M3 Junction 9 Improvement

Scheme Number: TR010055

6.1 Environmental Statement Chapter 13 Road Drainage and the Water Environment

APFP Regulation 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

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6.1 ENVIRONMENTAL STATEMENT - CHAPTER 13: ROAD DRAINAGE AND THE WATER ENVIRONMENT

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13 Road Drainage and the Water Environment

13.1 Introduction

13.1.1 This chapter presents the findings of the assessment of the construction and operation of the M3 Junction 9 Improvement Scheme (hereafter referred to as the Scheme) on road drainage and the water environment. This chapter outlines legislative, policy framework and guidance, describes the assessment methodology, study area, baseline conditions, an overview of potential impacts, mitigation measures, likely residual effects, monitoring and a summary. This chapter has been prepared by a competent expert, further details are provided in **Appendix 1.1 (Competent Expert Evidence)** of the **ES (Document Reference 6.3).**

13.1.2 This chapter should be read in conjunction with **Environmental Statement (ES) Figure 13.1 (Document Reference 6.2)** and **Appendix 13.1, 13.2 and Appendix 13.3** of the **ES (Document Reference 6.3)** which comprise:

- ES Appendix 13.1: Drainage Strategy Report
- ES Appendix 13.2: Hydrogeological Risk Assessment
- ES Appendix 13.3: Chalk Improvement and Stabilisation Technical Note

13.1.3 This chapter should also be read in parallel to the following assessments:

- **Flood Risk Assessment (FRA) (Document Reference 7.4)**
- **Water Framework Directive Compliance Assessment (Document Reference 7.7)**

13.1.4 Associated effects on ecology (including aquatic ecology) are considered in **Chapter 8 (Biodiversity)** of the **ES (Document Reference 6.1)**. Effects on ground conditions and water quality arising from existing land contamination are considered in **Chapter 9 (Geology and Soils)** of the **Environmental Statement (Document Reference 6.1)**. This chapter should also be read in parallel to **Chapter 15 (Cumulative Effects)** of the **ES (Document Reference 6.1)**.

13.2 Consultation

13.2.1 Consultation and engagement have informed the drainage and water environment assessment. Comments and responses to the Scoping Opinion received in November 2020 are provided in **Appendix 4.2 (Scoping Comments and Responses)** of the **ES (Document Reference 6.3)** and comments and responses received during the 2021 statutory consultation are provided in **Appendix K** of the **Consultation Report (Document Reference 5.1).**

13.2.2 **Table 13.1** outlines further engagement that has been undertaken with the Environment Agency to inform the Scheme and the assessment.

Table 13.1: Consultation undertaken relevant to road drainage and water environment

Reference	Comment	Response
Environment Agency		
16 June 2019	Meeting to discuss drainage, water environment, groundwater, flood risk, and Water Framework Directive. The Scheme overview provided. Confirmation of no drainage works in Source Protection Zone. One catchment confirmed to drain to the River Itchen with increased permeable and impermeable contributing catchment areas. Discharge to be limited to existing runoff rate, attenuated via a pond. All other catchments to drain to soakaways or infiltration trenches. Water quality assessment completed which confirmed that the catchment is considered to be (lower end) medium risk. Spillage risk assessment completed and confirmed that M3 Junction 9 is at very low risk (<1:1000). Confirmed that no hydraulic modelling was being completed due to the scheme being located in Flood Zone 1 (at the time). Confirmed that standalone Water Framework Directive assessment to be provided covering ground and surface water bodies. Agreed that no specific hydromorphological assessment required.	Updated Highways England Water Risk Assessment Tool (HEWRAT) **Section 6.2** of the **ES (Document Reference 6.3)** includes a water quality assessment. The Scheme has progressed, and hydraulic modelling has been completed due to the new proposed crossing of the River Itchen reported in the **Flood Risk Assessment (Document Reference 7.4).**
27 June 2019	The Scheme overview provided. Confirmed Flood Risk Assessment would be produced to support the ES. Confirmed Scheme location within Flood Zone 1 with no new crossings. Confirmed that river model files had been provided.	The Scheme has progressed and is now located within Flood Zone 1, 2 and 3, with a new crossing of the River Itchen proposed. The hydraulic modelling has been completed and reported in the **Flood**

Reference	Comment	Response
	Discharge of groundwater would be dependent on quality, with on-site treatment being sufficient (lined pond). The Scheme is downstream of Source Protection Zone so there should not be interaction with public water supply extraction. Attenuation storage provided by ponds or underground storage tanks prior to discharge to watercourses or surface water drainage network. Attenuation storage sized to: a) store flows up to the 1 in 100yr storm +20% Climate Change uplift factor (and assessed against a +40% Climate Change uplift). b) allowable discharge rates are to be limited to 1 in 1-year greenfield runoff for offline sections. c) allowable discharge rates are to be limited to the existing highway peak runoff rates for existing online sections. d) a minimum practicable discharge of 5l/s. Pollution control would be critical for discharge to ground and watercourse due to Source protection zone and abstraction licences. Existing outfalls to River Itchen will be utilised where possible.	**Risk Assessment (Document Reference 7.4)**.
24 February 2021	Confirmed that flood risk is of lower concern and requested that the Flood Risk Assessment be clear on any impacts of the Scheme. Climate change allowances applied within the available hydraulic model are inputted differently to the standard approach due to the detailed hydrological study completed which took account of non-stationarity. Confirmation requested by National Highways (the Applicant) that it was appropriate to continue to apply climate change allowances in a consistent manner. High level intentions for the drainage design were presented. Outlined the target of 2l/s per	Liaison was undertaken with the Environment Agency to confirm that National Highways approach to climate change assessment was appropriate (confirmed in email correspondence from Environment Agency dated 25 May 2021). Correspondence is appended to the **Flood Risk Assessment**

Reference	Comment	Response
	hectare of long-term storage rate and total discharge of 20l/s to be discharged across three outfalls for area contributing new runoff to River Itchen. Current and proposed pollution treatment measures were outlined. Queried whether discharge rate discussions are being held with Lead Local Flood Authority (LLFA).	**(Document Reference 7.4)**. Discussions have been held with the LLFA and discharge rates confirmed.
9 August 2021	EA confirmed that the hydraulic model did not need to be re-run with new climate change allowances and technical assessment was appropriate	Noted. Correspondence is appended to the **Flood Risk Assessment (Document Reference 7.4).**
4 October 2021	Discussion undertaken in relation to proposed construction methodology associated with drainage outfalls and the preference for use of temporary framed cofferdam is the Applicant's preferred option. The Environment Agency stated that pleased to see that piling is not proposed and this proposed method is acceptable. The Environment Agency stated the impacts on fish migration and brook lamprey larvae need to be considered along with fish friendly pump. The Environment Agency raised the issue of angling impacts (especially upstream) and noted the importance of this recreational activity. The Environment Agency stated that the water framework directive is a live document and must be updated accordingly. Flood risk assessment permits (FRAPS) need to be reviewed by Environment Agency	The proposed methodology for drainage outfalls construction is outlined in the optioneering report which forms part of the application for Development Consent Order, see **Appendix 2.1** of the (**Outfall Installation Methodology Statement)** of the **ES (Document Reference 6.3).** The proposed mitigation (see **Section 13.8**) **and fiEMP (Document Reference 7.3)** includes confirmation that a fish friendly pump would be used and works would not take place during a flood event. Further liaison would be undertaken with respect to angling activities on the River Itchen prior to the siEMP being finalised.

Reference	Comment	Response
		The **Water Framework Directive Compliance Assessment (Document Reference 7.7)**. FRAPs for all works within 8m of River Itchen would be submitted to the Environment Agency prior to construction commencing.
24 August 2020	Model files and data requested (Products 5, 6 and 7) and provided.	Updated hydraulic modelling of River Itchen based on the Environment Agency's model files provided has been completed for baseline and with Scheme scenarios. This is detailed in the hydraulic model report included within the **Flood Risk Assessment (Document Reference 7.4).**
Hampshire County Council		
27 June 2019	Meeting with Hampshire County Council as LLFA. Design criteria agreed: a) Attenuation of 1 in 100yr storm +20% Climate Change uplift factor (and assessed against a +40% Climate Change). b) Allowable discharge rates are to be limited to 1 in 1-year greenfield runoff for offline sections. c) Allowable discharge rates are to be limited to the existing highway peak runoff rates for existing online sections. d) Restricted discharge rate of 5l/s. e) Hampshire County Council confirmed no official betterment requirements but stated designing to current standards and	**Appendix 13.1 (The Drainage Strategy Report)** of the **ES (Document Reference 6.3)** confirms the drainage strategy for the Scheme complies with LLFA design criteria.

Reference	Comment	Response
	limiting discharge to 5l/s minimum would be an improvement.	
2nd June 2021	Follow up meeting with LLFA. LLFA initial review of drainage strategy proposals: Discharge rates of 2l/s/ha acceptable. Arrangement of Motorway upgrades connection from south is ok with orifice plate restricting discharge to existing levels into the Scheme. Proposed groundwater monitoring programme acceptable. LLFA will need to review calculations. Further details required on management of construction runoff and watercourse pollution resulting from Temporary works.	**Appendix 13.1 (The Drainage Strategy Report)** of the **ES (Document Reference 6.3)** confirms drainage strategy for the Scheme complies with the LLFA design criteria.
Natural England		
19 January 2021	Meeting with Natural England to provide an update of the Scheme and key deliverables and discuss outcomes of the Environmental Impact Assessment (EIA) Scoping Opinion. It was highlighted that the Natural England Scoping Opinion response did not reference the requirement of a Nutrient Neutrality Assessment, however other consultee responses (Winchester City Council and South Downs National Park Authority) identified the need for consideration. Natural England agreed that there did not appear to be nutrient input pathways, however the Applicant would be required to demonstrate this within the assessments being completed to inform the ES.	A **Water Framework Directive Compliance Assessment (Document Reference 7.7)** and HEWRAT assessment**,** Appendix J of **Appendix 13.1 (Drainage Strategy Report)** of the **ES (Document Reference 6.3)** and **Appendix 13.2 (Hydrogeological Risk Assessment)** of the **ES (Document Reference 6.3)** has been completed which considered nutrients and nutrient pathways and is reported in the **Sections 13.6** and **13.9.** **Chapter 9 (Geology and Soils)** of the **ES (Document Reference 6.1)** also considers pathway-receptors in relation to geology and groundwater.

