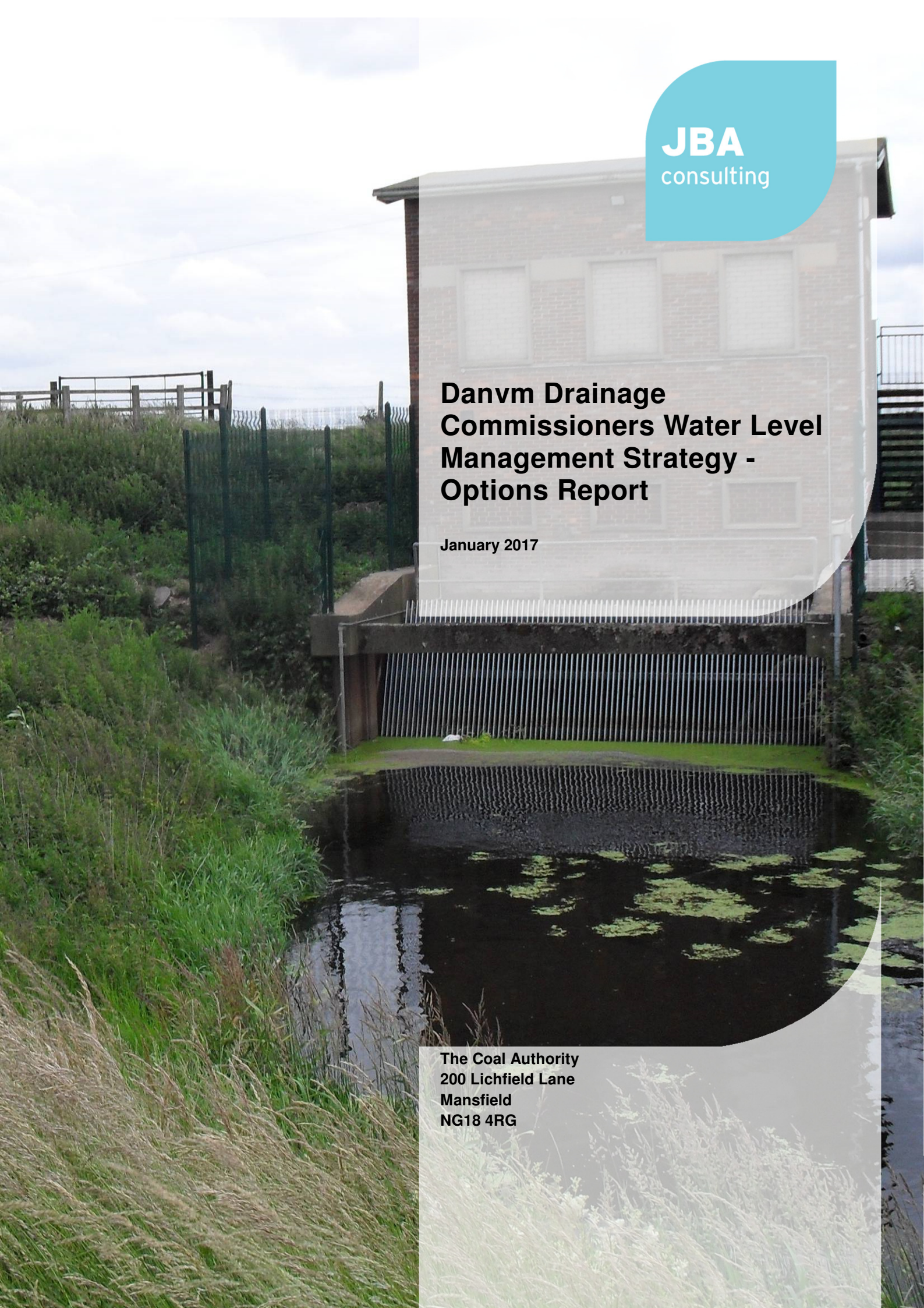

Danvm Drainage Commissioners Water Level Management Strategy - Options Report

January 2017

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Revision History

Revision Ref / Date Issued	Amendments	Issued to
Draft Report / February 2015		The Coal Authority Danvm Drainage Commissioners
Draft v2.0 / April 2015		The Coal Authority Danvm Drainage Commissioners
Final Draft v3.0 / June 2015		The Coal Authority Danvm Drainage Commissioners
Final Draft v4.0 / August 2015		The Coal Authority Danvm Drainage Commissioners
Final v5.0 / December 2016	Revision to running costs	The Coal Authority Danvm Drainage Commissioners

Contract

This report describes work commissioned by The Coal Authority and supported in partnership by the Danvm Drainage Commissioners. The Danvm Drainage Commissioners representative for the contract was Paul Jones. Jonathan Canham, Rachael Brady, Chris Wright, Jason Boasman and Malcolm Muscroft of JBA Consulting carried out this work.

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Purpose

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Acknowledgements

The assistance of the Client is gratefully acknowledged.

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Abbreviations

AFCE ..... Approved Forward Capital Expenditure
AWB ..... Artificial Waterbody
CA ..... Coal Authority
CFMP ..... Catchment Flood Management Plan
CRT ..... Canal & River Trust
DDA ..... Doncaster Drainage Act
DDC ..... Danvm Drainage Commissioners
Defra ..... Department for Environment, Food and Rural Affairs
EA ..... Environment Agency
EIA ..... Environmental Impact Assessment
ES ..... Environmental Statement
FCERM ..... Flood and Coastal Erosion Risk Management
FDGiA ..... Flood Defence Grant in Aid
FRMP ..... Flood Risk Management Plan
GEP ..... Good Ecological Potential
GIS ..... Geographic Information System
HRA ..... Habitats Regulations Assessment
HMWB ..... Heavily Modified Waterbody
IDB ..... Internal Drainage Board
IDD ..... Internal Drainage District
LiDAR ..... Light Detection and Ranging
LLFAs ..... Lead Local Flood Authorities
LWS ..... Local Wildlife Site
PSCA ..... Public Sector Cooperation Agreement
PS ..... Pumping Station
RBMP ..... River Basin Management Plan
RFCC ..... Regional Flood and Coastal Committee

SAC..... Special Area of Conservation
SEA..... Strategic Environmental Assessment
SPA..... Special Protection Area
SSSI..... Site of Special Scientific Interest
SuDS……..Sustainable Drainage Systems
UDP ..... Unitary Development Plan
WFD..... Water Framework Directive
WLM..... Water Level Management
WLMP ..... Water Level Management Plan
WLMS ..... Water Level Management Strategy
YW ..... Yorkshire Water

1 Introduction

1.1 Background

There is no single body responsible for managing flood risk in the UK. The body with powers to address a given issue depends on the location and nature of the problem.

The Department for Environment, Food and Rural Affairs (Defra) and the Welsh Government lead on Flood and Coastal Erosion Risk Management in England and Wales. They develop new or revised policies with other parts of government, such as the Treasury and Cabinet Office, and these national policies then form the basis of the Environment Agency's and lead local flood authorities' work.

1.1.1 Environment Agency (EA)

The EA is a Non-Departmental Public Body of Defra.

The EA has a strategic overview of all sources of flooding and coastal erosion (as defined in the Flood and Water Management Act). It is also responsible for flood and coastal erosion risk management activities on main rivers and the coast, regulating reservoir safety, and working in partnership with the Met Office to provide flood forecasts and warnings. It must also look for opportunities to maintain and improve the environment for people and wildlife while carrying out all of its duties.

In England, Defra decides upon the designation of main rivers, and these are marked as such on an official main river map. Main rivers are usually larger streams and rivers, but occasionally include smaller watercourses of local significance. A main river can also include any structure or appliance that controls or regulates the flow of water in, into, or out of, a main river.

The EA is the principal flood risk management operating authority in England and undertakes general supervision on flooding matters including flood risk management, floodplain mapping, flood warning, and floodplain development advice. It has concurrent powers to undertake works on behalf of Internal Drainage Boards (IDBs) or Lead Local Flood Authorities (LLFAs).

The EA exercises powers under the Land Drainage Act 1991 and the Water Resources Act 1991 to maintain and improve designated main rivers in order to ensure the efficient passage of flood flow and to manage water levels. Most powers under the Land Drainage Act 1991 are permissive, and not a legal duty, so it is at the discretion of the authority as to whether or not it exercises them.

Under the Flood and Water Management Act 2010 Public Sector Cooperation Agreements (PSCAs) allow a risk management authority to arrange for another risk management authority to exercise a flood risk management function on its behalf. For example the EA can arrange for works to be carried out on its behalf by an IDB, key benefits can be more efficient working practices, using local resources with lower overheads.

The EA administers Flood Defence Grant in Aid (FDGiA) for flood and coastal risk management capital projects by other risk management authorities (Local Authorities and Internal Drainage Boards). The regional capital programme is agreed by the Regional Flood and Coastal Committee (RFCC) who provide an important role in guiding the EA's flood and coastal erosion risk management activities in their region and providing a local democratic input into the decision making process.

The RFCC are also responsible for raising the local levy, and helping to decide how these and other locally raised funds (such as general and special drainage charges and contributions from IDBs) will be spent.

1.1.2 Lead Local Flood Authorities (LLFAs)

LLFAs are county councils and unitary authorities who, under the Flood and Water Management Act, LLFAs are required to:

- prepare and maintain a strategy for local flood risk management in their area (and consult with local communities about such)
- maintain a register of assets (physical features that have a significant effect on flooding in their area
- investigate significant local flooding incidents and publish the results of such investigations

- establish approval bodies for the design, building and operation of Sustainable Drainage Systems (SuDS)
- issue consents for altering, removing or replacing certain structures or features on ordinary watercourses
- play a lead role in emergency planning and recovery after a flood event

LLFAs and the EA work closely together to ensure that the plans they are making both locally and nationally link up. An essential part of managing local flood risk is taking account of new development in any plans or strategies.

LLFAs may work with local communities, community volunteers, local flood action groups, or other organisations that represent those living and working in areas at risk of flooding, to raise awareness of flood and coastal erosion risks, share up-to-date information, guidance and support, and help them prepare flood action plans.

1.1.3 Internal Drainage Boards (IDBs)

IDBs are local public bodies established under statute in areas of special drainage need in England and Wales, with permissive powers to undertake work to provide land drainage and water level management within their Internal Drainage District (IDD).

Each IDD has a defined area within which the IDB has operational and regulatory powers over ordinary watercourses. An ordinary watercourse is every river, stream, ditch, drain, cut, dyke, sluice, sewer (other than a public sewer) and passage through which water flows and which does not form part of a main river.

IDBs predominantly operate under the Land Drainage Act 1991 using legislative and permissive powers to undertake work to manage the drainage and water levels of their districts in a sustainable way and to significantly reduce the risk of flooding to local communities, property, businesses and infrastructure.

Most powers under the Land Drainage Act 1991 are permissive, and not a legal duty, so it is at the discretion of the IDB as to whether or not it exercises them.

Reliance on multiple riparian owners to maintain their watercourses can be problematic and, although an IDB can serve improvement notices on landowners to maintain watercourses, the IDBs often decide to maintain those watercourses which act as main arteries (carrying more major flows) through the drainage district.

Much of their work involves the maintenance of ordinary watercourses, drainage channels, outfalls and pumping stations, consenting works, facilitating drainage of new developments and, although not a statutory consultee, advising on planning applications. They also have statutory duties with regard to the environment and recreation when exercising their functions.

The role of IDBs was historically focused on the drainage of land, and water level management still has vital economic consequences for food production, infrastructure, leisure, tourism, industry, and other businesses in lowland IDD areas. IDBs still therefore aim to manage water levels and reduce the risk from flooding by co-operative means between agencies, groups and communities.

However, as modern flood risk management authorities, IDBs now have a far wider range of duties and responsibilities, including roles within planning and environmental management, that stem from a more strategic catchment-based approach to flood risk management. They now guide and advise Planning Authorities regarding surface water management, flood risk and sustainable drainage systems and support and develop agricultural, commercial, biodiversity and leisure objectives.

IDBs hold important knowledge and expertise of identifying, reducing and managing flood risk within their IDDs. When instructed by a responsible authority IDBs may also agree to undertake works on behalf of that authority outside their established Board District.

1.1.3.1 IDB boundaries

IDDs are not determined by county or unitary council boundaries, but by consideration of the hydrological catchment within a given area. IDDs are defined as areas of land which "will derive benefit, or avoid danger, as a result of drainage operations".

In order to clarify the meaning of this the Medway Letter of 1933 was written as a statement from the then Minister of State for Agriculture and Fisheries. At this time IDBs performed a

predominantly rural function and so the principles suggested in the Medway Letter vary for rural and urban areas in tidal and non-tidal areas.

In the non-tidal districts the areas of benefit were defined as the highest known flood level in urban areas and eight feet (2.4 metres) above highest known flood level in rural areas. In tidal districts the areas of benefit were defined as high (ordinary spring) tide level in urban areas and five feet (1.5 metres) above high tide level in rural areas.

Although the Medway Letter is not a statutory provision it has been used as the precedent for setting the boundaries of IDBs all over England and its principles still stand. However, where there is significant justification and the benefits can be clearly demonstrated, exceptions may be made if agreed by the Minister.

Whilst IDBs still manage predominantly rural catchments there has been a significant spread of urban areas into existing IDDs, and the importance of urban flood risk and surface water management has increased substantially. Our understanding of hydrological and catchment processes has also developed significantly and, as a result of these factors, the principles of the Medway Letter are currently under review.

1.1.3.2 IDB Structure

IDB activities are directly controlled by a Board consisting of members elected from the agricultural drainage rate payers, and members appointed by levy-paying local authorities.

The Board can employ or contract in staff, and pay salaries, pension contributions and other benefits. Staff usually includes a Clerk, who acts as the executive officer, an Engineer, to advise and oversee all water level management activities, and, dependent upon the size and needs of a particular IDD, others such as finance, ratings, and asset managers, biodiversity and planning officers, operational supervisors and labour forces.

1.1.3.3 IDB funding

Historically, following the principle that all occupiers who directly benefited from the land drainage and flood risk management service provided by an IDB paid directly for that service, all occupiers of agricultural property, houses, commercial properties, etc., within an IDD received a rate bill based on the rateable value of their properties and land directly from the IDB.

This position still essentially remains the same. Agricultural properties and land owners still pay a drainage rate directly to the IDB, based on the assessable "annual" value of their land. The IDB also issues a special levy on all district or unitary local authorities to cover other business properties and land, houses, roads, power stations etc. in the IDD. These drainage rates and special levies provide the core funding for the IDBs works.

The EA may also pay IDBs for the costs of catering for water from higher areas that flows into drainage districts. This is typically offset by the payment of precepts from IDBs to the EA for works the EA undertake on main rivers carrying water away from the IDD. IDBs may also secure grants to assist with the funding of capital and environmental works via FDGiA from Defra, local levy, the lottery funding agencies and the European Union where appropriate.

1.1.4 The Local Authority

Where there is no IDB the local authority is the regulatory authority for ordinary watercourses. The local authorities has powers to carry out works on ordinary watercourses for certain purposes and may implement their own regulations and byelaws that affect what can and cannot be done.

Local authorities may also take enforcement action against any ‘riparian owner’ failing to maintain a watercourse for which they are responsible.

Local authorities have additional mechanisms of raising funding for works including applying Community Infrastructure Levy, Business Improvement Districts, etc.

1.1.5 Other Relevant Organisations

Other organisations which may have responsibilities for the maintenance and improvement of land drainage assets include:

1.1.5.1 The Coal Authority

The Coal Authority provides contributions to the maintenance and capital costs of 29 land drainage pumping stations within the Danvm Drainage Commissioners (DDC) IDD. The majority are maintained, by the DDC through agreement with the National Coal Board under the Doncaster Drainage Act 1929 Part II, Sections 9(1) 9(9) as described below. In a number of cases, maintenance of specific infrastructure is referred to in old correspondence and this is referred to in the descriptions of the relevant options.

The enacting of the Doncaster Drainage Act 1929 resulted in mine owners being responsible for the provision and maintenance of drainage works within the area prescribed within the Act, made necessary by subsidence due to mining operations. Part 2 of the Act is headed *Obligations of Mineowners in Relation to Works Necessitated by Subsidence* and Section 9 (1) and 9 (9) describe the mineowner's liabilities as follows (See Appendix H):

Section 9 (1) Subject to the provisions of this Part of this Act, it shall be the duty of every mineowner working or proposing to work minerals under any lands situate within the Doncaster district, or so near thereto that the surface of any lands in the said district will or may be affected by the working of the minerals, to construct and maintain in proper condition such works, and do such things as may, by reason of any subsidence which results or may result from the working of the minerals by requisite, in order to obviate or remedy, so far as having regard to all the circumstances of the case is reasonably necessary, any loss of efficiency which has risen or may arise in the drainage system and drainage works of the Doncaster district.

Section 9 (9) Any drainage authority may agree with any mineowner to execute, on his behalf, on such terms, as to payment or otherwise, as may be agreed between them, any works which are required under this Part of this Act to be executed by the mineowner for the purpose of or in connection with the drainage of the district of that authority.

The Doncaster Drainage Act area is bounded by the Rivers Aire and Ouse in the north, the River Trent in the east, the River Idle in the south and higher ground in the west, and a map showing this area is attached at Appendix A.

1.1.5.2 Water Companies

The local water company is responsible for the maintenance and improvement of public (not private) sewers and any associated land drainage problems.

A public sewer is a pipe that serves more than one property and if ownership of a sewer is in doubt the water company will advise on responsibility.

A pipe serving only one property is privately owned by the home owner, but once it crosses the property boundary this pipe becomes the responsible of the water company.

Public sewers are usually in roads or public open spaces, but may run through private gardens. The sewerage company has a right of access to these sewers for maintenance. If the water company carries out work on sewers on your land they must follow a code of practice, which is available from them.

1.1.5.3 Canal and River Trust (CRT)

The Canal and River Trust maintain a network of 2,000 miles of canals and navigable rivers in England and Wales.

Many of the navigations were built at the height of the industrial revolution and are home to over 2,700 listed structures, 50 scheduled ancient monuments and five UNESCO world heritage sites.

1.1.5.4 Highways Agency / County Councils

The Highways Agency is responsible for the maintenance and improvement of main trunk roads and motorways, and the local County Council is similarly responsible for other adopted public roads. Although it is not automatically the case, the appropriate road authority may also be responsible for the maintenance and improvement of drainage facilities associated with the road. If the ownership of a road or road drainage is in doubt the appropriate road authority will advise on responsibility.

1.1.5.5 Riparian Owners

Unless otherwise evidenced by deed the owner or occupier of land or property adjoining a watercourse is a 'riparian owner' under common law, and has certain rights and responsibilities. These rights and responsibilities are outlined in 'Living on the Edge', (Environment Agency, 4th Edition, 2013).

Even on those watercourse identified for maintenance by the EA or an IDB the riparian owner remains responsible for any field drainage outfalls, catch pits, watercourse access structures, stock or boundary fencing, maintaining or cutting hedges or trees to prevent growth over the watercourse, preventing damage to banks from livestock and machinery, and the clearance of any animal carcasses from watercourses. The riparian owner is also responsible for minor works to remove shoals on the ditch bed, banks slips, fallen trees, accumulations of rubbish, etc. which do not obstruct flow.

Those renting land should agree with the owner who manages these rights and responsibilities. For some activities the riparian owner will need permission from the relevant drainage authority.

1.1.5.6 Parish Councils, management companies and social landlords may also have responsibilities for land drainage infrastructure.

1.2 Danvm Drainage Commissioners

The Danvm Drainage Commissioners (DDC) are a non-governmental organisation formed by Constitution Order under the Land Drainage Act 1991 (as amended) in April 2012 as an IDB to work with other public bodies to provide a public service by continuing to manage water levels for the overall benefit of people, property, commerce, industry, agriculture and the aquatic environment within the defined Drainage District.

The Constitution Order permitted the amalgamation of the former Dearne & Dove IDB, Dun Drainage Commissioners, Knottingley to Gowdall IDB, and Went IDB.

The amalgamated board meets the requirements to enhance IDB capacity introduced to IDBs by the Minister following the Defra sponsored Review of IDBs in 2006.

The improvements to IDB management arrangements from amalgamation are considerable, improved access to professional engineering, financial and administrative services with a larger critical mass of expertise, improved organisational resilience, financial sustainability, and more transparent governance.

With the improved arrangements of an amalgamated board the DDC are well placed to take on a locally focussed, catchment wide, enhanced role as the operating authority of choice for Local Lead Flood Authorities and other partners.

The DDC is currently in the process of signing up to Public Sector Cooperation Agreements (PSCA's) with the EA which allows the EA to appoint the Board directly for undertaking works in the drainage district including work on main river.

The flood and coastal erosion risk management (FCERM) Framework within which the DDC will operate in the future is likely to be significantly different from that we see today and the improved management arrangements provide more capacity to adjust to new challenges, adapt in the face of climate change, and deal with future Government priorities.

The arrangements also tend to help with some of the difficulties in dealing with the continuous proliferation of legislation such as the Water Framework Directive 2000, Climate Change Act 2008, Flood Risk Regulations 2009, Eel Regulations 2009, and the Flood and Water Management Act 2010.

The IDB powers to undertake water level management activities are permissive and therefore not a legal duty. The IDB exercises a general power of supervision over all matters relating to water level management as well as choosing to maintain pumping stations and key ordinary watercourses to permit flow through the District and benefit flood risk management.

1.3 Purpose

The purpose behind this Strategy is to provide an overview of water level management within the Danvm IDD in order to progress towards a more sustainable water level management plan, reduce

costs and carbon footprint where feasible, and take into account the views of others for the wider benefit of the local community.

This is the first time in the history of the IDB that information relating to water level management from a catchment perspective has been collated and made publicly available. The overriding desire is to demonstrate and promote IDB activities in the Drainage District and provide information on the maintenance of IDB maintain Ordinary Watercourses and pumping stations.

The aim is to investigate and identify the potential for the following within the Drainage District:

- catchment users and potential future partnerships
- reducing pumping requirements across the district
- reducing maintenance of minor or secondary watercourses
- increasing the volume of storage within the system
- optimising gravity systems

Any options identified will be used and tested within a Drainage District hydraulic model against the impacts of climate change and vegetation management to provide an opportunity to review pump activities and visually demonstrate the benefits of water level management in support of flood risk management.

The options to be pursued will be subject to strict benefit cost analysis and consultation. This will include consideration of social as well as economic benefits. There will be opportunities for consulting with the public and relevant interested organisations. It will also be necessary to comply with current environmental legislation.

For convenience the Drainage District has been split into twenty sub catchments. These are not a representation of hydraulic catchments but simply represent areas that flow to common outlets in the watercourse system.

A separate overview of each sub catchment, which may contain multiple pumping stations and watercourses, is provided to briefly describe the sub catchment, identify assets, maintenance processes, environmental baseline, flood risk, links to flood management plans, and options.

Providing the relevant criteria, including benefit cost analyses, are met FDGiA may be available towards the costs of capital works resulting from these studies. Obtaining FDGiA may be facilitated by gaining other contributions from beneficiaries.

DDC work in partnership with many flood risk management and other authorities, including LLFA's, EA, Water Company's, Power Utilities, River Don Catchment Partnerships, River Restoration Groups, Environmental Groups, Natural England, etc.

Due to the complexity and interaction of the various drainage and flood management systems in the area it is important to for all parties to continue to cultivate partnership working opportunities wherever possible. All parties must promote a holistic approach and not look at matters in isolation.

DDC support flood risk management through partnership working and also recognise the social and economic benefits which can come from engaging with the public. Where possible DDC will seek opportunities to encourage community engagement and management.

Whilst different requirements can potentially lead to conflict it is also true that a range of outcomes can often be delivered more efficiently by working together.

It is important to recognise that all flood risk management, and other, authorities are being exposed to reduced budgets (budget squeeze) and it becomes ever more important to consider partnership working to deliver efficiencies and mitigate the effects of this.

A detailed Options Plan summarising the options for each sub catchment is annexed at Appendix C.

1.4 Outline Description of the Study Area

The IDD is predominantly rural but includes parts or all of the towns of Doncaster, Askern, Fishlake, and Stainforth. It covers some 21,500ha along the lower reaches of the rivers Don and Aire as shown on the map at Appendix A.

Parts of the IDD lie within the Humberhead Levels, which stretch between Doncaster and Scunthorpe, and from the Vale of York in the north to Retford in the south.

The Humberhead levels are low lying flat land, typically below mean high water spring level, through which the lower reaches of several main rivers, including the Trent, Don, Torne, Went, Idle, Aire, Ouse and Derwent flow into the Humber estuary. The combined catchment area of the major rivers comprising the Humber basin is considerable, with a freshwater drainage capacity of about one fifth of the area of England.

The climate of the levels is one of the most favourable for agriculture in northern England with relatively low rainfall and relatively high summer temperatures.

The distribution of soils reflects the glacial history of the area. Some 11,000 years ago the Humberhead Levels were covered by glacial Lake Humber. Lake deposits, silts and clays, were laid across the whole area forming the '25 ft drift'. As the ice melted the melt water deposited sheets of sand over parts of the lake deposits.

These glacial deposits have subsequently been modified by alluvium and peat deposits to the river floodplains, and artificial practices such as warping. Warping was a common practice in this area where high tides were allowed to flood onto the land to deposit thin layers of sediment. This process was carried out repeatedly to raise land levels and increase the fertility of these marshy areas.

The low lying floodplain between Doncaster and Goole is underlain by the Jurassic Sherwood Sandstone, a major aquifer extensively used for industrial, agricultural, public, and private potable water supplies.

To the west of the floodplain a 6km wide outcrop of Permian Magnesian Limestone forms a gentle ridge running north-south from Castleford to Sprotbrough and the groundwater base flow from this aquifer provides an important contribution to surface flows in the River Went.

Land levels at Doncaster are around 8.0m AOD but a significant proportion of the Levels are only 2 to 3 metres AOD. Due to the low lying nature of the natural flood plain, the high fluvial flows in the rivers from upstream areas, and the high tidal influences downstream of Doncaster, the area has a long history of widespread flooding.

Urban development along the rivers, together with years of work to drain land for agricultural use, improve navigation, and mitigate the effects of flooding, has significantly altered natural catchment processes.

The risk of flooding is typically reduced by the provision of artificial flood risk management systems which include raised defences, pumped drainage systems, washlands and overland flow routes.

The flood risk map (the area outline being provided by the EA) showing those areas which would be at risk of flooding from rivers and the sea if there were no defences is included at Appendix A'A'.

There is an extensive canal network in the wider area with the Sheffield and South Yorkshire Canal connecting Sheffield to Goole via the Aire and Calder Navigation.

From Rotherham boats can follow navigable sections of the River Don and canal cuts to Doncaster Lock where the canal separates from the river. The canal then splits at Kirk Bramwith to form the New Junction Canal, which flows north east to meet up with the Aire and Calder Navigation, and the Stainforth and Keadby Canal, which flows east to the river Trent.

As the canals were built legislation often required the creation of soak dykes alongside the canals to maintain drainage of the adjacent lands, and CRT remain responsible for the maintenance of these soak dykes and any ancillary infrastructure.

The DDC maintain over 400km (250 miles) of ordinary watercourses within the IDD and 46 pumping stations, 29 of which are maintained on behalf of the Coal Authority due to historic mining activities.

With a relatively generally high water table and low drainage margin the area generally requires a positive drainage systems to enable agricultural use and land development.

The land drainage systems are largely man made and designed to remove surface water and regulate ground water levels. These systems outfall into the River Don, the River Aire, their

tributaries or the Aire & Calder Navigation and these outfalls, typically part gravity and part pumped discharges, are dependent upon the river water levels.

Due to the complexity and interaction of the various drainage and flood management systems in the area it is important to for all parties to continue to cultivate partnership working opportunities wherever possible. All parties must promote a holistic approach and not look at matters in isolation.

The District includes Sites of Special Scientific Interest (SSSI) at Shirley Pool, Went Ings Meadows, Forlorn Hope Meadows, Brockadale and Denaby Ings as well as a number of non-designated local wildlife sites. These are described in detail in the Strategic Environmental Assessment Scoping Report at Appendix D.

1.5 Past and Future Mining Activities

For nearly a century deep coal mining has been carried out under a wide area of low-lying land to the north and east of Doncaster and, as a result, parts of the DDC district have been subject to subsidence.

In 1926, due to the associated ill effects of subsidence on the land drainage, which if not corrected would lead to permanent flooding or waterlogging of an extensive area around Doncaster, the Home Office appointed a Royal Commission report into mining and drainage at Doncaster.

The findings of the Commission were instrumental in the passing of the Doncaster Drainage Acts of 1929 and 1933. These Acts, in effect, placed a legal obligation on mine owners to execute land drainage works necessitated by subsidence within the area defined by the Acts.

As a result mine owners, the National Coal Board. UK Coal, Hatfield Colliery and the Coal Authority have paid for changes to land drainage systems and the construction and maintenance of a number of pumping stations. Where appropriate pumping stations have also been constructed and maintained with contributions from other authorities. The percentage of these contributions can be seen within the Shire Group of IDBs forward plan at Appendix B.

Where stations have been jointly funded the historic agreements outlining the percentage contributions, are often not well documented, and do not necessarily provide a reliable indicator for future funding provision. In the future the requirements and funding position of the contributors may alter as they are exposed to changing governance and reducing budgets (budget squeeze).

Mining is currently taking place from Kellingley Colliery near Hensall (UK Coal) and Hatfield Colliery near Fishlake.

Recent mining from Kellingley Colliery has affected the land drainage systems in the Great Heck and Beal Lane areas and proposed mitigation works are in the process of being agreed with UK Coal.

It is likely that mining operations at these collieries will cease by the end of 2016 although mitigation works to the land drainage systems will be carried out after that date. Responsibility for ongoing operation and maintenance of these works will initially lie with the mine owners and will fall to the Coal Authority once the collieries have closed.

Strategic options within areas of current mining have not been considered due to the changes that could result from mining subsidence. However, these areas could be reviewed once the effects of mining activities are finalised (see **Error! Reference source not found.**).

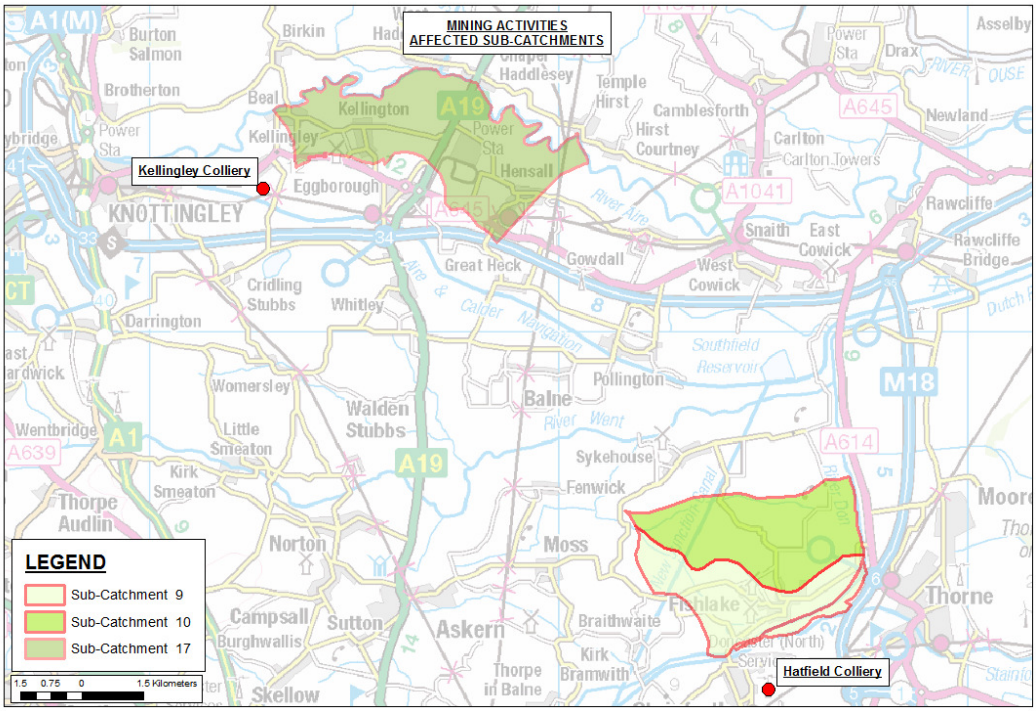


Figure 1-1: Sub-catchments affected by Current Mining Activities

1.6 Existing Capital Works Forward Plan

The Forward Plan includes an estimated expenditure of £12.6m in the 10 years to 2025, with the refurbishment of 25 pumping stations (budget estimated cost £8.6m) and the replacement of 4 pumping stations (budget estimated costs £4m).

A copy of the existing DDC Capital Works Forward Plan can be found at Appendix B.

1.7 Current Maintenance Activity and Asset Condition

1.7.1 Ordinary Watercourses

Maintenance typically consists of flailing (or grass cutting) of watercourse banks, deweeding (or weed cutting), hand work, debris or blockage clearance, and bush and tree clearance. Desilting (or the removal of "soft" silt material from the watercourse bed) is not currently a planned maintenance activity and any work within the bed of the channel should be carefully considered so as to avoid environmental deterioration and potential impacts on invertebrates, and not to undermine the banks of the watercourse or disturb any toe piling which is reducing the risk of bank failure.

The images below demonstrate handwork activities, flailing activities which are usually undertaken with a tractor and specialist flail mowing attachments, and deweeding activities which are usually undertaken with an excavator and specialist deweeding bucket attachments.

The DDC implements a prioritisation regime for all maintained ordinary (open channel) watercourses. The watercourses are classified as Major (priority), Secondary and Minor and indicated on maintenance plans as red, amber and green. The maintenance plans can be viewed via the Shire Group website. The extract below outlines the type of maintenance undertaken as shown in Appendix G and taken from the DDC 'Maintenance Statement'.

'The Maintenance Plan is dynamic, and may change due to weather patterns, ground conditions, available access, and benefit. If the Board chooses to include an Ordinary Watercourse as part of its annual maintenance plan, it is because it provides water level management benefits to the Drainage District. For clarity, the Board does not 'adopt' any watercourse as this implies ownership.

Ordinary Watercourses identified for maintenance shall be those that generally serve more than one riparian landowner within its catchment, those that present a long term risk to households without regular maintenance, and those arteries flowing to pumping stations.

The level of maintenance undertaken on identified Ordinary Watercourses shall be at the discretion of the IDB and will normally be to de-weed the channel and flail the appropriate bank to improve the line of sight for de-weeding machine operations.'

Through maintenance of the channel system and pumping stations the Commissioners seek to maintain a general standard capable of providing flood protection to agricultural land and developed areas of 1 in 10 and 1 in 50 years respectively. This return period cannot be taken literally and should be considered as a chance of some overspilling from the system taking place each year as being 10% and 2% respectively.

1.7.2 Pumping Stations

Pumping stations are essentially a mechanical means of lifting water from a low level to a higher level, as illustrated in Figure 1.7 below. Over the years this has been achieved through a variety of products such as windmills, steam pumps, diesel pumps, Archimedean screw pumps, and electric pumps.

A pumping station is needed where there is an inadequate drainage margin, ie a watercourse is unable to flow sufficiently by gravity, or where the water level in a watercourse is below the typical water level in another watercourse to which it must discharge.

The hydraulic design of a land drainage pumping station is based on catchment rainfall and providing an adequate drainage margin for the lowest land levels within the catchment (to permit the discharge of field under-drainage systems and allow air into soils).

Current pumping station operation is usually for water levels to be monitored via sensors (often either side of the weed screen) with electronic controls starting and stopping the pumps to maintain pre-defined water levels in the watercourse. Telemetry systems may also be installed to monitor and control the station remotely (via text alarms to mobile phones, laptops, office computer systems).

On first appearances a pumping station may seem relatively small. However, these first appearances can be deceiving as, apart from a kiosk or brick building (also known as a control house), which is the above ground and immediately visible element, the majority of the pumping station structure is below ground.

The below ground elements typically consists of a sump (inlet), discharge bay (outlet), and foundations. These elements are normally the most costly part of the pumping station to provide and, dependant on the soils encountered, some foundations can extend up to 20 metres (66 foot) below ground level.

The sump is normally designed to house the pumps that will lift the water through pipework and discharge to a higher level. A weed or trash screen is usually installed at the inlet to protect the pumps from damage due to waterborne debris. Debris or weed caught on the screen is either removed by manual raking or mechanical weed screen cleaners.

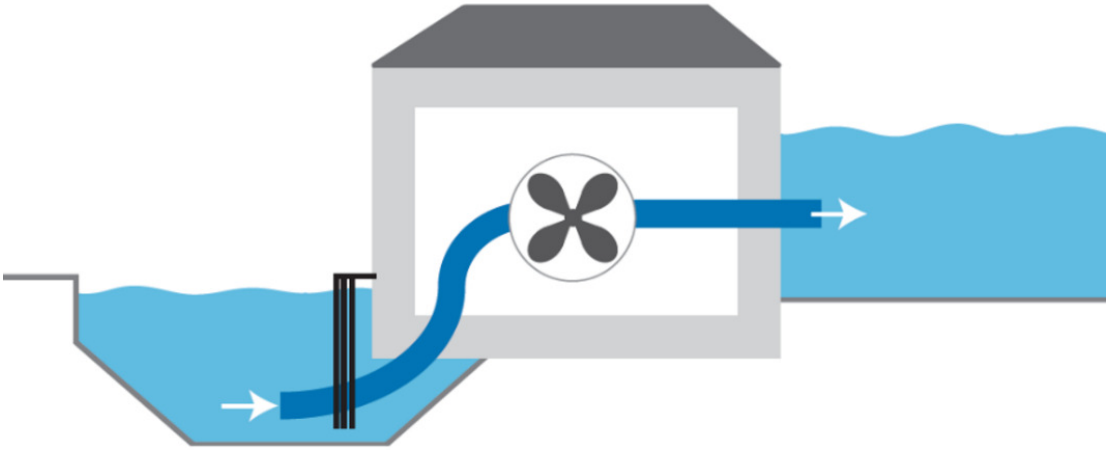


Figure 1-2: Simple illustration of a Pumping Station[1]

The discharge bay typically consist of pipework with either a horizontal end piece or with a 90º bend to dissipate the energy of flow and reduce the risk of erosion, as well as a series of “non-return” valves (air release valves, flap valves etc.) within the pipework to prevent water from the higher level returning to the lower level.

The control house normally contains the electronic equipment to control the pumping station, ie an incoming electricity supply, an electricity meter, the main pump control panel, and any control panels for automatic weed screen cleaners and telemetry systems.

The most important element of the control house (and the entire pumping station) is the incoming electricity supply (or diesel stock). This is often in the form of a pole mounted transformer outside the control house with a feed into the station, or via a ground mounted transformer adjacent to the control house.

Pumping station maintenance may be categorised into three types:

1.7.2.1 Type A, General maintenance / Inspection

Visual only and does not include any dismantling or removal of any components. May take place monthly and cover all aspects of health & safety and maintenance visible without interruption of the operation of the station. May include:

[1] Why are IDBs so Important to the UK, Association Drainage Authorities, 2013

- Grass cutting around the compound for access, manual handling of weed/debris including raking the screen and minor repairs.
- Assessing whether the access track, perimeter fencing, compound access, control house, handrails, sumps covers, flap valves, lighting, and safety signs are satisfactory and secure, require Minor Works or Capital Works, or are unsafe.
- Checking that the control panel (stop/start/reset and warning issues) and pumps are operational, obtaining electricity meter readings and pump hours run.

Any defects identified during a General Inspection may trigger a Non-Intrusive inspection or Intrusive Inspection.

1.7.2.2 Type B, Non-Intrusive Mechanical, Electrical and Structural Inspection

A Non-Intrusive Inspection may be triggered by a defect being identified during a General Inspections but, more normally, may take place annually.

Inspection may include the opening of control cabinets and the temporary isolation of electrical supplies to certain parts of the asset, but does not include any dismantling or removal of components.

The Inspection is usually undertaken by qualified mechanical, electrical or structural engineers without significant interruption of the operation of the station.

Any defects identified during a Non-Intrusive Inspection may trigger an Intrusive Inspection

1.7.2.3 Type C, Intrusive Mechanical, Electrical and Structural Inspection

An Intrusive Inspections may be triggered by a defect identified during General or Non-Intrusive Inspections but, more normally, may take place on a five yearly cycle.

An intrusive examination may include isolation and the dismantling and removal of components if required.

The Inspection is usually undertaken by qualified mechanical, electrical or structural engineers and may significantly interrupt the normal operation of the station.

