highways england

A417 Missing Link
TR010056

6.4 Environmental Statement Appendix 2.1 EMP Annex G Ground and Surface Water Management Plan

Planning Act 2008

APFP Regulation 5(2)(a)
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Development Consent Order 202[x]

6.4 Environmental Statement
Appendix 2.1 EMP Annex G Ground and Surface Water Management Plan

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Annex G Ground and surface water management plan

1 Introduction

1.1 Purpose of this document

1.1.1 This document forms Annex G of Appendix 2.1 Environmental Management Plan (EMP) (Document Reference 6.4). Annex G is a Ground and surface water management plan (GSWMP) for the A417 Missing Link scheme (the scheme).. It sets out the management measures to be adopted during construction to prevent the risk of pollution and contamination to ground and surface water. The contractor would manage risk in accordance with best practicable means which include general site management procedures, controls and measures, and refine this GSWMP to a second iteration prior to construction taking into account detailed design and any additional information necessary to manage the effects of the scheme on ground and surface water.

Annex Ground and surface water management plan is secured by environmental commitment MAW2 in the Register of Environmental Actions and Commitments (REAC). The REAC described in Table 3-2 of Appendix 2.1 EMP (Document Reference 6.4) presents an initial register which has been developed using information presented in the ES. The EMP and its associated Annexes will be updated by the contractor when preparing the EMP (construction stage) and then 'as required' as the scheme progresses.

1.2 Structure of the GSWMP

1.2.1 This GSWMP includes:

- Section 1: The scope of the GSWMP, the likely permit requirements for the scheme and relevant guidance and standards.
- Section 2: This details the mitigation measures required to protect ground and surface waters through the construction phase of the scheme.
- Section 3: This details a surface water, groundwater and rainfall monitoring plan, additional monitoring and inspection requirements for surface water and groundwater and reporting commitments.

1.3 Project team roles and responsibilities

1.1.1 This GSWMP provides the framework to be used as a basis from which to develop the GSWMP (construction stage). The contractor would confirm exact roles and responsibilities, however, key likely roles and responsibilities are summarised in Table 1-1.

Table 1-1 GSWMP roles and responsibilities during construction

Position	Responsibility
Contractor Project Manager	• Approval for sign off of the GSWMP for the relevant phase of works. • Ensure that all controls specified within the GSWMP are implemented by employees and sub-contractors.
Contractor Environmental Manager	• Undertake site inspections to monitor compliance with the environmental licences/consents for the works and the measures within the GSWMP.

Position	Responsibility
	• Ensure that the scheme complies with all environmental legislation, consents, objectives, targets and other environmental commitments, including those arising from the ES throughout the relevant project phase. • Report regularly to the Project Manager on the status and effectiveness of the implementation of the GSWMP. • Implement the Water Quality Monitoring described in section 3 of this plan. • Have powers to stop, or request a change to the method statement of, any works they consider are not compliant with this GSWMP or are causing or are likely to cause pollution. • Implement the GSWMP throughout the construction of the scheme and ensure it is updated.

1.3.1 All staff working on site will receive appropriate training from the contractor regarding:

- The water receptors present on site.
- Details of what impacts may occur and how to recognise them.
- What measures and procedures should be adopted to manage risks to the water environment.
- The pollution response procedures outlined in the GSWMP.

1.4 Scope

1.4.1 This GSWMP is based on the information available at the preliminary design stage. As the detailed design progresses, the plan would be reviewed and updated accordingly. The GSWMP would continue to be developed in consultation with the Environment Agency (EA) and agreed prior to the start of construction. It would then be further updated during construction, where required, by the contractor, in consultation with the EA.

1.4.2 The GSWMP considers all drainage required during the construction phase and references all industry and regulatory pollution prevention guidelines.

1.4.3 The GSWMP considers all activities to be undertaken during the construction phase that may require groundwater control through pumping. The GSWMP references the relevant industry and regulatory pollution prevention guidelines. It also details regulatory requirements with respect to relevant licencing requirements associated with abstracting water during construction. The GSWMP considers structures required for managing groundwater in areas of cut and excavations required for subsurface structures/utilities that may encounter shallow groundwater. The GSWMP defines the nature and approach for groundwater management following its abstraction, including monitoring to determine the acceptability of chemical and physical quality with respect to discharge to the surface water system. The GSWMP considers local surface water and groundwater catchments in relation to management of groundwater removed from the ground.

1.4.4 The GSWMP defines measures minimising potential impacts of works involving grout/cement injection on groundwater or groundwater receptors that may be required in areas of proposed structures and earthworks.

1.4.5 Further updates will:

- Describe the design of each element of surface water management system required to manage surface water runoff during construction and potential risks to surface waters, including consideration of temporary storage and settlement requirements to manage sediment load of waters.
- Define the water quality criteria to ensure any discharge to receiving watercourses meets regulatory requirements, following the completion of pre-construction (baseline) monitoring.

1.5 Consents and licences

1.5.1 The contractor shall prepare construction Method Statements (or otherwise entitled) in line with the minimum requirements set out in this GSWMP.

1.5.2 The permits, consents and agreements that may need to be sought separately from the DCO are identified in Appendix A of the Consents and Agreements Position Statement (Document Reference 7.2). The consents listed are largely dependent on finalisation of the detailed design, the detailed construction site set up and working methodologies, and discussions with the consenting authorities in light of the detailed design. Details of the water specific consents and licences and their relationship to the draft DCO are detailed in Table 1-2.