13.3 Legislative, policy framework and guidance

13.3.1 This assessment has been undertaken considering current legislation, together with national, regional, and local plans and policies. A list is provided below, and further detail regarding National Policy can be found in the **Case for the Scheme (Document Reference 7.1)** and **National Networks National Policy Statement Accordance Table (Document Reference 7.2)**:

- Environmental Protection Act 1990
- Environment Act 1995
- The Water Resources Act 1991
- Land Drainage Act 1991
- Flood and Water Management Act 2010
- Water Act 2014
- The Flood Risk Regulations 2009
- Water Framework Directive (Standards and Classifications) Directions 2015
- The Groundwater (Water Framework Directive) (England) Direction 2016
- Water Environment (Water Framework Directive (England and Wales) Regulations 2017
- Environmental Permitting (England and Wales) (Amendment) (EU Exit) Regulations 2019
- National Policy Statement for National Networks (2014)
- National Planning Policy Framework 'Planning Practice Guidance' (2021)
- Environment Agency Flood Risk Assessments: Climate Change Allowances guidance released February 2016 (Updated 2021)
- South East River Basin Management Plan (RBMP) (2016)
- Winchester City Council Strategic Flood Risk Assessment (SFRA) (2007)
- Hampshire Minerals and Waste Plan (2013)
- Winchester District Local Plan Part 1 – Joint Core Strategy (2013)
- South Downs National Park Authority Water Cycle Study and SFRA (2015)
- Winchester District Local Plan Part 2 – Development Management and Site Allocations (2017)

- Hampshire County Council Preliminary Flood Risk Assessment (PFRA)(2011) and 2017 review
- Hampshire County Council SuDS Design Guide (2018)
- Winchester District Draft Local Plan 2018-2038 (emerging)
- South Downs Local Plan (2019)

13.3.2 In addition to the legislation and national and local planning policies listed above, this assessment has also been carried out in accordance with the following professional standards and guidance:

- C (construction) G (general information) 501 – Design of highway drainage systems
- CD (design) 356 – Design of highways structures for hydraulic action
- CD 521 – Hydraulic design of road edge surface water channels and outlets
- CD 522 – Drainage of runoff from natural catchments
- CD 532 – Vegetated drainage systems for highway runoff
- CD 530 – Design of Soakaways
- GD 301 – Smart motorways
- DMRB LA 102 Screening projects for Environmental Impact Assessment (Highways England, 2019)
- DMRB LA 104 Environmental assessment and monitoring (Highways England, 2020)
- DMRB LA 113 Road drainage and the water environment (Highways England, 2020)
- Environment Agency R&D Report P2-159/TR2 Guidance Manual for Constructed Wetlands
- Non-statutory Technical Standards for Sustainable Drainage Systems
- Rainfall Runoff Management for Developments (Report SC030219/R, October 2013)
- CIRIA Sustainable Drainage Systems (SuDS) Manual (C753)
- 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)
- Environmental good practice on site (C692)
- Groundwater control: design and practice (second edition) (C750)

13.4 Assessment methodology

Scope of the assessment

13.4.1 This chapter presents an assessment of impacts on flood risk, geomorphology (including surface Water Framework Directive water bodies), water quality and groundwater (including groundwater Water Framework Directive water bodies) during both the construction and operation of the Scheme. The assessment is based on the two main DMRB documents (others relied upon when applicable); DMRB LA 113 Road drainage and the water environment (Highways England, 2020) and DMRB LA 104 Environmental assessment and monitoring (Highways England, 2020).

Study area and baseline approach

13.4.2 The study area is defined within **Section 13.5.** Baseline data (and identification of receptors / features) is outlined in **Section 13.6.**

13.4.3 The baseline (and identification of receptors) has been informed through gathering readily available desk-based information and, requesting data from stakeholders including the Environment Agency together with the following:

- Site walkover (undertaken on 6 October 2020)
- Updated hydraulic modelling of River Itchen (based on existing Environment Agency model) undertaken in early 2021
- The **Flood Risk Assessment (Document Reference 7.4)**
- The **Water Framework Directive Compliance Assessment (Document Reference 7.7)**
- **Appendix 13.1 (Drainage Strategy Report)** (including HEWRAT assessment)) of the **ES (Document Reference 6.3)**
- **Appendix 13.2 (Hydrogeological Risk Assessment)** of the **ES (Document Reference 6.3)**
- The **Ground Investigation Report (Document Reference 7.11)**

13.4.4 Standard industry guidance for the methodology of each technical assessment/report used to inform this ES chapter has been applied e.g. the **Flood Risk Assessment (Document Reference 7.4)** was prepared in line with the NPPF and PPG to define baseline fluvial flood risk in terms of flood zones

and the **Water Framework Directive Compliance Assessment (Document Reference 7.7)** was undertaken following Planning Inspectorate's guidance on the preparation of WFD assessments for a NSIP.

Approach to design, mitigation and enhancement measures

13.4.5 The Scheme has been designed to avoid or reduce effects on road drainage and the water environment which has also shaped the results of the modelling studies and investigations described in paragraph 13.4.2. Embedded mitigation is listed within **Chapter 4 (Environmental Assessment Methodology)** of the **ES (Document Reference 6.1).** Mitigation measures have been identified with reference to *Protecting Groundwater and Preventing Groundwater Pollution Guidance (Environment Agency, March 2017)* and various *Construction Industry Research and Information Association (CIRIA)* publications which set out current best practice measures toward preventing and mitigating construction phase impacts on surface and groundwater resources in agreement with the Environment Agency and the Lead Local Flood Authority. This mitigation is also included within the **first iteration Environmental Management Pan (fiEMP) (Document Reference 7.3).**

Assessment approach - importance (value / sensitivity) of resource

13.4.6 The assessment of residual effects has been undertaken in accordance with the DMRB LA 113 Road Drainage and the Water Environment (Highways England, 2020) which outlines a number of stages. The first stage of the assessment of effects on the quality and quantity of surface and groundwaters is to give an importance to identified receptors, using the categories defined in **Table 13.2**. All water environment receptors within the study area have been reviewed against **Table 13.2** (see 13.5 for definition of study area)

Table 13.2: Estimating the importance of the water environment receptors / features

Importance	Typical Criteria	Typical Examples	
Very high	Nationally significant attribute of high importance	Surface water	Watercourse having a WFD classification shown in RBMP and Q_{95} ≥1.0m^3/s (defined as the flow equalling or exceeding 1 cubic metre per second for 95% of the flow record) Site protected/designated, such as SAC, SPA, SSSI, Ramsar site, salmonid water/Species protected by European Commission (EC) legislation
		Groundwater	Principal aquifer providing a regionally important resource and/or supporting a site

Importance	Typical Criteria	Typical Examples	
			protected under EC and UK legislation DMRB LA 108 Biodiversity (Highways England, 2020) Groundwater locally supports Ground Water Dependent Terrestrial Ecosystem (GWDTE) SPZ1
		Flood risk	Essential infrastructure or highly vulnerable development
High	Locally significant attribute of high importance	Surface water	Watercourse having a WFD classification shown in a RBMP and Q_{95} <1.0m^3/s Species protected under EC or UK legislation
		Groundwater	Principal aquifer providing a locally important resource or supporting a river ecosystem Groundwater locally supports GWDTE SPZ2
		Flood risk	More vulnerable development
Medium	Of moderate quality and rarity	Surface water	Watercourses not having a WFD classification shown in a RBMP and Q_{95} >0.001m^3/s
		Groundwater	Aquifer providing water for agricultural or industrial us with limited connection to surface water SPZ3
		Flood risk	Less vulnerable development
Low	Lower quality	Surface water	Watercourses not having a WFD classification shown in a RBMP and Q_{95} ≤0.001m^3/s
		Groundwater	Unproductive strata
		Flood risk	Water compatible development

Assessment approach - magnitude of impact

13.4.7 The next step is to take into account the likely magnitude of environmental change (or impact) caused by the Scheme. Definitions are provided in **Table 13.3** and consider the nature, scale / extent, and duration of change.

Table 13.3: Estimating the Magnitude of an Impact

Magnitude	Criteria	Typical example	
Major adverse	Results in loss of attribute and/or quality and integrity of the attribute	Surface water	Failure of both acute-soluble and chronic sediment related pollutants in HEWRAT and compliance failure with Envionmental Quality Standard (EQS) values Calculated risk of pollution from a spillage ≥2% annually (spillage assessment) Loss or extensive change to a fishery. Loss of regionally important public water supply Loss or extensive change to a designated nature conservation site Reduction in water body WFD classification
		Groundwater	Loss of, or extensive change to, an aquifer Loss of regionally important water supply Potential high risk of pollution to groundwater from routine runoff - risk score >250 (groundwater quality and runoff assessment) Calculated risk of pollution from spillages ≥2% annually (spillage assessment) Loss of, or extensive change to GWDTE or baseflow contribution to protected surface water bodies Reduction in water body WFD classification

Magnitude	Criteria	Typical example	
			Loss or significant damage to major structures through subsidence or similar effects
		Flood risk	Increase in peak flood level (>100mm)
Moderate adverse	Results in effects on integrity of attribute, or loss of part of attribute	Surface water	Failure of both acute-soluble and chronic-sediment related pollutants in HEWRAT but compliance with EQS values Calculated risk of pollution from spillages ≥1% annually and <2% annually Partial loss in productivity of a fishery Degradation of regionally important public water supply or loss of major commercial/industrial/agricultural supplies Contribution to reduction in water body WFD classification
		Groundwater	Partial loss or change to an aquifer Degradation of regionally important public water supply or loss of significant commercial/ industrial/ agricultural supplies Potential medium risk of pollution to groundwater from routine runoff - risk score 150-250 Calculated risk of pollution from spillages ≥1% annually and <2% annually Partial loss of the integrity of GWDTE Contribution to reduction in water body WFD classification Damage to major structures through subsidence or similar effects or loss of minor structures

Magnitude	Criteria	Typical example	
		Flood risk	Increase in peak flood level (> 50mm)
Minor adverse	Results in some measureable change in attributes, quality or vulnerability	Surface water	Failure of either acute-soluble or chronic sediment related pollutants in HEWRAT. Calculated risk of pollution from spillages ≥0.5% annually and <1% annually Minor effects on water supplies
		Groundwater	Potential low risk of pollution to groundwater from routine runoff - risk score <150 Calculated risk of pollution from spillages ≥0.5% annually and <1% annually Minor effects on an aquifer, GWDTEs, abstractions and structures
		Flood risk	Increase in peak flood level (>10mm)
Negligible	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity	The proposed project is unlikely to affect the integrity of the water environment	
		Surface water	No risk identified by HEWRAT (pass both acute-soluble and chronic-sediment related pollutants) Risk of pollution from spillages <0.5%
		Groundwater	No measurable impact upon an aquifer and/or groundwater receptors and risk of pollution from spillages <0.5%
		Flood risk	Negligible change to peak flood level (≤ +/- 10mm)
Minor beneficial	Results in some beneficial effect on attribute or a reduced risk	Surface water	HEWRAT assessment of either acute soluble or chronic-sediment related pollutants becomes pass from an existing site where the baseline was a fail condition

Magnitude	Criteria	Typical example	
	of negative effect occurring		Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is <1% annually)
		Groundwater	Calculated reduction in existing spillage risk by 50% or more to an aquifer (when existing spillage risk <1% annually) Reduction of groundwater hazards to existing structures Reductions in waterlogging and groundwater flooding
		Flood risk	Creation of flood storage and decrease in peak flood level (> 10mm)
Moderate beneficial	Results in moderate improvement of attribute quality	Surface water	HEWRAT assessment of both acute-soluble and chronic-sediment related pollutants becomes pass from an existing site where the baseline was a fair condition Calculated reduction in existing spillage by 50% or more (when existing spillage risk >1% annually) Contribution to improvement in water body WFD classification
		Groundwater	Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is >1% annually) Contribution to improvement in water body WFD classification Improvement in water body Catchment Abstraction Management Strategy (CAMS) (or equivalent) classification Support to significant improvements in damaged GWDTE

Magnitude	Criteria	Typical example	
		Flood risk	Creation of flood storage and decrease in peak flood level (>50mm)
Major beneficial	Results in major improvement of attribute quality	Surface water	Removal of existing polluting discharge, or removing the likelihood of polluting discharges occurring to a watercourse Improvement in water body WFD classification
		Groundwater	Removal of existing polluting discharge to an aquifer or removing the likelihood of polluting discharges occurring Recharge of an aquifer Improvement in water body WFD classification
		Flood risk	Creation of flood storage and decrease in peak flood level (> 100mm)
No change		No loss or alteration of characteristics, features or elements; no observable impact in either direction.	

Assessment approach - significance of effect

13.4.8 The overall significance of effects is then derived by combining the importance of the receptor with the magnitude of the impact (change). Where more than one effect is possible, professional judgement is used to determine which is most appropriate on a case-by-case basis and ensuring regard to the precautionary principle.

Table 13.4 Interpretation of significance matrix from DMRB LA 104 Environmental Assessment and Monitoring (Highways England, 2020)

Importance	Magnitude of impact				
	No change	Negligible	Minor	Moderate	Major
Very High	Neutral	Slight	Moderate or large	Large or very large	Very large
High	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large

Importance	Magnitude of impact				
	No change	Negligible	Minor	Moderate	Major
Medium	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
Low	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
Negligible	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

13.4.9 Effects have been assigned using the criteria in **Tables 13.3** to **13.5**. These are residual effects after mitigation embedded etc have been taken into consideration to prevent or reduce effects, best practice construction methods and bespoke additional mitigation identified as necessary by the flood modelling study.

13.4.10 Effects assigned an overall significance of Neutral to Slight are considered to be 'non-significant'. Moderate, Large and Very Large effects are considered 'significant' for the purposes of EIA.

