

**PERMANENT WAY INSTITUTION:
LUNCH & LEARN**

**LITTLEBOROUGH CULVERT
PROJECT**

9TH MAY 2023

Presentation Structure:

- **Speaker Introductions**
- **Project Background & Context**
- **Key Parties Involved**
- **Design Challenges & Groundwater Issues**
- **Track Design & Construction Highlights**
- **Civils Delivery**
- **Take Home Learning**

ROCHDALE AND LITTLEBOROUGH FLOOD RISK MANAGEMENT SCHEME (FRMS) - £56M



River Roch – Rochdale Town Centre

- Boxing Day 2015 – Storm Eva.
- 324 properties severely damaged.
- Two care homes fully evacuated.
- 25,000 homes temporarily without electricity.
- Climate change has potential to make flood events more frequent.



www.thefloodhub.co.uk/rochdale-and-littleborough/

Rochdale and Littleborough Flood Risk Management Scheme

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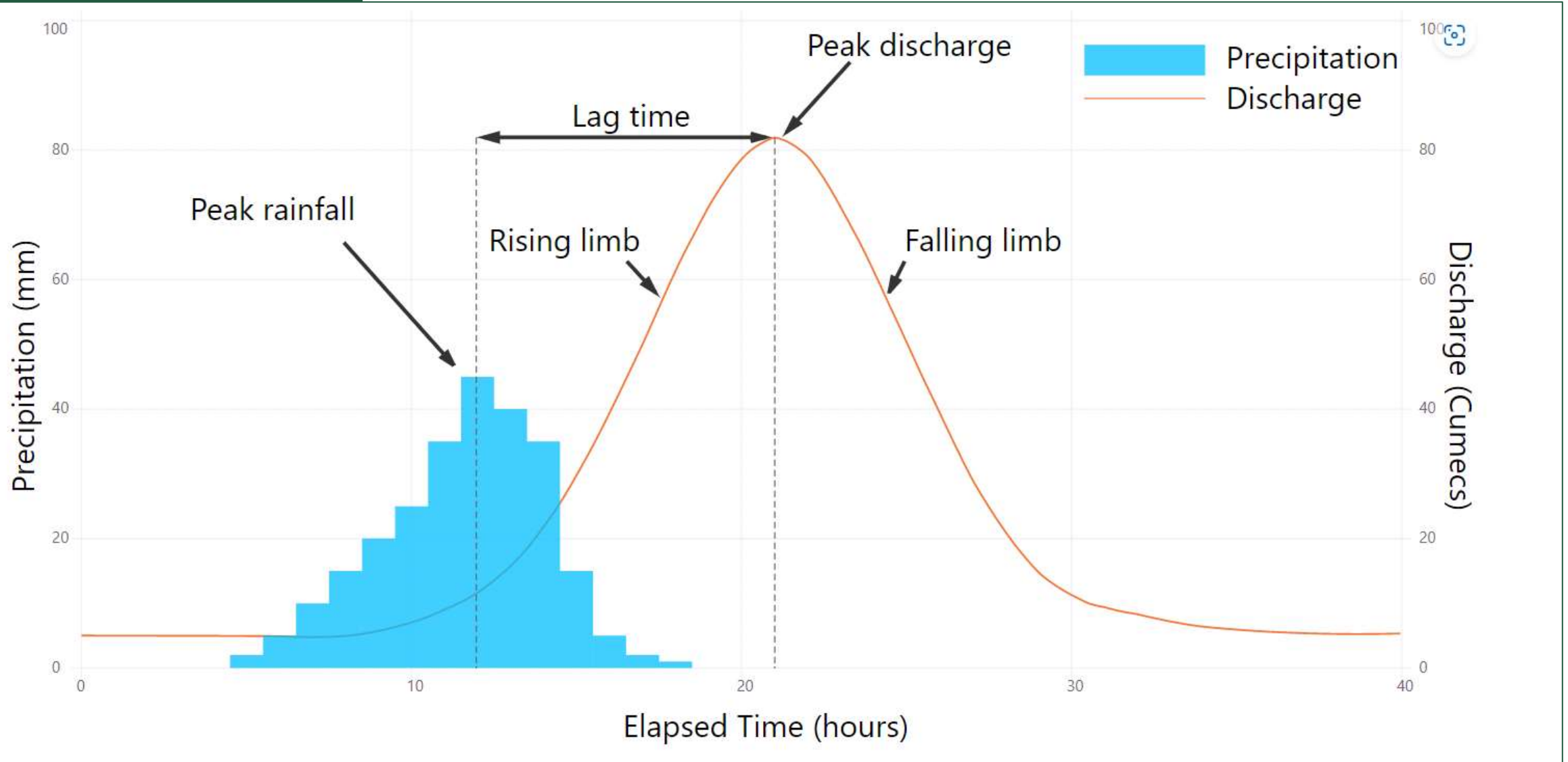
Environment Agency Jacobs VolkerStevin ROCHDALE BOROUGH COUNCIL HM Government Network Rail Transport for Greater Manchester

