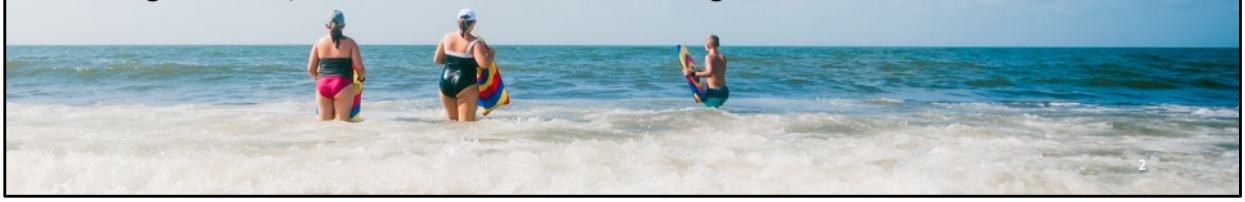
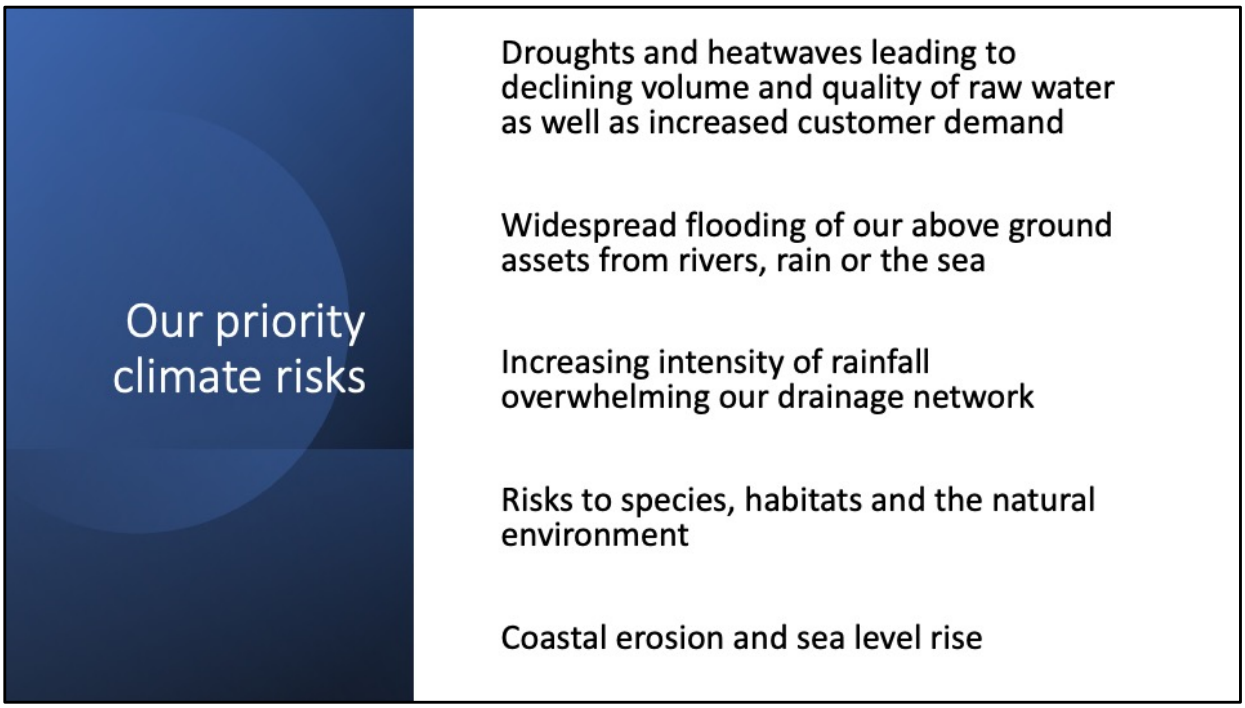
Quick overview of Yorkshire Water's main climate risks
Focus particularly on some projects we have carried out to protect our assets from coastal erosion and sea level rise.
Showcasing some of the innovation, partnership working and also highlighting some of the challenges we face working along our coast.

