Martin van Nieuwenhuyzen

*Fish friendly pumps are increasing asset life for land drainage pumping stations*
Aquatic Control Engineering

• Established 1995 – 22 years
• First to supply HDPE and Stainless steel water flow equipment in the UK
• Carried out and project managed water flow control projects up to £1.4 million
• Represent the premier Dutch manufacturers for mechanical structures in water
• In house project management and installation facilities and capabilities
• ACE act as both principle contractor as well as sub-contractors to many well known Tier 1 contractors.
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...for innovation and Sustainability

Fish friendly pumps
Conventional pumping station conflict with fisheries
Root cause – Money talks

Quality ➔ Speed ➔ Efficiency ➔ Cost

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What if we change the criteria and starting points
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...for innovation and versatility

Fish Flow innovations

- Started by Gerard Manshanden
- Specialise in innovations to help fish, however sometimes helping the fish helps product development in general
- Hold seven patents including one for screw pumps
- Excellent manufacturing capabilities
- 3D design (Solidworks) capabilities
- Innovation business
- 2400m² Factory
### Current screw pumps – impact on fish

<table>
<thead>
<tr>
<th>Reference</th>
<th>Name</th>
<th>Cap (m³/h)</th>
<th>Head (m)</th>
<th>Fish specie</th>
<th>Length (cm)</th>
<th>N alive</th>
<th>n dead</th>
<th>% dead</th>
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<tbody>
<tr>
<td>1</td>
<td>Denayer &amp; Belpaire, 1992</td>
<td>De Seine</td>
<td>35</td>
<td>Div. cyprinids</td>
<td>6-15</td>
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<td>103</td>
<td>35</td>
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<td>Eels</td>
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<td>52</td>
<td>33</td>
<td>19</td>
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<td>2</td>
<td>Germonpré et al., 1994</td>
<td>Sint Karelsmoln</td>
<td>30</td>
<td>Div. cyprinids</td>
<td>6-32</td>
<td>517</td>
<td>300</td>
<td>217</td>
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<td>Eels</td>
<td>15-37</td>
<td>57</td>
<td>49</td>
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<tr>
<td>3</td>
<td>Lange &amp; Mercx, 2005</td>
<td>Snelrewaard</td>
<td>100</td>
<td>Div. coarse fish</td>
<td>3-29</td>
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Fish first design
<table>
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<tr>
<th>Fish specie</th>
<th>Length (cm)</th>
<th>No Injuries</th>
<th>Injured</th>
<th>Total number</th>
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<tr>
<td>Roach</td>
<td>13-24</td>
<td>33</td>
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<td>33</td>
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<tr>
<td>Bream</td>
<td>10-50</td>
<td>33</td>
<td></td>
<td>33</td>
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<tr>
<td>Silver bream</td>
<td>15-32</td>
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<tr>
<td>Perch</td>
<td>15-18</td>
<td>3</td>
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<tr>
<td>Eel</td>
<td>55-82</td>
<td>23</td>
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<td>23</td>
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<td>Ruffe</td>
<td>13</td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Pike</td>
<td>44</td>
<td>1</td>
<td></td>
<td>1</td>
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Monitoring – Kortenhoef

<table>
<thead>
<tr>
<th>Emptying of fish stock fyke net</th>
<th>Perch</th>
<th>Roach</th>
<th>Eel</th>
<th>Ruffe</th>
<th>Crayfish</th>
<th>Total</th>
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<td>7-10-2014</td>
<td>217</td>
<td>37</td>
<td>10</td>
<td>6</td>
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<td>277</td>
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<tr>
<td>14-10-2014</td>
<td></td>
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<tr>
<td>Total</td>
<td>217</td>
<td>37</td>
<td>12</td>
<td>6</td>
<td>5</td>
<td>277</td>
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<tr>
<td>Average per monitoring night (N=2)</td>
<td>108.5</td>
<td>18.5</td>
<td>6</td>
<td>3</td>
<td>2.5</td>
<td>138.5</td>
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<tr>
<td>Length range (cm)</td>
<td>0-30</td>
<td>0-20</td>
<td>&gt;50cm</td>
<td>0-20</td>
<td>N/A</td>
<td>N/A</td>
</tr>
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</table>

Table 10. Fish stock Catches pumping station Kortenhoef broken down into species, number per monitoring night and length range.
<table>
<thead>
<tr>
<th>Datum</th>
<th>Alver</th>
<th>Perch</th>
<th>Roach</th>
<th>Bream</th>
<th>Eel</th>
<th>Ruffe</th>
<th>Gudgeon</th>
<th>Pike perch</th>
<th>Tench</th>
<th>Cray fish</th>
<th>Mitten crab</th>
<th>frog</th>
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<td>29</td>
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<td>6</td>
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<td>1</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>1</td>
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<td>48</td>
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<td>14-10-2014</td>
<td>172</td>
<td>7</td>
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<td>2</td>
<td>9</td>
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<td>6</td>
<td>2</td>
<td>1</td>
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<td></td>
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<td>16-10-2014</td>
<td>77</td>
<td>7</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
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<td>95</td>
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<tr>
<td>20-10-2014</td>
<td>125</td>
<td>56</td>
<td>6</td>
<td></td>
<td>6</td>
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<td>196</td>
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<td></td>
<td>267</td>
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<tr>
<td>11-11-2014</td>
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<td>90</td>
<td>5</td>
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<td>7</td>
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<td></td>
<td>133</td>
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<tr>
<td>TOTAL</td>
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<td>647</td>
<td>205</td>
<td>21</td>
<td>8</td>
<td>28</td>
<td>1</td>
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<td>1</td>
<td>1</td>
<td>12</td>
<td>10</td>
<td>934</td>
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<table>
<thead>
<tr>
<th></th>
<th>Number damaged</th>
<th>Percentage damaged</th>
<th>Number dead</th>
<th>Percentage dead</th>
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<tr>
<td></td>
<td>1</td>
<td>12.5</td>
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</table>