Reasonable worse case parameters for assessment

13.4.11 The assessment has been conducted within the Limits of Deviation (LoD) outlined within **Chapter 2 (The Scheme and its Surroundings)** of the **ES (Document Reference 6.1)**. The vertical and lateral LoD for the Scheme have been reviewed with respect to sensitive receptors identified within this ES chapter. The vertical and lateral LoD would not affect the conclusions of the assessment reported in this chapter.

Assessment assumptions and limitations

13.4.12 The information presented in this chapter is based on the information available at the time of writing the ES chapter and the design information available.

13.4.13 This chapter is based on desk and site-based assessment and hydraulic modelling. Limited groundwater quality monitoring has been undertaken.

13.4.14 Each of the key appendices - **Appendix 13.1 (Drainage Strategy Report)** of the **ES (Document Reference 6.3)** and **Appendix 13.2 (Hydrogeological Risk Assessment)** of the **ES (Document Reference 6.3)** individually list their own assumptions and limitations.

13.4.15 The assessment reported in this chapter draws on the findings of the initial ground investigation works undertaken to inform the design, which did not cover the entire Application Boundary. However, it is considered that the ground

investigation works undertaken provide sufficient detail at this stage to allow a robust assessment of potential impacts which have been reported in this ES chapter.

13.4.16 It should also be noted that groundwater levels, groundwater chemistry, surface water levels, surface water chemistry, can vary due to seasonal, climatic and man-made effects.

13.4.17 A provisional design infiltration rate of 1 x 10^{-6} m/s has been assumed within the chalk bedrock based on an interpretative assessment of percolation rates obtained during previous geotechnical test results. The same infiltration rate of 1 x 10^{-6} m/s has been assumed to be present in superficial deposits overlying the chalk bedrock. This infiltration rate has been assumed in the design of the drainage strategy for the permanent works and is considered to be supported by baseline data gathered to date.

13.4.18 It is acknowledged that uncertainty is inherent in the assessment of interaction between surface water and groundwater. However the collected data have enhanced the understanding of the current and future conditions and are reported in the ES.

13.4.19 The findings and interpretation of additional intrusive works would be undertaken to inform the detailed design and would be available to support the discharge of relevant Development Consent Order (DCO) requirements. This information would be incorporated into the Environmental Management Plan (EMP) to add further detail to environmental control measures where necessary – this is secured within the **fiEMP** (**Document Reference 7.3**).

13.5 Study area

13.5.1 The overall study area has been defined by considering the Zone of Influence (the distance the Scheme could cause effects based on professional judgement), professional judgement and the hydrological connectivity of land within the Application Boundary (through direct pathways or indirect such as migration of surface-borne pollutants). The study area comprises the Application Boundary, plus a buffer zone of 1km. A 500m buffer zone was proposed within the EIA Scoping Report. This has been increased to 1km for the ES Assessment in response to EA comments received during statutory consultation and further review of the Zone of Influence.

13.5.2 DMRB LA 104 Environmental Assessment and Monitoring (Highways England, 2020) and LA 113 Road Drainage and the Water Environment Highways England, 2020) does not specify a minimum / maximum study area distance for the assessment of impacts to road drainage and the water environment but supports the development of a scheme specific study area.

13.5.3 The 1km buffer (i.e. considered Zone of Influence) is considered a suitable extent to assess direct potential impacts as well as encompassing indirect pathways, such as the migration of surface-borne pollutants, and the effects of any prolonged interception of groundwater flows. The study area encompasses

surface water and groundwater features and associated uses, located up to 1km from the Application Boundary. Land within the study area is considered to be in hydraulic connectivity with the Scheme to assess potential indirect impacts. The study area is based on the source-pathway-receptor' pollutant linkage principle. A 1km study area is considered appropriate for the assessment of surface water and groundwater quality soluble pollutants (direct and indirect pathways) as beyond this dilution would be expected to occur and therefore reduce potential impacts.

13.5.4 Although located further than 1km from the Application Boundary, the River Itchen Navigation Canal (a heavily modified water body located just under 5km to the south of the site) has been included in this assessment due to its status as a WFD designated waterbody.

13.5.5 **Figure 13.1 (Study Area and Receptors)** of the **ES (Document Reference 6.2)** presents the study area considered within this chapter.

13.6 Baseline conditions

13.6.1 A description of the land within the Application Boundary and the surrounding land use is provided in **Chapter 2 (The Scheme and its Surroundings)** of the **ES (Document Reference 6.1)**.

13.6.2 This baseline section describes the existing condition of surface waters, groundwater, and flood risk within the study area. The following key data sources and technical assessments have been used to inform a description of the existing water environment baseline conditions:

- Observations from site walkover surveys (October 2020)
- Site specific topographical survey (2020)
- British Geological Survey mapping (BGS) (BGS, 2020)
- Magic Map (DEFRA, 2020)
- Flood Map for Planning (Environment Agency, 2020)
- Long Term Flood Risk (Environment Agency, 2020)
- Historic Flood Map (Environment Agency, 2020)
- South East River Basin Management Plan (Environment Agency, 2015)
- Test and Itchen Catchment Flood Management Plan (Environment Agency, 2009)
- South Downs National Park Authority Water Cycle Study SFRA Level 1 (AMEC, 2015)
- Winchester City Council Strategic Flood Risk Assessment (Halcrow, 2007)

- HCC Hampshire Groundwater Management Plan (Hampshire County Council, 2013)
- National Highway's Drainage Data Management System (HADDMS)
- River Itchen Modelling Study (Environment Agency, 2019)
- Ground Investigation (Soils Limited 2020 and Stantec 2021)
- Updated River Itchen Hydraulic Modelling Study (Stantec, 2021)
- **Flood Risk Assessment (Document Reference 7.4)**
- **Water Framework Directive Compliance Assessment (Document Reference 7.7)**
- **Appendix 13.1 (Drainage Strategy Report)** of the **ES (Document Reference 6.3)**
- **Appendix 13.2 (Hydrogeological Risk Assessment)** of the **ES (Document Reference 6.3)**
- **Ground Investigation Report (Document Reference 7.11)**

13.6.3 Key features i.e., watercourses, groundwater WFD waterbody are identified in **Figure 13.1 (Study Area and Receptors)** of the **ES (Document Reference 6.2)**.

Surface water features

13.6.4 The Scheme alignment crosses the River Itchen at three locations, along the A34, A33 and M3. The Scheme also crosses one of the River Itchen's tributaries, the Nun's Walk Stream, which is crossed by the A34.

13.6.5 The River Itchen and the Nun's Walk Stream are classified as 'Main Rivers' and therefore regulated by the Environment Agency. The River Itchen also has a separate arm called the River Itchen Navigation Canal, located approximately 5km downstream of the site. The River Itchen Navigation Canal has been heavily modified and forms part of the floodplain of the River Itchen.

13.6.6 The River Itchen flows in a channel in a south-westerly direction and comprises several tributaries and land drains. There are also a number of ditches, ponds, wetlands, and ordinary watercourses associated with this floodplain.

13.6.7 All other watercourse channels and ditches within the Application Boundary are either highway drainage ditches alongside the A33 and A34 highway embankments or are ditches draining pasture. All watercourse channels and highway ditches are confirmed by Hampshire County Council (LLFA) as Ordinary Watercourses under their responsibility. Ditches that drain the A33/A34 highways are also recorded as National Highways drainage assets on the HADDMS online asset database.

13.6.8 All watercourses within the study area form part of the Test and Itchen *Catchment Flood Management Plan (CFMP) (Environment Agency, 2009)* and the *South East River Basin District RBMP (Environment Agency, 2015)*.

Rainfall and recharge

13.6.9 **Appendix 13.2 (Hydrogeological Risk Assessment)** of the **ES (Document Reference 6.3)** states that the Standard Average Annual Rainfall (SAAR) for the area around the River Itchen at Easton River monitoring point (42016) is 848 mm (National River Flow Archive, 2021).

13.6.10 According to the *National River Flow Archive* the mean flow data of the River Itchen upstream of the Application Area (location 42016 - Itchen at Easton) is 4.239 m3/s. Downstream of the Application Area (location 42010 - Itchen at Highbridge & Allbrook Total) mean flow is 5.539 m3/s, implying that the River gains within the Application Boundary. At both locations there is evidence of substantial surface and groundwater abstraction and the presence of cress beds and fish farms. The baseflow index (BFIHOST) at the River Itchen at Easton is 0.95, indicating that it is almost entirely groundwater fed.

Surface water environment designations and water framework directive classifications

13.6.11 The River Itchen catchment area is designated as a SAC and SSSI, both of which are situated within the study area. The River Itchen SAC is designated for its riverine habitats and species. The SSSI is designated due to the complex mosaic of riparian habitats it supports including the chalk stream and associated fen meadow, flood pasture and swamp habitats. Unlike the SAC, the SSSI designation also includes some of the habitats adjacent to the river channel including the historic water meadow habitats.

13.6.12 The River Itchen also flows into the Southampton and Solent Water SPA and Ramsar site, located approximately 16km downstream of the Scheme, where the River Itchen discharges into the Solent.

13.6.13 The River Itchen also flows through the South Downs National Park. The River Itchen floodplains forms part of the River Itchen SSSI, and much of the floodplain is lowland fen wetland priority habitat. The floodplain is anticipated to protect in excess of 100 properties in Winchester and Kings Worthy from flooding (CFMP and RBMP).

13.6.14 The quality of the River Itchen and the Nun's Walk Stream is monitored by the Environment Agency against the objectives of the WFD. There are two WFD designated water bodies in the vicinity of the Scheme: the River Itchen (GB107042022580) and Nun's Walk Stream (GB107042022730). Both water bodies are currently classified as at overall 'Moderate' status, with 'Good' ecological status, but 'Fail' chemical status (Cycle 2, 2019). The future WFD objective cycle (Cycle 3 for years 2021 – 2027) for both WFD surface water bodies is to achieve overall 'Good' status. The Scheme is underlain by the River Itchen Chalk WFD groundwater body (GB40701G505000), which is currently at

'Poor' overall status, with 'Poor' status for both quantitative and chemical elements (Cycle 2, 2019). The future Cycle 3 objective for the WFD groundwater body is to achieve overall 'Good' status.

13.6.15 The River Itchen Navigation Canal is designated as a heavily modified waterbody and is located approximately 5km downstream of the Scheme (southern extent). It is currently classified as at overall Moderate status with 'Good' ecological status, but 'Fail' chemical status (Cycle 2, 2019). The future Cycle 3 objective for this WFD surface water body is to achieve overall 'Good' status.

Existing surface water drainage

13.6.16 The HADDMS has Priority Asset Registers that identify existing outfalls, culverts and soakaways that potentially pose a risk of pollution or flooding. There are 17 Priority Outfalls from the National Highways network to the River Itchen catchment within the study area and numerous soakaway chambers and soakaway trenches. The database also identifies four surface water Priority Culverts. Existing highway catchments and outfalls are shown in dwg HE551511-VFK-HDG-X_XXXX_XX-DR-CD-0515_Existing Catchment Overview Plan, which is included in **Appendix F** of **Appendix 13.1 (Drainage Strategy Report)** of the **ES (Document Reference 6.3)**.

13.6.17 The majority of the Application Boundary area lies to the south of the River Itchen and includes cuttings and drains to soakage features.

13.6.18 The area of existing M3 Junction 9 carriageway and cuttings area, which comprises 3.4 ha of A33/A34 carriageway to the north of the River Itchen and immediately south of the River Itchen, drains to the River Itchen or its immediate floodplain, via highway drainage ditches.

13.6.19 Existing highway soakaways serving the M3 Junction 9 mainline carriageway, verge and diverge lanes and gyratory are maintained by National Highways. Soakaway features draining two carriageways off the M3 Junction 9 gyratory fall under HCC's ownership; Easton Lane (south-west exit); and the A272 Spitfire Link Road (eastern exit).

