Appendix E2:
Appropriate Assessment: Groundwater (SNZ): New borehole at Petworth (4Ml/d)

1. Option Summary

1.1 Overview and European site context

1.1.1 This option will return Petworth WSW to service with a new borehole c. 700m south of the main WSW. The option is to drill a new replacement borehole for Petworth WSW in Sussex North Area. The borehole will be a minimum c. 300mm diameter, and c. 80m depth. The earliest utilisation of this option is 2040 – 2041.

1.1.2 This would require (inter alia):

- 1 No. 400mm diameter, 80m deep abstraction borehole (cased to 20m, screened 20-80m);
- 2 No. abstraction pumps (Duty/ Standby) 2.5Mld @ 57m (static) + 20m (dynamic);
- 4 No. 100mm diameter, 80m deep monitoring boreholes;
- 4 No. pressure filters;
- Ultra-violet disinfection, hypochlorite and orthophosphoric acid dosing pumps;
- DN200 rising main, 2600m to existing network.

1.1.3 The proposed option and pipeline location are in close proximity to (within 10km) The Mens Special Area of Conservation (SAC), Duncton to Bignor Escarpment SAC, Arun Valley Ramsar, Arun Valley Special Protection Area (SPA), Arun Valley SAC and Ebernoe Common SAC.

1.2 Environmental changes and option assumptions / uncertainties

Potential construction-related environmental changes

1.2.1 'Generic' environmental risks typically associated with the construction of new infrastructure may be realised (e.g. site-derived pollutants; additional noise or lighting; visual disturbance; etc.) although these cannot be reliably scoped or assessed at the plan-level as they are entirely dependent on the detailed design; however, such risks can almost certainly be avoided through scheme-design and/or the established best-practice measures noted in Appendix C.

1.2.2 However:

- the works will require construction of a new borehole (and monitoring boreholes) with associated supporting works (as above) and a new 2600m length mains connecting to the existing distribution network, which may result in temporary or permanent habitat loss (if pipelines are surface-laid or with shallow cut-and-cover);
- the works will temporarily affect areas of agricultural land that may be functionally associated with some species from The Mens SAC, Arun Valley Ramsar, Arun Valley SPA, and Ebernoe Common SAC.

Potential operation-related environmental changes

1.2.3 'Generic' environmental risks typically associated with the operation of new infrastructure may be realised (e.g. additional noise or lighting, albeit minor in this instance) although these cannot be reliably scoped or assessed at the plan-level as they are entirely dependent on the detailed design; however, the operational plant required is not inherently high-impact in this regard, and potentially notable environmental changes can almost certainly be avoided through scheme-design.

1.2.4 The principal environmental changes from operation will therefore relate to:

- Abstraction from the underlying Hythe beds (Lower Greensand) and potential localised drawdown of the water table, hence potential effects on flows in the River Rother upstream of the Arun Valley Ramsar, Arun Valley SPA, and Arun Valley SAC.

Assumptions and uncertainties

1.2.5 It is assumed that the borehole, kiosk and pipeline will be designed according to best practice to minimise the effects on the environment; and that reduced-disturbance construction techniques are achievable if required. It is also assumed that the scheme will operate on a full-time basis for energy-efficiency reasons.

2. Screening Summary

2.1.1 The screening assessment is outlined in Table 2.1. In summary, significant effects cannot be self-evidently excluded for the following sites:

- The Mens SAC;
- Arun Valley Ramsar;
- Arun Valley SPA;
- Arun Valley SAC; and
- Ebernoe Common SAC.

Table 2.1 Screening Summary

Site	Location (km)*	LSE?		Rationale
		Cons	Oper	
The Mens SAC	2.3	U*	0	Construction: Site not exposed to construction effects (distance, no pollutant pathways, up-catchment); pipeline within Core Sustenance Zone (CSZ; see Appendix B) defined for the mobile interest features of the site, and effects on supporting habitats cannot be excluded at the plan level (although the risk of significant effects would be low based on the nature of the works). Significant and/or significant adverse effects almost certainly avoidable with established measures / normal best-practice, although these must necessarily be accounted for at AA (hence 'screened in'). Operation: No pathways for operational effects (site not groundwater dependent).
Duncton to Bignor Escarpment SAC	3.6	0	0	Construction: No pathways for construction effects (distance, site up-catchment). Operation: No pathways for operational effects (distance, features not GW sensitive).
Arun Valley Ramsar	4.4/DS	U*	U	Construction: Indicative pipeline route crosses tributaries of this site; site features may also utilise functional habitats outside the site boundary. Significant and/or significant adverse effects almost certainly avoidable with established measures / normal best-practice, although these must necessarily be accounted for at AA (hence 'screened in'). Operation: Sensitivity of the site habitats is likely to be relatively low due to the active management of water levels in the ditch network; in addition, direct effects from drawdown are unlikely. However, this would require additional characterisation, including details of likely effects on flows in the Rother.
Arun Valley SPA	4.4/DS	U*	U	Construction: Indicative pipeline route crosses tributaries of this site; site features may also utilise functional habitats outside the site boundary. Significant and/or significant adverse effects almost certainly avoidable with established measures / normal best-practice, although these must necessarily be accounted for at AA (hence 'screened in'). Operation: Sensitivity of the site habitats is likely to be relatively low due to the active management of water levels in the ditch network; in addition, direct effects from drawdown are unlikely. However, this would require additional characterisation, including details of likely effects on flows in the Rother.

Site	Location (km)*	LSE?		Rationale
		Cons	Oper	
Arun Valley SAC	4.9/DS	U*	U	Construction: Indicative pipeline route crosses tributaries of this site but site features will have a low exposure to potential effects due to their location within the site. Significant and/or significant adverse effects almost certainly avoidable with established measures / normal best-practice, although these must necessarily be accounted for at AA (hence 'screened in'). Operation: Sensitivity of the site habitats is likely to be relatively low due to the active management of water levels in the ditch network; in addition, direct effects from drawdown are unlikely. However, this would require additional characterisation, including details of likely effects on flows in the Rother.
Ebernoe Common SAC	5.7	U*	0	Construction: Site not exposed to construction effects (distance, no pollutant pathways, up-catchment); pipeline outside Core Sustenance Zone (CSZ; see Appendix B) defined for the mobile interest features of the site, but effects on supporting habitats cannot be excluded at the plan level (although the risk of significant effects would be low based on the nature of the works). Significant and/or significant adverse effects almost certainly avoidable with established measures / normal best-practice, although these must necessarily be accounted for at AA (hence 'screened in'). Operation: No pathways for operational effects (site not groundwater dependent).

* Closest point of site to option; DS = downstream receptor

3. Assessment: The Mens SAC, Ebernoe Common SAC

3.1 Core Designation Information

3.1.1 The Mens SAC and Ebernoe Common SAC are addressed together in the following sections as the mechanisms by which the sites might be affected by this option are essentially the same.

3.1.2 The Mens SAC is an extensive area of mature beech *Fagus sylvatica* woodland rich in lichens, bryophytes, fungi and saproxylic invertebrates, and is one of the largest tracts of Atlantic acidophilous beech forests in the south-eastern part of the habitat's UK range. It is developing a near-natural high forest structure, in response to only limited silvicultural intervention over the 20th century, combined with the effects of natural events such as the 1987 great storm.

3.1.3 Ebernoe Common SAC is an extensive block of beech *Fagus sylvatica* high forest and former wood-pasture over dense holly *Ilex aquifolium*, with a very rich epiphytic lichen flora, including *Agonimia octospora* and *Catillaria atropurpurea*. It represents Atlantic acidophilous beech forests in the south-eastern part of the habitat's UK range. The beech woodland is associated with other woodland types, open glades and pools, which contribute to a high overall diversity. The woods are important for a number of bat species, in particular Bechstein's bat *Myotis bechsteinii* and barbastelle *Barbastella barbastellus*.

3.1.4 The core information relating to the designation (i.e. qualifying features, conservation objectives, supplementary advice documents, information on typical species, supporting habitats and known functional land) is available online and so not replicated here in detail, to minimise repetition and over-simplification of freely available data; Table 3.1 provides links to the key documents and information relating to the designation. Specific information that may be relevant to the assessment of effects is noted as necessary in the assessment sections below (e.g. known areas of functional land identified in the Supplementary Advice on Conservation Objectives (SACO) documentation).

Table 3.1 Core Site Information

Aspect	Site Data
Site Name	The Mens SAC
Site Code	UK0012716
Qualifying features	- H9120: Atlantic acidophilous beech forests with Ilex and sometimes also Taxus in the shrub layer (Quercion robori-petraeae or Ilici-Fagenion) - S1308: Barbastelle Barbastella barbastellus
Standard Data Form	Available at: https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0012716.pdf
Conservation Objectives	Available at: http://publications.naturalengland.org.uk/publication/5642356338458624?category=6528471664689152
Site Improvement Plan	Available at: http://publications.naturalengland.org.uk/publication/5642356338458624?category=6528471664689152
Supplementary advice	Available at: http://publications.naturalengland.org.uk/publication/5642356338458624?category=6528471664689152
Associated SSSIs	Sites of Special Scientific Interest (SSSI): Available at: https://designatedsites.naturalengland.org.uk/SiteGeneralDetail.aspx?SiteCode=UK0012716
Functional land	Specific areas of functional land are not noted in the supplementary advice, although the Core Sustenance Zones (CSZs) for barbastelle are 6km and so suitable habitats within this range may be functionally-linked.

*Water resource sensitive features, based on EA guidance

Table 3.2 Core Site Information

Aspect	Site Data
Site Name	Ebernoe Common SAC
Site Code	UK0012715
Qualifying features	- H9120: Atlantic acidophilous beech forests with Ilex and sometimes also Taxus in the shrub layer (Quercion robori-petraeae or Ilici-Fagenion) - S1308: Barbastelle Barbastella barbastellus - S1323: Bechstein`s bat Myotis bechsteini
Standard Data Form	Available at: https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0012715.pdf
Conservation Objectives	Available at: http://publications.naturalengland.org.uk/publication/6255629165395968?category=6528471664689152
Site Improvement Plan	Available at: http://publications.naturalengland.org.uk/publication/6255629165395968?category=6528471664689152
Supplementary advice	Available at: http://publications.naturalengland.org.uk/publication/6255629165395968?category=6528471664689152
Associated SSSIs	Available at: https://designatedsites.naturalengland.org.uk/SiteGeneralDetail.aspx?SiteCode=UK0012715
Functional land	Specific areas of functional land are not noted in the supplementary advice, although the Core Sustenance Zones (CSZs) for barbastelle are 6km and so suitable habitats within this range may be functionally-linked.

*Water resource sensitive features, based on EA guidance

3.2 Mitigation Assumptions

Standard Measures / Best-practice

3.2.1 Appendix C identifies standard and established measures that are known to be available, achievable and likely to be effective in avoiding or mitigating potentially adverse effects on European sites and interest features. These are based on best- and case-practice from similar schemes, and so there can be high confidence in their deliverability and effectiveness. These measures would be applied unless project-level Habitats Regulation Assessments (HRA) or project-specific environmental studies demonstrate that they are not required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate.

Bespoke measures

3.2.2 Site- or feature-specific mitigation that may be required for specific atypical effects are identified in the assessment sections.

3.3 Assessment – Construction

3.3.1 Screening has determined that the sites themselves (and hence the habitat features) will not be exposed to construction effects. However, the pipeline is within the Core Sustenance Zone (CSZ; see Appendix B) defined for the mobile interest features of the sites, and effects on supporting habitats cannot be excluded. Likely Significant Effects during the construction phase cannot, therefore, be ruled out, and potential pathways for effects on qualifying features of the site have been considered below.

3.3.2 In summary:

- The proposed pipework is within the CSZ for Barbastelle (defined as 6km from the European site boundary) associated with The Mens SAC and Ebernoe Common SAC (note, works are likely to be outside the CSZ for Bechstein's associated with Ebernoe Common SAC (4km)). Barbastelle primary habitats are deciduous woodland, wet meadows and water bodies, such as woodland streams and rivers, riparian margins and unimproved grassland. Secondary habitats can be field margins and hedgerows. The species typically commutes along hedgerows, riparian corridors and treelines.
- The installation of the pipework may affect bats through:
  - permanent or temporary loss of habitats and features that may support the bat population associated with the SAC (e.g. impacts on commuting routes or roosts);
  - Increased human and machinery activity causing noise / vibration / visual disturbance during the construction period.
- Adverse effects as a result of these pathways can be reliably avoided using normal project-level design and delivery best-practice (e.g. surveys for roosts; identification and avoidance of important features; re-instatement of affected habitats; etc; see also Appendix C) and no adverse effects would occur.

3.4 Assessment – Operation

3.4.1 Screening has determined that there are no pathways for operational effects.

3.5 In combination effects

3.5.1 Note, it is anticipated that the 'alone' effects of this option on these sites can (with the benefit of mitigation) be effectively reduced to 'nil' and so in combination effects would not be anticipated.

Other WRMP options

3.5.2 The potential for these European sites to be affected by two or more Water Resource Management Plan (WRMP) options (either options within the Southern Water (SWS) revised draft WRMP (rdWRMP), or options in the rdWRMPs of neighbouring water companies) is set out in Appendix F and Appendix G.

3.5.3 In summary, no unavoidable adverse in combination effects are anticipated.

Other Water Company Plans

Drought Plans

3.5.4 The Drought Plan will be revised several times before this WRMP option is implemented, and following option delivery, and so a meaningful in combination assessment arguably cannot be undertaken at this point. Furthermore, a future Drought Plan will necessarily reflect the abstraction baseline at that point (i.e. it will account for options implemented at that point in time) and be subject to HRA when revised, which provides a mechanism to ensure that in combination effects do not occur.

3.5.5 No drought options identified in SWS's revised draft Drought Plan 2022[1], or the plans of neighbouring water companies, will affect these sites.

Drainage and Wastewater Management Plans

3.5.6 The interaction of the WRMP options with specific schemes derived from the emerging Drainage and Wastewater Management Plan (DWMP) can only be assessed at the project level due to the generic nature of the DWMP options.

[1] Southern Water (2021). Draft Drought Plan 2022 Main report. 31 March 2021, Version 1.0.

Other projects 'in combination'

Minor projects

3.5.7 It has not been possible to produce a definitive list of existing (minor) planning applications near this option's zone of influence, and generating a list at this stage would be of little value given the lead times for the option. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the All Company Working Group (ACWG) guidance on cumulative/in combination assessments[2].

Major Projects

3.5.8 Reference has been made to the Planning Inspectorate's National Infrastructure Projects database[3] which includes major projects; no major projects are identified that are likely to affect these European sites.

3.6 Conclusion: The Mens SAC / Ebernoe Common SAC

3.6.1 At this strategic plan level, no additional mitigation measures have been identified, above and beyond those set out in best practice guidance (Appendix C). Incorporated mitigation measures will be developed in more detail and secured during the project-stage HRA when a detailed design and construction method statement is available, although there is no reason to assume that adverse effects on The Mens SAC or Ebernoe Common SAC cannot be avoided at the project-level.

4. Assessment: Arun Valley SPA, Arun Valley Ramsar, Arun Valley SAC

4.1 Core Designation Information

4.1.1 Note, the Arun Valley SPA, Arun Valley Ramsar and Arun Valley SAC (collectively, the Arun Valley sites) are addressed together in the following sections as the mechanisms by which the sites might be affected by this option are largely the same (although mobile species associated with the SPA and Ramsar may be affected if using habitats outside the site boundaries).

4.1.2 The Arun Valley is located just north of the South Downs escarpment about 15 km inland from the south coast of England. It consists of low-lying grazing marsh, largely on alluvial

[2] For more information see: https://www.wrse.org.uk/media/fspcib0h/acwg-design-principles-process-and-gate-2-indicators.pdf

[3] Available at: https://infrastructure.planninginspectorate.gov.uk/projects/

soils, but with an area of peat derived from a relict raised bog. Southern parts of the Arun Valley are fed by calcareous springs, while to the north, where the underlying geology is Greensand, the water is more acidic. The history of management of fields, and their water levels, determines the plant communities present. The wet neutral grassland is subject to winter and occasional summer flooding. The site is dissected by a network of wet ditches which support a rich aquatic flora and invertebrate fauna. Variation in the chemical status of the water has resulted in an exceptionally high diversity of aquatic plant species in some of the ditches.

4.1.3 The core information relating to the designation (i.e. qualifying features, conservation objectives, supplementary advice documents, information on typical species, supporting habitats and known functional land) is available online and so not replicated here in detail, to minimise repetition and over-simplification of freely available data; Table 4.1 provides links to the key documents and information relating to the designation. Specific information that may be relevant to the assessment of effects is noted as necessary in the assessment sections below (e.g. known areas of functional land identified in the SACO documentation).

Table 4.1 Core Site Information

Aspect	Site Data
Site Name	Arun Valley SAC
Site Code	UK0030366
Qualifying features	- S4056: Ramshorn snail Anisus vorticulus*
Standard Data Form	Available at: https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0030366.pdf
Conservation Objectives	Available at: http://publications.naturalengland.org.uk/publication/4924283725807616?category=6528471664689152
Site Improvement Plan	Available at: http://publications.naturalengland.org.uk/publication/4924283725807616?category=6528471664689152
Supplementary advice	Available at: http://publications.naturalengland.org.uk/publication/4924283725807616?category=6528471664689152
Associated SSSIs	Available at: https://designatedsites.naturalengland.org.uk/SiteGeneralDetail.aspx?SiteCode=UK0030366
Functional land	None noted; interest features confined to site.

*Water resource sensitive features, based on Environment Agency (EA) guidance

Table 4.2 Core Site Information

Aspect	Site Data
Site Name	Arun Valley SPA
Site Code	UK9020281
Qualifying features	- A037w: Tundra swan Cygnus columbianus bewickii* - WATR: Waterbird assemblage*
Standard Data Form	Available at: https://jncc.gov.uk/jncc-assets/SPA-N2K/UK9020281.pdf
Conservation Objectives	Available at: http://publications.naturalengland.org.uk/publication/4567444756627456?category=6528471664689152
Site Improvement Plan	Available at: http://publications.naturalengland.org.uk/publication/4567444756627456?category=6528471664689152
Supplementary advice	Available at: http://publications.naturalengland.org.uk/publication/4567444756627456?category=6528471664689152
Associated SSSIs	Available at: https://designatedsites.naturalengland.org.uk/SiteGeneralDetail.aspx?SiteCode=UK9020281
Functional land	Some bird features may utilise habitats outside the site boundary including farmland for foraging.

*Water resource sensitive features, based on EA guidance

Table 4.3 Core Site Information

Aspect	Site Data
Site Name	Arun Valley Ramsar
Site Code	UK11004
Qualifying features	- Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. Communities (seven RDB wetland invertebrate species; four rare / scarce plant species)* - Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity (ditch flora)* - Crit. 5 - regularly supports 20,000 or more waterbirds (wintering bird assemblage)*
Standard Data Form	Available at: https://jncc.gov.uk/jncc-assets/RIS/UK11004.pdf
Conservation Objectives	As per associated SAC / SPA, or underpinning SSSI(s)

Aspect	Site Data
Site Improvement Plan	As per associated SAC / SPA, or underpinning SSSI(s)
Supplementary advice	As per associated SAC / SPA, or underpinning SSSI(s)
Associated SSSIs	Available at: https://designatedsites.naturalengland.org.uk/SiteGeneralDetail.aspx?SiteCode=UK11004
Functional land	Some bird features may utilise habitats outside the site boundary including farmland for foraging.

*Water resource sensitive features, based on EA guidance

4.2 Mitigation Assumptions

Standard Measures / Best-practice

4.2.1 Appendix C identifies standard and established measures that are known to be available, achievable and likely to be effective in avoiding or mitigating potentially adverse effects on European sites and interest features. These are based on best- and case-practice from similar schemes, and so there can be high confidence in their deliverability and effectiveness. These measures would be applied unless project-level HRAs or project-specific environmental studies demonstrate that they are not required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate.

