



Rail Accident Investigation Branch



Learning from Grange-over Sands

PWI – Water management on the railway

Tony Butler

Inspector of Rail Accidents

7 May 2025

From the past....

“Amongst the many important works connected with the construction of a railway, it is doubtful whether any require more attention, experience and knowledge than the earthworks”

“The hidden and insidious enemy – water. Wherever water is known or suspected to exist, its immediate source should be traced, and every possible means adopted of diverting it from slopes.”

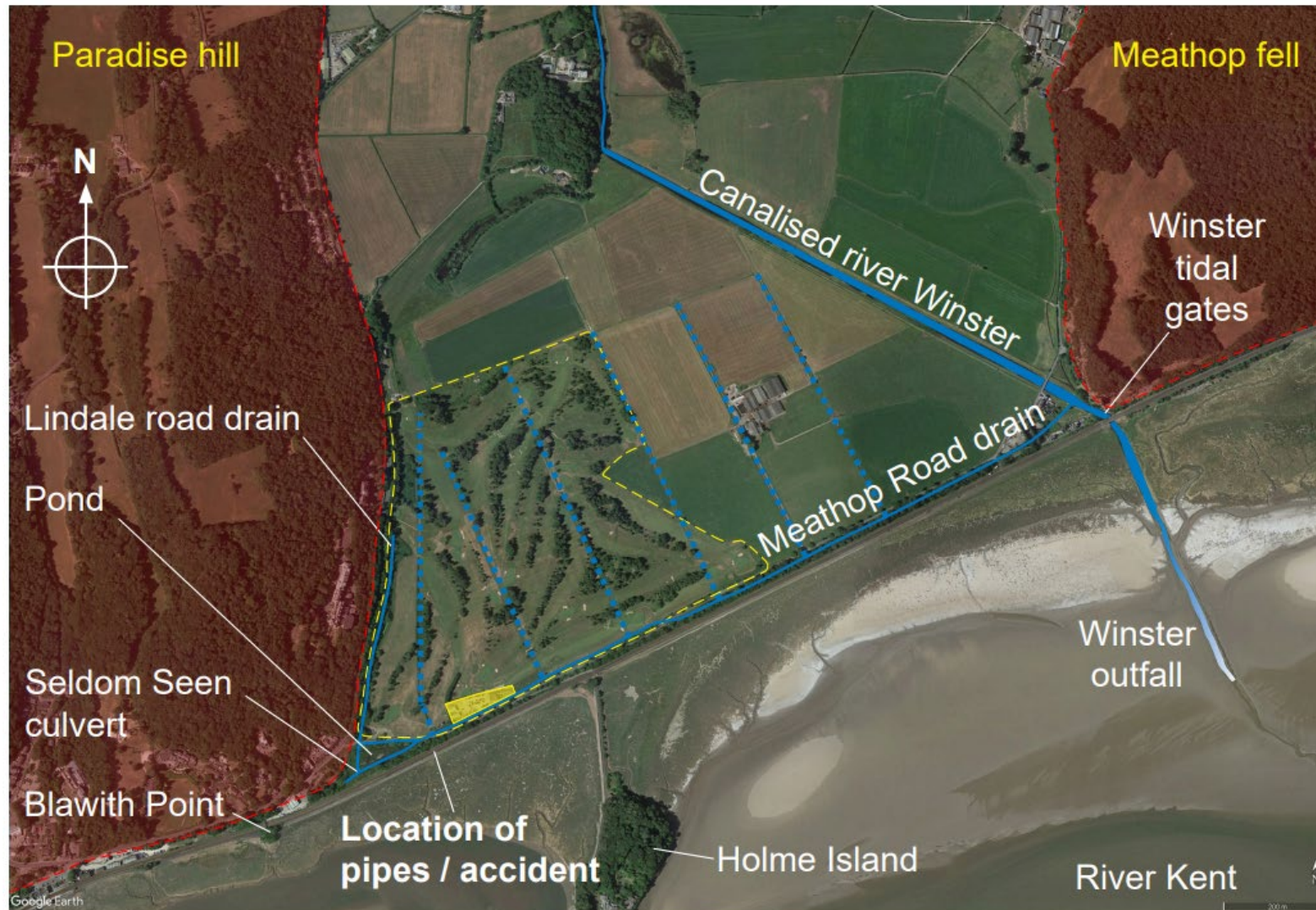
Railway Construction (2nd Edition) 1864 (available from the Institution of Civil Engineers (ICE) library)

Site Location



Extract from Ordnance Survey map showing location of the accident at Grange-over-Sands (Figure: RAIB)

Main Site Features of Derailment



Plan showing main features of site (Image: RAIB with RAIB annotations)

Slide 5

Flooding December 2023



Flooding at Grange-over-Sands Golf Club (Image: Leslie Micklethwaite)

Slide 6

1851 - Original Specification

XXV. That, subject to any Waiver or Alteration to be allowed and approved as aforesaid, the said Company shall form in the Embankment or Viaduct for carrying the said Railway across the *Winster Bay* not less than Four Openings, of Twenty Feet wide each, for the free Ingress and Egress and Scour of the Tides and Flood Water, with a clear Headway under each of the said Openings of not less than Ten Feet each, between High-water Mark of ordinary Spring Tides and the Soffit of the said Embankment or Viaduct.

Provision as to crossing Winster Bay.

XXVI. That neither of the said Three Viaducts or Embankments for carrying the said Railway across the said Estuary of the *Leven*, the said *Kent Estuary*, or the *Winster Bay* shall be so constructed as to deviate from the Black continuous Line shown on the Plan deposited at the Admiralty, without the previous Consent of the said Lord High Admiral or the said Commissioners, signified in Writing under the Hand of the Secretary of the Admiralty, and then only in accordance with such Consent.

Not to deviate in construction of Viaducts, &c., without Consent of the Admiralty.

