Quatre étapes pour des stations de pompage « respectueuses des poissons »

Four Steps to 'Fish Friendly' Pumping Stations

Comment une réglementation fondée sur des données probantes améliore la migration de l'anguille

How Evidence-Led Regulation is Improving Eel Migration

Andy Don
National Fisheries Services

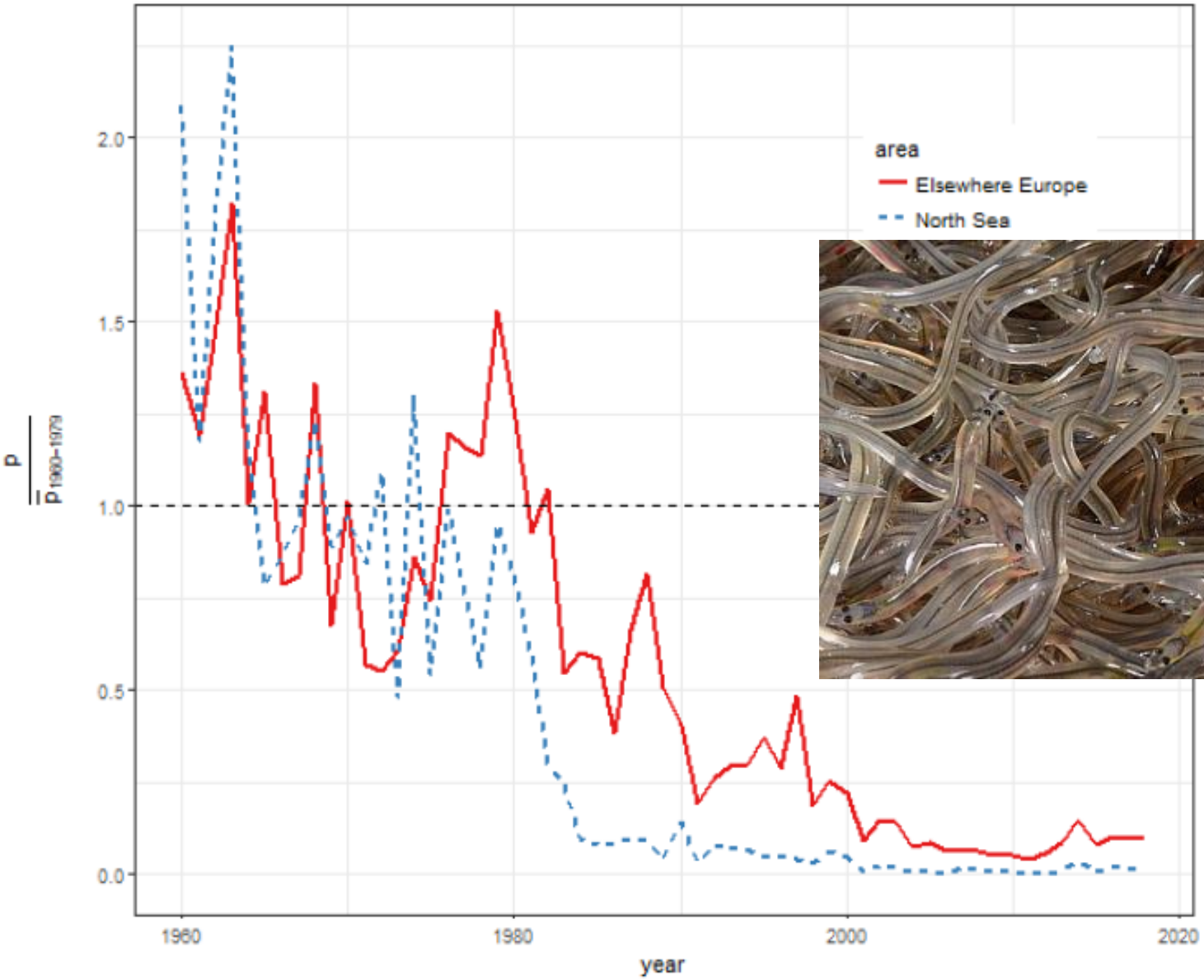
Migrateurs Rhône-Méditerranée

Novembre 2023

Environment Agency

Contexte : De quoi s'agit-il...?

Background: What's it all about...?



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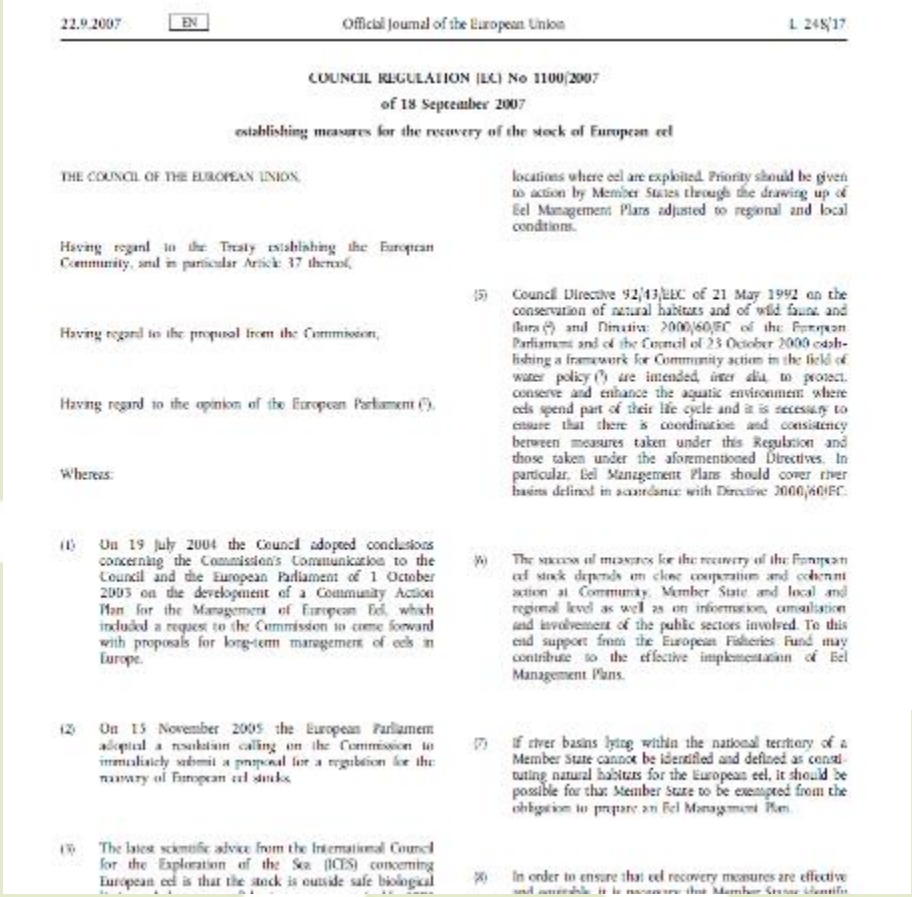
Le Règlement Européen sur l'anguille