13.6.20 The HADDMS shows the condition status of all existing highway soakaways as 'low risk' or 'risk addressed'.

13.6.21 One pollution control device (PCD) exists close to the gyratory roundabout and is located just upstream of the only river outfall (Outfall 8 on Existing Catchment Overview Plan HE551511-VFK-HDG-X_XXXX_XX-DR-CD-0515 P01) of the **Appendix 13.1 (Drainage Strategy Report)** of the **ES (Document Reference 6.3)** from the existing M3 Junction 9 drained area. The PCD serves Existing Catchment 8, the A33 southbound approach to M3 Junction 9 from the north-west, on the southern bank of the River Itchen. The PCD comprises an open ditch of approximately 60m3 capacity, which terminates in a penstock, a full-retention interceptor and a 300m diameter piped outfall to the River Itchen. The PCD is intended to be retained, subject to inspection and renovation.

13.6.22 Existing overland flows from South Downs National Park to the east of M3 Junction 9 are captured in soakaway trenches against the eastern side of the M3 earthworks or piped under the M3 corridor via an existing 300mm diameter culvert.

13.6.23 The greatest concentration of drained area to a single soakage feature (4.1 ha), is the M3 mainline corridor, which currently drains to a single existing soakaway ditch running parallel to the M3, which lies to the north of the National Highway depot and west of the M3. This location is the most sensitive location for the concentration of contaminated highway runoff within the existing scheme, in terms of traffic volume and drainage ratio (drained area/infiltration area).

Pollution risk

13.6.24 An assessment of the baseline pollution risk associated with the existing critical-case soakage ditch to the water environment receptors has been undertaken. Categories of pollution considered in the Pollution Prevention Report (2021) appended to the **Appendix 13.1 (Drainage Strategy Report)** of the **ES (Document Reference 6.3)** are listed below (along with assessment method):

- Copper, Zinc, Cadmium, Total Polyaromatic Hydrocarbons (PAH), Pyrene, Fluoranthene, Anthracene, Phenanthrene, which are the suite of contaminants in the Highway England Water Risk Assessment Tool v. 2.0.4 (HEWRAT)
- Total Suspended Solids (TSS) (assessed through HEWRAT)
- HGV-load spillage (unspecified liquids) (assessed through HEWRAT)
- Microplastics (MPs) (assessed through review of current research and application of qualitative source-pathway-receptor assessment)

13.6.25 The baseline pollution risk to groundwater from runoff and HGV-load spillage, via the existing M3 infiltration drainage measures was undertaken for the existing critical-case soakage ditch.

13.6.26 The HEWRAT groundwater screening results indicate that:

- the existing soakaway ditch risk to groundwater is in the high end of the Medium category, bordering the High category (scoring 245 out of 250)
- The existing return period probability for a spillage incident on the existing M3 corridor is 1 in 297 years, which would pass the 1 in 200-year return period risk expected by the Environment Agency in the context of the adjacent River Itchen SAC

13.6.27 In order to establish the baseline pollution risk to the River Itchen from existing runoff, a HEWRAT assessment in **Appendix J** of **Appendix 13.1** (**Drainage Strategy Report**) of the **ES** (**Document Reference 6.3**) has been undertaken for the existing discharge point; an outfall adjacent to the A34/A33 road bridges.

This indicated that the existing discharge to the River Itchen does not result in an unacceptable risk of pollution due to the exceedance of thresholds set for soluble contaminants or sediments, as defined in HEWRAT.

13.6.28 There are no specific existing mitigation measures for the settlement and filtration of Microplastics (MPs), or for the removal of MP-loaded sediments, within the existing drainage infrastructure. Although not confirmed, it is likely that a source-pathway-receptor evaluation would find that the pathway taken by most of the existing MP load in highway runoff would terminate in sediments in filter trenches and soakaways.

Groundwater features: geology

13.6.29 The **Ground Investigation Report (Document Reference 7.11)** confirms that the Scheme is underlain by bedrock geology of the Seaford Chalk Formation, which is described (by BGS online viewer definitions) as “firm white chalk with conspicuous semi-continuous nodular and tabular flint seams”. This chalk is itself underlain by the Lewes Nodular Chalk Formation, which is described as “composed of hard to very hard nodular chalks and hardgrounds, with interbedded soft to medium hard chalks” on the BGS online viewer.

13.6.30 Superficial deposits are limited across the study area. Superficial alluvium, river terrace and head deposits (comprising clay, silt, sand, and gravel) are present in close proximity to the River Itchen, within the extent of the river floodplain and adjacent riverbanks.

Groundwater Features: Hydrogeology

13.6.31 The **Ground Investigation Report (Document Reference 7.11)** confirms that both the Seaford Chalk and the Lewes Chalk strata are classified as Principal Aquifers. A Principal Aquifer is designated by the Environment Agency as layers of rock or drift deposits that have high intergranular and/or fracture permeability, meaning they usually provide a high level of water storage. These layers of rock or drift deposits may support water supply and/or river base flow on a strategic scale.

13.6.32 The Alluvium and River Terrace Deposits are classified as a Secondary A Aquifer by the *Environment Agency (DEFRA, 2020)*. A Secondary A Aquifer is defined as permeable layers of rock capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. The Head Deposits are classified as *Secondary Aquifer (undifferentiated) (DEFRA, 2020)*.

13.6.33 Groundwater monitoring undertaken during the ground investigation completed in 2019 identified that groundwater levels are a typical level of 37.5m Above Ordnance Datum (AOD) across the central part of the Application Boundary, with 38m AOD the approximate water level in the River Itchen. Full details of groundwater levels can be found in the **Appendix 13.2 (Hydrogeological Risk Assessment)** of the **ES (Document Reference 6.3)**.

13.6.34 Outside of the Source Protection Zone areas, groundwater flow in the Chalk is towards, and discharges to (via the superficial deposits), the River Itchen.

13.6.35 A provisional design infiltration rate of 1 x 10-6 m /s has been estimated within the chalk bedrock, based on an interpretative assessment of percolation rates obtained during previous geotechnical test results. The same infiltration rate of 1 x 10-6 m/s has been assumed to be present in superficial deposits overlying the chalk bedrock as this is reflective of the ground investigation results.

13.6.36 The River Itchen is a baseflow-dominated chalk stream, fed by three major tributaries in its upper reaches: the Candover Stream, River Alre and Cheriton Stream. The River Itchen catchment has undergone significant modification over centuries (including the construction of the downstream Itchen Navigation which was completed in 1710), which has had a lasting impact on the fluvial geomorphology of the river. Modifications include re-alignment and/or deepening for land drainage and the construction of a variety of sluices and artificial channels for navigation, milling and to feed water meadows.

13.6.37 Notwithstanding, the river mainly retains the chalk stream geomorphological characteristics (low energy, high width to depth ratio, gravel bed with abundant macrophyte growth) and water quality characteristics required to support the features for which it is designated.

Groundwater features: water quality

13.6.38 The Scheme lies within a Groundwater Vulnerability Zone of 'High'. These areas are able to easily transmit pollution to groundwater. They are characterised by high leaching soils and the absence of low permeability superficial deposits.

13.6.39 The Tier 2 Controlled Waters Risk Assessment included in the **Ground Investigation Report (Document Reference 7.11)**, identified one exceedance of copper, two exceedances of mercury, one exceedance of nickel and one exceedance of zinc against the EQS. Furthermore, the limit of detections for cadmium, hexavalent chromium, copper, lead and cyanide are above the EQS. It also identified one exceedance of mercury, one exceedance of nickel and two exceedances of nitrate compared to the *UK Drinking Water Standards (DWS)*. The nitrate exceedances were from wells sampling from the rural catchment to the east of the Scheme and the metal exceedances were from wells sampling close to historical landfills.

Groundwater features: WFD classifications

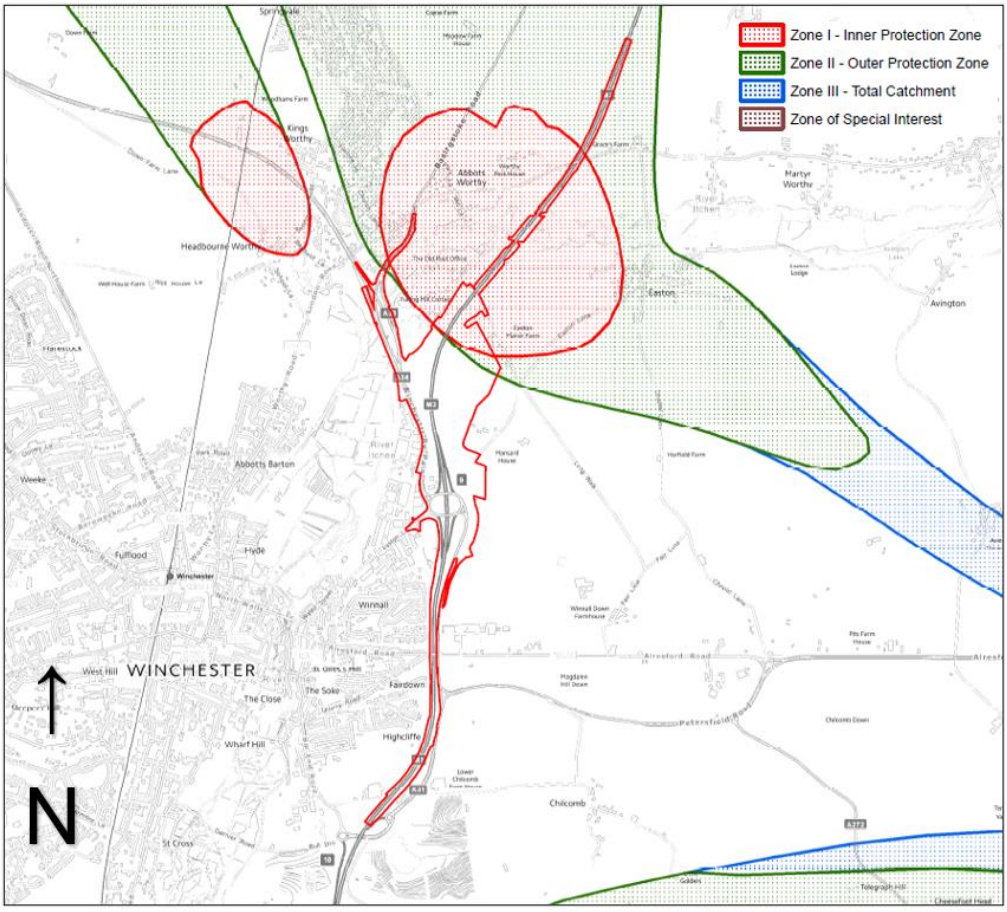
13.6.40 Groundwater in the study area has been assessed against the objectives of the WFD. The *RBMP (Environment Agency, 2015)* identifies the groundwater body underlying the Scheme to be the River Itchen Chalk Groundwater Body (GB40701G505000). The quality of the River Itchen Chalk is monitored by the Environment Agency against the objectives of the WFD. The groundwater body is currently (Cycle 2, 2019) classified as at overall 'Poor' status, with 'Poor' quantitative quality and chemical status. The reasons for the River Itchen Chalk

achieving a 'Poor' status are recorded on the *Environment Agency's Catchment Data Explorer* to be local agriculture and rural land management practices.

Groundwater features: groundwater abstractions

13.6.41 Review of the *Environment Agency SPZ* map shows that the northern parts of the M3 and the A34 within the Application Boundary traverse areas that are classified as SPZ 1: inner zones (50 day travel time of pollutant to source with a 50m default minimum radius) and SPZ 2: outer zone (400 day travel time of pollution to sources, with a 250m or 500m minimum radius around the source depending on the amount of water taken) and therefore at these locations there is a reduced travel time for water to travel through the underlying geology. The SPZ's are shown on **Inset 13.1**.

Inset 13.1: Environment Agency groundwater Source Protection Zones



13.6.42 The SPZs are used by the Environment Agency as screening tools to identify those areas where it would object in principle to certain potentially polluting activities, or other activities that could damage groundwater and/or where additional controls or restrictions on activities may be needed to protect water intended for human consumption. Zone 1 is the most sensitive of these protective areas and indicates the zone in which contamination released to the ground could reach the point of abstraction within 50 days. Zone 2 similarly

defines a travel time of 400 days. Typically discharges of road drainage should be outside SPZ 1 and should be avoided within SPZ 2.