Bespoke measures

4.2.2 Site- or feature-specific mitigation that may be required for specific atypical effects are identified in the assessment sections.

4.3 Assessment – Construction

4.3.1 The habitats of the Arun Valley sites will not be directly affected by construction due to the distance from the construction area; this also applies to the mobile qualifying features when within the site itself.

4.3.2 The proposed pipeline route crosses tributaries of the River Rother, which joins the River Arun at Pulborough and ultimately flows past these sites, providing a potential pathway for site-derived pollutants; it is also possible that mobile species (birds) of the SPA/Ramsar may be functionally associated with habitats directly affected by construction.

4.3.3 However, these effect pathways will not be realised or can be avoided for the following reasons:

- Established best-practice construction measures (including normal design practice) can reliably safeguard receptors (e.g. through pollution prevention measures; scheduling works to avoid wintering periods, if required; route design to minimise risks; controls on noise / visual disturbance etc.);
- The habitats likely to be directly affected by the pipeline will be temporarily affected only, and are not (based on aerial photographs) likely to be particularly attractive to the qualifying features of the European site (sightlines affected by hedges and treelines along field boundaries).

4.4 Assessment – Operation

4.4.1 Operation of the scheme may affect the River Rother, which ultimately flows past the Arun Valley sites below its confluence with the River Arun near Pulborough.

4.4.2 The sites are functionally linked to the River Arun (and Rother), being a series of wet meadows which are periodically flooded/ inundated. However, evidence from ongoing studies indicates that the majority of the wetlands are not fundamentally supported fluvially (i.e. they are are not reliant / dependent on (for example) winter flooding from the Arun to maintain water levels), and whilst there may be some localised inputs from the river where sluices etc. are not operating correctly, the vast majority of the site is not supported by inward flows from the Arun but by groundwater or other surface water inputs from the catchment (i.e. the dominant direction of flow is from the wetlands to the river). High flows in the river may impede discharges from the wetlands, but the hydrology of the wetlands is largely determined by groundwater inputs and subsequent interventionist management of the water levels in the ditch network.

4.4.3 The possible exception to this is a small part of Waltham Brooks SSSI (approximately 0.4ha) that is in direct connectivity with the river as it lies riverwards of the flood bank. According to the Sussex Wildlife Trust management plan the water levels on the Waltham Brooks reserve are maintained by a manually-operated steel lifting gate sluice positioned on the internal boundary of the site in front of the tidal flap. The lake is an important constituent of the Brooks and has become an area important for winter wildfowl. For the SPA interest features (wintering and passage waterfowl and waders) the Sussex Wildlife Trust Management Plan for Waltham Brooks Reserve 2012-2022 indicates the key hydrological factor to be large expanses of floodwater, no less than 50cm in depth, in Compartment C between November and February inclusive.

4.4.4 The Arun Valley sites are currently subject to sustainability studies, exploring the impact of abstractions on the designated sites; it should be noted that the abstraction licence at Petworth has not been scoped into this assessment, as direct effects on the designated sites due to drawdown from this source are not considered likely due to the distance and geology.

4.4.5 NE has noted that "*The Arun Valley Habitats sites have deteriorated in condition where there is a current known adverse effect on integrity from groundwater abstraction, and other water-related impacts which are all likely to be significantly contributing towards this decline. Designated site condition, risk to resilience and supporting long-term environmental*

improvement / restoration (rather than inhibiting) must be considered in the assessment of any options that could affect these sites".

4.4.6 With regard to the effects of the Petworth abstraction, the degree of connection between the Hythe Formation and the River Rother is not known, although the the Hythe Formation aquifer becomes semi-confined to confined to the south of the Petworth source. The worst-case scenario (i.e. the entirety of the groundwater abstraction (4 M/d) impacts river flows in the Rother and hence the Arun at Pulborough) is therefore assumed.

4.4.7 The approximate impact on flows in the Arun at Pulborough is summarised in Table 4.4 using data from the closest upstream gauging stations (Rother at Hardham, Station No. 41009; and Arun at Pallingham, Station No. 41014); note, this is conservative as there are other flow inputs to the Arun below Pallingham.

Table 4.4 Approximate flows in the River Arun at Pulborough

Flow percentile	Gauged flows (Ml/d)			Max. % impact on cumulative flows (4Ml/d abstraction)
	Rother at Hardham	Arun at Pallingham	Cumulative	
Mean	386.6	484.5	871.2	0.5
Q95	94.2	23.5	117.7	3.4
Q70	174.5	48.7	223.3	1.8
Q50	249.7	97.9	347.6	1.2
Q10	907.2	1339.2	2246.4	0.2
Q5	1304.6	2531.5	3836.2	0.1

4.4.8 Based on this:

- Under the worst-case scenario (i.e. assuming the entirety of the groundwater abstraction (4 Ml/d) impacts river flows) the maximum impact on very low flows in the Arun adjacent to the designated sites would be approximately 3.4%. However, the potential impact of the abstraction on low flows in the Arun arguably has limited relevance to the condition of the European site, as at very low flows the river is not directly supporting the adjacent wetlands (either through direct supply or by impeding drainage).
- At high / flood flows the estimated impact is <1% (0.2 – 0.1% at Q10 and Q5 respectively). It is therefore arguable that the effect of the Petworth abstraction on high / flood flows in the Arun will be inconsequential (essentially within normal variability) and will not meaningfully affect the volume of water entering the sites or its residence time within the site.
- The Waltham Brooks SSSI unit of the SPA/Ramsar has greater connectivity to the river and is partially reliant on winter flooding; the option will not substantively affect this (flooding will still occur, and water will be retained by the existing management

regime) although mitigation measures proposed for the **Pulborough Surface** Water -reduce Western Rother MRF drought option in SWS's revised draft Drought Plan 2022[4] would also be effective and potentially appropriate for the WRMP option (these mitigation measures include partial removal of embankments to re-connect river to the floodplain sooner, creation of new ditches that connect the floodplain with the river at different water levels).

- Consequently, the hydrological impact of the Petworth abstraction on the Arun Valley sites alone is considered to be negligible, particularly in relation to the dominant effect of groundwater supply to the designated sites and the active management of water levels within the sites; the predicted flow reductions in the Arun will not be of sufficient magnitude to adversely affect the site alone either directly or through secondary mechanisms such as via impacts on water quality; and the anticipated magnitude of effects can almost certainly be mitigated with the mitigation interventions identified for the Drought Plan, if required.
- It is recognised that the existing groundwater abstractions from Hardham and other sources may be adversely affecting the Arun Valley sites. It is assumed that these sources will be subject to sustainability reductions (this underpins the modelling of the supply demand balance for the WRMP) and that these reductions will be made before the Petworth option is required (2040 – 41). As a result, the Petworth option will not operate in combination with the existing abstraction regime; the nature of the option and magnitude of impacts from the Petworth option will ensure that it will not affect the future recovery and achievement of Favourable Conservation Status (FCS) at the Arun Valley sites.

4.5 In combination effects

4.5.1 Plans, programmes and projects that have been considered within the in-combination assessment are detailed below.

Other WRMP options

4.5.2 The potential for these European sites to be affected by two or more WRMP options (either options within the SWS rdWRMP, or options in the rdWRMPs of neighbouring water companies) is set out in Appendix F and Appendix G.

4.5.3 No other water company options will affect these sites. With regard to other SWS options, the principal in combination risk will relate to the operation of the Recycling (SNZ): Horsham WTW with storage at Pulborough (6.8Ml/d) option (note, no unavoidable in alone or in combination effects are anticipated from construction of any options).

4.5.4 The cumulative impact of the Petworth option with the Horsham Recycling option on flows in the Arun would be as follows:

[4] Southern Water (2021). Draft Drought Plan 2022 Main report. 31 March 2021, Version 1.0.

Table 4.5 Cumulative Impact of Horsham Recycling (~9.5Ml/d) and Petworth (max Ml/d on flows in the River Arun at Pulborough

Flow percentile	Gauged flows (Ml/d)			Max. % impact on cumulative flows (13.5Ml/d abstractions)
	Rother at Hardham	Arun at Pallingham	Cumulative	
Mean	386.6	484.5	871.2	1.5
Q95	94.2	23.5	117.7	11.5
Q70	174.5	48.7	223.3	6.0
Q50	249.7	97.9	347.6	3.9
Q10	907.2	1339.2	2246.4	0.6
Q5	1304.6	2531.5	3836.2	0.4

4.5.5 Low (Q95) flows in the river will be reduced by up to 11.5%, although as noted the integrity of the SPA/Ramsar is not influenced by the lowest flows in the river. As with the alone assessment, although the Waltham Brooks SSSI unit of the SPA/Ramsar has greater connectivity to the river and is partially reliant on winter flooding the cumulative operation of the options will not substantively affect this (flooding will still occur, and water will be retained by the existing management regime) although mitigation measures proposed for the **Pulborough Surface** Water - reduce Western Rother MRF drought option in SWS's revised draft Drought Plan 2022[5] would also be effective and potentially appropriate for the WRMP option (these mitigation measures include partial removal of embankments to re-connect river to the floodplain sooner, creation of new ditches that connect the floodplain with the river at different water levels). In summary, no unavoidable adverse in combination effects are anticipated.

Other Water Company Plans

Drought Plans

4.5.6 The Drought Plan will be revised several times before this WRMP option is implemented, and following option delivery, and so a meaningful in combination assessment arguably cannot be undertaken at this point. Furthermore, a future Drought Plan will necessarily reflect the abstraction baseline at that point (i.e. it will account for options implemented at that point in time) and be subject to HRA when revised, which provides a mechanism to ensure that in combination effects do not occur.

[5] Southern Water (2021). Draft Drought Plan 2022 Main report. 31 March 2021, Version 1.0.

4.5.7 One drought option identified in SWS's revised draft Drought Plan 2022[6], or the plans of neighbouring water companies, has the potential to affect these sites (**Pulborough Surface** Water - reduce Western Rother MRF). The HRA of the Drought Plan concluded that this drought option would have no adverse effects on these sites (absence of pathways for the SAC; with the benefit of interventionist mitigation to support water levels in some drains for particular units of the SPA/Ramsar). The mitigation proposed for the drought option is in the process of being finalised, although the measures proposed will also effectively mitigate any residual effects that may result from the WRMP option implementation. Adverse in combination effects would not therefore be expected.

Drainage and Wastewater Management Plans

4.5.8 The interaction of the WRMP options with specific schemes derived from the emerging Drainage and Wastewater Management Plan (DWMP) can only be assessed at the project level due to the generic nature of the DWMP options.

Other projects 'in combination'

Minor projects

4.5.9 It has not been possible to produce a definitive list of existing (minor) planning applications near this option's zone of influence, and generating a list at this stage would be of little value given the lead times for the option. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the ACWG guidance on cumulative/in combination assessments.

Major Projects

4.5.10 Reference has been made to the Planning Inspectorate's National Infrastructure Projects database[7] which includes major projects; no major projects are identified that are likely to affect this European site.

4.6 Conclusion: Arun Valley SPA, Arun Valley Ramsar, Arun Valley SAC

4.6.1 The hydrological impact of the Petworth abstraction on the Arun Valley sites alone is considered to be negligible, particularly in relation to the dominant effect of groundwater supply to the designated sites and the active management of water levels within the sites; the predicted flow reductions in the Arun will not be of sufficient magnitude to adversely affect the site alone either directly or through secondary mechanisms such as via impacts on water quality. It is considered that there is sufficient confidence to enable a conclusion of no adverse effect on the integrity of the Arun Valley SPA, Arun Valley Ramsar and Arun

[6] Southern Water (2021). Draft Drought Plan 2022 Main report. 31 March 2021, Version 1.0.

[7] Available at: https://infrastructure.planninginspectorate.gov.uk/projects/

Valley SAC to be drawn for the WRMP HRA in relation to this option, alone and in combination.

Appendix E3: Appropriate Assessment: Recycling (SNZ): Horsham with storage at Pulborough (6.8Ml/d)

1. Option Summary

1.1 Overview and European site context

1.1.1 This option is a new 9.5Ml/d water recycling plant producing a deployable output (DO) of 6.8Ml/d near Horsham WwTW and a transfer of the treated effluent to Church Farm reservoir, which feeds into Hardham WSW.

1.1.2 This would require:

- Upgrade of Horsham WwTW to tertiary treatment;
- 18km of 400mm pipeline to transfer treated effluent from Horsham WwTW to Church Farm reservoir.

1.1.3 The proposed option and pipeline location are in close proximity (within 10km) to The Mens Special Area of Conservation (SAC), Arun Valley Ramsar, Arun Valley Special Protection Area (SPA), Arun Valley SAC, Duncton to Bignor Escarpment SAC and Ebernoe Common SAC.

1.2 Environmental changes and option assumptions / uncertainties

Potential construction-related environmental changes

1.2.1 'Generic' environmental risks typically associated with the construction of new infrastructure may be realised (e.g. site-derived pollutants; additional noise or lighting; visual disturbance; etc.) although these cannot be reliably scoped or assessed at the plan-level as they are entirely dependent on the detailed design; however, such risks can almost certainly be avoided through scheme-design and/or the established best-practice measures noted in Appendix C.

1.2.2 However:

- the works will require construction of a pipeline, which may result in permanent habitat loss (if pipelines are surface-laid or with shallow cut-and-cover);

- the works will temporarily affect areas of agricultural land that may be functionally associated with some species from Arun Valley SPA, Arun Valley Ramsar, and The Mens SAC.

Potential operation-related environmental changes

1.2.3 'Generic' environmental risks typically associated with the operation of new infrastructure may be realised (e.g. additional noise or lighting, albeit minor in this instance) although these cannot be reliably scoped or assessed at the plan-level as they are entirely dependent on the detailed design; however, the operational plant required is not inherently high-impact in this regard, and potentially notable environmental changes can almost certainly be avoided through scheme-design.

1.2.4 The principal environmental changes from operation will therefore relate to:

- Reduction in flows discharged (treated effluent) to the River Arun at Horsham.

Assumptions and uncertainties

1.2.5 It is assumed that the tertiary treatment upgrade and pipeline will be designed according to best practice to minimise the effects on the environment; and that reduced-disturbance construction techniques are achievable if required. It is also assumed that the scheme will operate on a full-time basis for energy-efficiency reasons.

2. Screening Summary

2.1.1 The screening assessment is outlined in Table 2.1. In summary, significant effects cannot be self-evidently excluded for the following sites:

- The Mens SAC;
- Arun Valley Ramsar;
- Arun Valley SPA;
- Arun Valley SAC.

Table 2.1 Screening Assessment

Site	Location (km)*	LSE?		Rationale
		Cons	Oper	
The Mens SAC	3.7	U*	0	Construction: Site not exposed to construction effects (distance, no pollutant pathways, up-catchment); pipeline close to Core Sustenance Zone (CSZ; see Appendix B) defined for the mobile interest features of the site, and effects on supporting habitats cannot be excluded at the plan level

Site	Location (km)*	LSE?		Rationale
		Cons	Oper	
				(although the risk of significant effects would be low based on the nature of the works). Operation: No pathways for operational effects (separate catchment). "
Arun Valley Ramsar	0.3	U*	U	Construction: Scheme will involve construction within the catchment of this site; site features may also utilise functional habitats outside the site boundary. Operation: This option will reduce flows in the River Arun downstream of Horsham, which has the potential to affect this site - although the exposure of the site is likely to be low due to the relationship of the wetlands with the river and management of water levels within the site. However, this requires additional data to confirm acceptability. "
Arun Valley SPA	0.3	U*	U	Construction: Scheme will involve construction within the catchment of this site; site features may also utilise functional habitats outside the site boundary. Operation: This option will reduce flows in the River Arun downstream of Horsham, which has the potential to affect this site - although the exposure of the site is likely to be low due to the relationship of the wetlands with the river and management of water levels within the site. However, this requires additional data to confirm acceptability. "
Arun Valley SAC	0.3	U*	U	Construction: Scheme will involve construction within the catchment of this site, although site features will have a very low exposure to site-derived pollutants due to their location within the site (associated with ditches). Operation: This option will reduce flows in the River Arun downstream of Horsham, which has the potential to affect this site - although the exposure of the site is likely to be low due to the relationship of the wetlands with the river and management of water levels within the site. However, this requires additional data to confirm acceptability. "
Duncton to Bignor Escarpment SAC	5.8	0	0	Construction: No pathways for construction effects (distance, site up-catchment). Operation: No pathways for operational effects (distance, not exposed or sensitive to environmental changes). "
Ebernoe Common SAC	9.3	0	0	Construction: Site not exposed to construction effects (distance, no pollutant pathways, up-catchment site); pipeline substantially beyond the Core Sustenance Zone (CSZ; see Appendix B) defined for the mobile interest

Site	Location (km)*	LSE?		Rationale
		Cons	Oper	
				features of the site, and potentially significant effects on habitats functionally critical to the feature populations are very unlikely. Operation: No pathways for operational effects (network scheme only).

3. Assessment: The Mens SAC

3.1 Core Designation Information

3.1.1 The Mens SAC is an extensive area of mature beech *Fagus sylvatica* woodland rich in lichens, bryophytes, fungi and saproxylic invertebrates, and is one of the largest tracts of Atlantic acidophilous beech forests in the south-eastern part of the habitat's UK range. It is developing a near-natural high forest structure, in response to only limited silvicultural intervention over the 20th century, combined with the effects of natural events such as the 1987 great storm.

3.1.2 The core information relating to the designation (i.e. qualifying features, conservation objectives, supplementary advice documents, information on typical species, supporting habitats and known functional land) is available online and so not replicated here in detail, to minimise repetition and over-simplification of freely available data; Table 3.1 provides links to the key documents and information relating to the designation. Specific information that may be relevant to the assessment of effects is noted as necessary in the assessment sections below (e.g. known areas of functional land identified in the SACO documentation).

Table 3.1 Core Site Information

Aspect	Site Data
Site Name	The Mens SAC
Site Code	UK0012716
Qualifying features	- H9120: Atlantic acidophilous beech forests with Ilex and sometimes also Taxus in the shrub layer (Quercion robori-petraeae or Ilici-Fagenion) - S1308: Barbastelle Barbastella barbastellus
Standard Data Form	Available at: https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0012716.pdf
Conservation Objectives	Available at: http://publications.naturalengland.org.uk/publication/5642356338458624?category=6528471664689152

Aspect	Site Data
Site Improvement Plan	Available at: http://publications.naturalengland.org.uk/publication/5642356338458624?category=6528471664689152
Supplementary advice	Available at: http://publications.naturalengland.org.uk/publication/5642356338458624?category=6528471664689152
Associated SSSIs	Sites of Special Scientific Interest available at: https://designatedsites.naturalengland.org.uk/SiteGeneralDetail.aspx?SiteCode=UK0012716
Functional land	Specific areas of functional land are not noted in the supplementary advice, although the Core Sustenance Zones (CSZs) for barbastelle are 6km and so suitable habitats within this range may be functionally-linked.

*Water resource sensitive features, based on Environment Agency (EA) guidance

3.2 Mitigation Assumptions

Standard Measures / Best-practice

3.2.1 Appendix C identifies standard and established measures that are known to be available, achievable and likely to be effective in avoiding or mitigating potentially adverse effects on European sites and interest features. These are based on best- and case-practice from similar schemes, and so there can be high confidence in their deliverability and effectiveness. These measures would be applied unless project-level Habitats Regulation Assessments (HRA) or project-specific environmental studies demonstrate that they are not required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate.

Bespoke measures

3.2.2 Site- or feature-specific mitigation that may be required for specific atypical effects are identified in the assessment sections.

3.3 Assessment – Construction

3.3.1 Initial screening indicated that although the site was not exposed to construction effects, the pipeline is within the Core Sustenance Zone (CSZ; see Appendix B) defined for the mobile interest features of the site, and effects on supporting habitats could not be excluded. Likely Significant Effects during the construction phase cannot, therefore, be ruled out, and potential pathways for effects on qualifying features of the site have been considered below.