Introduction Overview Key Programme Dates Flood Risk Management Scheme

Introduction Overview

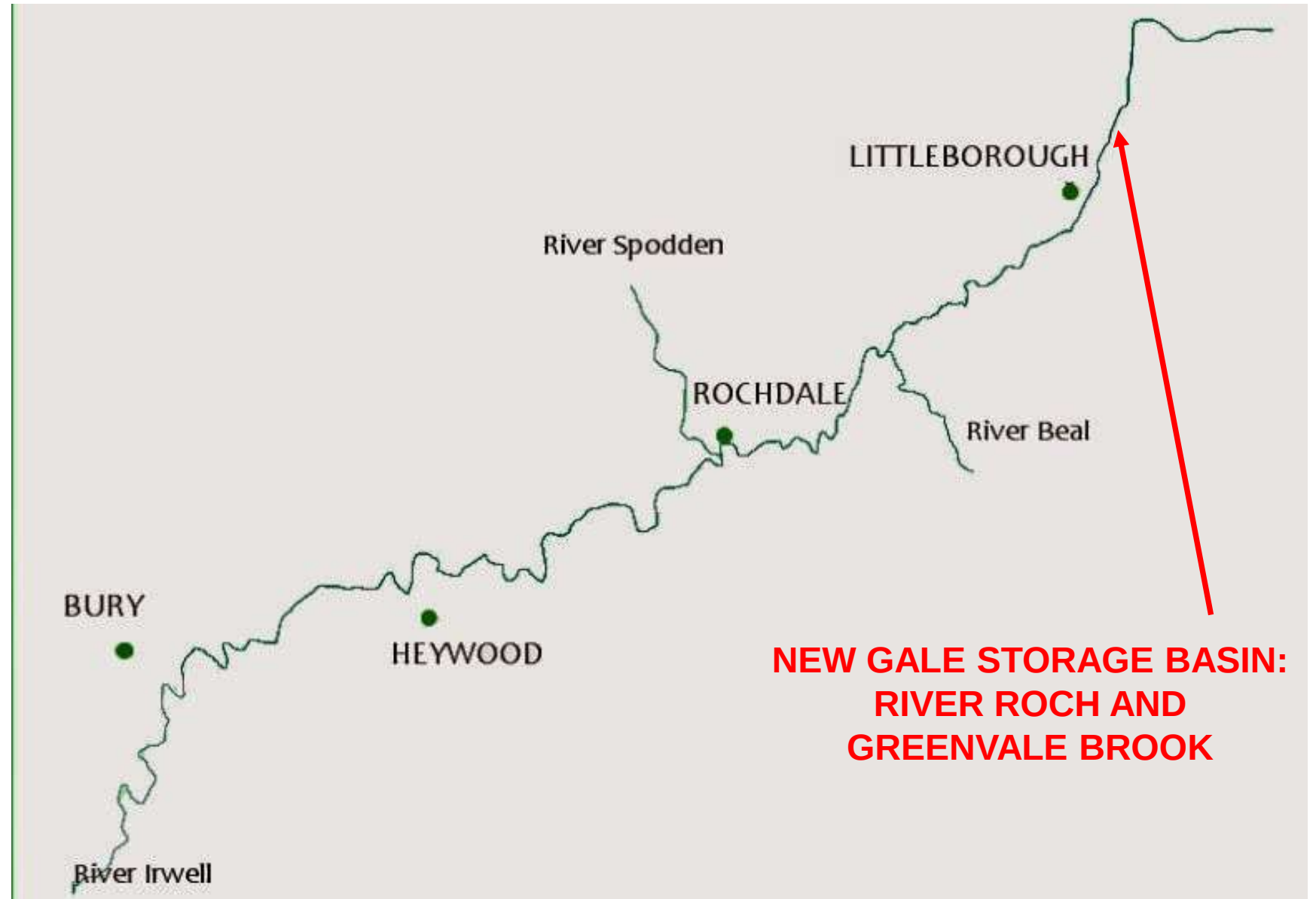
The River Roch, Rochdale and Littleborough Flood Risk Management Scheme (FRMS) seeks to address the high level of flood risk to the towns of Rochdale and Littleborough in Greater Manchester.

TYPICAL STORM EVENT - HYDROGRAPH



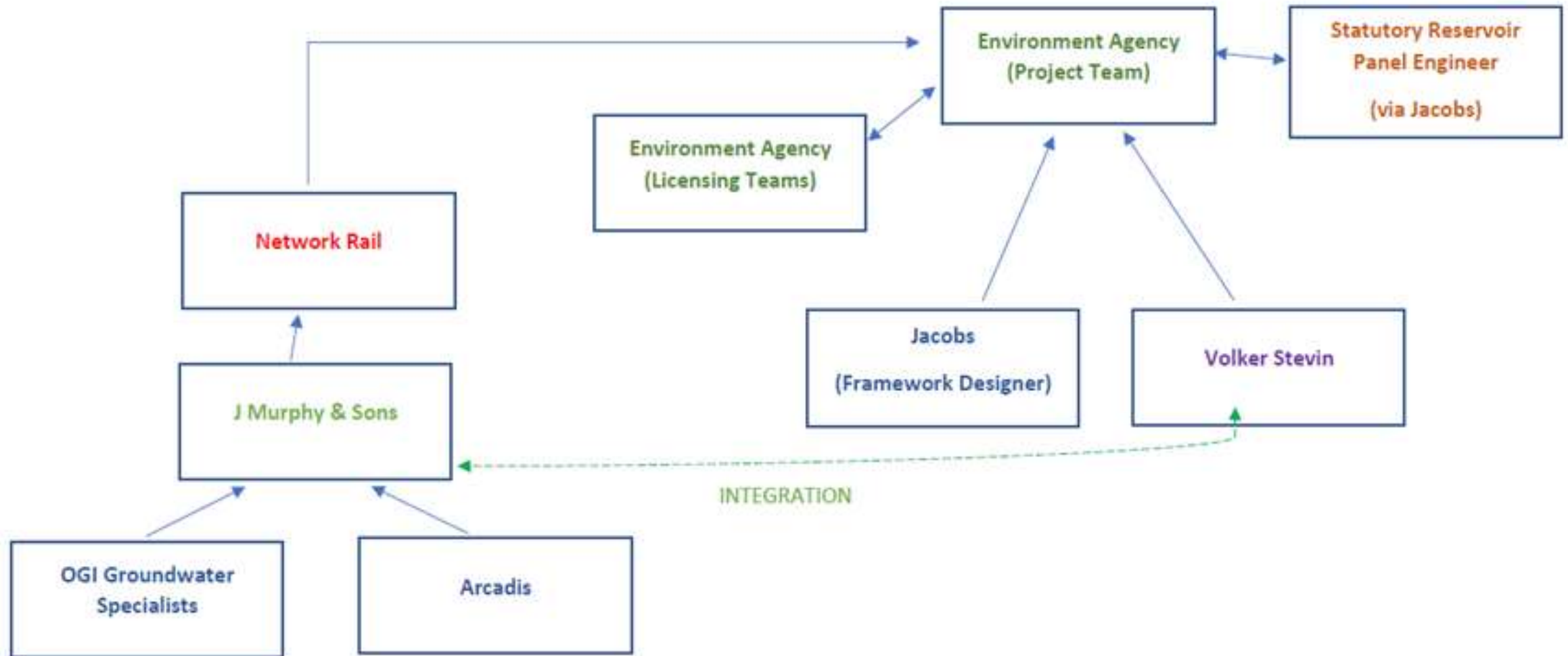
UPPER CATCHMENT ATTENUATION

- SLOWING THE
FLOW
- FLATTENING
THE PEAK



Unusual project from a Renewals perspective:

- **End Client:** Environment Agency – Client for wider flood alleviation scheme. Note separate designer and framework contractor for EA.
- **Immediate Client:** Network Rail – Capital Delivery (Note RAM approvals still required as usual)
- **Designer:** Arcadis for both civils and p-way designs (D&B). Note EA had their own designer.
- **Scope of Works:** New culvert under existing railway tracks to provide conveyance structure for flood basins. Reservoir Act 1975 applies to the scheme.