13.6.43 There are multiple public groundwater abstractions to the north and south of the Application Boundary. The majority of groundwater abstractions to the north are for potable water supply, with the abstractions to the south and west primarily used for water cress production and other agricultural purposes, see **Appendix 13.2 (Hydrogeological Risk Assessment)** of the **ES (Document Reference 6.3)**.

13.6.44 Given the groundwater divide between the River Itchen and adjacent public boreholes to the west and north, there is no hydrological connectivity from the land within the Application Boundary to these boreholes. Therefore, they are not considered further.

13.6.45 There are nine boreholes used for private water supplies, all of which are currently active and abstract from the underlying chalk aquifer. Since all of the private water supplies are on the western and northern side of the River Itchen, upgradient, or across gradient at a sufficient distance of the Scheme, they would have a negligible impact and are not considered further here.

13.6.46 **Table 3.15** in **Appendix 13.2 (Hydrogeological Risk Assessment)** of the **ES (Document Reference 6.3)** lists all licensed groundwater and surface water abstractions within 2km of the Application Boundary.

Flood risk: fluvial

13.6.47 The *Environment Agency Flood Map for Planning* indicates that the northern and western parts of land within the Application Boundary, particularly at the A34 Winchester Bypass and M3 north of Long Walk, extend into an area designated as Flood Zone 3: area with a 1% (1 in 100) Annual Exceedance Probability (AEP) risk or greater of fluvial flooding. The designated Flood Zone 3 area is associated with the River Itchen and its tributaries.

13.6.48 The northern and western part of the Application Boundary also extends into a Flood Zone 2 area: risk between a 0.1% (1 in 1000) and 1% (1 in 100) AEP of fluvial flooding. The remainder of the study area is situated within Flood Zone 1: less than 0.1% (1 in 1000) AEP risk of flooding.

13.6.49 The flood zones referred to above are shown in **Figure 13.1 (Study Area and Receptors)** of the **ES (Document Reference 6.2)**.

13.6.50 Site specific topographical survey was collected to inform the assessment. The existing *Environment Agency 2019 River Itchen model* (as provided by the Environment Agency) was updated to refine flood risk within the Application Boundary and to inform the design of Scheme in relation to the new bridge crossing of the Itchen and the location and design of surface water drainage features. Flood levels were almost identical to previous existing modelled flood levels.

Flood risk: tidal

13.6.51 The Scheme is not located within an area at risk of tidal flooding and therefore tidal flooding is not considered further.

Flood risk: surface water (pluvial)

13.6.52 *The Risk of Flooding from Surface Water (RoFSW) map* (EA Opensource Data) details that the study area is predominantly within an area at very low risk: less than 0.1% (1 in 1000) AEP of surface water flooding.

13.6.53 The *RoFSW map* identifies those parts of the M3 and slip roads at Junction 9 have a high: greater than 3.3% (1 in 30) AEP surface water flood risk.

13.6.54 *The RoFSW mapping* also identifies that there are several overland flow routes and isolated areas of ponding within the study area with a high: greater than 3.3% (1 in 30) AEP, to low: between 0.1% (1 in 1000) and 1% (1 in 100) AEP, risk of surface water flooding. These areas of flood risk are generally associated with topographic depressions within the fields to the east or where existing infrastructure (highways and residential development) causes an obstruction to natural overland flow paths.

13.6.55 There are several low-lying areas adjacent to watercourses to the west of the Scheme that are also shown to be at risk of surface water flooding. The flood risk associated with these areas are captured in the Fluvial section above.

Flood risk: groundwater

13.6.56 *The South Downs National Park Authority Water Cycle Study* and *SFRA Level 1 (AMEC, 2015) Groundwater Flood Risk Map* indicates a variable susceptibility to groundwater flooding within the study area. The level of risk ranges from high (>75% based on a 1km square grid area) to low (25 – 50% based on a 1km square grid area) susceptibility; from south (M3/A34 crossing) to north of the Scheme. There are areas identified to be of high groundwater flood risk within the study area to the south-west and north-east of the Scheme. The areas of greatest risk are generally at close proximity to the River Itchen and its tributaries.

13.6.57 *Winchester City Council SFRA (Halcrow, 2007)* states that there is a high proportion of chalk within the Winchester District. These geological conditions and the high-water table increase susceptibility to groundwater flooding. The *SFRA* details that flooding from a combination of sources including groundwater has occurred in Winchester, however there are no records of flooding occurring from groundwater only.

13.6.58 *The Hampshire Groundwater Management Plan (Hampshire County Council, 2013a)* identified areas throughout the county at risk of groundwater flooding. Kings Worthy village, located north of the A34, showed a significant history of groundwater flooding (21 properties flooded in 2000/2001) and continued susceptibility to this flood risk.

13.6.59 Groundwater levels were recorded as steady in three locations, at approximately 38m AOD, which is the approximate water level in the River Itchen at this location. The lowest existing carriageway level in the floodplain is approximately 40m AOD and therefore is considered to be at a low risk of groundwater flooding.

Flood risk: reservoir

13.6.60 The Environment Agency provides mapping (open source EA data) that gives an indication of the areas at risk of flooding due to reservoir failure. The northern extent of the Scheme Application Boundary is identified to be at risk of flooding, likely to be in the event of a failure of Old Alresford Pond. The mapped reservoir flood extents shown in Appendix A of the **Flood Risk Assessment (Document Reference 7.4)** are indicated to be similar to the fluvial flood extents, associated with the River Itchen.

Flood risk: historic flood events

13.6.61 The Environment Agency's Historic Flood Map identifies maximum extent of recorded flood outlines from the rivers, sea and groundwater springs. A review of the map identifies no recorded historic flood events within the Scheme Application Boundary, although there are areas of historic flooding recorded with the study area (Kings Worthy area immediately north-east of the A34) with most common source being groundwater, however this did not encroach on the road network.

13.6.62 Winchester City Council SFRA (Halcrow, 2007) identifies that there are historic flood records dating from 1997 to 2006 within the Winchester City Council local authority area; the source is identified to be a combination of groundwater, fluvial flooding and foul/combined systems. The nearest recorded flood report to the Scheme is approximately 750m south-west on Wales Street; flooding is reported to have occurred from sewer flooding (date not specified).

Flood risk: other flood sources

13.6.63 The Environment Agency Flood Map for Planning (Environment Agency, 2020a) highlights that there are no areas benefiting from flood defences within the vicinity of the Scheme and therefore no flood risk due to defence failure has been identified.

Assessment of value

13.6.64 **Table 13.5** summarises the assessment of the importance of water environment receptors within the study area in line with **Table 13.3** and as per DMRB LA 113 Road Drainage and the Water Environment (Highways England, 2020) standards. All assessed receptors are shown on **Figure 13.1 (Study Area and Receptors)** of the **ES (Document Reference 6.2)**.

Table 13.5: Water environment receptors, attributes, and value

Receptor	Value of Receptor	Explanation of Value
Surface Water – River Itchen	Very High	Watercourse having a WFD classification shown in a RBMP. Site protected/designated as a SAC, SPA, SSSI.
Surface Water – Nun's Walk Stream	High	Watercourse having a WFD classification shown in a RBMP.
Surface Water – River Itchen Navigation Canal	Very High	Watercourse having a WFD classification shown in a RBMP. Site protected/designated as a SAC.
Surface Water – Ordinary Watercourses	Medium	Watercourses not having a WFD classification shown in a RBMP.
Groundwater – River Itchen Chalk Groundwater Body (Principal Aquifers - Seaford Chalk and Lewes Chalk)	Very High	Principal Aquifers providing a regionally important resource (groundwater abstractions) and supporting a site protected under EC and UK legislation. Groundwater locally supports GWDTE. WFD designated waterbody. SPZ 1, SPZ2, SPZ3. Number of discharges via soakaways present within study area.
Groundwater – Secondary Aquifer (Alluvium and River Terrace Deposits)	Medium	No WFD designation. Secondary aquifer providing water for agricultural or industrial use with limited connection to surface water.
Flood Risk	Very High	Existing M3 Junction 9 and surrounding road network classified as 'Essential Infrastructure' under PPG. Scheme also classified as 'Essential Infrastructure'.

Baseline evolution

13.6.65 In the absence of the Scheme (no development scenario), the land uses within the Application Boundary would be retained and there would be no impacts upon road drainage or the water environment. Those areas within the Application Boundary currently in agricultural use would be retained in their current use and existing drainage regimes would continue.

13.6.66 **Appendix 15.1 (Long list of Cumulative Developments)** of the **ES (Document Reference 6.3)** provides a full list of schemes which have been identified as being likely to be in operation prior to the construction of the Scheme. These schemes form part of the future baseline scenario and have been taken into account in the assessment of likely significant effects from the Scheme (construction and operation) presented in this chapter. These schemes would not affect the baseline evolution.

13.7 Potential impacts

13.7.1 This section describes the potential impacts on the road drainage and water environment during the construction and operational phases without the implementation of mitigation measures.

Construction (including demolition works and site preparation)

13.7.2 During construction, potential impacts on surface water features, groundwater water bodies and flood risk could arise from the following activities (road drainage and water environment impacts listed after identified activity):

- **Construction and installation of drainage outfalls** - loss of floodplain storage due to temporary construction activities taking place within the watercourse channel and floodplain. Temporary reduction of flow area within River Itchen channel associated with use of portadam or cofferdam construction techniques for installation of drainage outfalls to the River Itchen potentially increasing flood risk. Construction activities taking place in close proximity to watercourses causing increased risk of water pollution. See **Appendix 2.1 (Drainage Outfall Methodology Optioneering Report)** of the **ES (Document Reference 6.3)**.

- **Construction of new foot/cycle bridge over River Itchen –** loss of floodplain storage due to temporary construction activities taking place within the watercourse channel and floodplain. Potential for temporary reduction of flow area within River Itchen channel dependent upon installation methodology chosen, potentially increasing flood risk. Construction activities taking place in close proximity to watercourses causing increased risk of water pollution

- **Modifications to Kings Worthy Bridge –** potential for temporary reduction of flow area within River Itchen channel dependent upon installation methodology chosen, potentially increasing flood risk. Construction activities

taking place in close proximity to watercourses causing increased risk of water pollution.

- **Increased surface water runoff from construction activity –** changes in surface water flow paths, either blocking existing or creating new flow paths, resulting in increased flood risk elsewhere.

- **Introduction of impervious structures and movement of and storage of earth material –** causing interception of overland surface water runoff potentially leading to an impact of disrupting local flow routes and increasing surface water flood risk.

- **Groundwater/chalk aquifer pathways altered from construction activity –** potential impact on hydrogeology. Local hydrogeology and groundwater resources affected through changes to groundwater levels, flows, pathways, and quality arising from construction activities, piling, construction of earthworks, ground investigations creating new flow paths for groundwater. Construction in the chalk has the potential to encounter solution features. Interception of the groundwater table potentially altering groundwater flow and increasing local groundwater flood risk.

- **Potential for fuel/chemical spillages –** potential impact of increased pollution risks from harmful substances which may be stored on or within the Application Boundary or from historic contaminants, or new contaminants (e.g., chemicals and fuels) causing an adverse effect on water quality.

- **Potential for mobilisation and deposition of fine materials** (e.g., sand and silts) **–** use of machinery and vehicles and increased sediment loading from localised changes to catchment hydrology (e.g., compaction of soil surfaces) causing an impact on water quality from an increased risk of water pollution from silt and debris. Construction debris and silt materials could also potentially block drainage systems potentially resulting in overflowing drains and increased surface water flood risk.

- **Increase in impermeable surfacing due to site compound and temporary haul roads –** resulting in increased surface water runoff and increased risk of flooding.

- **Construction activities associated with temporary works partly located in the floodplain –** impact of increased flood risk to workers.

- **Vegetation management –** clearance of riparian and in-channel vegetation during construction, for instance in vicinity of new drainage outfalls. This could result in an impact on water quality by increased sediment entering watercourses.