3.3.2 In summary:

- The proposed pipework is within the CSZ for Barbastelle (defined as 6km from the European site boundary). Barbastelle primary habitats are deciduous woodland, wet

meadows and water bodies, such as woodland streams and rivers, riparian margins and unimproved grassland. Secondary habitats can be field margins and hedgerows. The species typically commutes along hedgerows, riparian corridors and treelines.

- The installation of the pipework may affect bats through:
  - permanent or temporary loss of habitats and features that may support the bat population associated with the SAC (e.g. impacts on commuting routes or roosts);
  - Increased human and machinery activity causing noise / vibration / visual disturbance during the construction period.
- Adverse effects as a result of these pathways can be reliably avoided using normal project-level design and delivery best-practice (e.g. surveys for roosts; identification and avoidance of important features; re-instatement of affected habitats; etc; see also Appendix C) and no adverse effects would occur.

3.4 Assessment – Operation

3.4.1 Initial screening indicated that there are no pathways for operational effects.

3.5 In combination effects

3.5.1 Note, it is anticipated that the 'alone' effects of this option on these sites can (with the benefit of mitigation) be effectively reduced to 'nil' and so in combination effects would not be anticipated.

Other WRMP options

3.5.2 The potential for these European sites to be affected by two or more Water Resources Management Plan (WRMP) options (either options within the Southern Water (SWS) revised draft WRMP (rdWRMP), or options in the rdWRMPs of neighbouring water companies) is set out in Appendix F and Appendix G.

3.5.3 In summary, no unavoidable adverse in combination effects are anticipated.

Other Water Company Plans

Drought Plans

3.5.4 The Drought Plan will be revised several times before this WRMP option is implemented, and following option delivery, and so a meaningful in combination assessment arguably cannot be undertaken at this point. Furthermore, a future Drought Plan will necessarily reflect the abstraction baseline at that point (i.e. it will account for options implemented at that point in time) and be subject to HRA when revised, which provides a mechanism to ensure that in combination effects do not occur.

3.5.5 No drought options identified in SWS's revised draft Drought Plan 2022[1], or the plans of neighbouring water companies, will affect this site.

Drainage and Wastewater Management Plans

3.5.6 The interaction of the WRMP options with specific schemes derived from the emerging Drainage and Wastewater Management Plan (DWMP) can only be assessed at the project level due to the generic nature of the DWMP options.

Other projects 'in combination'

Minor projects

3.5.7 It has not been possible to produce a definitive list of existing (minor) planning applications near this option's zone of influence and generating a list at this stage would be of little value given the lead times for the option. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the All Company Working Group (ACWG) guidance on cumulative/in combination assessments[2].

Major Projects

3.5.8 Reference has been made to the Planning Inspectorate's National Infrastructure Projects database[3] which includes major projects; no major projects are identified that are likely to affect these European sites.

3.6 Conclusion: The Mens SAC

3.6.1 At this strategic plan level, no additional mitigation measures have been identified, above and beyond those set out in best practice guidance (Appendix C). Incorporated mitigation measures will be developed in more detail and secured during the project-stage HRA when a detailed design and construction method statement is available, although there is no reason to assume that adverse effects on The Mens SAC cannot be avoided at the project-level.

[1] Southern Water (2021). Draft Drought Plan 2022 Main report. 31 March 2021, Version 1.0.

[2] For more information see: https://www.wrse.org.uk/media/fspcib0h/acwg-design-principles-process-and-gate-2-indicators.pdf

[3] https://infrastructure.planninginspectorate.gov.uk/projects/

4. Assessment: Arun Valley SPA, Arun Valley Ramsar, Arun Valley SAC

4.1 Core Designation Information

4.1.1 Note, the Arun Valley SPA, Arun Valley Ramsar and Arun Valley SAC (collectively, the Arun Valley sites) are addressed together in the following sections as the mechanisms by which the sites might be affected by this option are largely the same (although mobile species associated with the SPA and Ramsar may be affected if using habitats outside the site boundaries).

4.1.2 The Arun Valley is located just north of the South Downs escarpment about 15 km inland from the south coast of England. It consists of low-lying grazing marsh, largely on alluvial soils, but with an area of peat derived from a relict raised bog. Southern parts of the Arun Valley are fed by calcareous springs, while to the north, where the underlying geology is Greensand, the water is more acidic. The history of management of fields, and their water levels, determines the plant communities present. The wet neutral grassland is subject to winter and occasional summer flooding. The site is dissected by a network of wet ditches which support a rich aquatic flora and invertebrate fauna. Variation in the chemical status of the water has resulted in an exceptionally high diversity of aquatic plant species in some of the ditches.

4.1.3 The core information relating to the designation (i.e. qualifying features, conservation objectives, supplementary advice documents, information on typical species, supporting habitats and known functional land) is available online and so not replicated here in detail, to minimise repetition and over-simplification of freely available data; Table 4.1, Table 4.2 and Table 4.3 provide links to the key documents and information relating to the designation. Specific information that may be relevant to the assessment of effects is noted as necessary in the assessment sections below (e.g. known areas of functional land identified in the Supplementary Advice on Conservation Objectives (SACO) documentation).

Table 4.1 Core Site Information

Aspect	Site Data
Site Name	Arun Valley SAC
Site Code	UK0030366
Qualifying features	- S4056: Ramshorn snail Anisus vorticulus*
Standard Data Form	Available at: https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0030366.pdf
Conservation Objectives	Available at: http://publications.naturalengland.org.uk/publication/4924283725807616?category=6528471664689152

Aspect	Site Data
Site Improvement Plan	Available at: http://publications.naturalengland.org.uk/publication/4924283725807616?category=6528471664689152
Supplementary advice	Available at: http://publications.naturalengland.org.uk/publication/4924283725807616?category=6528471664689152
Associated SSSIs	Available at: https://designatedsites.naturalengland.org.uk/SiteGeneralDetail.aspx?SiteCode=UK0030366
Functional land	None noted; interest features confined to site.

*Water resource sensitive features, based on EA guidance

Table 4.2 Core Site Information

Aspect	Site Data
Site Name	Arun Valley SPA
Site Code	UK9020281
Qualifying features	- A037w: Tundra swan Cygnus columbianus bewickii* - WATR: Waterbird assemblage*
Standard Data Form	Available at: https://jncc.gov.uk/jncc-assets/SPA-N2K/UK9020281.pdf
Conservation Objectives	Available at: http://publications.naturalengland.org.uk/publication/4567444756627456?category=6528471664689152
Site Improvement Plan	Available at: http://publications.naturalengland.org.uk/publication/4567444756627456?category=6528471664689152
Supplementary advice	Available at: http://publications.naturalengland.org.uk/publication/4567444756627456?category=6528471664689152
Associated SSSIs	Available at: https://designatedsites.naturalengland.org.uk/SiteGeneralDetail.aspx?SiteCode=UK9020281
Functional land	Qualifying species will periodically utilise a range of non-designated habitats close to the site for roosting or foraging, including agricultural land; some areas may be regularly used by relatively large proportions of the qualifying populations, and so may be considered functionally associated with the SPA.

*Water resource sensitive features, based on EA guidance

Table 4.3 Core Site Information

Aspect	Site Data
Site Name	Arun Valley Ramsar
Site Code	UK11004
Qualifying features	- Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. Communities (seven RDB wetland invertebrate species; four rare / scarce plant species)* - Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity (ditch flora)* - Crit. 5 - regularly supports 20,000 or more waterbirds (wintering bird assemblage)*
Standard Data Form	Available at: https://jncc.gov.uk/jncc-assets/RIS/UK11004.pdf
Conservation Objectives	As per associated SAC / SPA, or underpinning SSSI(s)
Site Improvement Plan	As per associated SAC / SPA, or underpinning SSSI(s)
Supplementary advice	As per associated SAC / SPA, or underpinning SSSI(s)
Associated SSSIs	Available at: https://designatedsites.naturalengland.org.uk/SiteGeneralDetail.aspx?SiteCode=UK11004
Functional land	Qualifying species will periodically utilise a range of non-designated habitats close to the site for roosting or foraging, including agricultural land; some areas may be regularly used by relatively large proportions of the qualifying populations, and so may be considered functionally associated with the Ramsar.

*Water resource sensitive features, based on EA guidance

4.2 Mitigation Assumptions

Standard Measures / Best-practice

4.2.1 Appendix C identifies standard and established measures that are known to be available, achievable and likely to be effective in avoiding or mitigating potentially adverse effects on European sites and interest features. These are based on best- and case-practice from similar schemes, and so there can be high confidence in their deliverability and effectiveness. These measures would be applied unless project-level HRAs or project-specific environmental studies demonstrate that they are not required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate.

Bespoke measures

4.2.2 Site- or feature-specific mitigation that may be required for specific atypical effects are identified in the assessment sections.

4.3 Assessment – Construction

4.3.1 The habitats of the Arun Valley sites will not be directly affected by construction due to the distance from the construction area; this also applies to the mobile qualifying features when within the site itself.

4.3.2 Initial screening indicated that the proposed pipeline route crosses tributaries of habitats of the Arun Valley sites at several points, and mobile species (birds) of the sites may be functionally associated with habitats affected by construction. Likely Significant Effects during the construction phase cannot, therefore, be ruled out, and potential pathways for effects on qualifying features of the site have been considered below.

4.3.3 The proposed pipeline route crosses tributaries of the River Arun, which ultimately flows past these sites, providing a potential pathway for site-derived pollutants; it is also possible that mobile species (birds) of the SPA/Ramsar may be functionally associated with habitats directly affected by construction.

4.3.4 However, these effect pathways will not be realised or can be avoided for the following reasons:

- Established best-practice construction measures (including normal design practice) can reliably safeguard receptors (e.g. through pollution prevention measures; scheduling works to avoid wintering periods, if required; route design to minimise risks; controls on noise / visual disturbance etc.)
- The habitats likely to be directly affected by the pipeline will be temporarily affected only, and are not (based on aerial photographs) likely to be particularly attractive to the qualifying features of the European site (sightlines affected by hedges and treelines along field boundaries).

4.4 Assessment – Operation

4.4.1 Operation of the scheme will affect the River Arun which ultimately flows past the Arun.

4.4.2 The sites are functionally linked to the River Arun, being a series of wet meadows which are periodically flooded/ inundated. However, evidence from ongoing studies indicates that the wetlands are not fundamentally supported fluvially (i.e. they are are not reliant / dependent on (for example) winter flooding from the Arun to maintain water levels), and whilst there may be some localised inputs from the river where sluices etc. are not operating correctly, the vast majority of the site is not supported by inward flows from the Arun but by groundwater or other surface water inputs from the catchment (i.e. the dominant direction of flow is from the wetlands to the river). High flows in the river may impede discharges from the wetlands, but the hydrology of the wetlands is largely determined by groundwater inputs and subsequent interventionist management of the water levels in the ditch network.

4.4.3 The possible exception to this is a small part of Waltham Brooks SSSI (approximately 0.4ha) that is in direct connectivity with the river as it lies riverwards of the flood bank. According to the Sussex Wildlife Trust management plan the water levels on the Waltham Brooks reserve are maintained by a manually-operated steel lifting gate sluice positioned on the internal boundary of the site in front of the tidal flap. The lake is an important constituent of the Brooks and has become an area important for winter wildfowl. For the SPA interest features (wintering and passage waterfowl and waders) the Sussex Wildlife Trust Management Plan for Waltham Brooks Reserve 2012-2022 indicates the key hydrological factor to be large expanses of floodwater, no less than 50cm in depth, in Compartment C between November and February inclusive.

4.4.4 The Arun Valley sites are currently subject to sustainability studies, exploring the impact of abstractions on the designated sites. NE has noted that "*The Arun Valley Habitats sites have deteriorated in condition where there is a current known adverse effect on integrity from groundwater abstraction, and other water-related impacts which are all likely to be significantly contributing towards this decline. Designated site condition, risk to resilience and supporting long-term environmental improvement / restoration (rather than inhibiting) must be considered in the assessment of any options that could affect these sites*".

4.4.5 With regard to the effects of the Horsham recycling scheme, it is assumed that the impact on flows in the Arun will be ~9.5Ml/d.

4.4.6 The approximate impact on flows in the Arun at Pulborough is summarised in Table 4.4 using data from the closest upstream gauging stations (Rother at Hardham, Station No. 41009; and Arun at Pallingham, Station No. 41014); note, this is conservative as there are other flow inputs to the Arun below Pallingham.

Table 4.4 Approximate flows in the River Arun at Pulborough

Flow percentile	Gauged flows (Ml/d)			Max. % impact on cumulative flows (9.5Ml/d abstraction)
	Rother at Hardham	Arun at Pallingham	Cumulative	
Mean	386.6	484.5	871.2	1.1
Q95	94.2	23.5	117.7	8.1
Q70	174.5	48.7	223.3	4.3
Q50	249.7	97.9	347.6	2.7
Q10	907.2	1339.2	2246.4	0.4
Q5	1304.6	2531.5	3836.2	0.2

4.4.7 Based on this:

- Under the worst-case scenario (i.e. assuming 9.5Ml/d) impacts river flows) the maximum impact on very low flows in the Arun adjacent to the designated sites would

be approximately 8.1%. However, the potential impact of the abstraction on low flows in the Arun arguably has limited relevance to the condition of the European site, as at very low flows the river is not directly supporting the adjacent wetlands (either through direct supply or by impeding drainage).

- At high / flood flows the estimated impact is <1% (0.4 – 0.2% at Q10 and Q5 respectively). It is therefore arguable that the effect of the Horsham recycling scheme on high / flood flows in the Arun will be inconsequential (essentially within normal variability) and will not meaningfully affect the volume of water entering the sites or its residence time within the site.
- The Waltham Brooks SSSI unit of the SPA/Ramsar has greater connectivity to the river and is partially reliant on winter flooding; the option will not substantively affect this (flooding will still occur, and water will be retained by the existing management regime) although mitigation measures proposed for the **Pulborough Surface** Water - reduce Western Rother MRF drought option in SWS's revised draft Drought Plan 2022[4] would also be effective and potentially appropriate for the WRMP option (these mitigation measures include partial removal of embankments to re-connect river to the floodplain sooner, creation of new ditches that connect the floodplain with the river at different water levels).
- Consequently, the hydrological impact of the Petworth abstraction on the Arun Valley sites alone is considered to be negligible, particularly in relation to the dominant effect of groundwater supply to the designated sites and the active management of water levels within the sites; the predicted flow reductions in the Arun will not be of sufficient magnitude to adversely affect the site alone either directly or through secondary mechanisms such as via impacts on water quality; and the anticipated magnitude of effects can almost certainly be mitigated with the mitigation interventions identified for the Drought Plan, if required.
- With regard to impacts on water quality, this will depend on the precise operation of the recycling scheme and the mechanisms for disposal of the waste stream from the recovered water. Assuming a worst case (i.e. that the waste stream is also discharged to the Arun) then operation would be expected to increase the concentration of some determinands in the Arun, although the total load would not be affected. It is possible that water quality changes may occur at the lowest flows, although as noted these are not considered relevant to the water supply to the Arun Valley sites. At the highest flows the water quality changes associated with the scheme operation are likely to be negligible. Adverse effects through secondary mechanisms such as via impacts on water quality would not therefore be expected.
- It is recognised that the existing groundwater abstractions from Hardham and other sources may be adversely affecting the Arun Valley sites. It is assumed that these sources will be subject to sustainability reductions (this underpins the modelling of the supply demand balance for the WRMP) and that these reductions will be made before this option is required (2056-57). As a result, the Horsham recycling option will not

[4] Southern Water (2021). Draft Drought Plan 2022 Main report. 31 March 2021, Version 1.0.

operate in combination with the existing abstraction regime; the nature of the option and magnitude of impacts from the option will ensure that it will not affect the future recovery and achievement of Favourable Conservation Status (FCS) at the Arun Valley sites.

- Residual uncertainties over operation are noted however, particularly with regard to water quality, which will require additional investigation and modelling at the project-level to resolve fully.

4.5 In combination effects

4.5.1 Plans, programmes and projects that have been considered within the in-combination assessment are detailed below.

Other WRMP options

4.5.2 The potential for these European sites to be affected by two or more WRMP options (either options within the SWS rdWRMP, or options in the rdWRMPs of neighbouring water companies) is set out in Appendix F and Appendix G.

4.5.3 No other water company options will affect these sites. With regard to other SWS options, the principal in combination risk will relate to the operation of the Groundwater (SNZ): New borehole at Petworth (4Ml/d) option (note, no unavoidable in alone or in combination effects are anticipated from construction of any options).

4.5.4 The cumulative impact of the Petworth option with the Horsham Recycling option on flows in the Arun would be as follows:

Table 4.5 Cumulative Impact of Horsham Recycling (~9.5Ml/d) and Petworth (max Ml/d on flows in the River Arun at Pulborough

Flow percentile	Gauged flows (Ml/d)			Max. % impact on cumulative flows (13.5Ml/d abstractions)
	Rother at Hardham	Arun at Pallingham	Cumulative	
Mean	386.6	484.5	871.2	1.5
Q95	94.2	23.5	117.7	11.5
Q70	174.5	48.7	223.3	6.0
Q50	249.7	97.9	347.6	3.9
Q10	907.2	1339.2	2246.4	0.6
Q5	1304.6	2531.5	3836.2	0.4

4.5.5 Low (Q95) flows in the river will be reduced by up to 11.5%, although as noted the integrity of the SPA/Ramsar is not influenced by the lowest flows in the river. As with the

alone assessment, although the Waltham Brooks SSSI unit of the SPA/Ramsar has greater connectivity to the river and is partially reliant on winter flooding the cumulative operation of the options will not substantively affect this (flooding will still occur, and water will be retained by the existing management regime) although mitigation measures proposed for the **Pulborough Surface** Water - reduce Western Rother MRF drought option in SWS's revised draft Drought Plan 2022[5] would also be effective and potentially appropriate for the WRMP option (these mitigation measures include partial removal of embankments to re-connect river to the floodplain sooner, creation of new ditches that connect the floodplain with the river at different water levels). In summary, no unavoidable adverse in combination effects are anticipated.

Other Water Company Plans

Drought Plans

4.5.6 The Drought Plan will be revised several times before this WRMP option is implemented, and following option delivery, and so a meaningful in combination assessment arguably cannot be undertaken at this point. Furthermore, a future Drought Plan will necessarily reflect the abstraction baseline at that point (i.e. it will account for options implemented at that point in time) and be subject to HRA when revised, which provides a mechanism to ensure that in combination effects do not occur.

4.5.7 One drought option identified in SWS's revised draft Drought Plan 2022[6], or the plans of neighbouring water companies, has the potential to affect these sites (**Pulborough Surface** Water - reduce Western Rother MRF). The HRA of the Drought Plan concluded that this drought option would have no adverse effects on these sites (absence of pathways for the SAC; with the benefit of interventionist mitigation to support water levels in some drains for particular units of the SPA/Ramsar). The mitigation proposed for the drought option is in the process of being finalised, although the measures proposed will also effectively mitigate any residual effects that may result from the WRMP option implementation. Adverse in combination effects would not therefore be expected.

Drainage and Wastewater Management Plans

4.5.8 The interaction of the WRMP options with specific schemes derived from the emerging Drainage and Wastewater Management Plan (DWMP) can only be assessed at the project level due to the generic nature of the DWMP options.

[5] Southern Water (2021). Draft Drought Plan 2022 Main report. 31 March 2021, Version 1.0.

[6] Southern Water (2021). Draft Drought Plan 2022 Main report. 31 March 2021, Version 1.0.

Other projects 'in combination'

Minor projects

4.5.9 It has not been possible to produce a definitive list of existing (minor) planning applications near this option's zone of influence, and generating a list at this stage would be of little value given the lead times for the option. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the ACWG guidance on cumulative/in combination assessments.

Major Projects

4.5.10 Reference has been made to the Planning Inspectorate's National Infrastructure Projects database[7] which includes major projects; no major projects are identified that are likely to affect this European site.