**Volker Stevin enabling works:
Site Access**



RESERVOIR ACT 1975

Key Highlights:

- Potential for catastrophic risk if reservoir works are not managed or constructed correctly.
- Requirement to appoint a named Reservoir Engineer where works fall under this legislation.
- Register of approved Reservoir Engineers for the UK.

Key Event:

- Toddbrook Reservoir incident – August 2019 - Whaley Bridge (near Peak District). Spillway defect being scoured by water.
- Closest we have come in a long time to a reservoir dam collapse.
- 1500 residents evacuated.
- RAF Chinook helicopters used to drop tonne bags (400t total) onto spillway to prevent collapse.
- Fire Service pumped continuously for 5 days to reduce the reservoir level by 8m.

Gale West – Pre start GI



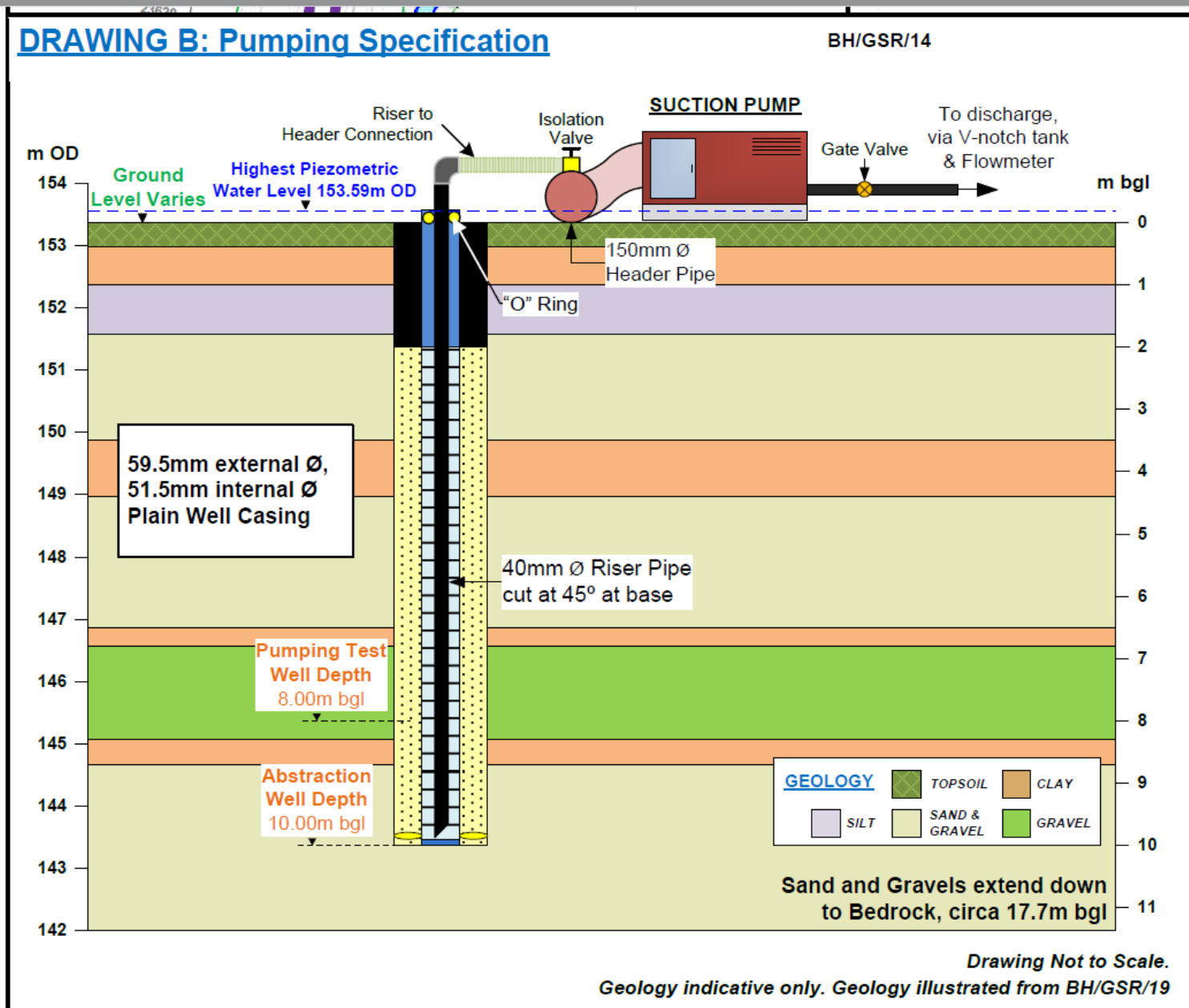
EXTREMELY CHALLENGING PRE-EXISTING GROUNDWATER CONDITIONS

ARTESIAN CONDITIONS IN PLACES

**PUMP TEST TO
INFORM THE DESIGN
(PROVES DESIGN
PARAMETERS)**

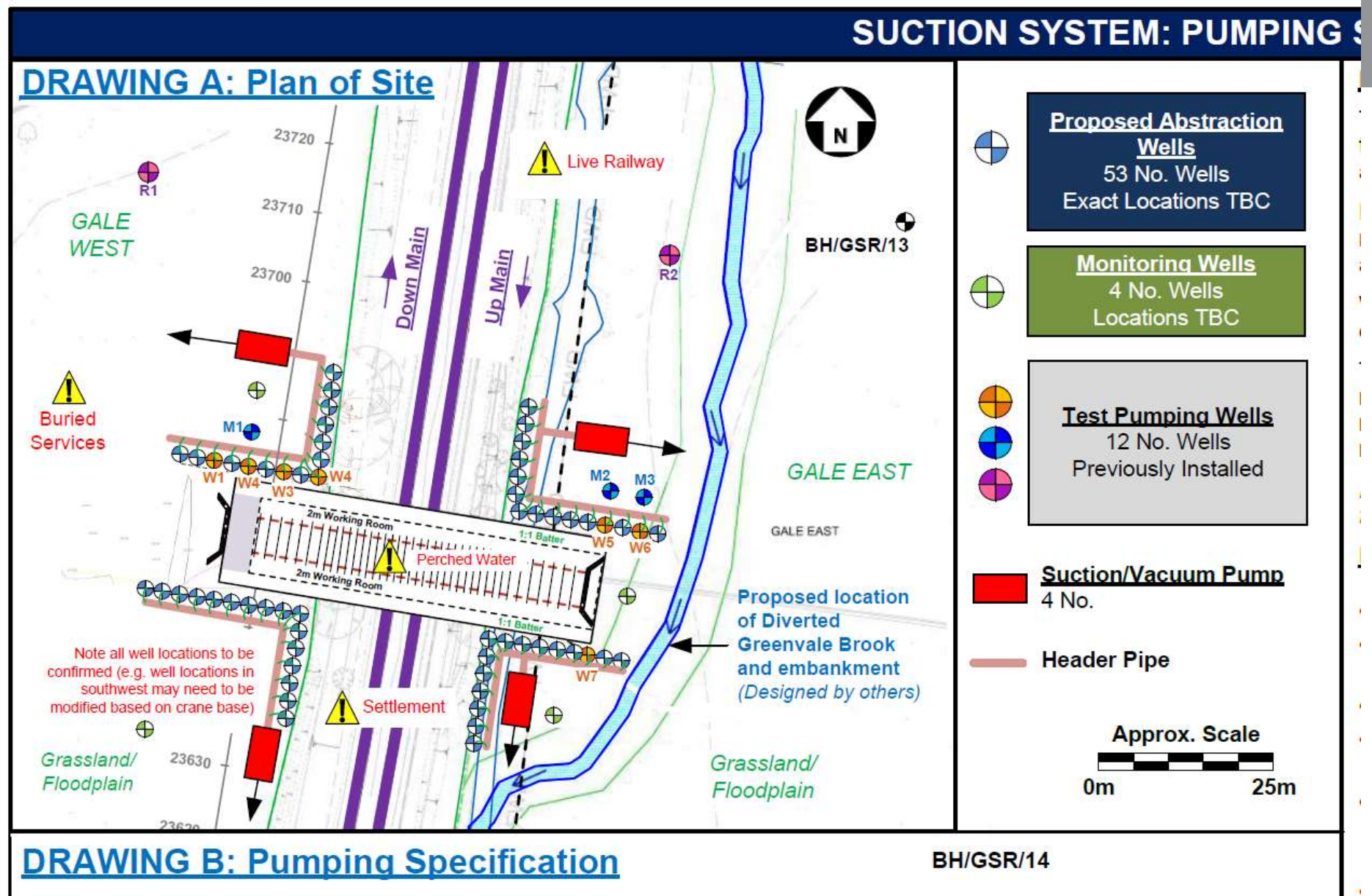
**DESIGN WAS 53NO.
ABSTRACTION
WELLS AROUND 10M
DEEP**

**MONITORING WELLS
TO MEASURE
DRAWDOWN**



FOUR PUMPS
(ONE PER
CORNER OF
DIG)

DISCHARGE TO
TWO
LOCATIONS –
RIVER ROCH
AND
GREENVALE
BROOK
(EA SPECIFIED)



Licences/Permits are issued by the Environment Agency (Legal Requirements)

Abstraction Licence:

- To remove groundwater for any given purpose.
- EA will set an upper limit on the volume per day that can be abstracted.

Discharge Permit:

- To discharge water into a public watercourse.
- EA will specify exact point(s) of discharge.

Allow plenty of time for the design/permitting process.

KEY DATES

Timeline:

- Scheme Involvement Commenced – **March 2020**
- Several iterations of technical scope/CR-T throughout 2020 and 2021
- Permanent works design activity – **May 2020 to July 2021**
- Dewatering design and licencing – **Jan 2021 to October 2021**
- Core blockade – **late October 2021**