The European Eel Regulation

(EC 1100/2007)



22.9.2007 EN Official Journal of the European Union L 248/17

COUNCIL REGULATION (EC) No 1100/2007

of 18 September 2007

establishing measures for the recovery of the stock of European eel

THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty establishing the European Community, and in particular Article 37 thereof,

Having regard to the proposal from the Commission,

Having regard to the opinion of the European Parliament (1),

Whereas:

(1) On 19 July 2004 the Council adopted conclusions concerning the Commission's Communication to the Council and the European Parliament of 1 October 2003 on the development of a Community Action Plan for the Management of European Eel, which included a request to the Commission to come forward with proposals for long-term management of eels in Europe.

(2) On 15 November 2005 the European Parliament adopted a resolution calling on the Commission to immediately submit a proposal for a regulation for the recovery of European eel stocks.

(3) The latest scientific advice from the International Council for the Exploration of the Sea (ICES) concerning European eel is that the stock is outside safe biological

locations where eel are exploited. Priority should be given to action by Member States through the drawing up of Eel Management Plans adjusted to regional and local conditions.

(5) Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (2) and Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (3) are intended, inter alia, to protect, conserve and enhance the aquatic environment where eels spend part of their life cycle and it is necessary to ensure that there is coordination and consistency between measures taken under this Regulation and those taken under the aforementioned Directives. In particular, Eel Management Plans should cover river basins defined in accordance with Directive 2000/60/EC.

(6) The success of measures for the recovery of the European eel stock depends on close cooperation and coherent action at Community, Member State and local and regional level as well as on information, consultation and involvement of the public sectors involved. To this end support from the European Fisheries Fund may contribute to the effective implementation of Eel Management Plans.

(7) If river basins lying within the national territory of a Member State cannot be identified and defined as constituting natural habitats for the European eel, it should be possible for that Member State to be exempted from the obligation to prepare an Eel Management Plan.

(8) In order to ensure that eel recovery measures are effective

COUNCIL OF THE EUROPEAN UNION

Brussels, 14 August 2007 (OR. en)

12031/07

Interinstitutional File: 2005/0201 (CNS)

PECHE 241

LEGISLATIVE ACTS AND OTHER INSTRUMENTS

Subject: COUNCIL REGULATION establishing measures for the recovery of the stock of European eel

Environment Agency

Les principaux facteurs impactant les populations d'anguilles

The main impacting factors on eel populations

Exploitation,

Barrières d'accès/migration,

Entraînement

Access/migration barriers,

Entrainment, Loss of habitat,

Predation, Water quality/pollution,

Pathogens & parasites,

Climate change/oceanic factors

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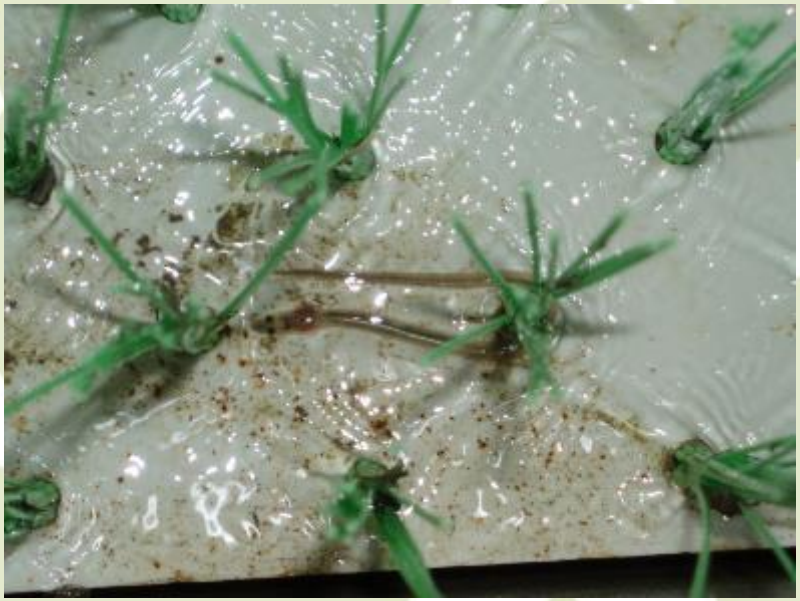
The Eels (England & Wales) Regulations 2009 Statutory Instrument

‘The Eel(s) Regs.’