The DDC have in place a programme for all pumping stations to be inspected dependant on a priority ranking determined by the DDC as indicated in the following table.

Table 1-1: DDC - Planned Preventative Maintenance Regime Ranking

Priority Ranking	Sub-Catchment	Pumping Stations
1	Sub-Catchment 2	Adwick Mill PS, Goosepool PS, Tilts PS, Tilts Hills PS, Hall Villa PS, Toll Bar Rugby Club PS
2	Sub-Catchment 10	Blackshaw Clough PS
3	Sub-Catchment 11	Towns Clough PS
4	Sub-Catchment 9	Taining Drain PS, Church Walk PS, Sour Lane PS

Priority Ranking	Sub-Catchment	Pumping Stations
5	Sub-Catchment 7	Kirk Bramwith PS, Thistlegoit PS, Haywood PS
6	Sub-Catchment 5	Tilts Bridge PS, Thornhurst PS, Duckholt PS
7	Sub-Catchment 4	Norwood PS, Sandall Nooking PS, Flood Evacuation PS
8	Sub-Catchment 13	Norton Common PS
9	Sub-Catchment 15	Beal Lane Booster PS, Beal Lane PS, Southfield PS, Whitley Bridge PS, Rampart PS
	Sub-Catchment 16	Town Drain PS, East Ings PS, Woodholmes PS
10	Sub-Catchment 14	Lake Drain PS, Longwood PS, Jenny Lane PS, Fulham Lane PS, Blowell No.2
11	Sub-Catchment 19	Goosehole PS
12	Sub-Catchment 3	Arksey PS
13	Sub-Catchment 12	Balne Fleet PS, Park Farm PS
14	Sub-Catchment 6	Reedholme PS
15	Sub-Catchment 1	Ackworth School PS
16	Sub-Catchment 18	Gowdall PS
17	Sub-Catchment 17	Hensall PS, Old Hee PS
18	Sub-Catchment 20	Lake Outfall

1.8 Catchment Flood Management Plans (CFMPs)

The EA have prepared CFMPs as a long term planning document describing how they propose to manage flood risk within defined catchments.

The CFMPs relevant to the areas covered by this report are:-

- River Aire (Lower Aire sub area) December 2010
- River Don (Barnsley & Mexborough, Doncaster & Lower Don sub areas) December 2010

1.9 Flood Risk Management Plans (FRMPs)

Under the Flood Risk Regulations 2009 the EA is required to prepare FRMPs to show where and how flood risk from main rivers, the sea and reservoirs is to be managed to provide most benefit to communities and the environment.

The Humber River Basin FRMP is currently (January 2015) in draft form and is at the consultation stage.

The area covered by the Humber River Basin FRMP includes all the sub-catchments considered in this report. It describes in brief ongoing and agreed measures the Agency is taking to manage flood risk as well as proposed measures over three periods, 2015-2021, 2021-2027 and 2027-2032.

1.10 CFMPs and FRMPs Relevant to the Sub-Catchments

The table below identifies the relevant EA CFMP and sub-area, and EA FRMP sub-area for each of the sub-catchments assessed in this report.

Table 1-2: DDC - Relevant CFMPs & FRMPs

Sub-Catchment	Pumping Stations	CFMP & Sub-Area	Humber FRMP Sub-Area
Sub-Catchment 1	Ackworth School PS	Don - Lower Don	Don & Rother
Sub-Catchment 2	Adwick Mill PS, Goosepool PS, Tilts PS, Tilts Hills PS, Hall Villa PS, Toll Bar Rugby Club PS	Don - Doncaster	Don & Rother
Sub-Catchment 3	Arksey PS	Don - Doncaster	Don & Rother
Sub-Catchment 4	Norwood PS, Sandall Nooking PS, Flood Evacuation PS	Don - Doncaster	Don & Rother
Sub-Catchment 5	Tilts Bridge PS, Thornhurst PS, Duckholt PS	Don - Doncaster	Don & Rother
Sub-Catchment 6	Reedholme PS	Don - Doncaster	Don & Rother
Sub-Catchment 7	Kirk Bramwith PS, Thistlegoit PS, Haywood PS	Don - Lower Don	Don & Rother
Sub-Catchment 9	Taining Drain PS, Church Walk PS, Sour Lane PS	Don - Lower Don	Don & Rother
Sub-Catchment 10	Blackshaw Clough PS	Don - Lower Don	Don & Rother
Sub-Catchment 11	Towns Clough PS	Don - Lower Don	Don & Rother
Sub-Catchment 12	Balne Fleet PS, Park Farm PS	Don - Lower Don	Don & Rother
Sub-Catchment 13	Norton Common PS	Don - Lower Don	Don & Rother
Sub-Catchment 14	Lake Drain PS, Longwood PS, Jenny Lane PS, Fulham Lane PS, Blowell No.2	Don - Lower Don	Don & Rother
Sub-Catchment 15	Beal Lane Booster PS, Beal Lane PS, Southfield PS, Whitley Bridge PS, Rampart PS	Don - Lower Don	Don & Rother
Sub-Catchment 16	Town Drain PS, East Ings PS, Woodholmes PS	Aire - Lower Aire	Aire & Calder
Sub-Catchment 18	Gowdall PS	Aire - Lower Aire	Aire & Calder
Sub-Catchment 19	Goosehole PS	Don - Doncaster	Don & Rother
Sub-Catchment 20	Lake Outfall PS	Don - Barnsley & Mexborough	Don & Rother

1.11 Local Authority Future Development

Doncaster Metropolitan Borough Council is the principal local authority within the DDC area with Selby District Council covering the northern part of the district.

Within the DMBC area residential development, as outlined in the Doncaster Local Development Framework (LDF), is proposed at Askern, Carcroft, and Adwick. There are no significant major employment areas within the district.

The Selby DC Strategic Housing Land Availability Assessment (SHLAA) shows potential residential development in Eggborough, Hensall, Kellington and Whitley with employment development at Eggborough.

In assessing the feasibility of future works to DDC infrastructure due cognisance should be taken of the then current planning policies of the local authorities.

1.12 Protection of the Environment

The Water Framework Directive (WFD), which came into force in December 2000, is a European Directive which requires the introduction of strategic planning measures to manage, protect and improve the water environment. The WFD was transposed into UK legislation in 2003 and resulted in the EA being made responsible for the production of River Basin Management Plans (RBMPs).

The Danvm IDD is situated within the Humber RBMP. The RBMP identifies the current quality of water bodies in the district and sets objectives for making further improvements to their ecological and chemical quality.

Within the Danvm IDD there are a number of waterbodies which have been classified under the WFD and are detailed within the Humber RBMP. Some of these waterbodies are divided into a number of sections due to changes in their biological, chemical and hydrological characteristics throughout their length.

The majority of these classified waterbodies within the IDD are designated as artificial or heavily modified water bodies (AWB/HMWB) as they have been created or significantly altered through human activity (for example by flood risk management, urbanisation, land drainage and navigation). Further details are contained in the SEA Scoping Report at Appendix D.

AWB/HMWBs have a target to achieve Good Ecological Potential (GEP) and the EA have identified specific mitigation measures and environmental improvements for each AWB/HMWB to reduce the existing ecological and hydromorphological impacts on the waterbody and achieve GEP. These mitigation measures/environmental improvements are listed in the RBMP.

Whilst these AWB/HMWBs can benefit the environment and ecosystems and create important habitats, they must be managed in a way that ensures they continue to serve their primary purpose, albeit whilst making the most of opportunities to also provide ecological and amenity benefits.

Potential impacts on WFD objectives are identified in the environmental appraisal and we should not carry out actions that would incur a deterioration in ecological status of a waterbody.

Future works may provide an opportunity to carry out mitigation measures or environmental improvements that have been identified as necessary to reduce the existing ecological and hydromorphological impacts on waterbodies and contribute towards achieving a GEP.

1.13 Strategic Environmental Assessment (SEA)

SEA is a systematic process for anticipating and evaluating the environmental consequences of plans and programmes prior to decisions being made. The purpose of SEA is to provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to promoting sustainable development.

There is no legal requirement to undertake an SEA for this WLMS as it is not required by legislation, regulation or administrative provision. However, the WLMS will clearly help set the framework for future water level management planning, have the potential to result in significant environmental effects and, as a result, we have followed a SEA approach.

More information about the SEA process and the key environmental characteristics of the drainage district can be found within the SEA Scoping Report at Appendix D.

The SEA has been developed concurrently with the WLMS and this report includes the following elements of the environmental assessment:

- Identification of environmental opportunities and constraints (within each sub catchment chapter)
- Assessment of impacts of options (chapter 23)
- Identification of potential mitigation and enhancements (chapter 23)
- Identification of further assessment, survey, consenting requirements (chapter 23)
- Screening assessment with regards to the Habitats Directive (Appendix E)

1.14 Data & Licence Information

Information requested on behalf of the Shire Group of IDBs to assist with the production of Water Level Management options included:

- Local Development Plans and core strategies.
- Future planned mining works
- ArcGIS shape files highlighted land ownership / areas of responsibility
- ArcGIS shape files of maintained assets in conjunction with future maintenance plans and any legal requirements of these assets
- Current Water Level Management Plans

The information requested has been directly fed into the proposed WLMS options (see Figure 1-1) and is represented in each individual option plan seen within Appendix C.

Data supplied to the Shire Group of IDBs by others is recorded and kept within the JBA Consulting Data Register, '2013s7706 - Project Data Register v2.0'. This data will be retained within the job file until completion at which time it will be deleted.

The licences shown in Table 1-3 are relevant to the contents of the report.

Table 1-3: DDC - Licence Agreements

Organisation	Data	Licence Reference (Agreement)
Danvm Drainage Commissioners	OS10k Mapping	Reproduced by permission of Ordnance Survey on behalf of HMSO. © Crown copyright and database right 2014. All rights reserved. Ordnance Survey Licence number 100026380.
Geomatics Group	LiDAR	Special Licence - Non-Commercial (FRA/FCA-A/SFRA/other Strategic Studies) *LiDAR data used has a vertical accuracy of between 5 and 15cm and a spatial resolution of 2m.*

1.15 Consultation

Following initial discussions with the Shire Group of IDBs we collated a list of other organisations, as indicated below, including Local Authorities, water companies and other local and national government bodies who might be affected as a result of the options contained within this report.

The Coal Authority	Coal Authority
Environment Agency	Environment Agency
Canal & Rivers Trust	Canal & River Trust
Yorkshire Water	YorkshireWater
Doncaster Metropolitan Borough Council	Doncaster
Wakefield Council	wakefield council working for you
Rotherham Metropolitan Borough Council	Rotherham Metropolitan Borough Council Where Everyone Matters
Barnsley Metropolitan Borough Council	BARNSLEY Metropolitan Borough Council
Selby District Council	SELBY DISTRICT COUNCIL
North Yorkshire County Council	North Yorkshire County Council
East Riding of Yorkshire Council	EAST RIDING OF YORKSHIRE COUNCIL
Eggborough Power Ltd	Eggborough Power Ltd

We consulted the organisations indicated and used their responses in the option selection process as indicated in Figure 1-3. Moving forward, a far wider discussion and consultation will be required if options are to be developed towards implementation.

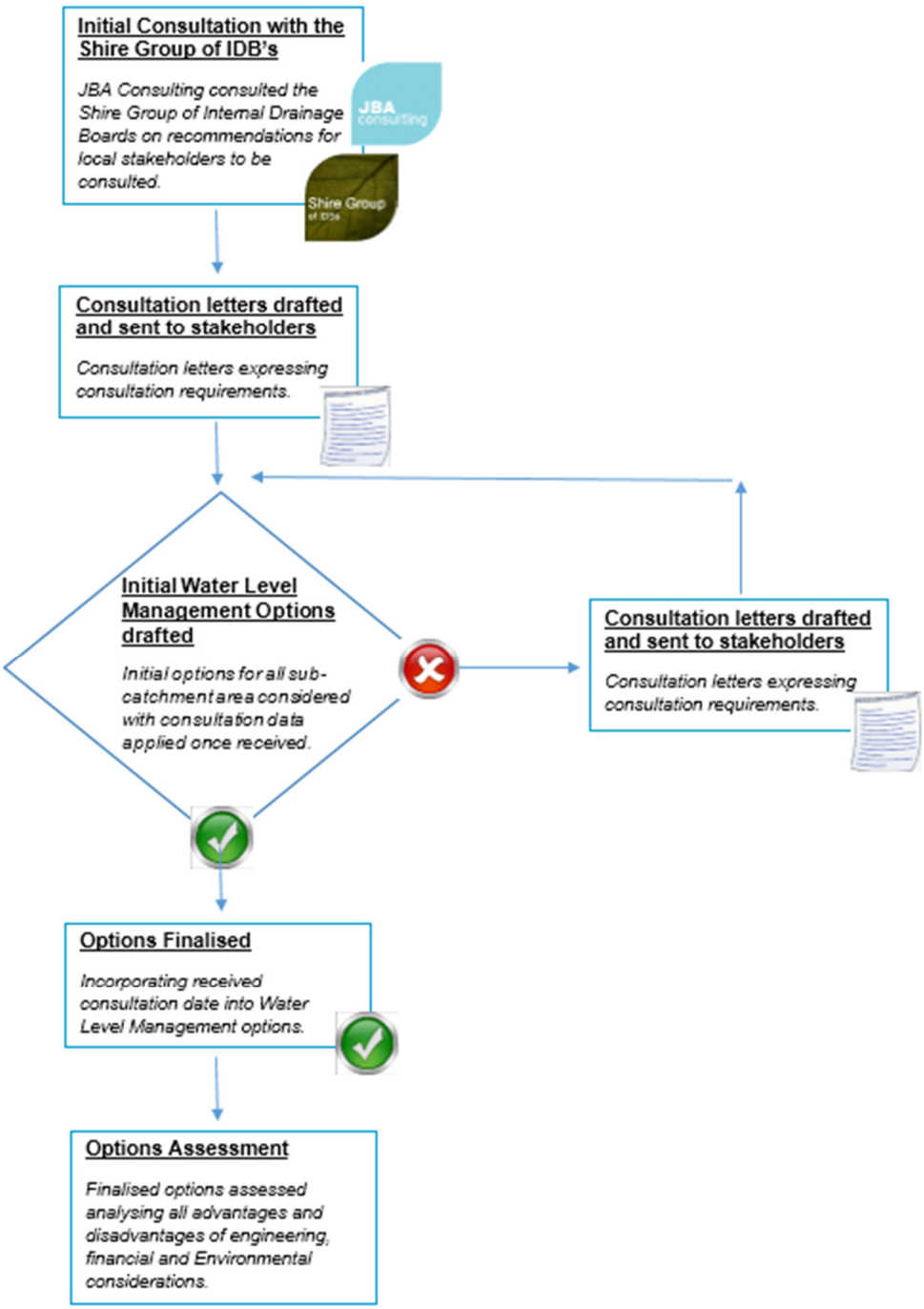


Figure 1-3: Stakeholder Consultation and Option Selection

1.16 Approximate Running Costs & Forward Planning

The pumping station data include annual running costs. These have been obtained as follows: -

- Coal Authority - Electrical Financial Statement 2015-2015 (CA data)
- Danvm DC Pumping Stations Running Costs 2013-2014 (IDB data)

A copy of these documents is included in Appendix B.

These costs should only be used as a guide to actual costs. Relevant costs over a longer period should be obtained when assessing life time costs of options.

Also in Appendix B is the Danvm DC Forward Plan April 2013 (AFCE) from which the proposed timing of capital expenditure has been obtained.

1.17 Total Catchment Management

Consideration should be given to the Total Catchment Management (TCM) ethos. At present all stakeholders operate largely independently, not fully taking into account, recognising, or accepting that successful catchment management should address inter-dependability on the requirements of others. There are many reasons why this may not happen as stakeholders often have different drivers especially when Public Limited Companies (PLCs) report to shareholders as opposed to Non-Governmental Organisations (NGO's) and Public Bodies reporting to central and local government.

Ideally, stakeholders should consider the alignment of Strategic Asset Management Plans (SAMPs) and AMPs of others and then produce an overarching SAMP document for all. We accept that facilitation of this process would be challenging but we believe it would be advantageous for all concerned. Recognition of localism and the present Government vision of local people making local decisions on expenditure is valid and could be explored further. The release of BS ISO 55000:2014 family of Standards on Asset Management gives an opportunity to encouraging all stakeholders to work together collaboratively rather than being independent and working in isolation.

We understand that there is a view within IDBs to move towards the creation of Water Management Boards which would eventually have the powers to expand their operations beyond existing IDB districts.

2 Strategic Options

2.1 Options Proposed for Consideration

The following options have been developed to investigate cost and carbon usage savings in operation, maintenance and renewal of pumping stations and watercourses currently maintained by the DDC.

2.1.1 Continue as Present

Under this option all measures, existing maintenance and pumping regimes currently provided in the catchment area will continue unaltered.

This option has only been considered if the other options are deemed, due to the catchment size, stakeholder interests, watercourse priority, local development plans or other issues identified within Section 3, not feasible. Where other options are feasible this option has been omitted from the sub-catchment options summary.

Table 2-1: DDC - Continue as Present - Advantages and disadvantages

	Advantages	Disadvantages
Continue as Present	Familiarity	No reduction in costs or carbon footprint
	Planned maintenance and capital works continue	Maintenance and capital works do not reduce
	No additional construction costs	No health & safety improvement

2.1.2 Discharging water by gravity

The option of a gravity discharge is preferred to a pumped discharge due to the significantly lower costs. Whilst this is always the starting point for a discharge, the existing topography and ground levels often means that a gravity outfall cannot provide an adequate discharge, and a pumped discharge may also be required.

However, if it feasible to supplement a pumped discharge with an element of gravity discharge this may tend to reduce operational costs and increase the life of the pumping station.

Table 2-2: DDC - Discharging Water via Gravity- Advantages and disadvantages

	Advantages	Disadvantages
Discharging water via gravity	Simplicity	Increased risk of outfall siltation
	Lower costs	Risk of gravity outfall being 'locked off' for long periods by high downstream levels
	Reduced carbon footprint	
	Environmental benefits (passage when gravity outfall operational)	
	May work alongside an existing pumping station, i.e. high and low level system	
	Increased life span of any pumping station	

2.1.3 Decommission Pumping Station

We have considered the decommissioning of a pumping station when water from the area it serves can be diverted into an adjoining sub-catchment.

This new diversion would require civils and earthworks, the redundant station would need decommissioning and the destination station would need works to increase the pumping capacity.

This option is to be carried out in conjunction with works on the drainage system.

Table 2-3: DDC - Decommission Pumping Station - Advantages and disadvantages

	Advantages	Disadvantages
Decommission Pumping Station	Reduced operational, maintenance and capital costs	Costs of diversion
	Savings available for use elsewhere in the catchment	Costs incurred for decommissioning
		Costs incurred to up-grade the destination station
		Increased operational, maintenance and capital costs at the destination station

2.1.4 In-line storage via widening of 'priority' watercourse

We have considered widening all priority watercourses which are the main carriers within a catchment, including the main approach drains to pumping stations, and other significant drains due to their situation and the areas which they serve.

Widening may be by the addition of a berm to the profile of the channel. This is however subject to further study and modelling of a catchment.

There may also, subject to further study and modelling, be an opportunity to provide in-line storage by working with land owners to introduce the temporary storage of water on lower lying land.

Increased in-line storage may improve the viability of a gravity outfall or help to facilitate cheaper rate / more efficient night time pumping (lower costs and less pump on/off cycles). It may also enable the establishment of more natural channels with associated biodiversity improvements and reductions in maintenance.

Table 2-4: DDC - In-line storage via widening - Advantages and disadvantages

	Advantages	Disadvantages
In-line storage via widening of watercourse	reduced pumping and maintenance costs	Costs for increasing channel size
	Reduced environmental impact / Increase in biodiversity	Increased land take
	Reduced channel maintenance	
	Improved health & safety during maintenance	
	Increased life span of pumping station	
	Reduced carbon footprint	

2.1.5 In-line storage via installation of control structures

Watercourse control structures, such as penstocks or tilting weirs, would be installed to temporarily hold water upstream (raise upstream water levels) and better utilise the inherent storage within the existing open channel.

The control structures would be controlled automatically, via telemetry, with manual override available. The control structures would normally lower, allowing the retained water to flow through the system, to achieve a more efficient gravity discharge or optimise pumping arrangements.

In order not to increase flood risk the control structures would overtop or lower if the free board limit is reached (allowing water to flow through the system and be discharged) and the control structures would also be overridden to release any retained water in advance of heavy rainfall or flood conditions.

Table 2-5: DDC - In-line storage via control structures- Advantages and disadvantages

	Advantages	Disadvantages
In-line storage via control structures	Reduced operational and maintenance pump costs	Costs incurred for civils and earthworks.
	Reduced environmental impact / Increase in biodiversity	Increased maintenance costs for control structures and channel
	Water can be controlled with greater flexibility	Potential obstruction to flow
	Increased life span of pumping station	Potential increased siltation
	Reduced carbon footprint	Potential increase in flood risk

2.1.6 Water containment via non-return valves

Strategically located non-return valves, flap valves, or penstocks would be installed to control the flow of water between identified boundary points. This option could be implemented to prevent flooding backing up drainage systems into less affected areas.

Table 2-6: DDC - Water containment via control structures- Advantages and disadvantages

	Advantages	Disadvantages
Water containment via non return valves	Control of flood water between identified boundary points	Installation and maintenance costs
	Potential reduction in flood damage	"You flooded us to protect them" arguments

2.1.7 Reduction in maintained watercourse length

The DDC currently maintain 416km of watercourse incurring a significant cost. This option has been considered to explore the possibility of reducing this annual cost by diverting the surface water within a catchment along a shorter length of watercourse without reducing flood protection and with flows still reaching the destination outfall.

However, as the majority of the IDD is situated within low lying land with marginal variations in bed levels, this option is unlikely to be beneficial unless areas are situated directly adjacent or in close proximity to one another.

Table 2-7: DDC - Reduction in maintained watercourse length- Advantages and disadvantages

	Advantages	Disadvantages
Reduction in maintained watercourse length	Reduced maintenance costs	Costs incurred for civils and earthworks
	Increased life span of machinery	
	Reduced future capital costs of remedial works	

2.1.8 Removal of piped watercourses

This option is the removal of piped watercourses to create an open channel (daylighting).

Throughout the IDD there are a large number of culverts, access culverts and pipelines. Where these are monitored or maintained by the DDC it is possible they could be removed and maintained as an open channel.

The reintroduction of open channels would not result in a change of ownership but the DDC would need to work with the individual land owners who may feel disadvantaged by this and the potential loss of land and associated income.

Table 2-1: DDC - Removal of piped watercourses- Advantages and disadvantages

	Advantages	Disadvantages
Removal of Piped Watercourses	May reduce flood risk (increased storage)	Associated civils and earthworks costs
	Reduced blockage potential	The profile (depth/width) of an open watercourse may not be maintainable or stable
	Reduced maintenance costs (a pipeline costs more than an open channel watercourse)	Health and safety issues (open watercourse)
	Reduce Health & safety issues (no pipeline)	

2.2 Options Currently Being Tested

2.2.1 Dual Tariff Pumping

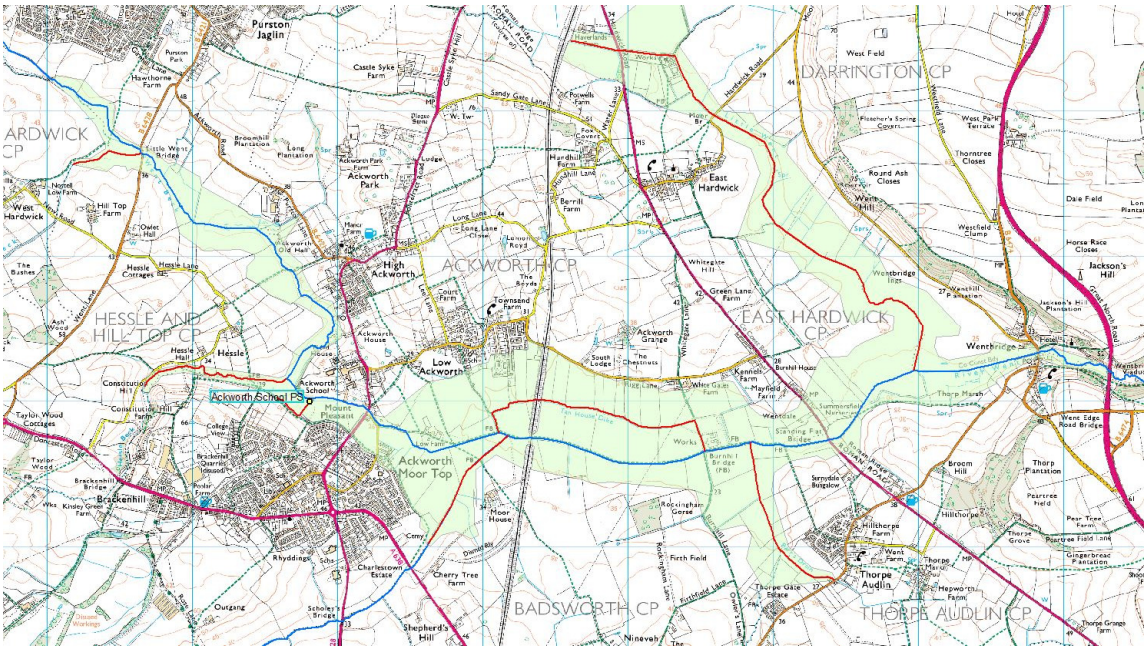
The DDC are currently reviewing the cost benefit of switching all pumping stations onto dual tariff arrangements allowing for peak pumping to be carried out at lower tariff times. Below is a table of the current electrical supply detail of pumping stations within the DDC district as of October 2014. This has not been assessed or included for further study in table 24-3,

Table 2-2: DDC - Electricity Records

Pumping Station	Dual Tariff (night/day)	Available Capacity (KVA)	Pumping Station	Dual Tariff (night/day)	Available Capacity (KVA)
Ackworth School Pumping Station	No	100	Norton Common Pumping Station	Unknown	-
Adwick Mill Pumping Station	No	100	Norwood Pumping Station	Unknown	-
Almholme Pumping Station	Unknown	-	Old Hee Pumping Station	Yes	-
Arksey Pumping Station	Unknown	-	Park Farm Pumping Station	Yes	-
Balne Fleet Pumping Station	Yes	-	Rampart Pumping Station	Yes	-
Beal Lane Booster Pumping Station	Unknown	-	Reedholme Pumping Station	Unknown	-
Beal Lane Pumping Station	Yes	-	Sour Lane Pumping Station	Yes	-
Blackshaw Clough Pumping Station	Yes	63	Southfield Lane Pumping Station	Yes	100
Blowell No.2 Pumping Station	No	-	Taining Drain Pumping Station	Yes	2
Bramwith Rands Weed screen Cleaner	No	-	Thistlegoit Pumping Station	No	100
Church Walk Pumping Station	Yes	100	Thornhurst Pumping Station	Yes	-
Depot	No	-	Tilts Bridge Pumping Station	Unknown	-
Duckholt Pumping Station	Unknown		Tilts Hills Farm Pumping Station	Unknown	-
East Ings Pumping Station	No	-	Tilts Pumping Station	Unknown	-
Fulham Lane Pumping Station	Unknown		Toll Bar Rugby Club Pumping Station	Unknown	-
Goosehole Pumping Station	Unknown		Town Drain Pumping Station	Yes	

Goosepool Pumping Station	Yes	100	Towns Clough Pumping Station	Yes	20
Gowdall Pumping Station	Yes	-	Whitley Bridge Pumping Station	Yes	5
Hall Villa Pumping Station	Unknown	-	Woodholmes Pumping Station	Yes	
Haywood Pumping Station	Unknown	-	Longwood Pumping Station	Yes	-
Hensall Pumping Station	Yes	247			
Jenny Lane Pumping Station	No	-			
Kirk Bramwith Pumping Station	Yes	540			
Lake Drain Pumping Station	Unknown	-			
Lake Outfall Pumping Station	Yes	18			

3 Sub-Catchment 1 - Ackworth



3.1 Sub-Catchment Description

The sub-catchment lies on both sides of the River Went, a designated main river, which flows in an Easterly direction from Featherstone through Ackworth to Wentbridge and acts as the main carrier for the drainage system. The A1 bounds the sub-catchment to the East.

The area is rural in nature and consists of gently sloping arable and pasture fields within the River Went valley adjacent to the villages of Ackworth, East Hardwick and Wentbridge. The sub-catchment contains several farms, and properties on the periphery of Ackworth, including Ackworth School, are located adjacent to the boundary.

The A628, A639 and the A1 pass through the sub-catchment.

The Sheffield to Church Fenton railway line passes through the area in a North-South direction and cross the River Went and a DDC managed watercourse, Tan House Dyke.

All watercourses within the sub-catchment discharge into the River Went either by gravity or pumping. These watercourses have been categorized by using the DDC watercourse prioritisation regime as secondary and minor and are all of an open channel profile.

Ackworth School Pumping Station is located in the South West of the sub-catchment and is funded 100% by the CA towards capital works and maintenance.

Table 3-1: DDC - Sub-catchment 1 - AFCE Overview

Pumping Station	Contribution breakdown (%)	Annual Running Costs (£) CA Data	Annual Running Costs (£) IDB Data	Catchment Area (ha)	Capital expenditure due (year)
Ackworth School PS	CA - 100	580.00	1,909.00	5	2025 / 26

3.2 Stakeholder Assets

The EA manage the River Went, some outfalls to the River Went, a viaduct and pump house, all located around the village of Wentbridge.

Yorkshire Water (YW) manage the sewer system.

The roads authority is responsible for the roads and the culverted drain crossings of DDC managed watercourses.

Network Rail, the authority responsible for the United Kingdom's railway network, is responsible for the railway infrastructure, including crossings over the River Went and Tan House Dyke.

3.3 Current Maintenance Prioritisation

The sub-catchment is currently ranked as 15 using the DDC 'Planned Maintenance Regime' as identified within section 1.7.

3.4 Environmental Baseline

The sub-catchment contains the communities and infrastructure described above.

Wentbridge Ings Site of Special Scientific Interest (SSSI) and Brockadale SSSI are located adjacent to the sub-catchment boundary.

Wentbridge Ings SSSI lies on the floodplain of the Little Went, a tributary of the River Went. The underlying geology of the site is Middle Coal Measures sandstone overlain with river alluvium and the main interest of the site centres on the vegetation associated with two spring lines. The spring-fed marsh and wet grassland supports a good diversity of wetland plant species.

Brockadale SSSI comprises the narrow, steep-sided valley of the River Went which cuts through Magnesian Limestone rocks. The valley slopes include occasional outcrops and crags which are, for the most part, wooded but the site is designated for its species-rich limestone grassland.

Two Grade II listed structures are Went Bridge and Little Went Bridge with several others located within the surrounding villages.

3.5 Flood risk

The sub-catchment contains areas within Flood Zone 3 and Flood Zone 2 as indicated on the EA Flood Map for Planning (Rivers and Sea), a drawing showing details is included at Appendix A.

3.6 Flood resilience

We consider that the DDC maintained infrastructure is not susceptible to flooding from the River Went.

3.7 Link to Risk Management Plans and Other Strategies

3.7.1 CFMP Impact

The sub-catchment lies within the Lower Don sub area of the River Don CFMP. The CFMP proposed Policy 3 indicates the EA continuing to manage flood risk by maintaining flood defences and washlands in the sub area.

This sub-catchment is elevated and remote from the main rive defences and will not be affected by the Agency's CFMP policy.

3.7.2 FRMP Impact

Potential measures in the Lower Don area to be considered by the EA include:

- Channel management - shoal, silt and vegetation removal
- Middle Don - modelling update to inform future scheme development
- Middle Don & Lower Don - improvements to in channel habitat
- Produce updated Don Strategy
- Identify projects to promote community ownership of watercourses
- Deliver catchment level flood risk management projects

3.7.3 Development Proposals

This small agricultural sub-catchment is unlikely to be subject to development

3.8 Strategic Sub-Catchment Options

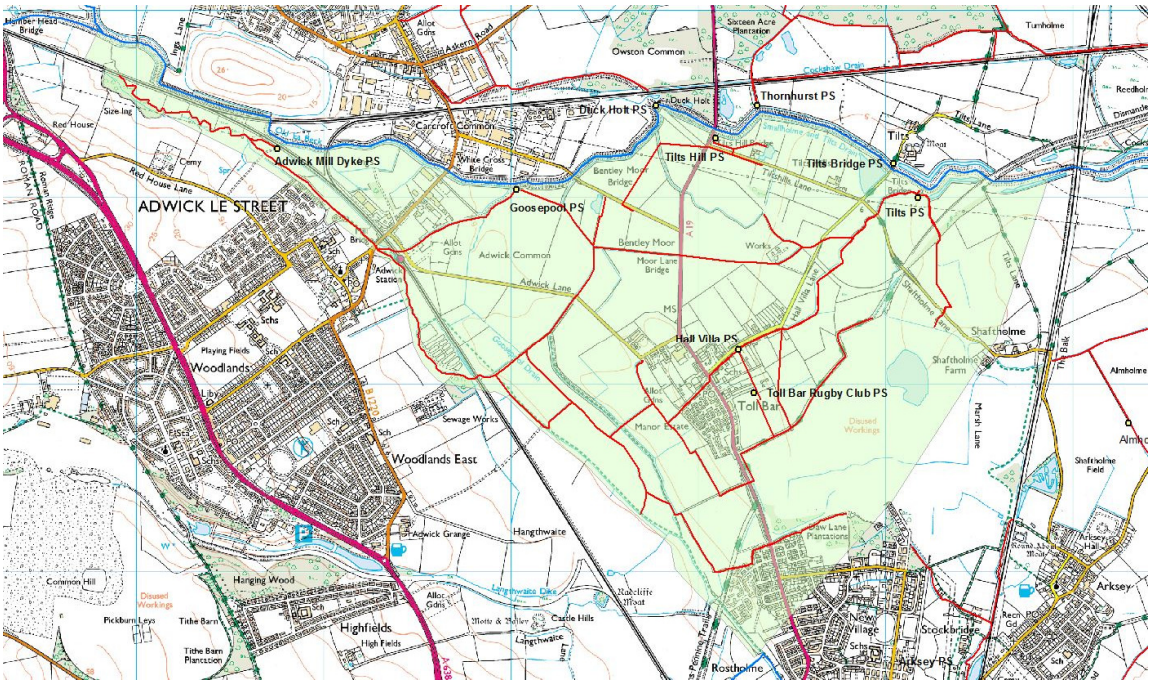
As the pumped catchment is very small (5ha) and most of the watercourses discharge by gravity into the River Went the strategic options offer little, if any, benefit over current arrangements.

We therefore recommend the 'continue as present' option.

3.8.1 Continue as Present

As current WLM activities will continue we do not anticipate any environmental impacts as a result of the WLMS. However, there are potential opportunities for habitat enhancement and/or creation. The Yorkshire Wildlife Trust has undertaken a project to improve Water Vole habitat on the Little Went and Hessle Beck watercourses. This work could be expanded to include potential wetland habitat creation adjacent to watercourses for example, reedbeds and wet grassland.

4 Sub-Catchment 2 - Goosepool



4.1 Sub-Catchment Description

The Sub-catchment is bounded by the Ea Beck, a designated main river, in the North and Mill Dyke in the south and covers agricultural and developed land between the villages of Carcroft, Toll Bar and Bentley.

Ea Beck is a small river tributary of the River Don and flows east to meet the River Don near Thorpe-in-Balne. The Ea Beck Outfall has pointing doors which are tide-locked when the Don is high leading to a ponded water profile in the lower reaches.

Ea Beck is effectively a high-level carrier carrying run-off from west of the A1, and pumped outfalls from the surrounding low-lying area to the east. Normal water levels in Ea Beck are often around two metres above surrounding land levels.

For much of the 6 miles from the A1 trunk road to its confluence with the Don the Ea Beck flows within banks which were initially raised and strengthened around 1928 using colliery waste from Bullcroft Colliery and some locally dug materials.

From 1939 to 1940 Brundell and Farran prepared a remedial and improvement scheme for the Bentley area which included some 2.5miles of bank raising along Ea Beck. The works were carried out using cable-operated tractor-drawn scrapers, an innovation at that time, with materials obtained from local borrow pits.

Major bank raising work for a further area subsided from Bentley Colliery was undertaken in the 1940's including the construction of a new pumping station at Goosepool and the reconstruction of 4 road bridges, including the new bridge (Whitecross Syphon) on Station Road, Adwick-le-Street in the form of three pressure culverts.

The sub-catchment takes surface water from both agricultural land, industrial and residential properties via both piped and open channel watercourses categorised as secondary or priority using the DDC watercourse prioritisation regime.

The A19 and B1220 cross DDC managed watercourses Mill Dyke West, Norwood & Sandall Nooking Drain and Bentley Moor Drain. Smaller minor roads also cross over the DDC drainage system at various locations.

The Doncaster-Leeds and Carcroft-Stainforth railway lines cross DDC managed watercourses Adwick Common Drain, Bowling Alley Drain, the delivery pipelines from Adwick Mill Dyke PS, and Wellsyke Drain.

Castle Hill Drain, Goosepool Drain, Adwick Common Drain, Mill Dike East, Mill Dike and Bowling Alley Drain are classed as DDC priority watercourses.

The majority of the drainage system is pumped into the Ea Beck by Goosepool PS and Tilts PS. Adwick Mill Dyke PS and Tilts Hills PS both serve smaller catchments and also discharge into the Ea Beck.

Toll Bar Rugby Club PS and Hall Villa PS act as booster stations within the larger Tilts PS catchment to reduce flood risk to the village of Toll Bar.

Table 4-1: DDC - Sub-catchment 2 - AFCE Overview

Pumping Station	Contribution breakdown (%)	Annual Running Costs (£) CA Data	Annual Running Costs (£) IDB Data	Catchment Area (ha)	Planned Capital Works
Goosepool PS	EA - 2.50 CA - 50.00 YW - 22.50 DDC - 25.00	4,201.00	36,861.00	269	2014 / 15
Adwick Mill Dyke PS	CA - 33.33 YW - 33.33 DDC - 33.33	5,177.00	4,761.00	55	2015 / 16
Toll Bar Rugby Club	CA - 100.00	801.00	15.00	15	2019 / 20
Tilts PS	CA - 100.00	13,828.00	823.00	163	2019 / 20
Hall Villa PS	CA - 100.00	518.00	1,463.00	33	2025 / 26
Tilts Hills PS	CA - 100.00	357.00	823.00	52	2025 / 26

4.2 Stakeholder Assets

The EA manage the raised defences along both sides of Ea Beck, the watercourse itself, and the screened White Cross Syphon under the B1220. There is a licensed abstraction on Ea Beck located in the East of the sub-catchment.

Concerns about the stability and condition of the banks led to the Ea Beck Comprehensive Scheme which was initially approved by the Yorkshire Regional Flood Defence Committee in April 1990.

This scheme to repair, rebuild and improve the majority of the banks from the downstream end of the Ea Beck Triangle to where it meets the Don was designed to protect against a 1 in 50 year flood event, which has a 2% chance of happening in any one year, and was partly funded by the Coal Authority to mitigate the effects of mining subsidence.

Between Duck Holt and Tilts Bridge the embankments were not rebuilt but simply raised by over a metre in anticipation of future mining subsidence, which did not occur. As a result the banks were left excessively high, narrow and difficult to access and maintain.

In 2011 works to improve the banks at Skellow, from Duck Holt to Tilts Bridge and at Tilts Lane began. At Skellow sheet piling was used to repair a low bank at the back of the old Bullcroft Colliery spoil heap. From Duck Holt to Tilts Bridge the bank was re-built and re-profiled to a lower level to improve its condition and make it easier to maintain, and, adjacent to Tilts Lane three areas of slippage on the left bank were repaired.

YW hold a large area of land between Adwick PS and Goosepool PS which could impact on options 1 and 2.

The YW sewer system serves properties within the sub-catchment and around the area of Toll Bar and connects into the pipeline draining to the DDC Tilts PS. YW sewers cross the following DDC managed watercourses: Bowling Alley Drain, Adwick Common Drain and Bentley Moor Drain, Bentley Moor Wood and Hall Villa Drain.

The roads authority is responsible for the roads and culverted drain crossings of DDC managed watercourses.

Network Rail, the authority responsible for the United Kingdom's railway network, is responsible for the railway infrastructure and culverted drain crossings of DDC managed watercourses.

4.3 Current Maintenance Prioritisation

The sub-catchment is currently ranked as 1 using the DDC 'Planned Maintenance Regime'. Further details or this can be seen within section 1.7.