- **Discharge of abstracted water from construction activities –** potentially could give rise to increased flood risk or impact on water quality if discharging contaminated waters to ground via re-injection (or possible soakaway) without treatment.

13.7.3 Any impact on water quality could have implications for abstractions downstream and WFD compliance.

Operation

13.7.4 During operation, it is considered likely that potential impacts to surface water features, groundwater features and flood risk could arise from the following activities (road drainage and water environment impacts listed in the bullet points):

- **New watercourse crossing –** if floodplain storage/flow area reduced at proposed new Itchen bridge then could result in the potential impact of increased flood levels and an increase in flood risk.
- **Increase in impermeable area –** increased surface water runoff (peak rates and volumes) leading to increased flood risk. Increase in impermeable area also leading to higher chance of pollutants reaching the watercourses (surface and groundwater receptors) (e.g., suspended solids, de-icing materials, heavy metals and hydrocarbons) causing increased risk of downstream pollution.
- **Permanent surface water drainage features –** increased groundwater pollution risks from specific surface water drainage features such as soakaways, notably those installed and operating in the near vicinity of SPZ designated areas and/or catchment areas of licensed and unlicensed groundwater abstractions.
- **Continued operational road use –** increased pollution risks from routine surface water runoff, primarily consisting of silts, hydrocarbons and dissolved heavy metals and increased risk of accidental spillage incidents (including road collisions with heavy goods vehicles and potential spillage of fuels) causing increased risk of downstream pollution for surface and groundwater receptors including abstractions.
- **Change in ground surface cover and introduction of new surface water drainage systems –** could lead to a change in rate of recharge of aquifers.

13.8 Design, mitigation, and enhancement measures

13.8.1 Mitigation measures incorporated into the design of the Scheme are reported as embedded mitigation in **Chapter 4 (Environmental Assessment Methodology)** of the **ES (Document Reference 6.1)**, those relevant to road drainage and the water environment are included below. This section also outlines essential mitigation required. Essential mitigation is outlined within the **fiEMP (Document Reference 7.3).** Prior to the implementation of mitigation, the Scheme has the potential to have road drainage and water environment impacts during construction and operation, both beneficial and adverse.

Embedded mitigation

Construction (including demolition works and site preparation)

13.8.2 The new bridge (footway and cycleway) over the River Itchen has been designed to be a clear span structure with abutments set back from the river channel and has been designed to ensure no construction works are required within the river channel.

13.8.3 No intrusive temporary construction measures are proposed within the River Itchen to facilitate cleaning of an existing headwall and installation of two new headwalls to serve the operational drainage strategy or works proposed to Kings Worthy Bridge and the new bridge over the River Itchen.

13.8.4 It is envisaged that piled foundations would be pre-cast to seek to avoid the use of wet concrete reaching the river system through ground fissures. Timber and steel are being considered for the proposed structure, which would be lifted into place as a pre-constructed item with the crane situated on the adjacent highway.

Operation

13.8.5 The operational drainage system has been designed to modern highway standards. The drainage design includes a range of features to treat highway runoff including wetlands, attenuation basins, and swales. The drainage strategy is set out in **Appendix 13.1 (Drainage Strategy Report)** of the **ES (Document Reference 6.3)**. No specific mitigation measures are required once operational in relation to flood risk.

13.8.6 The design approach is to install new gravity drainage for all new carriageway, or to replace existing highway drainage that is being built over by new impermeable highway, such as hardening of the central reserve and lane widenings. In areas where existing carriageway is being overlaid only, then existing highway drainage is retained.

13.8.7 The proposed measures for the Scheme surface water drainage system include:

- Over-the-edge drainage of run-off from carriageways on embankments to filter strips and to infiltration ditches
- Collection of run-offs at carriageway edge in linear drains, gullies or filter drains, which is piped to the following
- Attenuation and primary settlement treatment in filtration forebays and unplanted, lined detention basins
- Attenuation, secondary settlement, and filtration treatment in vegetated extended detention basins, containing both wet and dry habitats
- Tertiary treatment in a grassed swale prior to discharge to the River Itchen

13.8.8 In areas where existing carriageway is being overlaid and existing highway drainage is being retained, run-off is either discharged over-the-edge to filter strips or infiltration ditches, or is captured in road gullies and channels, and conveyed to infiltration features such as existing soakaways or trenches.

13.8.9 Areas of local, minor lane widenings proposed remote from the main works, are drained to existing highway drainage, which is modified, where required, to maintain existing discharge rates and no-flooding capacity.

13.8.10 All new drainage conveys run-off to soakaways or extended detention basins (EDBs), which infiltrate to ground where the DQRA assessment of risk to groundwater confirms it is acceptable and outlined in **Appendix 13.2 (Hydrogeological Risk Assessment)** of the **ES (Document Reference 6.3)**.

13.8.11 Further measures to manage pollution include catchpits, swales and unsaturated zones above the geocell tank (although the geocell tank does not drain to ground).

13.8.12 Runoff volumes from the Scheme would primarily discharge to the River Itchen and that infiltration would be maximised during conveyance and attenuation where possible. Highway runoff that is conveyed to the new outfall to the River Itchen is to be attenuated as long-term storage and limited to 2l/s/ha.

13.8.13 Prior to entry into the EDB's large items are screened out within the pollution control device and vertical separation forebays. Within the EDB's, finer suspended sediment would settle out as flow velocities diminish. EDB's 1, 3A and 4 are sealed and would not discharge to ground. Discharge from the lined EDB's is to the unlined EDB's 2, 3B, 3C, 5 and 6. Within these EDB's there would be secondary attenuation, settlement, and filtration. A HEWRAT screening assessment and Detailed Qualitative Risk Assessment (DQRA) has been undertaken as part of the Hydrogeological Risk Assessment, **Appendix 13.2 (Hydrogeological Risk Assessment)** of the **ES (Document Reference 6.3)** to confirm the impact of the EDB's on groundwater quality.

13.8.14 The new bridge over the River Itchen has been designed to reduce impacts by incorporating a clear span structure (which the Environment Agency and Natural England are supportive of). The abutments would be set back from the riverbank, away from SAC and SSSI designation boundaries therefore there would be no impact on floodplain storage and conveyance during operational use once constructed.

13.8.15 The standard requirements for bridge soffit height are that it is set a minimum of 600mm above the design 1 in 200 annual probability plus climate change allowance (*CD356 – Design of Highway Structures for Hydraulic Action*). In this instance, the relevant climate change allowance is 120%.

13.8.16 The existing bridge over the River Itchen upstream of the proposed new footbridge and cycleway has a lowest beam soffit level of 39.79m AOD. The existing bridge over the River Itchen downstream of the proposed new footbridge and cycleway has a lowest beam soffit level of 40.56m AOD. The

soffit level of the proposed bridge is proposed to be set at 40.56m AOD minimum at this stage for the proposed footbridge and cycleway crossing of the River Itchen. This provides a freeboard of 2.31m AOD to the modelled 1 in 200 annual probability +120% climate change allowance flood event. This is equal to and higher than the upstream and downstream lowest beam soffit levels, and therefore would not introduce constriction to in-channel flows.

13.8.17 The proposed bridge span is set at this stage to approximately 35m. This is a wider span than both the upstream and downstream existing bridges over the River Itchen (approximately 30m and 24m respectively) and would therefore not cause a constriction to flow in the localised area.

13.8.18 The modelled extents for the design scenario indicate that the Scheme does not encroach on existing floodplain when considering the 1 in 100 annual probability +120% climate change event. No additional measures with regards to floodplain compensation are therefore required and have not been provided

Essential mitigation

Construction (including demolition works and site preparation)

13.8.19 Essential mitigation measures which would be implemented during the construction phase are outlined in the **fiEMP (Document Reference 7.3)**, in accordance with LD 120 Environmental management plans (Standards for Highways, 2020) and secured by the Requirements in the DCO. The **fiEMP (Document Reference 7.3)** has been drafted in consultation with the Environment Agency and Hampshire County Council.

13.8.20 The **fiEMP (Document Reference 7.3)** includes measures considered as standard good practice that would be implemented by the construction contractor to reduce the likelihood of effects or their magnitude if they were to occur. The standard control measures are based on the *Environment Agency's Pollution Prevention Guidelines (withdrawn in 2015)*, subsequent guidance provided in *Pollution Prevention for Businesses (DEFRA, 2019)*, the relevant CIRIA publications and best practice measures. Any hazardous materials would be appropriately and suitably stored and managed. These control measures include:

- Fuel tanks would be appropriately bunded
- The construction works would be appropriately phased to include suitable surface water drainage measures prior to construction works commencing, to intercept potential contaminates which may arise
- Use of silt fencing, cut off ditches, settlement retention in lined ponds and bunds to manage surface water
- Implementing appropriate surface water drainage measures to reduce opportunities for construction activities to pollute nearby sensitive receptors (including the River Itchen and chalk groundwater body

- Reducing the amount of topsoil stripping where possible and soil stockpiles would be located as far from watercourses as practicable
- Use of silt fences at bases of stockpiles
- Plant and wheel washing and haul road damping in designated areas
- Plant to be re-fuelled in designated locations at a safe distance from water courses and good practise to be in place with relation to pollution prevention (adequate bunding, storage etc) to reduce risk associated with spills
- Spill kits are to be positioned at strategic locations on site and thorough training provided for staff to ensure a rapid and effective response to any pollution incidents that occur on site
- Use of an Ecological Clerk of Works, along with toolbox talks and training to promote contractor awareness of pollution risks
- Areas of exposed soils deemed at risk of erosion during heavy rainfall or flood inundation would be protected using temporary measures (for example sheeting) until vegetation is able to establish on these surfaces
- Works would be suspended during out-of bank river flows or during intense rainstorms
- Preparing an Emergency Spill Response Plan (this would be included within the siEMP).
- For all works within the vicinity of the watercourses, the Scheme would be registered with the recognised Environment Agency Flood Warning Service so if a flood event was expected, all plant/material/staff would be moved out of potential floodplain extents. The construction compound is located in Flood Zone 1
- For all works within 8m of the River Itchen i.e., new drainage outfalls, cleaning existing outfall, new bridge, improvements to Kings Worthy Bridge, method statement FRAP applications would be prepared for Environment Agency approval refer to the **Consents and Agreements Position Statement (Document Reference 3.3)**.

13.8.21 In conjunction with the permanent works drainage strategy (which would be secured through the Requirements in the DCO), the drainage parameters for the construction phasing would account for the Environment Agency's Flood Risk Assessment Climate Change Allowance document which advises for the period 2015 to 2039, a peak rainfall allowance of 10% is used for climate change.

13.8.22 Temporary dewatering is not anticipated to facilitate construction except in relation to install the drainage outfalls. Discharge from dewatering would be subject to consent and licences from Environment Agency refer to the

Consents and Agreements Position Statement (Document Reference 3.3). Construction of the outfalls would be non-intrusive; no piling is considered necessary to isolate the working areas and appropriate silt prevention methodology would be employed.

13.8.23 Temporary works associated with a new bridge over the River Itchen footway and cycleway would include measures, such as bunds situated around hydraulic machines and plant nappies installed beneath machinery to reduce the risk of a hydraulic failure resulting in fluid leakage to the watercourse. Bunding would also be provided to capture any concrete waste from in-situ placement (if required).

13.8.24 Depending on the bridge deck installation detail over the River Itchen, access may be required to potential bolt connections positions. If this is necessary, pontoons could be used to support an access system to the bridge. It is anticipated that this pontoon would only be in place for a few days. An assessment of the proposed piling platform relating to any impact on flood risk would be undertaken and a Flood Risk Activity Permit (FRAP) obtained from the Environment Agency. Depending on the outcome of this assessment, in the detailed design stage of the temporary platform could include the use of pre-cast voided units under the platform to provide a flow area in flood conditions. Notwithstanding this, works would be carried out under 'normal' flow conditions so impact on floodplain storage and flood risk would be limited.