STATUTORY INSTRUMENTS

2009 No. 3344

FISHERIES, ENGLAND AND WALES

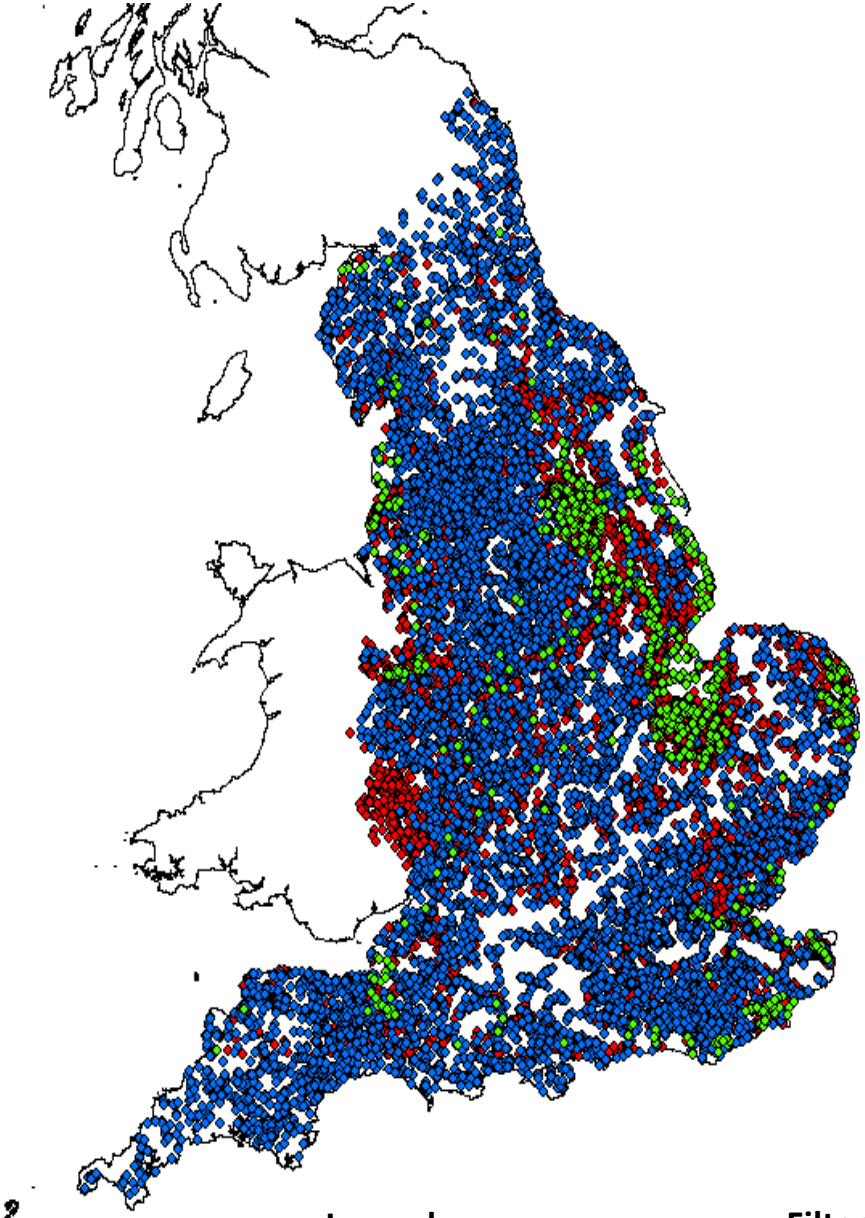
RIVER, ENGLAND AND WALES

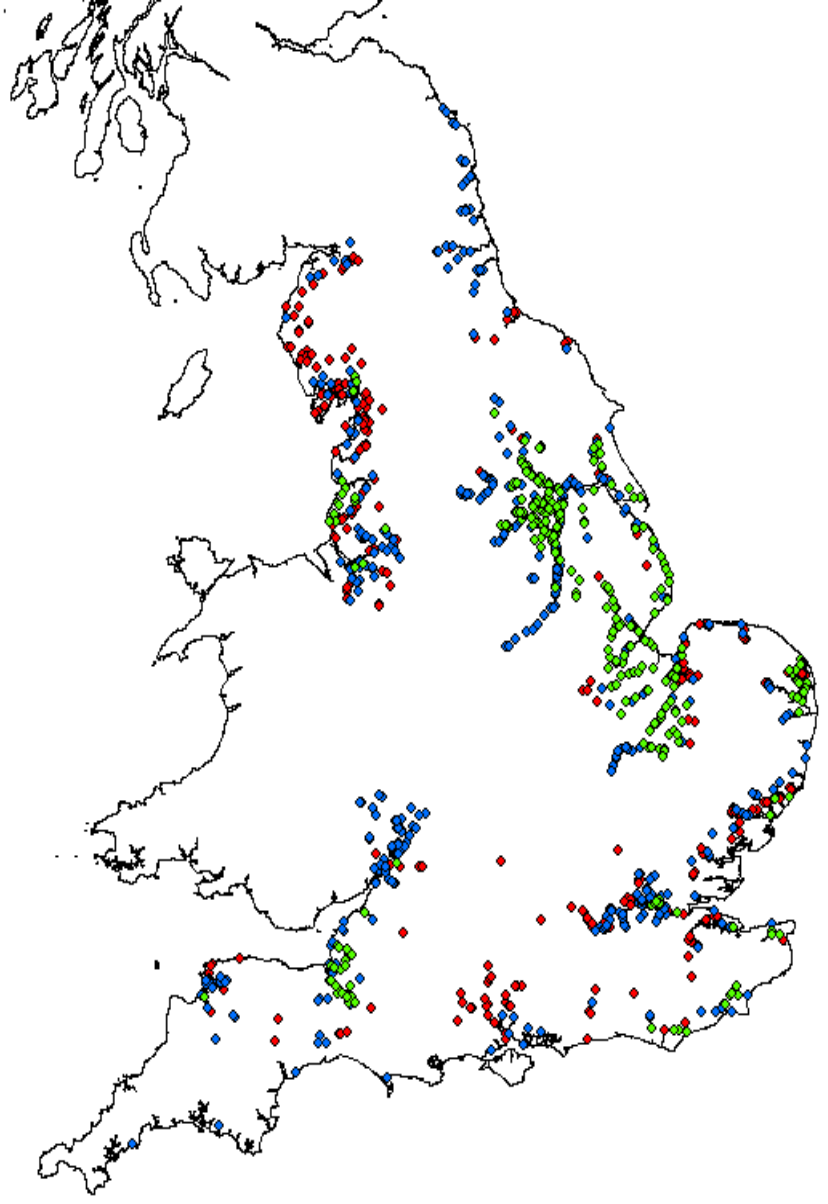
The Eels (England and Wales) Regulations 2009

Made - - - - 14th December 2009
Laid before Parliament 21st December 2009
Laid before the National Assembly for Wales 21st December 2009
Coming into force - - 15th January 2010

CONTENTS

Environment Agency





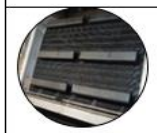
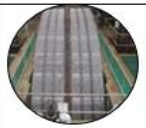
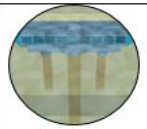
Legend:
Abstractions – **Red**
Obstructions – **Blue**
Pumping Stations – **Green**

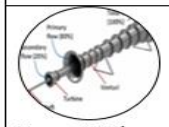
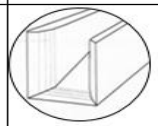
Filtered Numbers, High Priority Sites:
Abstractions: **603**; Obstructions: **640**; Pump Stns: **292**

Environment Agency

À quoi ressemble une « meilleure mesure de protection de l'anguille » ?