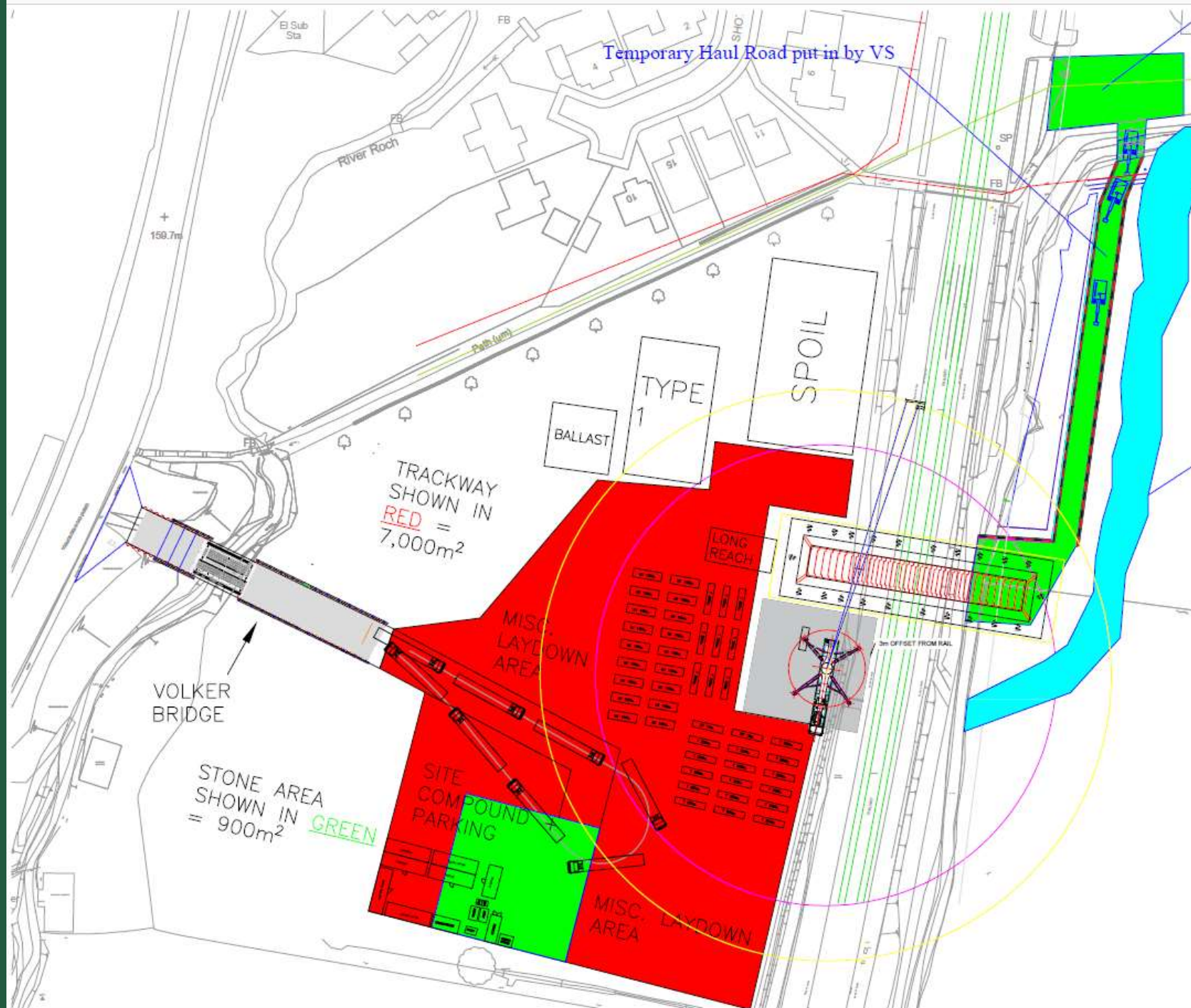
INTEGRATING THE DEWATERING

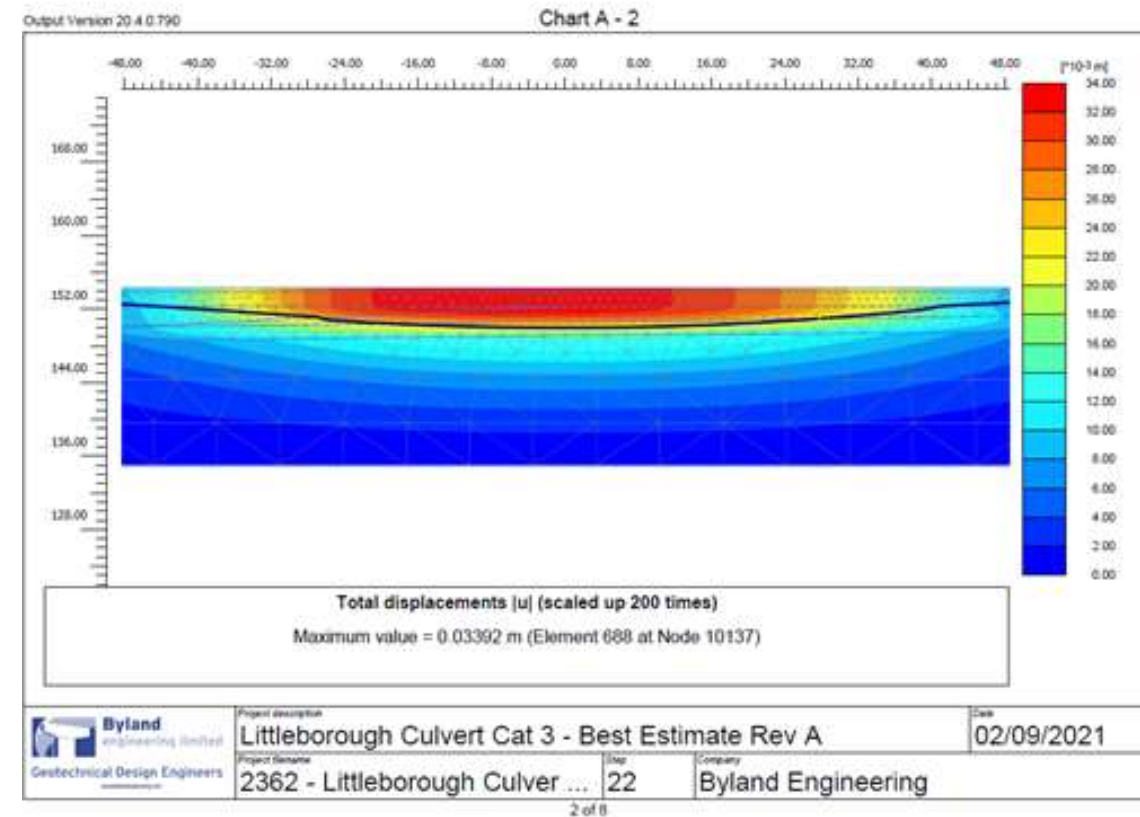
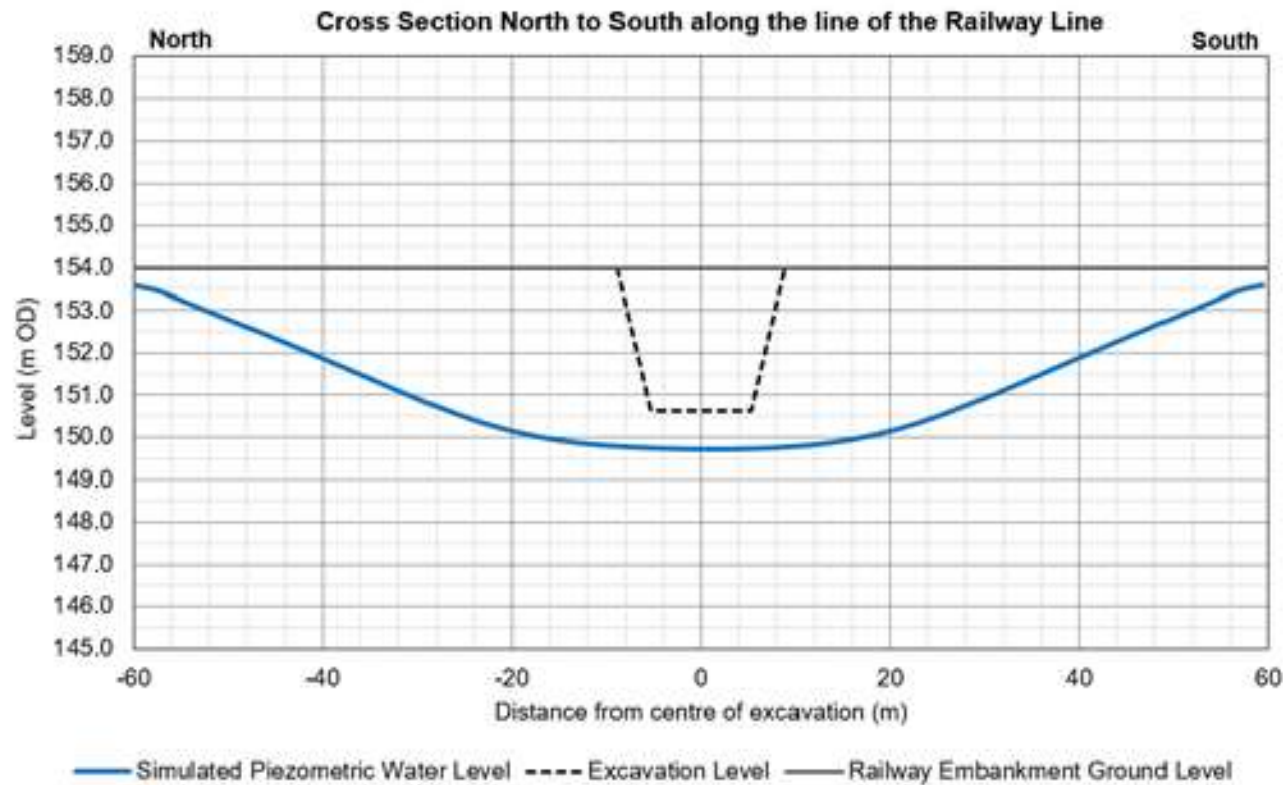
ANY DEWATERING
EQUIPMENT WILL
NEED TO BE
INTEGRATED INTO
THE OVERALL
SITE

THIS COULD
PROVE
CHALLENGING IN
ITSELF

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WORLD-CLASS INFRASTRUCTURE





SETTLEMENT:

- Dewatering would need to be commenced with trains running as normal.
- Understanding the impact of the dewatering drawdown on track settlement is critically important.
- NR required a Cat 3 Check (Plaxis FAE Model).