**Figure 12.** Catch results and damage percentages per species.
Archimedean screw pump
direct channel pumping
Efficiency Performance

- No leakage path with sealed rotating drum
- Less energy lost by noise on intake due to sweeping leading edge design
- More flexible for variable flow
- Reduced effective lift
OPEX savings

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Speed

Asset life

Maintenance

Efficiency

Power
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Fish Friendly Screw Pump
• Manufacturing pumps since 1930s
• Over 150 staff
• Manufactures surface water pumps from 0.4m³/s - 60m³/s
• In house foundry and testing facilities
• Only company licenced to manufacture the fish flow innovations fish friendly impellor
“vintage” axial flow land drainage pumps

Hobhole re-firb 2017 original pump installed mid 50’s and runs at 100rpm pumping 9.43m³/s
“modern” axial flow land drainage pumps

Kenwith pump replacement 2018 initial pumps installed 1995 and runs in aprox. 1000rpm
Kenwith pump replacement 2018 initial pumps installed 1995 and runs at 1000rpm.
Change over time non fish friendly pumps

- Efficiency
- CAPEX cost
- Asset life
- Speed
- Maintenance requirement
Fish Friendly References

H.H. VAN SCHIELAND EN DE KRIMPENERWAARD
Pumping station “Kralingseplas”

Pump Type: VPF1-600.200
Capacity: 1,800 [m³/h]
Head: 1,6 [mwc]
Speed: 358 [rpm]
Efficiency: 78,5 [%]

Independent research - contracted by end user - showed great fish friendliness results:
>27,000 fishes passed, <0,05% damaged
WATERSCHAP RIVIERENLAND
Pumping station “Buurmalsen”

**Pump Type: VPF1-800.200**
- Capacity: 3,900 [m³/h]
- Head: 2,2 [mwc]
- Speed: 320 [rpm]
- Efficiency: 80,3 [%]

**Pump Type: VPF1-700.200**
- Capacity: 3,000 [m³/h]
- Head: 2,15 [mwc]
- Speed: 318 [rpm]
- Efficiency: 78,3 [%]
Fish Friendly References

WATERSCHAP RIVIERENLAND
Pumping station “De Nieuwe Horn”

**Pump Type:** VPF1-1400.200 - CONCRETE VOLUTE

- **Capacity:** 18,000 [m³/h]
- **Head:** 4,2 [mwc]
- **Speed:** 261 [rpm]
- **Efficiency:** 82,6 [%]
Fish Friendly References

H.H. VAN SCHIELAND EN DE KRIMPENERWAARD
Pumping station “Verdoold”

Pump Type: VPF1-1200.200
Capacity: 13.500 [m³/h]
Head: 5,5 [mwc]
Speed: 333 [rpm]
Efficiency: 82 [%]

Test results:
No mortality
Scaled fish: 100[%] undamaged
Eel: 100[%] undamaged
Fish Friendly References

H.H. DE STICHTSE RIJNLANDEN
Pumping station “Haarrijn”

Pump Type: VPF1-1000.200
Capacity: 6.840 [m³/h]
Head: 2,65 [mwc]
Speed: 283 [rpm]
Efficiency: 81,2 [%]
Fish Friendly References

H.H. NOORDERZIJLVEST
Pumping station “Transferium”

Pump Type: HPFM1-800.200
Capacity: 3.420 [m³/h]
Head: 1,45 [mwc]
Speed: 268 [rpm]
Efficiency: 80,4 [%]
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Fish Friendly Axial Pump

Product CAPEX Cost

OPEX

Asset Life

TOTEX
Unique features

Critical fish friendly features
- Low operating speeds
- VSD driven
  - Low speed start up
  - Lower speeds at lower flows
  - Pump operating at peak fish friendly points in curve
  - Pump is quiet due to operating in peak points in curve
- Permanent magnet drive provides larger space for fish passage (much more compact than squirrel cage motors)

Performance and resilience features
- In house foundry, enabling quick supply of spares
- Permanent magnet motor provides increased efficiency
- Low operating speeds increase pump life
- FAT facility enables pumps and VSD’s to be set to true flow rates
- Fairbanks Nijhuis is Pentair's centre of excellence for fluid dynamics
- In house CFD analysis capabilities
Thank You For Listening

For any further information, please contact our Customer Services department:
Phone 01777 249080
Email: info@aquaticcontrol.co.uk
Or visit our new website:
www.aquaticcontrol.co.uk