What does a BAEP solution look like?

 Vertical Travelling Band Screen (Engineered Polymer)	 Vertical Travelling Band Screen (Stainless Steel)	 Coanda Effect Screen
 Horizontal Travelling Band Screen (Engineered Polymer)	 Passive Wedge Wire Panel	 Passive Wedge Wire Cylinder
 Fish Recovery and Return Band Screen (Engineered Polymer)	 Fish Recovery and Return Drum Screen	 Fish Recovery and Return Launder/Ancillaries
 Contra-Flow Self-Cleaning Screen	 Sub-Gravel Intake	 Low Velocity Side Entry Intake Head

 Open 'Archimedes' Hydrodynamic Screw Turbine	 True Archimedes Screw Turbine	 Traditional Water Wheel
 Venturi-Enhanced Turbine Technology	 True Archimedes Screw Pump	 Less damaging Vertical Canister or other Axial/Volute Pump
 Less damaging Horizontal Canister Pump	 Less damaging Pipework, Siphon Valves, Control Structures, Ancillaries	 Less damaging Portable/Towable Pump
 Appropriately dimensioned Bar Rack	 Appropriately configured Bypass	

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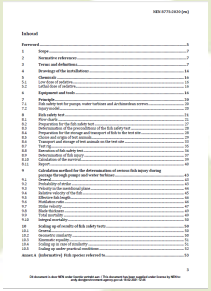
Utiliser des données probantes pour conduire cette réforme réglementaire

Using evidence to lead this regulatory reform

Relating to less damaging pump systems EA has used / is using:

Desktop

- The Dutch NEN 8775 Standard



- Computational Fluid Dynamics (CFD) Modelling

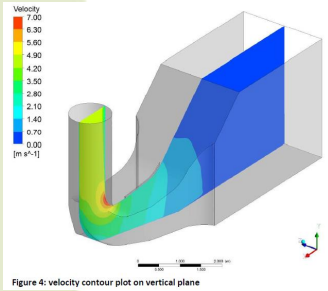


Figure 4: velocity contour plot on vertical plane

Practical

- Barotrauma Detection System (BDS)

- Live fish trials

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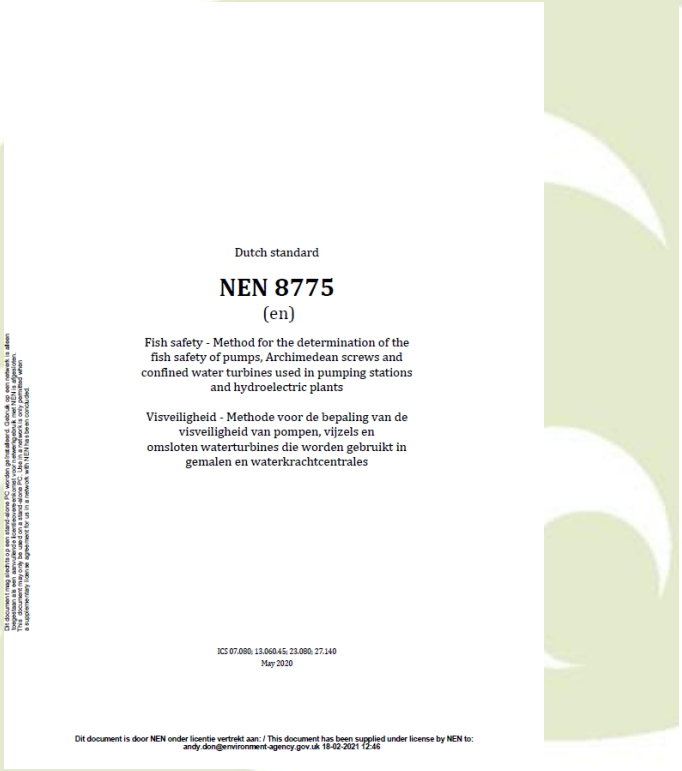

Dutch standard

NEN 8775

(en)

Fish safety - Method for the determination of the fish safety of pumps, Archimedean screws and confined water turbines used in pumping stations and hydroelectric plants

Visveiligheid - Methode voor de bepaling van de visveiligheid van pompen, vijzels en omsloten waterturbines die worden gebruikt in gemalen en waterkrachtcentrales

ICS 07.080; 13.060.45; 23.080; 27.140
May 2020

Method for carrying out lab and field tests

Method for calculating blade strike probabilities and likelihood of mutilation for pumps/turbines

Inhoud

The full scale mortality $P_{m,v}$ can then be determined from the mortality on a model scale $P_{m,s}$ according to formula (26):

$$P_m\left(L_{f,v}, D_v, Q_v, n_v\right) = f_c . P_m\left(L_{f,s}, D_s, Q_s, n_s\right) \quad (26)$$

where the scaling factor f_c for scaly fish is determined with formula (27):

$$f_c = \frac{\left\{\left(\frac{L_f}{d}\right)\left[a.ln\left(\frac{L_f}{d}\right)+b\right]\right\}_v}{\left\{\left(\frac{L_f}{d}\right)\left[a.ln\left(\frac{L_f}{d}\right)+b\right]\right\}_s} \quad (27)$$

(see for explanation Table 2 and formula (16) on page 47)

and that for eel with formula (28):

$$f_c = \frac{\left\{\left(\frac{L_f}{d}\right)^2\right\}_v}{\left\{\left(\frac{L_f}{d}\right)^2\right\}_s} \quad (28)$$