Yorkshire Water

- Serve 5 million customers
- Supply 1.3 billion litres of drinking water every day
- Treat 1 billion litres of waste water every day
- Manage 120 reservoirs, 600 waste water treatment works, 53 drinking water treatment works, 2000 sewage pumping stations and 83,000km of pipes
- One of Yorkshire's largest landowners 49,000ha
- Dependent on weather and climate for our core business and have statutory responsibilities to include climate change in our decision making
- Have an important role in managing flooding incidents under the Flood and Water Management Act, 2010 as well as other civil contingencies.





Drought, heatwaves and hot spells leading to declining volume and quality of raw water as well as increased customer demand –

The drought we experienced in 2018 can be expected every other year by 2050, and our modelling shows that we can expect a deficit of 100ml/day by 2045 due to climate change.

We plan to meet this deficit by reducing leakage by 15% and working with customers to encourage them to use water wisely.

Widespread flooding of above ground assets from rivers, rain or the sea

Many of our assets are, by necessity, located by rivers or the sea and cannot be fully flood proofed and we have experienced significant costs from flood events in recent years however luckily no customers have lost drinking water supply due to flooding.

Our assets also play an important role in managing flood risk in many places, especially in York and Hull where our pumps help remove surface water during

flood events.

Increasing intensity of rainfall overwhelming our drainage network

Our sewer network carries not just sewage but also highway drainage, watercourses, and surface water and which are only designed to cope with a 1 in 30 rainfall event.

We are seeing an increase in the intensity of rainfall which combined with population growth and urban creep are driving an increased risk of sewer flooding and discharges from storm overflows.

Next year we will publish our long term drainage water management plans which will include the impacts of climate change and will also look at partnership solutions to manage the risk of sewer flooding.

Risks to habitats, species and the natural environment

We rely on good quality habitats such as healthy peat bogs and rivers to provide good quality raw water.

Poor quality habitats provide poor quality water which requires more chemicals and energy to treat.

Invasive species such as zebra mussels or floating pennywort can impact the quality of water and our ability to abstract and treat it.

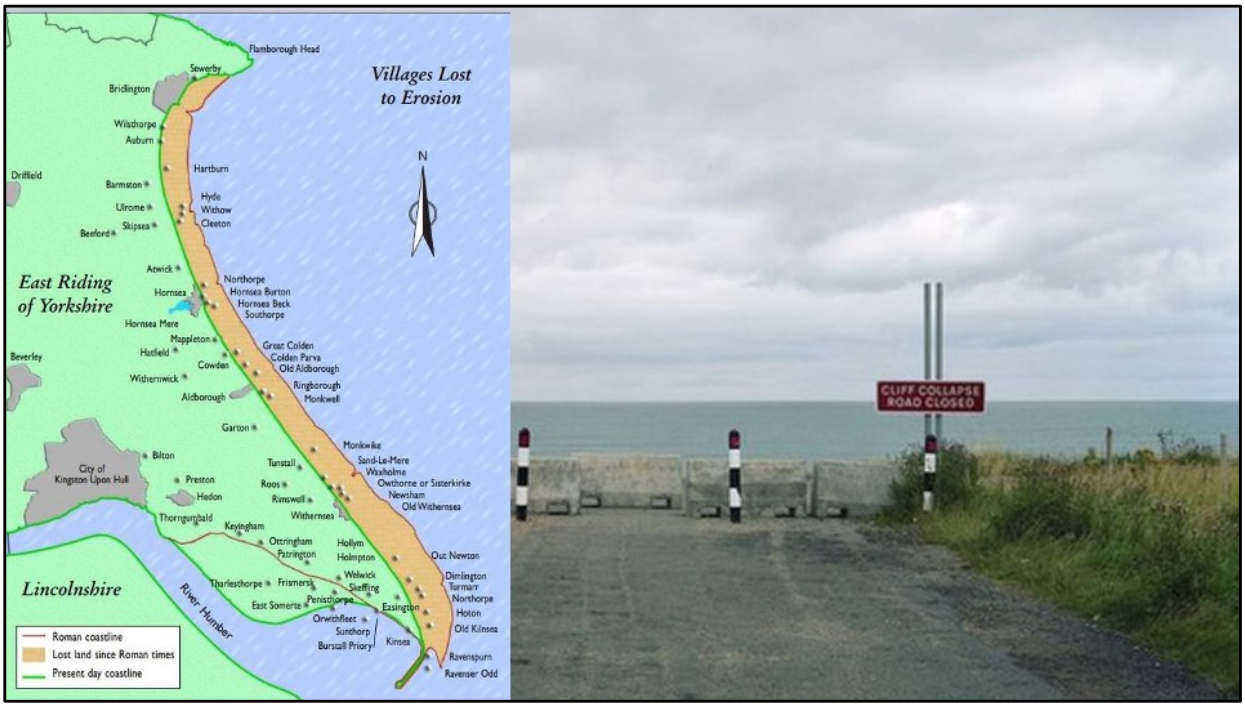
Peat bog habitats can be damaged by poor land management practices, human-set fires, and the impacts of climate change such as droughts.