Table 1-2 Water consents and licences and relationship to draft DCO

Consent / Licence / Agreement & Legislation	Relevant authority	Description	Status	Relationship to the draft DCO
Discharge to surface water and/or groundwater under Schedule 21 and 22 of the Environmental Permitting (England and Wales) Regulations 2016	Environment Agency	Required following treatment of waters arising from construction activity or for the discharge of treated contaminated waters to ground, via re-injection (or possible soakaway) or a watercourse.	Engagement is ongoing with the EA. Requirement for licence will be determined based on construction method and sequencing. Discussions are ongoing in relation to agreement to disapply Schedule 21 and 22 in the draft DCO.	This is a Prescribed Consent which Highways England are seeking to disapply in the draft DCO.
Abstraction of water under Section 24 of the Water Resources Act 1991	Environment Agency	Required for de-watering operations on site during construction.	Discussions with the Environment Agency have taken place on the potential impact of the scheme. Engagement is ongoing. Requirement for licence will be determined based on construction methods and sequencing.	Sections 24 is a Prescribed Consent which Highways England are seeking to disapply in the draft DCO.
Ordinary Watercourse Land Drainage Consent: under Section 23 of The Land Drainage Act 1991.	Tewkesbury Borough Council, Cotswold District Council and Gloucestershire County Council	Required for all works over, under or near ordinary watercourses. Required for all culvert or structures likely to affect flow in ordinary watercourses. This will include all ordinary watercourses crossed by the scheme.	Discussions with the relevant authorities have taken place in relation to the scheme and will continue in relation to the relevant works and agreement to disapply Section 23 in the draft DCO.	Section 23 is a Prescribed Consent which Highways England are seeking to disapply in the draft DCO.
Trade Effluent Consent under the Water Industry Act 1991	Local water undertaker	For the purposes of discharging trade effluent from welfare facilities.	The requirement for a Trade Effluent Consent will be discussed with the relevant local water undertaker should it be required during the construction phase.	Highways England are not seeking to disapply this consent in the draft DCO.

1.5.3 There are no main rivers which are crossed by the scheme, therefore no Flood Risk Activity Permit is required.

1.6 Guidance and standards

1.6.1 EA's Pollution Prevention Guidelines (PPGs) (withdrawn in 2015), and their replacement series – Guidance for Pollution Prevention (GPPs), particularly preventing pollution[i], working on or near water[ii] and for managing water on land[iii], and the relevant CIRIA publications should be referred to in reference to this document.

1.6.2 CIRIA guidance includes:

- Control of Water Pollution from Construction Sites – Guide to Good Practice (SP156)
- Control of Water Pollution from Construction Sites – Guidance for Consultants and Contractors (C532)
- Control of Water Pollution from Linear Construction Projects – Technical Guidance (C648)
- Control of Water Pollution from Linear Construction Projects – Site guide (C649)
- Environmental good practice on site (C692)
- Groundwater control: design and practice (second edition) (C750)
- The SuDS Manual (C753)
- Guidance on the construction of SuDS (C768)

2 Mitigation measures

2.1 General measures

2.1.1 Temporary surface water management systems would be installed early in the construction sequencing and carefully managed to prevent localised flooding or pollution of surface and groundwater from sediment and other contaminants.

2.1.2 In areas where potentially contaminated land has been identified, specific mitigation measures would be designed to manage and contain potential contamination. These would be described in the second iteration GSWMP and detailed method statements would be prepared for works in these areas.

Induction of site personnel

2.1.3 All personnel would attend a site induction before commencing work on site. The briefing would emphasise the sensitivity of the watercourses, surrounding habitat and methods and working practices employed to protect the water environment.

Emergency response planning

2.1.4 An emergency response plan would be developed in accordance with *Pollution Prevention Guideline (PPG) 21: Pollution Incidence Response Planning*[iv]. That plan would be communicated to all personnel. Emergency spill control equipment such as spill kits, oil booms and absorbent materials, would be held at appropriate locations on site and within site compounds.

Climate change resilience planning

2.1.5 The contractor should consider the potential impacts of extreme weather events during construction. To ensure resilience of the scheme to such extreme weather events, the contractor should use a short to medium-range weather forecasting service from the Met Office or other approved weather forecast provider to manage climate-related risks and inform programme management and impact mitigation measures. The contractor should register with the EA's Floodline Warnings Direct service.

2.1.6 The contractor's Environmental Management System (EMS) would consider all measures deemed necessary and appropriate to manage extreme weather events and specifically cover training of personnel and prevention and monitoring arrangements.

Land contamination risk management

2.1.7 The completed land contamination risk assessments have identified areas of concern with respect to measured concentrations of contaminants in either groundwater or soils. Details of areas of concern with respect to land contamination are presented in ES Chapter 9 Geology and soils (Document Reference 6.2). The risks to controlled waters specifically from arising from these areas of concern would be further managed through measures set out in ES Appendix 2.1 EMP Annex E Materials Management Plan (Document Reference 6.4) and Annex H Site waste management plan (Document Reference 6.4). General mitigation measures with respect to prevention of pollution of controlled waters set out in this GSWMP would still apply.

Voids treatment protocol

2.1.8 Voids treatment protocol shall be developed by the contractor. This shall set out procedures and measures allowing for targeted investigation and treatment of voids that will reduce impact on groundwater flows.

2.1.9 In some instances, grouting may be required to treat voids encountered during earthworks. Furthermore, cutting and slope stabilisation works may involve the use of soil nails, rock anchors and/or rock bolts, all of which involve the use of typically steel reinforcing elements drilled and grouted into the slopes or cutting faces. Appropriate grouting methodologies shall be developed by the contractor and adopted to reduce any risks to the water environment.