SETTLEMENT AS A RESULT OF DEWATERING

SCENARIO	CALCULATED SETTLEMENT ON TRACK CENTRELINE
Minimum	6mm
Most Likely	15mm
Maximum	28mm

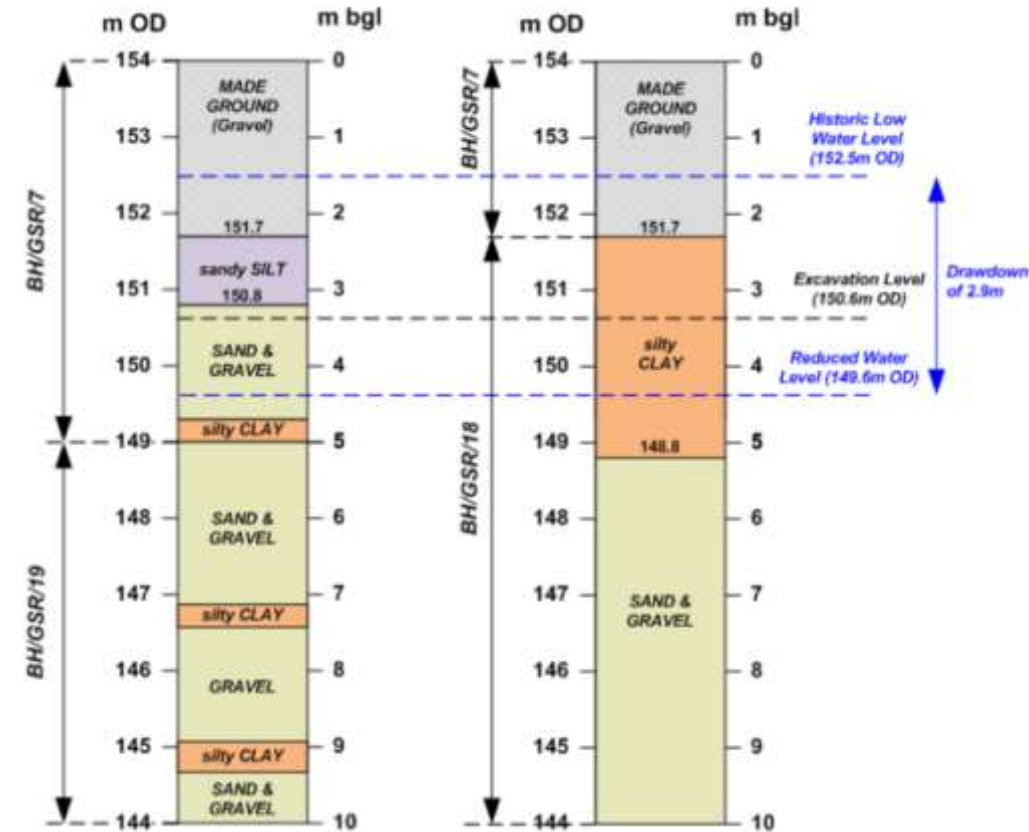
Notes:

- Settlement calculation is only as good as the input data. So an accurate understanding of the compressibility of the various soils is very important.
- The rate of settlement seems to be particularly difficult quantity to establish. Amount of published academic literature on this topic seems to be limited. Tricky as this is critical from track geometry point of view.
- Above calculated settlement used to prepare a robust track monitoring plan (TMP). This needed to include defined opportunities for intervention if need arose.

DEWATERING TRACK MONITORING

Notes:

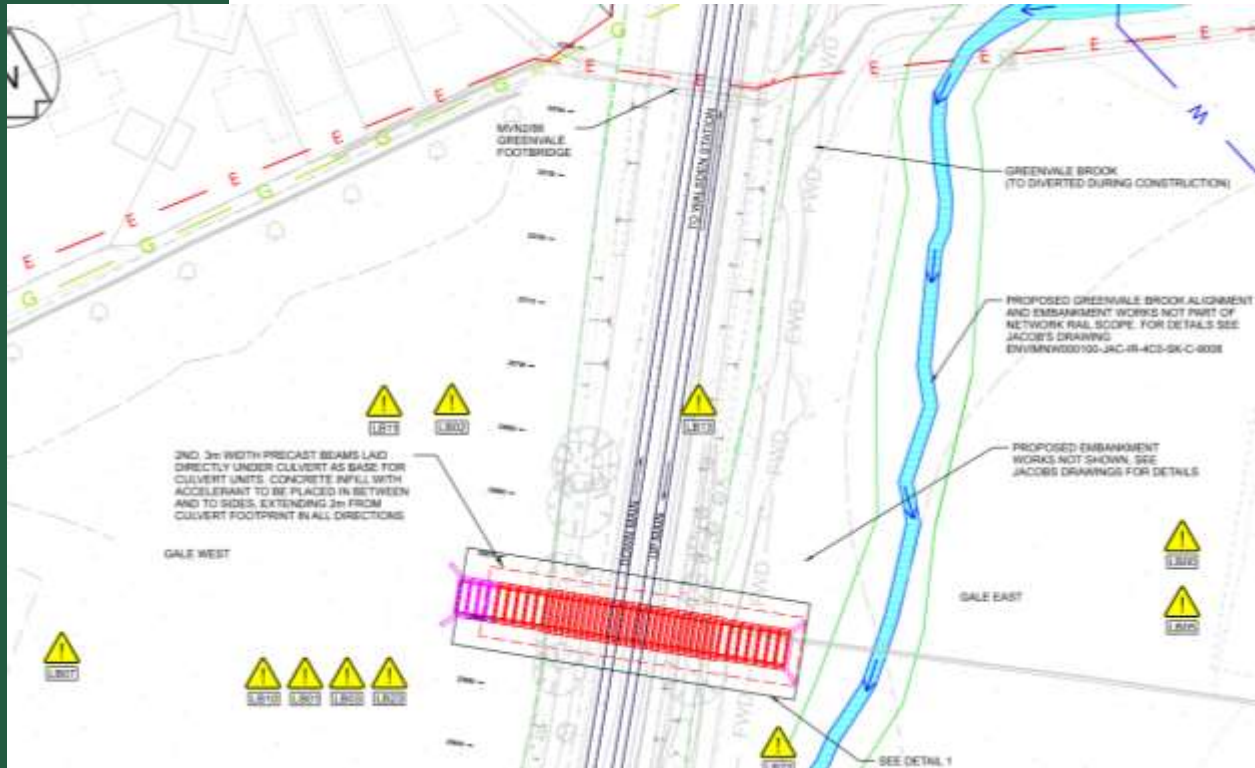
- Settlement period difficult to determine.
- With a relatively large upper-limit, there could be significant impact to track geometry.
- Anticipated a rapid initial period of dewatering due to the wells being situated in the granular layer, followed by a steadier draw-down of water from the cohesive material.
- During dewatering of the granular layer, thrice-daily monitoring.
- Once initial draw-down slowed and we could assume we were dewatering the cohesive layer, monitoring reduced to twice-daily ahead of core works involving the removal of the track.
- Access secured during dewatering period for necessary track interventions.