We also have an impact on the natural environment from the water we abstract and the final treated effluent we return.

These impacts are carefully managed through the regulatory regime, our environmental investment programme and our work with our own tenants and other land owners to encourage sustainable land management practices such as our Beyond Nature farming programme.

Coastal erosion and sea level rise

Finally, we have assets along the coast at risk from erosion and sea level rise which I will talk about in a bit more detail.



Natural process

Official planning policy - allow natural processes to continue whilst maintaining the existing line of defences around towns and villages.

Sea level rise and an increase in the number and frequency of storms - coastal defences overtopped more often and erosion rates will increase

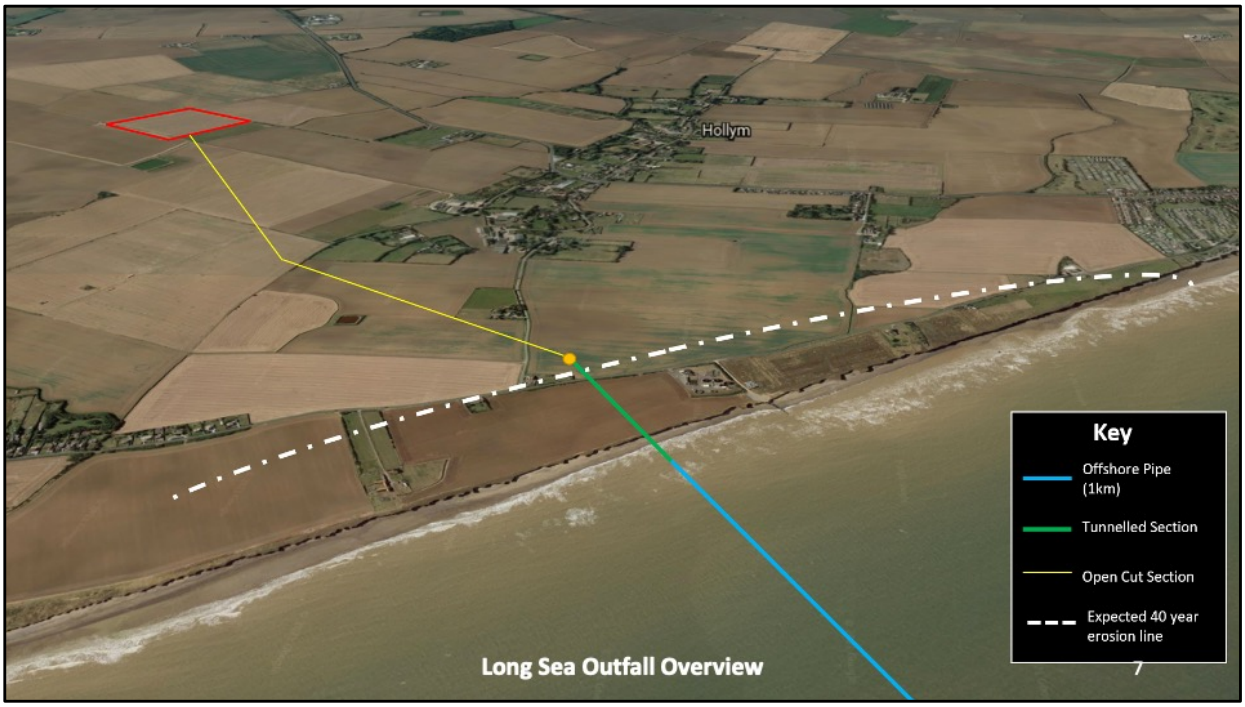
Coastal risk assessment - prioritised list of assets that need relocating or protecting