4.6 Conclusion: Arun Valley SPA, Arun Valley Ramsar, Arun Valley SAC

4.6.1 The hydrological impact of the Horsham recycling option on the Arun Valley sites alone is considered to be negligible, particularly in relation to the dominant effect of groundwater supply to the designated sites and the active management of water levels within the sites; the predicted flow reductions in the Arun will not be of sufficient magnitude to adversely affect the site alone either directly or through secondary mechanisms such as via impacts on water quality. It is considered that there is no reason to assume that adverse effects on Arun Valley SPA, Arun Valley Ramsar and Arun Valley SAC cannot be avoided at the project-level; however, it will be necessary to undertake further investigations in relation to the scheme operation at the project level (particularly with regard to water quality impacts).

[7] https://infrastructure.planninginspectorate.gov.uk/projects/

Appendix E4: Appropriate Assessment: Desalination (SWZ): Tidal River Arun

1. Option Summary

1.1 Overview and European site context

1.1.1 This option comprises a 20Ml/d desalination plant to treat seawater abstracted offshore near Littlehampton to supply treated water to the Sussex Worthing Water Resource Zone (WRZ). It is assumed that the water could be used during drought conditions to meet demand in the Sussex Worthing WRZ. There is bi-directional transfer between Sussex Worthing WRZ and Sussex North WRZ which means this option could result in additional benefit to Sussex North WRZ. This transfer would likely require additional connectivity between Perry Hill WSR and Tenants Hill WSR.

1.1.2 An investigation in AMP4 indicated that land adjacent to Littlehampton wastewater treatment works (WwTW) showed the greatest potential for a new desalination site because of the existing land use, the availability of services (access roads, power, etc.).

1.1.3 This option would require:

- Construction of a reverse osmosis desalination plant and buildings including pre- and post-treatment facilities and delivery and storage facilities for chemicals and consumables.
- Necessary site facilities and service connections (e.g. power connection, fencing, car park).
- Mains connection (up to 4km) to the local distribution network (potable water supply).
- Screened intake and pumping station on the coast and a pipeline to the works inlet.
- A new long-sea outfall and diffuser outfall.
- Distribution enhancements may be required to allow distribution of water to the Sussex Worthing WRZ.

1.1.4 The chemicals used in descaling and preserving the reverse osmosis membranes will be collected into a waste tank on site prior to disposal to a nearby wastewater treatment works. Additional on-site treatment may be required depending on the receiving sewerage network.

1.1.5 The construction works for this proposed option are, at their closet point, approximately 4.6km south of the closest boundary of the Arun Valley SPA and Arun Valley Ramsar site. (where the transfer main links with the supply network). The intake and pumping station on the coast and the long-sea outfall would, at the closest point, be located approximately 1.2km to the east of the Solent and Dorset Coast SPA.

1.1.6 The scheme would be required by 2046.

1.2 Environmental changes and option assumptions / uncertainties

Potential construction-related environmental changes

1.2.1 The Arun Valley SPA and Ramsar site are located upstream of all construction areas and there is no potential for any direct effects on these sites.

1.2.2 Wintering bird features of the Arun Valley SPA and Ramsar site may utilise habitats close to construction area and, therefore, there is risk of disturbing birds using non-designated functionally linked land. Site-derived pollutants from run-off have the potential to enter local watercourses, which may represent functionally linked habitat to the Arun Valley SPA and Ramsar site. There is, therefore, potential for effect on supporting habitats for the bird qualifying features outside the Arun Valley SPA and Ramsar site. The construction of the pipeline to the coastal intake will affect grazing marshes alongside the Arun estuary.

1.2.3 With regard to the Solent and Dorset Coast SPA, potential construction phase effects are related to water quality (i.e. accidental spills and pollution and potential for increases in suspended sediment concentrations and dispersion into the SPA during construction of the long-sea outfall).

1.2.4 Although the proposed works would be approximately 1.2km from the Solent and Dorset Coast SPA boundary, on a precautionary basis, there is potential for noise disturbance during the construction phase.

Potential operation-related environmental changes

1.2.5 'Generic' environmental risks typically associated with new infrastructure may be realised (e.g. additional noise or lighting) although these cannot be reliably scoped or assessed at the plan-level as they are entirely dependent on the detailed design. However, the operational plant required is not inherently high impact in this regard and there are no European sites in close proximity that may be exposed to environmental changes associated with the generic operation of the plant, and it is very unlikely that such environmental changes would extend over 1km from the plant location.

1.2.6 The principal environmental changes from operation will therefore relate to the discharge of wastewater from the reverse osmosis process via the newly constructed intake/outfall, and potentially the entrainment of marine species (i.e. prey items) at the intake. It is concluded that this is only a credible effect pathway for the Solent and Dorset Coast SPA.

1.2.7 Assessments of other desalination plants of a similar scale to the proposed option indicate that any increase in salinity would extend over a small area (up to 10m) (EDF, 2021). This area of effect was predicted for a site located on an open coastline, which is similar in nature to the location of the proposed discharge for this desalination option. Many other studies[1] have demonstrated that near-field dilution of brine to ambient levels typically occurs within a relatively short distance (tens or hundreds of metres rather than kilometres), and that impacts to benthic communities from concentrate discharges can be reliably minimised by using properly-designed diffuser systems.

1.2.8 Research from California suggests that a desalination plant of ~200Ml/d capacity will impinge approximately 1kg/day of marine biota (Water Reuse Association, 2011). Given the smaller scale of the proposed desalination plant proposed as part of this option, this figure is likely to be less for the proposed option.

1.2.9 It should be noted that the desalination scheme will be relatively small-scale (i.e. up to 20Ml/d, compared to (for example) 75Ml/d proposed for the Fawley desalination scheme considered at Water Resources Management Plan 2019 (WRMP19)).

Assumptions and uncertainties

1.2.10 Option-specific wastewater dispersion modelling cannot be conducted without detailed designs. As such, modelling from previous desalination plants of a similar scale to the proposed option has been used to provide an approximate zone of influence for any wastewater discharge.

2. Screening Summary

2.1.1 The screening assessment is outlined in Table 2.1. In summary, significant effects cannot be self-evidently excluded for the following sites:

- Arun Valley SPA and Ramsar site.
- Solent and Dorset Coast SPA.

[1] e.g. Roberts DA, Johnston EL & Knott NA (2009) Impacts of desalination plant discharges on the marine environment: A critical review of published studies. *Water Research* 44 (2010) 5117-5128; Fernández-Torquemada Y, Gónzalez-Correa JM, Loya A, Ferrero LM, Díaz-Valdés M (2009) Dispersion of brine discharge from seawater reverse osmosis desalination plants. *Desalination and Water Treatment* 5 (2009) 137–145; Portillo E., Ruiz de la Rosa M., Louzara G., Quesada J., Ruiz J.M. & Mendoza H. (2014) Dispersion of desalination plant brine discharge under varied hydrodynamic conditions in the south of Gran Canaria, *Desalination and Water Treatment*, 52:1-3, 164-177.

Table 2.1: Sites for which significant effects cannot be self-evidently excluded.

Site	Location (km)*	LSE?		Rationale
		Cons	Oper	
Arun Valley SPA and Ramsar site	4.6km	Y	N	Construction: Pipeline construction will affect grazing marshes alongside the Arun estuary which may be periodically utilised by waterbirds (named species and overall assemblage) of the SPA and Ramsar site. There is the potential for water pollution events during construction to affect supporting habitat for the bird qualifying features of the SPA and Ramsar site. However, because the construction works are several kilometres downstream of the Ramsar site, it is concluded that there is no credible risk of an effect on the non-waterbird criteria of the Ramsar site. There is a risk of disturbance to the bird qualifying features of the SPA and Ramsar site which may utilise habitats close to construction area. Operation: It is considered there is no credible effect pathway due to the distance of the SPA and Ramsar site from the location of this option.
Solent and Dorset Coast SPA	1.2km	Y	Y	Construction: Potential effects are related to water quality (i.e. accidental spills and pollution and potential for increases in suspended sediment concentrations and dispersion into the SPA during construction of the long-sea outfall). On a precautionary basis, there is potential for noise disturbance to qualifying features of the SPA during the construction phase. Operation: During operation, seawater would be abstracted from coastal waters, potentially affecting prey items for foraging terns (through impingement and entrainment). Hypersaline brine would be discharged into the marine environment via the long-sea outfall. This has the potential to affect water quality within the SPA, with consequences for the prey items of the qualifying interest features (foraging terns).

2.1.2 Some of the potential effects noted above will be clearly avoidable with established measures, which are accounted for at the appropriate assessment stage in accordance with People over Wind.

3. Assessment: Arun Valley SPA and Ramsar site

3.1 Core Designation Information

3.1.1 The Arun Valley is located approximately 15 km inland from the coast and consists of low-lying grazing marsh, largely on alluvial soils, but with an area of peat derived from a relict raised bog. It supports important numbers of wintering waterbirds, which feed in the wetter, low-lying fields and along ditches (Natural England, 2019).

3.1.2 The boundaries of the Arun Valley Ramsar site are coincident with the Arun Valley SPA. The 'Information Sheet on Ramsar Wetlands' for the Arun Valley Ramsar site notes that the site hosts seven wetland invertebrate species listed in the British Red Data Book as threatened. One of these, *Pseudamnicola confusa*, is considered to be endangered. The site also supports four nationally rare and four nationally scarce plant species. In addition, the ditches intersecting the site have a particularly diverse and rich flora.

3.1.3 The SPA and Ramsar site also hosts an internationally important assemblage of non-breeding waterbirds.

3.1.4 The Arun Valley consists of three component Sites of Special Scientific Interest (SSSI). Together these sites comprise an area of wet meadows on the floodplain of the River Arun between Pulborough and Amberley.

3.1.5 Table 3.1 provides links to the key documents and information relating to the designation. These documents are considered to be relevant to both the SPA and Ramsar site. Specific information that may be relevant to the assessment of effects is noted as necessary.

Table 3.1 Arun Valley SPA and Ramsar site-specific details

Aspect	Notes
Qualifying features	SPA • A037 Bewick's swan *Cygnus columbianus bewickii* (non-breeding) • Waterbird assemblage (non-breeding) (27,241 individual waterfowl (5 year peak mean for 1992/93 to 1996/97), including shoveler *Anas clypeata*, teal *Anas crecca*, wigeon *Anas penelope*, Bewick's swan). Ramsar site • Criterion 2: Supports vulnerable, endangered or critically endangered species or threatened ecological communities. • Criterion 3: Supports populations of plant/animal species important for maintaining regional biodiversity. • Criterion 5: Regularly supports 20,000 or more waterbirds.
Conservation Objectives	Available at: UK9020281-Arun-Valley-SPA-V2019.pdf
Site Improvement Plan	Available at: Site Improvement Plan: Arun Valley - SIP004 (naturalengland.org.uk)
Supplementary advice	Available at: UK9020281_ArunValleySPA_COSA_Formal Published 24 Mar 19.pdf

Associated SSSIs	Amberley Wild Brooks SSSI, Pulborough Brooks SSSI, Waltham Brooks SSSI.
Functional land	According to Natural England (2019), broad habitat types present within Arun Valley SPA which support wintering non-breeding birds include: • MG5 *Cynosurus cristatus-Centaurea nigra* lowland meadows. • MG13-related; Inland wet grassland. • S5 *Glyceria maxima* (Reed Sweet-grass) swamp. • S22 *Glyceria fluitans* (floating-sweet grass) water-margin vegetation. • Network of ditch systems. Lowland meadows, inland wet grassland and network of ditch systems are the important habitats that support the Ramsar site criteria.

Interest Feature Exposure

3.1.6 Natural England's supplementary advice (Natural England, 2019) states that the preferred food plants of Bewick's swan include *Potamogeton*, *Ceratophylum*, *Zannichellia*, *Myriophyllum* (aquatic freshwater plants) and *Chara* spp. (freshwater algae). Principal habitats for this species within and surrounding the site include grazing marsh, water fen and reedbeds, mesotrophic species-rich and poor grasslands, surrounding arable land, open water, rivers and ditches.

3.1.7 In the Arun Valley, Bewick's swan tends to roost overnight on disturbance-free floodwaters at Pulborough Brooks, Amberley Wild Brooks or the Arundel WWT Reserve. This species then feeds during the day on pastures within the Arun Valley SPA (and Ramsar site) or at a range of sites to the south of the SPA, between Arundel and Amberley (Natural England, 2019). However, the supplementary advice notes that Bewick's swan will fly up to 10km from their roost sites to feed.

3.1.8 The principal habitats known (or likely) to support the waterbird assemblage feature of the Arun Valley SPA and Ramsar site are grazing marsh and improved grassland (Natural England, 2019).

3.1.9 Based on the information in Natural England's supplementary advice (Natural England, 2019), it appears that the key areas of habitat that support the qualifying features of the Arun Valley SPA (and the waterbird assemblage of the Ramsar site) are located to the north of the area that would be affected by the construction works. It is concluded that the qualifying features of the SPA, and the waterbird assemblage feature of the Ramsar site, are at low risk of exposure to the effects of this option.

3.1.10 As noted in Table 2.1, the construction works would be located at least 4.6km downstream of the Ramsar site. Consequently, it is concluded that there is no credible risk of effect on the invertebrate and plant criteria of the Ramsar site, and these features are not considered further.

3.2 Mitigation Assumptions

Standard Measures / Best-practice

3.2.1 Appendix C identifies standard and established measures that are known to be available, achievable and likely to be effective in avoiding or mitigating potentially adverse effects on European sites and interest features. These are based on best- and case-practice from similar schemes, and so there can be high confidence in their deliverability and effectiveness. These measures would be applied unless project-level Habitats Regulation Assessments (HRA) or project-specific environmental studies demonstrate that they are not required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate.

Bespoke measures

3.2.2 Site- or feature-specific mitigation that may be required for specific atypical effects are identified in the assessment sections.

3.3 Assessment – Construction

Loss of Functional Habitat (On/Offsite) and Disturbance

3.3.1 The supplementary advice (Natural England, 2019) for the Arun Valley SPA and Ramsar site does not suggest the land that would be affected by the construction works plays a supporting role to the qualifying features of the SPA and Ramsar site. The advice notes that Bewick's swan roost within the SPA and feed during the day within the SPA and north of Arundel.

3.3.2 The key habitats for the waterbird assemblage are within the SPA and Ramsar site.

3.3.3 It is possible that areas of suitable habitat that could be affected by the construction works may be used by qualifying features of the SPA and the waterbird assemblage of the Ramsar site. However, on the basis of the information provided in the supplementary advice, it is highly unlikely that such land constitutes functionally linked land (i.e. the land is not necessary to the conservation of the protected habitat types and species (*Holohan v An Bord Pleanala C-461/17*) or play an important role in maintaining or restoring the population of qualifying species at favourable conservation status report (Chapman and Tyldesley, 2016)). On this basis, adverse effects can be excluded due to both habitat loss and disturbance.

Mitigation

3.3.4 No specific mitigation is deemed necessary beyond the standard measures set out in Appendix C. Project level surveys and / or more detailed assessment will further assess the role that any affected land may play in supporting non-breeding bird qualifying features of the SPA and Ramsar site. As a consequence, some of the mitigation measures

defined in Appendix C (in particular designing to avoid an impact and timing of works) may be appropriate.

Water Quality

3.3.5 Given the location of the construction works relative to the SPA and Ramsar site and potentially functionally linked land, there is a low risk of any pollution incident causing a water quality impact that could affect the qualifying features of the SPA and Ramsar site. However, should deterioration in water quality occur, this could affect supporting habitat for the qualifying features.

Mitigation

3.3.6 Best practice mitigation measures, detailed in Appendix C, will be followed during construction to ensure no adverse effects on the water quality of habitats that may have a supporting function to the non-breeding bird qualifying features of the SPA and Ramsar site occur as a result of construction activities. These are standard measures, with a high degree of confidence that they can be fully effective in preventing deterioration of water quality during construction.

3.4 Assessment – Operation

3.4.1 The screening assessment concluded that there is no credible risk of operational phase effects on the Arun Valley SPA and Ramsar site.

3.5 In combination effects

Other WRMP options

3.5.1 The potential for this European site to be affected by two or more WRMP options (either options within the SWS revised draft WRMP (rdWRMP), or options in the rdWRMPs of neighbouring water companies) is set out in Appendix F and Appendix G.

3.5.2 In summary this option will not have operational effects on these sites, and so no unavoidable in combination effects with other options will occur (all construction effects avoidable with normal measures).

Other Water Company Plans

Drought Plans

3.5.3 The Drought Plan will be revised several times before this WRMP option is implemented, and following option delivery, and so a meaningful in combination assessment arguably cannot be undertaken at this point. Furthermore, a future Drought Plan will necessarily reflect the abstraction baseline at that point (i.e. it will account for options implemented at that point in time) and be subject to HRA when revised, which provides a mechanism to ensure that in combination effects do not occur.

3.5.4 This site is the ultimate down-catchment receptor for a number of options identified in SWS's revised draft Drought Plan 2022[2], or the plans of neighbouring water companies. However, the Zones of Hydrological influence of these options will not coincide with this WRMP option to affect this SPA (and in reality, the SPA will have a very low sensitivity to the short-term temporary environmental changes associated with the drought options).

Other plans and projects 'in combination'

Minor projects

3.5.5 It has not been possible to produce a definitive list of existing (minor) planning applications near this option's zone of influence, and generating a list at this stage would be of little value given the lead times for the option. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the All Company Working Group (ACWG) guidance on in combination assessments[3].

Major projects

3.5.6 Reference has been made to the Planning Inspectorate's National Infrastructure Projects website[4] which includes major projects.

3.5.7 A review of that status of major projects that are located within or in close proximity to these European sites has been undertaken to assess the potential for in combination effect with this option. The following summarises the findings of this review:

- Rampion 2 Offshore Wind Farm - on 4th April 2025 consent was granted for development of an offshore wind farm with up to 90 wind turbines, associated foundations and all the electrical infrastructure required to transmit the power into the national electricity network at Bolney in Mid Sussex. The accompanying HRA OBJ records that the '*Secretary of State is satisfied that, given the relative scale and magnitude of the identified effects on the qualifying features of the protected sites and where relevant, the measures secured in the DCO and DML to avoid or reduce potential adverse effects, there would not be any implications for the achievement of site conservation objectives and therefore adverse effects on the integrity*' on all sites local to the south-east of England. Effects upon Flamborough and Filey Coast SPA and the Farne Islands SPA were not ruled out however, in the absence of alternatives and with a clear public interest compensation is to be provided to maintain the overall coherence of the UK National Site Network.

[2] Southern Water (2021). Draft Drought Plan 2022 Main report. 31 March 2021, Version 1.0.

[3] For more information see: https://www.wrse.org.uk/media/fspcib0h/acwg-design-principles-process-and-gate-2-indicators.pdf

[4] https://infrastructure.planninginspectorate.gov.uk/projects/

3.5.8 There is the potential for in combination effect with the Rampion 2 Offshore Wind Farm project, although the Secretary of State has concluded that the project will not give rise to adverse effects upon the integrity of nearby European sites. It will be necessary for a project level assessment of the Tidal River Arun desalination project to assess the potential for in combination effects with this project, depending on the timing of implementation relative to this option. At this stage, given the assessed potential effects of this option at the plan level, the potential for an adverse in combination effect is considered unlikely.

3.6 Conclusion: Arun Valley SPA and Ramsar site

3.6.1 In light of the predicted effect of this option both alone and in combination with other plans and projects, it is considered that there is sufficient confidence that appropriate mitigation measures are available and can be implemented to enable a conclusion of no adverse effect on the integrity of the Arun Valley SPA and Ramsar site to be drawn.

3.6.2 It is possible that there will be in combination project-specific construction effects associated with projects or plans that cannot be reasonably identified and assessed at the WRMP level, and which can only be assessed at the time of any application or delivery. This is consistent with the ACWG guidance on in combination assessments.