13.8.25 The existing Kings Worthy Bridge may require strengthening of the existing concrete edge beams (this is subject to further assessment during detailed design). However, if required this strengthening would include carbon fibre plates that are stuck to the underside of the edge beams. They would be carried and fixed into position by hand. In order to fix the carbon fibre plates onto the bridge beam access would be required for up to three weeks, either form a pontoon or from an overhung system from the bridge deck. In order to ensure no effect on water quality of the watercourse arising from the release of carbon fibre dust particles. a dust protection frame with a cover would be placed across the river in the work area for the duration of the concrete grinding operation.

13.8.26 Construction methods / control measures such as appropriate piling techniques (if required) to minimise the risk of mixing of aquifer bodies through the creation of new pathways are outlined in the **fiEMP (Document Reference 7.3).** Control measures may include the provision of a FWRA which would be undertaken once the proposed foundation solutions are known, in accordance with the Environment Agency guidance *'Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination' (Environment Agency, 2001)*. Further details are provided in **Chapter 9 (Geology and Soils)** of the **ES (Document Reference 6.1)**.

13.8.27 Temporary works to implement the permanent drainage scheme would involve cleaning of the existing outfall, as well as the temporary installation of two localised dams to dewater an isolated area to facilitate the permanent installation of the two new outfalls – this is outlined in the **fiEMP (Document Reference 7.3).**

13.8.28 Construction in the Chalk has the potential to encounter solution features. A preliminary Geotechnical Risk Register and Engineering Assessment has been carried out and is presented in the Ground Investigation Report (Document Reference 7.11). A small part at the northern end of the Scheme includes construction activities within a Source Protection Zone I (Inner Protection Zone) and a slightly larger part within SPZ II/III (Outer / Total Protection Zone) as shown on Drawing HE5515511-VFK-EGT-X_XXXX_XX-DR-LE-0100. Where the Scheme design identifies the need for mitigation of additional risks, such as those posed by solution features, additional phased site specific intrusive ground investigation would be carried out to inform appropriate risk assessment and, where necessary, treatment measures

Operation

13.8.29 Basins, ponds, lagoons or other such features for operational pollution control (settlement) would be designed in accordance with CIRIA C648 recommendations including selecting appropriate probability rainfall events (10-year return period) and overspill contingencies. Due to the sensitivity of the receptors (River Itchen and Chalk Aquifers) Factors of Safety would be incorporated, to be agreed with the regulatory bodies (Lead Local Flood Authority and the Environment Agency).

13.8.30 The permanent drainage strategy **Appendix 13.1 (Drainage Strategy Report)** of the **ES (Document Reference 6.3)** would utilise one existing Priority A outfall (which would require to be cleaned) and would require two new outfalls into the River Itchen, consisting of both permanent and temporary works.

Enhancements

13.8.31 No enhancement is proposed as part of the Scheme.

13.9 Assessment of likely significant effects

13.9.1 This section presents the assessment of likely significant effects for construction and operation on important water environment receptors set out in **Table 13.6**. As set out in **Section 13.4**, important water environment features have been identified, and the potential impacts from the Scheme on those receptors have been described in accordance with the criteria set out in **Tables 13.3** and **13.4** and matrix in **Table 13.5**. The assessment of effects takes into account the potential impacts to each receptor following the implementation of embedded and essential mitigation measures (outlined in **Section 13.9**) to determine residual effects and identify whether they are significant or not.

13.9.2 The assessment identifies a number of adverse and beneficial impacts to water environment receptors.

Construction (including demolition works and site preparation)

Surface water – River Itchen

13.9.3 The construction and installation of the new drainage outfalls (including short term damming and de-watering) is likely to cause short term localised impacts around the drainage outfall in relation to changes to flow volumes, flow area and potential for impacts on water quality in relation to silt and other pollutants relating to construction activities.

13.9.4 The works are proposed to be undertaken sequentially and subject to FRAP permits.

13.9.5 Mitigation measures proposed would ensure that appropriate pollution and silt control measures are implemented and secured through the **fiEMP (Document Reference 7.3)**.

13.9.6 Construction activities associated with the construction of the new bridge over the Itchen and potential modifications to the Kings Worthy Bridge have the potential to impact on water quality due to the proximity of the works to the watercourse. No intrusive works are proposed in the channel and pollution control measures are included in the **fiEMP (Document Reference 7.3)**.

13.9.7 Surface water runoff from temporary construction compounds in the vicinity of the River Itchen would be subject to pollution control measures as part of the proposed temporary works drainage strategy to ensure minimal changes on water quality of surface water runoff.

13.9.8 It is considered that following the inclusion of the mitigation outlined in **Section 13.8**, construction activities are unlikely to affect the integrity of the water environment and therefore result in a negligible impact to the River Itchen. The receptor has a very high sensitivity and therefore a negligible magnitude impact would result in a slight temporary adverse effect. The temporary adverse slight effect would not have permanent effects on the River Itchen (in terms of water quality and WFD parameters) and would not undermine the integrity of the River Itchen SAC and therefore the residual effect associated with the construction of the Scheme to the River Itchen is not significant.

Surface water – Nun's Walk Stream

13.9.9 No construction activities are proposed over the Nun's Walk Stream. Construction works associated with the Scheme would however be located within the vicinity of the watercourse and it is a WFD waterbody and tributary to the River Itchen.

13.9.10 It is considered that the temporary drainage strategy and pollution control measures proposed would ensure that there would be minimal impact on water quality of the Nun's Walk Stream however the Scheme is unlikely to affect the integrity of the water environment and therefore result in a negligible impact to the Nun's Walk Stream. The receptor has a high sensitivity and therefore a

negligible impact would result in a temporary adverse slight effect. The temporary adverse slight effect would not have permanent effects on the Nun's Walk Stream (in terms of water quality and WFD parameters) and therefore the residual effect associated with the construction of the Scheme to the Nun's Walk Stream are not significant.

Surface water – River Itchen navigation canal

13.9.11 The River Itchen Navigation Canal is located outside of the Study Area but has been considered in this assessment as per statutory consultee requirements.

13.9.12 It is a heavily modified waterbody which the River Itchen flows into. Therefore, any impacts on water quality in the River Itchen would pass downstream to the River Itchen Navigation Canal.

13.9.13 The mitigation measures proposed would ensure that there is a negligible impact on the water environment in relation to the River Itchen and therefore this is reasonable to assume for the Itchen Navigation Channel too as the watercourses are in direct hydraulic connectivity.

13.9.14 The receptor has a very high sensitivity and therefore a negligible magnitude impact would result in a temporary adverse slight effect. The temporary adverse slight effect would not have permanent effects on the River Itchen navigation canal (in terms of water quality and WFD parameters) and therefore the residual effect associated with the construction of the Scheme to the River Itchen navigation canal are not significant.

Surface water – ordinary watercourses

13.9.15 No works are proposed in the immediate vicinity of any ordinary watercourses; however, construction works would be taking place within the drainage catchment of the watercourses and therefore any changes in surface water runoff water quality could impact this receptor.

13.9.16 It is considered that following the inclusion of the mitigation outlined in **Section 13.8** (to include temporary drainage strategy and pollution prevention measures), construction activities are unlikely to affect the integrity of the water environment and therefore result in a negligible impact to the ordinary watercourses within the Study Area. The receptor has a medium sensitivity and therefore a negligible magnitude impact would result in a neutral effect. The neutral effect would not have permanent effects on the ordinary watercourses and therefore the residual effect associated with the construction of the Scheme to the ordinary watercourses is not significant.

Groundwater – River Itchen chalk groundwater body (principal aquifer- seaford chalk and lewes chalk)

13.9.17 Construction activities located above the Chalk aquifer could alter pathways for groundwater flow and cause an increase in groundwater pollution.

13.9.18 Construction methods such as appropriate piling techniques (if required) to minimise the risk of mixing of aquifer bodies through the creation of new pathways would form part of the essential mitigation.

13.9.19 The temporary drainage strategy for construction compounds and the wider Scheme would ensure minimal impacts on groundwater quality due to pollution control measures.

13.9.20 A HEWRAT assessment has not been specifically undertaken for the construction works but the mitigation measures proposed would ensure no measurable impact upon the aquifer and groundwater receptors and therefore result in a negligible impact to the chalk groundwater bodies.

13.9.21 Stabilisation material options and methods for the excavated chalk to be re-used as engineering fill within the Site will be determined during Stage 5 detailed design. A Risk to Controlled Waters from potential use of cement and lime has been considered for both infiltration capacity and for water quality (see **Chalk Improvement and Stabilisation Technical Note Appendix 13.3** of the **ES (Document Reference 6.3)** and it is considered at this stage that there will be no significant change in infiltration capacity or water quality.

13.9.22 If during the detailed design phase, it is established that additives will eb required and/or different stabilisation or treatment methods are necessary, then the appropriate Controlled Waters risk assessment will be undertaken to determine the likely risk (both for quantity and quality) to Controlled Waters. Prior to undertaking such risk assessments, discussion and agreement will be sought with the EA.

13.9.23 The receptor has a very high sensitivity and therefore a negligible magnitude impact would result in a temporary adverse slight effect. The temporary adverse slight effect would not have permanent effects on the River Itchen chalk groundwater body (in terms of water quality and WFD parameters) and would not undermine the integrity of the chalk WFD groundwater body and therefore the residual effect associated with the construction of the Scheme to the River Itchen Chalk groundwater body are not significant.

Groundwater – secondary aquifer (alluvium and river terrace deposits)

13.9.24 Construction activities located above the secondary aquifer could alter pathways for groundwater flow and cause an increase in groundwater pollution.

13.9.25 Construction methods such as appropriate piling techniques (if required) to minimise the risk of mixing of aquifer bodies through the creation of new pathways would form part of the essential mitigation.

13.9.26 The temporary drainage strategy for construction compounds and the wider Scheme would ensure minimal impacts on groundwater quality due to pollution control measures.

13.9.27 Mitigation measures proposed would ensure no measurable impact upon the aquifer and groundwater receptors and therefore result in a negligible impact to the secondary aquifer.

13.9.28 The receptor has a medium sensitivity and therefore a negligible magnitude impact would result in a neutral effect. The neutral effect would not have permanent effects on the secondary aquifer (in terms of water quality) and therefore the residual effect associated with the construction of the Scheme to the secondary aquifer is not significant.

Flood risk

13.9.29 The construction and installation of the new drainage outfalls (including short term damming and de-watering) is likely to cause short term localised impacts around the drainage outfall in relation to changes to flow volumes and flow area due to works taking place within the River Itchen watercourse channel and floodplain. Any reduction in floodplain storage would be temporary and works would take place when flows are low.

13.9.30 The works are proposed to be undertaken sequentially and subject to FRAP permits. Construction activities would be subject to review of Environment Agency flood warnings.

13.9.31 Construction activities associated with the construction of the new bridge over the Itchen and potential modifications to the Kings Worthy Bridge have the potential to impact on flood risk due to potential for temporary reduction in flow area associated with pontoon construction techniques (if required).

13.9.32 The temporary drainage strategy proposed during construction works would ensure that increased surface water runoff associated with an increase in impermeable surfacing within the Application Boundary would be managed appropriately.

13.9.33 It is considered that following the inclusion of the mitigation outlined in **Section 13.8**, construction activities are unlikely to affect the integrity of the water environment and therefore result in a negligible change to peak flood levels. The receptor has a very high sensitivity due to the vulnerability of the land use and therefore a negligible magnitude impact would result in a temporary adverse slight effect. The temporary adverse slight effect would not have permanent effects on flood risk and therefore the residual effect associated with the construction of the Scheme on flood risk is not significant.

Operation

Surface water – River Itchen

13.9.34 The impacts upon surface water quantity and quality are principally related to the drainage design of the Scheme.

13.9.35 Runoff from existing retained carriageway is to be discharged at existing runoff rates through existing highway drainage infrastructure. Existing carriageway with adjacent widenings that drain onto the existing carriageway surface shall discharge at existing runoff rates via the existing drainage infrastructure.

13.9.36 Highway runoff that is to be conveyed to new outfalls to the River Itchen is to be attenuated as long-term storage and limited to 2l/s/ha. This results in a reduction of runoff rates when compared to the greenfield rates.