Pop 6000, protected by a sea wall, sewage treatment works which serves the village is not protected.

This part of the coast is eroding at around 3-4m/year.

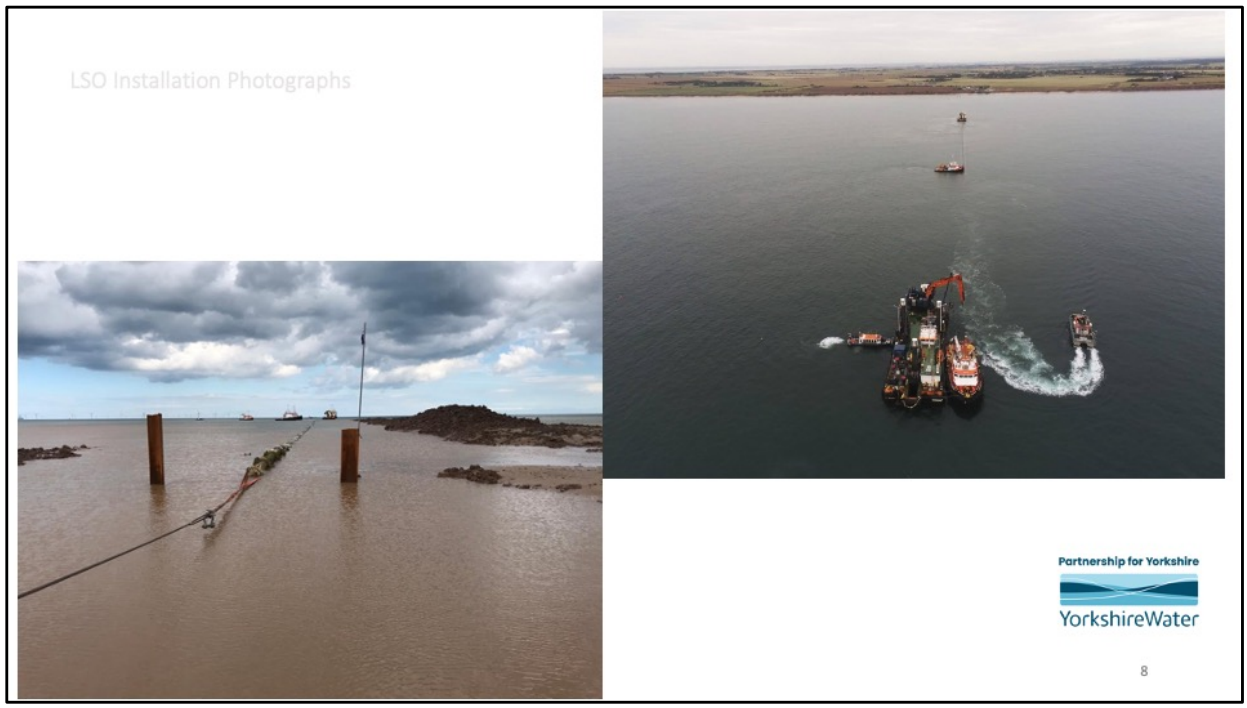
The current distance from the cliff edge is around 40-45m and more than 100m of land have been lost over the last 30 years.