4.4 Environmental Baseline

The sub-catchment contains the communities and infrastructure described above.

Habitats predominantly comprise agricultural fields with some areas of woodland and grassland adjacent to the Ea Beck. Bentley Community Woodland is located within the south-east of the catchment.

There are 5 non-statutory designated local wildlife sites (LWS) wholly or partly within the area:

- Bentley Moor Wood
- Adwick le Street Sewage Works
- Size Ings
- Norwood, Tilts Drain and Old Ea Beck
- Daw Lane Plantation

Ea Beck supports a course fishery, wildfowl and kingfishers. Flowers such as orchids, cat's ear, common bird's foot trefoil, great burnet and oxeye daisy, grow on its banks.

Where materials were dug out to build the banks along Ea Beck these 'borrow-pits', often partially edged with willow or hawthorn, provide a series of diverse habitats, including open water, marsh, reed swamp, willow carr and dry, grassy hollows. These support a wide range of plants and wildlife, including great water dock, pepper saxifrage, three-spined sticklebacks, dragonflies, damselflies, common frogs, smooth and great crested newts, reed bunting, sedge and reed warblers.

Great Crested Newts are recorded within borrow pits adjacent to the Ea Beck in the vicinity of Duckholt Pumping Station.

There are three listed structures; two are mileposts and one is former mill building located adjacent to an enclosed section of Mill Dyke.

4.5 Flood Risk

The flood defences along Ea Beck and the River Don reduce the risk of flooding from main rivers. Any failure of the artificial raised defences is likely to lead to a rapid inundation of the adjacent area, and if the Ea Beck banks collapsed up to 65 square kilometres of land in and around Almholme, Arksey, Carcroft, Toll Bar and Askern could be flooded.

The majority of the sub-catchment lies within Flood Zone 3 and Flood Zone 2 as indicated on the EA Flood Map for Planning (Rivers and Sea), a drawing showing details is included at Appendix A.

There are only pumped drainage discharges and failure of the pumped drainage system will result in a steady accumulation of surface water and spread of flooding over the sub-catchment (with the potential to spread to adjacent areas).

If any of the flood risk management systems in this area fail Toll Bar, due to it being lower lying, is one of the first communities likely to be directly affected by flooding.

Flooding from surface and ground water is possible due to the topography and geology.

In 1928 serious floods occurred in the Carcroft and Toll Bar area due to failure of the banks of the Old Ea Beck.

The sub-catchment has also been affected as part of much more widespread flooding as outlined below:

- In 1931 flooding covered a 15 mile radius of Doncaster, Toll Bar was under 5ft of water

- In 1932 30 hours of torrential rainfall caused extensive flooding in the Doncaster area with Toll Bar and Carcroft again affected
- In March 1933 widespread flooding again occurred in the Doncaster area
- In 1941 a thaw of heavy snows caused the 4th major flood in 10 years, 300 houses in Toll Bar were affected
- In 1947 flooding inundated much of Doncaster, the surrounding districts and a considerable area of the surrounding countryside. This was the 5th major flood in 16 years. The road bridge over Ea Beck partially collapsed to the volume of water rushing under it

Toll Bar has since flooded in 1958 and 2007.

In 2007 flooding affected the East Coast main line, Adwick-le-Street and Toll Bar. Some parts of Toll Bar first suffered from ground water flooding before the onset of more widespread surface water and river flooding.

4.6 Flood Resilience

The control panels and/or incoming transformers at Toll Bar Rugby Club PS are raised to reduce the risk of flooding 'knocking out' the power supply and stopping the PS working.

Goosepool, Tilts, Adwick Mill Dyke, Tilts Hills and Hall Villa pumping stations may all be susceptible to being affected by flooding.

4.7 Link to Risk Management Plans and Other Strategies

4.7.1 CFMP Impact

The sub-catchment lies within the Doncaster sub-area of the River Don CFMP and the proposed policy for the sub-area, proposed Policy 5, indicates the EA taking action to reduce flood risk.

Recent EA improvement works on the Ea Beck have impacted on DDC maintained assets including the discharge pipes at Adwick Mill Dyke Pumping Station which had to be extended.

The EA will consult DDC if they propose further works which may affect DDC maintained infrastructure.

4.7.2 FRMP Impact

Potential measures in the Doncaster area to be considered by the EA include:

- Channel management - shoal, silt and vegetation removal
- Middle Don - modelling update to inform future scheme development
- Middle Don & Lower Don - improvements to in channel habitat
- Produce updated Don Strategy
- Identify projects to promote community ownership of watercourses
- Deliver catchment level flood risk management projects

4.7.3 Development Proposals

The Doncaster LDF Core Strategy predicts significant residential development in Adwick with up to 400 permissions from 2011 and 380 in urban extensions from 2021. It is likely that some of this development will drain surface water into the DDC maintained systems.

The LDF also contains a potential employment development site north of Toll Bar and west of the A19.

4.8 Strategic Sub-Catchment Options

4.8.1 Option 1 - Decommission Adwick Mill Dyke PS

Under this option we consider the potential to decommission Adwick Mill Dyke PS (to reduce future pumping costs, maintenance costs, capital expenditure and carbon footprint). The option includes diversion of water to, and upgrade of, Goosepool PS. In-line storage could also be created together with improvements to the environment / ecology and health and safety. Adwick Mill Dyke PS and

Goosepool PS are currently shown in the planned capital works schedule for works in 2014/15 and 2015/16 respectively. In brief the option covers the following:

- Decommission Adwick Mill Dyke PS
- Re-grade Mill Dyke and Bowling Alley Drain.
- Upgrade to Goosepool PS

For a high level plan of the option refer to drawing no.'2013s7706 - 100 - 002 - 001' within Appendix C.

4.8.2 Option 2 - In-line storage via installation of control structures

Under this option we consider the potential to increase in-line storage (to reduce pumping costs, pump maintenance costs, and carbon footprint) by looking at:

- Creating upstream storage to Goosepool PS
- Installation of weirs

For a high level plan of the option refer to drawing no.'2013s7706 - 100 - 002 - 002' within Appendix C.

4.8.3 Option 3 - Water containment via non-return valves

The areas served by the Tilts and Goosepool Pumping Stations are effectively connected by the drainage system. An ability to manage flows between the two halves of the sub-catchment, by managing flows beneath the A19, may provide some benefits. Under this option we consider:

- Installation of non-return valves on all crossings beneath the A19.
- Possible re-grade of some watercourse / pipelines.
- Upgrade to Goosepool PS

For a high level plan of the option please refer to drawing no.'2013s7706 - 100 - 002 - 003' within Appendix C.

4.8.4 Option 4 - Decommission Tilts Hills pumping station

Under this option we consider the potential to decommission Tilts Hills PS (to reduce future pumping costs, maintenance costs, capital expenditure and carbon footprint). The option includes diversion of water to, and upgrade of, Tilts PS. Tilts Hills PS and Tilts PS are currently shown in the planned capital works schedule for works in 2025/26 and 2019 / 20 respectively. In brief the option covers the following:

- Decommission Tilts Hills PS
- Re-routing culverted watercourse.
- Upgrade to Tilts PS.

For a high level plan of the option refer to drawing no.'2013s7706 - 100 - 002 - 004' within Appendix C.

4.8.5 Option 5 - Decommission Toll bar Rugby Club PS

Under this option we consider the potential to decommission Toll Bar Rugby Club PS (to reduce future pumping costs, maintenance costs, capital expenditure and carbon footprint) and re-direct flows along Norwood Sandall Nooking Drain towards Tilts PS.

A new section of watercourse either piped or open would be required to provide a new connection between the upstream end of Norwood Sandall Nooking Drain and the pipeline North of Shaftholme Lane. From LiDAR data supplied by DDC a suitable gradient to provide this new connection cannot be achieved, so this option is not feasible and has been discounted from further study.

For a high level plan of the option please refer to drawing no.'2013s7706 - 100 - 002 - 005' within Appendix C.

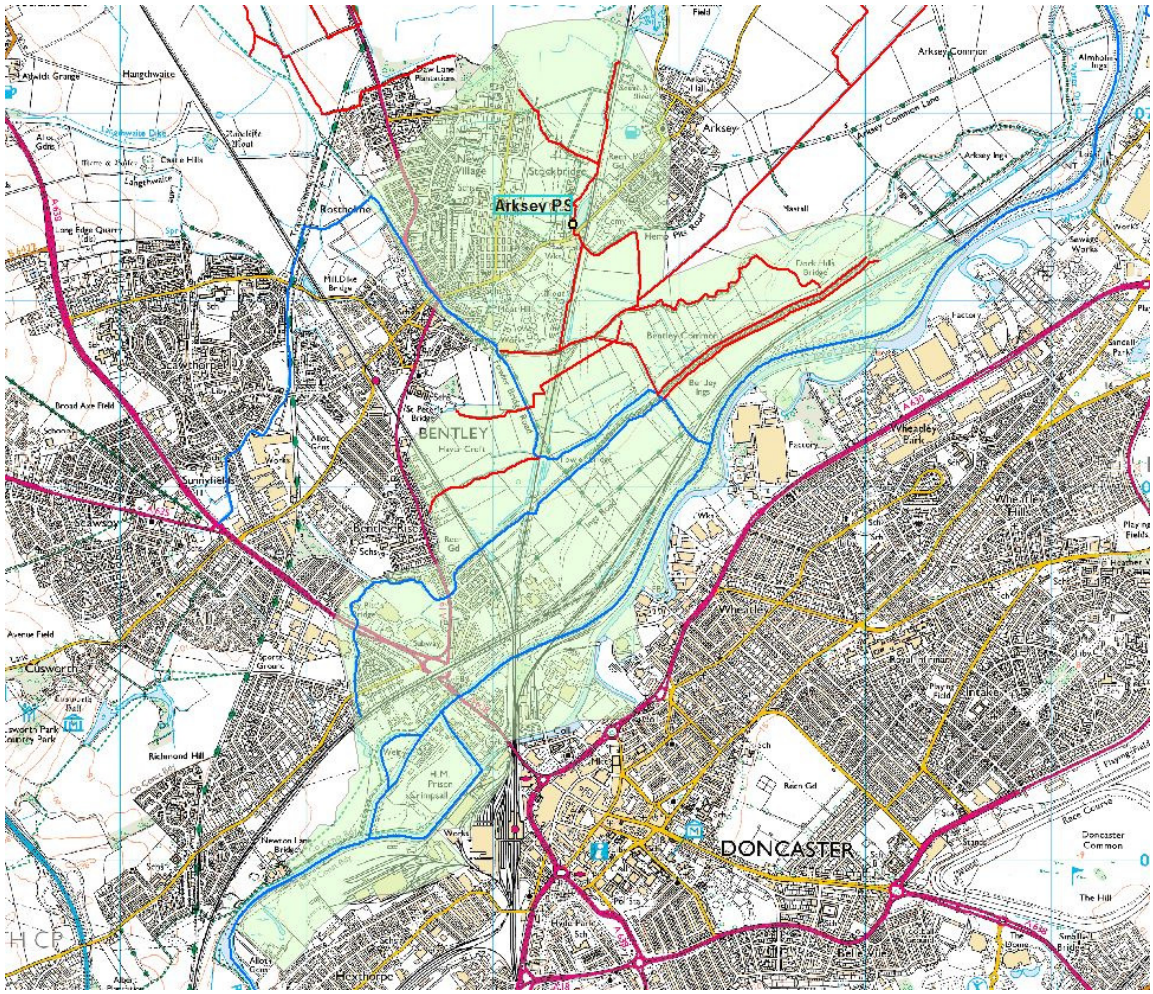
4.9 Opportunities and Constraints

WLMS Options	Opportunities	Constraints
Option 1 - Decommission Adwick Mill Dyke PS	**Engineering** Reduced operational, maintenance and future capital costs. Re-grading of Mill Dyke and Bowling Alley Drain, and the possible introduction of berms, could improve access for machinery and health & safety during maintenance. The introduction of a berm (changed drain profile and increased cross sectional area) may facilitate a change in maintenance practice. Capital works money allocated to Adwick Mill Dyke PS can be re-allocated throughout the district or saved.	**Engineering** Demolition and 'making safe' costs. Civil works to existing culverts and pipelines including road and rail culverts to increase size and/or lower invert levels. Without a change in maintenance practice the introduction of a berm (changed drain profile and increased cross sectional area) may increase maintenance costs. Costs of civils works to increase capacity at Goosepool PS. Increased operational, maintenance and future capital costs at Goosepool PS.
	Environmental The re-grading of Mill Dyke and Bowling Alley Drain, and the possible introduction of berms, provides opportunities to enhance the channel and bankside habitat for species such as Water Vole.	**Environmental** Potential impacts on Size Ings, Adwick le Street Sewage Works LWS and the listed mill building. Any adverse impacts would need to be avoided or mitigated.
Option 2 - Create upstream storage to Goosepool PS.	**Engineering** If option 1 was carried out it would increase flows and costs at Goosepool PS. The creation of storage may reduce operational and maintenance costs at Goosepool PS.	**Engineering** Civils and earthworks costs of the construction phase. Operational, maintenance and capital costs of the control structures. Increased maintenance costs of the watercourse. Watercourse runs parallel to Yorkshire Water property with possible infrastructure and outfalls discharging into the watercourse. Live rail lines runs in close proximately to the watercourse and increased water levels may reduce the stability of the ground.
	Environmental The creation of upstream storage provides opportunities to enhance the habitat for species such as Water Vole. This could be achieved through the inclusion of berms if the watercourse is	**Environmental** Potential impacts on Adwick le Street Sewage Works LWS. Any adverse impacts would need to be avoided or mitigated. Potential impacts on drainage/flood risk to nearby rail

WLMS Options	Opportunities	Constraints
	re-graded or the creation of ponds/wetland to provide storage.	infrastructure, including Adwick station.
Option 3 - Water containment via non-return valves on A19 crossings	**Engineering** Installing control structures on drain crossings beneath the A19 may increase the management of water flows during periods of intense or prolonged rainfall and reduce flood risk in parts of the sub-catchment.	**Engineering** Civils and earthworks costs of control structures. Costs of civils works to existing pipes/drains. Costs of civils works to increase capacity at Goosepool PS. Operational, maintenance and capital costs of the control structures. Ground Investigation required to determine suitability of sub-strata below A19 to prevent cross-flows.
	Environmental Any modifications to watercourses i.e. re-grading and the possible introduction of berms, provides opportunities to enhance the channel and bankside habitat for species such as Water Vole.	**Environmental** Any re-grading of Bentley Moor Drain may have potential impacts on the adjacent Bentley Moor Wood SSI. Any adverse impacts would need to be avoided or mitigated. Potential impacts on drainage/flood risk to Toll Bar and the A19.
Option 4 - Decommission of Tilts Hills PS	**Engineering** Reduced operational, maintenance and future capital costs. Capital works funding allocated to Tilts Hills PS could be re-allocated throughout the district or saved.	**Engineering** Demolition and 'making safe' costs. Costs of significant works to re-direct flow towards Tilts PS including lowering of inverts, increasing pipe sizes and possibly a replacement of pipes with open channel watercourses. Future maintenance of these works, would increase if an open channel watercourse was created. Potential costs of works at Tilts PS to increase pumping capacity. Potential Increased operational, maintenance and future capital costs at Tilts PS.
	Environmental Any modifications to watercourses i.e. re-grading and the	**Environmental** Potential impacts on drainage/flood risk to the A19.

WLMS Options	Opportunities	Constraints
	possible introduction of berms, provides opportunities to enhance the channel and bankside habitat for species such as Water Vole.	Potential impacts on Norwood, Tilts Drain and Old Ea Beck SSI. Any adverse impacts would need to be avoided or mitigated. Potential presence of Great Crested Newt.
Option 5 - Decommission Toll Bar Rugby Club PS **This option has been discounted due to LiDAR data confirming bed levels immediately upstream of Toll Bar Rugby Club PS are significantly lower than bed levels along the proposed diversion route.**	**Engineering** Reduced operational, maintenance and future capital costs. Directing flow around the village of Toll Bar rather than through it may reduce flood risk to the village. Capital works funding allocated to Toll Bar Rugby Club PS can be re-allocated throughout the district or saved.	**Engineering** Demolition and 'making safe' costs. Civils and earthworks costs of the construction phase. Longer watercourses may increase future maintenance costs. Costs of creation/upgrade of road culvert beneath Shaft Holme Lane. Potential costs of civils works at Tilts PS to increase pumping capacity. Potential Increased operational, maintenance and future capital costs at Tilts PS.
	Environmental Any modifications to watercourses i.e. re-grading, new cuts, and the possible introduction of berms provides opportunities to enhance the channel and bankside habitat for species such as Water Vole.	**Environmental** Potential impacts on Norwood, Tilts Drain and Old Ea Beck SSI. Any adverse impacts would need to be avoided or mitigated. Potential presence of Great Crested Newt.

5 Sub-Catchment 3 - Bentley Ings



5.1 Sub-Catchment Description

The sub-catchment is located on the northern outskirts of Doncaster, at the southern end of the DDC district, and covers an area from Sprotbrough through Bentley to the village of Arksey.

The land use is predominantly residential, including the settlements of Bentley and Arksey, with a mixture of retail, industrial and areas of agricultural land. The area contains a hospital, a prison, schools, a police station, a cemetery, a retail park, a caravan park, a number of sports/recreation grounds, and numerous industrial estates and units.

The East Coast main lines, Doncaster to York and Leeds, pass through the sub-catchment from North to South and cross 4 DDC managed watercourses. A number of major roads including the A19 and A638, and a number of watercourses and the River Don, which are designated as main river, run through the sub-catchment.

The watercourses, classed in accordance with the DDC prioritisation regime, include minor, secondary and priority watercourses. Bentley Mill Goit, Bentley Commons Soak, Bentley Ings Drain, New Cut, Bentley Town Drain and Fowler Bridge Drain are classed as DDC priority watercourses.

These watercourses are not crossed by any major roads, but the DDC managed watercourse Dam Hill Drain passes in culvert below a minor road in the village of Arksey.

Arksey PS is a booster stations within the larger Bentley Ings PS catchment and provides drainage and reduces flood risk to land to the north and parts of Bentley New Village. Surface water managed by the DDC is discharged via the EA managed Bentley Ings PS into the River Don.

Table 5-1: DDC - Sub-catchment 3 - AFCE Overview

Pumping Station	Contribution breakdown (%)	Annual Running Costs (£) CA Data	Annual Running Costs (£) IDB Data	Catchment Area (ha)	Planned Capital Works
Arksey PS	CA - 100	-	2,487.00	112	-

5.2 Stakeholder assets

The EA manage North Swaith Dike, Swaith Dike, Bentley Mill Dike, the River Cheswold and the River Don. The EA also maintain artificial raised defences along the River Don, the Bentley Barrier Bank, Bentley Ings PS, Crimpsall weir and rock chute weir.

Flood risk management measures also include the Bentley washland system and the historic Doncaster Flood Corridor.

Overtopping of the main river defences is likely to first occur on the left bank adjacent to St George's Bridge in around a 1 in 80 year event (1.25% probability) with floodwaters spreading through the Hunt Lane / Conyers Road area of Bentley before passing into the Bentley washland.

The Bentley and Thorpe Marsh washland system will contain coincident spills from the River Don and Ea Beck up to slightly above a 1 in 100 year event (1% probability). When the washland system is full the floodwaters will spill over the spillway at the end of Ea Beck and will initially fill low lying areas around Thorpe in Balne and Trumfleet Marshes before generating overland flows past Braithwaite and Kirk Bramwith towards Fishlake.

The Doncaster Flood Corridor operates from a spillway adjacent to Newton Farm in around a 1 in 150 year event (0.67% probability) with flooding spreading via Black Pond, Sprotbrough Road, Morrisons, Tatters Field, and the Hunt Lane / Conyers Road area of Bentley before passing into the Bentley washland.

There are a number of licensed abstraction points around the villages of Arksey and Almholme.

The YW sewer system features extensively throughout the villages of Bentley and Arksey, along with a treatment site and pump houses/depots/buildings. Their existing sewer crosses the DDC maintained watercourse Dam Hill Drain within the southern corner of Arksey.

YW Rostholme PS also lifts water from a DMBC drainage network in the adjacent area, and from the EA maintained North Swaith Dike, and discharges them to Mill Dike, which in turn is discharged via the EA operated and maintained Bentley Ings PS.

Surface water drainage in the Hunt Lane / Conyers Road area of Bentley is via a low-level flapped outfall to the River Don and at times of high rainfall and high flow in the River Don this area is susceptible to surface water flooding. DMBC manage a small pump adjacent to St George's Bridge to reduce the risk of surface water flooding.

The roads authority is responsible for the roads and culverted drain crossings of DDC managed watercourses.

Network Rail, the authority responsible for the United Kingdom's railway network, is responsible for the railway infrastructure and culverted drain crossings of DDC managed watercourses.

5.3 Current Maintenance Prioritisation

The sub-catchment is currently ranked as 12 using the DDC 'Planned Maintenance Regime'. Further details or this can be seen within section 1.7.

5.4 Environmental Baseline

The sub-catchment contains the communities and infrastructure described above.

Habitats consist of a mixture of arable fields, floodplain grasslands, and a number of wetland habitats adjacent to the River Don. Hedgerows and trees are common along field boundaries, watercourses and railway embankments.

Water Vole and Great Crested Newt have been recorded within watercourses/waterbodies.

There are 14 non-statutory designated local wildlife sites wholly or partly within the area:

- Bentley Railway Embankments and Ponds
- Bentley Common
- Bentley Ings
- Wheatley Park and Old Don Oxbows
- Arksey Ings
- Moat Hill, Bentley
- Arksey Pond
- Arksey Round About Moat
- Willow Garth Fish Ponds
- Daw Lane Plantation
- Old River Don Oxbow
- Black Pond
- Plant Works Railway Sidings
- Hexthorpe Ings

There are two Scheduled Monuments:

- Moat Hill Moated Site, Bentley
- Round About Moat, Arksey

There are twelve listed buildings, including Bentley Mill and a road bridge.

5.5 Flood risk

The flood defences along the River Don, the Bentley Barrier Bank, Bentley washland system and Bentley Ings PS reduce the risks of flooding from main rivers.

Any failure of the artificial raised defences along the rivers, or the Bentley Barrier Bank, is likely to lead to a rapid inundation of the adjacent area.

The majority of the sub-catchment lies within Flood Zone 3 and Flood Zone 2 as indicated on the EA Flood Map for Planning (Rivers and Sea), a drawing showing details is included at Appendix A.

Flooding from surface water is possible due to the topography.

Failure of the pumped drainage system will result in a steady accumulation of surface water and a spread of flooding over the sub-catchment (and adjacent areas).

Flood risk in this sub-catchment is particularly complex due to the interaction of different stakeholder assets and there are 4 primary elements which manage flood risk in the area. These are:

- Artificial raised defences
- Bentley & Thorpe Marsh washlands + upstream washlands on the Rother, Dearne and Don
- Pumped drainage and sewage systems
- The historic Doncaster 'flood corridor'

The sub-catchment has been affected as part of more widespread flooding of the Doncaster area as outlined below:

- In 1931 flooding covered a 15 mile radius of Doncaster including Bentley and Arksey, Arksey was under 5ft of water
- In 1932 30 hours of torrential rainfall caused extensive flooding in the Doncaster area. Many roads including Hunt Lane, Bentley Road and ones between Shaftholme and Arksey were under 10ft of water. 679 houses in Bentley were evacuated

- In March 1933 widespread flooding again occurred in the Doncaster area
- In 1941 a thaw of heavy snows caused the 4th major flood in 10 years, 350 houses in Bentley were under 3ft of water, 700 families from Bentley and Arksey were temporarily housed in Bentley New Village school
- In 1947 flooding inundated much of Doncaster, the surrounding districts and a considerable area of the surrounding countryside. This was the 5th major flood in 16 years. Troops from Aldershot brought amphibious DUKW vehicles up to Bentley to help with the evacuation of people from their flooded houses

In 2007 flooding affected houses adjacent to parts of High Street and Askern Road, at Bentley.

In more recent times the 'flood corridor' has operated in 1931, 1932, 1947 and 2007.

5.6 Flood resilience

The control panels and/or incoming transformers at Arksey PS and Bentley Ings PS are raised to reduce the risk of flooding 'knocking out' the power supply and stopping the PS working.

5.7 Link to Risk Management Plans and other Strategies

5.7.1 CFMP Impact

The sub-catchment lies within the Doncaster sub area of the River Don CFMP. The CFMP proposed Policy 5 indicates the EA taking action to reduce flood risk.

Works by the EA on their infrastructure could affect DDC systems and the Agency will consult DDC if they propose works which may affect the commissioners' infrastructure.

5.7.2 FRMP Impact

Potential measures in the Doncaster area to be considered by the EA include:

- Channel management - shoal, silt and vegetation removal
- Middle Don - modelling update to inform future scheme development
- Middle Don & Lower Don - improvements to in channel habitat
- Produce updated Don Strategy
- Identify projects to promote community ownership of watercourses
- Deliver catchment level flood risk management projects
- R Don, Thorne to Arksey - Mile Thorne to Arksey Bank refurbishment
- R Don Bentley - Bentley Pumping Station replacement and Barrier Bank refurbishment
- Swaith Dyke, New Swaith Dyke & Bentley Moor Dyke - Modelling review
- R Don, R Skell & Bentley Mill Stream - improvements to in-channel & riparian habitat

5.7.3 Development Proposals

In the Doncaster LDF, this area is included in the 'Main Urban Area' of Doncaster. There are a number of potential residential development sites within and around the Bentley area.

5.8 Option Summary

5.8.1 Option 1 - Decommission Arksey PS

Under this option we consider the potential to reduce pumping, maintenance and capital costs within the sub-catchment at Arksey PS. This may be achieved by:

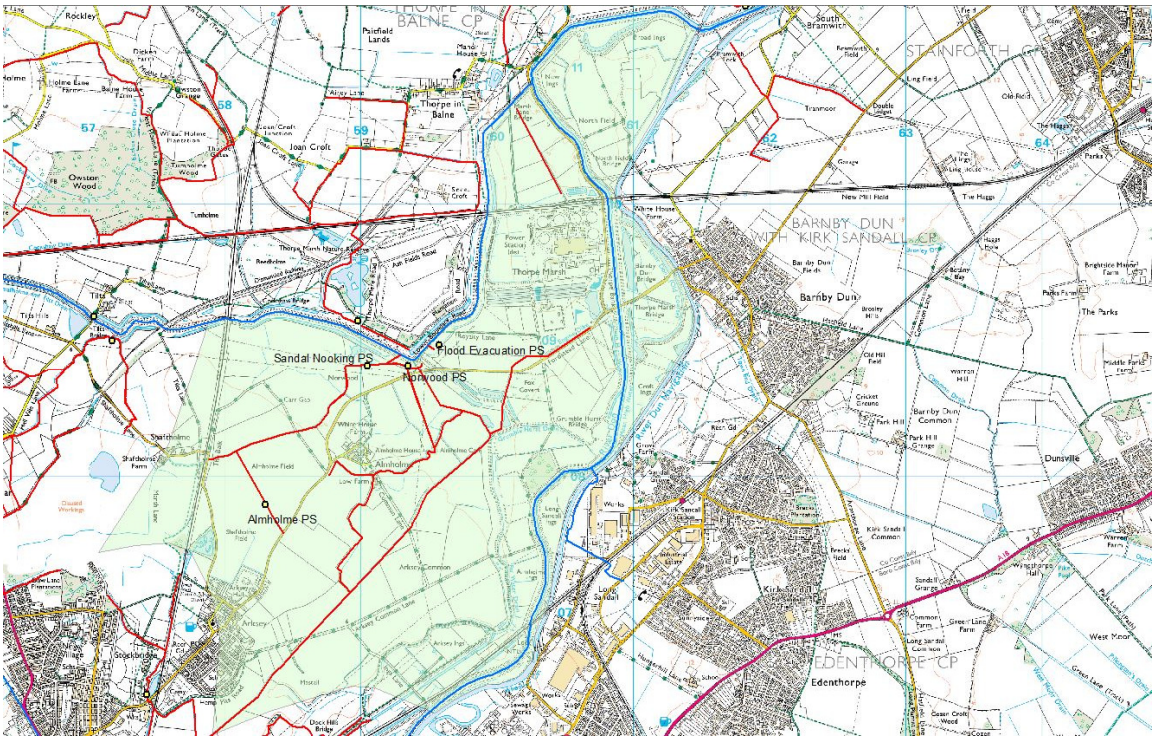
- Decommission Arksey PS
- Re-grade Whelps Croft Drain
- New cut drain along Shaftholme Road
- Up-grade to Sandall Nooking PS
- Up-grade of existing railway culvert

For a high level plan of the option please refer to drawing no.'2013s7706 - 100 - 003 - 001' within Appendix C.

5.9 Opportunities and Constraints

WLMS Options	Opportunities	Constraints
Option 1 - Decommission Arksey PS.	**Engineering** Reduced operational, maintenance and future capital costs. Maintenance costs would be reduced to mowing and de-silting. Flows through the village of Arksey would be re-directed through areas of agricultural land. Capital works funding allocated to Arksey PS can be re-allocated through the district or saved.	**Engineering** Demolition and 'making safe' costs. Civil works to existing culverts and pipelines including road and rail culvert to lower invert levels. Civil works to cut a new drain to connect into Norwood & Sandall Nooking Drain. Ground Investigation is needed to determine ground stability. Potential costs of works at Sandall Nooking PS to increase pumping capacity. Potential Increased operational, maintenance and future capital costs at Sandall Nooking PS.
	Environmental The re-grading of Whelps Croft Drain, the cutting of a new drain, and the possible introduction of berms provides opportunities to enhance the channel and bankside habitat for species such as Water Vole.	**Environmental** Potential impacts on Arksey Pond and Willow Garth Fish Ponds LWS and Arksey Round About Moat Scheduled Monument and LWS. Any adverse impacts would need to be avoided or mitigated. Working adjacent to the railway line. Potential impacts on drainage/flood risk.

6 Sub-Catchment 4 - Norwood



6.1 Sub-Catchment Description

The sub-catchment covers an area from the village of Arksey in the South to Barnby Dun in the North and is bounded to the North West by Ea Beck, a designated main river, as it flows towards its confluence with the River Don near Thorpe in Balne, and the South Yorkshire Navigation in the East.

The sub-catchment is mainly agricultural but includes part of Arksey, including a caravan site, and the small hamlets of Almholme and Shaftholme.

The 45 hectare (111 acre) site of the former Thorpe Marsh Power Station lies to the west of Barnby Dun and is currently utilised by a national repair centre and sub-station serving the National Grid.

Pilkington's Burgy Banks is an adjacent post-industrial brownfield site. These banks contain the settlement lagoons for the liquid waste from the former Pilkington's factory sheet glass production.

There are no major roads within the sub catchment but Almholme Lane/Fordstead Lane runs from Arksey to Barnby Dun, and The Doncaster-York, Carcroft-Stainforth and Doncaster-Thorne railway lines pass through the district at three separate locations.

Land drainage and surface water from Arksey and Almholme flows in Bentley & Arksey Common Drain, a DDC open channel watercourse.

The DDC managed watercourses are all classed as secondary in accordance with the DDC prioritisation regime, with the majority of flows being pumped into the Ea Beck via Sandall Nooking PS or Norwood PS.

The DDC managed watercourse Thorpe Marsh Engine Drain gravity discharges to the River Don at the DDC Engine Drain outfall. (EA manage the penstocks and flaps which prevent reverse flow from the River Don back up Engine Drain).

The area also contains Almholme PS, a small booster station which lifts water towards Sandall Nooking PS to remediate the effects of mining subsidence to farmland, and a Flood Evacuation PS, which, post event, is used to accelerate the removal of floodwater from the Thorpe Marsh Washland.

There are a number of road culverts, on Mastall Lane, Arksey Common Lane, Common Lane and Almholme Lane, and Showfield Pipeline carries water from Arksey Field Drain to Norwood PS crosses under Almholme Lane.

Table 6-1: DDC - Sub-catchment 4 - AFCE Overview

Pumping Station	Contribution breakdown (%)	Annual Running Costs (£) CA Data	Annual Running Costs (£) CA Data	Catchment Area (ha)	Planned Capital Works
Almholme	CA - 100	848.00	824.00	97	2015 / 16
Norwood	CA - 100	9,203.00	2,313.00	628	2025 / 26
Sandall Nooking	*	*	1,063.00	*	*
Flood Evacuation	*	*	6,295.00	*	*

* The power supplies for Sandall Nooking and Flood Evacuation PSs are taken from the Norwood control panel so the details for Norwood include those for Sandall Nooking and Flood Evacuation PSs.

6.2 Stakeholder assets

The EA manage the raised defences along the rivers Don and Ea Beck, the rivers themselves, and the Ea Beck outfall.

The outfall has pointing doors on the downstream side to prevent reverse flow from the River Don back up Ea Beck, and a penstock on the upstream side of the outfall which may be lowered if the pointing doors are held open by debris.

The EA is also responsible for the assets associated with the Bentley and Thorpe Marsh washland system, including the Bentley Barrier Bank, Grumblehust Barrier Bank, Norwood Spillway, and the spillway at the end of Ea Beck. The washland system is generally described under the preceding sub-catchment 3 - Bentley Ings.

Water levels in the lower reaches of Ea Beck are controlled by Norwood Spillway (spillway level 6.2m AOD) with Ea Beck spilling to the Thorpe Marsh washland with an average frequency of every 18months to 2 years. However, the spillway can overtop regularly during periods of intense rainfall similar to 2012.

This is a designed overspill which may flood Almholme Lane/Fordstead Lane as it passes through the Thorpe Marsh washland.

There are a number of current licensed abstraction points from Ea Beck.

The YW sewer records show assets through the village of Arksey.

The site of the former Thorpe Marsh Power Station has immediate access to the National Grid via an adjacent sub-station, and a new 400kV 4 bay double bus-bar AIS substation, two skeleton generator bays, four circuit feeder bays and four new transformers were recently added, together with major work to the National Grid infrastructure, to upgrade the facility.

CRT are responsible for the South Yorkshire (River Dun) Navigation and low level soak dyke systems in the north eastern parts of the sub catchment, including a soak dyke and gravity outfall adjacent to Broad Ings.

Town End Drain near Barnby Dun is the responsibility of the Coal Authority which serves highway drainage, land drainage, discharge from the Maltings development and railway infrastructure flowing into a canal soak dyke system and gravitating into the River Don.

The roads authority is responsible for the roads and culverted drain crossings of DDC managed watercourses.

Network Rail, the authority responsible for the United Kingdom's railway network, is responsible for the railway infrastructure and culverted drain crossings of DDC managed watercourses.

6.3 Current Maintenance Prioritisation

The sub-catchment is currently ranked as 7 using the DDC 'Planned Maintenance Regime'. Further details or this can be seen within section 1.7.

6.4 Environmental Baseline

The sub-catchment contains the communities and infrastructure described above.

The dominant habitat is arable fields with some areas of grassland adjacent to watercourses and two woodlands. There are several ponds within the sub catchment including borrow pits adjacent to the Ea Beck and River Don and oxbows associated with the former course of the River Don.

Water Vole and Great Crested Newt have been recorded within watercourses/waterbodies.

There are 18 non-statutory designated local wildlife sites located wholly or partly within the area:

- Broad Ings Oxbow
- Thorpe in Balne/Kirk Bramwith Area
- Bentley Tilts and Course of Old Ea Beck
- Barnby Dun Old Don Oxbows
- Barnby Dun Borrow Pits
- Croft Ings
- Old River Don Oxbow
- Fox Covert
- Marsh Lane
- Pilkington's Burgy Banks
- Bentley Bank
- Long Sandall Ings
- Norwood, Tilts Drain and Old Ea Beck
- Shaftholme
- Bentley Common
- Bentley Ings
- Arksey Ings
- Willow Garth Fish Ponds

There are six listed buildings including Arksey Hall and a number of farm houses.

6.5 Flood risk

The flood defences along the River Don and Ea Beck and the Bentley Barrier Bank reduce the risk of flooding from main rivers and the Thorpe Marsh and Bentley washland respectively. Any failure of the artificial raised defences may lead to a rapid inundation of the adjacent area.

The whole of the sub-catchment lies within Flood Zone 3 and Flood Zone 2 as indicated on the EA Flood Map for Planning (Rivers and Sea), a drawing showing details is included at Appendix A.

Flooding from surface water is possible due to the topography.

Failure of the pumped drainage system will result in a steady accumulation of surface water and a spread of flooding over the sub-catchment.

Flood risk in this sub-catchment is complex due to the interaction of different stakeholder assets and there are 4 primary elements which manage flood risk. These elements and the history of widespread flooding of the Doncaster area are generally described under the preceding sub-catchment 3 - Bentley Ings.

Almholme Lane/Fordstead Lane passes through the Thorpe Marsh washland and, in order to prevent motorists driving into the floodwaters, Doncaster MBC have installed, and operate, barriers to close the road when the washland floods.

In 2007 the Bentley and Thorpe Marsh washland system was full of floodwater with flows over the spillway at the end of Ea Beck into the lower lying areas around Thorpe in Balne and Trumfleet Marshes.

Also in 2007 the sub-station on the site of the former Thorpe Marsh Power Station was in danger of flooding and emergency defences and pumps were installed to prevent disruption to the National Grid and maintain electricity supplies to the surrounding district.

6.6 Flood resilience

The pumping station control panels and/or incoming transformers are raised at Norwood PS, Sandall Nooking PS and the Flood Evacuation PS to reduce the risk of flooding 'knocking out' the power supply and stopping the PS working.

Almholme PS is susceptible to being affected by flooding.

6.7 Link to Risk Management Plans and other Strategies

6.7.1 CFMP Impact

The Sub-catchment lies within the Doncaster sub area of the River Don CFMP. The CFMP proposed Policy 5 indicates the EA taking action to reduce flood risk. This has already included bank improvements on the Ea Beck upstream of this sub-catchment.

The Agency will consult DDC if they propose further works which would affect DDC maintained infrastructure.

6.7.2 FRMP Impact

Potential measures in the Doncaster area to be considered by the EA include:

- Channel management - shoal, silt and vegetation removal
- Middle Don - modelling update to inform future scheme development
- Middle Don & Lower Don - improvements to in channel habitat
- Produce updated Don Strategy
- Identify projects to promote community ownership of watercourses
- Deliver catchment level flood risk management projects
- Ea Beck - Ea Beck & Engine Drain tidal doors
- Ea Beck - River restoration

6.7.3 Development Proposals

The Doncaster LDF contains a proposal for a gas fired power station on the site of the former Thorpe Marsh power station.

These plans, approved by the Department of Energy on 31st October 2011, are to build up to a 1,500 MW Combined Cycle Gas Turbine and 100MW open cycle gas turbine power station.

6.8 Option Summary

6.8.1 Option 1 - Decommission Almholme PS

Under this option we consider the potential to reduce pumping, maintenance and capital costs at Almholme PS.

From the DDC LiDAR coverage for this area a connection from further downstream along Norwood & Sandall Nooking Drain to upstream of Almholme PS seemed viable. The works required are:

- Install a new enclosed or open watercourse to connect Norwood & Sandall Nooking Drain to upstream of Almholme Pumping Station
- Decommission Almholme Pumping Station

A high level plan of the option is shown on drawing no.'2013s7706 - 100 - 004 - 001' within Appendix C.

However, from consultation with the DDC the civil works for this option would encounter difficult geotechnical / ground condition and the option is dismissed as unviable.

