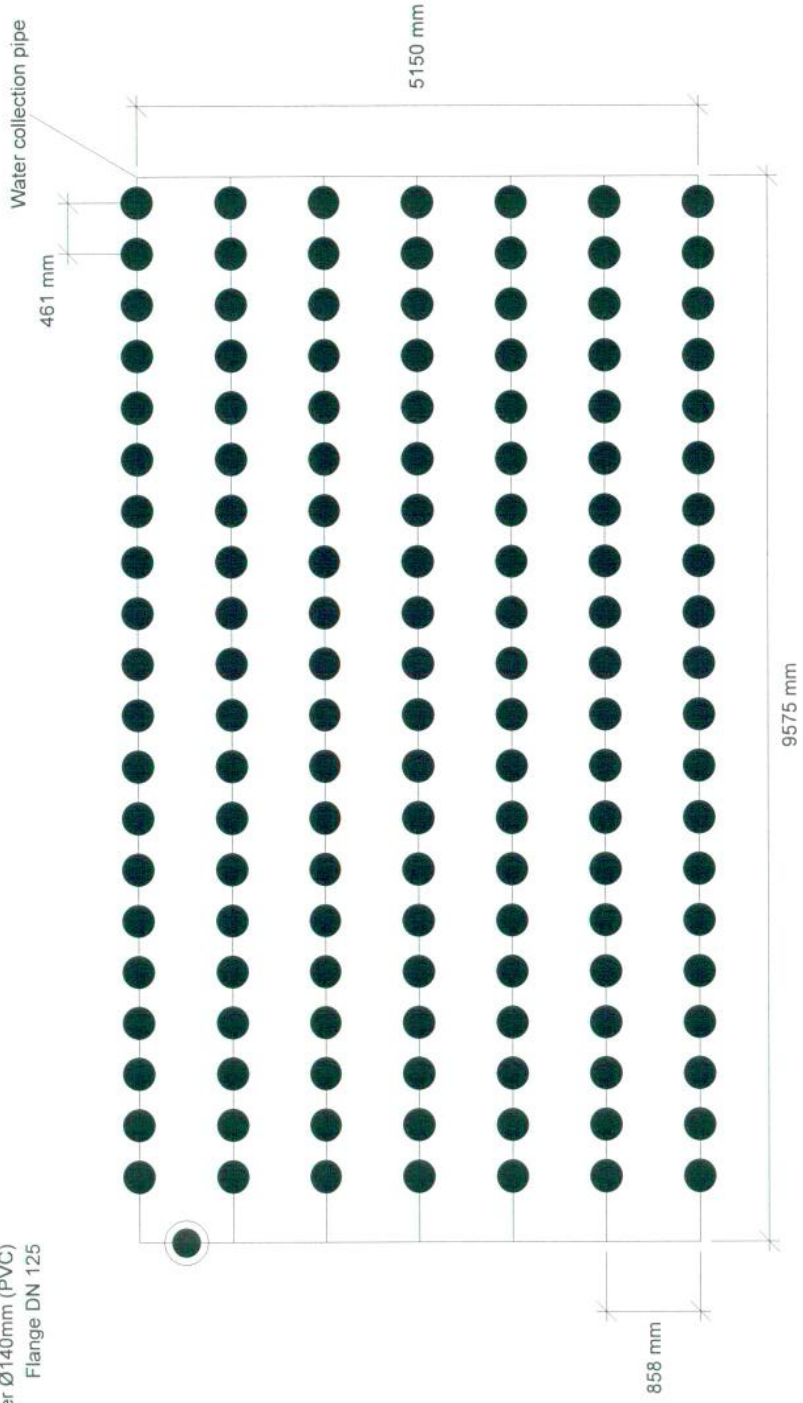
Rev:  
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Zone, Group, Diff.type, count  
2, aerobic cell 2, PIK300, 16

Rev date:  
24/11/2005

Designer:  
Itnsael

Zone header Ø140mm (PVC)  
Flange DN 125



Project:  
WEWPCC\_tender 1 basin\_final

Zone, Group, Diff.type, count  
3, aerobic cell 3, PIK300, 14



Number:

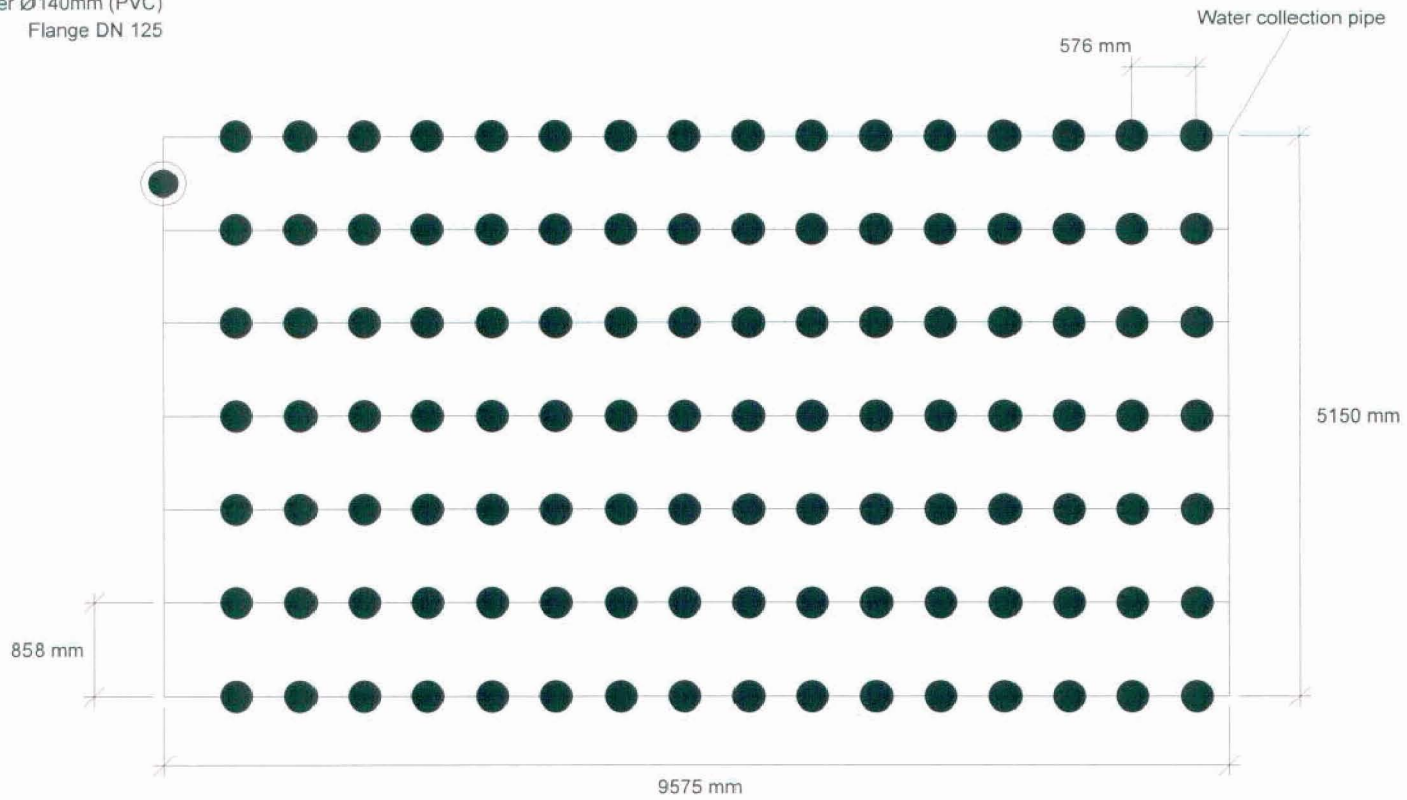
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Rev date:  
24/11/2005

Designer:  
Itnsael



Zone header Ø140mm (PVC)  
Flange DN 125



  NOPOL®Aeration System	Project: WEWPCC_tender 1 basin_final		Zone, Group, Diff.type, count 4, aerobic cell 4, PIK300, 11	
	Number:	Rev: 0	Rev date: 24/11/2005	Designer: Itnsael