As well as the new WwTW, a new Long Sea Outfall required as the existing was now exposed on the foreshore – currently being protected with 8tonne bags of aggregate.



2.5km inland and 10m above sea level
considered to be safe from erosion for at least 100 years (design life of the plant is 40 years) even under the most extreme projections for sea level rise.

The new plot is a good distance from flood zones 2&3 and has less than a 1 in 1000 annual probability of being flooded by rivers or the sea and is also at a less than 1 in 1000 annual risk of flooding from surface water.



The new long sea outfall was towed across from Norway

Fig3 provides an overview of the works. In short these included:

- 2.5km opencut installation across farmland,
- 15m depth drive shaft for TBM,
- tunnelled section under the cliffs of approx. 250m,
- 1km offshore installation

Construction Photographs – November 2020

Partnership for Yorkshire
YorkshireWater

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Construction Photographs – Feb 2021

Partnership for Yorkshire
YorkshireWater

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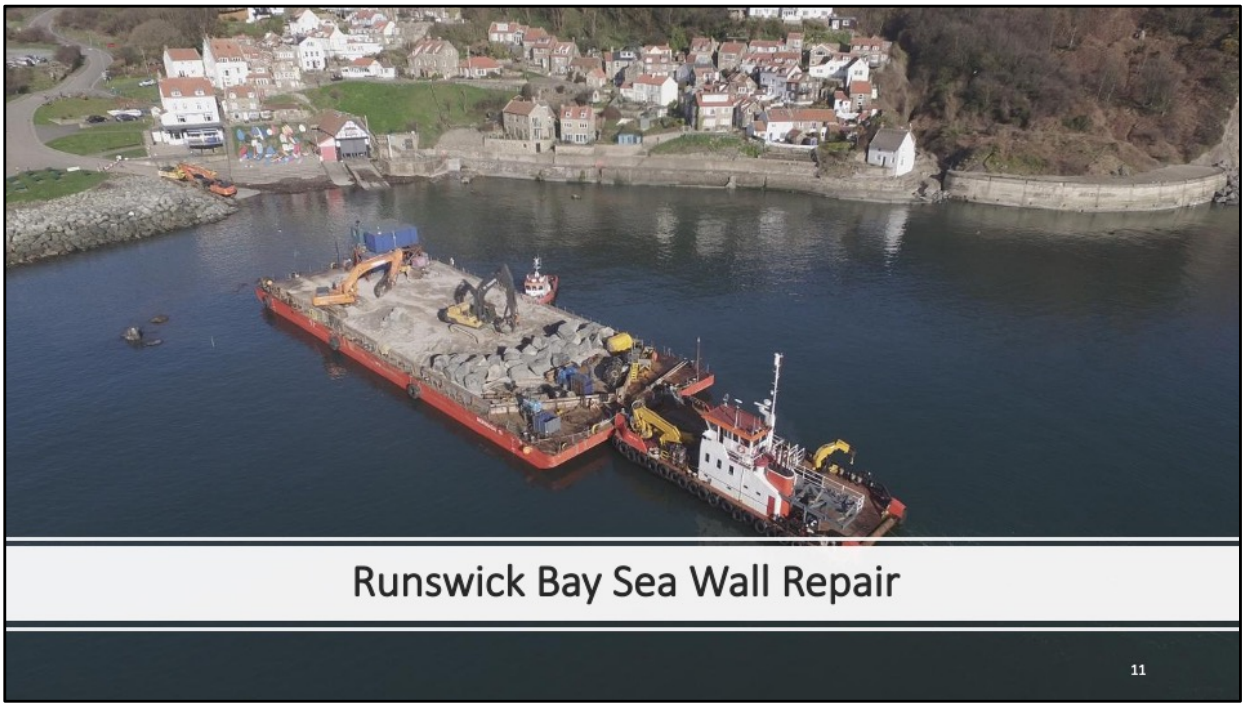
Aero-Fac no chemicals, is aerated by wind and produces no sludge.
This will be the UK's largest Aero-Fac system and is designed to treat population equivalent (summer / winter) of 14,712 / 7,100. The next largest in the UK of this system is for a population of 3000 / 2000
Lagoons means they fall under the Reservoir Safety Act so this technology would only be suitable for use in rural locations with plenty of space.
This saves £7m vs a conventional ASP plant and a load of carbon from energy, chemicals and tanker movements. Total cost £35m
The new plant will go live in September.



