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HS2

High Speed Rail (Crewe – Manchester) Environmental Statement

Volume 5: Appendix WR-007-00000

Water resources and flood risk

Draft water resources and flood risk operation and maintenance plan

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Department for Transport

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1 Introduction

1.1 Background

1.1.1 This report provides a high-level approach to the operation and maintenance of water management assets for the Proposed Scheme setting out the nature of the work, possible sources of pollution and flood risk as a result of rail operations and measures to manage these and the residual risks. It has been developed using guidance from other infrastructure operators and agreements these operators may have with regulatory bodies such as the Environment Agency. An example of such guidance is the Network Rail Drainage Systems Manual: Drainage Design (NR/L2/CIV/005/09, 2018)[1], which states that drainage systems for railways infrastructure are required to:

- collect and carry water from rainfall and/or runoff from adjacent land, from flooded rivers, the sea or groundwater so that risks to the stability and/or operation of infrastructure is acceptable; and
- prevent pollutants from leaving infrastructure in an uncontrolled manner.

1.1.2 To deliver this, drainage systems should:

- operate without blocking;
- mitigate flooding and surcharging following rainfall events that would otherwise result in a reduction in safety or loss of performance; and
- provide access for maintenance for life-cycle asset management activities such as maintenance and renewal.

1.1.3 This draft plan[2] establishes the principles the nominated undertaker of the Proposed Scheme may wish to consider as part of a future memorandum of understanding (MoU) with the relevant regulatory authority.

1.1.4 The operation and maintenance plan for water resources and flood risk will evolve and is subject to refinement, amendment and expansion as necessary as the Proposed Scheme's design, assessment, consultation and Parliamentary processes develop. Engagement with stakeholders will inform its future development.

[1] Network Rail (2018), *Drainage Systems Manual: Drainage Design (NR/L2/CIV/005/09)*.

[2] This Draft water resources and flood risk operation and maintenance plan should not be taken to represent the views of the Secretary of State for Transport until such time as it has been finalised prior to Royal Assent of the Crewe – Manchester Bill.

2 Proposed Scheme operation and maintenance

2.1 Operation of the Proposed Scheme

2.1.1 The Proposed Scheme will be operated using electric passenger and works/engineering trains.

2.1.2 The trains will use an intelligent maintenance system to avoid maintenance having to be carried out anywhere except in controlled conditions in depots.

Risks from operation

2.1.3 It is anticipated that there is a potential risk from the deposit of hydrocarbons from lubrication systems and power supply systems from the trains during operation. Whilst there is no data available at this time to indicate the quantity of these used during operations, there is no evidence to indicate any damage to the environment from modern electric trains.

2.1.4 Where trains are stabled it is assumed that there will be limited sources of hydrocarbons from the electrified fleet, it is anticipated that any hydrocarbon losses will not be significant and should also be mitigated by the proposed track bed and associated drainage system.

2.1.5 There is no data available on the pollution impact on the water environment from high speed railways. The following case study (see Table 1) illustrates research carried out to assess the quantitative impact of metal contaminants affecting the water bodies.

Table 1: Research on impacts from metal contaminants on watercourses

Case study
In order to quantitatively assess the impact from track drainage on receiving water quality, geochemical modelling was undertaken to predict water quality from operational drainage arising from the wear and release of metal components to the track drainage. The principal metals released to the track are iron, copper and zinc. The iron mainly arises from wheel and track wear, copper is derived from the attrition and wear of the copper contact wire as part of the overhead electrification apparatus and zinc is mainly derived from the galvanised parts of the masts, poles and structures. The quantities of these metals released during railway operations was the subject of a study conducted on the Swiss Federal railway network in Burkhardt et al. (2008)[3]. It was also noted that the main source of polycyclic aromatic hydrocarbon (PAH) is creosote treated sleepers which will not be used in the Proposed Scheme. Using data from Burkhardt, the modelling showed that the principal metal release in track drainage is dissolved zinc with a predicted concentration of 274µg/l. Dissolved copper was predicted to be 74µg/l and dissolved iron (ferric) was a much lower 2.3 x 10^{-6}µg/l. An initial dilution of around 3.5 for zinc and 7 times for copper upon discharge to the water environment is required to achieve the relevant environmental quality standard (EQS) for freshwater bodies. This is for surface water with moderate hardness (100 – 250mgl/l $CaCO_3$).

[3] Burkhardt, M. et al. (2008), *Diffuse release of environmental hazards by railways*, *Desalination*, Volume 226 (1-3), 106-113.

2.1.6 The concentration of dissolved metals would be diluted within the track and railway drainage system and are not expected at levels with the potential to cause pollution.