Extract from Ulverston and Lancaster Railway Act 1851

1855 – Embankment Construction

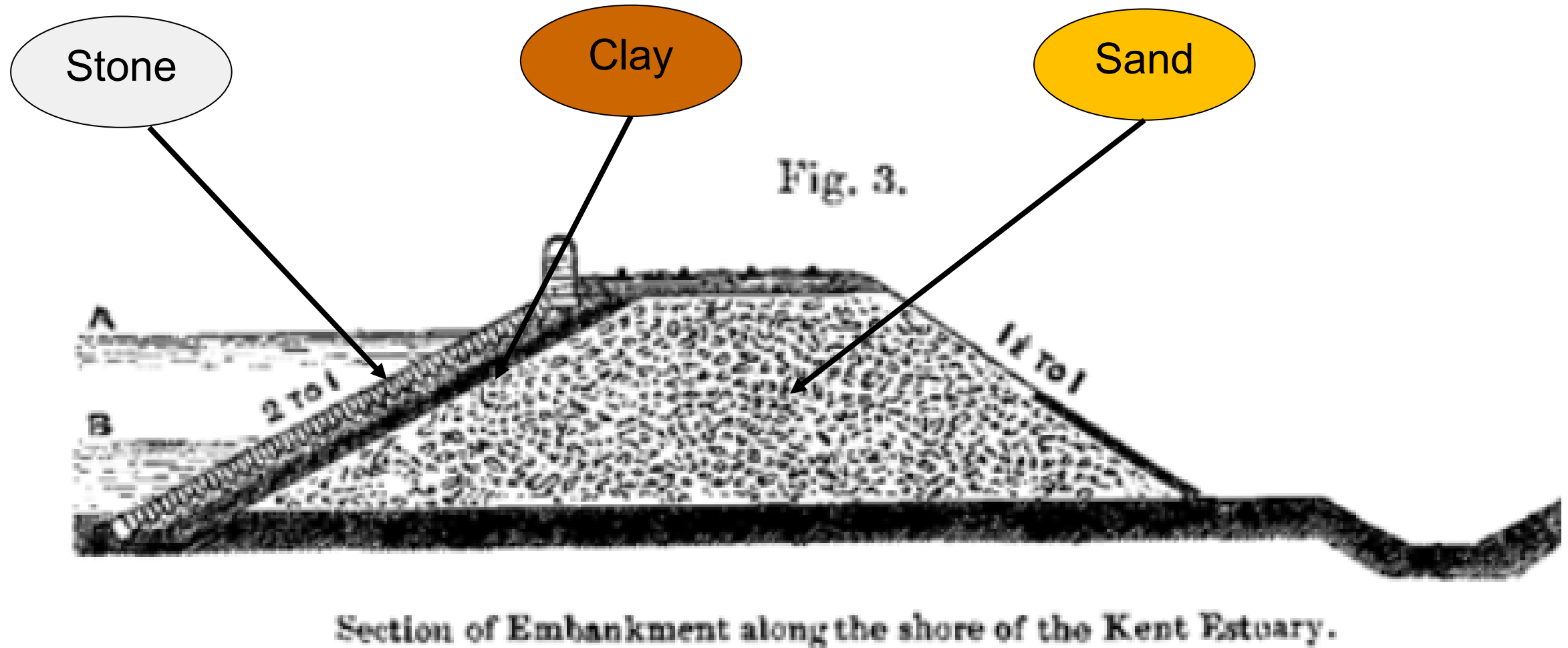


Figure from Minutes of the Proceedings of the ICE Vol. 14, Issue 1855: Session 1854-1855

1851 - Deposited Plan



We have no record of any Waiver or Alteration having been approved by the Lord High Admiral but we have a plan* which, under date of 20th June, 1853, records the following:-

"Memo. of Agreement"

We the undersigned hereby agree, 1st, that the River Winster shall be diverted from Castlehead to Meathop Fell Point as shown on the Ordinance Plan signed by us.

2nd, that in lieu of the four openings provided for in the Act of 1851 for making the Ulverston and Lancaster Railway a sluice of the dimensions shown on this drawing shall be substituted the sill of which shall be placed at least three feet below the present sill at Castlehead and the floodgates shall be hung on the same principle as those at Castlehead. Stop gates not more than ten feet in height above the sill shall be placed on the land side of the sluice for the purpose of scouring out the channel; the same shall be accessible at all times to the Winster Drainage Commissioners or their Surveyors.

(Signed) William Thornboard (?) on behalf of the Winster Drainage.

(Signed) James Brunlees on behalf of the Ulverston and Lancaster Railway Co.

The land on which the training walls are situated is within the B.T.C.'s Deed Boundary

Tidal Gates



Tidal Gates River Winstar (Image: RAIB with RAIB annotations)

Seldom Seen Culvert



Lancashire Sheet XVII Published 1893



Seldom Seen Culvert (Images: RAIB)