2.1.10 The results of intrusive and geophysical investigations, and tracer tests where available, shall be considered when developing design solutions.

General mitigation measures

2.1.11 An outline of the main work activities to be carried out throughout the construction of the scheme is set out in Table 2-1. The mitigation and management measures described in Table 2-1 shall be employed by the contractor.

Table 2-1 Main work activities and mitigation proposals

Construction risks	Mitigation
Concrete wash water reaching controlled waters	• Work involving concrete and cement will be carried out in accordance with *PPG5: Works in, near or liable to affect a watercourse*. Controls will be implemented to ensure that wet cement does not come into contact with controlled waters. • Adequately sized and fully lined designated concrete washout areas will be developed and maintained. • Investigate concrete supplier's use of concrete socks, which will help reduce the need for washout areas. • Waters outside of designated concrete washout areas that have come into contact with wet concrete/cement will be captured and treated accordingly (e.g. using a Siltbuster Roadside Concrete Washout facility and/or pH control). • Any waste material recovered following the drying of concrete washout areas or following treatment, should be re-used onsite, if possible, or should be removed from site by a licensed waste carrier for disposal to an appropriately licensed facility. • Detailed response plan, linked to regular monitoring of wash water and wash water vessels will be compiled and adhered to.
Excavation activities	• Silt fencing, cut-off ditches and soil bunds will be constructed downslope of excavations, to retain and convey water to adequately sized treatment areas to prevent the ingress of sediment contaminated water.
Dewatering	• Control pumping rates to avoid erosion or scouring of land downslope of the discharge point or watercourse banks or bed. • Discharge via settlements ponds, where possible, or through vegetation via silt socks and appropriate downslope pollution prevention mitigation, such as silt fences. • Detailed response plan, linked to regular monitoring of the discharge of water will be compiled and adhered to.
Location of site compound facilities (including car parks)	• Site compounds will be located away from all surface water features and watercourses and outside of the flood plain. • A site drainage plan will be prepared in advance of construction works, identifying the location of all watercourses and drains/drainage paths and showing mitigation measures to protect the receiving water environment from pollutants from the scheme's construction. • All drainage on site will be identified and mapped, with colour coding used to distinguish between surface water, foul sewer and combined drainage. This would ensure that all those working on site are aware of the type of drain in the event of a pollution incident. Pollution control measures such as the use of oil interceptors, the placement of bunds or sediment traps would be used to prevent sediment run-off entering drains.
In-channel working	• Temporary works to divert watercourses during culvert construction, either by gravity flumes or over pumping will include suitable provisions to pass high flows.

Construction risks	Mitigation
Vehicle/plant movements and cleaning	• Haul routes will be regularly inspected and maintained to minimise sediment laden run-off. • During the earthworks mass haul operation, damping down of the haul roads to minimise dust being generated by plant movements would be required. This would minimise dust pollution causing nuisance to neighbouring properties and businesses along the route of the scheme. • All vehicles, plant and equipment will be regularly inspected and maintained in accordance with manufacturers' recommendations. Records of inspections will be maintained on site. • Areas of hard standing will be provided at site access and egress points, where practicable. The areas will be regularly inspected and cleaned. Road sweepers/cleaners will be employed on existing highways near the construction area. • Site wheel washing facilities will be established at designated locations, away from watercourses and the floodplain. Cleaning will be carried out in a bunded area and wastewater would either be recycled or discharged to foul sewer (under permit from the sewerage undertaker). If unable to be discharged, waste would be removed from site by a licensed waste carrier for disposal to an appropriately licensed facility. • Guidance from PPG13 will be used to put in place good practice for vehicle washing and cleaning.
Topsoil stripping and storage	• Wherever possible, vegetation and topsoil will be left in place to minimise the amount of unprotected ground exposed to runoff. Where topsoil removal is required it would take place as late as possible prior to other works in the area. Topsoil will be stored outside of the floodplain areas on level ground. • In advance of vegetation clearance and soil stripping operations commencing, appropriate control measures would be implemented to prevent contamination. • Topsoil stockpiles will be created and managed in accordance with best practice guidance (PPG6). The sides of stockpiles would be graded to prevent ponding and to help shed rainwater. Exposed stockpiles that are to remain for long periods will be seeded with a standard Rye Grass seed mix immediately upon completion and in suitable weather conditions. This would minimise soil erosion during the soil storage period and to help reduce colonisation of nuisance weeds. • Silt fencing would be installed around the margins of topsoil mounds to minimise the risk of sediment-laden runoff reaching watercourses.
Field drainage - irrigation	• Details of the irrigation system on each land holding will be gathered during the detailed design stage and irrigation plans developed to inform the management of agricultural land drainage during construction. • The contractor will be responsible for consulting with each individual landowner to obtain the relevant information and to be a point of contact to report concerns regarding irrigation systems during construction. The plans will include the following information: – location of boreholes and water supplies used by each farmer – irrigation or impoundment licence granted by the EA – system of irrigation applied and the location of irrigation network for each field