6.8.2 Option 2 - In-line storage via installation of control structures

Under this option we consider the potential to reduce running costs by creating a system of upstream storage along Hirst Pit Drain and Bentley & Arksey Common Drain. These open watercourses may have the capacity to retain water upstream and help to optimise pumping at Norwood PS. The works required are:

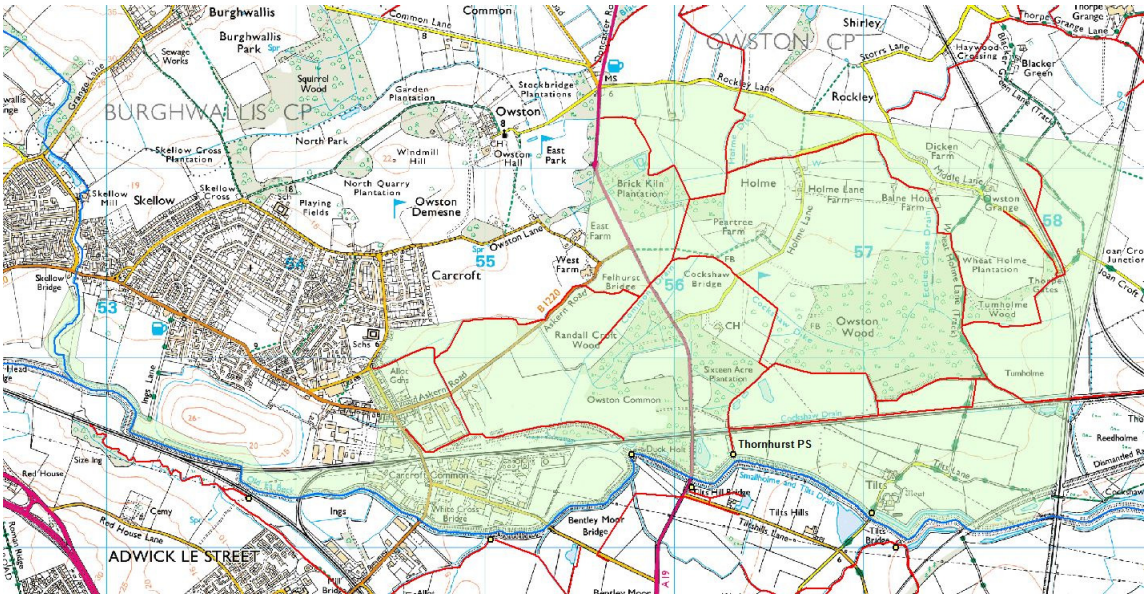
- Install control structures upstream of Norwood PS

A high level plan of the option is shown on drawing no.'2013s7706 - 100 - 004 - 002' within Appendix C.

6.9 Opportunities and Constraints

WLMS Options	Opportunities	Constraints
Option 1 - Decommission Almholme PS **This option is dismissed as the ground conditions within the local area are expected to be unsuitable for the associated civil works.**	**Engineering** Reduced operational, maintenance and future capital costs. Future capital expenditure could be re-allocated throughout the district. Capital works funding allocated to Arksey PS can be re-allocated through the district or saved. Reduced maintenance cost due to reduced channel length.	**Engineering** Demolition and 'making safe' costs. Civil works to cut a new drain to connect into Norwood and Sandall Nooking Drain. Ground Investigation is needed to determine ground stability. Ground conditions within this area are expected to be unstable due to historic mining. Potential costs of works at Sandall Nooking PS to increase pumping capacity. Potential Increased operational, maintenance and future capital costs at Sandall Nooking PS.
	Environmental The cutting of a new drain, and the possible introduction of berms, provides opportunities to enhance the channel and bankside habitat for species such as Water Vole.	**Environmental** Potential impacts on drainage/flood risk to Almholme/Arksey and nearby rail infrastructure.
Option 2 - Upstream storage via installation of control structures along Hirst Pit Drain	**Engineering** Reduced operational and maintenance costs at Norwood PS.	**Engineering** Potential Civil works to lower invert level and increase capacity of road and access track crossings along Bentley & Arksey Common Drain. Civils and earthworks costs of the construction phase. Operational and maintenance costs of the control structures. Ground investigation is needed at the control structure sites.
	Environmental The creation of upstream storage provides opportunities to enhance the habitat for species such as Water Vole. This could be achieved through the inclusion of berms if the watercourse is re-graded or the creation of ponds/wetland to provide storage.	**Environmental** Potential impacts on drainage/flood risk to Almholme, Arksey and nearby rail infrastructure.

7 Sub-Catchment 5 - Thornhurst



7.1 Sub-Catchment Description

The sub-catchment is located approximately 6kn North of Doncaster with Carcroft in the West, and Ea Beck, a designated main river, along the southern boundary. The A19 and two railway lines bisect the area.

Land use within the sub-catchment includes agricultural, industrial and residential, and dominant features include Owston Wood, adjacent woodland plantations, and Thornhurst Park Golf Club.

The Carcroft to Stainforth railway line crosses the area East to West, over DDC managed watercourses Wellsyke Drain and Cockshaw Dyke, and the Shaftholme to Askern line crosses North to South over Tumholme Drain.

Due to the topography and land use the number of roads is relatively low. Roads cross DDC managed watercourses at 5 locations, namely where the A19 crosses Cockshaw Drain, Askern Road crosses Wellsyke Drain, Holme Lane crosses Cockshaw Drain and Eccles Close Drain, and Joan Croft Lane crosses Tumholme Drain.

The 3 DDC managed pumping stations, Duckholt PS (to the West), Thornhurst PS (centre) and Tilts Bridge PS (to the East) each serves a separate drainage network and discharge water by pumping to Ea Beck.

There are 11 DDC managed watercourses with the majority of the open channels being identified as either minor, secondary, or priority under the DDC maintenance prioritisation regime. The 2 priority watercourses, Carcroft Drain and Wellsyke Drain, are both served by Duckholt PS.

Table 7-1: DDC - Sub-catchment 5 - AFCE Overview

Pumping Station	Contribution breakdown (%)	Annual Running Costs (£) CA Data	Annual Running Costs (£) IDB Data	Catchment Area (ha)	Planned Capital Works
Tilts Bridge	CA - 100	6,120.00	1,014.00	75	2014 / 15
Thornhurst	DDC - 100	-	5,086.18	352	2019 / 20
Duckholt	CA - 100	3,884.00	1,159.00	154	2025 / 26

7.2 Stakeholder assets

The EA manage Ea Beck, the raised defences (banks) along it, Whitecross syphon, and own Shaftholme Railway Bridge.

There is a licensed abstraction at the Eastern corner of the sub-catchment.

YW manage the sewer system within the village of Carcroft. This system appears to discharge into the Duckholt PS catchment.

The roads authority is responsible for the roads and culverted drain crossings of DDC managed watercourses.

Network Rail, the authority responsible for the United Kingdom's railway network, is responsible for the railway infrastructure and culverted drain crossings of DDC managed watercourses.

7.3 Current Maintenance Prioritisation

The sub-catchment is currently ranked as 6 using the DDC 'Planned Maintenance Regime'. Further details or this can be seen within section 1.7.

7.4 Environmental Baseline

The sub-catchment contains the communities and infrastructure described above.

The dominant habitat is broadleaved plantation woodland and amenity grassland associated with the golf course. There are also a number of arable fields and borrow pits/ponds adjacent to Ea Beck.

There are 9 non-statutory local designated wildlife sites located wholly or partly within the area:

- Owston Wood
- Owston Park
- Brick Kiln Plantation
- Sixteen Acre Plantation
- Randall Croft Wood
- Duck Holt Plantation
- Thornhurst (Carcroft) Ponds
- Wellsyke Drain
- Bentley, Tilts and course of Old Ea Beck

Great Crested Newt have been recorded within borrow pits/ponds adjacent to the Ea Beck.

There is one listed structure, a milepost on the A19.

7.5 Flood risk

Failure of the artificial raised defences along the Ea Beck may lead to a rapid inundation of the adjacent area.

The whole of the sub-catchment lies within Flood Zone 3 and Flood Zone 2 as indicated on the EA Flood Map for Planning (Rivers and Sea), a drawing showing details is included at Appendix A.

Flooding from surface water is possible due to the topography.

Failure of the pumped drainage system will result in a steady accumulation of surface water and a spread of flooding over the sub-catchment.

The history of widespread flooding of the Doncaster area is generally described under sub-catchment 2, Goosepool.

7.6 Flood resilience

Duckholt PS, Thornhurst PS and Tilts Bridge PS are all susceptible to being affected by flooding.

7.7 Link to Risk Management Plans and other Strategies

7.7.1 CFMP Impact

The Sub-catchment lies within the Doncaster sub area of the River Don CFMP. The CFMP proposed Policy 5 indicates the EA taking action to reduce flood risk. This has already included bank improvement works on the Ea Beck.

The Agency will consult DDC if they propose further works which would affect DDC maintained infrastructure.

7.7.2 FRMP Impact

Potential measures in the Doncaster area to be considered by the EA include:

- Channel management - shoal, silt and vegetation removal
- Middle Don - modelling update to inform future scheme development
- Middle Don & Lower Don - improvements to in channel habitat
- Produce updated Don Strategy
- Identify projects to promote community ownership of watercourses
- Deliver catchment level flood risk management projects
- Ea Beck - River restoration

7.7.3 Development Proposals

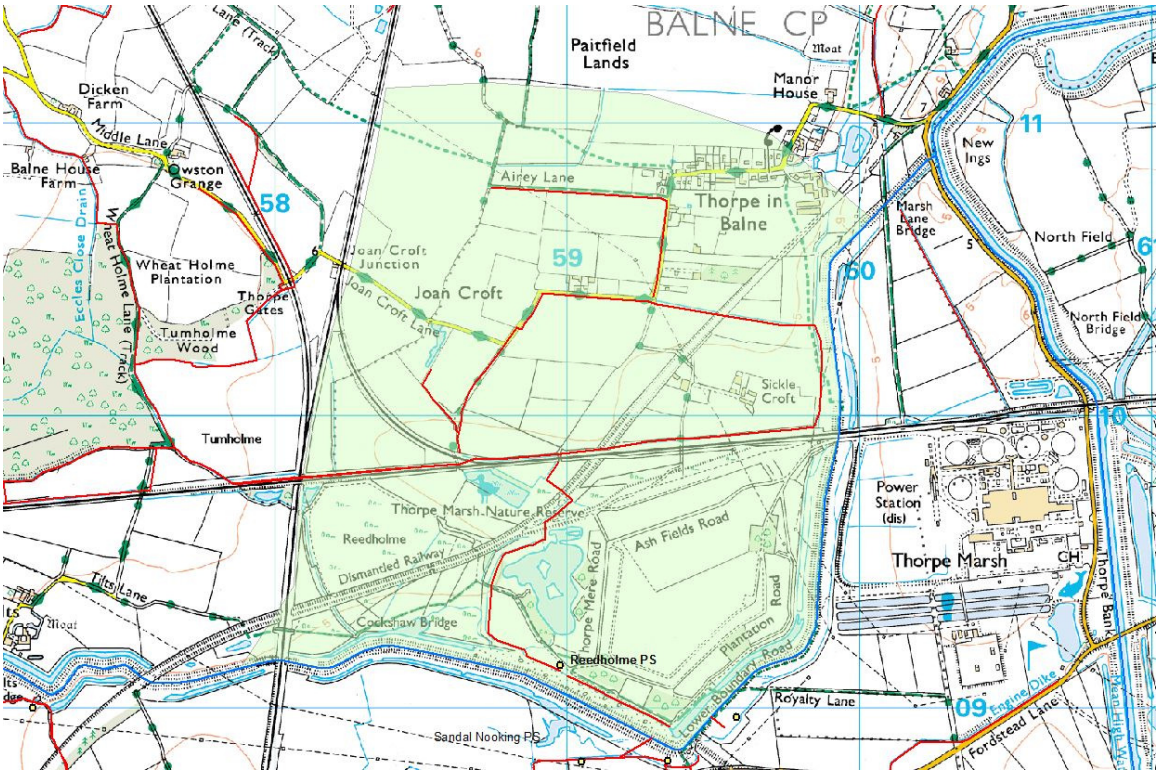
The Doncaster LDF contains minor residential development on the eastern edge of Carcroft. Otherwise, the catchment is largely in green belt.

7.8 Option Summary

7.8.1 Continue as Present

As the current drainage system is separated into three distinct drainage networks, with little scope to improve this and reduce future costs, we recommend the 'continue as present' option.

8 Sub-Catchment 6 - Reedholme



8.1 Sub-Catchment Description

The sub-catchment is located approximately 6km North of Doncaster and consists of agricultural land with residential property within the small village of Thorpe in Balne and a few outlying farms. The area is bounded to the South and East by the Ea Beck, a designated main river, and to the West by the East Coast Main Line.

The Skellow to Stainforth railway line crosses the area East to West and crosses DDC managed watercourses Shaftholme Road Drain and Joan Croft Drain. There are a few minor roads serving the village of Thorpe in Balne.

A significant feature within the area is the Thorpe Marsh Nature Reserve. The reserve lies in the south and is part of the area where fly-ash from the former Thorpe Marsh Power Station was deposited.

To the North of Thorpe Marsh Nature Reserve, and adjacent to the Western boundary, a new 3.2km twin track railway, the Doncaster chord, now connects the Skellow and Askern railway lines and enable freight trains to travel up and over the East Coast Main Line. The chord improves the reliability of passenger services and the speed and frequency of freight trains travelling between the Humber ports and the Aire Valley power stations.

The Ea Beck outfall to the River Don, the River Don, and the Thorpe Marsh washland all lie adjacent to the sub-catchment. Details of the washland system are generally outlined under sub-catchment 3 - Bentley Ings.

There are 6 watercourses which are ranked as minor, secondary or priority under the DDC maintenance prioritisation regime and Reedholme PS pumps land drainage into the Ea Beck.

The watercourses to either side of the DDC managed Reedholme PS are classed as priority.

Table 8-1: DDC - Sub-catchment 6 - AFCE Overview

Pumping Station	Contribution breakdown (%)	Annual Running Costs (£) CA Data	Annual Running Costs (£) IDB Data	Catchment Area (ha)	Planned Capital Works
Reedholme	CA - 100	2,065.00	15.00	280	2019 / 20

8.2 Stakeholder assets

The EA manage Ea Beck, the raised defences (banks) along it, Norwood Bailey Bridge, and Norwood Spillway.

Yorkshire Wildlife Trust manage Thorpe Marsh Nature Reserve.

The roads authority is responsible for the roads and culverted drain crossings of DDC managed watercourses.

Network Rail, the authority responsible for the United Kingdom's railway network, is responsible for the railway infrastructure and culverted drain crossings of DDC managed watercourses.

8.3 Current Maintenance Prioritisation

The sub-catchment is currently ranked as 15 using the DDC 'Planned Maintenance Regime'. Further details or this can be seen within section 1.7.

8.4 Environmental Baseline

The sub-catchment contains the communities and infrastructure described above.

Habitats largely comprise agricultural land to the north of the Carcroft to Stainforth railway line and grassland, woodland and open water associated with the Thorpe Marsh Nature Reserve to the south.

There are 3 non-statutory designated local wildlife sites located wholly or partly within the area:

- Thorpe Marsh Area
- Joan Croft Pond
- Bentley, Tilts and Course and Old Ea Beck

Water Vole and Great Crested Newt have been recorded within watercourses/waterbodies.

Thorpe Marsh Nature Reserve is managed by the Yorkshire Wildlife Trust and contains habitats which support species including Water Vole, Great Crested Newt, Grass Snake, Long-eared Owl, and a number of waders and water birds.

There is one listed building, a farmhouse.

8.5 Flood risk

The flood defences along the River Don and Ea Beck reduce the risk of flooding from main rivers. Any failure of the artificial raised defences may lead to a rapid inundation of the adjacent area.

The whole of the sub-catchment lies within Flood Zone 3 and Flood Zone 2 as indicated on the EA Flood Map for Planning (Rivers and Sea), a drawing showing details is included at Appendix A.

Flooding from surface water is possible due to the topography.

Failure of the pumped drainage system will result in a steady accumulation of surface water and a spread of flooding over the sub-catchment.

The history of widespread flooding of the Doncaster area is generally described under sub-catchment 3, Bentley Ings.

The left bank of the River Don is generally lower, and provides a lower standard of service, than the right bank in this area. At around a 1 in 40 year event (2.5% probability) the flow in the R Don

may exceed the channel capacity and the left bank between Thorpe in Balne and Stainforth Bridge will overtop at multiple locations.

These overtopping / spills will initially fill lower lying areas such as Trumfleet Marshes and then generate overland flows past Braithwaite and Kirk Bramwith towards Fishlake.

In events greater than 1 in 100 years (1% probability) these overland flows will be increased when the Thorpe Marsh and Bentley washland system is full and floodwaters spill over the spillway at the end of Ea Beck.

Most recently, in 2007, the Bentley and Thorpe Marsh washland system was filled to capacity and floodwater did spill over the spillway at the end of Ea Beck into the lower lying areas around Thorpe in Balne and Trumfleet Marshes.

8.6 Flood resilience

The control panels and/or incoming transformers at Reedholme PS are raised to reduce the risk of flooding 'knocking out' the power supply and stopping the PS working.

8.7 Link to Risk Management Plans and other Strategies

8.7.1 CFMP Impact

The Sub-catchment lies within the Doncaster sub area of the River Don CFMP. The CFMP proposed Policy 5 indicates the EA taking action to reduce flood risk. This has already included bank raising works on the Ea Beck.

The Agency will consult DDC if they propose further works which would affect DDC maintained infrastructure.

8.7.2 FRMP Impact

Potential measures in the Doncaster area to be considered by the EA include:

- Channel management - shoal, silt and vegetation removal
- Middle Don - modelling update to inform future scheme development
- Middle Don & Lower Don - improvements to in channel habitat
- Produce updated Don Strategy
- Identify projects to promote community ownership of watercourses
- Deliver catchment level flood risk management projects
- Ea Beck - Ea Beck & Engine Drain tidal doors
- Ea Beck - River restoration

8.7.3 Development Proposals

The Doncaster LDF contains a proposal for a gas fired power station adjacent to this sub-catchment on the site of the former Thorpe Marsh power station. Further details are contained under sub-catchment 4, Norwood.

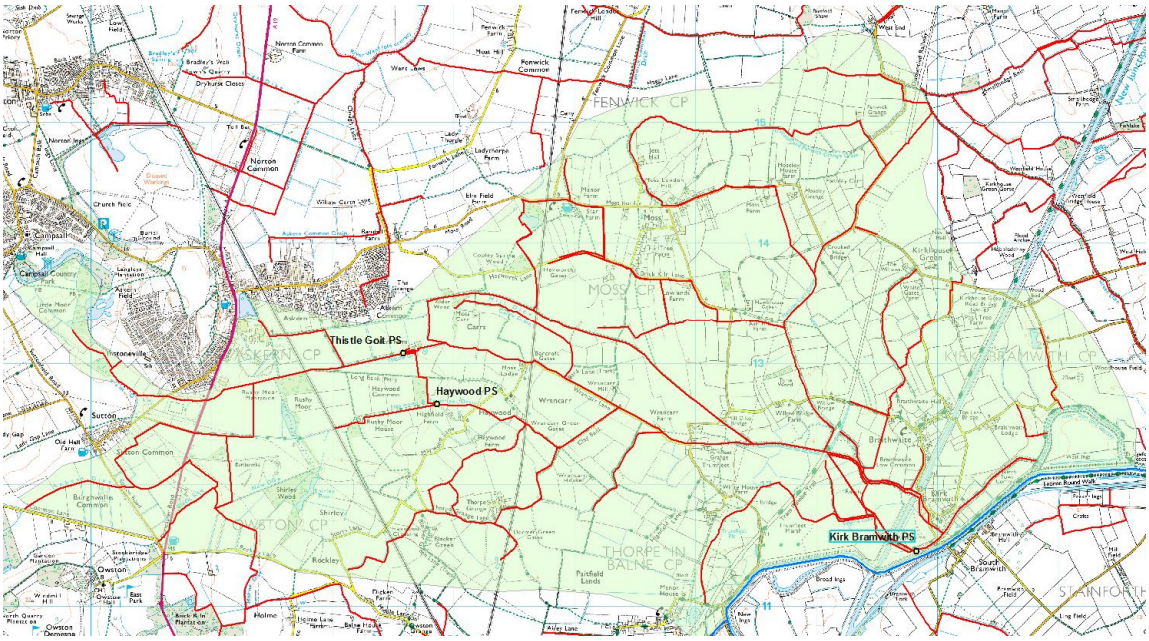
There are no development proposals for this sub-catchment within the Doncaster LDF.

8.8 Option Summary

8.8.1 Continue as Present

The drainage system is isolated from the rest of the drainage district by main rivers and rail infrastructure. As a result we recommend the 'continue as present' option.

9 Sub-Catchment 7 - Kirk Bramwith



9.1 Sub-Catchment Description

The sub-catchment is situated approximately 13km North of Doncaster and is 9km wide from East to West and 5km North to South. The River Don and Ea Beck, designated main rivers, form the South-Eastern boundary.

The area is largely rural in nature, with a mix of arable and pastoral fields, and includes the villages of Askern, Moss, Trumfleet, Kirk Bramwith and Braithwaite as well as a few smaller hamlets and outlying farms. The topography is fairly flat, typically several metres below mean high water spring level and inundation could affect the contained villages.

The Doncaster to York and Shaftholme to Askern railway lines run through the sub-catchment in a North-South direction. The A19 crosses the area in the west and many minor roads connect the villages.

From 1934 to 1951 the River Don channel was enlarged and the riverside embankments raised to reduce the risk of flooding. River diversions straightening the course of the river were also cut at Thorne Waterside, Fishlake, Stainforth, Wilsic, Barnby Dun and Waite House.

Older banks near Braithwaite, Kirk Bramwith and Fishlake, which were part of a preceding system to control the spread of river flooding, had very limited benefit after these works and, although some of these banks still remain, they were partially ploughed out, or removed, decades ago and the remaining banks are largely ineffective in any functional flood risk management terms.

The New Junction Canal passes through the eastern part of the sub-catchment adjacent to the villages of Kirk Bramwith and Braithwaite.

The Bramwith Aqueduct carries the New Junction Canal across the River Don. The aqueduct forms a significant obstruction in the river, and when river water levels are high the aqueduct is completely submerged. To both sides of the river the canal is provided with vertical gates which must be lowered to prevent the spread of floodwater back along the canal into the surrounding areas.

The DDC manage over 30 open channel watercourse and numerous pipelines classed as minor, secondary and priority in accordance with the DDC maintenance prioritisation regime.

Thistle Goit Drain, Wrancarr Drain, Flashley Carr Drain, Cross Engine drain, Old Ings & Rands Drain the lower reach of Bramwith & Braithwaite Drain, the lower reach of Kirk Bramwith New Cut, and the lower reach of Engine Dike are identified as priority watercourses.

The drains are served by 3 DDC managed pumping stations, Thistle Goit PS, Haywood PS and Kirk Bramwith PS. The first two act as booster stations and Kirk Bramwith PS provides a pumped discharge to the River Don.

Table 9-1: DDC - Sub-catchment 7 - AFCE Overview

Pumping Station	Contribution breakdown (%)	Annual Running Costs (£) CA Data	Annual Running Costs (£) IDB Data	Catchment Area (ha)	Planned Capital Works
Haywood	CA - 100	-	2,041.00	114	2017 / 18
Kirk Bramwith	DDC - 100	=	21,027.43	3064	2019 / 20
Thistlegoit	CA - 88.5 DDC - 11.5	10,625.00	10,992.00	453	2025 / 26

9.2 Stakeholder assets

The EA manage the raised defences along the River Don and Ea Beck, the watercourses themselves, and the Ea Beck outfall.

Due to ground settlement a section of masonry floodwall adjacent to Kirk Bramwith PS was in a poor condition and leaked significantly at times of high water levels in the River Don. Some 79m of the wall, which incorporated two outfalls from the old Kirk Bramwith Pumping Station was replaced with a new sheet piled wall, incorporating one new outfall, in 1995.

Works to strengthen and improve the Ea Beck Outfall were completed in December 1998 as part of the Ea Beck Comprehensive Scheme. Further details of works along Ea Beck and the Ea Beck Comprehensive Scheme are generally outlined under sub-catchment 2 - Goosepool.

The A19 and minor roads pass over numerous watercourses. The roads authority is responsible for the roads and culverted drain crossings of DDC managed watercourses.

Network Rail, the authority responsible for the United Kingdom's railway network, is responsible for the railway infrastructure and culverted drain crossings of DDC managed watercourses.

CRT manage the New Junction Canal, the Bramwith Aqueduct, the maintenance and operation of the vertical gates, and for the weight restricted bridge carrying a minor road over the River Don near Kirk Bramwith.

9.3 Current Maintenance Prioritisation

The sub-catchment is currently ranked as 5 using the DDC 'Planned Maintenance Regime'. Further details or this can be seen within section 1.7.

9.4 Environmental Baseline

The sub-catchment contains the communities and infrastructure described above.

Habitats include the fields, ditches and boundary hedges associated with the rural, agricultural nature of the area. Water Vole and Great Crested Newt have been recorded within watercourses/waterbodies.

Shirley Pool SSSI is designated for wetland habitats including open water, reed swamp, tall fen, wet neutral grassland and carr which grades into birch-oak woodland on drier ground. The DDC have a Water Level Management Plan (WLMP) for Shirley Pool SSSI and surrounding area to ensure that their activities do not adversely impact upon the site. This WLMP is due for review.

There are 11 non-statutory designated local wildlife sites located wholly or partly within the area:

- West Ings
- Lodge Lane Pond
- Ruskholme
- Old Ings and Chequer Land
- Wrancarr Drain & Braithwaite Delves

- Trumfleet Pond
- Trumfleet Pit
- Shirley Pool and Rushy Moor Area
- Copley Spring Wood
- Moss Brick Pond
- Campsall Country Park

There are two scheduled monuments:

- Sutton Common Earthworks
- Thorpe in Balne Moated Site

There are 20 listed buildings, the majority of which are farmhouses and associated buildings. Drain Bridge on Low Lane is a Grade II listed structure.

9.5 Flood risk

The flood defences along the River Don and Ea Beck reduce the risk of flooding from main rivers. Any failure of the artificial raised defences would lead to a rapid inundation of the adjacent area.

The left bank of the River Don is generally lower, and provides a lower standard of service, than the right bank in this area. At around a 1 in 40 year event (2.5% probability) the flow in the R Don may exceed the channel capacity and the left bank between Thorpe in Balne and Stainforth Bridge will overtop at multiple locations.

These overtopping / spills will initially fill low lying areas such as Trumfleet Marshes and then generate overland flows past Braithwaite and Kirk Bramwith towards Fishlake.

In events greater than 1 in 100 years (1% probability) these overland flows will be increased when the Thorpe Marsh and Bentley washland system is full and floodwaters spill over the spillway at the end of Ea Beck.

Approximately 3/4 of the sub-catchment lies within Flood Zone 3 and Flood Zone 2 as indicated on the EA Flood Map for Planning (Rivers and Sea), a drawing showing details is included at Appendix A.

Flooding from surface water is possible due to the topography.

Failure of the pumped drainage system will result in a steady accumulation of surface water and spread of flooding over the sub-catchment (and adjacent areas).

This sub-catchment has been affected as part of more widespread flooding of the Doncaster area as outlined in sub-catchment 3, Bentley Ings and sub-catchment 9 - Fishlake.

9.6 Flood resilience

Thistle Goit PS, Haywood PS, and Kirk Bramwith PS are all susceptible to being affected by flooding.

9.7 Link to Risk Management Plans and other Strategies

9.7.1 CFMP Impact

The sub-catchment lies within the Lower Don sub area of the River Don CFMP. The CFMP proposed Policy 3 indicates the EA continuing to manage flood risk by maintaining flood defences and washlands in the sub area.

This sub-catchment is adjacent to the main river defences and would be affected by any changes in the Agency's CFMP policy.

9.7.2 FRMP Impact

Potential measures in the Lower Don area to be considered by the EA include:

- Channel management - shoal, silt and vegetation removal
- Middle Don - modelling update to inform future scheme development

- Middle Don & Lower Don - improvements to in channel habitat
- Produce updated Don Strategy
- Identify projects to promote community ownership of watercourses
- Deliver catchment level flood risk management projects
- R Don, Milethorne Sidings to Arksey Slips - Bank refurbishment
- R Don Thorpe-in-Balne - Thorpe Marsh piles & bank refurbishment
- R Don Stainforth - Old Don Outfall repair/replacement
- R Don Kirk Bramwith - Kirk Bramwith Defences Bank refurbishment
- R Don Stainforth - Stainforth Left Bank refurbishment
- R Don Fishlake - Improve wetland area

9.7.3 Development Proposals

The Doncaster LDF contains some proposals for minor residential development in Moss and Sykehouse and employment and residential sites in Askern. There are no plans to develop the remainder of the area.

9.8 Option Summary

9.8.1 Option 1 - Decommission Haywood PS

Under this option we consider the potential to reduce pumping, maintenance and capital costs within the sub-catchment at Haywood PS by diverting flows to the neighbouring Thistle Goit PS. This may be achieved by:

- Construct a new drain connecting Haywood & Trumfleet Drain to Thistle Goit Drain
- Decommission Haywood Pumping Station
- Upgrade Thistle Goit Pumping Station

For a high level plan of the option please refer to drawing no.'2013s7706 - 100 - 007 - 001' within Appendix C.

9.8.2 Option 2 - Discharging water via gravity

Control structures currently force drainage from the Bramwith Rands area, via the Bramwith Rands pipeline, to Kirk Bramwith PS where it is pumped into the River Don.

Under this option we consider the potential to modify the current system and enable flows to pass through the existing drain network to the EA gravity outfall at West Ings and thereby reduce pumping at Kirk Bramwith PS.

In short this option covers:

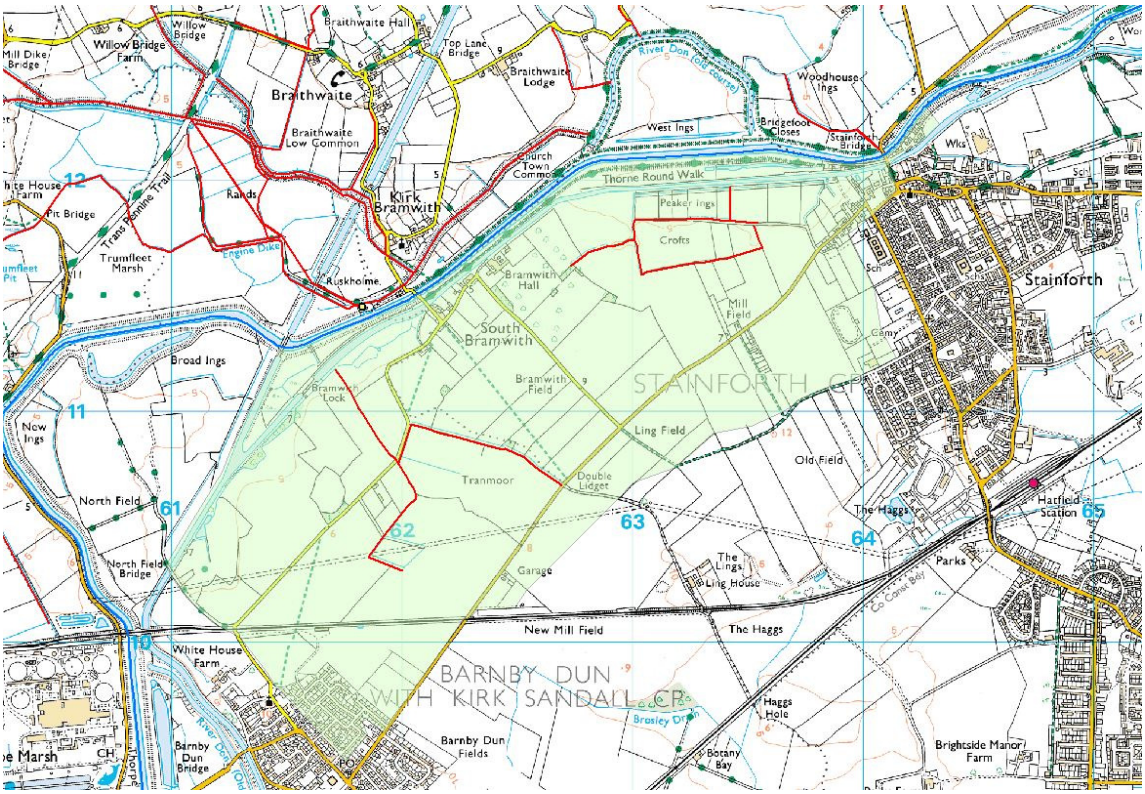
- Modify existing drainage system to increase gravity discharge
- Retain the facility for pumped discharge of Bramwith Rands pipeline under more extreme conditions

A high level plan of the option is shown on drawing no.'2013s7706 - 100 - 007 - 002' within Appendix C.

9.9 Opportunities and Constraints

WLMS Options	Opportunities	Constraints
Option 1 - Decommission Haywood PS	**Engineering** Reduced operational, maintenance and future capital costs. Future capital expenditure could be re-allocated throughout the district. Capital works funding allocated to Haywood PS can be re-allocated through the district or saved.	**Engineering** Demolition and 'making safe' costs. Civil works to construct a new road culvert beneath Rushy Moor Road. Civil works to construct a new open channel watercourse to connect into Thistlegoit drain. Ground Investigation is needed to determine ground stability. Potential costs of works at Thistlegoit PS to increase pumping capacity. Potential Increased operational, maintenance and future capital costs at Thistlegoit PS.
	Environmental The cutting of a new drain, and the possible introduction of berms, provides opportunities to enhance the channel and bankside habitat for species such as Water Vole.	**Environmental** Potential impacts on Shirley Pool SSSI through changes to hydrology and flows need to be considered.
Option 2 - Discharging water via gravity	**Engineering** Reduced operational, maintenance and future capital costs. The majority of flows would be discharged along open channel watercourse.	**Engineering** Increased surface water flows passing Kirk Bramwith, through open channel watercourses and the outfall. The condition of the outfall is currently unknown and improvement works may be needed. The condition of the Bramwith Rands pipeline is unknown.
	Environmental Any modifications to watercourses i.e. re-grading, and the possible introduction of berms, provides opportunities to enhance the channel and bankside habitat for species such as Water Vole. Increased use of the EA outfall may provide opportunity to facilitate eel passage to the upstream area.	**Environmental** Potential impacts on the following need to be considered: - Drainage/flood risk to properties and infrastructure. - Grade II listed bridge on Low Lane (Drain Bridge). - Great Crested Newt in the vicinity of Braithwaite Delves. - Water Voles within existing watercourses.

10 Sub-Catchment 8 - South Bramwith



10.1 Sub-Catchment Description

The sub-catchment is bounded by the River Don, a designated main river, to the North and covers an area from Barnby Dun in the West to Stainforth in the East.

The area is isolated from the rest of the Danvm drainage network.

Land use is mainly agricultural but the area includes the village of South Bramwith, a few residential properties on the edges of Stainforth and Barnby Dun, and a caravan site off Doncaster Road near Stainforth.

Minor roads cross the area, connecting the villages of Barnby Dun, Stainforth and Kirk Bramwith, and cross DDC managed watercourses Tranmoor Drain and Lidget Drain.

The Carcroft to Stainforth railway line runs through the Southern corner of the area but does not cross any DDC managed watercourse.

The 6 DDC managed watercourses, Lidget Drain, Tranmoor Drain, Peeker Ings Drain, Crofts Lane drain, Bramwith Hall Drain and Mill Field Drain, are categorised as minor watercourses in accordance with the DDC maintenance prioritisation regime.

The watercourses discharge by gravity into the soak dyke to the south of the Sheffield and South Yorkshire Navigation Canal which lies to the south of the River Don.

10.2 Stakeholder assets

The EA manage the River Don and the raised defences along it.

This reach of the River Don has a number of licensed abstractions.

The roads authority is responsible for the roads and culverted drain crossings of DDC managed watercourses.

CRT manage the Sheffield and South Yorkshire Navigation Canal.

Network Rail, the authority responsible for the United Kingdom's railway network, is responsible for the railway infrastructure.

10.3 Current Maintenance Prioritisation

This sub-catchment has been omitted from the DDC 'Planned Preventative Maintenance Regime' and does not currently have a priority ranking.

10.4 Environmental Baseline

The sub-catchment contains the communities and infrastructure described above.

There are 5 non-statutory local designated wildlife sites located wholly or partly within the area:

- Bramwith Hall
- Bramwith Lock Woods
- Bramwith Lane Wood
- North Field Pond
- North Field Lane

Water Voles have been recorded within watercourses/waterbodies.

There are ten listed buildings, including the Grade II listed Bramwith Hall and associated buildings.

10.5 Flood risk

The flood defences along the River Don reduce the risk of flooding from main river. Any failure of the artificial raised defences would lead to a rapid inundation of the adjacent area.

The whole of the sub-catchment lies within Flood Zone 3 and Flood Zone 2 as indicated on the EA Flood Map for Planning (Rivers and Sea), a drawing showing details is included at Appendix A.

Flooding from surface water is possible due to the topography.

Failure of the pumped drainage system will result in a steady accumulation of surface water and spread of flooding over the lower lying areas.

10.6 Flood resilience

The sub-catchment does not contain DDC infrastructure which is susceptible to flooding.

10.7 Link to Risk Management Plans and other Strategies

10.7.1 CFMP Impact

The sub-catchment lies within the Lower Don sub area of the River Don CFMP. The CFMP proposed Policy 3 indicates the EA continuing to manage flood risk by maintaining flood defences and washlands in the sub area.

This sub-catchment is adjacent to the main river defences and would be affected by any changes in the Agency's CFMP policy.

10.7.2 FRMP Impact

Potential measures in the Lower Don area to be considered by the EA include:

- Channel management - shoal, silt and vegetation removal
- Middle Don - modelling update to inform future scheme development
- Middle Don & Lower Don - improvements to in channel habitat
- Produce updated Don Strategy
- Identify projects to promote community ownership of watercourses
- Deliver catchment level flood risk management projects
- R Don, Thorne to Arksey - Mile Thorne to Arksey Bank refurbishment
- R Don Fishlake - Improve wetland area

10.7.3 Development Proposals

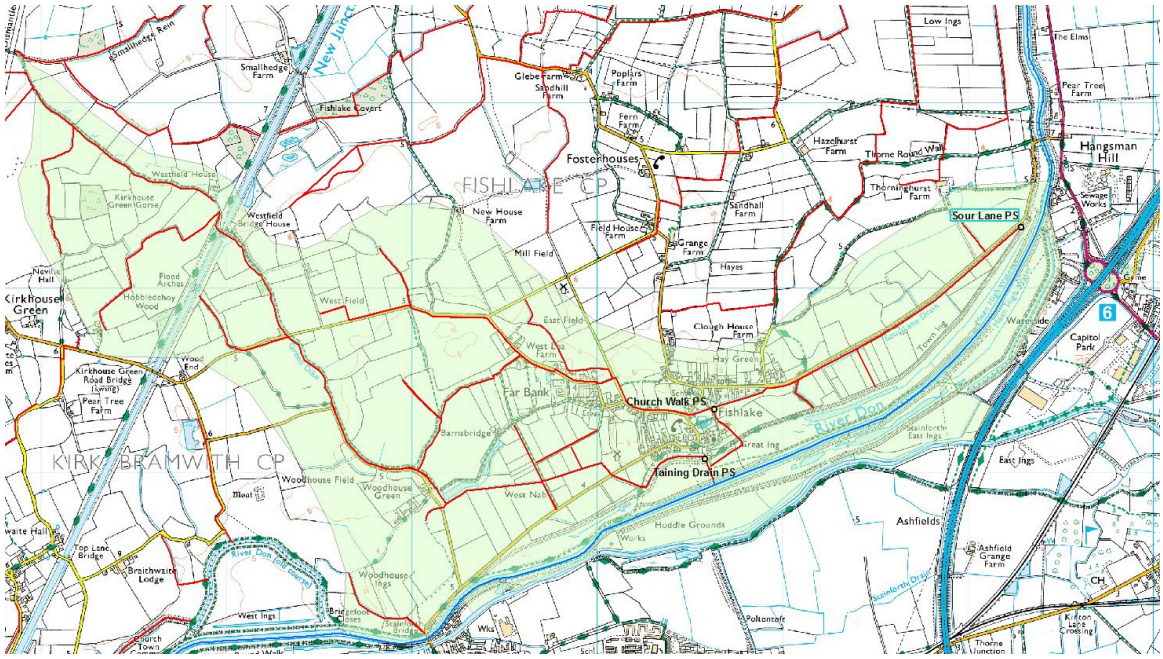
The Doncaster LDF does not include any significant proposals for development in the sub-catchment.

10.8 Option Summary

10.8.1 Continue as present

The land drainage system in this area is isolated from the rest of the Danvm drainage network and discharges via gravity. As a result we recommend the 'continue as present' option.

11 Sub-Catchment 9 - Fishlake



11.1 Sub-Catchment Description

The sub-catchment is located around the village of Fishlake approximately 2km North of Stainforth, Doncaster and extends from Fenwick Grange in the West to Sour Lane PS near Jubilee Bridge in the East. The Sheffield and South Yorkshire Navigation Canal forms the majority of the southern boundary and the River Don lies just to the north of the canal.

The topography is fairly flat, typically several metres below mean high water spring level, and land use is predominantly agricultural. Parts of the area are subject to mining subsidence due to mining from Hatfield Colliery.