https://www.nen.nl/en/nen-8775-2020-en-278917

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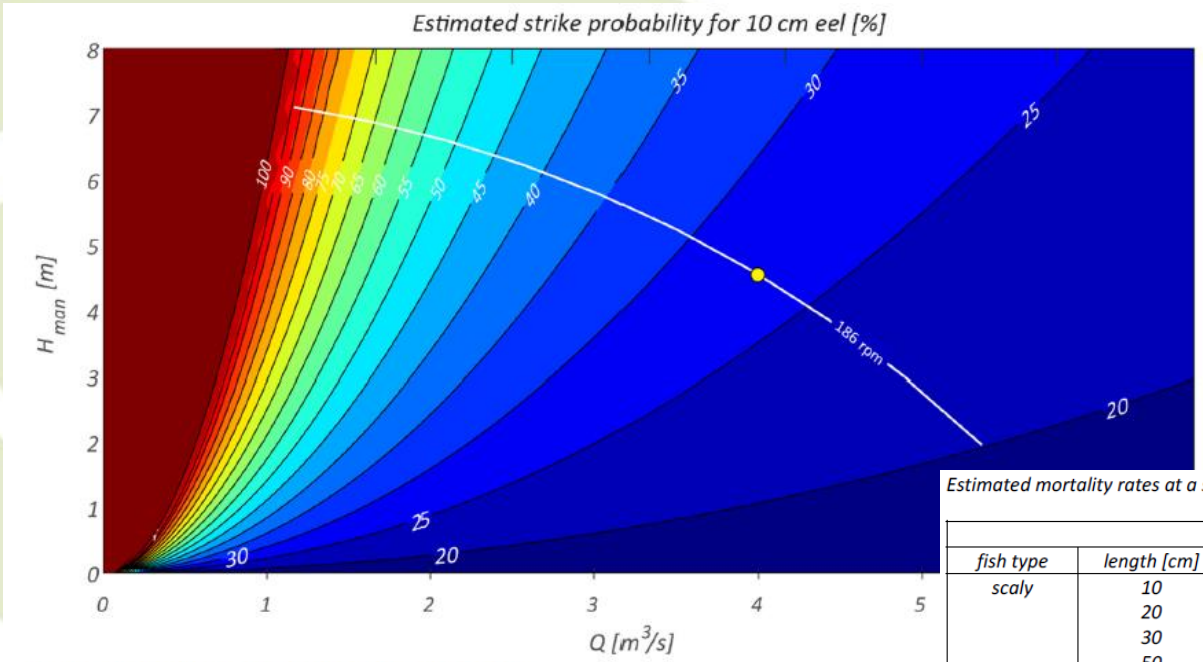
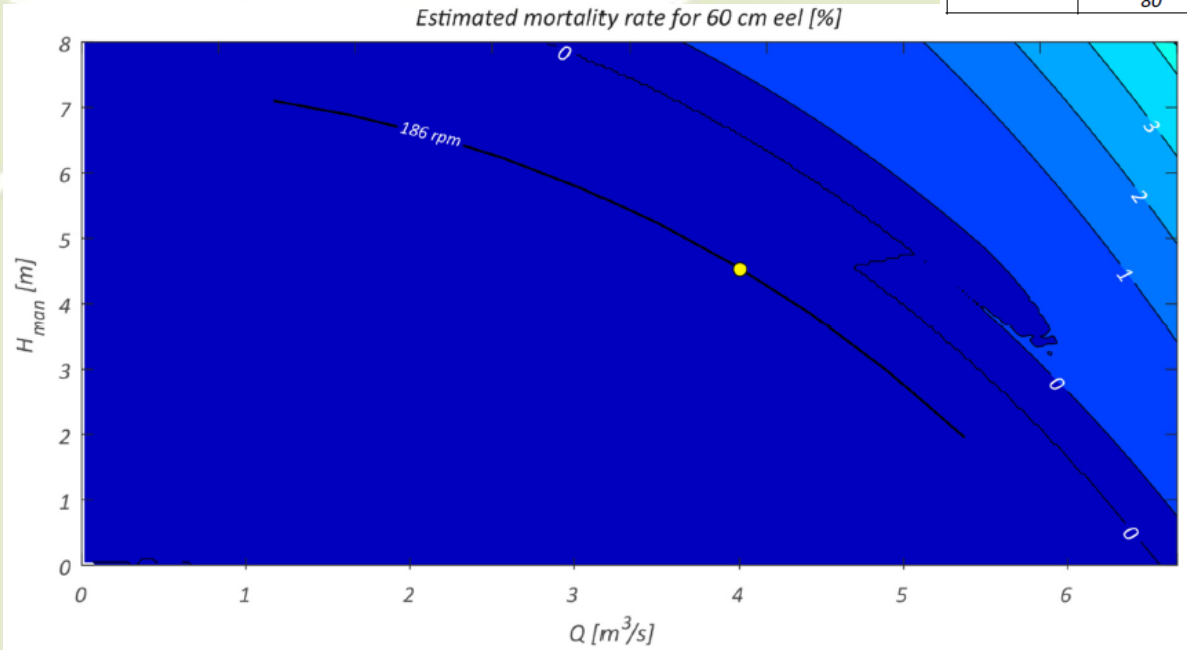


Figure 8a: Strike probability in % for eel of 10 cm

Estimated mortality rates at a shaft speed of 186 rpm and three different flow rates

		estimated mortal damage [%]		
fish type	length [cm]	2 m^3/s	4 m^3/s	5 m^3/s
scaly	10	2.8	1.8	1.6
	20	8.9	5.6	5.2
	30	15.8	10.3	9.4
	50	17.5	18.9	17.4
eel	40	0	0	0
	60	0	0	0
	80	0	0	0



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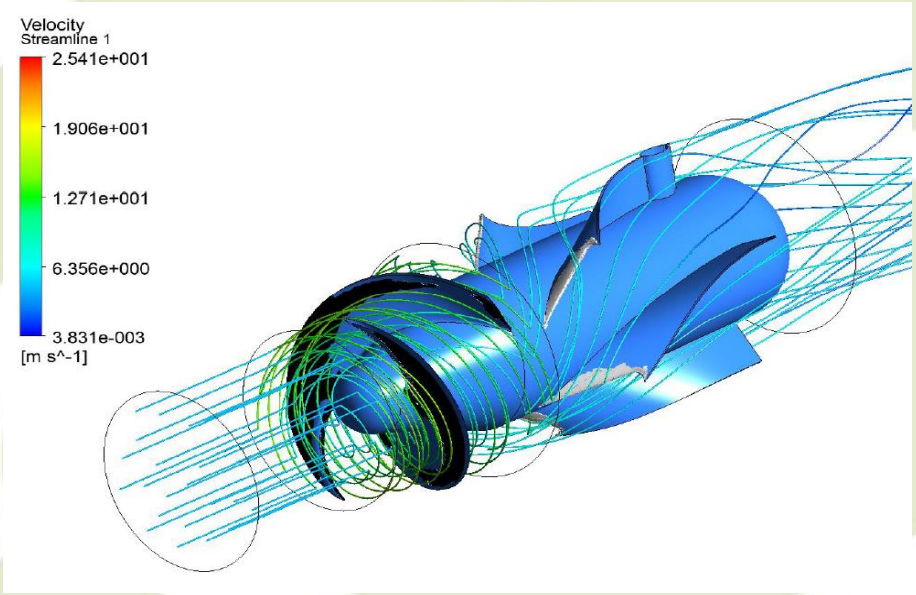
CFD