Construction risks	Mitigation
Aquatic protection	• Any instream works or works close to watercourses may result in a change of aquatic conditions downstream. Such works would take into account best practice mitigation measures. • Advice on aquatic protection and constraints will be sought from all specialists involved in the scheme and will be entered into method statements and issued through to the workforce and management ahead of works affecting watercourses. • Appropriate precautions will be taken when working within, or adjacent to, watercourses to appropriately manage the potential for deposition of sediment or release of other forms of suspended material or pollution into the watercourse. • Instream prevention and control measures to reduce or avoid sediment ingress into the watercourse, would include (but not exclusively): – avoiding instream activity during wet weather – check dams or cofferdams – sediment absorbent matting – bank reinstatement/stabilisation • The use of construction materials on site will be free from contaminated material to avoid potential contamination of the watercourse. • Water (surface and spring) monitoring will be conducted across the scheme at appropriate locations (see section 3) to detect any changes in the water environment during the construction phase, and to determine locations for additional new mitigation or maintenance of existing mitigation measures. • Water monitoring will be conducted (of parameters selected to capture construction and operational risks) and results plotted against appropriate trigger values, based upon Water Framework Directive (WFD) status, Environmental Quality Standards (EQS) and baseline monitoring results prior to construction by the Contractor in consultation with the EA. Further details are provided in section 3. • Activities will be overseen and audited by an appropriately qualified Environmental Clerk of Works (ECoW) (or team of). They will provide details of non-compliance in reports provided to the contractor to use to design and implement measures to address non-compliance and exceedances in water quality parameters.

Construction risks	Mitigation
Storage of fuels, oils and other chemicals	• Spill kits would be available near all points of work and personnel trained in their use. • COSHH store would be bunded and locked when not in use. • In areas where there is limited space within the construction area to treat contaminated water from the work areas, settlement tanks and oil separators will be used. • Physical barriers would be provided to stop material overspill. • No fuels, oils or other chemicals will be stored in high- risk locations such as: – within 50 metres of a spring, well or borehole – within 10 metres of a watercourse – places where spills could enter open drains or soak into groundwater – on a floodplain • Storage tanks for oils, fuels or chemicals will be sited on an impermeable base, surrounded by an impermeable bund, and inspected regularly for leaks. Any valve, filter, sight gauge, vent pipe or other ancillary equipment must be kept within the bund when not in use. The drainage system of bunded areas shall be sealed with no outlet to any watercourse, pond or underground strata. • Bunded areas will be located on stable and on level ground and located away from watercourses, ditches and drains. • Associated pipework should be situated above ground and protected from accidental damage. • All bulk fuel storage must be contained within a double skinned bowser/container or have a bund. Double skinned tanks or bowsers must also be bunded unless the outer skin would provide secondary containment. The bund must have sufficient volume to contain 110% of the contents of the largest fuel/pipe container or 25% of the total storage capacity of all the containers, whichever is the greater. • All fuel containers, including those containing waste fuels, must be stored on a drip tray/bunded area away from vehicle traffic within a designated storage area, where possible, to avoid damage. • Guidance from PPG3 will be followed for the use and design of oil separators for the surface water drainage systems and guidance from PPG2 will be used regarding to ground storage oil. • Plant will be regularly inspected, serviced and maintained to minimise the risk of leaks/spills. At the end of each working day, driveable plant will be removed from any areas of floodplain.

Construction risks	Mitigation
Surface water run-off/Sediment from earthworks and in-channel works.	• Oil interceptors, bunds or sediment traps will be used to prevent polluted run-off entering drains, additional guidance from PPGs will also be followed. • Areas of exposed sediment deemed at risk of erosion during heavy rainfall or flood inundation should be protected using either temporary measures (e.g. sheeting) or semi-permanent measures (for example coir matting) until vegetation is able to establish on these surfaces. • Temporary surface water drainage measures would be planned and designed appropriately prior to installation and recorded on drawings. This should include details on: – soil/sediment settlement rate – drainage system capacity – details of systems installed to intercept and treat contaminated water run-off – details of steps to prevent bypassing of the drainage system • Cut-off drains or ditches would be used to convey water around the site and/or prevent sediment laden water entering excavations and watercourses. These should be constructed downstream of construction areas to prevent water entering receptors. These should discharge to settling ponds/tanks. • Sediment laden water would be treated by flocculants and/or coagulants to allow suspended solids to settle out before disposal. A flocculant/coagulant dosing and monitoring plan would be established and agreed with the EA prior to use. Any use of flocculants and/or coagulants, including quantities and locations where used, would be recorded by the contractor. • Settlement ponds would be constructed to promote the removal of sediment from site runoff. Ponds should be designed for the maximum predicted drainage catchment runoff using a 1 in 100 year plus the relevant climate change allowance (1:100+CC) event and should be large enough to ensure sufficient residence time for particulates to settle out, prior to discharge of the water. • All water pumped from excavations would be pumped via a pipe and gravel sump to prevent sediment being agitated from the base of the excavation and to provide rudimentary filtration to the water prior to abstraction. • For low volume pumping, water would either be pumped into a vegetated area remote from surface water drainage or into a small attenuation lagoon prior to being directed into the drainage system. For high volume pumping (100mm pipe diameter or above) water would be passed through an attenuation tank with a capacity of not less than 8m^3. The outlet from the tank could be placed directly into site drainage, provided the water is free from sediment contamination. • Wherever practicable, grey water systems would be used at site compounds to reduce run-off from site, improve water efficiency and reduce the potential for polluting discharges to surface watercourses. • Water monitoring of parameters will be conducted across the scheme at appropriate locations to detect any changes in the water environment during the construction phase (see section 3), and be used to determine locations for additional new mitigation or maintenance of existing mitigation measures. • Detailed response plan, linked to regular monitoring of watercourses will be compiled and adhered to.