The New Junction Canal crosses in the west of the area. The canal is elevated above the surrounding land and has provision for drains and overland flood flows to pass beneath it. Minor roads cross run through the area and cross DDC managed watercourses Green Dike, Taining Drain, Westfield Road Drain and Sour Lane Drain.

From 1934 to 1951 the River Don channel was enlarged and the riverside embankments raised to reduce the risk of flooding. River diversions straightening the course of the river were also cut at Thorne Waterside, Fishlake, Stainforth, Wilsic, Barnby Dun and Waite House.

Fishlake Barrier Bank is part of the preceding system to control the spread of river flooding and had a limited benefit after these works. Although much of the bank still remains, sections were partially ploughed out, or removed, decades ago and more recently a length has been affected by mining subsidence.

There are 17 DDC managed watercourses, which are categorised as minor, secondary and priority, in accordance with the DDC maintenance prioritisation regime, the majority are categorised as secondary. The lower reaches of Sour Lane Drain and Taining Drain are classed as priority watercourses.

The drains are served by 3 DDC managed pumping stations, Sour Lane PS, Church Walk PS and Taining Drain PS which discharge to the River Don when triggered by set drain levels.

Table 11-1: DDC - Sub-catchment 9 - AFCE Overview

Pumping Station	Contribution breakdown (%)	Annual Running Costs (£) CA Data	Annual Running Costs (£) IDB Data	Catchment Area (ha)	Planned Capital Works
Sour Lane	CA - 75 DDC - 25	539.00	7,045.00	113	2014 / 15
Taining Drain	CA - 75 DDC - 25	2,142.00	3,010.00	233	2014 / 15
Church Walk	CA - 75 DDC - 25	793	1,621.00	177	2015 / 16

11.2 Stakeholder assets

The EA manage the River Don and raised flood defences (banks), which are typically set back from the River Don in this area, a high level outfall adjacent to Taining Drain PS, the Fishlake Barrier Bank, and associated stop log structures at gateways, accesses, etc.

In February 2010 engineering consultants White Young Green and Arup completed their investigation (for the EA) of the condition of the main flood bank near Fishlake finding that the bank did not require any work to improve its stability.

In 2010 environmental habitat creation works were carried out on both sides of the river near Fishlake. This work included re-shaping areas of the site, changing outfalls, installing new drainage, and creating a fish refuge lake on the Thorne side of the river.

In addition to ensuring that the structural integrity of the flood defence was not affected hydraulic modelling was used during the detailed design work for the habitat creation to ensure that the level of protection the defence provides was not compromised.

For outline details of the sliding gates at Jubilee Bridge see sub-catchment 10 - Blackshaw Clough.

Following seepage problems in late 2012 around the high level outfall near Taining Drain PS the EA subsequently carried out improvement works to reduce the potential for seepage.

CRT manage the New Junction Canal and the associated structures which allow drains and overland flood flows beneath it.

YW maintain sewer systems within Fishlake.

The roads authority is responsible for the roads and culverted drain crossings of DDC managed watercourses.

11.3 Current Maintenance Prioritisation

The sub-catchment is currently ranked as 4 using the DDC 'Planned Maintenance Regime'. Further details or this can be seen within section 1.7.

11.4 Environmental Baseline

The sub-catchment contains the communities and infrastructure described above.

Water Voles have been recorded within watercourses/waterbodies.

There are 3 non-statutory designated local wildlife sites located wholly or partly within the area:

- Thorne Waterside, Oxbows and Ings
- Thorne Ashfields
- Hobbledehoy Wood

There are 12 listed buildings, the majority of which are residential properties located within Fishlake.

11.5 Flood risk

The flood defences along the River Don reduce the risk of flooding from main river. Any failure of the artificial raised defences along the River Don would lead to a rapid inundation of the adjacent area.

Approximately 3/4 of the sub-catchment lies within Flood Zone 3 and Flood Zone 2 as indicated on the EA Flood Map for Planning (Rivers and Sea), a drawing showing details is included at Appendix A.

The left bank of the River Don is generally lower, and provides a lower standard of service, than the right bank between Thorpe in Balne and Stainforth Bridge in the south west corner of the sub-catchment. At around a 1 in 40 year event (2.5% probability) the flow in the R Don may exceed the channel capacity with the left bank overtopping at multiple locations.

These overtopping / spills will initially fill low lying areas such as Trumfleet Marshes and then generate overland flows towards Fishlake.

In events greater than 1 in 100 years (1% probability) these overland flows will be increased when the Thorpe Marsh and Bentley washland system is full and floodwaters spill over the spillway at the end of Ea Beck.

The remaining sections of the historic Fishlake Barrier Bank, and the associated stop log structures at gateways, accesses, etc may currently be ineffective in providing a functional barrier to overland flows.

Flooding from surface water is possible due to the topography.

Failure of the drainage system will result in a steady accumulation of surface water and spread of flooding over the lower lying areas.

The sub-catchment has been affected as part of more widespread flooding of the Doncaster area as outlined below:

- In 1931 flooding covered a 15 mile radius of Doncaster with Fishlake being one of the worst hit area
- In 1932 30 hours of torrential rainfall caused extensive flooding in the Doncaster area. Including Thorne, Fishlake and Moorends
- In March 1933 widespread flooding again occurred in the Doncaster area
- In 1941 a thaw of heavy snows caused the 4th major flood in 10 years
- In 1947 flooding inundated much of Doncaster, the surrounding districts and a considerable area of the surrounding countryside, including Fishlake

In more recent times parts of Fishlake were affected by flooding in November 2000, and June 2007.

11.6 Flood resilience

The pumping station control panels and/or incoming transformers are raised at Taining Drain PS, Sour Lane PS, and Church Walk PS to reduce the risk of flooding 'knocking out' the power supply and stopping the PS working.

11.7 Link to Risk Management Plans and other Strategies

11.7.1 CFMP Impact

The sub-catchment lies within the Lower Don sub area of the River Don CFMP. The CFMP proposed Policy 3 indicates the EA continuing to manage flood risk by maintaining flood defences and washlands in the sub area.

This sub-catchment is adjacent to the main river defences and would be affected by any changes in the Agency's CFMP policy.

11.7.2 FRMP Impact

Potential measures in the Lower Don area to be considered by the EA include:

- Channel management - shoal, silt and vegetation removal
- Middle Don - modelling update to inform future scheme development
- Middle Don & Lower Don - improvements to in channel habitat
- Produce updated Don Strategy
- Identify projects to promote community ownership of watercourses
- Deliver catchment level flood risk management projects
- R Don, Thorne to Arksey - Mile Thorne to Arksey Bank refurbishment
- R Don Thorne - Mile Thorne Bank replace damaged section
- R Don Fishlake - Fishlake Bank, penstock & tidal doors refurbishment
- R Don Stainforth - Stainforth Left Bank refurbishment
- R Don Fishlake - Improve wetland area
- E Don Thorne - Thorne Flood Wall replacement

11.7.3 Development Proposals

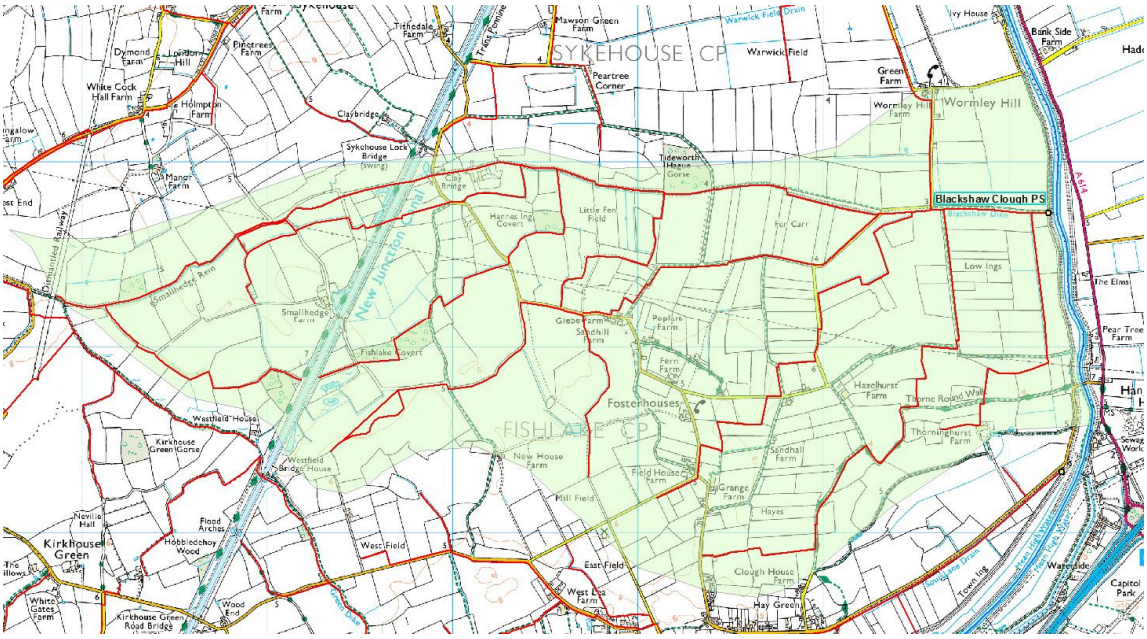
The Doncaster LDF does not include any significant proposals for development in the sub-catchment.

11.8 Option Summary

11.8.1 Continue as present

As current and potential future coal mining from Hatfield Colliery is likely to affect this area no Water Level Management Options have been developed at this time.

12 Sub-Catchment 10 - Blackshaw Clough



12.1 Sub-Catchment Description

The sub-catchment lies to the north of Fishlake and is bounded by the River Don in the East.

The topography is fairly flat, typically several metres below mean high water spring level, and land use is predominantly agricultural with a few residential properties around Fishlake and Fosterhouses, and a few outlying farms.

The New Junction Canal crosses in the west of the area. The canal is elevated above the surrounding land with provision for drains to pass beneath it, the watercourses on either side are connected via inverted syphons.

Minor roads cross the area and DDC managed watercourses Clay Dyke, Westfield House Drain, Stony Lane Drain, Millfield Drain, Field House Drain, Wood Lane Drain, Low Ings & Thorninghurst Drain and Wormley Hill Drain.

Parts of the sub-catchment are subject to mining subsidence due to mining from Hatfield Colliery and Stony Lane Drain PS is under construction to remediate the effects of mining subsidence in the Fosterhouses area. When completed Stony Lane Drain PS and a proposed Field House Drain PS will lift water on towards Blackshaw Clough PS.

The majority of DDC managed watercourses, are categorised as minor and secondary in accordance with the DDC maintenance prioritisation regime, and Clay Dyke, the main arterial drain is categorised as a priority watercourse.

The DDC manage 1 pumping station, Blackshaw Clough PS. Just upstream of the PS the water level in Clay Dyke is controlled by a sheet pile weir across the Dyke, with a small adjacent storage area to hold overtopping flows before they spill to the PS sump.

The operation of Blackshaw Clough PS is triggered by levels in the PS sump and the pumps lift water to a raised tank which then gravity discharges, via flap valves, to the River Don.

Table 12-1: DDC - Sub-catchment 10 - AFCE Overview

Pumping Station	Contribution breakdown (%)	Annual Running Costs (£) CA Data	Annual Running Costs (£) IDB Data	Catchment Area (ha)	Planned Capital Works
Blackshaw Clough	DDC - 100	-	9,226.00	1051	2015 / 16

12.2 Stakeholder assets

The EA manage the River Don and the flood defences along it.

The 2.6m high x 2.5m wide x 10m long culvert at Blackshaw Clough was repaired in 1982 by lining the internal faces masonry soffit, sides and invert with a 75mm thick layer of reinforced gunnite.

DMBS manage Jubilee Bridge, a weight and width restricted crossing of the River Don.

The road over Jubilee Bridge is lower than the adjacent flood defence banks creating a 'gap' in the defences, and when the water level in the River Don is high sets of flood-gates are slid into position to close the gap. This also effectively prevents access over the bridge which is underwater during high river levels.

The EA maintain and operate the sliding gates.

There are 2 deregulated abstraction points within the sub-catchment.

The roads authority is responsible for the roads and culverted drain crossings of DDC managed watercourses.

CRT manage the New Junction Canal, the soak dykes, the inverted syphons and the canal embankments.

12.3 Current Maintenance Prioritisation

The sub-catchment is currently ranked as 2 using the DDC 'Planned Maintenance Regime'. Further details or this can be seen within section 1.7.

12.4 Environmental Baseline

The sub-catchment contains the communities and infrastructure described above.

Water Voles and Great Crested Newt have been recorded within watercourses/waterbodies.

There are 8 non-statutory designated local wildlife sites located wholly or partly within the area:

- Fen Carr
- Little Fen Fields
- Clay Bridge Field
- Westfield Ings
- Geeseness Lane Meadows
- Low Ings
- Steward's Ings Lane Meadows
- Cowick Road Pasture and Pond

There is one listed building located; the remains of Tower Mill at Mill House.

12.5 Flood risk

The flood defences along the River Don reduce the risk of flooding from main rivers. Any failure of the artificial raised defences along the River Don would lead to a rapid inundation of the adjacent area.

Failure to operate the sliding gates to close the gap in the defences at Jubilee Bridge would increase the risk of flooding.

Approximately 3/4 of the sub-catchment lies within Flood Zone 3 and Flood Zone 2 as indicated on the EA Flood Map for Planning (Rivers and Sea), a drawing showing details is included at Appendix A.

Additional flood risk details and a history of more widespread flooding are outlined in the preceding sub-catchment 9, Fishlake.

Flooding from surface water is possible due to the topography.

Failure of the drainage system will result in a steady accumulation of surface water and spread of flooding over the lower lying areas.

12.6 Flood resilience

The pumping station control panels and/or incoming transformers are raised at Blackshaw Clough PS to reduce the risk of flooding 'knocking out' the power supply and stopping the PS working.

12.7 Link to Risk Management Plans and other Strategies

12.7.1 CFMP Impact

The sub-catchment lies within the Lower Don sub area of the River Don CFMP. The CFMP proposed Policy 3 indicates the EA continuing to manage flood risk by maintaining flood defences and washlands in the sub area.

This sub-catchment is adjacent to the main river defences and would be affected by any changes in the Agency's CFMP policy.

12.7.2 FRMP Impact

Potential measures in the Lower Don area to be considered by the EA include:

- Channel management - shoal, silt and vegetation removal
- Middle Don - modelling update to inform future scheme development
- Middle Don & Lower Don - improvements to in channel habitat
- Produce updated Don Strategy
- Identify projects to promote community ownership of watercourses
- Deliver catchment level flood risk management projects

12.7.3 Development Proposals

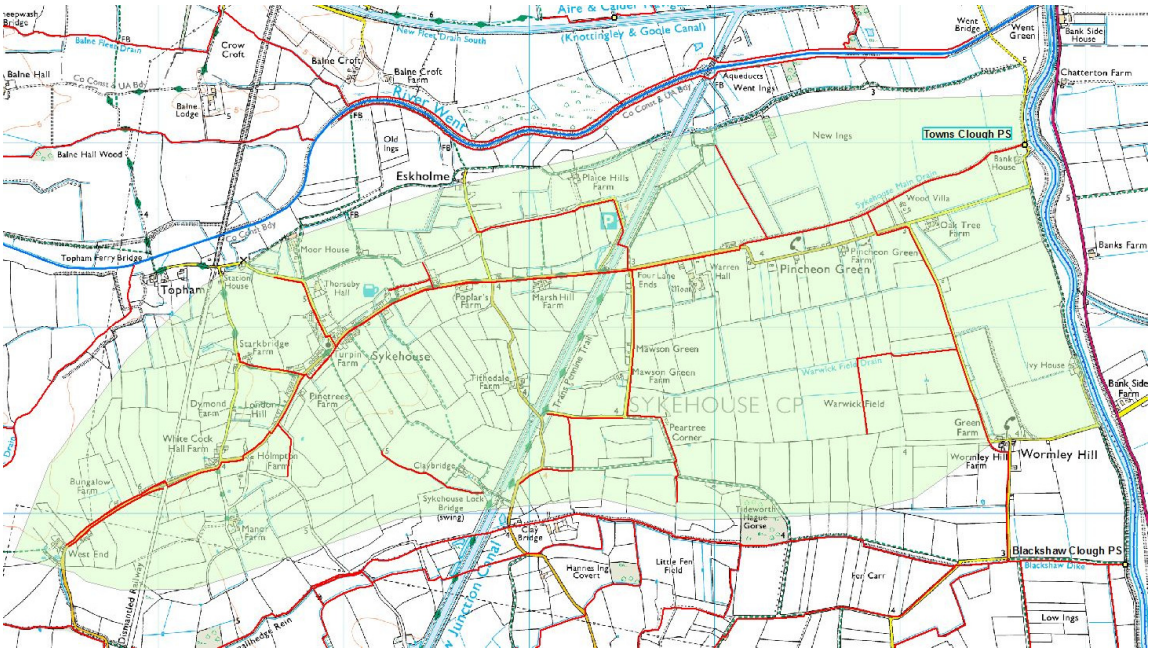
The Doncaster LDF does not contain any proposals for development in the sub-catchment.

12.8 Option Summary

12.8.1 Continue as present

As current and potential future coal mining from Hatfield Colliery is likely to affect this area no Water Level Management Options have been developed at this time.

13 Sub-Catchment 11 - Towns Clough



13.1 Sub-Catchment Description

The sub-catchment is located approximately 5km North West of Thorne, Doncaster. The River Don bounds the sub-catchment on the East and the Sykehouse Barrier Bank, the southern boundary of the Went Lows washland, lies along the northern boundary.

Some additional details of the Sykehouse Barrier Bank and the Went Lows washland are outlined in the subsequent sub-catchment 12, Pollington and Balne.

The topography is fairly flat, typically several metres below mean high water spring level, and land use is predominantly agricultural. The area contains the village of Sykehouse, hamlets such as Pincheon Green, Eskholme, and outlying farms.

Minor roads cross the area and DDC managed watercourses Sykehouse Main Town Drain, Eskholme drain, Wormley Hill Drain, Tideworth Hague Drain and Asenthorpe Green Drain.

The New Junction Canal passes through the centre of the sub-catchment (in an approximately North-South direction). The canal is elevated above the surrounding land with provision for drains to pass beneath it, the watercourses on either side are connected via inverted syphons.

The majority of DDC managed watercourses, are categorised as minor and secondary in accordance with the DDC maintenance prioritisation regime, and Sykehouse Main Town Drain, the main arterial drain is categorised as a priority watercourse.

The land drainage system discharges into the River Don via Towns Clough Pumping Station.

Table 13-1: DDC - Sub-catchment 11 - AFCE Overview

Pumping Station	Contribution breakdown (%)	Annual Running Costs (£) CA Data	Annual Running Costs (£) IDB Data	Catchment Area (ha)	Planned Capital Works
Towns Clough	DDC - 100	-	7,524.00	895	2017 / 18

13.2 Stakeholder assets

The EA manage the River Don, the flood defences along it, and the Sykehouse Barrier Bank.

CRT manage the New Junction Canal, the soak dykes, the inverted syphons and the canal embankments.

The roads authority is responsible for the roads and culverted drain crossings of DDC managed watercourses.

13.3 Current Maintenance Prioritisation

The sub-catchment is currently ranked as 3 using the DDC 'Planned Maintenance Regime'. Further details or this can be seen within section 1.7.

13.4 Environmental Baseline

The sub-catchment contains the communities and infrastructure described above.

Water Voles have been recorded within watercourses/waterbodies.

A small field, which is part of Went Ings Meadows SSSI designated for its species-rich hay meadows, and a small part of Went Valley SSI, are located in the north of the sub-catchment.

Warren Hall Moated Site is a Scheduled Monument and there are seven listed structures including a church and a number of farm buildings.

13.5 Flood risk

The flood defences along the River Don and Sykehouse Barrier Bank reduce the risk of flooding from main rivers.

Approximately 2/3 of the sub-catchment lies within Flood Zone 3 and Flood Zone 2 as indicated on the EA Flood Map for Planning (Rivers and Sea), a drawing showing details is included at Appendix A.

Additional flood risk details and a history of more widespread flooding are outlined in sub-catchment 9, Fishlake.

In Nov 2007 floodwater passed through a damaged section of the barrier bank to the west of Topham and followed lower lying land eastwards across Bate Lane, around Starkbridge Farm and affecting properties near the junction of Bate Lane with Starkbridge Lane.

Flooding from surface water is possible due to the topography.

Failure of the drainage system will result in a steady accumulation of surface water and spread of flooding over the lower lying areas.

The pipeline running through the village is considered to be a potential factor in surface water flooding issues.

13.6 Flood resilience

The pumping station control panels and/or incoming transformers are raised at Towns Clough PS to reduce the risk of flooding 'knocking out' the power supply and stopping the PS working.

13.7 Link to Risk Management Plans and other Strategies

13.7.1 CFMP Impact

The Sub-catchment lies within the Lower Don sub area of the River Don CFMP. The CFMP proposed Policy 3 indicates the EA continuing to manage flood risk by maintaining flood defences and washlands in the sub area.

This sub-catchment is adjacent to the main river defences and would be affected by any changes in the Agency's CFMP policy.

13.7.2 FRMP Impact

Potential measures in the Lower Don area to be considered by the EA include:

- Channel management - shoal, silt and vegetation removal
- Middle Don - modelling update to inform future scheme development
- Middle Don & Lower Don - improvements to in channel habitat
- Produce updated Don Strategy
- Identify projects to promote community ownership of watercourses
- Deliver catchment level flood risk management projects
- R Went Sykehouse - Sykehouse Barrier Bank refurbishment

13.7.3 Development Proposals

The Doncaster LDF contains a small area for public utility development in Sykehouse but no proposals for residential or commercial development.

13.8 Option Summary

13.8.1 Option 1 - Install 'two tier' system

Sykehouse Main Town Drain suffers from bank instability in a number of locations.

Under this option we consider the potential to install a perforated pipe into Sykehouse Main Town Drain with the open drain above the pipe being used as a high level overflow channel.

This would reduce the depth of the open drain, improve stability, and allow flow along the open channel when the capacity of the pipe is exceeded.

The areas where the option might be implemented would be subject to further study and survey. In short the option includes the following:

- Installation of sections of perforated piping for normal flows
- Construction of a high level overflow channel

A high level plan of the option is shown on drawing no.'2013s7706 - 100 - 011 - 001' within Appendix C.

13.8.2 Option 2 - In-line storage via widening of watercourse

Under this option we consider the potential to create a berm in the left hand bank of Sykehouse Main Town Drain between Marsh Hill Lane and Towns Clough PS

This would improve stability of the left hand bank and reduce health and safety risk during maintenance.

A high level plan of the option is shown on drawing no.'2013s7706 - 100 - 011 - 002' within Appendix C.

13.8.3 Option 3 - Removal of piped watercourses

Under this option we consider the potential to replace the pipeline through the village with an open channel. This cannot be achieved on line but a different route may, subject to further study, be feasible.

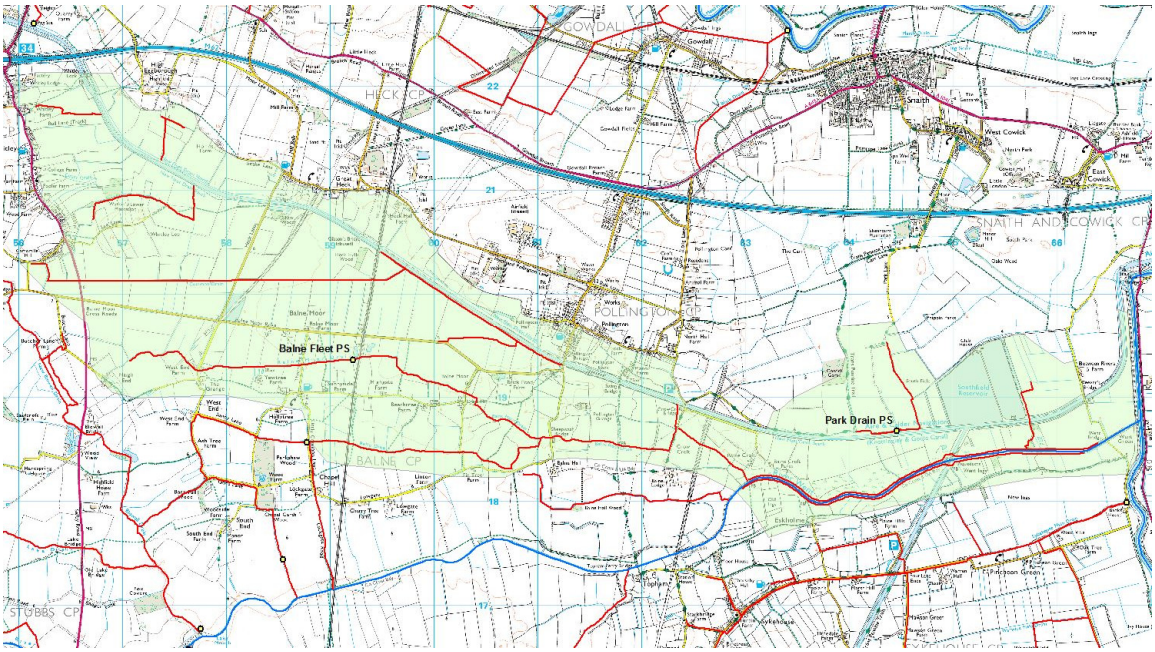
A diversion to the North of the village will need new road crossings and a diversion to the South may be cheaper, as the only apparent obstructions are hedgerows and vegetation. The new channel would connect into Sykehouse Main Town Drain downstream.

A high level plan of the option is shown on drawing no.'2013s7706 - 100 - 011 - 003' within Appendix C.

13.9 Opportunities and Constraints

WLMS Options	Opportunities	Constraints
Option 1 - install 'two tier' system	**Engineering** reduced maintenance costs: - The smaller open drain profile reduces maintenance - A smaller machine may carry out works - Improved stability results in less remedial works	**Engineering** The New Junction Canal, all inverts of infrastructure etc. need to be considered. Civils and earthworks costs of the construction phase.
	Environmental The modifications may provide opportunities to enhance the channel and bankside habitat for species such as Water Vole.	**Environmental** Potential impacts on drainage/flood risk to properties and infrastructure. Potential impacts on the Water Voles.
Option 2 - In-line storage via widening of the watercourse	**Engineering** Reduced operational and maintenance costs at Towns Clough PS. The introduction of a berm would allow for a smaller machine to carry out works improving health & safety.	**Engineering** Civils and earthworks costs of the construction phase.
	Environmental The creation of a berm provides opportunities to enhance the habitat for species such as Water Vole.	**Environmental** Potential impacts on the Water Voles.
Option 3 - Removal of piped watercourse	**Engineering** Potential reduction in flood risk. The new channel has a greater water storage volume and may help to reduce the frequency of pumping at Towns Clough PS and reduce operational and maintenance costs. Potential maintenance and future capital costs of the pipeline are avoided.	**Engineering** Civils and earthworks costs of the construction phase. Land loss compensation costs. Ground Investigation would be required to determine ground stability in the area. Longer watercourses may increase future maintenance costs.
	Environmental The new channel, and the possible introduction of berms, provides opportunities to enhance the bankside habitat for species such as Water Vole.	**Environmental** Potential impacts on drainage/flood risk to properties and infrastructure. Potential impacts on Water Voles.

14 Sub-Catchment 12 - Pollington & Balne



14.1 Sub-Catchment Description

The sub-catchment is situated approximately 12km West of Goole and extends from Whitley in the West to the River Don, a designated main river, in the East. The Sykehouse Barrier Bank, the Southern boundary of the Went Lows washland, forms part of the sub-catchment Southern boundary.

The topography is fairly flat, typically several metres below mean high water spring level, and land use is predominantly agricultural. The sub-catchment contains the village of Balne and a few outlying farms; and the villages of Whitley, Pollington and Great Heck are adjacent to it.

Parts of the Great Heck area are subject to mining subsidence due to mining from Kellingley Colliery and a temporary pump currently maintains flow into the Aire and Calder Navigation south soak dyke. A permanent pumping station is proposed for this area to remediate against the effects of mining subsidence.

The Aire and Calder Navigation runs East to West through the area, and the Navigation, the New Junction Canal, the River Went (a designated main river) and Southfield Reservoir (a large canal reservoir) lie adjacent to each other in the eastern part of the sub-catchment.

The Aire and Calder Navigation and the New Junction Canal are elevated above the surrounding land with some provision for drainage to pass below them. The New Junction Canal has a parallel low-level soak dyke, and the Aire and Calder Navigation has low-level north and south soak dykes which merge into one southern soak dyke at Pollington flowing in an easterly direction to Beavers Bridge and its gravity outfall to the River Don.

A significant portion of the eastern sub-catchment lies within the Went Lows washland.

The Went Lows washland is the area of low-lying floodplain between the Aire and Calder Navigation in the North, the Sykehouse Barrier Bank in the South, the River Don in the East and slightly higher land to the West.

When higher water levels in the River Don close the pointing doors at the Went Outfall the River Went cannot discharge and its waters accumulate in the Went Lows. The depth and extent of flooding in the Lows will steadily increase until water levels in the River Don allow the pointing doors to open, and the River Went to discharge.

The closure of the pointing doors are known to prevent free discharge of the River Went for periods of up to 1 to 2 weeks during extreme conditions.

The East Coast Main Line passes through the area in a North-South direction, as does the A19, and there are a few minor roads.

The A19 crosses the DDC Balne Common Drain. Other minor roads cross the DDC managed watercourses Balne Fleet Drain, Bell Dyke and Pollington Fleet Drain. The Doncaster-York railway crosses over the DDC managed watercourses Bell Dyke, Balne Fleet Drain and Balne Common Dain.

Land to the west of the East Coast Main Line and south of the Aire and Calder Navigation has been affected by mining subsidence from Kellingley Colliery. The DDC is liaising with UK Coal to promote land drainage mitigation works which may include a new pumping station (Great Heck) discharging to the Canal Soak Dyke, and the diversion of DDC drains.

Watercourses are categorised as secondary and priority in accordance with the DDC maintenance prioritisation regime. Court Drain, Balne Common Drain, Balne Moor Drain, Canal Soak, Balne Fleet Drain, Pollington Fleet Drain, South Soak Drain, North Soak Drain and Cowdick Drain are all classed as priority watercourses.

Flows are either discharged via gravity outfalls to the River Went, the Aire and Calder Navigation or the canal soak drain, parts of which are maintained by the DDC on behalf of CRT.

There are 2 DDC managed pumping stations, Balne Fleet PS is a small booster station to remediate the effects of mining subsidence and Park Farm PS lifts drainage to the west of Southfield Reservoir to the Aire and Calder Navigation.

Table 14-1: DDC - Sub-catchment 12 - AFCE Overview

Pumping Station	Contribution breakdown (%)	Annual Running Costs (£) CA Data	Annual Running Costs (£) IDB Data	Catchment Area (ha)	Planned Capital Works
Balne Fleet	CA - 100	858.00	2,548.00	137	2015 / 16
Park Farm	DDC - 100	-	6,814.24	114	2015 / 16

14.2 Stakeholder assets

The EA manage the River Went, the River Went outfall, the River Don, the flood defences along the River Don, and the Sykehouse Barrier Bank.

The River Went Outfall was replaced in 1990 by a new reinforced concrete structure with pointing doors on the downstream side to prevent reverse flow from the River Don back up the River Went, and a penstock on the upstream side of the outfall which may be lowered if the pointing doors are held open by debris.

Sykehouse Barrier Bank is an earthen defence to reduce the risk from flooding from the Went Lows to village and farming communities to the south, including Sykehouse, Topham, Eskholme and Pincheon Green.

Sykehouse Barrier Bank was extensively refurbished following the Nov 2000 floods with the main works starting in spring 2002. The works comprised the reconstruction or repair of the bank from near the River Don to the west of Topham.

YW manage sewers in the village of Whitley.

The roads authority is responsible for the roads and culverted drain crossings of DDC managed watercourses.

Network Rail, the authority responsible for the United Kingdom's railway network, is responsible for the railway infrastructure, including culverted drain crossings of DDC managed watercourses.

CRT manage the Aire and Calder Navigation, the soak dykes, the canal embankments, drainage culverts below the canals, and an outfall along this reach.

14.3 Current Maintenance Prioritisation

The sub-catchment is currently ranked as 13 using the DDC 'Planned Maintenance Regime'. Further details or this can be seen within section 1.7.

14.4 Environmental Baseline

The sub-catchment contains the communities and infrastructure described above, and the Went Ings Meadows SSSI, identified as the best-known example of unimproved neutral grassland in South Yorkshire, and designated for its species-rich hay meadows.

Water Voles have been recorded within watercourses/waterbodies.

There are four non-statutory designated local wildlife sites:

- Went Valley
- Balne Moor Ponds
- Ditch west of Balne Moor Ponds
- Disused Railway Line

There are three listed buildings; a church, vicarage and school adjacent to Balne Moor Road near Pollington.

14.5 Flood risk

The flood defences along the River Don and Sykehouse Barrier Bank reduce the risk of flooding from main rivers and the Went Lows washland. Any failure of the artificial raised defences along the River Don or the Sykehouse Barrier Bank would lead to a rapid inundation of the adjacent area.

The most extensive flooding in recent times was probably in March 1947 but the water level reached during this event is not known. Since 1947 flood events have reached the following recorded levels (m AOD) in the Went Lows area

- July 1958 4.57
- February 1977 4.55
- December 1978 3.90
- April 1981 3.90
- January 1995 4.10
- November 2000 4.78

When water levels in the Went Lows washland are high a drainage culvert which passes below the Aire and Calder Navigation near Crow Croft Bridge enables the movement of flood water from the Went Lows northwards into lower lying areas around Pollington.

In Nov 2000 large areas of land to the north of Aire and Calder Navigation were underwater with a number of remote properties at risk of flooding.

More minor flooding within the Went Lows may typically occur several times a year.

The eastern half of the sub-catchment lies within Flood Zone 3 and Flood Zone 2 as indicated on the EA Flood Map for Planning (Rivers and Sea). There are further smaller areas of Flood Zone 3 and 2 along the line of the Aire and Calder Navigation. The areas at risk are indicated on a drawing included at Appendix A.

Flooding from surface water is possible due to the topography.

14.6 Flood resilience

Balne Fleet PS and Park Farm PS are susceptible to being affected by flooding.

14.7 Link to Risk Management Plans and other Strategies

14.7.1 CFMP Impact

The sub-catchment lies within the Lower Don sub area of the River Don CFMP. The CFMP proposed Policy 3 indicates the EA continuing to manage flood risk by maintaining flood defences and washlands in the sub area.

This sub-catchment is adjacent to the main river defences and would be affected by any changes in the Agency's CFMP policy.

14.7.2 FRMP Impact

Potential measures in the Lower Don area to be considered by the EA include:

- Channel management - shoal, silt and vegetation removal
- Middle Don - modelling update to inform future scheme development
- Middle Don & Lower Don - improvements to in channel habitat
- Produce updated Don Strategy
- Identify projects to promote community ownership of watercourses
- Deliver catchment level flood risk management projects
- R Went Outfall - Outfall refurbishment/replacement
- R Went Sykehouse - Sykehouse Barrier Bank refurbishment
- R Went Topham - R Went Left Bank refurbishment
- R Went - River restoration
- R Went - Went End Sluice - Improve fish/eel passage
- R Went Tributaries - Modelling review

14.7.3 Development Proposals

The Selby DC 2015 Strategic Housing Land Availability Assessment (SHLAA) indicates a number of potential residential sites in Whitley. There is one planning permission and one potential development site in Great Heck. There are no further development proposals within the sub-catchment.

14.8 Option Summary

Although Fulham Lane PS is located in sub-catchment 14, Lake Drain, we consider it here as the diversion would be into this sub-catchment.

14.8.1 Option 1 - Decommission Fulham Lane PS

Under this option we consider the potential to decommission Fulham Lane PS and re-direct flows towards the proposed new pumping station at Great Heck.

Further study would be required but using LiDAR data supplied by the DDC, bed levels within Blowell Drain and the proposed site of Great Heck PS indicate a suitable fall may be achieved to comply within the DDC's remit of a 1:4000 gradient.

A new road culvert under Sheepwash Lane and works to the Balne Common Drain / A19 culvert would be required.

In brief the option includes:

- Decommission Fulham Lane PS
- Create a new channel connecting to Balne Common Drain

For a high level plan of the option please refer to drawing no.'2013s7706 - 100 - 012 - 001' within Appendix C.

14.8.2 Option 2 - Decommission Fulham Lane PS

Under this option we consider the potential to decommission Fulham Lane PS and re-direct flows along Balne Common Drain into the Aire and Calder Navigation South Soak Drain.

This may allow water to be discharged from the system sooner and at a point further downstream. Road culverts, and a railway culvert in the downstream section of Balne Common Drain, will need to be reviewed.

In brief the option includes:

- Decommission Fulham Lane PS
- Create a new channel connecting to Balne Common Drain

For a high level plan of the option please refer to drawing no.'2013s7706 - 100 - 012 - 002' within Appendix C.

14.8.3 Option 3 - Discharging water via gravity

Under this option we consider the potential to pass flows from the South Soak Drain into Pollington Fleet Drain and discharge via gravity into the River Went.

Civil works would be required to create a control structure on the South Soak Drain to divert low level flows. There are culverts along this route and the existing gradient (using LiDAR data) would be within the DDC 1:4000 gradient remit.

For a high level plan of the option please refer to drawing no.'2013s7706 - 100 - 012 - 003' within Appendix C.

14.8.4 Option 4 - In-line storage via installation of control structures

Under this option we consider the potential to install flow control structures to manage flows and create upstream storage along Balne Fleet Drain and Bell Dike by.

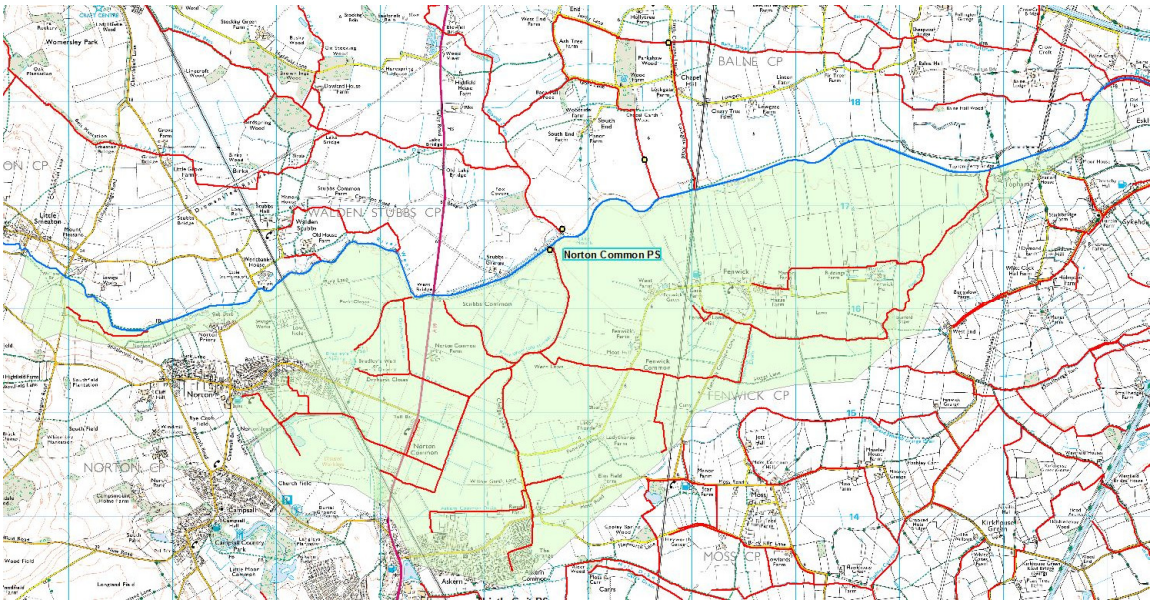
For a high level plan of the option please refer to drawing no.'2013s7706 - 100 - 012 - 004' within Appendix C.