4. Assessment: Solent and Dorset Coast SPA

4.1 Core Designation Information

4.1.1 The Solent and Dorset Coast SPA is a large site, covering approximately 88,981 ha and stretches from Worbarrow Bay in Dorset to Littlehampton in West Sussex incorporating most of the Hampshire and Isle of Wight coastline and adjacent offshore areas. The SPA protects the waters surrounding locations that are used by breeding tern colonies for foraging and maintenance activities, such as bathing and preening.

4.1.2 According to Natural England's designated sites view, the SPA supports over 12% of UK's tern breeding population, specifically, 4.92% of the common tern (*Sterna hirundo*), 4.01% of Sandwich tern (*Sterna sandvicensis*), and 3.31% of little tern (*Sternula albifrons*) populations.

4.1.3 Table 4.1 provides links to the key documents and information relating to the designation. Specific information that may be relevant to the assessment of effects is noted as necessary.

Table 4.1 Solent and Dorset Coast SPA site-specific details

Aspect	Notes
Qualifying features	• A193 Common tern, *Sterna hirundo* (breeding) • A195 Little tern, *Sternula albifrons* (breeding) • A191 Sandwich tern, *Sterna sandvicensis* (breeding)

Conservation Objectives	Available at: Marine site detail (naturalengland.org.uk)
Site Improvement Plan	Not available
Supplementary advice	Available at: Designated Sites View (naturalengland.org.uk)
Associated SSSIs	Various (see list under 'Site information')at: Marine site detail (naturalengland.org.uk))
Functional land	Marine waters off the coasts of Dorset, Hampshire, Isle of Wight and West Sussex.

Interest Feature Exposure

4.1.4 The boundaries of the SPA are defined based on the modelled usage of marine waters by terns from their colony locations. The SPA citation states that the westernmost extremity of the boundary (at Worbarrow Bay in Dorset) is determined by the modelled usage of Sandwich terns foraging from the Poole Harbour SPA. The easternmost extremity of the boundary (at Bognor Regis in West Sussex) is determined by the modelled usage of Sandwich terns foraging from Chichester and Langstone Harbours SPA.

4.1.5 Given the basis for the geographical extent of the SPA, it can be concluded that the qualifying features are not reliant on land (sea) beyond the boundaries of the SPA. The proposed option could affect the SPA through indirect means, namely dispersion of sediment that may be disturbed during marine construction works and underwater noise which may affect tern prey items. The proposed works are, however, located approximately 1.2km from the SPA boundary and, therefore, there is likely to be a low risk of significant exposure to the potential effects of the construction works.

4.1.6 During operation, seawater would be abstracted from coastal waters, potentially affecting prey items for foraging terns (through impingement and entrainment). Hypersaline brine would be discharged into the marine environment via the long-sea outfall. This has the potential to affect water quality within the SPA, with consequences for the prey items of foraging terns. However, the fact that the intake and outfall are not within the SPA, and are located over 1km to the east of the SPA boundary, means that the exposure of the qualifying features to the potential effects of this option is considered low.

4.2 Mitigation Assumptions

Standard Measures / Best-practice

4.2.1 Appendix C identifies standard and established measures that are known to be available, achievable and likely to be effective in avoiding or mitigating potentially adverse effects on European sites and interest features. These are based on best- and case-practice from similar schemes, and so there can be high confidence in their deliverability and

effectiveness. These measures would be applied unless project-level HRAs or project-specific environmental studies demonstrate that they are not required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate.

Bespoke measures

4.2.2 Site- or feature-specific mitigation that may be required for specific atypical effects are identified in the assessment sections.

4.3 Assessment – Construction

Water Quality

4.3.1 The construction of the long-sea outfall could, depending on construction technique, result in the disturbance of seabed sediments that could potentially disperse within the boundary of the SPA. The risk of this pathway occurring is largely dependent on the physical nature of the seabed that could be disturbed; non-cohesive finer sediments (e.g. silt) would remain in suspension for longer than coarser sediments (e.g. sand) and, therefore, would disperse further, with greater potential to affect water quality within the SPA.

4.3.2 The European Commission's European Marine Observation and Data Network (EMODnet) Map Viewer includes data on seabed sediment type. At the location of the proposed long-sea outfall, the seabed is described as coarse-grained sediment and slightly gravelly sand, indicating that any sediment disturbed would rapidly settle to the seabed.

4.3.3 Reporting research undertaken by Bray (2008), advice produced by JNCC and Natural England (2011) includes a prediction of the extent of effects predicted to arise during dredging and dredged material placement (noting that these activities would be expected to generate notably higher levels of suspended sediment than construction of the long-sea outfall as part of this option). The advice states that the turbidity, smothering of organisms and reduced water quality are only likely to occur in the short-term (defined as less than 1 week) and would be near-field (less than 1km). Considering the above advice, the nature of the seabed at the location of the proposed long-sea outfall and the likely very small quantity of seabed that could be disturbed relatively to dredging activity, it is highly unlikely that sediment would disperse to within the boundaries of the SPA.

4.3.4 Due to the proposed long-sea outfall being located in excess of 1km from the SPA boundary, there is limited risk of any pollution event during construction affecting the site. Through the use of best practice construction measures and adherence to appropriate pollution prevention guidelines, such effects can be avoided or effectively mitigated during the construction phase.

Mitigation

4.3.5 Best practice mitigation measures, detailed in Appendix C, will be followed during construction to ensure no adverse effects on the water quality of the SPA occur as a result of construction activities.

4.3.6 In addition, the use of alternative construction methods such as horizontal directional drilling (HDD) should be considered, as such methods would further significantly reduce the risk of adverse water quality effects occurring.

4.3.7 It is concluded that there is a low risk of construction works negatively affecting the SPA. In addition, there are effective construction techniques available to ensure no adverse effect on the integrity of the SPA.

Disturbance

4.3.8 Noise, both above water (or airborne) and underwater, arising during the construction of the long-sea outfall, the intake and pumping station on the coast has the potential to cause disturbance to foraging terns within the SPA and to cause changes in the distribution of prey items for terns.

4.3.9 While developed from evidence of the responses of non-breeding waterbirds to airborne noise, the Waterbird Disturbance Mitigation Toolkit (Cutts et al., 2013) is a useful reference source in providing an indication of the level of risk of disturbance associated with generation of above water noise. Cutts et al. (2013) identify an 'acceptable' noise level of approximately 70 dB(A), below which low level responses to noise are likely. For the highest noise level at source (120 dB(A)) reported by Cutts et al. (2013), an 'acceptable' noise level is predicted at a distance of approximately 340m from the source (66 dB(A)).

4.3.10 According to a JNCC advice note (JNCC, 2022), little tern and Sandwich tern are considered relatively insensitive to disturbance. The advice note does not refer to common tern (which is the other qualifying tern species of the SPA), but does also class roseate tern and Arctic tern as relatively insensitive to disturbance, implying this would also apply to common tern.

4.3.11 As part of the Shadow HRA for the Wylfa Newydd new nuclear build project on Anglesey (Horizon Nuclear Power, 2018), a literature review of evidence on the response of terns to above water noise stimuli when they are commuting or foraging in offshore environments was undertaken. This review confirmed that there is little direct evidence available for tern species; however, broad-based and qualitative consideration has been given to how different seabird species respond to anthropogenic disturbance in offshore environments (Garthe, S and Hüppop, O., 2004; Furness et al., 2013). These studies suggest that terns are relatively insensitive to anthropogenic disturbance in the offshore environment.

4.3.12 Horizon Nuclear Power (2018) concludes that the available evidence that suggests terns are unlikely to show marked responses to above water noise levels below 70 dB(A) when foraging or commuting. Combined with the reported low sensitivity to anthropogenic disturbance sources in the offshore environment, a highly precautionary assumption was made that birds would avoid offshore areas where the noise levels from plant and machinery during the construction period were predicted to exceed 65 dB(A).

4.3.13 Horizon Nuclear Power (2018) also researched the potential indirect effect of the generation of underwater noise disturbance. This could have indirect effects on terns as a result of impacts on their fish prey, which may suffer injury or direct mortality when in close proximity to noise sources or be displaced from the affected waters.

4.3.14 The marine construction works for the Wylfa Newydd project included rock breaking; this was predicted to produce the highest levels of underwater noise. The underwater noise modelling indicated that Temporary Threshold Shifts (TTS) in fish with swim bladders could occur up to a distance of 180m, with more extreme effects of recoverable injury and mortality at distances of less than 10m. For hearing sensitive fish, the risks of behavioural effects to continuous sound is considered high within tens of metres of the source, medium at distances of hundreds of metres and low at distances of kilometres (Horizon Nuclear Power, 2018).

4.3.15 The above review, which is based on noise levels likely to be well in excess of those generated by the construction works for this option, indicates that above water and underwater noise levels are highly unlikely to exceed a level that could cause any disturbance beyond a few hundred metres from the source. Given the distance of the construction works to the SPA, no disturbance effect due to above water noise is predicted to the foraging terns of the Solent and Dorset Coast SPA, and no effect is predicted on prey items for foraging terns due to underwater noise.

Mitigation

4.3.16 Although no disturbance effect is predicted, the use of alternative construction methods such as HDD should be considered, as such methods would further significantly reduce the generation of noise (in particular underwater noise).

4.3.17 It is concluded that there is no credible risk of an adverse effect on the integrity of the SPA.

4.4 Assessment – Operation

Saline discharge

4.4.1 The saline discharge may lead to a very minor increase in salinity in the vicinity of the outfall. This change in salinity is unlikely to lead to any material impacts on biological elements given the hydrographic regime and ambient salinity at this location.

4.4.2 Assessments of other desalination plants of a similar scale to the proposed option indicate that any increase in salinity would extend over a small area (up to 10m) (EDF, 2021). This area of effect was predicted for a site located on an open coastline, which is similar in nature to the location of the proposed discharge for this desalination option. Many other

studies[5] have demonstrated that near-field dilution of brine to ambient levels typically occurs within a relatively short distance (tens or hundreds of metres rather than kilometres), and that impacts to benthic communities from concentrate discharges can be reliably minimised by using properly-designed diffuser systems.

4.4.3 No higher sensitivity habitats are located in the vicinity of the proposed intake/outfall location; however, dispersion modelling should be conducted to ensure that no areas of habitat further afield from the intake/outfall could be subject to increased salinity.

4.4.4 During operation, a number of chemicals will be required in the operational processes (e.g. biocides and anti-scalants). The settlement stage of the process will use an inlet storage tank to provide settlement of solids and to balance salinity. It is anticipated that any solids that are settled out (without treatment aid – see below) would be discharged in a controlled manner with the brine, ensuring that the suspended sediment load is not too high for the receiving waters. The pre-filtration stage will remove solids that are not settled in first stage and it is anticipated that backwash water would be discharged with the brine. These discharges will encompass a very limited spatial extent, with no risk of dispersion to within the SPA and, therefore, there is no risk of the qualifying features being exposed directly to any contaminants.

Impingement and entrainment

4.4.5 The intake for the desalination plant could lead to impingement of organisms (organisms trapped on filter screens), entrainment (organisms drawn into the intake structure) and/or entrapment (organisms trapped within intake pipeline structure). These impacts to marine biota could change the food availability, distribution and density in the area immediately around the intake and therefore indirectly impact the feeding patterns of the qualifying bird species (noting that no direct effect is predicted within the SPA, which defines the core foraging area of the qualifying tern species of the SPA).

4.4.6 Research from California suggests that a desalination plant of ~200Ml/d capacity will impinge approximately 1kg/day of marine biota (Water Reuse Association, 2011). Given the significantly smaller scale of the proposed desalination plant, this figure is likely to be reduced in the case of the proposed option.

4.4.7 Mitigation measures and use of best practice design, such as the use of a passive wedge-wire cylinder (PWWC) with an appropriate mesh size would be able to greatly minimise the impacts of impingement and entertainment. At the detailed design stage, consideration will be given to use of a surface or sub-surface intake, capped intake to reduce vertical flow, low velocities through the screens, sizing of the screens and deflection technologies.

[5] e.g. Roberts DA, Johnston EL & Knott NA (2009) Impacts of desalination plant discharges on the marine environment: A critical review of published studies. Water Research 44 (2010) 5117-5128; Fernández-Torquemada Y, Gónzalez-Correa JM, Loya A, Ferrero LM, Díaz-Valdés M (2009) Dispersion of brine discharge from seawater reverse osmosis desalination plants. Desalination and Water Treatment 5 (2009) 137–145; Portillo E., Ruiz de la Rosa M., Louzara G., Quesada J., Ruiz J.M. & Mendoza H. (2014) Dispersion of desalination plant brine discharge under varied hydrodynamic conditions in the south of Gran Canaria, Desalination and Water Treatment, 52:1-3, 164-177.

4.4.8 In addition, the intake will be located outside the SPA, which represents the core foraging area for the nearby tern colonies.

Mitigation

4.4.9 The following mitigation techniques are available and could be applied to this option:

- Residual chemicals from treatment process to be neutralised before release with brine discharge.
- Incorporate best practice technologies for intake to minimise impingement and entrainment issues of prey features, such as PWWC with an appropriate mesh size.

4.5 In combination effects

Other WRMP options

4.5.1 The potential for this European site to be affected by two or more WRMP options (either options within the SWS revised draft WRMP (rdWRMP), or options in the rdWRMPs of neighbouring water companies) is set out in Appendix F and Appendix G.

4.5.2 In summary the no other options are likely to operate in combination with the Arun desalination scheme to affect this site.

Other Water Company Plans

Drought Plans

4.5.3 The Drought Plan will be revised several times before this WRMP option is implemented, and following option delivery, and so a meaningful in combination assessment arguably cannot be undertaken at this point. Furthermore, a future Drought Plan will necessarily reflect the abstraction baseline at that point (i.e. it will account for options implemented at that point in time) and be subject to HRA when revised, which provides a mechanism to ensure that in combination effects do not occur.

4.5.4 This site is the ultimate down-catchment receptor for a number of options identified in SWS's revised draft Drought Plan 2022[6], or the plans of neighbouring water companies. However, the Zones of Hydrological influence of these options will not coincide with this WRMP option to affect this SPA (and in reality, the SPA will have a very low sensitivity to the short-term temporary environmental changes associated with the drought options).

[6] Southern Water (2021). Draft Drought Plan 2022 Main report. 31 March 2021, Version 1.0.

Drainage and Wastewater Management Plans

4.5.5 The interaction of the WRMP options with specific schemes derived from the emerging Drainage and Wastewater Management Plan (DWMP) can only be assessed at the project level due to the generic nature of the DWMP options.

Other projects 'in combination'

Minor projects

4.5.6 It has not been possible to produce a definitive list of existing (minor) planning applications near this option's zone of influence, and generating a list at this stage would be of little value given the lead times for the option. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the ACWG guidance on cumulative/in combination assessments.

Major projects

4.5.7 Reference has been made to the Planning Inspectorate's National Infrastructure Projects website[7] which includes major projects.

4.5.8 A review of that status of major projects that are located within or in close proximity to this European site has been undertaken to assess the potential for in-combination effect with this option. The following summarises the findings of this review:

- Hampshire Water Transfer and Water Recycling Project – is at the pre-application stage, the project includes:
  - Circa 40km underground pipeline (minimum 800mm diameter) to transfer at peak operation (i.e. in a drought scenario) at least 75Ml/d of water from Havant Thicket Reservoir to Lower Itchen Water Supply Works;
  - Short circa 0.5km underground pipeline to transfer at peak operation a) at least 19Ml/d of treated waste water between Portsmouth Water Water Treatment Works and the proposed Water Recycling Plant and b) waste arising from the water recycling process from the WRP back to the Portsmouth Water area;
  - Water Recycling Plant in vicinity of Portsmouth Water Water Treatment Works with a peak output of at least 15 Ml/d of recycled water;
  - High lift pumping station, either located at the site of the Water Recycling Plant or located along the underground water transfer pipelines between Water Recycling Plant, Havant Thicket Reservoir and Lower Itchen Water Supply Works;
  - Second stage pumping station and break pressure tank located along the underground water transfer pipelines between Water Recycling Plant, Havant

[7] https://infrastructure.planninginspectorate.gov.uk/projects/

Thicket Reservoir and Lower Itchen Water Supply Works; an application is expected to be submitted to the Planning Inspectorate.

- Rampion 2 Offshore Wind Farm - on 4th April 2025 consent was granted for development of an offshore wind farm with up to 90 wind turbines, associated foundations and all the electrical infrastructure required to transmit the power into the national electricity network at Bolney in Mid Sussex. The accompanying HRA records that the 'Secretary of State is satisfied that, given the relative scale and magnitude of the identified effects on the qualifying features of the protected sites and where relevant, the measures secured in the DCO and DML to avoid or reduce potential adverse effects, there would not be any implications for the achievement of site conservation objectives and therefore adverse effects on the integrity' on all sites local to the south-east of England. Effects upon Flamborough and Filey Coast SPA and the Farne Islands SPA were not ruled out however, in the absence of alternatives and with a clear public interest compensation is to be provided to maintain the overall coherence of the UK National Site Network.
- AQUIND Interconnector – a decision is awaited on development of AQUIND Interconnector with a nominal net capacity of 2000MW between Great Britain and France located off the coast of Portsmouth offshore and between Portsmouth and Lovedean substation onshore. The HRA report[8] concludes that '*subject to the mitigation secured in the DCO, the effects of the Project, either alone or in-combination with other plans or projects, on the features of the aforementioned 13 protected sites, would not lead to an adverse effect on the integrity of these sites.'* Onshore mitigation includes, established measures such as directional drilling, pollution prevention, screening (to reduce disturbance), seasonal timing of work and restoration following construction.

4.5.9 Given the nature, location, current status of the environmental information and/or conclusion of the Secretary of State's HRA relating to the major projects reviewed above, it can be concluded that there is either no realistic potential for in-combination effects with the proposed option, or the environmental assessment of the major projects is not sufficiently advanced to enable in-combination assessment to be undertaken.

4.6 Conclusion: Solent and Dorset Coast SPA

4.6.1 In light of the predicted effect of this option both alone and in-combination with other plans and projects, it is considered that there is sufficient confidence that appropriate mitigation measures are available and can be implemented to enable a conclusion of no adverse effect on the integrity of the Solent and Dorset Coast SPA to be drawn.

[8] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN020022/EN020022-004430-EN020022%20-%20HRA%20Report.pdf

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Appendix E5:
Appropriate Assessment: Groundwater (IOW): New boreholes at Newchurch (LGS) (1.9Ml/d)

1. Option Summary

1.1 Overview and European site context

1.1.1 This option proposes replacing all three Lower Greensand (LGS) boreholes on site so that the source can operate to its licensed capacity. Currently BH4 is non-operational. BH1 and BH2 are operational but at reduced capacity due to screen de-watering. No additional treatment is proposed.

1.1.2 The location of the three Lower Greensand boreholes is close to (within 10km) Briddlesford Copses Special Area of Conservation (SAC), Solent and Dorset Coast Special Protection Area (SPA), South Wight Maritime SAC, Solent and Southampton Water Ramsar, Solent and Southampton Water SPA, Solent and Isle of Wight Lagoons SAC, Solent Maritime SAC, Isle of Wight Downs SAC.

1.2 Environmental changes and option assumptions / uncertainties

Potential construction-related environmental changes

1.2.1 'Generic' environmental risks typically associated with the construction of new infrastructure may be realised (e.g. site-derived pollutants; additional noise or lighting; visual disturbance; etc.) although these cannot be reliably scoped or assessed at the plan-level as they are entirely dependent on the detailed design; however, such risks can almost certainly be avoided through scheme-design and/or the established best-practice measures noted in Appendix C.

1.2.2 However:

- the works will require the replacement of boreholes near to several European sites, which may result in permanent habitat loss in the absence of best practice guidance and mitigation.