Construction risks	Mitigation
Field/agricultural land drainage	• Particular care will be taken to ensure that the existing land drainage system is not compromised as a result of construction. Land drainage systems will be maintained during construction and reinstated on completion. • The contractor will coordinate drainage surveys to establish the existing drainage position including any related farm drainage that may be affected by the scheme. The services of a suitably qualified drainage engineer will be employed by the contractor to act as a drainage expert during the detailed design process and liaise with landowners or occupiers to consult on the pre and post drainage schemes required. This would include the design of any land drainage works required during construction, and on the design and timing of any land drainage works required for the subsequent restoration of the land. This process would take due regard of any local and site-specific knowledge. • Existing agricultural land drains, where encountered during the construction of each phase, would be appropriately marked. The location of drains cut or disturbed by the construction works would be photographed, given a unique number and the coordinates logged. The actual condition and characteristics (e.g. depth of installation, pipe type and diameter) of the existing drainage would also be recorded upon excavation. • During the construction works, temporary drainage would be installed to intercept existing field drains and ditches to maintain the integrity of the existing field-drainage system during construction. Such measures would also assist in reducing the potential for wet areas to form during the works, thereby reducing the impact on soil structure and fertility. Drainage systems however would not be installed into areas where they are not currently present, e.g. environmental wetlands. • Any field drainage intercepted during construction would either be reinstated following reinstatement of the land or diverted to a secondary channel. Landowners and occupiers would be informed of the design of drainage works required during construction. The drainage would be reinstated in a condition that is at least as effective as the previous condition and follow best practice for field drainage installations taking into account site specific conditions. • Landowners and occupiers would be provided with the opportunity to inspect land drainage works as they progress, subject to health and safety considerations. Records of existing and remedial drainage would be maintained by the contractor with copies provided to the landowner (and the occupier, if applicable) following the completion of construction works in each phase. • A dispute resolution process would be established including the appointment of a jointly agreed Independent Expert for drainage design and implementation, if required.

Construction risks	Mitigation
Realignment of tributary of Norman's Brook	• Drainage design of the embankment will enable groundwater flow maintaining the groundwater regime of the tributary of Norman's Brook. • Detailed design of construction mitigation and realignment method statements will be prepared in the detailed design phase and approved prior to construction, and these measures implemented prior to commencement of the works. • Temporary works when diverting Norman's Brook watercourse during construction, either by gravity flumes or over pumping will include suitable provisions to pass high flows. • No fuels, oils or other chemicals will be stored within the catchment (shown on Figure 13.3 WFD Surface Waterbodies), unless at construction compounds and with appropriate mitigation measures in place. • Volume of flow within the catchment area and from springs, will be monitored and reviewed. Where shortages are identified that are potentially a result of construction of the scheme, appropriate measures proposed to address this. • All activities associated with Norman's Brook and its tributaries with the potential to impact the water environment will be overseen and audited by an ECoW (or team of), with appropriate experience in water environment and aquatic protection. They will provide details of non-compliance in reports provided to the contractor to use to design and implement measures to address non-compliance and exceedances in water quality parameters. • All other points in this document will be adhered to in addition to the above specific measures. • Detailed response plan, linked to regular monitoring of watercourses will be compiled and adhered to.
Maintenance, inspection and management	• A maintenance, inspection and management plan for ground and surface water would be prepared by the contractor prior to construction and adhered to throughout construction. • Incident response plans for potential pollution events and potential impacts to surface water and groundwater receptors should be prepared and regularly updated to reflect current construction risks detailing as a minimum: – responsible persons from the contractor – an inventory of all substances stored on site, along with the storage locations and details of the maximum quantity held – a full list of the pollution prevention equipment available, details of storage and locations, and Personal Protective Equipment (PPE) required to be used following a pollution incident – rapid response actions to be taken following a pollution incident, including contact details in the event of a pollution event

3 Monitoring plan

3.1 Introduction

3.1.1 Monitoring of flow/level and quality of surface water, springs and groundwater will be conducted by the contractor to ensure that the scheme does not cause detrimental impact on controlled water receptors during construction.

3.1.2 The contractor will develop and implement a monitoring plan during the detailed design stage. The plan would be based upon the baseline ES monitoring and will be adapted to reflect site specific requirements during and post construction. The scope, methodology and results of the ES baseline monitoring are presented in ES Appendix 13.12 Water Environment Monitoring Data (Document Reference 6.4) and outlined below.

3.1.3 Further baseline water quality data will be obtained by the contractor before construction to establish the existing conditions against which monitoring during and post completion of the scheme construction works can be compared. Results of the ES baseline monitoring will be incorporated into the pre-construction baseline and used to derive control and trigger levels.

3.1.4 Further ground investigations will be undertaken by the contractor to inform the detailed design (Phase 3 investigation). It is envisaged that the scope of these investigations will include installation of further groundwater monitoring locations followed by groundwater quality and level monitoring, and additional permeability and infiltration testing. Data obtained from these investigations would also supplement pre-construction baseline information.

3.2 Surface water

Surface water quality monitoring

Locations

3.2.1 Surface water quality monitoring will be undertaken by the contractor at the locations indicated Table 3-1. The locations are shown on ES Figure 13.15 Water environment monitoring locations (Document Reference 6.3). Where construction activities related to the realignment of the tributary of Norman's Brook do not allow access to monitoring locations, monitoring will be undertaken immediately downstream of the construction area to monitor impacts to offsite receptors where safe and practical. Additional monitoring locations may be identified at detailed design, where necessary.