14.9 Opportunities and Constraints

WLMS Options	Opportunities	Constraints
Option 1 - Decommission Fulham Lane PS **This options is discounted as option 2 achieves the same result without a need for pumping, saving on initial and future costs.**	**Engineering** Reduced operational, maintenance and future capital costs at Fulham Lane PS. Capital works funding allocated to Fulham Lane PS can be re-allocated through the district or saved.	**Engineering** Demolition and 'making safe' costs. Civil works to construct a new road culvert beneath Sheepwash Lane Moor Road. Civil works to road culverts along the A19 to lower invert levels. Potential costs of works at Great Heck PS to increase pumping capacity. Potential Increased operational, maintenance and future capital costs at proposed Great Heck PS. The system would discharge upstream of a potential option further downstream.
	Environmental The cutting of a new drain, and the possible introduction of berms, provides opportunities to enhance the channel and bankside habitat for species such as Water Vole.	**Environmental** Potential impacts on drainage/flood risk to properties and infrastructure (A19).
Option 2 - Decommission Fulham Lane PS	**Engineering** This may allow flows to be discharged via gravity. Reduced operational, maintenance and future capital costs. Capital works are due at Fulham Lane PS during 2025 / 26 giving time to fully investigate the options feasibility.	**Engineering** Demolition and 'making safe' costs. Civil works to construct a new road culvert beneath Sheepwash Lane Moor Road. Civil works to road culverts along the A19 to lower invert levels.
	Environmental The cutting of a new drain, and the possible introduction of berms, provides opportunities to enhance the channel and bankside habitat for species such as Water Vole.	**Environmental** Potential impacts on drainage/flood risk to properties and infrastructure (A19 and Aire & Calder Navigation Canal).
Option 3 - Discharging water via gravity	**Engineering** The re-direction of flows from the existing Canal South Soak Drain into the River Went would discharge land drainage surface water faster, reducing the risk of flooding upstream. Reduced flows in the downstream reach of the Canal South	**Engineering** Ground Investigation will be required to determine ground stability a**t the location of the control structures**. The invert levels, capacity and structural integrity of road and

WLMS Options	Opportunities	Constraints
	Soak Drain.	rail crossings will need to be investigated. The impact on flooding downstream / flooding in the Went Lows will need to be assessed, probably through hydrological modelling.
	Environmental The installation of flow control structures could provide opportunities to enhance habitats or create ponds/wetland.	**Environmental** Potential impacts on drainage/flood risk to properties and infrastructure. Potential impacts on Water Voles.
Option 4 - In-line storage via installation of control structures	**Engineering** Control structures could manage water levels within the upstream drains. Increased storage upstream may reduce flood risk downstream in periods of high rainfall.	**Engineering** **Inverts and structural capabilities of road crossing culverts will require further investigation.** Ground Investigation will be required to determine ground stability a**t the location of any control structures**. The drainage system discharges via gravity so there are no pumping stations savings etc.
	Environmental The creation of storage provides opportunities to enhance the habitat for species such as Water Vole. This could be achieved through the inclusion of berms if watercourses are re-graded or the creation of ponds/wetland to provide storage.	**Environmental** Potential impacts on drainage/flood risk to properties and infrastructure. Potential impacts on Water Voles.

15 Sub-Catchment 13 - Norton Common



15.1 Sub-Catchment Description

The sub-catchment is located approximately 13km North of Doncaster, and covers an area from Askern and Norton in the West to Topham in the East, and is bounded by the River Went, a designated main river, to the North and rising ground levels around Askern and Norton to the West.

Predominantly consisting of agricultural land the area includes part of Askern, part of Norton, the small village of Fenwick, Topham, and outlying farms.

The Doncaster to York (East Coast Mainline) and Shaftholme to Askern railway lines, run through the area in a North/South direction. Roads include the A19 to the West, but are predominantly minor rural roads, connecting Askern, Fenwick, Moss and Norton.

The A19 crosses DDC managed watercourses Ings Dike and Swans Sike Drain. Other minor roads cross DDC managed watercourses Fenwick Lane Drain (West), Shaw Lane Drain and Fenwick Fleet Drain. The railway lines cross DDC managed watercourses Sawn Sike Drain, Fenwick Lane Drain (East) and Shaw Lane Drain.

Land drainage to the West of the area falls to the old southerly loop of the River Went, which acts as a lowland carrier, and is discharged by the DDC managed Norton Common PS via a pipeline to the later embanked channel of the River Went. (The PS, and nearly a mile of new embanked channel, were built to mitigate the effects of subsidence due to workings from Askern Colliery around 1940).

Land drainage to the East drains and outfalls via gravity to the River Went near Topham.

There are various weirs and outfalls along this reach of the River Went.

Adjacent to the gravity outfall near Topham, Fenwick Fleet Drain passes under the upstream end of the Sykehouse Barrier Bank into the Went Lows washland, with a flap valve to prevent reverse flow from the Went Lows back up Fenwick Fleet Drain.

When water levels in the Went Lows prevent Fenwick Fleet Drain from discharging to the River Went water from the drain floods a storage area on the upstream side of the flap valve.

Further details of the Went Lows washland are included in the preceding sub-catchment 12, Pollington and Balne.

Watercourses are categorised as minor, secondary and priority in accordance with the DDC maintenance prioritisation regime.

Bath Drain, Askern Common Drain, Clough Lane Drain, the lower reaches of Great Common Drain East, the lower reaches of Ings Dike, the lower reaches of Fenwick Fleet Drain and part of the old River Went are categorised as priority watercourses.

Table 15-1: DDC - Sub-catchment 13 - AFCE Overview

Pumping Station	Contribution breakdown (%)	Annual Running Costs (£) CA Data	Annual Running Costs (£) IDB Data	Catchment Area (ha)	Planned Capital Works
Norton Common	DDC - 100	3,158.00	3,203.17	1234	2015 / 16

15.2 Stakeholder assets

The EA manage the River Went and the Sykehouse Barrier Bank.

There is a licensed abstraction on the old course of the River Went and another on the River Went in the North East of the area.

YW assets include parts of their sewer system around Askern and a waste water treatment plant adjacent to Norton.

The roads authority is responsible for the roads and culverted drain crossings of DDC managed watercourses.

Network Rail, the authority responsible for the United Kingdom's railway network, is responsible for the railway infrastructure, including culverted drain crossings of DDC managed watercourses.

15.3 Current Maintenance Prioritisation

The sub-catchment is currently ranked as 10 using the DDC 'Planned Maintenance Regime'. Further details or this can be seen within section 1.7.

15.4 Environmental Baseline

The sub-catchment contains the communities and infrastructure described above.

There are nine non-statutory designated local wildlife sites located within the sub catchment:

- Norton Priory, Mill Stream and Fields
- Bradley's Well
- River Went Oxbow
- Fenwick Churchyard
- Riddings Farm Pond
- Fenwick Hall Moat
- Bunfold Shaw
- Went Valley
- River Went Floodbank

There are four Scheduled Monuments located within the sub catchment:

- Multivallate enclosure 550yds (500m) W of Norton Mills
- Manorial complex including the site of Norton Manor House, Chapel, Dovecote, Moat, Fishponds, Field system and mill, 600m south-west of Westbank House
- Moat Hill Moated Site
- Fenwick Hall Moated Site

There are ten listed buildings/structure located within the sub catchment including a number of bridges.

15.5 Flood risk

The flood defences along the River Don and Sykehouse Barrier Bank reduce the risk of flooding from main rivers.

Parts of the area are slightly higher than much of the lower lying land to the East and are therefore slightly less susceptible to the risk of flooding.

Approximately 1/2 of the sub-catchment lies within Flood Zone 3 and Flood Zone 2 as indicated on the EA Flood Map for Planning (Rivers and Sea), a drawing showing details is included at Appendix A.

Flooding from surface water is possible due to the topography.

15.6 Flood resilience

The pumping station control panels and/or incoming transformers are raised at Norton Common PS to reduce the risk of flooding 'knocking out' the power supply and stopping the PS working.

15.7 Link to Risk Management Plans and other Strategies

15.7.1 CFMP Impact

The sub-catchment lies within the Lower Don sub area of the River Don CFMP. The CFMP proposed Policy 3 indicates the EA continuing to manage flood risk by maintaining flood defences and washlands in the sub area.

This sub-catchment is adjacent to the main river defences and would be affected by any changes in the Agency's CFMP policy.

15.7.2 FRMP Impact

Potential measures in the Lower Don area to be considered by the EA include:

- Channel management - shoal, silt and vegetation removal
- Middle Don - modelling update to inform future scheme development
- Middle Don & Lower Don - improvements to in channel habitat
- Produce updated Don Strategy
- Identify projects to promote community ownership of watercourses
- Deliver catchment level flood risk management projects
- R Went - River restoration
- R Went Tributaries - Modelling review

15.7.3 Development Proposals

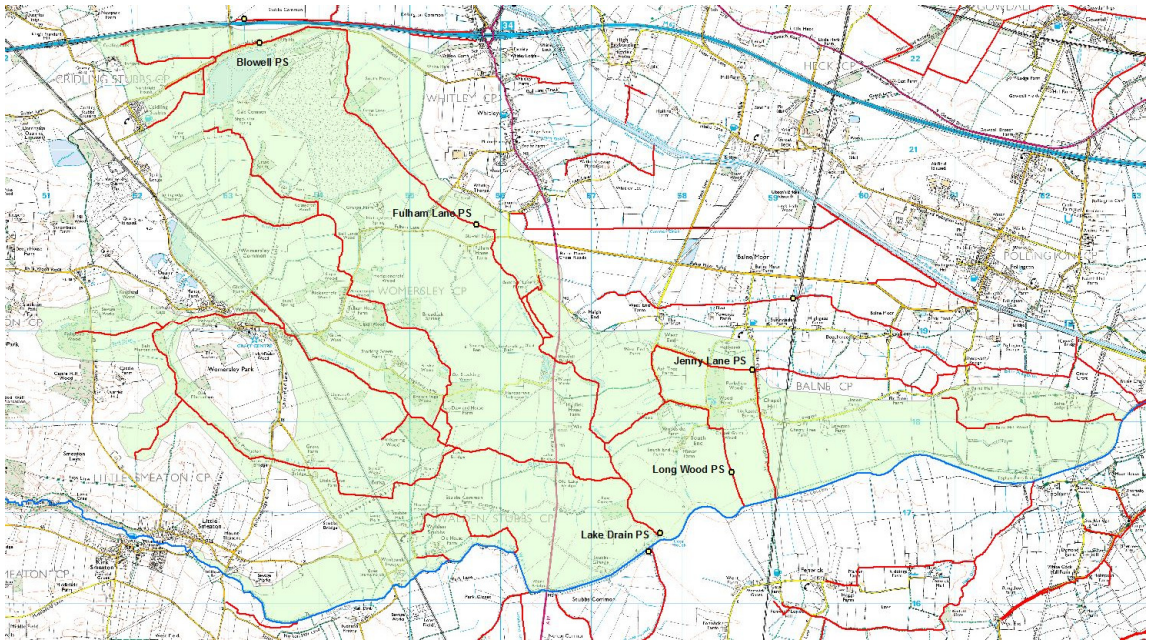
The Doncaster MBC LDF shows a potential employment site in Askern. There are no further development sites shown on the plan.

15.8 Option Summary

15.8.1 Continue as present

About half of the sub-catchment discharges via gravity outfall to the River Went. Taking into consideration that watercourses draining to Norton Common PS carry water from built up residential areas we propose the option of 'continue as present'.

16 Sub-Catchment 14 - Lake Drain



16.1 Sub-Catchment Description

The sub-catchment is located approximately 5km South East of Knottingley and covers an area from Cridling Stubbs in the North West to Topham in the East. The M62 motorway is the northern boundary, the River Went, a designated main river, the southern boundary, and the western boundary is formed by higher ground.

This large area predominantly consists of agricultural land, and contains the villages of Walden Stubbs, Womersley, several large farms, and the Gale Common ash disposal site (which accepts pulverised fuel ash from the nearby Eggborough and Ferrybridge power stations). Two lagoons within the Gale Common site are no longer operational and have been restored to provide habitat for wildlife.

The eastern end of the catchment lies within the Went Lows washland area and the Balne barrier Bank is located on the north side of the River Went. Further details of the Went Lows washland are included in sub-catchment 12, Pollington and Balne.

The Doncaster to York and Shaftholme to Knottingley railway lines cross the area in a North to South direction. Roads include the M62, which bounds the area to the North, the A19, which passes centrally in a North to South direction, and other minor roads.

The railway lines cross DDC managed watercourses Birka Drain and Womersley Beck. The A19 crosses DDC managed watercourses Lake Drain and Blowell Drain. Minor roads cross DDC managed watercourses Wood Lane Drain, Bradley Drain, Womersley Beck, Longwood Drain and Jenny Lane Drain.

The drainage system drains agricultural land and residential properties at Womersley, Walden Stubbs and Balne. In the North of the sub-catchment the drainage system drains out of this sub-catchment to Beal lane PS via a culvert beneath the M62.

Watercourses are categorised as minor, secondary, or priority using the DDC prioritisation regime. Sandy Dike, Blowell Drain, Blowell Drain tributary, Sewage Works Drain, Lake Drain, Longwood Drain, Longgate Road Drain, Balne Hall Wood Drain are categorised as priority watercourses.

The DDC currently manage 5 pumping stations which were installed to remediate the effects of mining subsidence. Long Wood PS, Jenny Lane PS, Fulham Lane PS and Blowell PS are 4 booster stations and Lake Drain PS provides a pumped discharge from Lake Drain to the River Went.

Table 16-1: DDC - Sub-catchment 14 - AFCE Overview

Pumping Station	Contribution breakdown (%)	Annual Running Costs (£) CA Data	Annual Running Costs (£) IDB Data	Catchment Area (ha)	Planned Capital Works
Jenny Lane	CA - 100	2,432.00	2,751.00	80	2015 / 16
Longwood	CA - 100	407.00	2,086.00	90	2016 / 17
Lake Drain	CA - 100	11,308.00	6,104.00	3225	2025 / 26
Fulham Lane	UK Coal - 100	-	2,114.10	611	2025 / 26
Blowell No.2	CA - 100	7,180.00	11,494.00	188	-

16.2 Stakeholder assets

The EA manage the River Went, the Balne Barrier Bank, some outfalls and bridges.

YW manage sewer systems in the villages of Womersley, Whitley and Little Smeaton.

The roads authority is responsible for the roads and culverted drain crossings of DDC managed watercourses.

Network Rail, the authority responsible for the United Kingdom's railway network, is responsible for the railway infrastructure and culverted drain crossings of DDC managed watercourses.

16.3 Current Maintenance Prioritisation

The sub-catchment is currently ranked as 10 using the DDC 'Planned Maintenance Regime'. Further details or this can be seen within section 1.7.

16.4 Environmental Baseline

The sub-catchment contains the communities and infrastructure described above.

Water Voles have been recorded within watercourses/waterbodies.

Two lagoons at the Gale Common site are no longer operational and have been restored to provide habitat for wildlife. There are also a number of woodlands.

There are 18 non-statutory designated local wildlife sites:

- Fox Covert
- River Went Floodbank
- Bam Fall Wood
- Parkshaw Wood
- Birdspring Wood
- Brown Ings Wood
- Ox Stocking Wood, Womersley
- Busky Wood
- Saulcroft Wood
- Broadoak Spring
- Clipsall Wood
- Ricketcroft Wood
- Steel Spring
- Belt Plantation
- Kingsland Wood
- Grant Spring, Womersley

- Gale Common Ash Disposal Site
- Great Lawn Rein, Womersley

There are four Scheduled Monuments:

- Multivallate enclosure 550yds (500m) W of Norton Mills
- Womersley Medieval settlement remain and Victorian Ice House in Icehouse Park
- Parkshaw Moated Site
- Whitley Thorpe moated templar grange site, 600m north west of Fulham House

There are eight listed buildings located including a number of farm houses and associated buildings.

16.5 Flood risk

The flood defences along the Rivers Don and Went reduce the risk of flooding from main rivers.

The only areas of Flood Zone 3 and Flood Zone 2, as indicated on the EA Flood Map for Planning (Rivers and Sea), lie along the River Went valley and adjacent to the M62 motorway. Flood zones are as indicated on a drawing included at Appendix A.

Flooding from surface water is possible due to the topography.

16.6 Flood resilience

The pumping station control panels and/or incoming transformers at Blowell PS are raised to reduce the risk of flooding 'knocking out' the power supply and stopping the PS working.

Long Wood PS, Jenny Lane PS, Lake Drain PS, and Fulham Lane PS are susceptible to being affected by flooding.

16.7 Link to Risk Management Plans and other Strategies

16.7.1 CFMP Impact

The sub-catchment lies within the Lower Don sub area of the River Don CFMP. The CFMP proposed Policy 3 indicates the EA continuing to manage flood risk by maintaining flood defences and washlands in the sub area.

This sub-catchment is adjacent to the main river defences and would be affected by any changes in the Agency's CFMP policy.

16.7.2 FRMP Impact

Potential measures in the Lower Don area to be considered by the EA include:

- Channel management - shoal, silt and vegetation removal
- Middle Don - modelling update to inform future scheme development
- Middle Don & Lower Don - improvements to in channel habitat
- Produce updated Don Strategy
- Identify projects to promote community ownership of watercourses
- Deliver catchment level flood risk management projects
- R Went - River restoration
- R Went Tributaries - Modelling review

16.7.3 Development Proposals

The Selby DC SHLAA shows potential residential development sites only in Womersley, There are no other allocated development sites in the sub-catchment.

16.8 Option Summary

Although Fulham Lane PS is located in this sub-catchment we consider it under sub-catchment 12, Pollington and Balne, as the diversion would be into that sub-catchment.

16.8.1 Option 1 - Discharging water via gravity

Under this option we consider the potential to connect the M62 South Drain to Blowell Drain / Fulham Lane PS and block the culvert beneath the M62. The culvert beneath White Lane may require works to accommodate any change in bed levels. Any increase in flow would be attenuated and stored within the diversion drain. In brief this option includes the following works:

- Create a new connection between the M62 South Drain and Blowell Drain
- Seal the culvert beneath the M62
- Possible upgrade to existing Whitefield Lane culvert

For a high level plan of the option please refer to drawing no.'2013s7706 - 100 - 014 - 001' within Appendix C.

16.8.2 Option 2 - In-line storage via installation of control structures

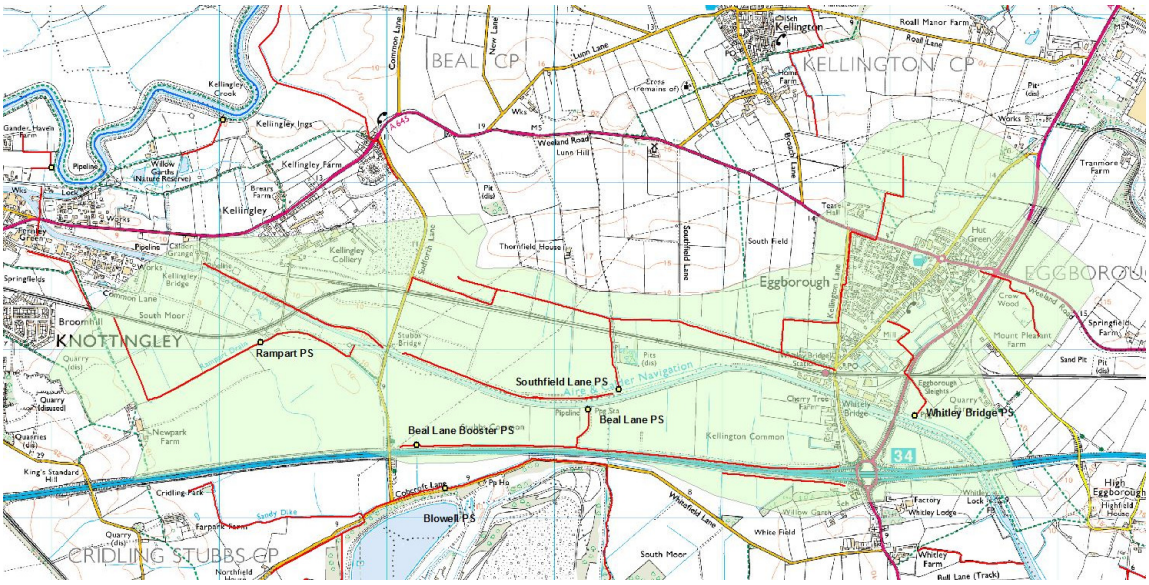
Under this option we consider the potential to create storage along Blowell Drain upstream of Fulham Lane PS to better manage pumping at Fulham Lane PS. Blowell Drain is approximately 3km in length and in-line storage could be created by the use of control structure such as tilting weirs, penstocks or stop logs. Raised water levels within the drain would produce minimal flood risk to residential properties.

For a high level plan of the option please refer to drawing no.'2013s7706 - 100 - 014 - 002' within Appendix C.

16.9 Opportunities and Constraints

WLMS Options	Opportunities	Constraints
Option 1 - Discharging water via gravity	**Engineering** The M62 South Drain would be connected to Blowell Drain and the culvert below the M62 sealed. The M62 will act as a barrier, potentially protecting land to one side if the other side were in a flood situation. Reduced operational, maintenance and future capital costs at Beal Lane PS.	**Engineering** Costs of civil works to cut a new watercourse/pipeline to connect into Blowell Drain and seal the culvert below the M62. Ground Investigation will be required to determine ground stability. The invert levels, capacity and structural integrity of road crossings will need to be investigated. Potential costs of works at Fulham Lane PS to increase pumping capacity. Increased operational, maintenance and future capital costs at Fulham Lane PS.
	Environmental Any modifications to watercourses i.e. re-grading, the inclusion of berms, etc provides opportunities to enhance the channel and bankside habitat for species such as Water Vole.	**Environmental** Potential impacts on drainage/flood risk to properties and infrastructure (M62).
Option 2 - In-line storage via the use of control structures	**Engineering** Reduced operational and maintenance costs at Fulham Lane PS.	**Engineering** The invert levels, capacity and structural integrity of road crossings will need to be investigated. Ground Investigation will be required to determine ground stability at the location of the proposed control structures. Civils and earthworks costs of construction phase. Increased maintenance costs of the watercourse and control structures.
	Environmental The installation of flow control structures could provide opportunities to enhance or create ponds/wetland.	**Environmental** Potential impacts on drainage/flood risk to properties and infrastructure (M62), Gale Common Ash Disposal Site LWS, and Great Lawn Rein LWS.

17 Sub-Catchment 15 - Eggborough



17.1 Sub-Catchment Description

The sub-catchment is located approximately 8km East of Pontefract and covers an area from Knottingley in the West to Eggborough in the East. Sub-catchments 16 - Knottingley and 17 - Hensall lie immediately to the north and to the south of the River Aire, a designated main river.

Land use includes agricultural land, the village of Low Eggborough, residential property and industrial works.

The M62, A19, A645 and minor roads run through the area with the M62 lying West to East adjacent to the southern boundary. The Aire & Calder Navigation (Knottingley and Goole Canal) also passes West to East and there are a number of railway lines which run through the area.

Roads cross DDC managed watercourses Kellington Lane Drain, Whitley Bridge Inlet Drain, and Beal Common Drain. The Knottingley to Drax railway line crosses DDC managed watercourses Beal Common Drain, Southfield Drain and Whitley Bridge Inlet Drain.

The adjacent sub-catchments 16 - Knottingley, and 17 - Hensall, contain parts of an extensive washland system along the River Aire and if there were problems with that system, or the capacity of the washlands were exceeded, the impacts may spread into this area.

Some outline details of the washland system are included within the descriptions of subsequent sub-catchments 16 - Knottingley and 17 - Hensall.

Watercourses are categorised as secondary, or priority using the DDC prioritisation regime.

Sleights Drain, Southfield Pump Drain, Stubbs Bridge to Southfield PS, Southfield Pump Drain, Beal Lane approach channel, Rampart Drain, and Beal Common Drain are categorised as priority watercourses.

There are 5 DDC managed pumping stations, Rampart PS is a booster stations lifting Rampart Drain via open watercourse and pipeline to Beal Lane Booster PS. Beal Lane Booster PS lifts water to Beal Lane PS. Beal Lane PS, Southfield Lane PS and Whitley Bridge PS pump discharges to the Aire and Calder Navigation.

Part of Kellingley Colliery is situated in the area and land to the south of the Aire and Calder Navigation has been affected by mining subsidence from Kellingley Colliery. The DDC is liaising with UK Coal to promote subsidence mitigation and the associated land drainage works may include lowering the pumping levels at Beal Lane Pumping Station and changes to drains.

Table 17-1: DDC - Sub-catchment 15 - AFCE Overview

Pumping Station	Contribution breakdown (%)	Annual Running Costs (£) CA Data	Annual Running Costs (£) IDB Data	Catchment Area (ha)	Planned Capital Works
Beal Lane	HA - 100	-	6,020.00	310	2015 / 16
Southfield Lane	CA - 100	3,564.00	8,567.00	458	2015 / 16
Beal Lane Booster	CA - 100	2,224.00	827.00	55	2016 / 17
Rampart	CA - 100	1,353.00	2,562.00	83	2025 / 26
Whitley Bridge	HA - 72 DDC - 28	-	3,468.91	122	2025 / 26

17.2 Stakeholder assets

There are a number of licensed abstraction points and reaches.

There are 2 YW buildings on the banks of the Aire & Calder Navigation.

CRT manage the Aire and Calder Navigation, the soak dykes, and the canal embankments.

The roads authority is responsible for the roads and culverted drain crossings of DDC managed watercourses.

Network Rail, the authority responsible for the United Kingdom's railway network, is responsible for the railway infrastructure, including culverted drain crossings of DDC managed watercourses.

17.3 Current Maintenance Prioritisation

The sub-catchment is currently ranked as 9 using the DDC 'Planned Maintenance Regime'. Further details or this can be seen within section 1.7.

17.4 Environmental Baseline

The sub-catchment contains the communities and infrastructure described above.

Water Voles have been recorded within watercourses/waterbodies.

There are no designated nature conservation sites or heritage assets.

17.5 Flood risk

The flood defences along the River Aire reduce the risk of flooding from main rivers.

There are areas of Flood Zone 3 and Flood Zone 2, as indicated on the EA Flood Map for Planning (Rivers and Sea), in the eastern part of the sub-catchment and to the south of Eggborough, a drawing showing details is included at Appendix A.

Flooding from surface water is possible due to the topography.

17.6 Flood resilience

The pumping station control panels and/or incoming transformers are raised at Beal Lane PS and Beal Lane Booster PS to reduce the risk of flooding 'knocking out' the power supply and stopping the PS working.

Rampart PS, Southfield Lane PS, and Whitley Bridge PS are susceptible to being affected by flooding.

17.7 Link to Risk Management Plans and other Strategies

17.7.1 CFMP Impact

The sub-catchment lies within the Lower Don sub area of the River Don CFMP. The CFMP proposed Policy 3 indicates the EA continuing to manage flood risk by maintaining flood defences and washlands in the sub area.

This sub-catchment is remote from the main river defences and would be unlikely to be affected by any changes in the Agency's CFMP policy.

17.7.2 FRMP Impact

Potential measures in the Lower Don area to be considered by the EA include:

- Channel management - shoal, silt and vegetation removal
- Middle Don - modelling update to inform future scheme development
- Middle Don & Lower Don - improvements to in channel habitat
- Produce updated Don Strategy
- Identify projects to promote community ownership of watercourses
- Deliver catchment level flood risk management projects
- R Went - River restoration
- R Went Tributaries - Modelling review

17.7.3 Development Proposals

The Selby DC Local Plan shows employment and residential development sites in Eggborough and the SHLAA shows significant areas of potential residential development on the west side of the village.

17.8 Option Summary

17.8.1 Option 1 - In-line storage via installation of control structures

Under this option we consider the potential to create storage upstream along Rampart Drain. The use of control structures such as titling weirs, penstocks and/or stop logs may be used to better manage flows to Rampart PS, Beal Lane Booster PS, and Beal Lane PS.

For a high level plan of the option please refer to drawing no.'2013s7706 - 100 - 015 - 001' within Appendix C.

17.8.2 Option 2 - In-line storage via installation of control structures

Under this option we consider the potential to create storage in the drain between Stubbs Bridge and Southfield PS. The use of control structures such as titling weirs, penstocks and/or stop logs may be used to better manage flows to Southfield PS.

For a high level plan of the option please refer to drawing no.'2013s7706 - 100 - 015 - 002' within Appendix C.

17.8.3 Option 3 - In-line storage via installation of control structures

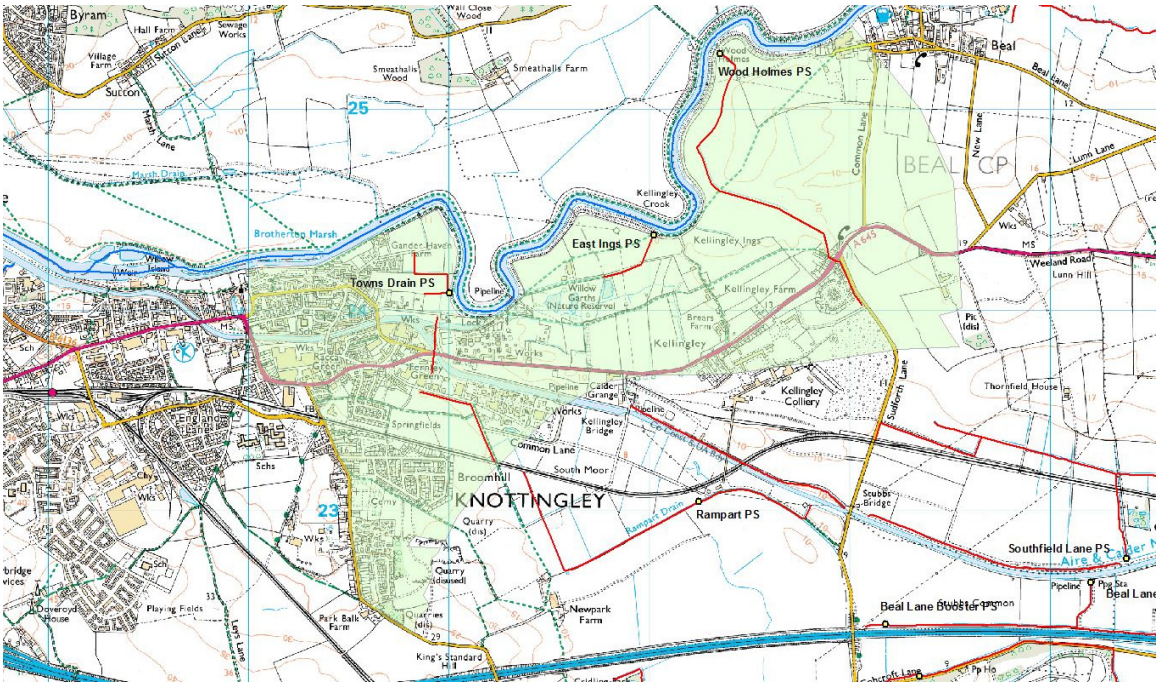
Under this option we consider the potential to utilise in-line storage along the western section of Southfield Lane Drain which could be used to hold water during periods of heavy rainfall and allow preferential pumping from the eastern length of the drain serving residential properties.

For a high level plan of the option please refer to drawing no.'2013s7706 - 100 - 015 - 003' within Appendix C.

17.9 Opportunities and Constraints

WLMS Options	Opportunities	Constraints
Option 1 - In-line storage via the installation of control structures	**Engineering** Reduced operational and maintenance costs at Rampart PS, Beal Lane Booster PS, and Beal Lane PS.	**Engineering** The invert levels, capacity and structural integrity of access track crossings will need to be investigated. Ground Investigation will be required to determine ground stability at the location of any control structures. Civils and earthworks costs of construction phase. Increased maintenance costs of the watercourse and control structures.
	Environmental Could provide opportunities to enhance or create ponds/wetland.	**Environmental** Potential drainage/flood risk impacts on railway infrastructure.
Option 2 - In-line storage via the installation of control structures	**Engineering** Reduced operational and maintenance costs at Southfield Lane PS.	**Engineering** Civils and earthworks costs of construction phase. Increased maintenance costs of the watercourse and control structures. Ground Investigation will be required to determine ground stability at the location of any control structures. It is not clear whether sections of this watercourse are piped.
	Environmental The installation of flow control structures could provide opportunities to enhance or create ponds/wetland.	**Environmental** No specific constraints identified.
Option 3 - In-line storage via the installation of control structures	**Engineering** Reduced operational and maintenance costs at Southfield Lane PS. Helps to move water away from residential property.	**Engineering** Civils and earthworks costs of construction phase. Increased maintenance costs of the watercourse and control structures. Ground Investigation will be required to determine ground stability at the location of any control structures.
	Environmental Could provide opportunities to enhance or create ponds/wetland.	**Environmental** Potential impacts on drainage/flood risk to railway infrastructure.

18 Sub-Catchment 16 - Knottingley



18.1 Sub-Catchment Description

The sub-catchment is located approximately 8km East of Pontefract to the south of the River Aire, covers an area from Knottingley in the West to Beal in the East, and includes a mixture of agricultural land, industrial works, the town of Knottingley, the village of Kellingley, part of the village of Beal, other outlying residential property and farms, and Kellingley Colliery.

The Knottingley to Drax railway line, the Aire & Calder Navigation (Knottingley and Goole Canal), and the A645 cross the area in a West to East direction. The area also contains minor roads.

The River Aire from Leeds to the Humber Estuary has approximately 109 kilometres of flood defences, comprising of raised walls, embankments and floodplain storage areas referred to as washlands. Importantly, the washlands are registered under the Reservoirs Act 1975.

The washlands are part of the River Aire's natural floodplain which, downstream of Knottingley, typically contain agricultural land. Land within the washlands is normally drained by a network of open channels, sluices and pumping stations managed by Internal Drainage Boards (IDBs).

Typically, raised embankments along the river (front washland banks) reduce the risk of the washlands flooding during lower return periods but during larger events these banks overtop and the washlands flood. High ground or a rear bank (barrier bank) is located at the back of the washlands to reduce the risk of water spreading to properties, business and infrastructure.

To the north east of Knottingley, adjacent to Gander Haven Farm, a setback bank reduces the risk of flooding from the River Aire to the area south of the bank. The area to the north of the bank floods from, and drains back to, the River Aire naturally. To the East floodwater within East Ings and Kellingley Ings washland area are evacuated, post event, by pumping at East Ings PS, and by gravity and pumping at Woodholmes PS.

Watercourses are categorised as minor, secondary, or priority in accordance with the DDC prioritisation regime. Only Canal Drain at Knottingley is categorised as a priority watercourse.

The land drainage is served by 3 DDC managed pumping stations, Town Drains PS, East Ings PS and Woodholmes PS. There are gravity outfalls to the River Aire at Town Drains PS and Woodholmes PS but these are supplemented by pumped discharges as necessary.

Table 18-1: DDC - Sub-catchment 16 - AFCE Overview

Pumping Station	Contribution breakdown (%)	Annual Running Costs (£) CA Data	Annual Running Costs (£) CA Data	Catchment Area (ha)	Planned Capital Works
Woodholmes	CA - 100	4,827.00	4,774.00	168	2014 / 15
East Ings	CA - 50 DDC - 50	271.00	1,993.00	71	2025 / 26
Town Drain	DDC - 100	-	3,509.00	43	-

18.2 Stakeholder assets

The EA manage flood defences along the River Aire, including front washland banks and barrier banks, and the River Aire.

There are a number of EA licensed abstraction points and a consented YW discharge to the River Aire North West of Kellingley.

YW is responsible for the sewer systems which runs through the sub-catchment serving Knottingley and the villages of Kellingley and Beal. The network crosses the DDC managed watercourse Woodholmes Drain.

Two Yorkshire water PSs and storm water outfalls discharge to watercourses served by Town Drain PS. The Station is not designed for these discharges and during wet weather conditions there is a danger of the station being overwhelmed, with sewage systems potentially backing up and affecting the sports field and property.

CRT manage the Aire and Calder Navigation, the soak dykes, and the canal embankments.

The roads authority is responsible for the roads.

Network Rail, the authority responsible for the United Kingdom's railway network, is responsible for the railway infrastructure.

18.3 Current Maintenance Prioritisation

The sub-catchment is currently ranked as 9 using the DDC 'Planned Maintenance Regime'. Further details or this can be seen within section 1.7.

18.4 Environmental Baseline

The sub-catchment contains the communities and infrastructure described above.

Willow Garth Nature Reserve, managed by the Yorkshire Wildlife Trust, contains a myriad of wetland habitats including willow scrub and marsh which supports a wide range of bird species.

Water Voles have been recorded within watercourses/waterbodies.

There are two listed buildings; a library and war memorial.

18.5 Flood risk

From the weir at Chapel Haddlesey to the River Aire confluence with the River Ouse at Airmyn flood risk is complicated by the interaction of fluvial and tidal waters and, during high tides, the River Aire can be 'tide locked' with fluvial or flood water taking longer to drain away.

The earliest records of flooding in the area date back to 1672 and in more recent times flooding has occurred in 2000 and 2007. Around 150 properties were flooded in October 2000, estimated as a 1 in 50 year event (2% AEP), when a breach in a barrier bank caused major flooding to the village of Gowdall. Approximately 20 properties were flooded in 2007, estimated as a 1 in 20 year flood (5% AEP).

A brief summary of historic flood events is outlined below:

Table 18-2: DDC - Sub-catchment 16 - Summary of flood events

Date of Event	Details
December 1672	Exact source, location and consequences unknown.
May 1906	Lower Aire, exact location unknown. Flooding of agricultural land noted along with the death of livestock.
December 1921	Lower Aire, exact location and consequences unknown.
March 1947	Knottingley, Ferrybridge, Gowdall, Snaith and Selby (via flow up the canal) affected.
November 1960	Extensive flooding at Castleford.
December 1978	Properties flooded in Ferrybridge, Brotherton and Knottingley. Barrier banks were overtopped between Knottingley and Beal and the riverbank breached at Birkin.
January 1995	Lower Aire washlands filled. Consequences unknown.
October/November 2000	16 properties in Brotherton and 105 in Gowdall flooded. Evacuation of Mickletown, Gowdall and Snaith.
June 2007	20 Properties flooded in Knottingley and Fairburn.

The flood banks along the River Aire reduce the risk of the washlands flooding from the River Aire. However, dependant on the prevailing weather and river conditions, the washlands may still flood several times a year.

The flood banks along the River Aire, the washlands, and the back bank to the washland reduce the risk of flooding from the River Aire to the wider area outside the washland. The dominant factor in reducing the risk of flooding to the wider area is the back bank to the washland.

When the washlands are flooded any failure of the back bank to the washland may lead to a rapid inundation of the adjacent area.

Approximately 1/2 of the sub-catchment lies within Flood Zone 3 and Flood Zone 2 as indicated on the EA Flood Map for Planning (Rivers and Sea), a drawing showing details is included at Appendix A.

Flooding from surface water is possible due to the topography.

Failure of the drainage system will result in a steady accumulation of surface water and spread of flooding over the lower lying areas.

18.6 Flood resilience

The pumping station control panels and/or incoming transformers are raised at Town Drains PS, East Ings PS and Woodholmes PS to reduce the risk of flooding 'knocking out' the power supply and stopping the PS working.

18.7 Link to Risk Management Plans and other Strategies

18.7.1 CFMP Impact

The sub-catchment lies within the Lower Aire sub area of the River Aire CFMP. Whilst the EA will continue to maintain major flood defences the CFMP proposed Policy 6 is likely to have the long term effect of increasing the frequency of inundation of the River Aire washlands. This may have an effect on land use and the volume of water pumped at Woodholmes.

This sub-catchment is adjacent to the main river defences and would be affected by any changes in the Agency's CFMP policy.

18.7.2 FRMP Impact

Potential measures in the Lower Aire area to be considered by the EA include:

- Habitat creation
- Detailed assessment of bank stability
- Improvements to habitats

18.7.3 Development Proposals

The Selby DC SHLAA shows a potential residential development on the north side of Kellingley village.

The Wakefield MDC Forward Plan shows potential employment development sites in the eastern part of Knottingley.

