Kirkstall Forge - Paving the Way for a new urban regeneration project in Leeds
Project Team

Commercial Estates Group Ltd (CEG) - Client

WYG - Environmental and Engineering Consultant

Rebecca Reynolds – Geotechnical Lead
Patricia Gill – Contaminated Land Director
Presentation Summary

• Site Setting and History
• Geology and Ground Investigations
• Redevelopment Plans
• Geotechnical Challenges
• Ground Contamination Challenges
Location and Setting

- 2.5km north west of Leeds city centre
- South of the A65 Abbey Road, Kirkstall
- River Aire
- Railway
- Canal
Site History

• 1200 – the Monks from Kirkstall Abbey started Kirkstall Forge making horse shoes and iron work for the Abbey
• 1589 – dissolution of the Monasteries – Earl of Cardigan
• 1600 to 2002/7 – Continuous use as an iron forge

Types of Industries
- Iron Forge
- Chemical Works
- Glue factory
- Oil and Stearine Works

Manufacture of:
- Nails
- Spades
- Fenders
- Axels (1798)
Site History
Site History - UXO

- Hazard zones
- 1942 bomb damage
Geology, hydrology & hydrogeology

• Made Ground
• Alluvium
• Millstone Grit bedrock
• Groundwater / flooding
Ground Investigations

• Prior to 2008 – Several phases of Environmental Ground Investigation
• 2008 to present – WYG Geotechnical and Environmental Investigation
  – Deeper boreholes
  – Groundwater installations
  – Geotechnical testing and sampling
Redevelopment – CEG’s Masterplan
Redevelopment

- 2008 - Demolition / archaeology / early remediation
- 2014 – Phase 1 Infrastructure
Phase 1 infrastructure

• 2014 - 2016 - Construction
Geotechnical Challenges

• Raising site levels up to 5m
• Retained heights up to 10m
• Foundations for an 18m wide 30m span bridge
• Foundations for two cantilever pedestrian platforms

• River environment
• Obstructions
• Variable Made Ground
Geotechnical Challenges

• Reinforced soil and wall solution
  – Re-use of site won materials
  – Allowed founding of bridge bank seats and platforms
  – Provided natural finish
Geotechnical Challenges
Geotechnical Challenges

Raising levels
Geotechnical Challenges

• Winter 2015 – worst flood on record
• Flood levels in line with those predicted
Contamination

Key Contaminants
- Diesel range hydrocarbons C10-28 – general former forge uses
- Coal tar – PAH – naphthalene and oil range hydrocarbons C20-35 – former chemical works
- Lubricating oils C20-C35 – Heat Treatment Area
Heat Treatment Area – Early Phase Remediation

• Worst area of contamination
• Former use – crane dipped heated metal into oil and then water prior to cooling on racks
• Included 3 oil quench tanks 52m³ each
• Significant oil spillages – some near surface contamination
• Greatest contamination at groundwater level / smear zone
• Up to 0.8m free product LNAPL
• Remediated two phases 2002 and 2008 as early phase betterment
Heat Treatment Area – Early Phase Remediation

• First Phase Remediation
  – Free product recovery from boreholes – 1,400m³ LNAPL removed
  – Residual LNAPL remained 0.1 to 0.4m thickness

• Second Phase Remediation
  – Excavation of clean overburden soils for re-use
  – Excavation of contaminated smear zone soils
  – Skimming of free product from water in excavation
  – Validation by visual inspection of groundwater – no visible free product
  – Limited off site disposal of most contaminated soils
  – Bioremediation of less contaminated soils for re-use
Heat Treatment Area – LNAPL
Heat Treatment Area - Obstructions
Remediation Strategy

• Detailed remediation strategy for rest of site – 2008

• Receptors - Human health (much residential) and River Aire
  • dQRA controlled waters – dilution but no degradation (river through site)

• Enabling works – source treatment - controlled waters driven
  • Development Works – cover layer and gas membrane – human health driven

• Cut and fill balance – sustainable re-use of materials wherever possible
Phase 1 Infrastructure Works

• No significant areas of hydrocarbon contamination
• Asbestos identified frequently in soils – improved lab testing
• Initially any asbestos contaminated soils – place 2m beneath new road
• Volume too great – agreed re-use where <0.001% asbestos
  – beneath roads – any depth
  – under cover layer for landscaping + to prevent dust generation by machine tracking
• Enabled maximisation of site soils for re-use
Future Works

• Former chemical works area
  – approximately 10,000m³ of soils - coal tar
  – likely stabilisation / solidification
  – re-use on site at locations not to be re-excavated

• Other areas of hydrocarbon contamination
  – mostly diesel range
  – likely treatable by bioremediation
Kirkstall Forge
If you would like any more information, please visit www.wyg.com