Lucky escapes!

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Conwy Crossing
North Wales, UK

East cut and cover

West cut and cover

M10 blow

Submerged tube tunnel

Main contractor: Costain Tarmac JV

Casting basin: Tunnel units cast in dry, basin flooded and units floated out to form tunnel
Typical section through perimeter bund

Hydraulic fill
$k = 1 \times 10^{-4} \text{ m/s}$

Alluvium: Sand and gravel
$k = 1 \times 10^{-4} \text{ m/s}$

Boulder Clay
$k = 1 \times 10^{-12} \text{ m/s}$

Lake Deposits: Laminated silt/clay/sand
$k_H = 4 \times 10^{-7} \text{ m/s} \quad k_V = \text{lower}$

Thin grout wall: Absent land side

River

Tide

mOD

Thin grout wall: Absent land side
Conwy: Glacial Lake Deposits

Laminated clay, silt and sand

Artesian relative to excavation level
Section through bund showing dewatering scheme

1st stage wellpoints

Well depth to -37 mOD

2nd stage wellpoints

Ejector wells

Residual seepage

Well depth to
-37 mOD
1st stage wellpoints

2nd stage wellpoints

Ejector wells

1st stage wellpoints
Conwy M10 blow

Embankment settles by 100mm over 100m length:
Ejector wells sheared

Ejector flow
~10 l/s

Blow flow
250 l/s +

Fresh water!

Deepwells installed:
High flow then reduced

Extensive sand aquifer?

Well depth
~37 mOD
Basement excavation

Marina channel

Residential development in Dubai Marina
Diaphragm wall

Service duct

Diaphragm wall
Future
Marina
channel

Service duct: Constructed previously

Service duct under construction

Service duct founded on gravel bed
Section through service duct

- Marina channel
- Service duct
- Quay
- Gravel bedding
- Diaphragm wall
  - each side of service duct
Section through service duct

- Marina channel
- Service duct
- Gravel bedding
- Diaphragm wall each side of service duct
- Backfill locally + secant piles in front of service duct
Granular soils: Slotted liner + filter
Filter rules: Conservative filter design?
Sandstone: Formation stabiliser
Ground loss due to migration of fines:
local **piping of uncemented sand horizon in sandstone**

**Mitigation:** Effective filter screens (discharge quality) + deeper cut-off?
- Conwy: Unidentified aquifer + ignore piezo data
- Marina: Man made seepage path
- Dubai + elsewhere: weak sandstone or sand? + filter spec