Slide 11

Land reclaimed following construction

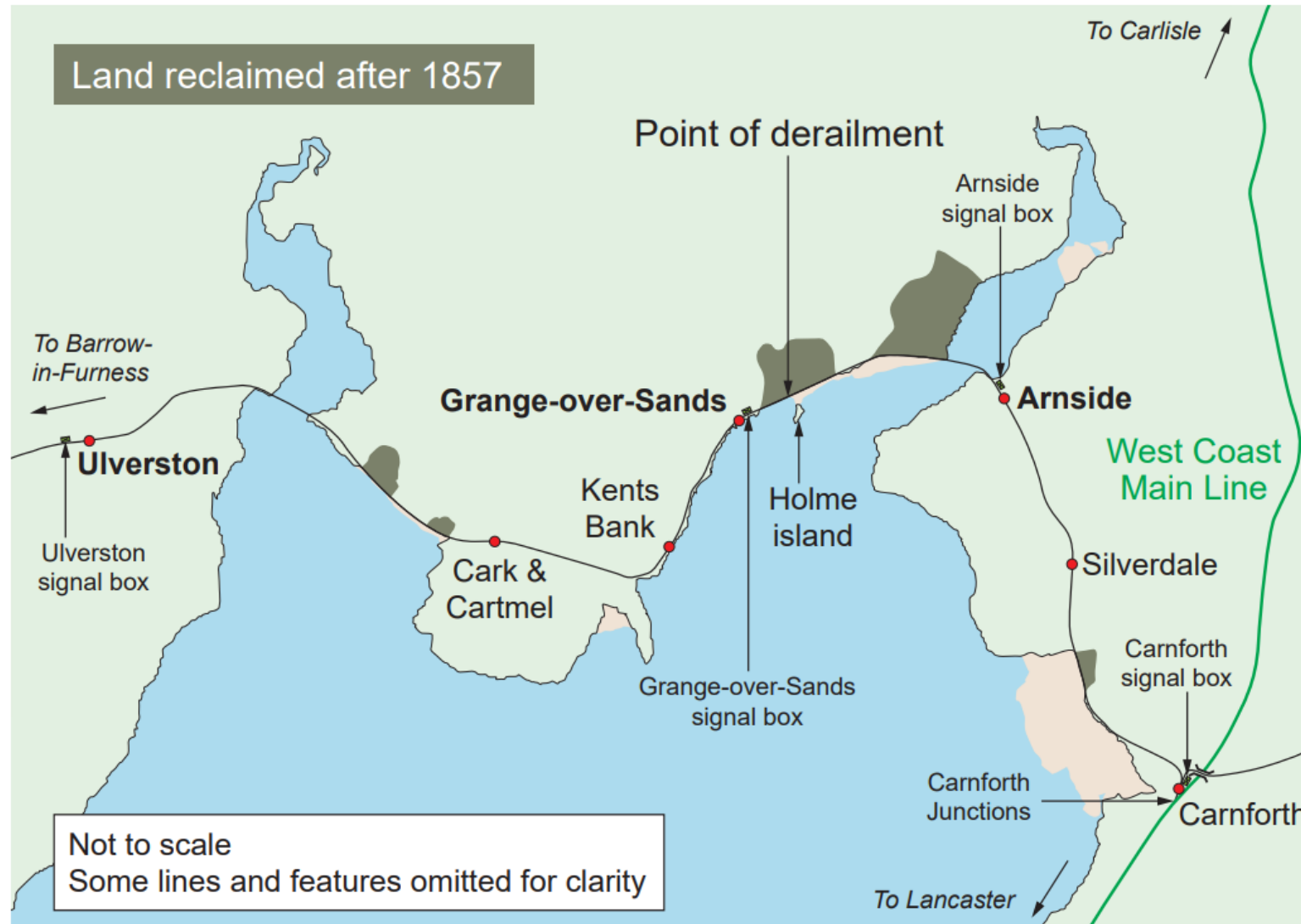
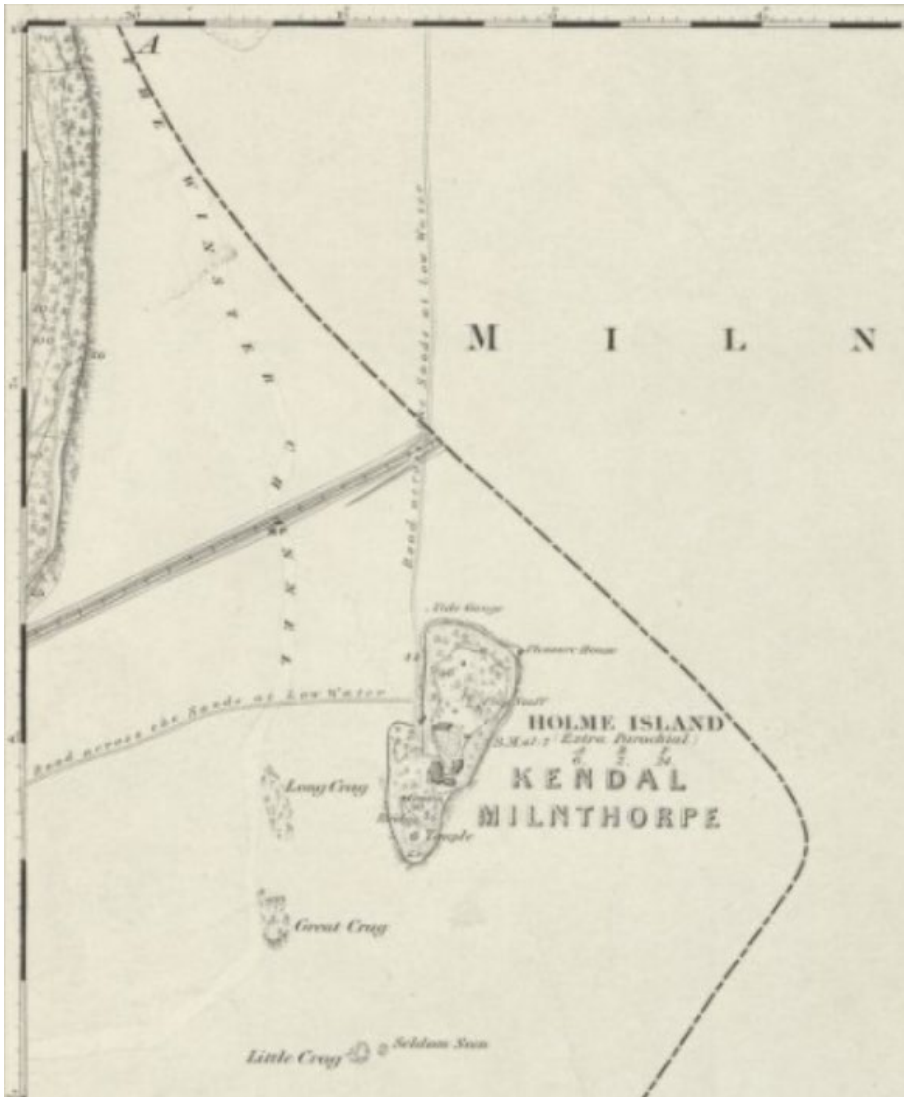


Figure showing areas of land reclaimed following railway construction (Figure: RAIB)