18.8 Option Summary

18.8.1 Option 1 - In-line storage via installation of control structures

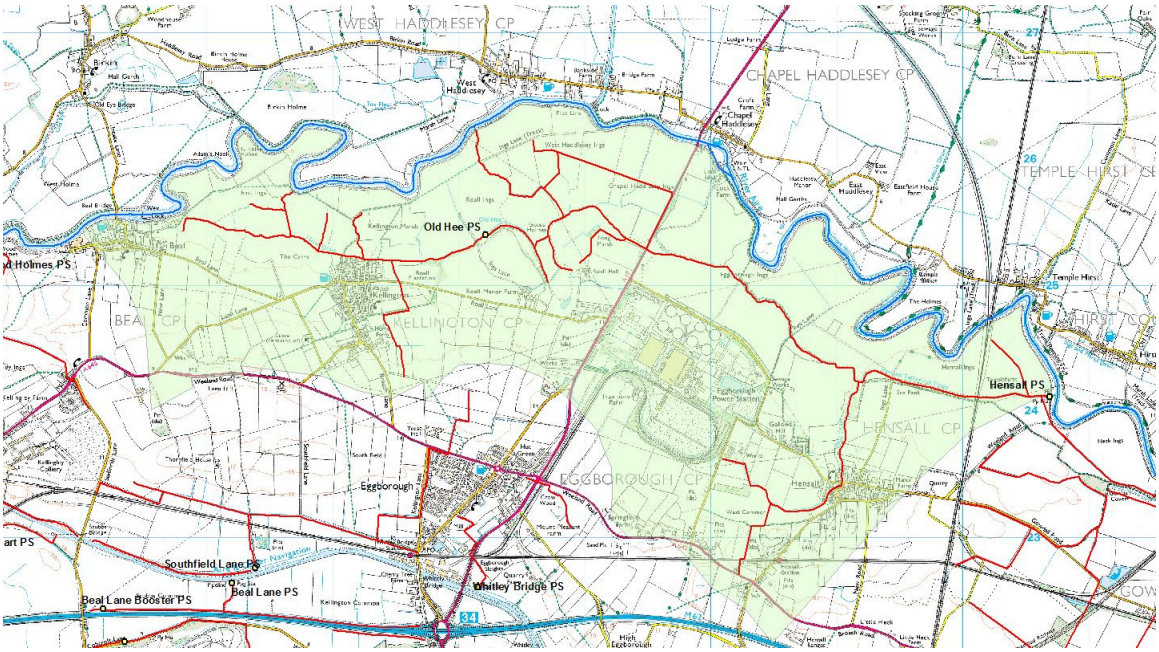
Under this option we consider the potential to create storage along Woodholmes Drain. The use of control structures such as titling weirs, penstocks and/or stop logs may be used to better manage flows to Woodholmes PS.

For a high level plan of the option please refer to drawing no.'2013s7706 - 100 - 016 - 001' within Appendix C.

18.9 Opportunities and Constraints

WLMS Options	Opportunities	Constraints
Option 1 - In-line storage via the installation of control structures	**Engineering** Reduced operational and maintenance costs at Woodholmes PS.	**Engineering** The proposed works are downstream of Kellingley limiting the amount that water levels can be raised. Civils and earthworks costs of construction phase. Increased maintenance costs of the watercourse and control structures. Ground Investigation will be required to determine ground stability at the location of any control structures.
	Environmental The installation of flow control structures could provide opportunities to enhance or create ponds/wetland.	**Environmental** Potential impacts on the Water Voles.

19 Sub-Catchment 17 - Hensall



19.1 Sub-Catchment Description

The sub-catchment, is located approximately 12km East of Pontefract to the south of the River Aire and covers an area from Beal in the West to Hensall in the East. It consists predominantly of agricultural land but also contains the villages of Beal, Kellington and Hensall, along with Eggborough Power Station.

The Doncaster to York (East Coast Main Line) and Knottingley to Drax railway lines pass through the East of the area. The A19 and other minor roads also pass through the area. The A19 and the railway lines cross the DDC managed watercourse Ings & Tetherings Drain and minor roads cross Kellington Drain.

Land to the west of the East Coast Main Line and south of the River Aire has been affected by mining subsidence from Kellingley Colliery. The DDC is liaising with UK Coal to promote land drainage mitigation works which may include a new pumping station (Hensall Village Drain) discharging to the Ings & Tetherings Drain and the diversion of some drains.

This area and the adjacent sub-catchments contain parts of an extensive washland system along the River Aire. Some outline details of the washland system and flood risk are included within sub-catchment 16 - Knottingley.

DDC managed watercourses consist of minor, secondary and priority watercourses when categorised in accordance with the DDC prioritisation regime. Holmes Drain West, Holmes Drain East, Marsh Drain, Roal Hall Drain, Ings and Tetherings Drain, and the lower reaches of Hensall Village Drain are categorised as priority watercourses.

The sub-catchment contains 2 DDC managed pumping stations Old Hee PS and Hensall PS. Old Hee is a booster station to remediate the effects of mining subsidence, and a gravity outfall, at Hensall PS, supplemented by pumping as necessary, discharges the land drainage network into the River Aire. Hensall PS also, post event, evacuates floodwater from the washland.

A pipeline from Hensall PS runs into Ings Drain in the downstream washland (sub-catchment 18 - Gowdall) and can be used to pass water downstream, but any flow through the pipeline is controlled by a penstock which is normally kept closed.

Table 19-1: DDC - Sub-catchment 17 - AFCE Overview

Pumping Station	Contribution breakdown (%)	Annual Running Costs (£) CA Data	Annual Running Costs (£) IDB Data	Catchment Area (ha)	Planned Capital Works
Hensall	DDC - 100	-	8,458.00	1551	2017 / 18
Old Hee	UK Coal - 100	-	10,174.46	506	2025 / 26

19.2 Stakeholder assets

The EA manage flood defences along the River Aire, the River Aire, and the banks forming the washland system (Sea Bank). The EA is also responsible for a number of outfalls around the village of Kellington.

A number of licensed abstraction points are located along this reach and within the wider sub-catchment.

The YW sewer systems serve the villages of Beal, Kellington, Eggborough and Hensall.

The roads authority is responsible for the roads and culverted drain crossings of DDC managed watercourses.

19.3 Current Maintenance Prioritisation

The sub-catchment is currently ranked as 17 using the DDC 'Planned Maintenance Regime'. Further details or this can be seen within section 1.7.

19.4 Environmental Baseline

The sub-catchment contains the communities and infrastructure described above.

Beal Carrs LWS is a coal mining subsidence flash which provides good wintering, breeding and passage habitat for a wide range of bird species and also supports a number of scarce invertebrate species.

Water Voles have been recorded within watercourses/waterbodies.

There is one Scheduled Monument; a Roman fort located 600m west of Roall Hall, and seven listed buildings.

19.5 Flood risk

This area and the adjacent sub-catchments contain parts of an extensive washland system along the River Aire. Some outline details of the washland system and flood risk are included within sub-catchment 16 - Knottingley.

The flood banks along the River Aire reduce the risk of the washlands flooding from the River Aire. However, dependant on the prevailing weather and river conditions, the washlands may still flood several times a year.

The flood banks along the River Aire, the washlands, and the back bank to the washland reduce the risk of flooding from the River Aire to the wider area outside the washland. The dominant factor in reducing the risk of flooding to the wider area is the back bank to the washland.

When the washlands are flooded any failure of the back bank to the washland may lead to a rapid inundation of the adjacent area.

Approximately 1/2 of the sub-catchment lies within Flood Zone 3 and Flood Zone 2 as indicated on the EA Flood Map for Planning (Rivers and Sea), a drawing showing details is included at Appendix A.

Flooding from surface water is possible due to the topography.

Failure of the drainage system will result in a steady accumulation of surface water and spread of flooding over the lower lying areas.

19.6 Flood resilience

The pumping station control panels and/or incoming transformers are raised at Old Hee PS and Hensall PS to reduce the risk of flooding 'knocking out' the power supply and stopping the PS working.

19.7 Link to Risk Management Plans and other Strategies

19.7.1 CFMP Impact

The sub-catchment lies within the Lower Aire sub area of the River Aire CFMP and includes washland. Whilst the EA will continue to maintain major flood defences the CFMP proposed Policy 6 is likely to have the long term effect of increasing the frequency of inundation of the River Aire washlands. This may have an effect on land use and the volume of water pumped at Hensall PS.

This sub-catchment is adjacent to the main river defences and would be affected by any changes in the Agency's CFMP policy.

19.7.2 FRMP Impact

Potential measures in the Lower Aire area to be considered by the EA include:

- Habitat creation
- Detailed assessment of bank stability
- Improvements to habitats

19.7.3 Development Proposals

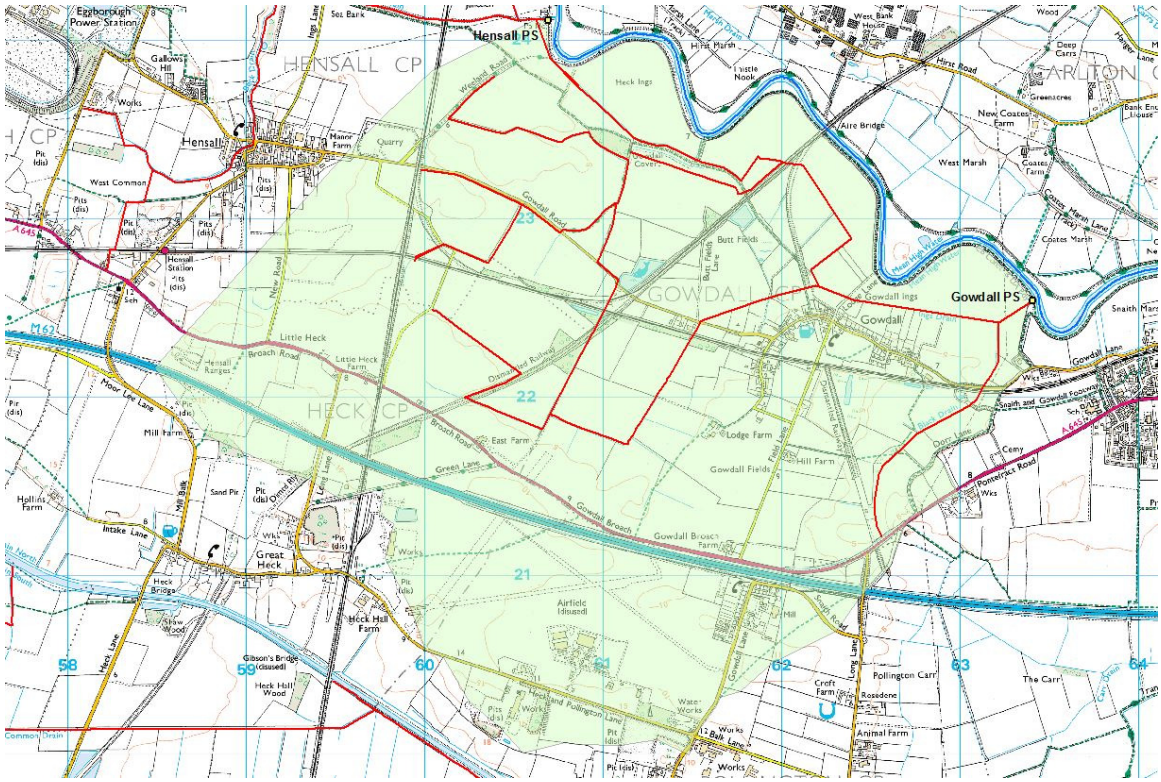
The Selby DC SHLAA shows a significant potential residential development on the west, east and south sides of Kellington village as well as smaller areas for development within Hensall and Beal villages.

19.8 Option Summary

19.8.1 Continue as present

As current and potential future coal mining from Kellingley Colliery is likely to affect this area no Water Level Management Options have been developed at this time.

20 Sub-Catchment 18 - Gowdall



20.1 Sub-Catchment Description

This sub-catchment is located to the south of the River Aire approximately 14km East of Pontefract and covers an area from Hensall in the West to Gowdall in the East.

The majority of the sub-catchment lies between the M62 motorway and the River Aire and the M62, A645, other minor roads, and a number of railway lines (including a number of disused railway lines) pass through it.

Land use is predominantly agricultural, with some industrial land, and includes the small village of Gowdall, small areas of Great Heck, Hensall and Pollington, and a number of farms.

The area to the south of the River Aire is part of an extensive washland system along the River Aire. Some outline details of the washland system and flood risk are included within sub-catchment 16 - Knottingley.

DDC managed watercourses consist of minor, secondary and priority watercourses as categorised in accordance with the DDC prioritisation regime. Ings Drain Gowdall, Black Drain, and the lower reaches of Heck Ings Lane Drain are categorised as priority watercourses.

Outline details of a piped connection from Hensall PS into Ings Drain are included in the description of the preceding sub-catchment 17 - Hensall.

The land drainage system flows in a north-easterly direction from Hensall and Great Heck to the lowest point at Gowdall PS where it outfalls by gravity, supplemented by pumping as necessary, to the River Aire. Gowdall Pumping Station also, post event, evacuates floodwater from the washland to the River Aire.

Table 20-1: DDC - Sub-catchment 18 - AFCE Overview

Pumping Station	Contribution breakdown (%)	Annual Running Costs (£) CA Data	Annual Running Costs (£) IDB Data	Catchment Area (ha)	Planned Capital Works
Gowdall	DDC - 100	-	5,787.00	1138	2017 / 18

20.2 Stakeholder assets

The EA manage the flood banks along the River Aire, washland banks, and a number of outfall structures.

In the Southern and Western areas of the sub-catchment there are licensed abstraction points on both sides of the M62.

YW sewer systems serve the villages Hensall, Pollington and Gowdall and includes a consented discharge point into the River Aire. The system which discharges into the River Aire crosses the path of the DDC Ings Drain at Gowdall which drains to Gowdall PS.

There are no major road crossings of DDC drains.

Railway lines pass over DDC managed watercourses Hensall Boundary Drain and Palmer Clough Drain which are culverted below them.

20.3 Current Maintenance Prioritisation

The sub-catchment is currently ranked as 16 using the DDC 'Planned Maintenance Regime'. Further details or this can be seen within section 1.7.

20.4 Environmental Baseline

The sub-catchment contains the communities and infrastructure described above.

Habitats predominantly comprise agricultural fields.

There is one non-statutory designated local wildlife site; Sand Quarry, Great Heck LWS.

There are three listed buildings, consisting of farm houses and associated buildings.

20.5 Flood risk

This area contains parts of an extensive washland system along the River Aire. Some outline details of the washland system and flood risk are included within sub-catchment 16 - Knottingley.

The flood banks along the River Aire reduce the risk of the washlands flooding from the River Aire. However, dependant on the prevailing weather and river conditions, the washlands may still flood several times a year.

The flood banks along the River Aire, the washlands, and the back bank to the washland, Sea Bank, reduce the risk of flooding from the River Aire to the wider area outside the washland. The dominant factor in reducing the risk of flooding to the wider area is the back bank to the washland, Sea Bank.

When the washlands are flooded any failure of the back bank to the washland, Sea Bank, may lead to a rapid inundation of the adjacent area.

The majority of the sub-catchment lies within Flood Zone 3 and Flood Zone 2 as indicated on the EA Flood Map for Planning (Rivers and Sea), a drawing showing details is included at Appendix A.

Flooding from surface water is possible due to the topography.

Failure of the drainage system will result in a steady accumulation of surface water and spread of flooding over the lower lying areas.

20.6 Flood resilience

The control panel at Gowdall PS is raised to reduce the risk of flooding 'knocking out' the power supply and stopping the PS working.

20.7 Link to Risk Management Plans and other Strategies

20.7.1 CFMP Impact

The sub-catchment lies within the Lower Aire sub area of the River Aire CFMP and includes washland. Whilst the EA will continue to maintain major flood defences the CFMP proposed Policy 6 is likely to have the long term effect of increasing the frequency of inundation of the River Aire washlands. This may have an effect on land use and the volume of water pumped at Gowdall PS.

This sub-catchment is adjacent to the main river defences and would be affected by any changes in the Agency's CFMP policy.

20.7.2 FRMP Impact

Potential measures in the Lower Aire area to be considered by the EA include:

- Habitat creation
- Detailed assessment of bank stability
- Improvements to habitats

20.7.3 Development Proposals

The East Riding District Council Local Plan - Proposed Submission Allocations Document January 2014 does not refer to any proposed development in Gowdall.

There is no developed area in the Selby DC part of the sub-catchment.

20.8 Option Summary

20.8.1 Option 1 - In-line storage via installation of control structures

Under this option we consider the potential to create in-line storage along Palmer Clough Drain and Brears Drain by the installation of tilting weirs, penstocks and/or stop logs which may be used to better manage flows to Gowdall PS.

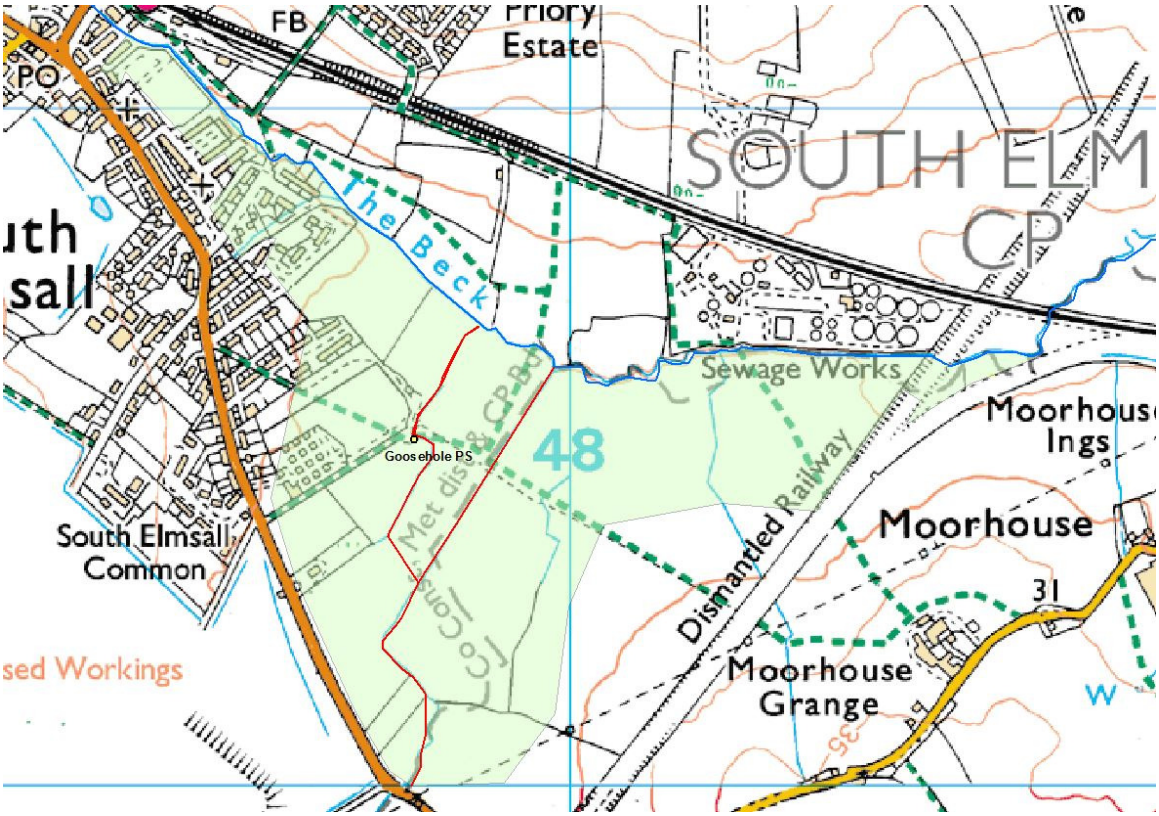
Road and rail culverts near Gowdall will require further consideration.

For a high level plan of the option please refer to drawing no.'2013s7706 - 100 - 018 - 001' within Appendix C.

20.9 Opportunities and Constraints

WLMS Options	Opportunities	Constraints
Option 1 - In-line storage via the installation of control structures	**Engineering** Reduced operational and maintenance costs at Gowdall PS.	**Engineering** Civils and earthworks costs of construction phase. Increased maintenance costs of the watercourse and control structures. Ground Investigation will be required to determine ground stability at the location of any control structures. Works may be required to road and rail culverts on Palmer Clough drain.
	Environmental The installation of flow control structures could provide opportunities to enhance or create ponds/wetland.	**Environmental** Potential impacts on drainage/flood risk to properties and infrastructure (railway lines and M62).

21 Sub-Catchment 19 - South Elmsall



21.1 Sub-Catchment Description

The sub catchment is a small area to the south of Ea Beck, a designated main river, between high ground to the East and the B6422 to the West. The area is predominantly agricultural but includes residential properties, including a recent small housing development, on the south-east of South Elmsall.

South Elmsall is served by a YW sewer system. The foul sewage system drains to the YW treatment works to the North of Ea Beck.

The land drainage system in this sub-catchment is relatively small at 38 hectares and outfalls to Ea Beck by means of gravity or pumping at Goosehole PS.

There are two DDC managed watercourses both of which are categorised as priority in accordance with the DDC prioritisation regime.

Frickley Beck and a short open channel section from the recent housing development are the only open channel watercourses and everything else is piped.

Goosehole PS was installed to mitigate the effects of mining subsidence

Table 21-1: DDC - Sub-catchment 19 - AFCE Overview

Pumping Station	Contribution breakdown (%)	Annual Running Costs (£) CA Data	Annual Running Costs (£) IDB Data	Catchment Area (ha)	Planned Capital Works
Goosehole	CA - 100	1,050.00	15.00	38	2019 / 20

21.2 Stakeholder assets

The EA manage Ea Beck.

YW manage the sewer system.

21.3 Current Maintenance Prioritisation

The sub-catchment is currently ranked as 11 using the DDC 'Planned Maintenance Regime'. Further details or this can be seen within section 1.7.

21.4 Environmental Baseline

The sub-catchment contains the communities and infrastructure described above.

There are no designated wildlife sites or heritage assets.

21.5 Flood risk

A small percentage of the sub-catchment lies within Flood Zone 3 and Flood Zone 2 as indicated on the EA Flood Map for Planning (Rivers and Sea), a drawing showing details is included at Appendix A.

Flooding from surface water is possible due to the topography.

Failure of the drainage system will result in a steady accumulation of surface water and spread of flooding over the lower lying areas.

21.6 Flood resilience

The control panel at Goosehole PS is raised to reduce the risk of flooding 'knocking out' the power supply and stopping the PS working.

21.7 Link to Risk Management Plans and other Strategies

21.7.1 CFMP Impact

The sub-catchment lies within the Doncaster sub area of the River Don CFMP. However, the elevation and distance from the main river defences mean that the proposed Policy 5 indicating that the EA will take action to reduce flood risk is unlikely to be implemented in this area.

21.7.2 FRMP Impact

Potential measures in the Doncaster area to be considered by the EA include:

- Channel management - shoal, silt and vegetation removal
- Middle Don - modelling update to inform future scheme development
- Middle Don & Lower Don - improvements to in channel habitat
- Produce updated Don Strategy
- Identify projects to promote community ownership of watercourses
- Deliver catchment level flood risk management projects

21.7.3 Development Proposals

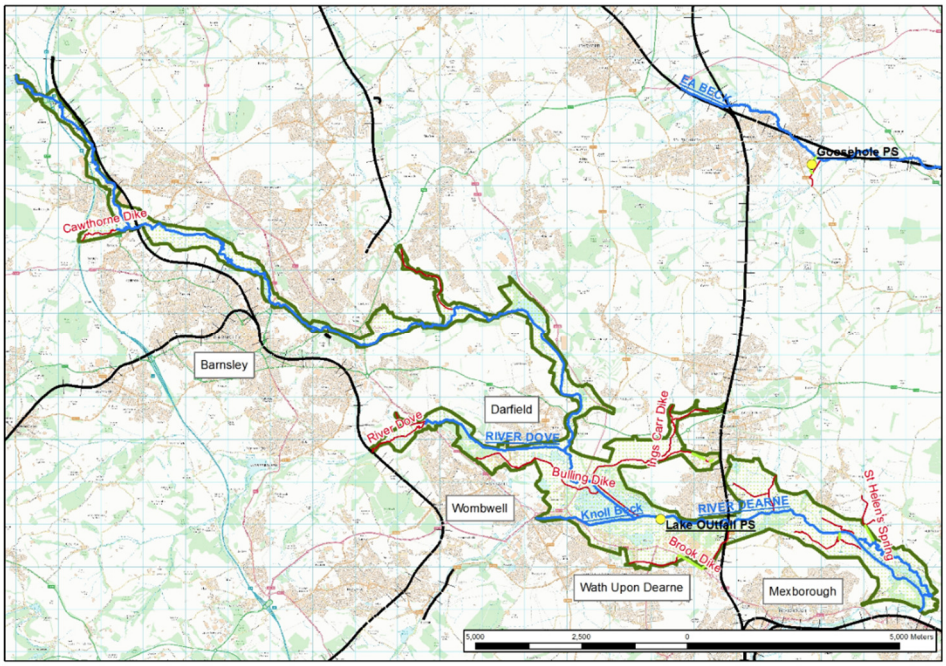
The Wakefield MDC Policies Map 2012 shows minor residential development sites in the south Eastern part of South Elmsall which are unlikely to be in the catchment area of Goosehole Pumping Station.

21.8 Option Summary

21.8.1 Continue as present

Due to the size and topography of the sub-catchment we recommend the 'continue as present' option.

22 Sub-Catchment 20 - Dearne Valley



22.1 Sub-Catchment Description

The sub-catchment comprises land around the River Dearne, a designated main river, and its tributaries, as it flows generally eastwards adjacent to the towns of Barnsley, Wombwell, Darfield, Wath upon Dearne, and Mexborough.

Land use in the Dearne Valley is mainly a mixture of agricultural and urban areas, including parts of Bolton upon Dearne, Wath upon Dearne, Darfield, Wombwell, Cudworth, Barnsley and Darton. Important transport routes include two railway lines, the M1, A637, A628, A6195, A635 and A633 and both roads and railways cross DDC managed watercourses.

Parts of the natural floodplain of the Rivers Dearne and Dove are referred to as formalised washlands. The washlands typically contain agricultural land and floodwater drains, post event, by gravity back to the River Dearne. Importantly, some of the washlands are registered under the Reservoirs Act 1975.

Typically, raised embankments along the river (front washland banks) reduce the risk of the washlands flooding during lower return periods but during larger events these banks overtop and the washlands flood. High ground or a rear bank (barrier bank) is located at the back of the washlands to reduce the risk of water spreading to properties, business and infrastructure.

The watercourses generally discharge via gravity to the River Dearne and have not yet been categorized under the DDC prioritisation regime.

In the Wath Manvers development area surface water drains to a lake and any excess water normally outfalls by gravity via a channel to the River Dearne. However, when the river level rises a penstock closes to prevent the river spilling back to the lake, and water from the lake is then pumped to the river by Lake Outfall PS. When the River level drops, the penstock opens and gravity flow resumes.

Table 22-1: DDC - Sub-catchment 20 - AFCE Overview

Pumping Station	Contribution breakdown (%)	Annual Running Costs (£) CA Data	Annual Running Costs (£) IDB Data	Catchment Area (ha)	Planned Capital Works
Lake Outfall	DDC - 100	-	1,541.00	243	2017 / 18

22.2 Stakeholder assets

The EA is responsible for the Rivers Dearne and Dove, front washland banks, barrier banks, a number of outfalls and flood defences.

The EA manages three land drainage pumping stations, Mexborough Pastures, Mill Lane and Pastures Lane on behalf of the Coal Authority. These stations were installed to mitigate the effects of mining subsidence and are located within washlands along the River Dearne.

Under normal conditions the pumping stations discharge DDC managed watercourses, but when the washlands flood they cease to operate. Post flood the washlands drain by gravity back to the River Dearne and the pumping stations will again operate after the washlands have emptied.

The area contains a number of licensed abstraction points.

YW is responsible for the sewer systems, the roads authority is responsible for the roads, and Network Rail, the authority responsible for the United Kingdom's railway network, is responsible for the railway infrastructure.

22.3 Current Maintenance Prioritisation

The sub-catchment is currently ranked as 18 using the DDC 'Planned Maintenance Regime'. Further details or this can be seen within section 1.7.

22.4 Environmental Baseline

The sub-catchment contains the communities and infrastructure described above.

Denaby Ings SSSI, located in the south-east of the sub catchment, is managed by the Yorkshire Wildlife Trust and contains a mosaic of habitats including woodland, scrub, wet meadows and open water. The open water habitats are as a result of mining subsidence.

Dearne Valley Park Local Nature Reserve contains high quality ancient acidic oak woodland together with a mosaic of wetland and grassland habitat. The site is particularly valuable to Barnsley residents as it is within one mile of the urban centre.

This sub-catchment also contains a number of non-statutory designated local wildlife sites, the majority of which are wetland habitats created as a result of mining subsidence:

- Denaby Ings
- Mexborough Low Pasture
- Bolton on Dearne Wetland
- Old Moor and Wath Ings
- Gipsy Marsh
- Broomhill Flash & Wombwell Ings
- Edderthorpe Ings
- Sunny Bank, Horse Carr & Storrs Wood
- Stairfoot Disused Railway
- Cliff Wood
- Old Mill Lane Culvert Bat Roost
- Barnsley Canal at Wilthorpe

Old Moor is a RSPB reserve and supports a large number of wetland birds throughout the year.

Water Voles have been recorded within watercourses/waterbodies.

There are two scheduled monuments:

- Monk Bretton Priory Cluniac and Benedictine Monastery: Monastic Precinct and two fish ponds
- Heavy Anti-aircraft Gun site 330m south-east of Lowfield Farm

There are seven listed buildings/structures, including a school, mill and a number of bridges.

22.5 Flood risk

The flood defences along the River Dearne reduce the risk of flooding from main rivers.

Front washland banks reduce the risk of the washlands flooding from the river. However, dependant on the prevailing weather and river conditions, the washlands may flood several times a year.

Where the washlands are restricted by higher ground river flooding may not affect the wider area. However, where a back barrier bank is provided to a washland, the front banks along the river, the washland, and the barrier bank reduce the risk of the river flooding the area beyond the washland.

Where a back barrier bank is provided it is the dominant factor in reducing the risk of river flooding to the wider area, and when the washlands are flooded any failure of the back bank to the washland may lead to a rapid inundation of the adjacent area.

A small percentage of the sub-catchment lies within Flood Zone 3 and Flood Zone 2 as indicated on the EA Flood Map for Planning (Rivers and Sea), a drawing showing details is included at Appendix A.

Flooding from surface water is possible due to the topography.

22.6 Flood resilience

The Lake Outfall PS control panel is raised to reduce the risk from surface water flooding.

22.7 Link to Risk Management Plans and other Strategies

22.7.1 CFMP Impact

The sub-catchment lies within the Barnsley and Mexborough sub area of the River Don CFMP. The CFMP proposed Policy 6 may have the effect of increasing the frequency of inundation of the River Dearne washlands. Although this may have an effect on land use, there should be no negative impact on the DDC drainage systems.

22.7.2 FRMP Impact

Potential measures in the Barnsley and Mexborough area to be considered by the EA include:

- Channel management - shoal, silt and vegetation removal
- Middle Don - modelling update to inform future scheme development
- Middle Don & Lower Don - improvements to in channel habitat
- Produce updated Don Strategy
- Identify projects to promote community ownership of watercourses
- Deliver catchment level flood risk management projects
- Dearne mouth sluice refurbishment

22.7.3 Development Proposals

There were development opportunities identified within this Sub-catchment. This was under The Unitary Development Plan (UDP) 2011 – 2016 for Doncaster Metropolitan Borough Council, Barnsley Unitary Development Plan – Proposals Map for Barnsley Metropolitan Borough Council and Rotherham Local Plan Core Strategy 2013 – 2028 for Rotherham Metropolitan Borough Council.

22.8 Option Summary

22.8.1 Continue as present

Due to the pumped catchment being limited to an area of commercial development and most of the watercourses discharging by gravity into the main arterial watercourses the option of 'remain as current' has been proposed for this sub-catchment.

23 Environmental Appraisal of WLMS Options

23.1 Impact Assessment

The unmitigated impacts of the WLMS options on achieving the SEA objectives were identified through the analysis of the baseline environmental conditions and use of professional judgement. The significance of effects was scored using the five point scale summarised in Table 23-1. If a high level of uncertainty regarding the likelihood and potential significance of an impact (either positive or negative) was identified, it was scored as uncertain.

Table 23-1: SEA Appraisal Codes

Impact significance	Impact symbol
Significant positive impact	++
Minor positive impact	+
Neutral impact	0
Minor negative impact	-
Significant negative impact	--
Uncertain impact	?

Throughout the assessment the following approach was applied:

- Positive, neutral and negative impacts are assessed, with uncertain impacts highlighted.
- The duration of the impact are considered over the short, medium and long term.
- The reversibility and permanence of the impact are assessed (e.g. temporary construction impacts, impacts which can be mitigated against/restored over time or completely irreversible changes to the environment).
- In-combination effects are also considered.

The significance of effects upon each of the SEA objectives (Table 23-2) are then evaluated and used to inform option selection.

Table 23-2: SEA Objectives

Receptor	SEA Objective	Receptor
Landscape	1	Protect the integrity of the district's urban and rural landscapes.
Biodiversity, flora and fauna	2	Protect and enhance designated, important and notable nature conservation sites, habitats species in the drainage district.
	3	Maintain and enhance habitat connectivity and wildlife corridors within the district.
Water environment	4	Do not inhibit achievement of the WFD objectives and contribute to their achievement where possible.
Historic environment	5	Preserve and where possible enhance important historic and cultural sites in the district and their settings.
Population	6	Protect key social infrastructure assets and services from flooding as a result of changes to water level management.
Material assets	7	Minimise the impacts of flooding to the district's transport network and key critical infrastructure.
Climate	8	Promote a more energy efficient and sustainable drainage system within the district.

Table 23-3 provides a summary of the outcomes of the environmental assessment of the WLMS options. An overall summary of impacts is detailed in Table 23-4.

Table 23-3: Assessment of WLMS Options against SEA objectives

Sub catchment	WLMS Option	SEA Objectives 1	2	3	4	5	6	7	8	Comments
1	No options have been identified	0	0	0	0	0	0	0	0	It is assumed that current WLM activities in this sub catchment will continue and therefore no impacts as a result of the WLMS are anticipated.
2	Option 1 - Decommission Adwick Mill Dyke PS Re-grade Mill Dyke and Bowling Alley Drain. Upgrade to Goosepool PS	0	?	+	+	?	0	0	+	This option could have a minor positive impact on habitat connectivity and achievement of WFD objectives through the decommissioning of pump station and re-grading of watercourses. However, the implementation of this option would need to consider potential impacts on Size Ings and Adwick le Street Sewage Works LWS and also a listed mill building. Any adverse impacts would need to be avoided and/or mitigated against. This option would result in reduced pumping and maintenance costs in the long term.
	Option 2 - Create upstream storage to Goosepool PS. Installation of weirs	0	?	0	0	0	0	?	+	The impacts on biodiversity, flora and fauna are unknown as the implementation of this option could have positive and/or negative impacts on Adwick le Street Sewage Works LWS. The implementation of this option would need to consider potential impacts on the features for which the site is designated. This option could also impact upon drainage/flood risk to nearby rail infrastructure, including Adwick station. This option would result in reduced pumping costs in the long term.
	Option 3 - Installation of flow control structure on all crossings beneath A19. Possible re-grade of some watercourse / pipelines. Upgrade to Goosepool PS	0	?	+	0	0	0	+	+	The impacts on biodiversity, flora and fauna are unknown as the implementation of this option could have positive and/or negative impacts on Bentley Moor Wood LWS. However, the re-grading of watercourses provides opportunities to enhance habitat connectivity and wildlife corridors. The implementation of this option could potentially reduce flood risk to the A19. Any upgrade of pumping stations provides opportunities to adapt to climate change impacts.
	Option 4 - Decommission of Tilts Hills PS Re-routing of enclosed watercourse. Upgrade to Tilts PS.	0	?	+	+	0	0	?	+	The impacts on biodiversity, flora and fauna are unknown as the implementation of this option could have positive and/or negative impacts on Norwood, Tilts Drain and Old Ea Beck LWS and may be constrained by the potential presence of Great Crested Newt. The re-routing and daylighting of enclosed watercourses provides opportunities to enhance habitat connectivity and wildlife corridors and contribute towards WFD objectives. The implementation of this option would need to consider potential impacts on drainage/flood risk to the A19. This option would result in reduced pumping and maintenance costs in the long term.
	Option 5 - Decommission Toll Bar Rugby Club PS Re-grade the inlet channel and Norwood & Sandall Nooking Drain with a new connection to Tilts Mill Clough Drain/enclosed watercourse. Upgrade to Tilts PS	0	?	+	+	0	0	0	+	The impacts on biodiversity, flora and fauna are unknown as the implementation of this option could have positive and/or negative impacts on Norwood, Tilts Drain and Old Ea Beck LWS and may be constrained by the potential presence of Great Crested Newt. The re-grading and creation of new watercourses provides opportunities to enhance habitat connectivity and wildlife corridors and contribute towards WFD objectives. This option would result in reduced pumping and maintenance costs in the long term.
3	Option 1 - Decommission Arksey PS. Re-grade Whelps Croft Drain. New cut drain along Shaftholme Road. Up-grade to Sandall Nooking PS Up-grade of existing railway culvert.	0	?	+	+	?	?	+	+	The impacts on biodiversity, flora and fauna are unknown as the implementation of this option could have positive and/or negative impacts on Arksey Pond and Willow Garth Fish Ponds LWS and may be constrained by the potential presence of Water Vole and Great Crested Newt. The re-grading and creation of new watercourses provides opportunities to enhance habitat connectivity and wildlife corridors and contribute towards WFD objectives. The impacts on cultural heritage are unknown as the implementation of this option could impact upon Arksey Round About Moat Scheduled Monument. The implementation of this option could potentially reduce flood risk to people, property and infrastructure, including the east coast mainline. This option would also result in reduced pumping and maintenance costs in the long term.
4	Option 1 - Install a new enclosed or open watercourse to connect Norwood & Sandall Nooking Drain to upstream of Almholme Pumping Station. Decommission of Almholme Pumping Station.	0	?	?	?	0	?	?	+	The impacts on biodiversity, flora and fauna are unknown, however the cutting of a new drain provides opportunities to enhance the channel and bankside habitat for species such as Water Vole and also provides opportunities to enhance habitat connectivity and wildlife corridors and contribute towards WFD. The implementation of this option could have

Sub catchment	WLMS Option	SEA Objectives 1	2	3	4	5	6	7	8	Comments
										potential impacts on drainage/flood risk to Almholme/Arksey and nearby rail infrastructure. This option would also result in reduced pumping and maintenance costs in the long term.
	Option 2 - Provide upstream storage along Bentley & Arksey Common Drain.	**0**	**?**	**+**	**?**	**0**	**?**	**?**	**+**	The impacts on biodiversity, flora and fauna are unknown, however the creation of upstream storage provides opportunities to enhance the habitat for species such as Water Vole. The implementation of this option could have potential impacts on drainage/flood risk to Almholme/Arksey and nearby rail infrastructure. This option would also result in reduced pumping and maintenance costs in the long term.
5	No options have been identified	0	0	0	0	0	0	0	0	It is assumed that current WLM activities in this sub catchment will continue and therefore no impacts as a result of the WLMS are anticipated.
6	No options have been identified	0	0	0	0	0	0	0	0	It is assumed that current WLM activities in this sub catchment will continue and therefore no impacts as a result of the WLMS are anticipated.
7	Option 1 - Create new drain to connect Haywood & Trumfleet Drain and Thistle Goit Drain. Decommission Haywood Pumping Station. Upgrade Thistle Goit Pumping Station	**0**	**?**	**+**	**?**	**?**	**?**	**?**	**+**	The implementation of this option could potentially impact upon Shirley Pool SSSI and Sutton Common Earthworks Scheduled Monument through changes to hydrology and flows. The cutting of a new drain provides opportunities to enhance the channel and bankside habitat for species such as Water Vole and also provides opportunities to enhance habitat connectivity and wildlife corridors and contribute towards WFD. The implementation of this option could have potential impacts on drainage/flood risk to properties and infrastructure. This option would also result in reduced pumping and maintenance costs in the long term.
	Option 2 - Modify existing drainage system to discharge to the River Don by gravity. Modify Bramwith Rands pipeline to be a high-level overflow channel, encouraging flows to discharge by gravity to reduce pumping costs at Kirk Bramwith.	**0**	**?**	**0**	**?**	**?**	**?**	**?**	**+**	The implementation of this option could impact upon protected species, in particular Water Vole and Great Crested Newt. The impacts on cultural heritage are also unknown and would need to consider the Grade II listed bridge on Low Lane (Drain Bridge). The implementation of this option could have potential impacts on drainage/flood risk to properties and infrastructure. This option would also result in reduced pumping and maintenance costs in the long term.
8	No options have been identified	0	0	0	0	0	0	0	0	It is assumed that current WLM activities in this sub catchment will continue and therefore no impacts as a result of the WLMS are anticipated.
9	No options have been identified	0	0	0	0	0	0	0	0	It is assumed that current WLM activities in this sub catchment will continue and therefore no impacts as a result of the WLMS are anticipated.
10	No options have been identified	0	0	0	0	0	0	0	0	It is assumed that current WLM activities in this sub catchment will continue and therefore no impacts as a result of the WLMS are anticipated.
11	Option 1 - Install perforated piping along Sykehouse Road, incorporating a high level channel above the pipe for high flows	**0**	**?**	**+**	**0**	**0**	**0**	**+**	**+**	The implementation of this option could impact upon protected species, in particular Water Vole. It may provide opportunities to enhance habitat connectivity and wildlife corridors. Drainage issues/flood risk to Sykehouse Road should be reduced. This option would also result in reduced maintenance costs in the long term.
	Option 2 - Creation of a berm within the downstream section of Sykehouse Main Town Drain	**0**	**+**	**+**	**+**	**0**	**0**	**0**	**+**	In the long term the implementation of this option would improve the habitat for Water Vole and also provides opportunities to enhance habitat connectivity and wildlife corridors and contribute towards WFD. This option would also result in reduced maintenance costs in the long term.
	Option 3 - Creation of a new diversion channel on Sykehouse Main Town Drain. Installation of control structures to provide upstream storage	**0**	**?**	**+**	**0**	**0**	**+**	**+**	**0**	The implementation of this option provides opportunities to enhance the habitat for species such as Water Vole and also provides opportunities to enhance habitat connectivity and wildlife corridors and contribute towards WFD. Drainage issues/flood risk to properties within Sykehouse and Sykehouse Road should be reduced.
12	Option 1 - Decommission Fulham Lane Pumping Station. Create new channel connecting Blowell Drain and Balne Common Drain and connect to proposed new Great Heck pumping station.	**0**	**0**	**+**	**0**	**0**	**?**	**?**	**+**	The cutting of a new drain provides opportunities to enhance habitat connectivity and wildlife corridors and contribute towards WFD. The implementation of this option could have potential impacts on drainage/flood risk to properties and infrastructure. This option would also result in reduced pumping and maintenance costs in the long term.