Table 3-1 Surface water quality monitoring locations

ID	Northing	Easting
SW1	391327	216435
SW2	392303	215719
SW3	394386	213349
SW4	394683	212717
SW5	395010	216262
SW6	396171	215337

Methodology

3.2.2 Each of these locations would be made clearly identifiable using marker posts, photographs and physical features as a reference to enable locations to be consistently identified for the duration of the monitoring programme.

3.2.3 Plan and cross section sketches at each location will be compiled by the contractor to aid the recording of physical features and the precise location of the site. These would be updated on a monthly basis.

3.2.4 At each sampling location photographs and notes of possible influencing factors, such as weather conditions, ambient air temperature, the weather, the presence of dead fish floating in the water or of oil slicks, growth of algae, any unusual sights or smells, and recent management of the watercourse, would be recorded as these may have a bearing on the water quality results. Where no water is present, this would be recorded.

In-situ monitoring

3.2.5 The following parameters will be monitored in-situ by the contractor, reducing the potential for contamination or degradation of the samples. The appropriate field kit for undertaking in-situ spot sampling would be used and the manufacturer's instructions followed carefully. Calibration of the in-situ monitoring equipment would be undertaken as per the manufacturer's instructions and a log detailing the type of calibration and results kept.

3.2.6 The in-situ parameters to be sampled at all locations include:

- Temperature
- pH
- Conductivity
- Total suspended solids
- Dissolved oxygen
- Turbidity
- Alkalinity
- Redox potential

Laboratory sampling

3.2.7 Testing of the below parameters would follow standard water quality sampling laboratory procedures and be undertaken in a United Kingdom Accreditation Service (UKAS) accredited laboratory facility. Samples would be transported to a certified laboratory for testing within 24 hours from sampling, or within the holding times of the certified laboratory for the parameters sampled (if shorter) in a sturdy insulated box to protect samples from sunlight, prevent the breakage of sample bottles, and the use of cool packs should allow a temperature of 4°C to be maintained during transport.

3.2.8 The laboratory parameters to be analysed at all locations include:

- general parameters: pH, electrical conductivity and alkalinity
- aluminium
- arsenic
- calcium
- copper (total and dissolved)
- cadmium (total and dissolved)
- dissolved organic carbon

- lead
- zinc
- total petroleum hydrocarbons (speciated, aliphatic and aromatic split)
- Polycyclic Aromatic Hydrocarbons (16 PAHs)
- major ions (anions and cations)
- nitrates and phosphate (total N and total P)

Frequency

3.2.9 Water quality sampling would be undertaken on a monthly basis, with samples taken at a similar time of day throughout the programme with approximately 4 weeks between samples.

Surface water flow monitoring

Locations

3.2.10 Surface water flow monitoring would be undertaken at the locations indicated in Table 3-2. The locations are shown on ES Figure 13.15 Water environment monitoring locations (Document Reference 6.3). Where construction activities related to the realignment of the tributary of Norman's Brook do not allow access to monitoring locations, monitoring would be undertaken immediately downstream of the construction area to monitor impacts to offsite receptors where safe and practical. Additional monitoring locations may be identified at detailed design, where necessary.

Table 3-2 Surface water flow monitoring locations

ID	Northing	Easting	Type of measurement
SW1	391327	216435	Manual
SW2	392303	215719	Automatic
SW3	394386	213349	Manual
SW4	394683	212717	Automatic
SW5	395010	216262	Manual
SW6	396171	215337	Automatic

Methodology

3.2.11 Each of these locations would be made clearly identifiable using marker posts, photographs and physical features as a reference to enable locations to be consistently identified for the duration of the programme.

3.2.12 Plan and cross section sketches at each location would be compiled to aid the recording of physical features and the precise location of the site. These would be updated on a monthly basis.

3.2.13 All surface water level monitoring activities and installations would be in accordance with relevant British Standards, industry guidance and best practice, including:

- Environment Agency (2011), Hydrometric manual
- British Standard ISO 4373: 2008 Hydrometry – Water level measuring devices

3.2.14 At surface water monitoring locations, the type of flow measurement depends upon the suitability of the location. Each location would be assessed for suitability prior to installation.

3.2.15 Calibration of monitoring equipment would be undertaken as per the manufacturer's instructions and a log detailing the type of calibration and results kept.

Automatic flow measurement

3.2.16 Acoustic (echo) correlation velocity profilers and ultrasonic doppler systems would be bed mounted onto a levelled concreted slab and left in-situ for the duration of the programme.

3.2.17 Should this method not be appropriate due to local conditions or circumstances alternative solutions would be developed and proposed. This would be considered particularly in locations that are temporarily dry for extended periods of time.

Manual flow measurement

3.2.18 Manual flow gauging measurements would be taken using the most appropriate technique, such as a calibrated rotating element or electromagnetic current meter for wade gauging or where flow monitoring locations are deeper than 0.5m at the deepest point of the cross section, flow gauging should be undertaken using an Acoustic Doppler Current Profiler (ADCP). The ADCP will be deployed either by raft, boat, cableway or rope and should be operated by a suitably qualified or experienced hydrologist.

3.2.19 Electromagnetic current meters would be considered where monitoring locations experience very low velocities (<0.1m/s), shallow depths, high silt loads and/or vegetated conditions.

3.2.20 When considering the use of an electromagnetic current meter, care would also be taken during the site selection process to ensure the monitoring location is remote from overhead or underground power cables, or other structure which may generate an electrical magnetic field which can interfere with the electromagnetic current meter.