Slide 12

1855ish... – Causeway Construction

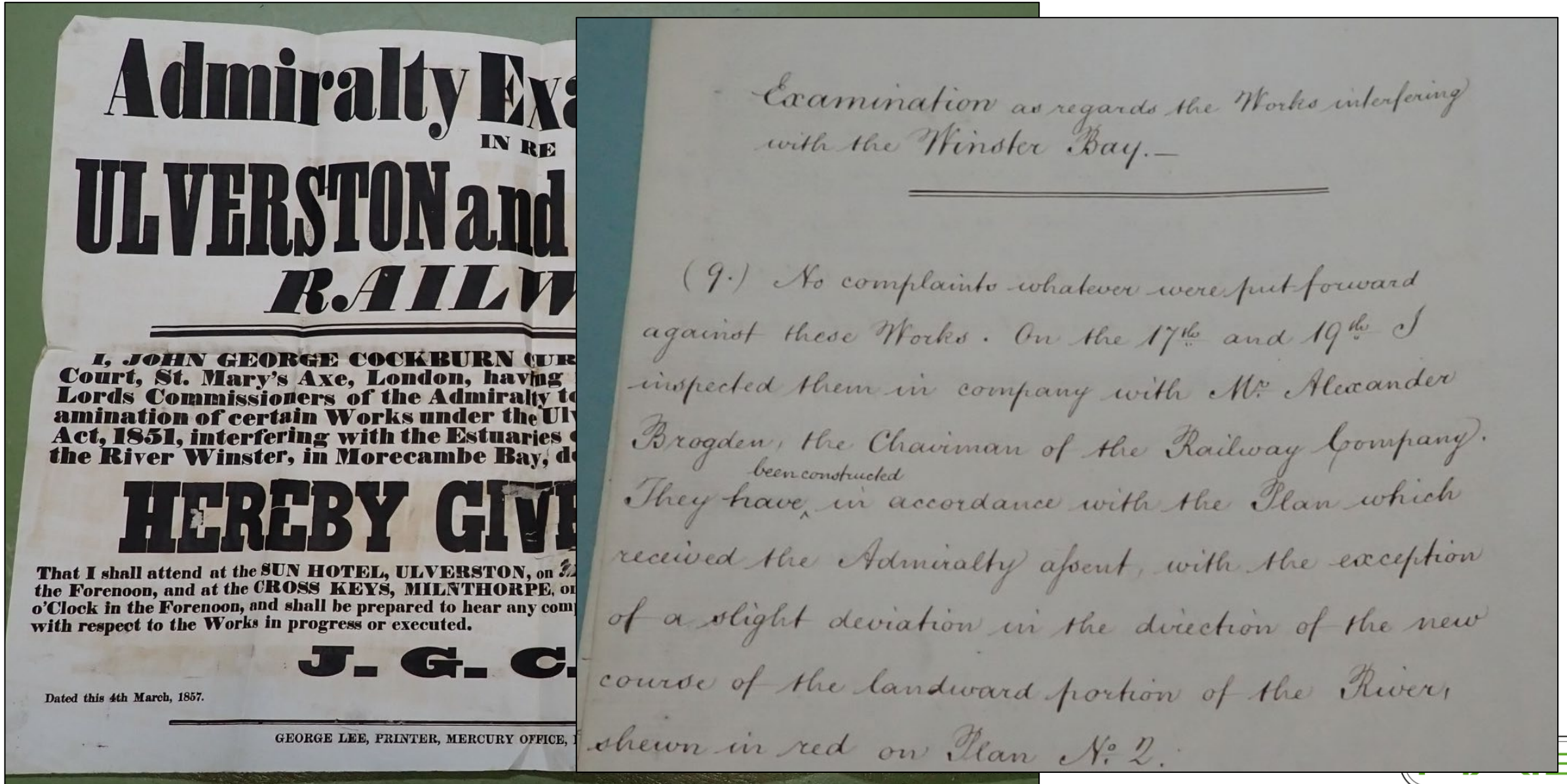


Lancashire Sheet XVIII Published 1848



Slide 12
Lancashire Sheet XVIII NW Published 1919
OFFICIAL-SENSITIVE

1857 - First Indication of Issues



1874 – River Winster Drainage



EXTRACT FROM WINSTER DRAINAGE MINUTES.

21st May 1874.

At a Meeting duly called and held at the Grange Hotel and adjourned to the Winster Bridge in connection with the Drainage of the Winster.

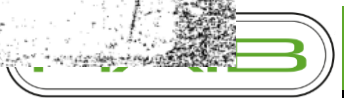
Sir James Ramsden on behalf of the Railway Company made the following proposition:

That the Railway Company will undertake to construct and maintain a stone embankment parallel with the existing embankments and as far as the River Kent (if considered necessary by the Commissioners) with the view of affording an outfall for the said drainage and, if required, the Railway Company will construct a clough for each opening on the inside of the Railway with all proper appliances for working the same upon the clear understanding that by so doing they are not be considered liable for any past damage that may have arisen from the defective state of the drainage.

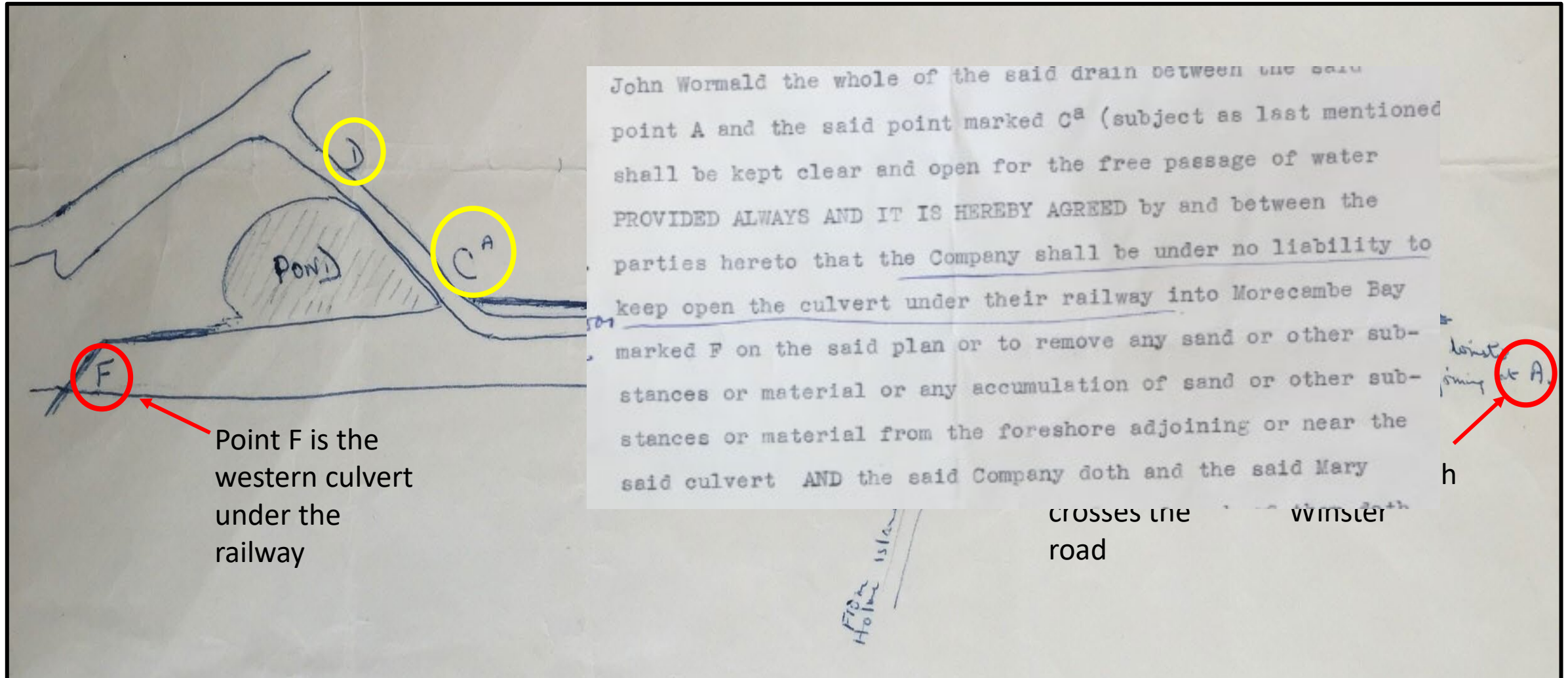
RESOLVED That the Commissioners having considered the above proposition hereby unanimously agree to accept the same.