TRACK DESIGN

Notes:

- 70mph twin-track, Down line CEN56 on concrete, Up line CEN56 on steel, non-electrified.
- Vertically limited due to footbridge within 90m of proposed culvert.
- C30mm lifts/slues required.



KEY TRACK DESIGN CHALLENGE



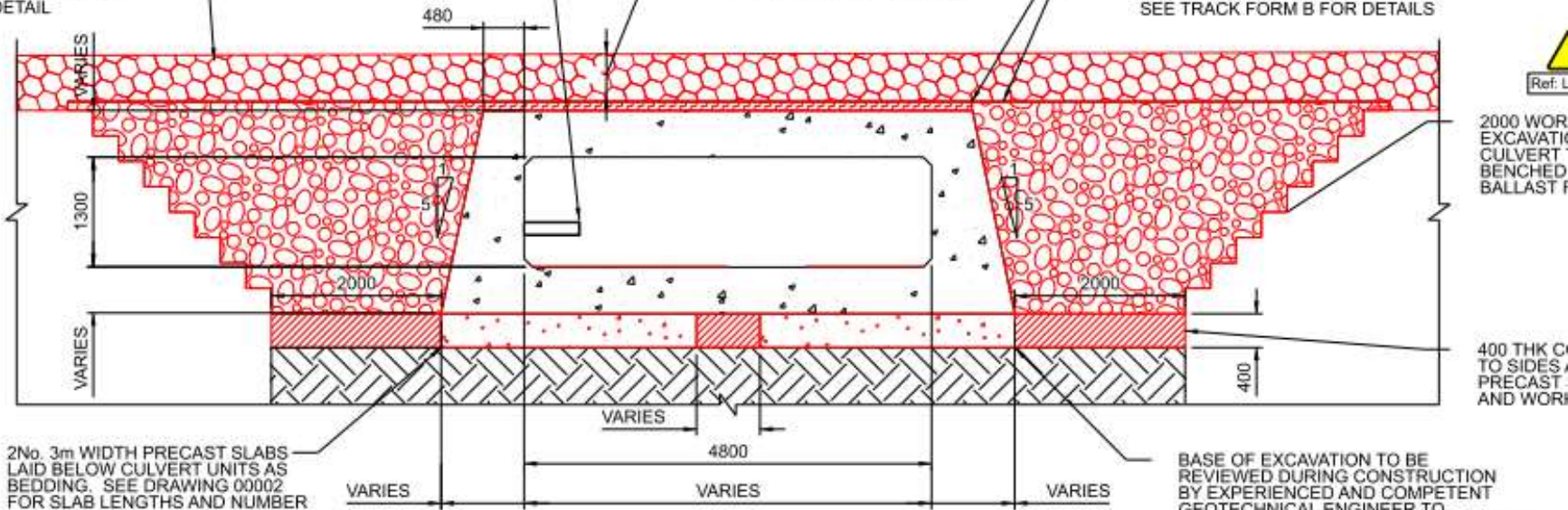
EXCAVATION TO SIDE OF CULVERT INCLUDES 2m WORKING ROOM AND 1 IN 4 BALLAST RAMP TO SUBGRADE DEPTH. SEE TRACK DRAWING 10040916-ARC-00-ZZ-DR-RT-000001 FOR DETAIL

38mm THICK GRP GRATING WITH 3mm GRP SOLID TOP MAMMAL SHELF AFFIXED TO CULVERT SIDE 550mm FROM CULVERT INVERT



MINIMUM BALLAST DEPTH TO BE 200mm IN ACCORDANCE WITH NR/L2/TRK/2102 CATEGORY 2 TRACK. 240mm PROVIDED. SEE SECTIONS FOR DEPTH

18mm THICK RUBBER BALLAST MAT LAYER PLACED UNDER TRACK AREA. GEOTEXTILE LAYER PLACED ON TOP OF BALLAST MAT FOR EXCAVATION EXTENTS. SEE TRACK FORM B FOR DETAILS