13.9.37 The drainage design of the Scheme discharges into eight EDBs. A HEWRAT/DQRA assessment for acute and chronic pollution of watercourses has been undertaken for all attenuation basins and the single geocellular tank (which does discharge directly to River Itchen) as if all these features discharged directly into the River Itchen. The HEWRAT assessment confirms that each detention basin provides sufficient removal of sediments and pollutants to preclude exceedance of the thresholds for acute and chronic pollutant contaminations. The lowest return for a spillage incident is 1 in 253 (for the proposed drainage system) years which meets the minimum 1 in 200-year return period expected for spillage probability in the context of River Itchen SAC.

13.9.38 A **Water Framework Directive Compliance Assessment (Document Reference 7.7)** has been completed. This provides a description of the relevant water bodies within the study area and how they could be impacted by the Scheme. It is considered that the activities related to the Scheme would not cause deterioration in the status of any WFD water bodies or prevent them from achieving either 'Good Ecological Status' or Good Ecological Potential' by 2027, following the mitigation described in **Section 13.8**. The delivery of this mitigation is secured by its inclusion within the **fiEMP (Document Reference 7.3).**

13.9.39 The WFD Compliance Assessment in the **Water Framework Directive Compliance Assessment (Document Reference 7.7)** indicates that the Scheme would not result in a change of the status of any WFD quality elements or prevent the River Itchen from reaching 'Good' status in the future.

13.9.40 It is considered that following the inclusion of the embedded mitigation outlined in **Section 13.8**, the permanent Scheme is unlikely to affect the integrity of the water environment. No risk has been identified by HEWRAT/DQRA (both acute soluble and chronic sediment related pollutants) and risk of pollution from spillages by HEWRAT has been assessed as less than 0.5%. The receptor has a very high sensitivity and therefore a negligible magnitude impact would result in an adverse slight effect. The proposed drainage strategy does represent an improvement in water quality when compared to existing, and therefore the residual effect associated with the operation of the Scheme to the River Itchen is not significant.

Surface water – Nun's Walk Stream

13.9.41 The Scheme is not proposed to discharge directly to the Nuns Walk Stream; however, the watercourse is located in the catchment area of the Scheme.

13.9.42 It is considered reasonable to conclude that the potential impacts associated with surface water quality in relation to the River Itchen would apply to the Nun's Walk Stream.

13.9.43 It is considered that following the inclusion of the embedded mitigation outlined in **Section 13.8**, the permanent Scheme is unlikely to affect the integrity of the water environment. No risk has been identified by HEWRAT (both acute soluble and chronic sediment related pollutants) and risk of pollution from spillages has been assessed as less than 0.5%. The receptor has a high sensitivity and therefore a negligible magnitude impact would result in an adverse slight effect. However, the proposed drainage strategy would not have permanent effects on the Nun's Walk Stream (in terms of water quality and WFD parameters) and therefore the residual effect associated with the operation of the Scheme to the Nun's Walk Stream is not significant.

Surface water – River Itchen navigation canal

13.9.44 The River Itchen Navigation Canal is located downstream of the Scheme and the Application Boundary. Any identified impacts on surface water quality associated with upstream watercourses would therefore impact this receptor.

13.9.45 It is considered reasonable to conclude that the potential impacts associated with surface water quality in relation to the River Itchen and Nun's Walk Stream would apply to the River Itchen Navigation Canal.

13.9.46 The receptor has a very high sensitivity and therefore a negligible impact would result in an adverse slight effect. The adverse slight effect would not have permanent effects the River Itchen navigation canal (in terms of water quality and WFD parameters) and therefore the residual effect associated with the Scheme to the River Itchen navigation canal is not significant.

Surface water – ordinary watercourses

13.9.47 The Scheme is not proposed to discharge directly to the Ordinary Watercourses within the Study Area; however, the watercourses are located in the catchment area of the Scheme.

13.9.48 It is considered reasonable to conclude that the potential impacts associated with surface water quality in relation to the main rivers would apply to the ordinary watercourses.

13.9.49 The Ordinary watercourses (receptor) have a medium sensitivity and therefore a negligible magnitude impact would result in a neutral effect. The neutral effect means that the residual effect associated with the Scheme to the ordinary watercourses is not significant.

Groundwater – River Itchen chalk groundwater body (principal aquifer- Seaford chalk and Lewes chalk)

13.9.50 The impacts upon groundwater quantity and quality are principally related to the drainage design of the Scheme.

13.9.51 A HEWRAT screening assessment and DQRA has been undertaken as part of the Hydrogeological Risk Assessment in **Appendix 13.2 (Hydrogeological Risk Assessment)** of the **ES (Document Reference 6.3)** to confirm the impact of the proposed EDB's on groundwater quality.

13.9.52 The results of the HEWRAT screening assessment show that all but one of the currently proposed EDB have a 'medium' risk to groundwater and one has a high risk (considered as moderate adverse impact) in accordance with **Table 13.4**. In order to mitigate against the high risk EDB, it is proposed that this EDB would be lined, thus preventing discharge to groundwater. The DQRA undertaken to further assess the risk from the un-lined EDB's confirms that the acute risk from soluble contaminants has been assessed as low. The contaminant concentrations in the EDBs as derived from the HEWRAT assessment are below the UK Drinking Water Standards and thus pose no significant risk to groundwater.

13.9.53 The lowest return for a spillage incident is 1 in 253 years which meets the minimum 1 in 200-year return period expected for spillage probability in the context of River Itchen SAC.

13.9.54 The proposed drainage discharges runoff via a far greater area of infiltration over granular soils, which provides a betterment in risk to groundwater from the existing M3 Junction 9 drainage configuration.

13.9.55 Infiltration features (basins) that are located in solid chalk geology have been sized assuming an impermeable liner, so that no infiltration is possible (Extended Detention Basins 1, 3A and 4). Where basins overlie granular, drift geology, infiltration has been assumed within the design of basin volumes.

13.9.56 The models demonstrate that none of the EDB's are likely to result in an impact in groundwater from soluble contaminants within the sediment lining the base of EDBs (chronic risk).

13.9.57 The HgRA model shows that there is a sufficient thickness of unsaturated zone beneath the EDB's, comprising material with sufficient organic carbon content to provide sufficient attenuation and ensure there is no discharge of PAH compounds to the water table. Model results are provided in the Hydrogeological Risk Assessment **Appendix 13.2 (Hydrogeological Risk Assessment)** of the **ES (Document Reference 6.3)**.

13.9.58 Soil and water testing on samples as part of the Controlled Waters risk assessment confirmed that risk to groundwater was low based on soil samples from soil disposal and fill areas.

13.9.59 It is considered that following the inclusion of the embedded mitigation outlined in **Section 13.8**, the permanent Scheme is unlikely to affect the integrity of the groundwater environment (groundwater, aquifers and groundwater source protection zones). No measurable impact upon the aquifer/chalk groundwater WFD body has been identified by HEWRAT/DQRA (both acute soluble and chronic sediment related pollutants) and risk of pollution from spillages has been assessed as less than 0.5%.

13.9.60 The receptor has a very high sensitivity and therefore a negligible magnitude impact would result in an adverse slight effect. The residual effect associated with the Scheme to the River Itchen chalk groundwater body is not significant.

Groundwater – secondary aquifer (alluvium and river terrace deposits)

13.9.61 The impacts upon groundwater quantity and quality within the Secondary Aquifer are principally related to the drainage design of the Scheme.

13.9.62 The drainage design and HEWRAT assessment outlined above also applies to the consideration of impacts on the Secondary A Aquifer and therefore the same conclusions can be drawn. It is considered that following the inclusion of the embedded mitigation outlined in **Section 13.8**, the permanent Scheme is unlikely to affect the integrity of the groundwater environment (groundwater, aquifers and groundwater source protection zones).

13.9.63 The receptor has a medium sensitivity and therefore a negligible magnitude impact would result in a neutral effect. The residual effect associated with the Scheme to the secondary aquifer is not significant.

Flood risk

13.9.64 The risk of flooding to the Application Boundary during operation of the Scheme is considered to be low in terms of fluvial, surface and groundwater flooding based on Environment Agency mapping.

13.9.65 The new bridge over the River Itchen has been designed to minimise impacts on floodplain storage and conveyance. The **Flood Risk Assessment (Document Reference 7.4)** summarises the results of the hydraulic modelling undertaken. The Scheme was represented within the hydraulic model to demonstrate anticipated changes to the flood risk in the area as a result of the works. The in-channel flood level changes as a result of the Scheme for the applicable 1 in 100 annual probability +120% climate change event are considered negligible in accordance with Table 13.4 (change in peak flood levels within 10mm of existing).

13.9.66 The Scheme does not encroach upon floodplain and therefore floodplain storage is not impacted as a result of the Scheme.

13.9.67 It is considered that following the inclusion of the mitigation outlined in **Section 13.8**, the Scheme would result in a negligible change to peak flood levels.

13.9.68 The receptor has a very high sensitivity due to the vulnerability of the land use (essential infrastructure) and therefore a negligible magnitude impact would result in an adverse slight effect. The adverse slight effect results in a negligible change to peak flood levels and therefore the residual effect associated with the Scheme on flood risk is not significant.

13.9.69 The assessment has considered the potential for future climatic conditions at the Scheme to alter the conclusions identified within this assessment. It is considered that the residual effects identified in this chapter would not be altered.

13.10 Monitoring

13.10.1 The assessment of effects from the Scheme has not identified any likely significant effects therefore no monitoring is required or proposed.

13.11 Summary

13.11.1 This chapter presents the findings from the assessment of potential effects from construction and operation of the Scheme on road drainage and the water environment.

13.11.2 This assessment has been guided by DMRB LA 113 Road Drainage and the Water Environment (Highways England, 2020) along with LA 104 Environmental Assessment and Monitoring (Highways England, 2020).

13.11.3 Data collection has included a site walkover, stakeholder consultation and several technical assessments completed in 2020/2021. This includes a Flood Risk Assessment, Water Framework Directive Compliance Assessment, hydraulic modelling of the River Itchen, Drainage Strategy Report, Pollution Prevention Technical Note and a Hydrogeological Risk Assessment. The findings of these assessments/reports have informed this ES chapter.

13.11.4 A number of important water environment receptors have been identified within the study area as listed below:

- Surface Water – River Itchen. Very high sensitivity due to watercourse having a WFD classification and designated as a SAC, SPA, SSSI
- Surface Water – Nun's Walk Stream. Very high sensitivity due to watercourse having a WFD classification
- Surface Water – River Itchen Navigation Canal. Very high sensitivity due to watercourse having a WFD classification and designated as a SAC
- Surface Water – Ordinary Watercourses. Medium sensitivity as watercourses do not have a WFD classification
- Groundwater – River Itchen Chalk Groundwater Body (Principal Aquifer). Very high sensitivity as designated as Principal Aquifer, groundwater locally

supports GWDTE, WFD designated waterbody, located in SPZ and number of discharges via soakaways present within study area

- Groundwater – Secondary Aquifer. Medium sensitivity as no WFD designation and classed as secondary aquifer

- Flood Risk – Essential Infrastructure land uses. Very high sensitivity as existing M3 Junction 9 and surrounding road network classified as Essential Infrastructure under PPG. Scheme also classified as Essential Infrastructure

13.11.5 Potential impacts from construction and operation of the Scheme that could relate to important water environment receptors include: loss of floodplain storage and impact on flow conveyance, mobilisation of contaminants, pollution incidents and changes to surface and groundwater flows.

13.11.6 The design of the Scheme has sought to avoid adverse impacts in the first instance through an iterative approach to design, e.g., informing bridge design to minimise flood risk impacts where possible, pollution control measures as part of temporary and permanent drainage strategy. In areas where avoidance is not possible, measures have been included to prevent or reduce potentially significant negative effects. A package of embedded and essential mitigation measures has been provided, as set out in **Section 13.8**.

13.11.7 The assessment identifies a number of adverse and beneficial impacts to water environment receptors, however in all cases the residual effects are not significant.