Incidents

2.1.7 Risks to the water environment in the event of a major incident could arise from:

- damage to drainage infrastructure;
- accidental spillage of fuels or chemicals as a result of the incident or its management;
- chemicals used in fire-fighting; and
- products of combustion dissolved or suspended in water.

Major works

2.1.8 Major works during operation that could affect surface or groundwater quality, flows and levels include:

- excavations;
- work in cuttings;
- work near watercourses; and
- renewals.

2.1.9 Major works will be implemented using an environmental management plan that will specify requirements for the contractor to follow to avoid or reduce potential environmental impacts.

2.1.10 Where it is assessed that such works could significantly affect water quality, flows or levels, discussions shall be held with the appropriate regulatory authority. Monitoring may be required to ensure there is no significant effect, and effective controls put in place if monitoring shows there to be the potential for a significant effect, whether temporary or permanent.

2.1.11 Work that could affect a watercourse or is within byelaw distance of a watercourse normally requires approval from the appropriate regulatory authority.

Flooding

2.1.12 The Proposed Scheme will fall into the Centre for the Protection of National Infrastructure definition of 'those facilities, systems, sites, information, people, networks and processes necessary for a country to function and upon which daily life depends'[4].

[4] Centre for the Protection of National Infrastructure (2017), *Critical National Infrastructure*. Available online at: https://www.cpni.gov.uk/critical-national-infrastructure-0.

2.1.13 Flood risk is the product of the likelihood of a flood event occurring and the severity of the consequences. Flood consequence severity depends on the flooding vulnerability of a particular receptor as defined in the Technical Guidance to the National Planning Policy Framework (NPPF)[5].

2.1.14 Assessing flood risk is an important consideration for the Proposed Scheme, and is considered an integral part of the operational decision making process. A route-wide flood risk assessment (see Volume 3, Section 6) and community area specific flood risk assessments (see Volume 5, Appendices WR-005) have been undertaken.

2.1.15 For the Proposed Scheme, high level climate change risk and resilience assessments have been undertaken as part of the Environmental Statement (ES) to identify the potential risks of climate change on the Proposed Scheme, and to assess the Proposed Scheme's resilience and capacity to cope with these potential risks (see Climate data and information, Volume 5, Appendix CL-001-00000, and Results of climate change assessments, Volume 5, Appendix CL-002-00000).

2.2 Maintenance of the Proposed Scheme

2.2.1 The maintenance of the Proposed Scheme rolling stock and engineering vehicles will be carried out in depots under controlled conditions.

2.2.2 Maintenance of the infrastructure should be managed using a system, based on ISO 55000:2014 Asset management[6].

Risks from maintenance of the Proposed Scheme

2.2.3 The following maintenance activities pose a potential risk of pollution to the water environment:

- maintenance of the drainage system entraining sediments and discharging them to the environment;
- maintenance of rolling stock including washing;
- maintenance of power distribution infrastructure including the autotransformer and feeder stations;
- de-icing of rolling stock, infrastructure and facilities;
- mobile wastewater systems at temporary welfare facilities during works;
- weed control;
- accidental spillage of fuels or chemicals during maintenance;

[5] Ministry of Housing, Communities and Local Government (2019), *National Planning Policy Framework,* Her Majesty's Stationery Office, London.

[6] International Standards Organisation (2014), *ISO 55000:2014, Asset management – overview, principles and terminology*. Available online at: https://committee.iso.org/home/tc251.

- rail grinding (controls will be in place to collect any waste); and
- cleaning of tunnel lining.

3 Management measures

3.1.1 Controls fall into three categories:

- planned;
- passive; and
- active.

3.1.2 Planned controls refer to measures designed to avoid or reduce the potential for pollution or flooding. This involves the identification of sensitive or risk prone areas such as Sites of Special Scientific Interest (SSSI) or groundwater Source Protection Zones (SPZ), watercourses crossed by viaducts, or groundwater bodies traversed by cuttings and designing the infrastructure in such a way that potentially negative impacts are eliminated. For example, the Proposed Scheme has been designed to withstand a 1 in 1,000 (0.1%) annual probability flooding event with a 1m freeboard below top of rail level.

3.1.3 Passive controls need no manual operation, though they require regular inspection and maintenance, and provide effective pollution and flood risk mitigation. These include Sustainable Drainage Systems (SuDS) e.g. balancing ponds, swales and filter drains, and the ballast substrate, where it exists, acting as a filter to any contaminated sediments. SuDS are particularly effective in the management of pollution from metals and will be used as appropriate. SuDS guidance including details of legislation and regulations applying to surface waters, ground waters, waste management, flood management, reservoir safety, drainage, water quality, biodiversity and health and safety is provided in CIRIA (2004) C625: Model agreements for sustainable water management systems[7].