Signed. George Drewry. Chairman.
 William Hall. }
 Geo. Pearson. } Commissioners.
 Francis Clark. }

Training Walls (Images from River Winster and Meathop Drain Investigation Report Aecom 2016)



1899 - Changes to landward drainage management



Later Biro sketch found with 1899 agreement

1902 - Council buy foreshore from Duchy of Lancaster



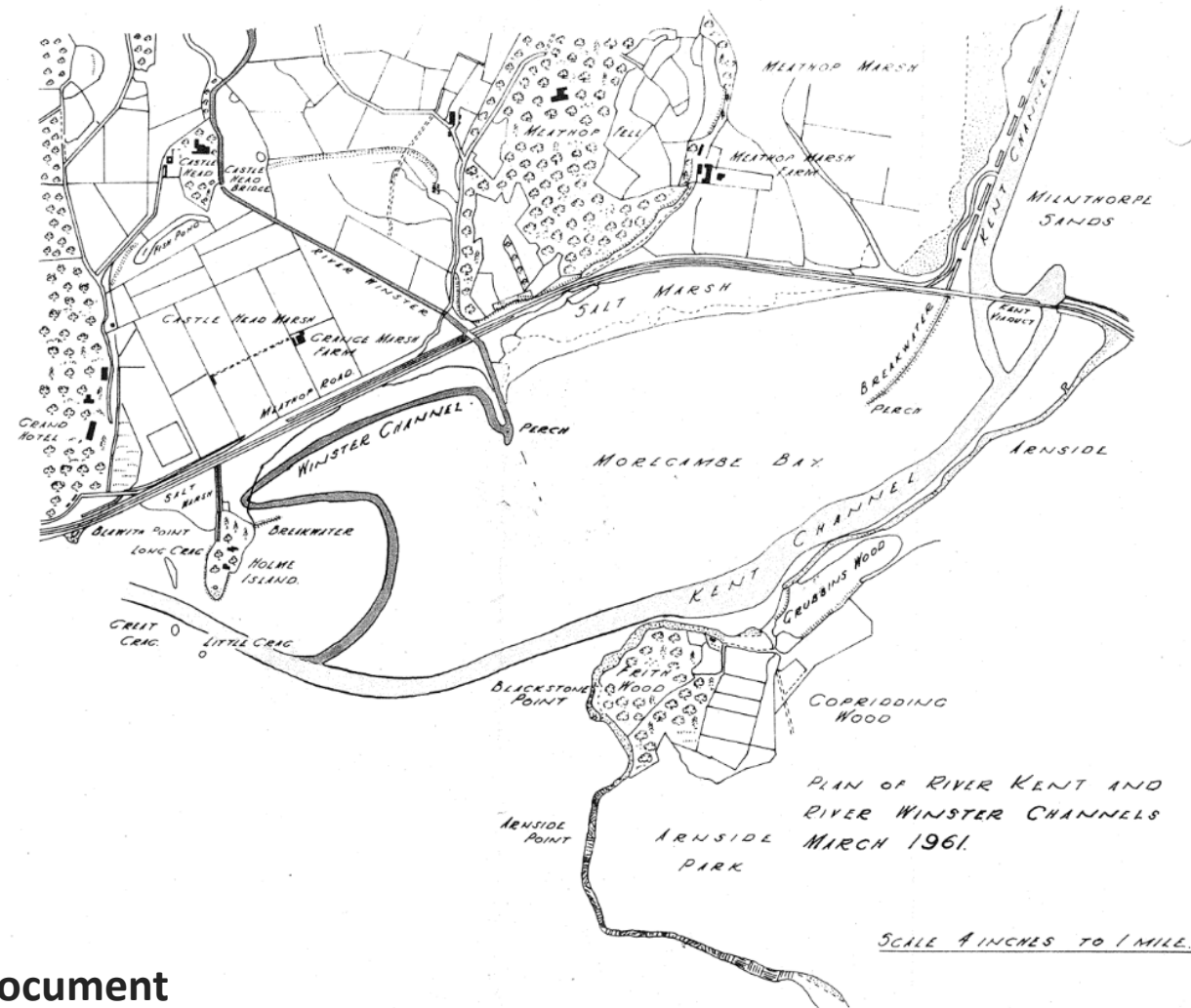
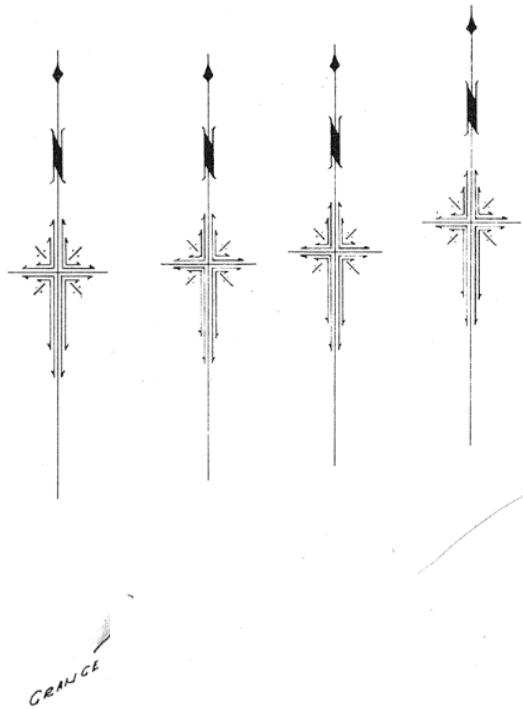
Copy of Plan with 1902 agreement of foreshore land purchase