B TYPICAL TRACK ZONE SECTION

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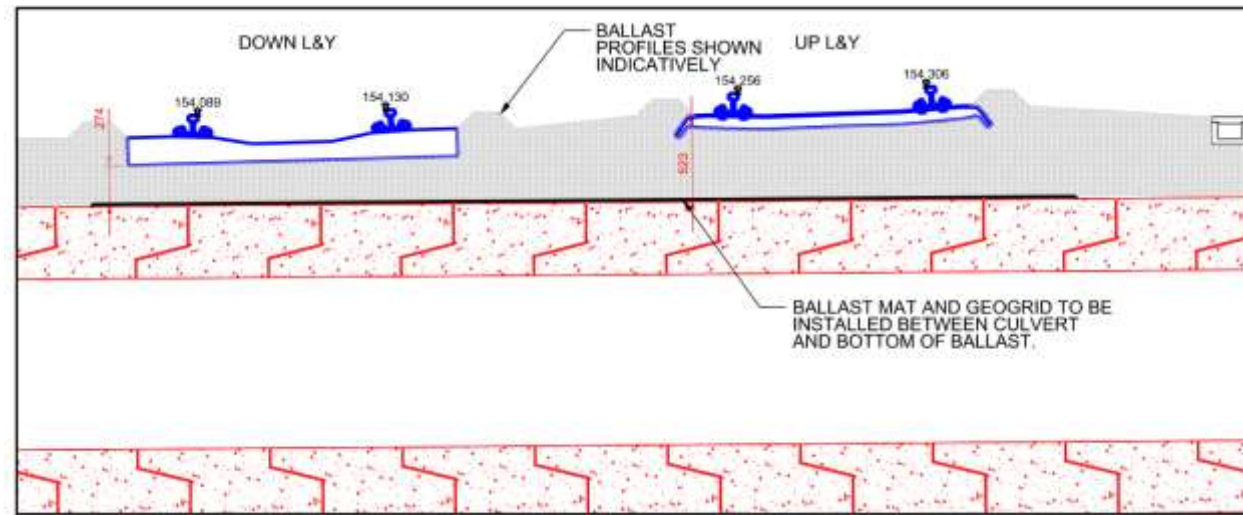
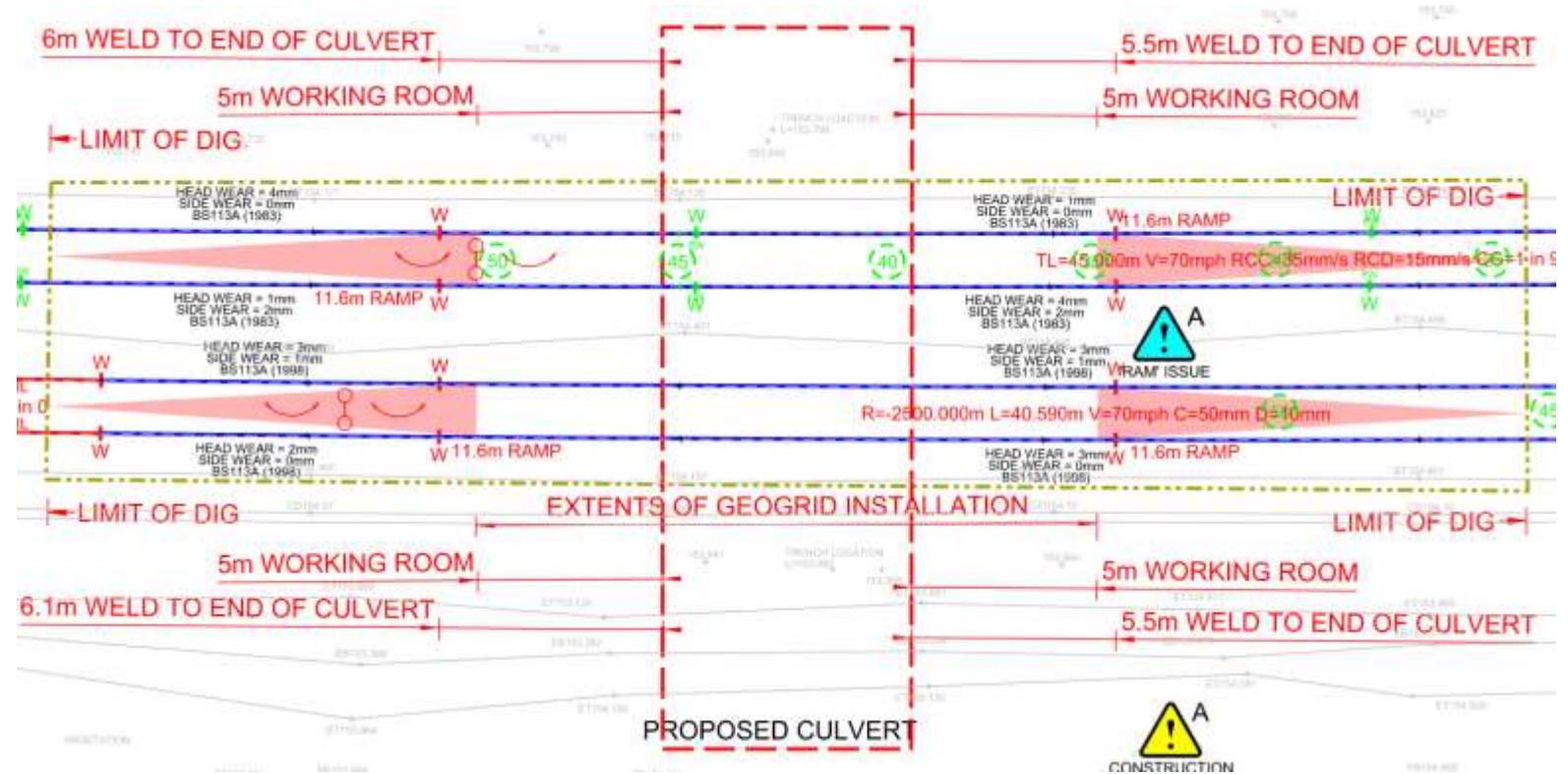
KEY TRACK DESIGN CHALLENGE

Dilapidation Survey and Site Arrangements



Ballast to be renewed throughout dig limits associated with culvert works, however, poor ballast condition throughout tamping limits may affect the line's ability to retain optimal top and alignment post-tamp

KEY TRACK DESIGN CHALLENGE



- Compliant ballast depth
- 18mm under-ballast mat
- Geo-grid
- 11.6m ballast ramps



TRACK REMOVAL

- Sufficient track needed to be removed to install the culvert, provide working room and excavate ballast ramps.
- To minimise the duration of track works, panel size and the number of welds had to be managed.
- Closure rails utilised to position welds in desirable locations and reuse as much of the existing rail as possible.



MCCULLOCH TRACK PANEL LIFTERS

- 43m track panels
- 21.1 tonnes
- 1 hour saved vs utilising the crane to lift and mitigating risk of being 'winded-off'









DECEMBER 2021

Groundwater
has rebalanced
back to original
state



TRANSFERABLE LEARNING:

- **ENGAGE SPECIALIST ADVICE EARLY:** On the Littleborough project it was dewatering which needed a very specialist skill set. On other railway projects it might be something like signalling interlocking, or power feeding arrangements etc
- **MULTI STAKEHOLDER PROJECTS:** Price and plan based on the complexities involved. Technical approvals are inevitably going to be complex. Prepare a **robust** programme. Allow for a lot of integration activity.
- **MANAGING WATER:** Water is at the heart of so many construction issues. Understanding and managing water is essential. Even more so with forecasted climate change. This scheme would have failed in construction if groundwater management was unsuccessful or problematic. Cost of an aborted blockade would be huge.
- **BE VERY AWARE OF IMPACT OF TECHNICAL/SCOPE CHANGE:** Technical change part way through a project is always tricky to manage. Proper time needs to be taken to fully understand the impacts and implications of technical change part way through design.

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THANK YOU

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