3.1.4 Active controls require manual operation and include items such as penstocks, rings for oil booms, shut off valves and filter membranes. These should be included as appropriate in the detailed design and their management requirements included in operation & maintenance (O&M) manuals handed over to the Infrastructure Manager (IM) to implement an effective maintenance intervention schedule.

3.1.5 CIRIA (2005) C643 Potential for Water Pollution from Railways[8] provides further guidance on the operational and environmental management of railways with regard to water pollution.

3.1.6 The nominated undertaker for the Proposed Scheme will be required to develop detailed environmental management plans outlining the specific measures that have been put in place to minimise pollution risk and flood risk during operation of the Proposed Scheme.

[7] Construction Industry Research and Information Association (2004), *C625: Model agreements for sustainable water management systems.* Available online at: https://www.ciria.org/ProductExcerpts/C625.aspx.

[8] Construction Industry Research and Information Association (2005), *C643 Potential for Water Pollution from Railways.* Available online at: https://www.ciria.org/ProductExcerpts/C643.aspx.

3.2 Drainage management plan

3.2.1 A drainage management plan should be compiled for each railway drainage system or set of such systems. The purpose of a drainage management plan is to record the strategy for achieving prescribed levels of serviceability and maintenance of a drainage system. More detailed O&M manuals setting out the life-cycle maintenance requirements and management activities associated with the drainage assets are handed over on completion of construction.

3.2.2 The scope of a drainage management plan would be complete drainage systems, including both track and off-track drainage, aligned where practical with the discrete route management sections adopted by the Proposed Scheme.

3.2.3 An integrated prioritisation system should be developed in cooperation with other engineering disciplines and infrastructure maintenance teams to prioritise remediation and maintenance on a risk and criticality basis.

3.2.4 It is envisaged that each drainage management plan would record:

- asset inventory and condition;
- the extent of the drainage system including a location plan on a suitable geographic information system (GIS) platform referenced to the UK Ordnance Survey (OS) datum;
- location and details of drainage systems abutting, feeding or receiving flow to or from railway drainage systems that could affect the safety or performance of the rail network;
- inspection intervals and the particular features to be observed;
- additional investigations required to improve asset performance knowledge;
- locations where inadequate drainage capacity could affect the safety or performance of the rail network;
- locations such as discharge of drainage from long viaducts;
- a risk based priority plan for maintenance;
- where waste exemptions and consent for maintenance are necessary and held; and
- requirements for monitoring and/or other conditions specified in consents.

3.2.5 Each drainage management plan would be reviewed at intervals and also following completion of any new works or the failure of the drainage system, and amended as necessary.

3.3 Pollution response plan

3.3.1 A pollution response plan could be compiled for each railway drainage system or set of such systems including track systems and off track systems.

3.3.2 The purpose of a pollution response plan is to record the potential sources of pollution, location of outfalls and control points and set out the procedures for rapidly responding to and managing pollution events. It should refer to the drainage management plan.

3.3.3 It is envisaged that each pollution response plan would record:

- the drainage catchment and its associated outfalls and control points;
- potential receptors and their sensitivity;
- the potential pollutants, where known;
- plans for storage of materials at depots or sidings;
- the location of management materials (spill kits, etc.);
- immediate action drills;
- list of first responders and their duties; and
- contact list for regulatory bodies and emergency services.

3.3.4 Reference, where necessary, should be made to the environmental good practice advice in the Pollution Prevention Guidelines (PPG) available from NetRegs[9], together with the replacement guidance series, Guidance for Pollution Prevention (GPP) as and when this becomes available[10].

3.3.5 Of particular relevance are the following GPPs:

- GPP21: Incident response planning; and
- GPP5: Works and maintenance in or near water.

3.3.6 Each pollution response plan would be reviewed at intervals and also following completion of any new works or a major pollution incident, and amended as necessary.

[9] NetRegs Pollution Prevention Guidelines (PPG) and replacement series Guidance for Pollution Prevention (GPP). Available online at: http://www.netregs.org.uk.

[10] GPPs provide environmental good practice guidance for the whole UK, and environmental regulatory guidance directly to Northern Ireland, Scotland and Wales only. Regulatory guidance for England is available from GOV.UK. Available online at: https://www.gov.uk/guidance/pollution-prevention-for-businesses.

3.4 Flood risk management plan

3.4.1 Flood risk assessment is carried out using a source-pathway-receptor model.

3.4.2 Mitigation of identified flood risks could be achieved through:

- management measures, where: a person is appointed to coordinate all flood related activities; attend regional flood coordination meetings with other organisations; receive and react to flood warnings; target inspections and prioritise drainage maintenance to known flood hotspots and locations dependent on pumped drainage systems; and
- physical measures such as cut-off drains on cuttings; or providing extra planting to absorb or slow down runoff.