3.2.21 Where no flow is present, this will be recorded.

Frequency

Automatic flow measurement

Automatic flow monitoring would be undertaken at 15-minute intervals, with data upload, analysis and reporting conducted on a monthly at minimum basis.
Manual flow measurement

3.2.22 Manual flow measurements would be undertaken on a monthly basis.

3.3 Spring water

Spring water quality monitoring

Locations

3.3.1 Spring water quality monitoring would be undertaken at the locations indicated in Table 3-3. The locations are shown on ES Figure 13.15 Water environment monitoring locations (Document Reference 6.3). Additional monitoring or surveyance locations may be identified during detailed design, where necessary.

Table 3-3 Spring water quality monitoring locations

ID	Northing	Easting	Spring Type
GW1	392415	215702	Spring (previously considered to be potential tufa formation)
GW2	392839	215713	Spring considered to support tufa habitat[v]
GW3	393056	215689	Spring
GW4	393069	215849	Spring
GW5	394249	213387	Spring
GW6	394392	213186	Spring with potential tufa formation
GW7	394154	216527	Spring
GW8	394531	214760	Spring with potential tufa formation

Methodology

3.3.2 Each location would be made clearly identifiable using marker posts, photographs and physical features as a reference to enable locations to be consistently identified for the duration of the programme.

3.3.3 Plan and cross section sketches at each location would be compiled to aid the recording of physical features and the precise location of the site. These should be updated on a monthly basis.

3.3.4 At each sampling location photographs and notes of possible influencing factors, such as weather conditions, ambient air temperature, the weather, the presence of dead fish floating in the water or of oil slicks, growth of algae, any unusual sights or smells, and recent management of the watercourse, would be recorded as these may have a bearing on the water quality results. Where no water is present, this will be recorded by the contractor.

3.3.5 Water sampling at springs with potential tufa formations would be taken from spring inflows, runnels or outflows in conjunction with in-situ water quality parameters and notes on the vegetation. The samples should not be collected from pure stands. Care needs to be made to avoid disturbing turbidity.

In-situ monitoring

3.3.6 The following parameters would be monitored in-situ, reducing the potential for contamination or degradation of the samples. The appropriate field kit for undertaking in-situ spot sampling would be acquired, and the manufacturer's instructions followed carefully. Calibration of the in-situ monitoring equipment should be undertaken as per the manufacturer's instructions and a log detailing the type of calibration and results kept.

3.3.7 The in-situ parameters to be sampled at all 8 locations include:

- Temperature
- pH
- Conductivity
- Total suspended solids
- Dissolved oxygen
- Turbidity
- Alkalinity
- Redox potential

Laboratory sampling

3.3.8 Testing of the below parameters would follow standard water quality sampling laboratory procedures and be undertaken in a United Kingdom Accreditation Service (UKAS) accredited laboratory facility. Samples should be transported to a certified laboratory for testing within 24 hours from sampling, or within the holding times of the certified laboratory for the parameters sampled (if shorter) in a sturdy insulated box to protect samples from sunlight, prevent the breakage of sample bottles, and the use of cool packs should allow a temperature of 4°C to be maintained during transport.

3.3.9 The following water quality parameters would be analysed for spring water samples:

- General parameters: pH, electrical conductivity and alkalinity
- Major ions (anions and cations)
- Nutrients: nitrates and phosphate (total N and total P)

Frequency

3.3.10 Water quality sampling would be undertaken on a monthly basis, with samples taken at a similar time of day throughout the programme with approximately 4 weeks between samples.

Spring water flow monitoring

Locations

3.3.11 Spring water flow monitoring would be undertaken at locations indicated in Table 3-4.

Table 3-4 Spring water flow monitoring locations

ID	Northing	Easting
GW2	392839	215713
GW4	393069	215849
GW6	394392	213186
GW7	394154	216527
GW8	394531	214760

Methodology

3.3.12 Each of these locations would be made clearly identifiable using marker posts, photographs and physical features as a reference to enable locations to be consistently identified for the duration of the programme.

3.3.13 Plan and cross section sketches at each location would be compiled to aid the recording of physical features and the precise location of the site. These would be updated on a monthly basis.

3.3.14 All surface water level monitoring activities and installations would be in accordance with relevant British Standards, industry guidance and best practice, including:

- Environment Agency (2011), Hydrometric manual
- British Standard ISO 4373: 2008 Hydrometry – Water level measuring devices

3.3.15 For spring flow monitoring locations, only manual flow measurements would be undertaken.

3.3.16 Calibration of monitoring equipment would be undertaken as per the manufacturer's instructions and a log detailing the type of calibration and results kept.

Manual flow measurement

3.3.17 Manual flow gauging measurements would be taken using the most appropriate technique, such as a calibrated rotating element (REM) or electromagnetic current meter for wade gauging.

3.3.18 Electromagnetic current meters would be considered where monitoring locations experience very low velocities (<0.1m/s), shallow depths, high silt loads and/or vegetated conditions. Alternative methods may be considered, such as bucket and stopwatch method, where possible.

3.3.19 Where no flow is present, this would be recorded.

Frequency

3.3.20 Manual flow measurements would be undertaken on a monthly basis.

3.4 Rainfall

Locations

3.4.1 Rainfall monitoring would be undertaken at locations indicated in Table 3-5.

Table 3-5 Rainfall monitoring locations

ID	Northing	Easting
R1	392468	215428
R2	394733	214567

Methodology

3.4.2 Prior to installation, the height of sheltering objects around the site would be measured, taking into account anticipated growth of surrounding vegetation. If the site is considered to be unsuitable following this, it would be relocated to a more suitable location nearby and the location recorded. In locations that may be over exposed, with no natural shelter, a turf wall may be used or a wind screen.