Slide 17

OFFICIAL-SENSITIVE

Movement of the Rivers Kent and Winster

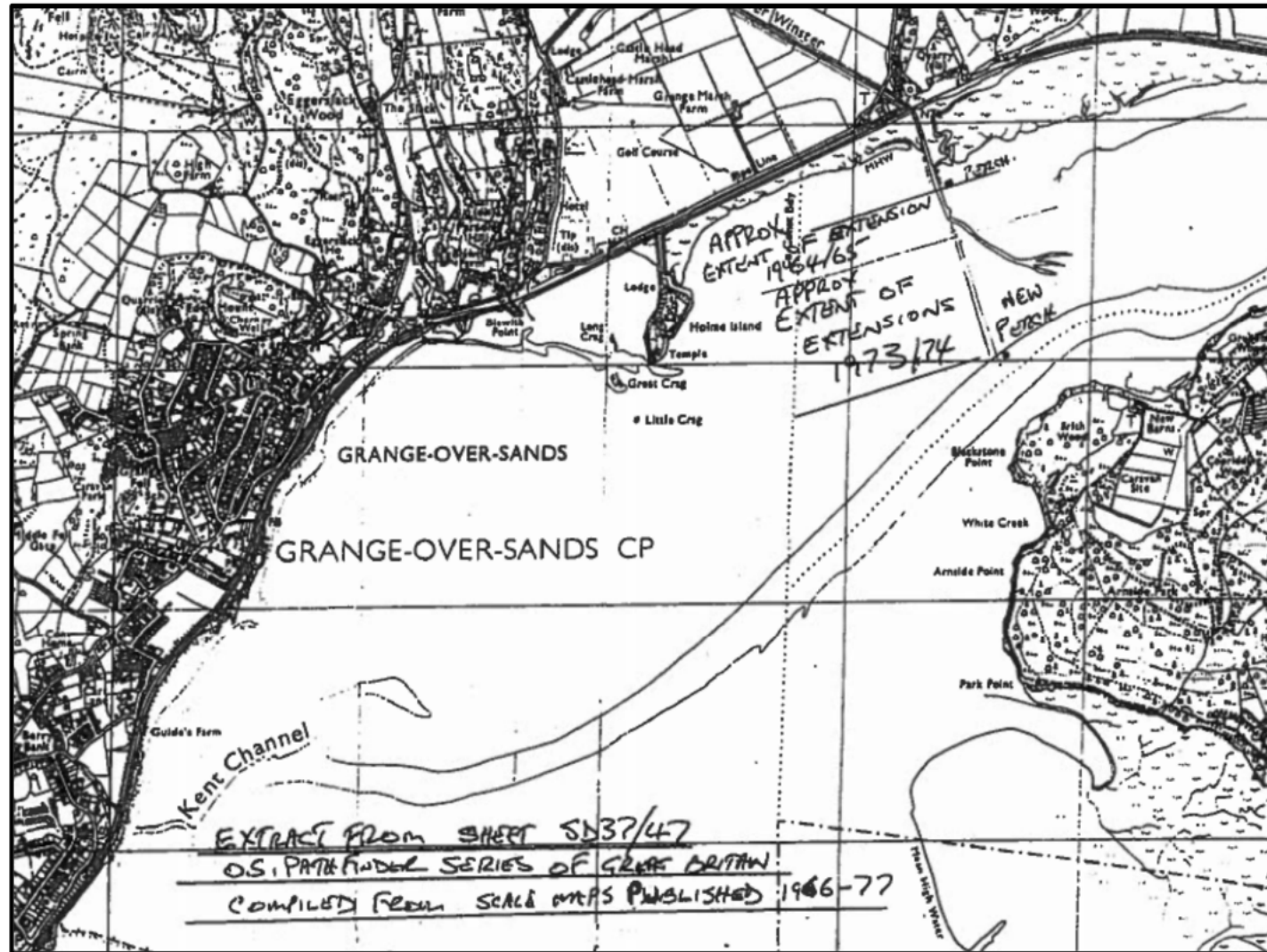
1961



1920's to 1970's

- 1920's/30's – Reclamation of Meathop Marsh as part of work relief for the unemployed
- 1940's – Railway company stopped maintaining the outflow channel at the Seldom Seen Culvert
- 1950's – Construction of alternative channel throughways at Kent/Arnside Viaduct may also have contributed led to fixing of the River Kent to the east side of the bay
- 1950's – Extensive correspondence between the Golf Course, Local council, and British Railway attempts to reopen and keep open the Seldom Seen Culvert open via dredging/excavation, but channel continually silts up shortly after any works are completed
- 1967 – Report produced for local authority suggests to divert all water towards the River Winster – fails due to disagreement between parties involved as to cost
- 1972 – Permanent pipe constructed through embankment to allow pumping of flood water

1964 – 1974 River Winster Training Walls extended



Annotated Map showing Extension of Training Walls (from River Winster and Meathop Drain Investigation Report Aecom 2016)

1990's to 2020's

- 1996 – Railtrack and Golf Club enter correspondence over the drainage and easement costs
- 1998 – Parts of River Winster Training walls removed to attempt to help drainage
- 2003 – Golf Club and EA correspond over creating a new discharge channel for drainage
- 2015 – Correspondence by local MP to the Chief Executive of Network Rail about ongoing drainage issues – discussions between all local stakeholders start to take place, Network Rail, Grange Golf Club, Environment Agency, Cumbria County Council, Marine Management Organisation, Natural England, South Lakeland Council and others....
- 2016 – Report produced for Network Rail looking at long term options – temporary pipe put in place to aid with pumping
- 2020 – Outlet channel to Seldon Seen Culvert re-opened but had silted up again by 2021

Temporary Pipe Installation and Subsequent Damage

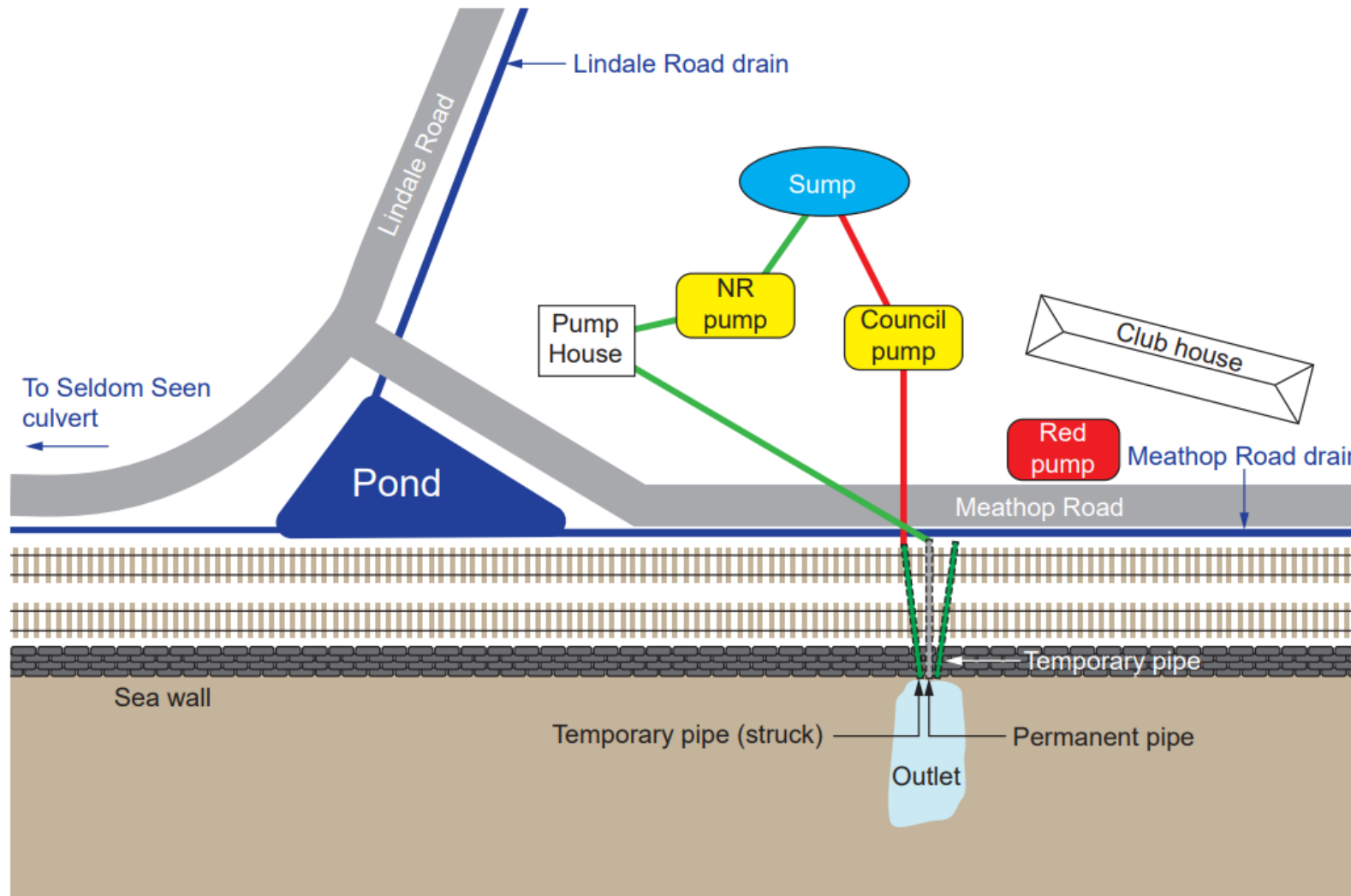


Installation of Tempory Pipe (Image: Network Rail)