Sub catchment	WLMS Option	SEA Objectives 1	2	3	4	5	6	7	8	Comments
	Option 2 - Decommission Fulham Lane Pumping Station. Create new channel connecting Blowell Drain and Balne Common Drain and discharge by gravity into South Soak Drain	**0**	**0**	**+**	**0**	**0**	**?**	**?**	**+**	The cutting of a new drain provides opportunities to enhance habitat connectivity and wildlife corridors and contribute towards WFD. The implementation of this option could have potential impacts on drainage/flood risk to properties and infrastructure. This option would also result in reduced pumping and maintenance costs in the long term.
	Option 3 - Installation of flow control structures on the South Soak Drain and Balne Fleet Drain to direct flows into the River Went.	**0**	**?**	**+**	**?**	**0**	**?**	**?**	**0**	The implementation of this option provides potential opportunities to enhance the habitat for species such as Water Vole and also provides opportunities to enhance habitat connectivity and wildlife corridors and potentially contribute towards WFD. Drainage issues/flood risk to properties and infrastructure may be reduced.
	Option 4 - Installation of flow control structures on Balne Fleet Drain and Bell Dike to provide upstream storage.	**0**	**?**	**?**	**?**	**0**	**?**	**?**	**0**	The implementation of this option provides opportunities to enhance the habitat for species such as Water Vole and also potentially provides opportunities to enhance habitat connectivity and wildlife corridors and contribute towards WFD. Drainage issues/flood risk to properties and infrastructure may be reduced.
13	No options have been identified	0	0	0	0	0	0	0	0	It is assumed that current WLM activities in this sub catchment will continue and therefore no impacts as a result of the WLMS are anticipated.
14	Option 1 - New culverted watercourse to connect the M62 South Drain to Blowell Drain. Will include re-grading of M62 South Drain and upgrade of road culvert.	**0**	**0**	**0**	**?**	**0**	**0**	**+**	**0**	This option could have positive and/or negative impacts on the achievement of WFD objectives due to the proposal for culverting. This option should reduce drainage issues/flood risk to the M62.
	Option 2 - Installation of control structures to provide upstream storage along Blowell Drain.	**0**	**?**	**0**	**?**	**0**	**0**	**?**	**+**	The implementation of this option provides opportunities to enhance the habitat for species such as Water Vole and also potentially contribute towards WFD. Drainage issues/flood risk to properties and infrastructure may be reduced. This option would also result in reduced pumping and maintenance costs in the long term.
15	Option 1 – Installation of control structures to create upstream storage on Rampart Drain.	0	?	0	?	0	0	?	+	The implementation of this option provides opportunities to enhance the habitat for species such as Water Vole and also potentially contribute towards WFD. The implementation of this option could have potential impacts on drainage/flood risk to railway infrastructure. This option would also result in reduced pumping and maintenance costs in the long term.
	Option 2 – Installation of control structures to create upstream storage along Stubbs Bridge to Southfield PS Drain.	0	?	0	?	0	0	0	+	The implementation of this option provides opportunities to enhance the habitat for species such as Water Vole and also potentially contribute towards WFD. This option would also result in reduced pumping and maintenance costs in the long term.
	Option 3 – Installation of control structures to create upstream storage along Southfield Lane Drain.	0	?	0	?	0	0	?	+	The implementation of this option provides opportunities to enhance the habitat for species such as Water Vole and also potentially contribute towards WFD. The implementation of this option could have potential impacts on drainage/flood risk to railway infrastructure. This option would also result in reduced pumping and maintenance costs in the long term.
16	Option 1 - Installation of control structures to provide upstream storage along Woodholmes Drain	**0**	**?**	**0**	**?**	**0**	**0**	**0**	**0**	The implementation of this option provides opportunities to enhance the habitat for species such as Water Vole and also potentially contribute towards WFD.
17	No options have been identified	0	0	0	0	0	0	0	0	It is assumed that current WLM activities in this sub catchment will continue and therefore no impacts as a result of the WLMS are anticipated.
18	Option 1 - Installation of control structures to provide storage along Palmer Clough Drain and Brears Drain.	**0**	**0**	**0**	**?**	**0**	**0**	**?**	**0**	The implementation of this option provides opportunities to potentially contribute towards WFD. This option could have potential impacts on drainage/flood risk to infrastructure (railway lines and M62).
19	No options have been identified	0	0	0	0	0	0	0	0	It is assumed that current WLM activities in this sub catchment will continue and therefore no impacts as a result of the WLMS are anticipated.
20	No options have been identified	0	0	0	0	0	0	0	0	It is assumed that current WLM activities in this sub catchment will continue and therefore no impacts as a result of the WLMS are anticipated.
	Overall Impact	**0**	**?**	**+**	**?**	**0**	**0**	**0**	**+**	

Table 23-4: Summary of Effects of the WLMS Options on SEA objectives

Receptor	SEA Objective		Summary of effects	Mitigation requirement
Landscape	**1**	Protect the integrity of the district's urban and rural landscapes.	No negative effects identified. None of the options will result in a significant impact on the landscape of the drainage district, either positive or negative. The options involve relatively small-scale works that are unlikely to be visually intrusive or require changes to existing landscape features of importance.	None required.
Biodiversity, flora and fauna	**2**	Protect and enhance designated, important and notable nature conservation sites, habitats species in the drainage district.	The potential impacts of many of the options are uncertain as the effects on designated sites, habitats and species could be positive or negative depending on how options are implemented. For example, the implementation of options within watercourses where protected species are known to be present could result in negative impacts if the design and undertaking of the works does not take into account such presence, however, the implementation of these options provides opportunities to incorporate habitat enhancement into the design and put in place mitigation to ensure protection of species such as Water Vole.	Ecological assessments, including protected species surveys, should be undertaken prior to the selection and implementation of options. These surveys will identify the need for specific mitigation and also opportunities to maximise the ecological benefits through incorporating habitat enhancements.
	3	Maintain and enhance habitat connectivity and wildlife corridors within the district.	No negative effects identified. Options for sub catchments 2, 3, 4, 7, 11 and 12 have the potential to deliver significant benefits due to the creation of new channels which will result in enhanced habitat connectivity and wildlife corridors, particularly for aquatic/riparian species.	None required.
Water environment	**4**	Do not inhibit achievement of the WFD objectives and contribute to their achievement where possible.	None of the options should inhibit the achievement of WFD objectives. The potential impacts of some of the options on WFD objectives are uncertain as the effects on biological and hydromorphological elements could be positive or negative depending on how options are implemented. Options for sub-catchments 2, 3 and 11 have the potential to contribute towards the achievement of WFD objectives through the daylighting of enclosed watercourses, and re-grading of existing watercourses to improve the habitat for aquatic macrophytes, invertebrates and fish and also improve hydromorphological conditions.	WFD compliance assessments should be undertaken prior to the selection and implementation of options. The WLMS should put in place necessary measures to ensure that any option selected does not inhibit the achievement of WFD objectives or have adverse impacts on the ecological status of any watercourse.
Historic environment	**5**	Preserve and where possible enhance important historic and cultural sites in the district and their settings.	No negative effects identified. The impacts of options for sub catchments 2, 3 and 7 are uncertain as these have the potential to impact upon designated heritage sites (Scheduled Monuments and listed buildings) depending on how they are implemented.	Prior to the selection and implementation of options for sub catchments 2, 3 and 7, an assessment of the potential impacts upon Scheduled Monuments and listed buildings should be carried out and, where required, measures put in place to ensure the preservation of these features.
Population	**6**	Protect key social infrastructure assets and services from flooding as a result of changes to water level management.	No negative effects identified. The impacts of certain options for sub catchments 3, 4, 7 and 12 are uncertain as depending on how the options are implemented drainage issues/flood risk to properties may be reduced or could potentially be adversely impacted upon. Option 3 for sub catchment 11 may result in reduced drainage issues/flood risk to properties within Sykehouse and Sykehouse Road.	Further assessment and modelling may be required to ensure that options chosen for sub catchments 3, 4, 7 and 12 do not increase flood risk to properties and communities.
Material assets	**7**	Minimise the impacts of flooding to the district's transport network and key critical infrastructure.	No negative effects identified. The impacts of certain options for sub catchments 2, 4, 7, 12, 14, 15 and 18 are uncertain as depending on how the options are implemented drainage issues/flood risk to infrastructure may be reduced or could potentially be adversely impacted upon. Options for sub catchments 2, 3, 11 and 14 have the potential to reduce drainage issues/flood risk to infrastructure including the M62, A19, east coast mainline and Sykehouse Road.	Further assessment and modelling may be required to ensure that options chosen for sub catchments 2, 4, 7, 12, 14, 15 and 18 do not increase flood risk to transport routes and other infrastructure.
Climate	**8**	Promote a more energy efficient and sustainable drainage system within the district.	No negative effects identified. Options for the majority of sub catchments promote measures to enable adaptation to climate change impacts such as reduced reliance on pumping stations.	None required.

23.2 SEA Conclusions

Many of the proposed options as detailed in the WLMS have the potential for environmental benefits. The cross-check assessment of the WLMS options against the SEA objectives highlights positive impacts particularly on SEA objectives 3, 4, 7 and 8. By implementing options to improve the efficiency of water level management there will be benefits to biodiversity, the achievement of WFD objectives, infrastructure and adapting to climate change.

The potential impacts of some of the WLMS options on SEA objectives 2, 4, 5, 6 and 7 are uncertain as the effects on environmental receptors could be positive or negative depending on how options are implemented. For example, the implementation of options within watercourses where protected species are known to be present could result in negative impacts if the design and undertaking of the works does not take into account such presence, however, the implementation of these options provides opportunities to incorporate habitat enhancement into the design and put in place mitigation to ensure protection of species such as Water Vole. Recommendations are provided below with regards to further assessment and/or mitigation measures required to ensure that the WLMS does not result in any significant adverse environmental impacts.

23.3 Habitat Regulations Assessment

European Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Flora and Fauna (Habitats Directive) provides legal protection to habitats and species of European importance. The principal aim of this directive is to maintain at, and where necessary restore to, the favourable conservation status of flora, fauna and habitats found at these designated sites (i.e. SACs, SPAs and Ramsar sites). The Directive is transposed into English legislation through the Conservation of Habitats and Species Regulations 2010 (as amended).

These Regulations set out **a consenting procedure** requiring all competent authorities to carry out an appropriate assessment (AA) of a plan or project, if that plan or project is likely to have a significant effect (LSE) on a European designated site. This is known as a **Habitats Regulations Assessment (HRA)**.

A HRA Screening Assessment (i.e. a test of likely significant effect) has been undertaken to determine whether the WLMS options could result in significant adverse effects on the integrity of any European sites. The results of this assessment can be found at Appendix E.

23.4 Next Steps

23.4.1 Recommendations

To ensure that the WLMS does not result in any significant adverse environmental impacts the following should be undertaken:

- Ecological assessments, including protected species surveys, prior to the selection and implementation of options for all sub catchments. These surveys will identify the need for specific mitigation and also opportunities to maximise the ecological benefits through incorporating habitat enhancements.
- WFD compliance assessments prior to the selection and implementation of options for all sub catchments. These will identify any necessary measures to ensure that any option does not inhibit the achievement of WFD objectives or have adverse impacts on the ecological status of any watercourse.
- An assessment of the potential impacts upon Scheduled Monuments and listed buildings prior to the selection and implementation of options for sub catchments 2, 3 and 7 and, where required, measures put in place to ensure the preservation of these features.
- Further assessment and modelling to ensure that options chosen for sub catchments 3, 4, 7 and 12 do not increase flood risk to properties and communities.
- Further assessment and modelling to ensure that options chosen for sub catchments 2, 4, 7, 12, 14, 15 and 18 do not increase flood risk to transport routes and other infrastructure.

23.4.2 Environmental Impact Assessment

Any works proposed to implement the WLMS options are likely, if undertaken by the Danvm Drainage Commissioners, to be classed as “permitted development” under the Town and Country

Planning (General Permitted Development) Order 1995 and are therefore exempt from planning permission. As such works may have significant effects on the environment, the principles of environment impact assessment (EIA) need to be applied to them.

Under the Environmental Impact Assessment (Land Drainage Improvement) Regulations 1999 (as amended) IDBs are required to determine whether “improvement works” will have a significant impact on the environment. If the environmental impacts are not deemed to be significant an Environmental Appraisal of the works will suffice. If it is determined that the works are likely to have significant environmental effects then a formal Environmental Statement should be produced.

The Regulations require that Natural England and English Heritage are consulted, along with any other public authority, statutory body or organisation which the IDB considers may have an interest in the proposed improvement works.

Having decided whether or not an Environmental Statement (ES) is to be prepared, this decision must be advertised in the local press. If it is initially decided that an ES will not be prepared, organisations and individuals with an interest in the proposed improvement works may object, and request that a formal ES be prepared. If, following further discussion, agreement cannot be reached, the appropriate Authority (i.e. Defra) may, as a last resort, be asked to decide whether or not an ES is required. When an ES has been prepared, organisations and individuals then have an opportunity to comment on the proposed improvement works. Again, if any objections are raised which cannot be reconciled, the appropriate Authority may, as a last recourse, be asked to decide whether the proposed works should proceed.

23.4.3 Habitat Regulations Assessment

The HRA screening assessment, as detailed in Appendix E, determined that the WLMS is unlikely to result in significant adverse impacts on European designated sites. However, as the WLMS is a high level plan, which is expected to result in further studies/work, it is recommended that before the implementation of any water level management option, further assessment is undertaken with regards to potential impacts on European sites.

24 Conclusion

24.1 Proposed Areas for Further Study

Based upon the opportunities, constraints and environmental assessment for the strategic options within each sub-catchment table 24-3 below summarises those strategic options which are recommended for further study through survey, hydraulic modelling or otherwise.

The sub-catchments are listed in the order of the priority ranking supplied by DDC and described in section 1.7.2.

A plan in Appendix F shows those sub-catchments recommended for further study.

The table includes the conclusions of the SEA in appraising the potential impact of each option for each of the SEA objectives. The objectives and impact symbols are as shown in the following tables.

Each sub-catchment is not limited to the further study and/or implementation of just a singular option. Two or three option may work in conjunction with each other and during the process of further study should be allowed to overlap if appropriate.

Table 24-1: SEA Objectives

Receptor	SEA Objective	Receptor
Landscape	1	Protect the integrity of the district's urban and rural landscapes.
Biodiversity, flora and fauna	2	Protect and enhance designated, important and notable nature conservation sites, habitats species in the drainage district.
	3	Maintain and enhance habitat connectivity and wildlife corridors within the district.
Water environment	4	Do not inhibit achievement of the WFD objectives and contribute to their achievement where possible.
Historic environment	5	Preserve and where possible enhance important historic and cultural sites in the district and their settings.
Population	6	Protect key social infrastructure assets and services from flooding as a result of changes to water level management.
Material assets	7	Minimise the impacts of flooding to the district's transport network and key critical infrastructure.
Climate	8	Promote a more energy efficient and sustainable drainage system within the district.

Table 24-2: SEA Appraisal Codes

Impact significance	Impact symbol
Significant positive impact	++
Minor positive impact	+
Neutral impact	0
Minor negative impact	-
Significant negative impact	--
Uncertain impact	?

In 8 sub-catchments there is an opportunity to reduce carbon / costs etc. Of those, 6 include pumping stations currently funded by the CA and 7 include pumping stations funded by the DDC.

Table 24-3: DDC - Options for Further Study

Sub-Catchment	Pumping Stations	WLMS Options	SEA Objectives								IDB PPM Priority
			1	2	3	4	5	6	7	8	
Sub-catchment 2	Adwick Mill PS, Goosepool PS, Tilts PS, Tilts Hills PS, Hall Villa PS, Toll Bar Rugby Club PS	Option 1 - Decommission Adwick Mill Dyke PS Re-grade Mill Dyke and Bowling Alley Drain. Upgrade to Goosepool PS	0	?	+	+	?	0	0	+	1
		Option 2 - Create upstream storage to Goosepool PS. Installation of weirs	0	?	0	0	0	0	?	+	
		Option 3 - Installation of flow control structure on all crossings beneath A19. Possible re-grade of some watercourse / pipelines. Upgrade to Goosepool PS	0	?	+	0	0	0	+	+	
		Option 4 - Decommission of Tilts Hills PS Re-routing of enclosed watercourse. Upgrade to Tilts PS.	0	?	+	+	0	0	?	+	
Sub-catchment 11	Towns Clough PS	Option 1 - Install perforated piping along Sykehouse Road, incorporating a high level channel above the pipe for high flows	0	?	+	0	0	0	+	+	3
		Option 2 - Creation of a berm within the downstream section of Sykehouse Main Town Drain	0	+	+	+	0	0	0	+	
		Option 3 - Creation of a new diversion channel on Sykehouse Main Town Drain. Installation of control structures to provide upstream storage	0	?	+	0	0	+	+	0	
Sub-catchment 7	Kirk Bramwith PS, Thistlegoit PS, Haywood PS	Option 1 - Create new drain to connect Haywood & Trumfleet Drain and Thistle Goit Drain. Decommission Haywood Pumping Station. Upgrade Thistle Goit Pumping Station	0	?	+	?	?	?	?	+	5
		Option 2 - Modify existing drainage system to discharge to the River Don by gravity. Modify Bramwith Rands pipeline to be a high-level overflow channel, encouraging flows to discharge by gravity to reduce pumping costs at Kirk Bramwith.	0	?	0	?	?	?	?	+	
Sub-catchment 4	Almholme PS, Norwood PS, Sandall Nooking PS, Flood Evacuation PS	Option 2 - Provide upstream storage along Bentley & Arksey Common Drain.	0	?	+	?	0	?	?	+	7
Sub-catchment 15	Beal Lane Booster PS, Beal Lane PS, Southfield Lane PS, Whitley Bridge PS, Rampart PS	Option 1 – Installation of control structures to create upstream storage on Rampart Drain.	0	?	0	?	0	0	?	+	9
		Option 2 – Installation of control structures to create upstream storage along Stubbs Bridge to Southfield Lane PS Drain.	0	?	0	?	0	0	0	+	
		Option 3 – Installation of control structures to create upstream storage along Southfield Lane Drain.	0	?	0	?	0	0	?	+	
Sub-catchment 16	Town Drain PS, East Ings PS, Woodholmes PS	Option 1 - Installation of control structures to provide upstream storage along Woodholmes Drain	0	?	0	?	0	0	0	0	9
Sub-catchment 14	Lake Drain PS, Longwood PS, Jenny Lane PS, Fulham Lane PS, Blowell No.2 PS	Option 1 - New culverted watercourse to connect the M62 South Drain to Blowell Drain. Will include re-grading of M62 South Drain and upgrade of road culvert.	0	0	0	?	0	0	+	0	10
		Option 2 - Installation of control structures to provide upstream storage along Blowell Drain.	0	?	0	?	0	0	?	+	
Sub-catchment 3	Arksey PS	Option 1 - Decommission Arksey PS. Re-grade Whelps Croft Drain. New cut drain along Shaftholme Road. Up-grade to Sandall Nooking PS Up-grade of existing railway culvert.	0	?	+	+	?	?	+	+	12
Sub-catchment 12	Balne Fleet Drain PS, Park Farm PS, Fulham Lane PS (in sub-catchment 14)	Option 2 - Decommission Fulham Lane Pumping Station. Create new channel connecting Blowell Drain and Balne Common Drain and discharge by gravity into South Soak Drain	0	0	+	0	0	?	?	+	13
		Option 3 - Installation of flow control structures on the South Soak Drain and Balne Fleet Drain to direct flows into the River Went.	0	?	+	?	0	?	?	0	
		Option 4 - Installation of flow control structures on Balne Fleet Drain and Bell Dike to provide upstream storage.	0	?	?	?	0	?	?	0	
Sub-catchment 18	Gowdall PS	Option 1 - Installation of control structures to provide storage along Palmer Clough Drain and Brears Drain.	0	0	0	?	0	0	?	0	16

24.2 Further Potential Outcomes

We consider that the completion of this Water Level Management Strategy should act as a trigger for further co-operation between the stakeholders with responsibility for water level management within the IDB District. We believe there would be benefits to all the stakeholders in exchanging knowledge as well as information on proposed capital and revenue works to ensure that those works provide the maximum benefit to the local population.

We therefore propose that efforts should be made to bring together the relevant stakeholders and to agree to methods and extents of exchange of information.

Appendices

A Location Maps

Danvm Sub-Catchment Plan

Doncaster Drainage Act 1929 Area Map

Danvm Sub-Catchment Plan with Flood Risk Areas

B IDBs Forward Planning & Summaries of Running Costs

C Sub-catchment WLMS Options

D SEA Scoping Report

E Habitats Regulations Assessment -Test of Likely Significance

This assessment identifies and considers the likely adverse effects of the WLMS, either individually or in combination with other plans or projects, upon a European site and considers whether these impacts are likely to be significant.

The assessment comprises a series of tables that identify the European sites of relevance to the WLMS (Table E-1); the potential hazards associated with the WLMS options and their relevance to these European sites (Table E-2).

Table E-4: European Sites

European Site Name	Hatfield Moor SAC
Distance to site	6km
List of Site Interest Features	Annex I habitat Degraded raised bogs still capable of natural regeneration
European Site Name	Thorne Moor SAC
Distance to site	3km
List of Site Interest Features	Annex I habitat Degraded raised bogs still capable of natural regeneration
European Site Name	Thorne & Hatfield Moors SPA
Distance to site	3.5km
List of Site Interest Features	During the breeding season the area regularly supports: Nightjar *Caprimulgus europaeus* 1.9% of the GB breeding population,5 count peak mean 1993, 1995-1998
European Site Name	Humber Estuary SAC, SPA and Ramsar
Distance to site	9km
List of Site Interest Features	**SAC Annex I habitats** *Estuaries* *Mudflats and sandflats not covered by seawater at low tide* *Sandbanks which are slightly covered by sea water all the time* *Coastal lagoons * Priority feature* *Salicornia and other annuals colonizing mud and sand* *Atlantic salt meadows (Glauco-Puccinellietalia maritimae)* *Embryonic shifting dunes* *Shifting dunes along the shoreline with Ammophila arenaria ("white dunes")* *Fixed coastal dunes with herbaceous vegetation ("grey dunes")* Priority feature* *Dunes with Hippopha rhamnoides* **SAC Annex II species** *Sea lamprey Petromyzon marinus* *River lamprey Lampetra fluviatilis* *Grey seal Halichoerus grypus* **SPA birds** *Great bittern Botaurus stellaris; (Breeding and Non-breeding)* *Common shelduck Tadorna tadorna; (Non-breeding)* *Eurasian marsh harrier Circus aeruginosus; (Breeding)* *Hen harrier Circus cyaneus; (Non-breeding)* *Pied avocet Recurvirostra avosetta; (Breeding and Non-breeding)* *European golden plover Pluvialis apricaria; (Non-breeding)* *Red knot Calidris canutus; (Non-breeding)* *Dunlin Calidris alpina alpina; (Non-breeding)* *Ruff Philomachus pugnax; (Non-breeding)* *Black-tailed godwit Limosa limosa islandica; (Non-breeding)* *Bar-tailed godwit Limosa lapponica; (Non-breeding)* *Common redshank Tringa totanus; (Non-breeding)* *Little tern Sterna albifrons; (Breeding)* *Waterbird Assemblages* **Ramsar Convention Criteria:** **Ramsar Criterion 1 -** *The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal*

	brackish/saline lagoons. **Ramsar Criterion 3 -** *The site supports a breeding colony of grey seals Halichoerus grypus at Donna Nook, the second largest grey seal colony in England and the furthest south regular breeding site on the east coast. The dune slacks at Saltfleetby-Theddlethorpe on the southern extremity of the Ramsar site are the most north-easterly breeding site in Great Britain of the natterjack toad Bufo calamita.* **Ramsar Criterion 5 -** *Assemblages of International Importance - 153,934 waterfowl, non-breeding season (5 year peak mean 1996/97-2000/2001)* **Ramsar Criterion 6 -** *Species/populations occurring at levels of international importance - Eurasian golden plover, Pluvialis apricaria; Red knot, Calidris canutus; Dunlin, Calidris alpina; Black-tailed godwit, Limosa limosa; Common redshank, Tringa totanus; Common shelduck, Tadorna tadorna; Bar-tailed godwit , Limosa lapponica.* **Ramsar Criterion 8 -** *The Humber Estuary acts as an important migration route for both river lamprey Lampetra fluviatilis and sea lamprey Petromyzon marinus between coastal waters and their spawning areas.* **Noteworhty Fauna:** **Birds -** *Great bittern, Botaurus stellaris* *Eurasian marsh harrier, Circus aeruginosus* *Pied avocet, Recurvirostra avosetta* *Little tern, Sterna albifrons* *Dark-bellied brent goose, Branta bernicla* *Eurasian wigeon, Anas penelope* *Common teal, Anas crecca* *Common pochard, Aythya ferina* *Greater scaup, Aythya marila* *Common goldeneye, Bucephala clangula* *Hen harrier, Circus cyaneus* *Eurasian oystercatcher, Haematopus ostralegus* *Great ringed plover, Charadrius hiaticula* *Grey plover, Pluvialis squatarola* *Northern lapwing, Vanellus vanellus* *Sanderling, Calidris alba* *Curlew, Numenius arquata* *Ruddy turnstone, Arenaria interpres* *Ruff, Philomachus pugnax* *Whimbrel, Numenius phaeopus* *Common greenshank, Tringa nebularia*
European Site Name	River Derwent SAC
Distance to site	8km
List of Site Interest Features	**Annex I Habitat:** *Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation* **Annex II Species:** *River lamprey Lampetra fluviatilis* *Sea lamprey Petromyzon marinus* *Bullhead Cottus gobio* *Otter Lutra lutra*
Is this proposal directly connected with or necessary to the management of the sites for nature conservation?	No

Table E-5: Potential hazards and effects to European sites associated with the WLMS

- Hazards and Effects in reference to the individual elements and consented activities of the project. Describe any hazards or effects with potential to give rise to impacts on the European Site (either alone or in combination with other plans or projects).

Sensitive Interest Features	**Potential Hazard(s)**	**Potential Exposure to hazard and mechanism of effect/impact if known**
Hatfield Moor SAC Degraded raised bogs still capable of natural regeneration	Changes in water quality. Changes in water levels or table.	The SAC is located a significant distance (6km) from the boundary of the Danvm Drainage Commissioners district. The site is not hydrologically linked with the district. Water level management activities will therefore have a local impact and will not extend a significant distance beyond the boundary of the district. No hazards will arise on the sensitive interest features as a result of implementation of the WLMS. Therefore, no likely significant effects are predicted.
Thorne Moor SAC Degraded raised bogs still capable of natural regeneration	Changes in water chemistry. Changes in water levels or table.	The SAC is not hydrologically linked with the Danvm Drainage Commissioners district. Water level management activities will therefore have a local impact and will not extend a significant distance beyond the boundary of the district. No hazards will arise on the sensitive interest features as a result of implementation of the WLMS. Therefore, no likely significant effects are predicted.
Thorne & Hatfield Moors SPA Nightjar Caprimulgus europaeus 1.9% of the GB breeding population,5 count peak mean 1993, 1995-1998	Changes in water chemistry. Changes in water levels or table Disturbance	The SPA is not hydrologically linked with the Danvm Drainage Commissioners district. Water level management activities will therefore have a local impact and will not extend a significant distance beyond the boundary of the district. No hazards will arise on the sensitive interest features as a result of implementation of the WLMS. Therefore, no likely significant effects are predicted. It is unlikely that any of the WLMS options will result in disturbance impacts that extend as far as the SPA. Therefore, no likely significant effects are predicted.
Humber Estuary SAC *SAC Annex I habitats* *Estuaries* *Mudflats and sandflats not covered by seawater at low tide* *Sandbanks which are slightly covered by sea water all the time* *Coastal lagoons * Priority feature* *Salicornia and other annuals colonizing mud and sand* *Atlantic salt meadows (Glauco-Puccinellietalia maritimae)* *Embryonic shifting dunes* *Shifting dunes along the shoreline with Ammophila arenaria ("white dunes")* *Fixed coastal dunes with herbaceous vegetation ("grey dunes")* Priority feature* *Dunes with Hippopha rhamnoides* *SAC Annex II species* *Sea lamprey Petromyzon marinus* *River lamprey Lampetra fluviatilis*	Changes in water chemistry. Changes in water levels or table.	The potential for adverse effects due to changes in water levels and/or quality is highly unlikely due to the distance (more than 9km) of the SAC from the Danvm Drainage Commissioners district and the small-scale localised nature of the options proposed and/or the lack of options for the sub-catchments which could impact upon this site. No hazards will arise on the sensitive interest features as a result of implementation of the WLMS. Therefore, no likely significant effects are predicted.

- Hazards and Effects in reference to the individual elements and consented activities of the project. Describe any hazards or effects with potential to give rise to impacts on the European Site (either alone or in combination with other plans or projects).

Sensitive Interest Features	Potential Hazard(s)	Potential Exposure to hazard and mechanism of effect/impact if known
Grey seal Halichoerus grypus		
Humber Estuary SPA *Great bittern Botaurus stellaris; (Breeding and Non-breeding)* *Common shelduck Tadorna tadorna; (Non-breeding)* *Eurasian marsh harrier Circus aeruginosus; (Breeding)* *Hen harrier Circus cyaneus; (Non-breeding)* *Pied avocet Recurvirostra avosetta; (Breeding and Non-breeding)* *European golden plover Pluvialis apricaria; (Non-breeding)* *Red knot Calidris canutus; (Non-breeding)* *Dunlin Calidris alpina alpina; (Non-breeding)* *Ruff Philomachus pugnax; (Non-breeding)* *Black-tailed godwit Limosa limosa islandica; (Non-breeding)* *Bar-tailed godwit Limosa lapponica; (Non-breeding)* *Common redshank Tringa totanus; (Non-breeding)* *Little tern Sterna albifrons; (Breeding)* *Waterbird Assemblages*	Changes in water chemistry. Changes in water levels or table. Disturbance.	The potential for adverse effects due to changes in water levels and/or quality is highly unlikely due to the distance (more than 9km) of the SPA from the Danvm Drainage Commissioners district and the small-scale localised nature of the options proposed and/or the lack of options for the sub-catchments which could impact upon this site. No hazards will arise on the sensitive interest features as a result of implementation of the WLMS. Therefore, no likely significant effects are predicted. It is unlikely that any of the WLMS options will result in disturbance impacts that extend as far as the Humber Estuary SPA. Therefore, no likely significant effects are predicted.
Humber Estuary Ramsar **Ramsar Criterion 1 -** *The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.* **Ramsar Criterion 3 -** *The site supports a breeding colony of grey seals Halichoerus grypus at Donna Nook, the second largest grey seal colony in England and the furthest south regular breeding site on the east coast. The dune slacks at Saltfleetby-Theddlethorpe on the southern extremity of the Ramsar site are the most north-easterly breeding site*	Changes in water chemistry. Changes in water levels or table. Disturbance.	The potential for adverse effects due to changes in water levels and/or quality is highly unlikely due to the distance (more than 9km) of the Ramsar from the Danvm Drainage Commissioners district and the small-scale localised nature of the options proposed and/or the lack of options for the sub-catchments which could impact upon this site. No hazards will arise on the sensitive interest features as a result of implementation of the WLMS. Therefore, no likely significant effects are predicted. It is unlikely that any of the WLMS options will result in disturbance impacts that extend as far as the Humber Estuary Ramsar. Therefore, no likely significant effects are predicted.

- Hazards and Effects in reference to the individual elements and consented activities of the project. Describe any hazards or effects with potential to give rise to impacts on the European Site (either alone or in combination with other plans or projects).

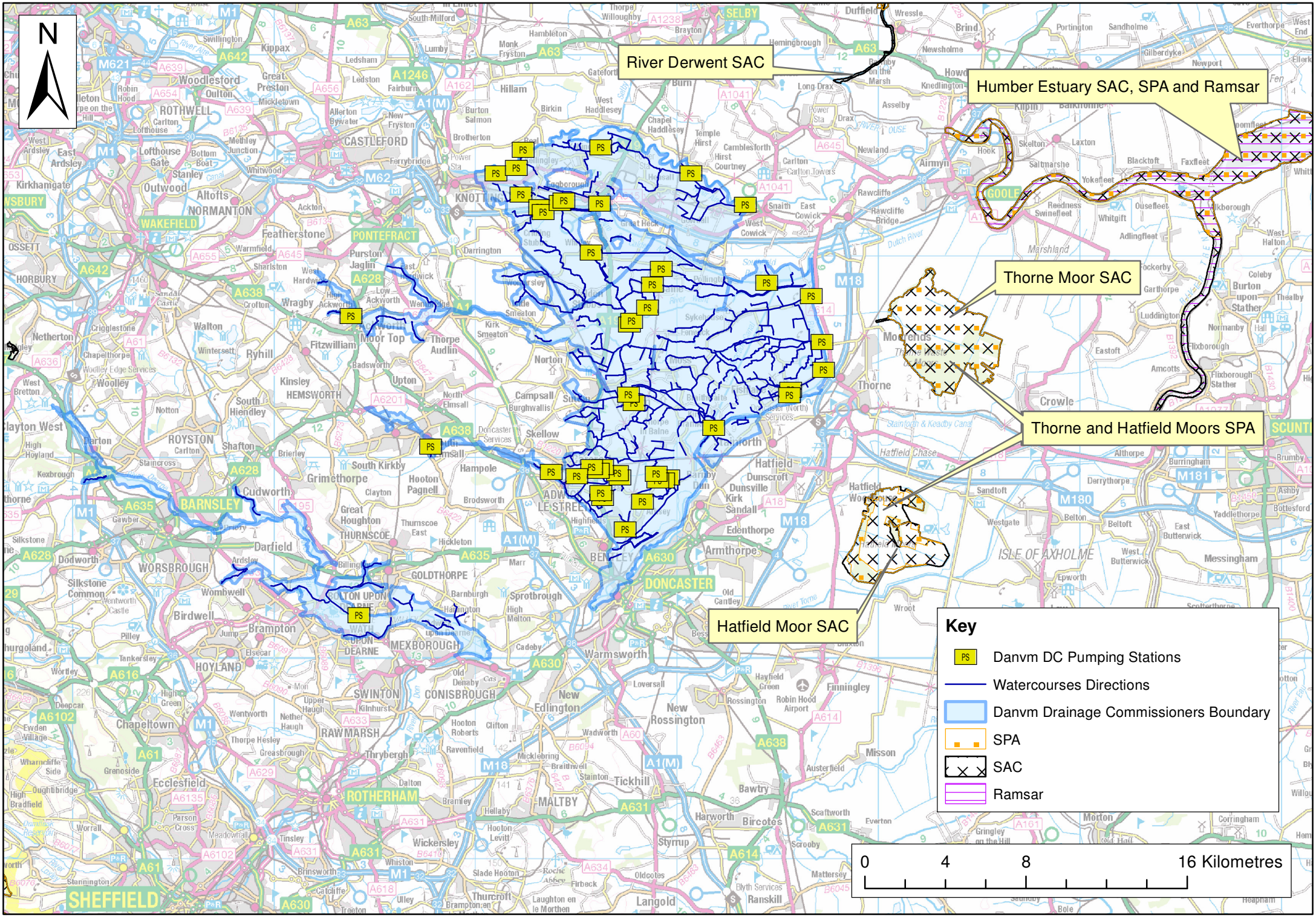
Sensitive Interest Features	Potential Hazard(s)	Potential Exposure to hazard and mechanism of effect/impact if known
in Great Britain of the natterjack toad Bufo calamita. **Ramsar Criterion 5 -** *Assemblages of International Importance - 153,934 waterfowl, non-breeding season (5 year peak mean 1996/97-2000/2001)* **Ramsar Criterion 6 -** *Species/populations occurring at levels of international importance - Eurasian golden plover, Pluvialis apricaria; Red knot, Calidris canutus; Dunlin, Calidris alpina; Black-tailed godwit, Limosa limosa; Common redshank, Tringa totanus; Common shelduck, Tadorna tadorna; Bar-tailed godwit , Limosa lapponica.* **Ramsar Criterion 8 -** *The Humber Estuary acts as an important migration route for both river lamprey Lampetra fluviatilis and sea lamprey Petromyzon marinus between coastal waters and their spawning areas.* **Noteworhty Fauna:** **Birds -** *Great bittern, Botaurus stellaris* *Eurasian marsh harrier, Circus aeruginosus* *Pied avocet, Recurvirostra avosetta* *Little tern, Sterna albifrons* *Dark-bellied brent goose, Branta bernicla* *Eurasian wigeon, Anas penelope* *Common teal, Anas crecca* *Common pochard, Aythya ferina* *Greater scaup, Aythya marila* *Common goldeneye, Bucephala clangula* *Hen harrier, Circus cyaneus* *Eurasian oystercatcher, Haematopus ostralegus* *Great ringed plover, Charadrius hiaticula* *Grey plover, Pluvialis squatarola* *Northern lapwing, Vanellus vanellus*		

- Hazards and Effects in reference to the individual elements and consented activities of the project. Describe any hazards or effects with potential to give rise to impacts on the European Site (either alone or in combination with other plans or projects).

Sensitive Interest Features	Potential Hazard(s)	Potential Exposure to hazard and mechanism of effect/impact if known
Sanderling, Calidris alba *Curlew, Numenius arquata* *Ruddy turnstone, Arenaria interpres* *Ruff, Philomachus pugnax* *Whimbrel, Numenius phaeopus* *Common greenshank, Tringa nebularia*		
River Derwent SAC **Annex I Habitat:** *Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation* **Annex II Species:** *River lamprey Lampetra fluviatilis* *Sea lamprey Petromyzon marinus* *Bullhead Cottus gobio* *Otter Lutra lutra*	Changes in water chemistry. Changes in water levels or table.	The SAC is located a significant distance (8km) from the boundary of the Danvm Drainage Commissioners district. The site is not hydrologically linked with the district. Water level management activities will therefore have a local impact and will not extend a significant distance beyond the boundary of the district. No hazards will arise on the sensitive interest features as a result of implementation of the WLMS. Therefore, no likely significant effects are predicted.

E.1 Conclusion

It has been determined that the WLMS will not result in significant adverse effects on the integrity of any European sites. This is due to the distance of the sites from the drainage district, the lack of hydrological connectivity and the localised nature of the options identified for the sub catchments. Before the implementation of any option resulting from the WLMS, further assessment will be undertaken with regards to potential impacts on European sites.



F Further Study

G DDC Maintenance Statement

H Doncaster Drainage Act Extract

Offices at

Coleshill
Doncaster
Dublin
Edinburgh
Exeter
Haywards Heath
Limerick
Newcastle upon Tyne
Newport
Saltaire
Skipton
Tadcaster
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