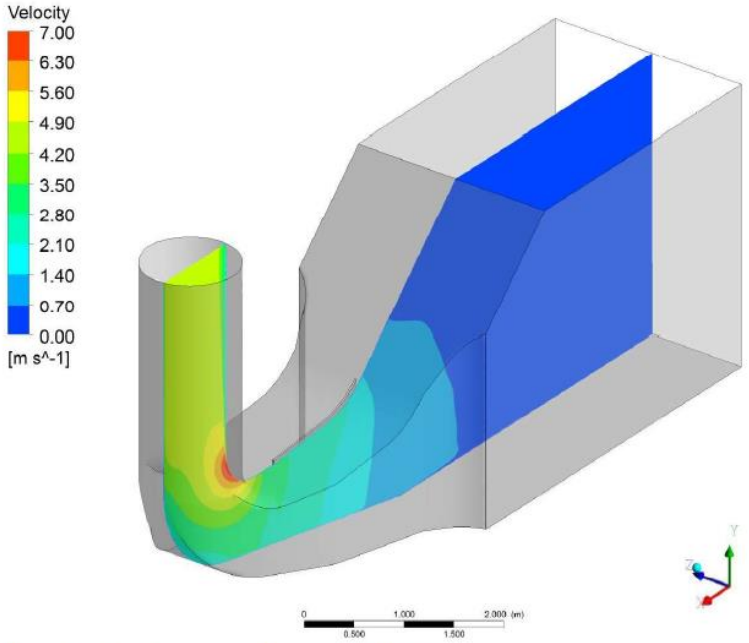


Figure 4: velocity contour plot on vertical plane

PENTAIR FAIRBANKS NIJHUIS

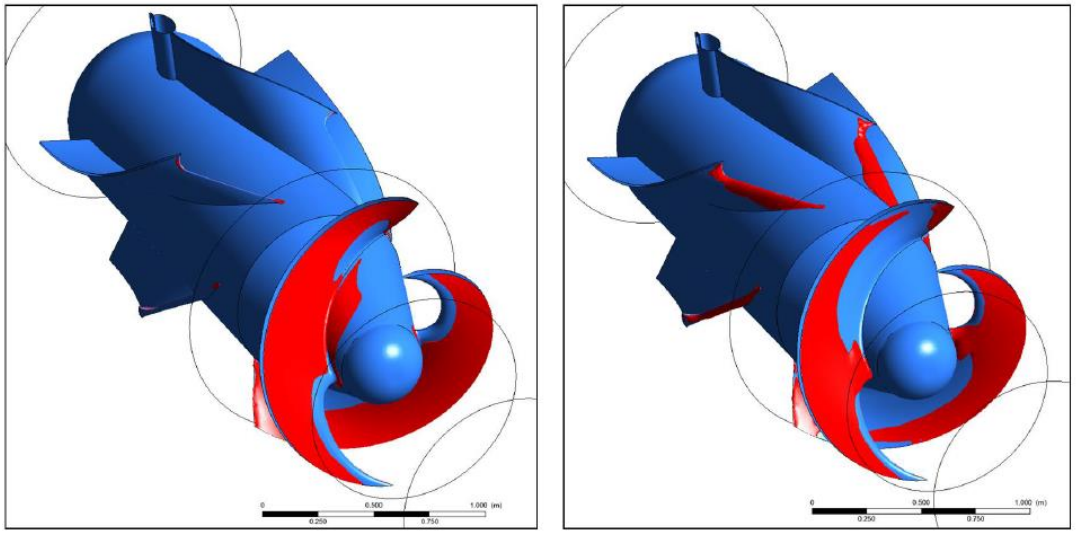


Figure 2 iso vorticity surfaces (500[1/s]) (red) for duty point 1 (left) and duty point 2 (right)

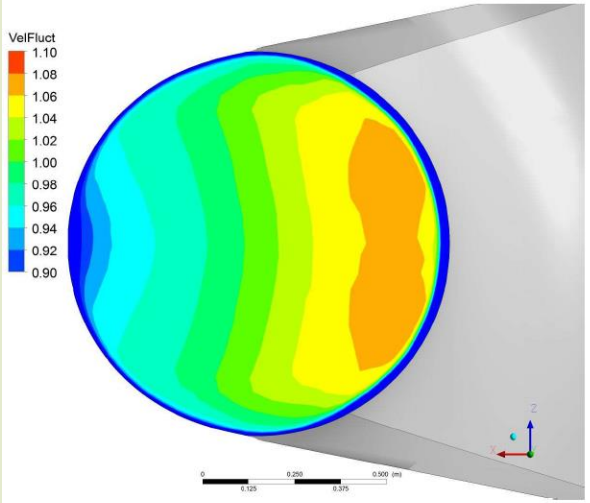


Figure 8: Percentage fluctuation velocity around average contour plot at impeller eye

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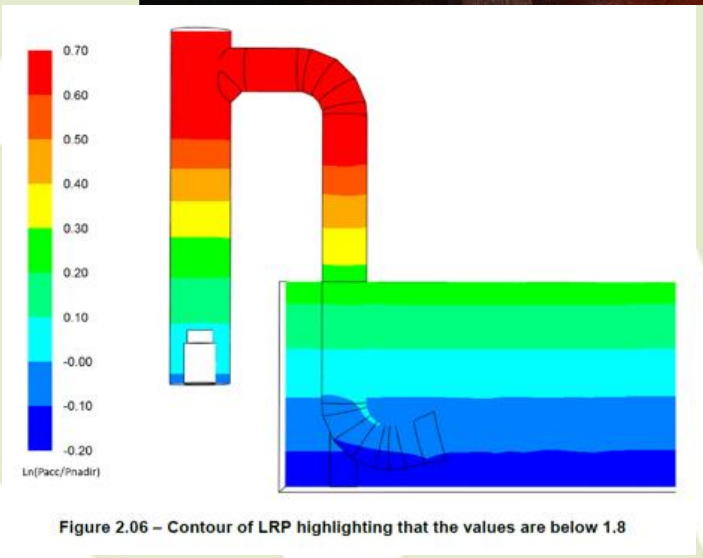