Damage to an existing sea wall caused by the storm surge in 2013 which required a partnership approach to resolve.
We created a partnership with the Council, the EA and local residents.
Local residents raised £100,000, and we agreed to divert the sewer at our own cost, which together demonstrated enough match funding to make the scheme viable for central government funding.
£2.3m scheme, YW £700,000 in kind, £1.5m central funding
Protects 113 properties and the tourist revenue for the town for the next 100 years
200 artificial rock pools were carved into the sea wall which have already been colonised by various seaweeds and creatures and which are being monitored by the University of Bournemouth for the next three years.
We think creating these rock pools in the sea wall is the first time this has been done on a coastal scheme in the UK.

Flamborough Head due to coastal erosion, which was completed back in 2016, cost £400k

Significant site constraints including:

scheduled ancient monument and popular tourist attraction, a nature reserve and SSSI (home to the only mainland colony of ganets), some domestic properties very close by, buried WW2 archaeology and throughout the build we had to maintain access to the foghorn signal which ran across the line of the inlet to the pump station.

Used precast sump and pipe rings saves on concrete (and carbon) and we also used an adaptive approach so that we can accommodate Northern Power Grids substation in our new compound when they need to move their asset in the future.

The new SPS is behind the 100 year erosion line.

Hard choices

Flat Cliffs, a tiny hamlet with a few permanent homes and several holiday caravan parks in North Yorkshire which is an area of rapid erosion and which has no defences. The access road had temporary works in 2017 however NYCC have made it clear that they are not able to protect this area.

The residents are being encouraged to move out but there is no financial support for this.

Solutions to relocate or reconfigure the sewer network are expensive, around £3-5m and would only benefit a small handful of properties which are themselves likely to be evacuated for safety reasons in the next few years.

This makes the cost benefit low and is illustrative of the difficult trade offs we will face in our region as coastal communities become increasingly unviable, but which don’t have access to any financial support to help them relocate.

Flavour of the types of risks and responses we face along the coast and some of the challenges and opportunities involved in managing these risks.
Challenges around
finding enough space and land available to buy to relocate assets
Working in partnership with coastal authorities
Site constraints such as nature reserves, historical artifacts, needing to complete all works during winter before tourist season
Managing community expectations
Making the cost benefit stack up

Opportunities
Chance to use new technology – eg Withernsea
Chance to create better schemes with wider outcomes and leverage match funding– eg Runswick Bay rock pools
Chance to future proof using modular design – Flamborough compound ready for NPG if needed

The newly publish FCERM strategy sets out the vision for a nation prepared for, and resilient to flooding and coastal change, which includes the strategic objective to

support coastal communities transition and adapt to a changing climate.
The strategy's action plan says that
New technical guidance will be issued later this year for coastal authorities, new coastal risk maps in 2023 and new shoreline management plans by 2025,
key time for understanding and planning for the changes we will inevitably face along our coast,
opportunity to have some of the hard conversations about how we can live with this dynamic and beautiful coast and set the policy for the next generation