3.4.3 Where required, protection, such as a fence, may need to be installed should the location be within a field containing livestock. If this is the case, care should be taken to ensure that this does not impact the performance of the rain gauge.

3.4.4 On a monthly basis, data would be downloaded from each of the gauges and calibration and maintenance undertaken where required, in line with the manufacturer's instructions. Additionally, photographs would be taken, and notes of possible influencing factors recorded, such as the height of sheltering objects (e.g. vegetation) at each rain gauge location.

Frequency

3.4.5 Data from the rain gauge would be downloaded and the location of the rain gauge inspected to note any changes in the exposure of the instrument on a monthly basis.

3.5 Groundwater

Locations

3.5.1 Existing groundwater monitoring locations are shown on ES Figure 13.9 Groundwater monitoring (Document Reference 6.4).

3.5.2 During construction groundwater monitoring would be undertaken in wells outside of the scheme construction area, where possible in series 400 wells. Additional monitoring installations may be introduced as part of further ground investigations (Phase 3) during the detailed design stage, where required, to allow for an adequate coverage along the scheme alignment during and post construction. Further monitoring installations may be required during construction. These would be determined on site specific basis.

Methodology

3.5.3 The installations would be placed in boreholes completed in accordance with Ground Investigation specification for the works. Each of the installations would be secured with an appropriate headwell cover and locations made visible and clearly identifiable throughout the monitoring programme.

3.5.4 Groundwater sampling and level monitoring activities would be in accordance with relevant British Standards, industry guidance and best practice, including:

- BS 5930: 2015: Code of Practice for Site Investigations
- BS 10175:2011 + A1 2013: Code of Practice for Investigation of Potentially Contaminated Sites

3.5.5 Groundwater levels would be obtained through manual dips. Automatic data loggers would be used in selected locations.

3.5.6 Calibration of monitoring equipment would be undertaken as per the manufacturer's instructions and a log detailing the type of calibration and results kept.

Laboratory testing

3.5.7 The laboratory parameters to be sampled at monitoring locations include:

- general parameters: pH, electrical conductivity and alkalinity
- dissolved metals
- total petroleum hydrocarbons (speciated, aliphatic and aromatic split)
- Polycyclic Aromatic Hydrocarbons (16 PAHs)

3.5.8 This suite of testing would be reviewed on a site and construction activities specific basis.

Frequency

3.5.9 During the pre-construction baseline gathering period, groundwater quality and level monitoring would be undertaken on a monthly basis. Download of data from loggers would also be undertaken on a monthly basis. The frequency of monitoring during construction would be set at site specific level to accommodate the construction and activities programme.

3.6 Additional monitoring and inspections

3.6.1 Scheduled inspections of the construction areas to be undertaken by the contractor. As part of this monitoring, water levels within settlement ponds, retention ponds and other surface water storage areas would be monitored and recorded.

3.6.2 Monitored data from these inspections would be recorded into the capacity tracking spreadsheet.

3.6.3 Following these inspections, erosion and sediment control monitoring and maintenance would be undertaken by the contractor, where the inspections indicate it is required or it is advised by the ECoW.

3.7 Reporting

3.7.1 Monitoring would be used to detect any impacts to the water environment, and to assist in determining locations for additional new mitigation or maintenance of existing mitigation measures.

3.7.2 The contractor will manage and oversee the water monitoring. They would be responsible for monitoring and ensure that all samples are appropriately labelled with locations and time of sampling.

3.7.3 The results of laboratory testing would be provided to the contractor, who would be responsible for reviewing the results in relation to trigger levels following pre-construction monitoring. The control and trigger values would be derived based upon WFD status, EQS values and baseline monitoring results (including flow where appropriate). Monthly results would be prepared and sent to Highways England by the contractor and can be provided to the EA on request.

3.7.4 Monitoring results would be plotted against pre-construction baseline data and action values on regular basis. Exceedance of action levels or visual observations indicating a pollution event, or a change from baseline conditions, would instigate an investigation. This would be detailed in an Accident Plan, which would be developed by the contractor to manage and develop a methodology to deal with exceedances. The plan would be prepared at detailed design stage prior to construction in consultation with the EA.

3.7.5 The following records relating to surface water management and monitoring are to be maintained by the contractor:

- spill or incident reports
- records of daily/weekly inspections during construction
- data relating to dewatering and re-injection as required by the EA
- a copy of this document, and the plans committed to within, is to be maintained for the project duration

3.7.6 On completion of the monitoring at each phase, the monitoring data would form part of a pre-construction baseline monitoring report, construction monitoring report and post-construction verification report which will be provided by the contractor to the EA, at their request.

References

[i] Environment Agency (2021). Pollution prevention for businesses [Online]. Available at: https://www.gov.uk/guidance/pollution-prevention-for-businesses (Accessed: 11/02/2021).
[ii] Environment Agency (2021). Check if you need permission to do work on a river, flood defence or sea defence [Online]. Available at: https://www.gov.uk/permission-work-on-river-flood-sea-defence (Accessed: 11/02/2021).
[iii] Environment Agency (2015). Manage water on land: guidance for land managers [Online]. Available at: https://www.gov.uk/guidance/manage-water-on-land-guidance-for-land-managers (Accessed: 11/02/2021).
[iv] Although the PPGs were revoked by the EA, they still maintain relevant as best practice guidance until updates are made available.
[v] Considered following an assessment of tufaceous vegetation