Figure 2.06 – Contour of LRP highlighting that the values are below 1.8

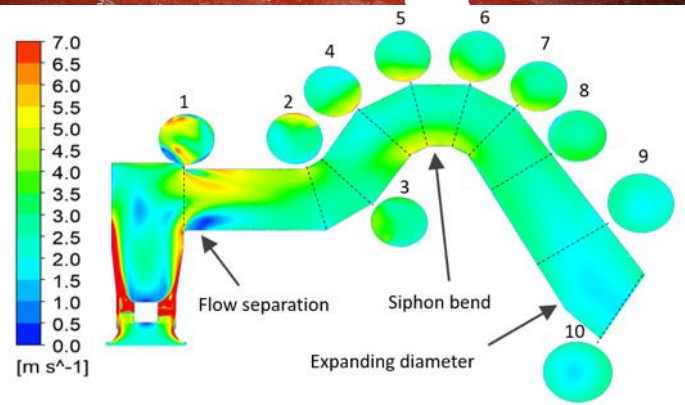

Figure 5 Velocity distribution for a cut-plane and streamwise cross-sections

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Keadby Station de Pompage: Actif EA sur la rivière à marée Trent

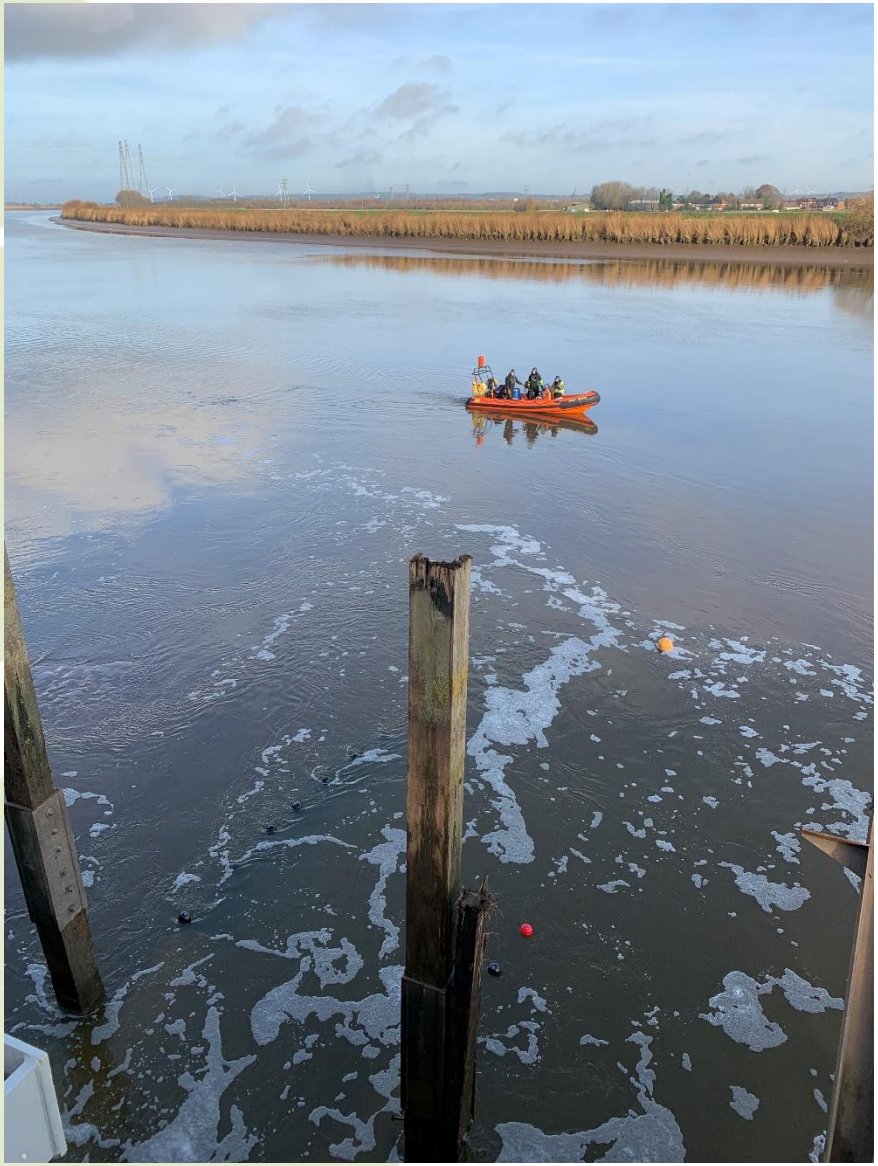
Environment Agency

Tests sur le terrain de la station de pompage de Keadby pour la validation de NEN + CFD

Keadby PS field trials for validation of NEN + CFD

Environment Agency

Environment Agency



Environment Agency

Health report

National Fisheries Services

This report is an internal Environment Agency document giving a health assessment of eel (post – entrainment) in an aim to determine the eel friendly status of pumping stations. These findings are based solely on the sample submitted and unless stated otherwise, will be deemed representative of wild populations undergoing the same entrainment process. All examinations were conducted under laboratory conditions following established diagnostic protocols.

Background information and sample submission details			
To	Andy Don, Jon Bolland	**From**	John Price
Date reported	10/03/2022	**Lab ref**	21/097
Origin of sample	Keadby Pumping Station South Bank Keadby with Althorpe Lincolnshire, DN17 3BU		
	NGR	SE8349511289	
Agency Area	Lincolnshire and Northamptonshire		
Capture method	Submitted as part of Keadby Pumping Station assessment trial		
Date sample submitted	15/12/2021	**Sample submitted by**	Oliver Evans (HIFI)

Fish examined			
Species	**Number**	**Length range (mm)**	**Weight range (g)**
European eel	14	418 - 959	121.2 – 1893.3

EVENT

Keadby Pumping Station renewal

Keadby Pumping Station is at the end of an intricate system of rivers and pumping stations within the low-lying Isle of Axholme catchment in Lincolnshire. It was originally built in the 1940s to discharge water from three parallel channels, known as the Three Rivers, into the River Trent during high tides. The Three Rivers service a catchment of some 37,000 hectares.