Damage to Pipe (Image: Network Rail)

2024 - Pumping arrangements



Pumping arrangements at time of derailment (Figure: RAIB)

2024 – Derailment



Void under track that caused the derailment (Image: Network Rail with RAIB annotations)

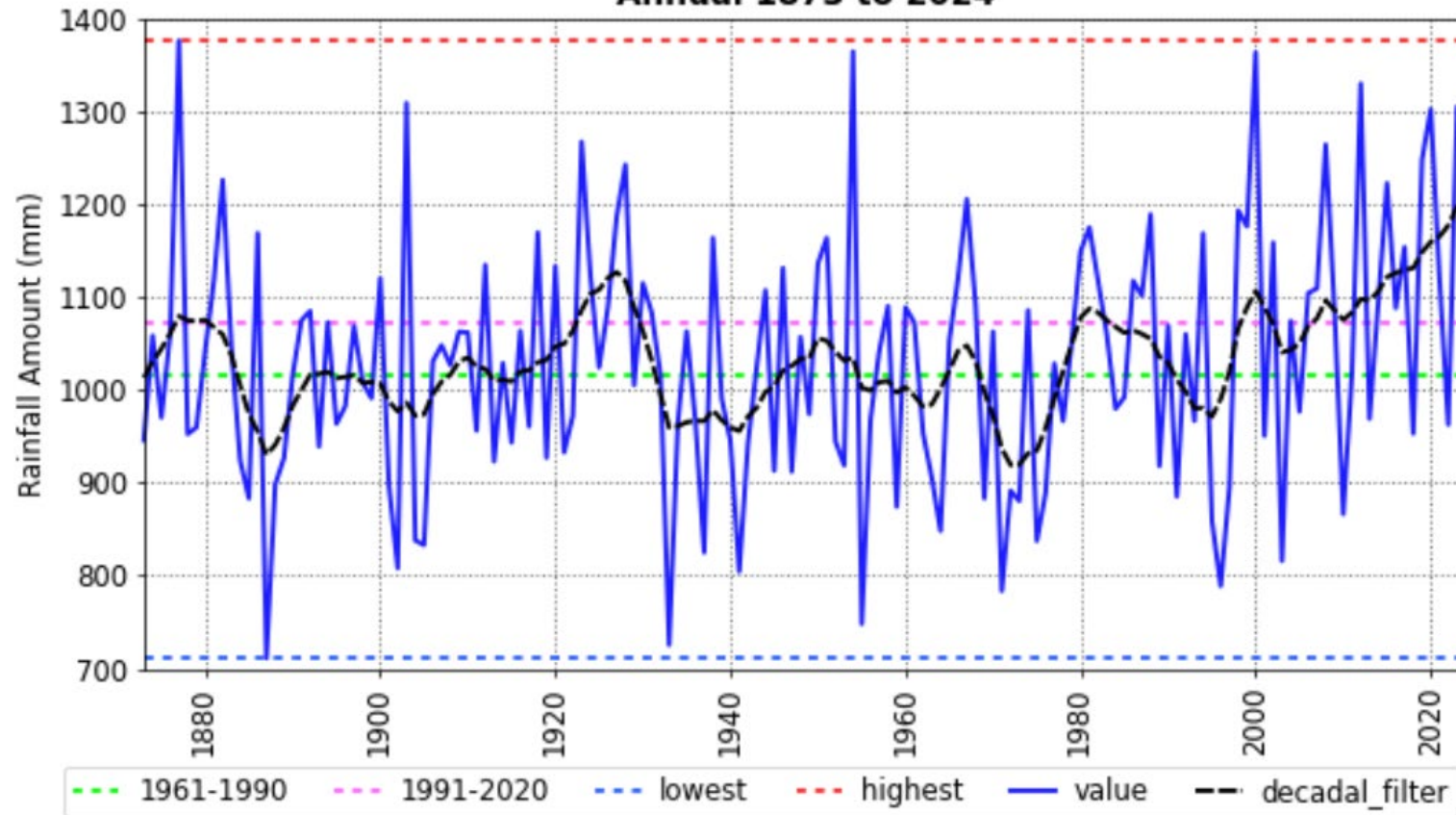
Slide 24

Increased rainfall



Source: HadUKP Creation Date: 05/04/2025 06:02 © Crown copyright

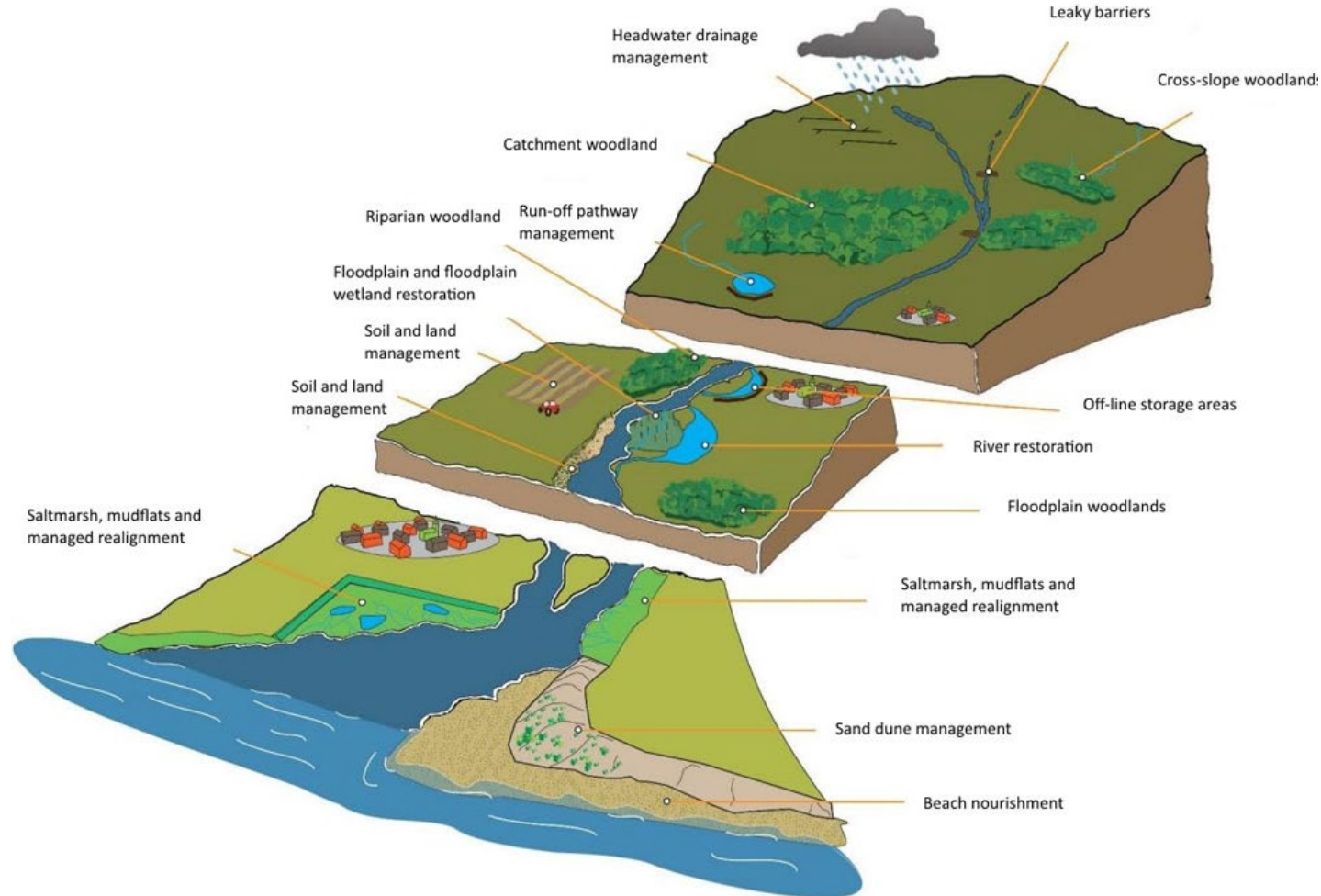
Rainfall Amount North West England Annual 1873 to 2024