Potential operation-related environmental changes

1.2.3 'Generic' environmental risks typically associated with the operation of new infrastructure may be realised (e.g. additional noise or lighting) although these cannot be reliably scoped or assessed at the plan-level as they are entirely dependent on the detailed

design; however, the operational plant required is not inherently high-impact in this regard, and potentially notable environmental changes can almost certainly be avoided through scheme-design.

1.2.4 Environmental changes from operation are not anticipated as the option would operate within licence, although the availability of the licensed volumes vs. recent actual abstraction requires confirmation as the Environment Agency's abstraction licensing strategy (ALS) suggests restricted groundwater (GW) available, and restricted or no surface water (SW) for this location depending on flows.

Assumptions and uncertainties

1.2.5 It is assumed that the borehole replacement works will be designed according to best practice and that the scheme will operate on a full-time basis for energy-efficiency reasons.

2. Screening Summary

2.1.1 The screening assessment is outlined in Table 2.1. In summary, significant effects cannot be self-evidently excluded for the following sites (operational phase only):

- Solent and Southampton Water SPA;
- Solent and Southampton Water Ramsar; and
- Solent and Isle of Wight Lagoons SAC.

Table 2.1 Screening Summary

Site	Location (km)*	LSE?		Rationale
		Cons	Oper	
Briddlesford Copses SAC	2.7	0	0	Construction: Site not exposed to construction effects (distance, no pollutant pathways, separate catchment); works are very small scale (borehole replacements) located in open fields, and so the feature population will not be functionally dependent or associated with the area exposed to environmental changes. There will be 'no effects' on this site or its features. Operation: No pathways for operational effects (site not groundwater dependent).

Site	Location (km)*	LSE?		Rationale
		Cons	Oper	
Solent and Dorset Coast SPA	3.8/DS	0	0	Construction: Works are very small scale (borehole replacements) located in open fields and so construction effects would not be anticipated irrespective of any additional mitigation measures. There will be 'no effects' on this site or its features. Operation: Site / features will not be exposed or sensitive to the anticipated environmental changes; this site is located outside Bembridge harbour and is predominantly marine at this location, and so exposure to environmental changes associated with the option operation will be inconsequential.
South Wight Maritime SAC	3.9	0	0	Construction: Works are very small scale (borehole replacements) located in open fields and so construction effects would not be anticipated irrespective of any additional mitigation measures. There will be 'no effects' on this site or its features. Operation: Site / features will not be exposed or sensitive to the anticipated environmental changes; this site is located outside Bembridge harbour and is predominantly marine at this location, and so exposure to environmental changes associated with the option operation will be inconsequential.
Solent and Southampton Water Ramsar	4.2/DS	0	U	Construction: Works are very small scale (borehole replacements) located in open fields and so construction effects would not be anticipated irrespective of any additional mitigation measures. There will be 'no effects' on this site or its features. Operation: The option would operate within licence, although the availability of the licensed volumes vs. recent actual abstraction requires confirmation as CAMS suggests restricted GW available, and restricted or no SW for this location depending on flows.
Solent and Southampton Water SPA	4.2/DS	0	U	Construction: Works are very small scale (borehole replacements) located in open fields and so construction effects would not be anticipated irrespective of any additional mitigation measures. There will be 'no effects' on this site or its features. Operation: The option would operate within licence, although the availability of the licensed volumes vs. recent actual abstraction requires confirmation as CAMS suggests restricted GW available, and restricted or no SW for this location depending on flows.

Site	Location (km)*	LSE?		Rationale
		Cons	Oper	
Solent and Isle of Wight Lagoons SAC	6.5/DS	0	U	Construction: Works are very small scale (borehole replacements) located in open fields and so construction effects would not be anticipated irrespective of any additional mitigation measures. There will be 'no effects' on this site or its features. Operation: There is likely to be little / no exposure to operational effects due to location / relationship of the lagoon network adjacent to Brading Marshes and Bembridge Harbour relative to Yar. In summary, two of the lagoons are seawater-dominated, and essentially have salinities similar to seawater. The other two lagoons receive freshwater input from Brading Marshes and are hence brackish or low-salinity, but the water levels in Brading Marshes are largely controlled through direct management (sluices etc.) with some inundation occurring when the river is tidally locked, and so not directly dependent on flows etc. within the Yar.
Solent Maritime SAC	6.9	0	0	Construction: No pathways for construction effects (distance, site in separate catchment). Operation: No pathways for operational effects (distance, site in separate catchment).
Isle of Wight Downs SAC	7.6	0	0	Construction: No pathways for construction effects (distance, site in separate catchment). Operation: Most of the site features are not sensitive to water resource permissions although the Vegetated sea cliffs feature can be supported by groundwater seepages at some sites. In this instance the closest unit of this site (Ventnor Downs SSSI) is chalk downland located on chalk hills above Ventnor that does not support this feature. In addition, the boreholes are accessing the Lower Greensand aquifer which will not be supporting any groundwater seepages in the chalk, and so operational effects will not occur.

* Closest point of site to option; DS = downstream receptor

3. Assessment: Solent and Southampton Water SPA, Solent and Southampton Water Ramsar and Solent and Isle of Wight Lagoons SAC

3.1 Core Designation Information

3.1.1 Note, the Solent and Southampton Water SPA, the Solent and Southampton Water Ramsar and the Solent and Isle of Wight Lagoons SAC are addressed together in the following sections as the mechanisms by which the sites might be affected by this option are largely the same (although mobile species associated with the SPA and Ramsar may be affected if using habitats outside the site boundaries).

3.1.2 The Solent and Southampton Water SPA encompasses a series of estuaries and adjacent coastal habitats, which are important for numerous bird species, including breeding gulls and terns, and wintering waterfowl[1].

3.1.3 The Solent and Southampton Water Ramsar comprises a series of estuaries and adjacent coastal habitats, ranging from intertidal flats and saline lagoons to saltmarsh and damp woodland. The site exhibits an 'unusual strong double tidal flow', with long periods of slack water at both high and low tides, and supports internationally important numbers of wintering waterfowl, important breeding gull and tern populations, and an array of rare invertebrates and plants.

3.1.4 The Solent and Isle of Wight Lagoons SAC encompasses a series of coastal lagoons, including percolation, isolated and sluiced lagoons. The site includes a number of lagoons in the marshes in the Keyhaven – Pennington area, at Farlington Marshes in Langstone Harbour, behind the sea-wall at Bembridge Harbour and at Gilkicker, near Gosport. The lagoons show a range of salinities and substrates, ranging from soft mud to muddy sand with a high proportion of shingle, which support a diverse fauna including large populations of notable species. The only lagoon potentially affected by the option is that located at Bembridge.

3.1.5 The core information relating to the designation (i.e. qualifying features, conservation objectives, supplementary advice documents, information on typical species, supporting habitats and known functional land) is available online and so not replicated here in detail, to minimise repetition and over-simplification of freely available data; Table 3.1 and Table 3.2 provide links to the key documents and information relating to the designation. Specific information that may be relevant to the assessment of effects is noted as necessary in the assessment sections below (e.g. known areas of functional land identified in the SACO documentation).

[1] Natural England (2014). EC Directive on the Conservation of Wild Birds: Solent and Southampton Water SPA.

Table 3.1 Core Site Information

Aspect	Site Data
Site Name	Solent and Southampton Water SPA
Site Code	UK9011061
Qualifying features	- A137w: Ringed plover Charadrius hiaticula - A176r: Mediterranean gull Larus melanocephalus - A616w: Black-tailed godwit Limosa limosa islandica - A195r: Little tern Sterna albifrons - A192r: Roseate tern Sterna dougallii - A675w: Dark-bellied brent goose Branta bernicla bernicla - A191r: Sandwich tern Sterna sandvicensis - A052w: Eurasian teal Anas crecca - A193r: Common tern Sterna hirundo - WATR: Waterbird assemblage
Standard Data Form	Available at: https://jncc.gov.uk/jncc-assets/SPA-N2K/UK9011061.pdf
Conservation Objectives	Available at: http://publications.naturalengland.org.uk/publication/6567218288525312?category=6528471664689152
Site Improvement Plan	Available at: http://publications.naturalengland.org.uk/publication/6567218288525312?category=6528471664689152
Supplementary advice	Available at: http://publications.naturalengland.org.uk/publication/6567218288525312?category=6528471664689152
Associated SSSIs	Sites of Special Scientific Interest available at: https://designatedsites.naturalengland.org.uk/SiteGeneralDetail.aspx?SiteCode=UK9011061
Functional land	Qualifying species will periodically utilise a range of non-designated habitats close to the site for roosting or foraging, including agricultural land; some areas may be regularly used by relatively large proportions of the qualifying populations, and so may be considered functionally associated with the SPA.

*Water resource sensitive features, based on Environment Agency (EA) guidance

Table 3.2 Core Site Information

Aspect	Notes
Site Name	Solent and Southampton Water Ramsar
Qualifying features	• Criterion 1 - sites containing representative, rare or unique wetland types. • Criterion 2 - supports vulnerable, endangered, or critically endangered species or threatened ecological communities. • Criterion 5 - regularly supports 20,000 or more waterbirds. • Criterion 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds.

Aspect	Notes
Conservation Objectives	As per associated SAC / SPA, or underpinning SSSI(s)
Site Improvement Plan	As per associated SAC / SPA, or underpinning SSSI(s)
Supplementary advice	As per associated SAC / SPA, or underpinning SSSI(s)
Associated SSSIs	N/A.
Functional land	Qualifying species will periodically utilise a range of non-designated habitats close to the site for roosting or foraging, including agricultural land; some areas may be regularly used by relatively large proportions of the qualifying populations, and so may be considered functionally associated with the SPA.

Table 3.3 Core Site Information

Aspect	Site Data
Site Name	Solent and Isle of Wight Lagoons SAC
Site Code	UK0017073
Qualifying features	- H1150: Coastal lagoons
Standard Data Form	Available at: https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0017073.pdf
Conservation Objectives	Available at: http://publications.naturalengland.org.uk/publication/5646122018144256?category=6528471664689152
Site Improvement Plan	Available at: http://publications.naturalengland.org.uk/publication/5646122018144256?category=6528471664689152
Supplementary advice	Available at: https://designatedsites.naturalengland.org.uk/Marine/SupAdvice.aspx?SiteCode=UK0017073&SiteName=solent+and&SiteNameDisplay=Solent+and+Isle+of+Wight+Lagoons+SAC&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=&NumMarineSeasonality=
Associated SSSIs	Brading Marshes to St Helens Ledges SSSI, Gilkicker Lagoon SSSI, Hurst Castle and Lymington River Estuary SSSI, Langstone Harbour SSSI
Functional land	No functional land identified, but nearby marshes are likely to be important to the functioning of the lagoons.

*Water resource sensitive features, based on EA guidance

3.2 Mitigation Assumptions

Standard Measures / Best-practice

3.2.1 Appendix C identifies standard and established measures that are known to be available, achievable and likely to be effective in avoiding or mitigating potentially adverse effects on European sites and interest features. These are based on best- and case-practice from similar schemes, and so there can be high confidence in their deliverability and effectiveness. These measures would be applied unless project-level Habitats Regulation Assessments (HRA) or project-specific environmental studies demonstrate that they are not required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate.

Bespoke measures

3.2.2 Site- or feature-specific mitigation that may be required for specific atypical effects are identified in the assessment sections.

3.3 Assessment – Construction

3.3.1 Initial screening indicated that there are no pathways for construction effects, as the works are very small scale and located in open fields; construction impacts would therefore not be anticipated, irrespective of any additional mitigation measures.

3.4 Assessment – Operation

3.4.1 This option proposes replacing all three boreholes so that the site can operate to its licensed capacity (currently operating at 1.5Ml/d instead of 6Ml/d). The abstraction is from the Newchurch Lower Greensand boreholes and not from the existing Newchurch Chalk Well and Adit.

3.4.2 Effects on flows in Yar due to groundwater drawdown cannot be accurately stated due to absence of detailed groundwater modelling for the source, but are likely to be small as much of the baseflow in the Yar is understood to be from the chalk rather than the Lower Greensand (although the interaction of the Lower Greensand with surface water is known to be complex); there is a Non-Deterioration investigation timetabled to complete in 2027 that is likely to confirm this. The ALS for the Lower Greensand currently states that "*Restricted water available for licensing…the impact of groundwater abstractions from the Lower Greensand on Eastern Yar, River Medina, Brighstone Stream and Atherfield Brook has been assessed, it is unlikely that there is any scope for further abstraction from this unit*", although it should be noted that this accounted for the existing licence at **Newchurch**.

3.4.3 However, there are a number of contextual factors that suggest that the effects of this option will not be adverse on these sites.

3.4.4 With regard to the marine / estuarine components of the SPA/Ramsar, flows from the Yar into Bembridge harbour are managed by a sluice, and effects of any changes in flows associated with the option on the marine components of the SPA/Ramsar are expected to

be nominal in relation to the dominance of tidal influence on the harbour habitats and biotopes.

3.4.5 With regard to the Brading Marshes components of the SPA/Ramsar, these are below sea level so are protected from seawater inundation by the seawall and tidal gates at the end of the Yar; water levels in Brading Marshes are largely controlled through direct management (sluices etc.) with some inundation occurring when the river is tidally locked. Water levels and are not therefore directly dependent on flows etc. within the Yar. Any effects of the option on water-supply to Brading Marshes will therefore be small, and substantially moderated in any case by the interventionist water level management of the marshes and by other surface water and rainfall inputs to the marshes. As a result, adverse effects are not anticipated as a result of reduced non-saline inputs to Brading Marshes that may occur relative to the current operation of the boreholes (recognising that the option is a restoration to licensed and previously abstracted volumes).

3.4.6 With regard to the Solent and Isle of Wight Lagoons SAC, the only unit of this site potentially exposed to this option is the lagoons adjacent to Bembridge Harbour. There are four lagoons at Bembridge known as Bembridge Lagoon, Harbour Farm Lagoon 1 and 2, and East Harbour Lagoon. The supplementary advice for the site notes that "*Bembridge Harbour lagoon has formed in a depression behind the sea-wall at Bembridge Harbour and sea water enters by percolation and by man-made culverts. Bembridge Harbour Lagoon also has an occasional connection at its western end to a ditch which feeds through a sluice into the Eastern Yar. Harbour Farm Lagoon 1 has a culverted connection with Bembridge Harbour Lagoon through the embankment along its northern margin. Harbour Farm Lagoon 2 receives freshwater from Brading Marshes and drains over through a narrow causeway into Harbour Farm Lagoon 1 through a sluice facility. East Harbour Lagoon receives seawater seepage from Bembridge Harbour through the sea wall (Bamber et al., 2014), (Bamber and Robbins, 2010)*"

3.4.7 In summary, two of the lagoons are seawater-dominated, and essentially have salinities similar to seawater. The other two lagoons receive freshwater input from Brading Marshes and are hence brackish or low-salinity, but the water levels in Brading Marshes are largely controlled through direct management (sluices etc.) with some inundation occurring when the river is tidally locked, and so not directly dependent on flows etc. within the Yar. The salinities in the lagoons are also therefore actively managed by sluices that influence the balance of non-saline inputs from Brading Marshes and the saline inputs from the sea. This management largely ensure that flows in the Yar do not fundamentally determine salinities in the lagoons, and so changes in non-saline flows in the Yar would not have a direct effect on the lagoons and their salinity. As a result, adverse effects are not anticipated as a result of reduced non-saline inputs to Brading Marshes from the Yar that may occur relative to the current operation of the boreholes (recognising that the option is a restoration to licensed and previously abstracted volumes).

3.5 In combination effects

3.5.1 Plans, programmes and projects that have been considered within the in-combination assessment are detailed below.

Other WRMP options

3.5.2 The potential for these European sites to be affected by two or more WRMP options (either options within the Southern Water (SWS) rdWRMP, or options in the rdWRMPs of neighbouring water companies) is set out in Appendix F and Appendix G.

3.5.3 In summary, this site is the downstream receptor for a number of schemes that may result in environmental changes associated with construction; however, the majority of these schemes are unlikely to occur in the same timescale, and effects can be reliably avoided with established measures. No unavoidable adverse in combination effects are anticipated.

Other Water Company Plans

Drought Plans

3.5.4 The Drought Plan will be revised several times before this WRMP option is implemented, and following option delivery, and so a meaningful in combination assessment arguably cannot be undertaken at this point. Furthermore, a future Drought Plan will necessarily reflect the abstraction baseline at that point (i.e. it will account for options implemented at that point in time) and be subject to HRA when revised, which provides a mechanism to ensure that in combination effects do not occur.

3.5.5 One drought option identified in SWS's revised draft Drought Plan 2022[2], or the plans of neighbouring water companies, has a Zone of Hydrological influence that may coincide with this WRMP option to affect these European sites (Eastern Yar Augmentation Scheme Surface Water Source, which will affect the Yar[3]).

3.5.6 The Eastern Yar Augmentation Scheme normally involves the transfer of raw water from the River Medina catchment to the river Eastern Yar for subsequent abstraction downstream (above the SPA/Ramsar – so the Augmentation Scheme does not fundamentally alter flows into the SPA/Ramsar); this would be amended during a drought so that this transfer would not occur, so the transferred water would not be available for abstraction. This would be the case irrespective of the WRMP options, and so no in combination effects would occur.

Drainage and Wastewater Management Plans

3.5.7 The interaction of the WRMP options with specific schemes derived from the emerging Drainage and Wastewater Management Plan (DWMP) can only be assessed at the project level due to the generic nature of the DWMP options.

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[2] Southern Water (2021). Draft Drought Plan 2022 Main report. 31 March 2021, Version 1.0.

[3] Note, other Drought Options (e.g. Caul Bourne Groundwater Source, Lukely Brook Groundwater Source (Bowcombe)) may affect other separate areas of this SPA/Ramsar, but the hydrological Zones of Influence will not overlap and synergistic effects would not be expected.

Other projects 'in combination'

Minor projects

3.5.8 It has not been possible to produce a definitive list of existing (minor) planning applications near this option's zone of influence, and generating a list at this stage would be of little value given the lead times for the option. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the All Company Working Group (ACWG) guidance on cumulative/in combination assessments[4].

Major Projects

3.5.9 Reference has been made to the Planning Inspectorate's National Infrastructure Projects database[5] which includes major projects; no major projects are identified that are likely to affect this European site.

3.6 Conclusion: Solent and Southampton Water SPA, Solent and Southampton Water Ramsar and Solent and Isle of Wight Lagoons SAC

3.6.1 The precise hydrological impact of the abstraction has some uncertainties associated with it, although these are likely to be resolved as an incidental consequence of the Non-Deterioration investigation timetabled to complete in 2027 (which is substantially ahead of the date for delivery of this option (2036). The ALS states that only restricted water is available for licensing, although the option operates within the terms of the existing licence. Without detailed hydrological and groundwater modelling investigations it is not possible to quantify the effects of the option on flows in the Yar; however, evidence suggests that the interest features of the SPA/Ramsar and SAC associated with Brading Marshes will not be fundamentally reliant on flows within the Yar due to the separation of the river from the marshes and the direct management of water levels across the marshes. (sluices etc.) Any effects of the option on water-supply to Brading Marshes will therefore be small, and moderated in any case by the interventionist water level management of the marshes and by other surface water and rainfall inputs to the marshes. The interest features associated with the estuarine habitats of Bembridge harbour will have a low exposure to flow changes within the Yar, and the magnitude of any variations in non-saline input will be dominated by the tidal turnover. As a result, adverse effects are not anticipated as a result of operation alone, although this necessarily requires additional investigation at the project-level.

[4] For more information see: https://www.wrse.org.uk/media/fspcib0h/acwg-design-principles-process-and-gate-2-indicators.pdf

[5] https://infrastructure.planninginspectorate.gov.uk/projects/

Appendix E6: Appropriate Assessment: Desalination (KTZ): East Thanet

1. Option Summary

1.1 Overview and European site context

1.1.1 This option group comprises a new desalination plant on the North Kent coast south of Birchington, Thanet. There are essentially three options relating to the desalination proposals for this location that would be phased / modular as required; currently the BVP is selecting two options, comprising an initial 20Ml/d plant (most of the construction, including the intake and outfall, would be associated with this phase) followed by an additional 20Ml/d plant (40Ml/d total). This would be required by 2041. Treated water would be passed via a new pipeline to Fleete for distribution to the network.