In 2019 the Environment Agency (EA), along with its delivery partners, began the construction phase of a £35 million project to renew the pumping station and ensure the ongoing reliable operation of the site for years to come. Over the last 18 months the project has made significant progress on site through one of the wettest winters on record and the global coronavirus pandemic. It is on track to deliver 20 m³/s of fish friendly pump capacity in 2021. All of this has been achieved whilst ensuring that flows can still be pumped and sluiced to maintain river levels and manage flood risk throughout the construction phase.

Keadby pumping station falls within the Isle of Axholme (IoA) Flood and Coastal Risk Management (FCRM) Strategy area. It is the final link in a complex network of managed drainage and pumping systems. The fundamental conclusion of the IoA FCRM Strategy was that the ongoing provision of a reliable pumping regime at Keadby was essential to protect over 15,000 homes from flooding, a fact which the Strategy recognised would require significant investment.

In developing the solution, the project team undertook an intensive period of flow modelling and design development in order to establish the best and most cost effective way of meeting this strategic requirement. The team worked with the EA's delivery supply chain (Arcadis, Capita and GBV) along with specialist equipment suppliers to evaluate potential solutions ranging from a new pumping station to a 'make-do and mend' approach. A major asset renewal solution was developed as the preferred option. This retained the main existing structure, whilst constructing a new outfall and inlet and replacing all the mechanical and electrical equipment at the site.

In addition to the requirement for improved resilience at the station there were two further key drivers to the project's development. The existing site had an exemption to the Eel Regulations 2009, but any changes to the station would require it to be made fully compliant. The project was also required to demonstrate a carbon saving and contribute towards the EA's carbon reduction and net zero targets.

The solution at Keadby was led by the EA teams, but was not developed in isolation. As the station is an asset in a wider catchment network, the EA and its supply chain worked together with local risk management authorities through the Isle of Axholme Asset Management & Delivery Group. Together the team developed and agreed a system of benefit apportionment ensuring a fair and equitable funding arrangement for the pumping station and wider catchment. The business case for the pumping station renewal was approved by the EA's Large Projects Review Group in late 2018, clearing the way for construction to commence in February of 2019.

The key component of the project has always been the replacement of the old diesel engine pumps with new electric pumps. Six vertically mounted, fish friendly, electric, axial flow pumps were designed for the site. The pumps, supplied from the Netherlands by Aquatic Control Engineering (ACE), are each capable of pumping nearly four m³/s of flow with a maximum lift of 6.6 metres from the Three Rivers into the River Trent. The pumps have been specifically designed to operate in new, core-drilled pump chambers that have been cut into the existing pumping station following the removal of the old diesel engines. Specially fabricated 'formed suction intakes' direct flows from the forebay to the pumps themselves to ensure that stable flow is presented to the pumps without causing rapid changes in pressure or velocities that would injure fish and eels.

To replace diesel engines with electric motors has meant that a new high voltage (HV) grid connection was required. Within the relatively rural setting of North Lincolnshire, this in itself, was no simple matter. Throughout the design and construction phases the project team worked with the local district network operator to put in place nine kilometres of new HV grid power supply. This meant drilling under three main rivers and a major passenger and freight railway line, along with cable laying through towns and highways to connect the station to the grid. This major component of the project was completed in June 2020 with the energisation of the pumping station's new HV switchgear, transformer, and Motor Control Centre (MCC), all of which sit on a newly constructed platform on the banks of the Three Rivers.

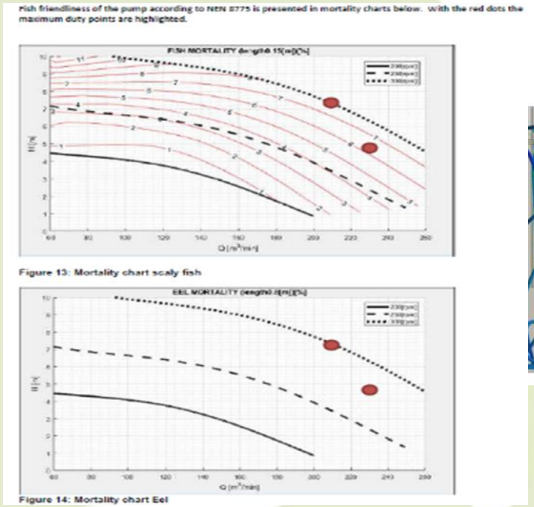
The final component to the project is the construction of a new outfall structure to discharge into the River Trent. The first phase of the work has been to complete new piling across the old outfall, whilst leaving a flow path for the continued operation of the pumping station during construction. In early 2021 the team will return to the outfall to construct a new concrete headwall and outfall chambers in the final stages of the project.

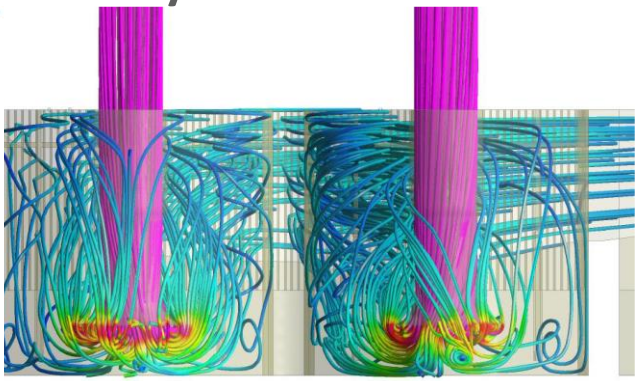
Throughout the delivery the project team has worked closely with the operational teams to dovetail the construction works with the ongoing operation of a live site ensuring that flood risk and water levels are actively managed. It is a testament to all involved that despite record breaking rainfall, catchment flows and water levels were kept in check. With the first of the new pumps now operational the team are starting to see light at the end of the pipes as we look forward to completion in 2021.

Environment Agency

In summary, the EA has endeavoured to be as evidence-led as possible in this process, including consultation and engagement.

Evidence and Guidance, and therefore BAEP solutions are all dynamic:





Right now we are forming better pump Guidance, feeding into a CEN Standard and are building a phone App around ‘FF’ pumps

Environment Agency

Thank you for listening!