Met Office Hadley Centre NW England Precipitation (Figure: Met Office)

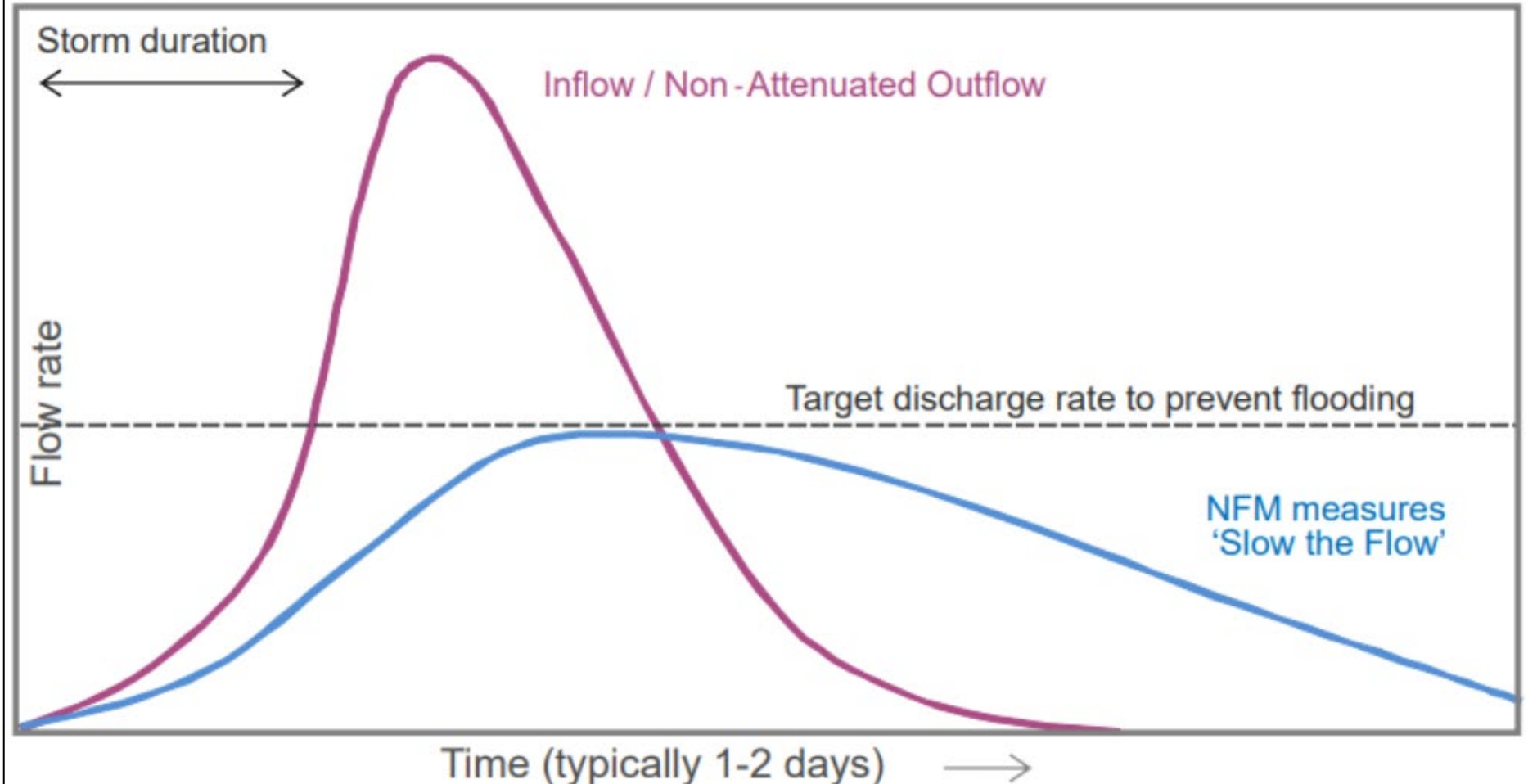
Slide 25

Changes in land management



Use of attenuation to prevent flooding

Slowing the Flow after heavy rainfall



Attenuated Flow (Figure: Slow the Flow © - <https://slowtheflow.net>)

Slide 27

Some Final Thoughts from Grange-over-Sands

- Decisions made in isolation but in “good faith” can have far reaching effects
- Increasing fragmentation/reorganisations of Private and Public bodies can lead to a loss of corporate memory, especially of written records and past agreements
- Relevant records can be held by many stakeholders, not just the obvious ones
- Who becomes the Controlling/Guiding mind in situations with multiple stakeholders and areas of responsibility?
- The UK faces increased climate challenges and reduced budgets – can we treat the underlying causes of these issues, just the symptoms or mitigate the consequences?

In the present...

“We are all aware that Britain is increasingly seeing more incidents of severe weather, and this presents a constant challenge to the safety and reliability of the railway. As the report details, this is particularly apparent in regard to earthworks – some of which are more than 150 years old – and drainage, as our country experiences more heavy rainfall and flooding. **Rebuilding thousands of miles of earthworks is simply not practicable, so we must look at how we manage the risk and what measures we must take to keep trains running and passengers safe.**”

Andrew Haines - *Interim report on Stonehaven to Secretary of State for Transport*
August 2020