1.1.2 This option would require:

- an intake (abstraction point) located approximately 2km offshore;
- an outfall (discharge point) located approximately 7km offshore;
- raw water / effluent pipelines approximately 5km long running from a location of the coast (situated between Reculver and Birchington) and a new desalination plant located inland south of Birchington;
- a modular desalination plant (20Ml/d by 2037, with two additional modules (10Ml/d and 20Ml/d) required by 2046);
- a pipeline approximately 5km long to transfer treated water from the desalination plant to Fleete WSR for distribution.

1.1.3 The proposed option overlaps with the Outer Thames Estuary SPA, Margate and Long Sands Special Area of Conservation (SAC) and the Thanet Coast and Sandwich Bay Special Protection Area (SPA)/Ramsar. It is approximately 0.3km from the Thanet Coast SAC, approximately 2.9km from Sandwich Bay SAC, approximately 5.3km from Stodmarsh SAC and approximately 5.7km from the Stodmarsh SPA/Ramsar.

1.1.4 Note that it is assumed that construction impacts associated with the later phases of this option would be substantially less than for the first phase, as construction of the intake/outfall and the majority of the desalination plant would have been completed. The assessments below therefore focus on the most environmentally notable aspects of the

scheme (i.e. construction associated with the first phase; and the operation of the options cumulatively (i.e. as if one 40Ml/d plant).

1.2 Environmental changes and option assumptions / uncertainties

Potential construction-related environmental changes

1.2.1 The proposed site of the desalination plant and associated intake/outfall and pipeline are located within and in close proximity to a number of European sites.

1.2.2 Construction activities have the potential to result in the following impacts:

- Loss of functional offsite habitat – use of undeveloped land adjacent to the proposed desalination plant and along the pipeline route which could support qualifying features;
- Physical damage to habitats (e.g. tidal flats/salt marshes, subtidal sedimentary habitat) – damage to existing habitat within European sites that is utilised by qualifying features (e.g. for foraging), or which constitutes a qualifying interest feature in its own right;
- Water quality – issues with accidental oil spills and pollution incidents when working at the main site of the desalination. In addition, there is potential for increases in turbidity in adjacent waterbodies from sediment laden runoff and seabed scour during intake and outfall construction;
- Disturbance – qualifying features could be disturbed and displaced by noise, vibration and visual (including light pollution);
- Contamination – smothering of habitats that support the qualifying features through dust generation, and increase nutrient nitrogen loading of supporting habitats through HGV/plant and vehicle movements; and
- Introduction of Invasive/Non-Native Species (INNS).

Potential operation-related environmental changes

1.2.3 'Generic' environmental risks typically associated with new infrastructure may be realised (e.g. additional noise or lighting) although these cannot be reliably scoped or assessed at the plan-level as they are entirely dependent on the detailed design. However, the operational plant required is not inherently high-impact in this regard, and potentially notable environmental changes can almost certainly be avoided through scheme-design.

1.2.4 The principal environmental changes from operation will therefore relate to:

- the discharge of wastewater from the reverse osmosis process via the newly constructed outfall;
- the entrainment of marine species (i.e. prey items) at the intake; and

- the presence of a new desalination plant and any potential increases in disturbance relating to its operation.

1.2.5 Assessments of other desalination plants of a similar scale to the proposed option indicate that any increase in salinity would extend over a small area (up to 10m) (EDF, 2021). This area of effect was predicted for a site located on an open coastline, which is similar in nature to the location of the proposed discharge for this desalination option. Many other studies have demonstrated that near-field dilution of brine to ambient levels typically occurs within a relatively short distance (tens or hundreds of metres rather than kilometres), and that impacts to benthic communities from concentrate discharges can be reliably minimised by using properly-designed diffuser systems.

1.2.6 Research from California suggests that a desalination plant of ~200Ml/d capacity will impinge approximately 1kg/day of marine biota (Water Reuse Association, 2011). Given the smaller scale of the proposed desalination plant proposed as part of this option, this figure is likely to be less for the proposed option.

Assumptions and uncertainties

1.2.7 Option-specific wastewater dispersion modelling cannot be conducted without detailed designs. As such, modelling from previous desalination plants of a similar scale to the proposed option has been used to provide an approximate zone of influence for any wastewater discharge.

2. Screening Summary

2.1.1 The screening assessment is outlined in Table 2.1. In summary, significant effects cannot be self-evidently excluded for the following sites:

Table 2.1: Sites for which significant effects cannot be self-evidently excluded

Site	Location (km)*	LSE?		Rationale
		Cons	Oper	
Thanet Coast and Sandwich Bay SPA and Ramsar	0/DS	Y	Y	Construction: The intake and outfall will cross this site, so direct and indirect effects on site habitats possible depending on construction approach; mobile features will be vulnerable to disturbance etc. Non-designated areas of functional land used by golden plover present near Minnis Bay, may be present elsewhere on pipeline route. Operation: Operation will discharge hypersaline brine offshore from this site; potential to affect supporting habitats.

Site	Location (km)*	LSE?		Rationale
		Cons	Oper	
Outer Thames Estuary SPA	0/DS	Y	Y	Construction: The intake and outfall will be within this site, so direct and indirect effects on site habitats possible depending on construction approach; mobile features will be vulnerable to disturbance etc. although sensitivity may be low. Operation: Operation will discharge hypersaline brine into this site; potential to affect supporting habitats for the interest features, although exposure and sensitivity may be low given the feature characteristics / preferences.
Thanet Coast SAC	0.3/DS	Y	Y	Construction: The intake and outfall will be close to site boundary, indirect effects on site habitats possible depending on construction approach. Operation: Operation will discharge hypersaline brine close to this site; potential to affect the typical species of the Reefs feature.
Margate and Long Sands SAC	0/DS	Y	Y	Construction: The intake and outfall will be within this site, direct effects on site habitats possible depending on construction approach. Operation: Operation will discharge hypersaline brine within this site.
Stodmarsh SPA	5.7	U*	U	Construction: No pathways for construction effects on site itself (distance, site up-catchment); mobile features may be functionally linked to wetland habitats crossed by pipeline (e.g. at Wade Marsh). Likely significant effect (LSE) almost certainly avoidable with established measures / normal best-practice, although these must necessarily be accounted for at the appropriate assessment stage (hence 'screened in'). Operation: No pathways for operational effects on site itself (distance; site up-catchment); some mobile features may periodically use habitats of the Stodmarsh SPA that may be exposed to environmental changes associated with operation, although sensitivity and exposure is likely to be low.

2.1.2 Some of the potential effects noted above will be clearly avoidable with established measures, which are accounted for at the appropriate assessment stage in accordance with People over Wind.

3. Assessment: Outer Thames Estuary SPA

3.1 Core Designation Information

3.1.1 The Outer Thames Estuary SPA consists of areas of shallow and deeper water, high tidal current streams and a range of mobile sediments. Large areas of mud, silt and gravelly sediments form the deeper water channels, including those which form the approach route to the ports of London and as such are continually disturbed by shipping and maintenance dredging. Sand in the form of sandbanks separated by troughs predominates in the remaining areas and the crests of some of the banks are exposed at mean low water

3.1.2 Table 3.1 provides links to the key documents and information relating to the designation. Specific information that may be relevant to the assessment of effects is noted as necessary.

Table 3.1 Outer Thames Estuary SPA site-specific details

Aspect	Notes
Qualifying features	• A001 Red-throated diver, *Gavia stellata* • A193 Common tern, *Sterna hirundo* • A195 Little tern, *Sternula albifrons*
Conservation Objectives	Available at: ThamesSPAConsObsVersion3 7 Mar2013FINAL.pdf
Site Improvement Plan	Available at: Site Improvement Plan: Outer Thames Estuary - SIP238 (naturalengland.org.uk)
Supplementary advice	Available at: Thames-brief_tcm6-21728.pdf
Associated SSSIs	Benfleet and Southend Marshes SSSI, Corton Cliffs SSSI, Crouch and Roach Estuaries SSSI, Dengie SSSI, Foulness SSSI, Great Yarmouth North Denes SSSI, Minsmere-Walberswick Heaths and Marshes SSSI, Pakefield to Winchester SSSI, The Cliff, Burnham-On-Crouch SSSI
Functional land	Subtidal sand; Subtidal coarse sediment; Subtidal mixed sediments; Subtidal mud; Circalittoral rock; Water column; Shallow subtidal waters; Sandbanks

Interest Feature Exposure

3.1.3 The red-throated diver, little tern and common tern populations within the Outer Thames Estuary SPA typically are found foraging within the sandbanks of the site, as they provide suitable hunting depths and support many of the prey species and their nursery grounds (Natural England, 2022a). As there are sandbanks where the intake and outfall would be constructed, there is potential for these species to be affected by the construction and/or operational effects of the proposed option.

3.2 Mitigation Assumptions

Standard Measures / Best-practice

3.2.1 Appendix C identifies standard and established measures that are known to be available, achievable and likely to be effective in avoiding or mitigating potentially adverse effects on European sites and interest features. These are based on best- and case-practice from similar schemes, and so there can be high confidence in their deliverability and effectiveness. These measures would be applied unless project-level Habitats Regulations Assessments (HRA) or project-specific environmental studies demonstrate that they are not required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate.

Bespoke measures

3.2.2 Site- or feature-specific mitigation that may be required for specific atypical effects are identified in the assessment sections.

3.3 Assessment – Construction

Loss of Functional Habitat

3.3.1 The qualifying features of the SPA typically forage within the sandbank habitat within the site. As the intake and outfall is located within areas of sandbank habitat, there is potential for direct effect on habitat that supports the foraging activity of the qualifying features of the SPA from construction of the desalination plant.

3.3.2 The precise effects on supporting habitat for the qualifying species of the SPA will depend on the construction method chosen. The most invasive method (open cut and cover) would result in the most significant effect on subtidal habitat, although given the sedimentary and mobile nature of the seabed, habitat recovery would occur and the effect of construction would not be expected to be permanent. In addition, the area affected is very small relative to the overall foraging area within the SPA (acknowledging that the foraging areas for the qualifying tern features are centred on the colony locations; the proposed option would affect the foraging area for terns from the colony at the Foulness SPA). Overall, it is concluded that adverse effect on integrity on the SPA can be excluded on the basis of a localised and temporary effect, affecting a very small proportion of the SPA.

Mitigation

3.3.3 Direct effects on the subtidal habitat within the SPA could be avoided through the use of horizontal directional drilling (HDD). In conclusion, there are effective construction techniques available to ensure no adverse effect on the integrity of the SPA.

3.3.4

Water Quality

3.3.5 Due to the proposed intake and outfall being located within the SPA, there is the potential for direct effects of pollution such as excess sediment discharge and accidental oil spill. Best practice mitigation measures, summarised below and further detailed in Appendix C, will be followed during construction to ensure no adverse effects on the water quality of the SPA occur as a result of construction activities.

Mitigation

3.3.6 Adherence to Environment Agency (EA) Pollution Prevention Guidelines (now archived) and NRW, SEPA's Guidance on Pollution Prevention including Works and Maintenance in or near Water (2017).

3.3.7 No water should be discharged directly to the river network connecting to the marine environment. A drainage strategy including treatment measures will need to be agreed with the relevant regulators (EA and Natural England (NE)). If the measures to remove silt and contaminants do not satisfy the EA and NE (to allow discharge to a watercourse likely to lead into the marine environment), then an alternative discharge arrangement will need to be made (e.g. to sewer or tankered off site).

Disturbance

Desalination Plant

3.3.8 The proposed site for the desalination plant is located in an area of low anthropogenic disturbance, with the closest settlement of Birchington located approximately 1.3km north of the proposed site for the option. Given the inland location of the desalination plant, the qualifying features of the SPA are highly unlikely to be exposed to construction phase disturbance effects.

Intake and Outfall

3.3.9 The intake and outfall location for the proposed option is located within the Outer Thames Estuary SPA. While no disturbance to breeding birds will occur, with the nearest breeding location being the sandbanks on the north side of the estuary approximately 27km away (Natural England, 2022a), the area potentially affected by the construction works for this option could represent foraging habitat for the qualifying bird species of the SPA. As such, there is the potential for individuals to be disturbed when foraging.

3.3.10 According to a JNCC advice note (JNCC, 2022), red-throated diver is considered more sensitive to disturbance relative to other seabird species. Little tern is considered relatively insensitive to disturbance (JNCC, 2022). The advice note does not refer to common tern (which is the other qualifying tern species of the SPA), but does also class Sandwich tern, roseate tern and Arctic tern as relatively insensitive to disturbance, suggesting this would also apply to common tern. This assertion is supported by a literature review of evidence on the response of terns to above water noise stimuli when they are commuting or foraging in offshore environments undertaken as part of the Shadow HRA for the Wylfa Newydd new nuclear build project on Anglesey (Horizon Nuclear Power, 2018). Broad-

based and qualitative consideration has been given to how different seabird species respond to anthropogenic disturbance in offshore environments (Garthe, S and Hüppop, O., 2004; Furness et al., 2013). These studies suggest that terns are relatively insensitive to anthropogenic disturbance in the offshore environment.

3.3.11 Horizon Nuclear Power (2018) also researched the potential indirect effect of the generation of underwater noise disturbance. This could have indirect effects on terns and red-throated diver as a result of impacts on the fish prey for these species, which may suffer injury or direct mortality when in close proximity to noise sources or be displaced from the affected waters.

3.3.12 The marine construction works for the Wylfa Newydd project included rock breaking; this was predicted to produce the highest levels of underwater noise. The underwater noise modelling indicated that Temporary Threshold Shifts (TTS) in fish with swim bladders could occur up to a distance of 180m, with more extreme effects of recoverable injury and mortality at distances of less than 10m. For hearing-sensitive fish, the risks of behavioural effects to continuous sound is considered high within tens of metres of the source, medium at distances of hundreds of metres and low at distances of kilometres (Horizon Nuclear Power, 2018).

3.3.13 The above review, which is based on noise levels likely to be well in excess of those generated by the construction works for this option, indicates that above water and underwater noise levels are highly unlikely to exceed a level that could cause any disturbance beyond a few hundred metres from the source.

3.3.14 Surveys will be required to determine the presence of qualifying SPA features in the zone potentially affected by the intake and outfall works and confirm the need for any mitigation measures. However, construction works are not uncommon in and close to this SPA, and evidence from previous schemes (e.g. offshore wind) demonstrates that construction can be delivered without adversely affecting these features.

Pipeline

3.3.15 Due to the qualifying features of the SPA not being species that rely on farmland for foraging, there is no realistic potential for any disturbance of SPA qualifying features during pipeline construction.

Mitigation

3.3.16 Summer and winter bird surveys should be conducted to determine if the area potentially affected by construction of the intake and outfall is utilised by significant numbers of foraging qualifying bird species.

- Although no disturbance effect is predicted, the use of alternative construction methods such as horizontal directional drilling (HDD) should be considered, as such methods would significantly reduce the generation of noise (in particular underwater noise). In conclusion, there are effective construction techniques available to ensure no adverse effect on the integrity of the SPA.

Contamination

3.3.17 Due to the qualifying features of the SPA not relying on habitats sensitive to contamination (e.g. dust generation, nutrient nitrogen loading), there is no potential for adverse effect arising from contamination from construction activities for the proposed option.

Invasive Non-Native Species

3.3.18 The works may have the potential to spread invasive non-native species. The introduction of invasive non-native species may affect prey species for the qualifying bird species through introduction of disease, predation or competition.

3.3.19 Habitat surveys in the terrestrial and marine environments should be conducted to indicate the presence of invasive species and any sensitive areas. Works, particularly in aquatic habitats, should follow best practice biosecurity measures as standard (see Appendix C for further detail).

Mitigation

3.3.20 Best practice biosecurity measures, as recommended by the GB Non-Native Species Secretariat[1] would guard against any potential for spreading invasive species as a result of construction

3.4 Assessment – Operation

Saline discharge

3.4.1 The saline discharge may lead to a very minor increase in salinity in the in the vicinity of the outfall.

3.4.2 Assessments of other desalination plants of a similar scale to the proposed option indicate that any increase in salinity would extend over a small area (up to 10m) (EDF, 2021). This area of effect was predicted for a site located on an open coastline, which is similar in nature to the location of the proposed discharge for this desalination option. Many other studies[2] have demonstrated that near-field dilution of brine to ambient levels typically occurs within a relatively short distance (tens or hundreds of metres rather than kilometres), and that impacts to benthic communities from concentrate discharges can be reliably minimised by using properly-designed diffuser systems.

[1] http://www.nonnativespecies.org/index.cfm?sectionid=58

[2] e.g. Roberts DA, Johnston EL & Knott NA (2009) Impacts of desalination plant discharges on the marine environment: A critical review of published studies. Water Research 44 (2010) 5117-5128; Fernández-Torquemada Y, Gónzalez-Correa JM, Loya A, Ferrero LM, Díaz-Valdés M (2009) Dispersion of brine discharge from seawater reverse osmosis desalination plants. Desalination and Water Treatment 5 (2009) 137–145; Portillo E., Ruiz de la Rosa M., Louzara G., Quesada J.,. Ruiz J.M. & Mendoza H. (2014) Dispersion of desalination plant brine discharge under varied hydrodynamic conditions in the south of Gran Canaria, Desalination and Water Treatment, 52:1-3, 164-177.

3.4.3 No higher sensitivity habitats such as tidal flats or saltmarshes are located in the vicinity of the proposed outfall location; however, dispersion modelling should be conducted to ensure that no areas of habitat further afield from the outfall could be subject to increased salinity.

3.4.4 During operation, a number of chemicals will be required in the operational processes (e.g. biocides and anti-scalants). The settlement stage of the process will use an inlet storage tank to provide settlement of solids and to balance salinity. It is anticipated that any solids that are settled out (without treatment aid – see below) would be discharged in a controlled manner with the brine, ensuring that the suspended sediment load is not too high for the receiving waters. The pre-filtration stage will remove solids that are not settled in first stage and it is anticipated that backwash water would be discharged with the brine. These discharges will encompass a very limited spatial extent, representing a very small proportion of the predicted foraging ranges for any of the qualifying features of the SPA, and as such there is limited chance for these features to be exposed directly to any contaminants.

3.4.5 Dispersion modelling would be carried out to take account of the final plant capacity. This would inform assessment of percentage increase in salinity and temperature against established baseline conditions and using agreed significance threshold.

Mitigation

3.4.6 Residual chemicals from treatment process to be neutralised before release with brine discharge.

Impingement and entrainment

3.4.7 The intake for the desalination plant could lead to impingement of organisms (organisms trapped on filter screens), entrainment (organisms drawn into the intake structure) and/or entrapment (organisms trapped within offshore intake pipeline structure). These impacts to marine biota could change the food availability, distribution and density in the area immediately around the intake and therefore impact the feeding patterns of the qualifying bird species.

3.4.8 Research from California suggests that a desalination plant of ~200Ml/d capacity will impinge approximately 1kg/day of marine biota (Water Reuse Association, 2011). Given the smaller scale of the proposed desalination plant proposed as part of this option, this figure is likely to be less for the proposed option.

3.4.9 Mitigation measures and use of best practice design, such as the use of a passive wedge-wire cylinder (PWWC) with an appropriate mesh size, would be able to greatly minimise the impacts of impingement and entertainment. At the detailed design stage, consideration will be given to use of a surface or sub-surface intake, capped intake to reduce vertical flow, low velocities through the screens, sizing of the screens and deflection technologies.

Mitigation

3.4.10 Incorporate best practice technologies for intake to minimise impingement and entrainment issues of prey features, such as PWWC with an appropriate mesh size.