3.4.3 Flood risk management plans for specific sites would take note of the FRA in the ES and any site-specific assessments.

3.4.4 CIRIA (2010) C688 Flood resilience and resistance for critical infrastructure[11] provides comprehensive guidance.

3.4.5 Each flood risk management plan would be reviewed at intervals and also following completion of any new works or a major flooding event, and amended as necessary.

[11] Construction Industry Research and Information Association (2010), *C688 Flood resilience and resistance for critical infrastructure.* Available online at: https://www.ciria.org/Resources/Free_publications/Flood_resilience.aspx.

4 Management considerations for works

4.1 Environmental management

4.1.1 The risk assessment for the method of working should include consideration of environmental risks, including:

- contaminated sediment or spoil that is to be removed from drains;
- waste disposal;
- protected sites and species;
- the potential discharge to ground, coastal and surface waters and the associated flood risk; and
- the presence of invasive species.

4.1.2 Waste material from site work should be removed so as not to contaminate surrounding ground, groundwater, watercourses and other bodies of water, ballast, walkways, and places of safety.

4.1.3 As part of the work planning process, it should be ascertained whether the worksite is in or adjacent to a protected site such as a SSSI or SPZ, or has the potential to detrimentally affect a nearby protected site. If this is possible, one of the following options should be followed:

- if a site management statement/management agreement (SMS) is held for the site, checks should be carried out to ascertain whether the proposed works are approved in the SMS. Where the proposed works are approved in the SMS, works should be carried out in accordance with any controls listed in the SMS; and/or
- where works are not approved in a SMS, or a SMS is not held for the site, consultation should be undertaken with the relevant regulatory body and any necessary approvals obtained.

4.1.4 Work planning should include a review of the ES to determine whether the location is known to contain any protected species. If protected species are identified at the location an ecologist or other environment professional should be consulted and agreement reached on the actions to be taken to maintain the protection of the species and its habitat. Any required approvals would be obtained prior to undertaking any works. CIRIA (2011) C691 Working with wildlife: guidance for the construction industry[12] and C613 (2004) Working with Wildlife: A Resource and Training Pack for the Construction Industry[13] provides guidance on

[12] Construction Industry Research and Information Association (2011), *C691 Working with wildlife: guidance for the construction industry.* Available online at: https://www.ciria.org/ProductExcerpts/C691.aspx.

[13] Construction Industry Research and Information Association (2004), *C613 Working with Wildlife: A Resource and Training Pack for the Construction Industry.* Available online at: https://www.thenbs.com/PublicationIndex/Documents/Details?DocId=281084.

the legislative and best-practice approach to take with regard to various legally protected and unprotected species.

4.2 Surface and groundwater

4.2.1 Work on the drainage system might require an approval to discharge to surface or groundwater (including indirect discharges). Where there is any doubt about whether an approval to discharge is required, consultation should be undertaken with the relevant regulatory body.

4.2.2 Discharges to groundwater should be assessed to determine their risk to Water Framework Directive (WFD) status and groundwater SPZ, the Environment Agency or Scottish Environment Protection Agency should be consulted to determine the extent of any limitations on discharges in the proposed area.

4.2.3 Guidance on legal requirements relating to works and maintenance in or near water is available in PPG5: Works and maintenance in or near water published by the Environment Agency.

4.3 Discharge to sewers

4.3.1 When trade effluent is planned to be diverted to a sewer, approval should be sought from the relevant sewerage authority.

4.4 Flood risk management during maintenance work

4.4.1 Diverting water from railway land should include consideration of:

- the need to consult with the Environment Agency or other regulatory bodies, such as the Water Authority and Natural England; and
- the impact of changes in water management on land owned by outside parties, on watercourses and other bodies of water, and any mitigation required.

4.5 Effluent

4.5.1 Where effluent (e.g. sewage or chemicals) is present in a railway drainage system, control measures should be put in place to ensure the pollutants are collected and disposed of at an approved location. Testing may be required prior to removal of the material, to determine where it can be disposed.

4.6 Invasive species

4.6.1 When invasive species (including those which might be spread through ineffective management practices) are identified before or during works, suitable control measures should be implemented to prevent their spread.

4.6.2 The Proposed Scheme would involve spraying as required with herbicides from rail mounted multipurpose vehicles to control the build-up of weeds in the ballast which reduces the performance of the formation. HS2 Ltd could aim to implement a similar regime to the existing agreement between Network Rail and the Environment Agency whereby the use of herbicides is agreed and reviewed at intervals and there are tight controls on the weather conditions in which it is suitable to spray. There is a very limited list of herbicides which are licensed for use on the railway.

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