Disturbance

3.4.11 The operational site is considered likely to produce low levels of constant noise as it processes water. In addition, operation of the site will require human presence, but likely to be at low levels. However, given the inland location of the desalination plant, the qualifying features of the SPA are highly unlikely to be exposed to operational phase disturbance effects. Furthermore, the majority of the plant will be housed in units and, therefore, operational noise is unlikely to be an issue as impulse noise will not generally occur. In addition, noise disturbance can be almost entirely attenuated through design and screening, if required.

3.5 In combination effects

3.5.1 Plans, programmes and projects that have been considered within the in-combination assessment are detailed below.

Other WRMP options

3.5.2 The potential for these European sites to be affected by two or more Water Resources Management Plan (WRMP) options (either options within the Southern Water (SWS) revised draft WRMP (rdWRMP), or options in the rdWRMPs of neighbouring water companies) is set out in Appendix F and Appendix G.

3.5.3 The following SWS option also has pathways through which this site may be affected:

- Desalination: Isle of Sheppey (10Ml/d, 20Ml/d & 20Ml/d Phase 2).

3.5.4 In combination effects associated with option construction are unlikely to occur, based on the scheme locations and intended delivery timescales.

3.5.5 Environmental changes associated with the operation of this option and the 'Desalination: Isle of Sheppey' option are expected to be highly localised. Although there are residual uncertainties that cannot be fully assessed at the WRMP level with the available data, it is considered that mitigation options are available that can reliably be applied through scheme detailed design (e.g. location of outfalls).

3.5.6 The Reculver Desalination option (SEW) is located close to the proposed East Thanet Desalination option (SWS). Both will require outfalls that will require permanent outfall structures in the **Outer Thames Estuary SPA** (impacts depend on the nature of the installation, although features will have low sensitivity) and operational discharges within or close to the **Outer Thames Estuary SPA**. It is likely that adverse effects can be avoided through appropriate design of these facilities, and evidence from other desalination plants suggests that the environmental changes will be relatively small magnitude (with the interest features having low sensitivity to these changes), however **there remains uncertainty over in combination effects** due to the proximity of the

options and the likelihood of spatially coincident environmental changes that cannot be quantified at the plan-level.

Other Water Company Plans

Drought Plans

3.5.7 The Drought Plan will be revised several times before this WRMP option is implemented, and following option delivery, and so a meaningful in combination assessment arguably cannot be undertaken at this point. Furthermore, a future Drought Plan will necessarily reflect the abstraction baseline at that point (i.e. it will account for options implemented at that point in time) and be subject to HRA when revised, which provides a mechanism to ensure that in combination effects do not occur.

3.5.8 No drought options identified in SWS's revised draft **Drought Plan 2022**[3], or the plans of neighbouring water companies, will affect these sites.

Drainage and Wastewater Management Plans

3.5.9 The interaction of the WRMP options with specific schemes derived from the emerging Drainage and Wastewater Management Plan (DWMP) can only be assessed at the project level due to the generic nature of the DWMP options.

Other projects 'in combination'

Minor projects

3.5.10 It has not been possible to produce a definitive list of existing (minor) planning applications near this option's zone of influence, and generating a list at this stage would be of little value given the lead times for the option. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the All Company Working Group (ACWG) guidance on cumulative/in combination assessments[4].

Major projects

3.5.11 Reference has been made to the Planning Inspectorate's National Infrastructure Projects website[5] which includes major projects.

3.5.12 A review of that status of major projects that are located within or in close proximity to this European site has been undertaken to assess the potential for in-combination effect with this option. It should be noted that the Outer Thames Estuary SPA comprises two separate areas; the review of major projects has focussed on those within or in close

[3] Southern Water (2021). Draft Drought Plan 2022 Main report. 31 March 2021, Version 1.0.

[4] For more information see: https://www.wrse.org.uk/media/fspcib0h/acwg-design-principles-process-and-gate-2-indicators.pdf

[5] https://infrastructure.planninginspectorate.gov.uk/projects/

proximity to the southern portion of the SPA given this is the part of the SPA within which the option is located. The following summarises the findings of this review:

- Cleve Hill Solar Park (approximately 2 km north-east of Faversham and 5 km west of Whitstable on the North Kent Coast) – the DCO was granted in May 2020. The Secretary of State's HRA does not make reference to the Outer Thames Estuary SPA and, therefore, it can be concluded that this European site is not affected by this proposed scheme.
- Extension to Kentish Flats Wind Farm (located west and south of the first Kentish Flats Wind Farm) – the DCO was granted in February 2013 and the project was constructed in 2015. Given this is a completed project, it is not relevant to an assessment of in-combination effect.
- Thanet Extension Offshore Wind Farm (located approximately 8km off the east coast of Kent) - the Secretary of State refused development consent in June 2020 and, therefore, this project is not relevant to an assessment of in-combination effect.
- Galloper Offshore Wind Farm (located approximately 27km off the coast of Suffolk) – the DCO was granted in May 2013 and the project is now constructed. Given this is a completed project, it is not relevant to an assessment of in-combination effect.
- Sea Link (a converter station within 5km of the proposed Friston substation, HVAC underground cables between the substation a converter station and the coast, an offshore HVDC cable between Suffolk and Kent, a new converter station within 5km of the existing Richborough substation with HVDC underground cables between the converter station and the coast at Pegwell Bay) - the application was submitted 27th March 2025. The information to inform HRA concludes that the project can be managed without an adverse effect either alone, or in-combination, upon the integrity of relevant Habitat sites.
- North Falls Offshore Wind Farm (approximately 24.5km from its nearest point at the Port of Lowestoft) - the application is currently at examination. Supporting assessment documents[6] without prejudice, set out the case for derogation relevant to the Alde Ore Estuary SPA, Flamborough and Filey Coast SPA and the Outer Thames Estuary SPA. The indicative export cable corridor passes through the Outer Thames Estuary SPA, but this is located approximately 50km to the north of the location of the intake / discharge for the new desalination plant.

3.5.13 Given the nature, location and/or current status of the environmental information relating to the major projects reviewed above, it can be concluded that there is either no realistic potential for in-combination effects with the proposed option, or the environmental assessment of the major projects is not sufficiently advanced to enable in-combination assessment to be undertaken.

3.5.14 It is known that there are other major projects that are located further north, within or in close proximity to the northern area of the Outer Thames Estuary SPA (e.g. the Sizewell C new nuclear build project). However, because the option is located approximately 66km to the south of the closest point of the northern area of this SPA, it is concluded that there is

[6] https://national-infrastructure-consenting.planninginspectorate.gov.uk/projects/EN010119

no realistic potential for in-combination effect between the option and major projects that could potentially affect the northern area of the Outer Thames Estuary SPA.

3.6 Conclusion: Outer Thames Estuary SPA

3.6.1 In light of the predicted effect of this option both alone and in-combination with other plans and projects, it is considered that there is sufficient confidence that appropriate mitigation measures are available at the project level and can be implemented to enable a conclusion of no adverse effect on the integrity of the Outer Thames Estuary SPA to be drawn for the WRMP HRA.

3.6.2 In addition, it is recognised that several desalination plants are proposed for the north Kent area by the SWS and SEW WRMPs; given the planning horizons for all of these schemes it is very likely that additional investigations in future WRMP cycles would be able to identify 'no adverse effect' alternative locations for larger combined desalination plants. For example, a plant between Deal and Folkstone could almost certainly be delivered without adverse effects on marine European sites from operation.

4. Assessment: Thanet Coast and Sandwich Bay SPA/Ramsar

4.1 Core Designation Information

4.1.1 Thanet Coast and Sandwich Bay SPA is a 18.8 km² site located at the north-eastern tip of Kent in southern England. It is a coastal site consisting of a long stretch of rocky shore, adjoining areas of estuary, sand dune, maritime grassland, saltmarsh and grazing marsh.

4.1.2 **Table 4.1** provides links to the key documents and information relating to the designation. Specific information that may be relevant to the assessment of effects is noted as necessary.

Table 4.1 Thanet Coast and Sandwich Bay SPA and Ramsar site-specific details

Aspect	Notes
Qualifying features	SPA: • A169w: Ruddy turnstone *Arenaria interpres* • A140w: European golden plover *Pluvialis apricaria* • A195r: Little tern *Sterna albifrons* Ramsar: • Crit 2: Supports vulnerable, endangered or critically endangered species or threatened eco communities • Crit 6: Regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds

Aspect	Notes
Conservation Objectives	Available at: European Site Conservation Objectives for Thanet Coast & Sandwich Bay SPA - UK9012071 (naturalengland.org.uk)
Site Improvement Plan	Available at: Site Improvement Plan: North East Kent (Thanet) - SIP240 (naturalengland.org.uk)
Supplementary advice	Available at: http://publications.naturalengland.org.uk/publication/6009926887407616?category=6528471664689152
Associated SSSIs	Thanet Coast and Sandwich Bay SSSI
Functional land	Subtidal coarse sediment, subtidal sand, subtidal mud, subtidal mixed sediment, subtidal seagrass beds.

Interest Feature Exposure

4.1.3 The golden plover and little tern populations within the site are primarily found foraging, and in the case of little tern breeding, in and around Sandwich Bay (Natural England, 2022b). As Sandwich Bay is located approximately 3km south of the existing Fleete WSR, no disturbance will occur to these features within Sandwich Bay.

4.1.4 With regard to golden plover, these are often associated with agricultural habitats; historically, golden plover have roosted in large numbers (+10,000 birds) at low tide on the intertidal mudflats of Pegwell Bay, with Musgrove et al. (2003) indicating that golden plover were largely confined to the area by the outflow of the Great Stour. Other datasets identify areas outside Pegwell Bay itself where potentially notable numbers of golden plover have been recorded:

- EN (2004): the largest aggregations of golden plovers identified in this report are largely outside Thanet, in fields adjacent to Sandwich Bay; three sites that appear particularly important for golden plover are identified and recommended for inclusion in the SPA (these either form part of the Ramsar site, or are immediately adjacent to the SPA). In addition, the fields around Reculver periodically support aggregations of golden plover.
- Surveys undertaken for the Richborough Grid Connection project (National Grid 2016) between 2012 and 2015 recorded several larger aggregations of golden plover on or near the grid connection route, notably:
    - 1200 north-east of Sevenscore, in December 2012;
    - 180 in fields north of Sandwich WWTW in January 2013;
    - 1500 near Richborough Castle in November 2013;
    - 540 near Stonelees in February 2014;

- Several flocks of over 200 birds were also recorded flying during vantage point surveys of the route, particularly over Ash Level.

4.1.5 Kent Ornithological Society (KOS) has several records from the last eight years where peak counts of golden plover exceed 100 birds at sites in Thanet, most notably from:

- Pegwell Bay (peak count of 1600 from November 2010); and
- The fields and marshes between Reculver and Birchington (several hundred birds recorded in most years).

4.1.6 KOS also has older incidental records of large aggregations in the fields around Nicholas St Wade (3,950 feeding on winter wheat in 2003) and around Reculver – Birchington (3,941 individuals recorded on one occasion in 2003).

4.1.7 Overall, the principal non-SPA areas within Thanet that appear to be commonly used by golden plover are:

- The fields between Richborough and Ramsgate, near Pegwell Bay, south and east of the A299 and A256[7]; and
- The fields between Reculver and Birchington on the north coast, north of the railway at this location (close to where works may take place for construction of the intake and outfall).

4.1.8 Individuals foraging on arable land along the pipeline route or in the waters around the intake and outfall locations could be subject to adverse effects of the proposed option.

4.1.9 The turnstone population is found foraging to the west of the site (Natural England, 2022b) and potentially in the vicinity of the works for the construction of the intake and outfall, and so could also be susceptible to adverse effects.

4.2 Mitigation Assumptions

Standard Measures / Best-practice

4.2.1 Appendix C identifies standard and established measures that are known to be available, achievable and likely to be effective in avoiding or mitigating potentially adverse effects on European sites and interest features. These are based on best- and case-practice from similar schemes, and so there can be high confidence in their deliverability and effectiveness. These measures would be applied unless project-level HRAs or project-specific environmental studies demonstrate that they are not required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate.

[7] Although it should be noted that this is based on data from EN (2004), which predates the completion of the A256 / A299 road construction, which cuts directly through this area.

Bespoke measures

4.2.2 Site- or feature-specific mitigation that may be required for specific atypical effects are identified in the assessment sections.

4.3 Assessment – Construction

Loss of Functional Habitat (On/Offsite)

4.3.1 Construction of the new desalination plant, associated pipeline, intake and outfall may lead to:

- the permanent loss of non-designated arable land onshore (due to the desalination plant) that may be utilised by SPA/Ramsar features (notably golden plover);
- permanent loss or changes to a small area of SPA/Ramsar intertidal habitat near Minnis Bay due to the intake and outfall pipes.

4.3.2 With regard to the non-designated functional habitat that might be affected by the plant, the area affected will be very small in proportion to the available habitat within the SPA and Ramsar, and locally across Thanet, and adverse effects would not be anticipated on this basis. Furthermore, any effects could be offset with the provision of alternative habitat resources as part of the scheme design.

4.3.3 With regard to the designated intertidal habitats, the precise effects of these options on site integrity will depend on the construction method chosen; the most invasive method (open cut) may result in a loss of habitat depending on the re-instatement / shielding method used for the pipes, although would be more likely to result in a change in the current habitats which may not necessarily be adverse (e.g. if foraging (etc.) conditions for the qualifying features are maintained). However, it is clear that direct effects on the habitats of the SPA/Ramsar could be avoided through the use of directional drilling (or similar), if required due to adverse effects identified at the project level.

4.3.4 As such, there will be no unavoidable loss of functional on/offsite habitat for the qualifying features from the SPA/Ramsar from construction of the desalination plant.

Water Quality

4.3.5 Due to the proposed intake/outfall being located close to the SPA and Ramsar, there is the potential for direct effects of pollution such as excess sediment discharge and accidental oil spill. Best practice mitigation measures, summarised below and further detailed in Appendix C, will be followed during construction to ensure no adverse effects on the water quality of the SPA/Ramsar occur as a result of construction activities.

Mitigation

4.3.6 Adherence to EA Pollution Prevention Guidelines (now archived) and NRW, SEPA's Guidance on Pollution Prevention including Works and Maintenance in or near Water (2017).

4.3.7 No water should be discharged directly to the river network connecting to the marine environment. A drainage strategy including treatment measures will need to be agreed with the relevant regulators (EA and NE). If the measures to removed silt and contaminations do not satisfy the EA and NE to allow discharge to a watercourse (likely to lead into the marine environment) then an alternative discharge arrangement will need to be made (e.g. to sewer or tankered off site).

Disturbance

Desalination Plant

4.3.8 The proposed site for the desalination plant is located in an area of low anthropogenic disturbance, with the closest settlement of Birchington located approximately 1.3km north of the proposed site for the option. Given the inland location of the desalination plant, the qualifying features of the SPA and Ramsar are generally unlikely to be exposed to construction phase disturbance effects, with the possible exception of golden plover which use non-designated land in the vicinity. However, effects on land used by plover will be temporary, and effects can be avoided with established measures.

Intake and Outfall

4.3.9 The intake and outfall for the proposed option is located within the SPA and Ramsar. While no disturbance to breeding birds (little terms) will occur due to the distance to the nearest colonies, qualifying bird features could be found foraging in the vicinity of the works. As such, there exists the potential for individuals to be disturbed when foraging within the site itself. Surveys will be required to determine the presence of the qualifying features of the SPA and Ramsar in the vicinity of the potential intake and outfall works and confirm the need for any mitigation measures, although effects can be reliably avoided with established measures (Appendix C).

Onshore Pipeline

4.3.10 High numbers of golden plover have been recorded as foraging in the low lying farmland within and outside of the SPA (Natural England, 2022b). As such, there exists the potential for construction activities relating to the onshore pipeline route to disturb the species during its overwintering period from October – February. As such, winter surveys will be required to determine the presence of the qualifying features of the SPA and Ramsar in the vicinity of the potential pipeline works and confirm the need for any mitigation measures. However, effects on land used by plover will be temporary, and effects can be avoided with established measures.

Mitigation

4.3.11 Conduct summer and winter bird surveys to determine if the land within 1km of the desalination plant and onward pipeline route is utilised by significant numbers of foraging bird species.

4.3.12 Produce working method for noise and visual stimuli and complete assessment to determine impacts and effectiveness of mitigation (e.g. hoarding, silencers, no working at dawn or dusk, limit use of onsite lighting). This should be completed with reference to the Waterbirds Disturbance Mitigation Toolkit (TIDE Tools, 2022) which details likely thresholds for noise and visual stimuli.

Contamination

4.3.13 Due to the lack of habitats sensitive to contamination being found within the vicinity of the proposed works, there is no potential for adverse effect arising from contamination from construction activities for the proposed option within the SPA and Ramsar. However, potential contamination effects can clearly be avoided with project-level measures.

Invasive Non-Native Species

4.3.14 The works may have the potential to spread invasive non-native species. The introduction of non-native species may affect prey species for the qualifying bird species through introduction of disease, predation or competition.

4.3.15 Habitat surveys in the terrestrial and marine environments should be conducted to indicate the presence of invasive species and any sensitive areas. Works, particularly in aquatic habitats should follow best practice biosecurity measures as standard (see Appendix C for further detail).

Mitigation

4.3.16 Best practice biosecurity measures, as recommended by the GB Non-Native Species Secretariat[8] would guard against any potential for spreading invasive species as a result of construction.

4.4 Assessment – Operation

Saline discharge

4.4.1 The saline discharge may lead to a very minor increase in salinity in the in the vicinity of the outfall, which would be offshore and over 1.5km from these sites.

4.4.2 Assessments of other desalination plants of a similar scale to the proposed option indicate that any increase in salinity would extend over a small area (up to 10m) (EDF, 2021). This area of effect was predicted for a site located on an open coastline, which is similar in nature to the location of the proposed discharge for this desalination option. Many other studies1 have demonstrated that near-field dilution of brine to ambient levels typically occurs within a relatively short distance (tens or hundreds of metres rather than kilometres), and that impacts to benthic communities from concentrate discharges can be reliably minimised by using properly-designed diffuser systems.

[8] http://www.nonnativespecies.org/index.cfm?sectionid=58

4.4.3 No higher sensitivity habitats such as tidal flats or saltmarshes are located in the vicinity of the proposed intake/outfall location; however, dispersion modelling should be conducted to ensure that no areas of habitat further afield from the intake/outfall could be subject to increased salinity.

4.4.4 During operation, a number of chemicals will be required in the operational processes (e.g. biocides and anti-scalants). The settlement stage of the process will use an inlet storage tank to provide settlement of solids and to balance salinity. It is anticipated that any solids that are settled out (without treatment aid – see below) would be discharged in a controlled manner with the brine, ensuring that the suspended sediment load is not too high for the receiving waters. The pre-filtration stage will remove solids that are not settled in first stage and it is anticipated that backwash water would be discharged with the brine. These discharges will encompass a very limited spatial extent, representing a very small proportion of the predicted foraging ranges for any of the qualifying features of the SPA, and as such there is limited chance for these features to be exposed directly to any contaminants.

4.4.5 Dispersion modelling would be carried out to take account of the final plant capacity. This would inform assessment of percentage increase in salinity and temperature against established baseline conditions and using agreed significance threshold.

Mitigation

4.4.6 Residual chemicals from treatment process to be neutralised before release with brine discharge.

Impingement and entrainment

4.4.7 The intake for the desalination plant could lead to impingement of organisms (organisms trapped on filter screens), entrainment (organisms drawn into the intake structure) and/or entrapment (organisms trapped within offshore intake pipeline structure). These impacts to marine biota could change the food availability, distribution and density in the area immediately around the intake and therefore impact the feeding patterns of the qualifying bird species.

4.4.8 Research from California suggests that a desalination plant of ~200Ml/d capacity will impinge approximately 1kg/day of marine biota (Water Reuse Association, 2011). Given the smaller scale of the proposed desalination plant on the Isle of Sheppey, this figure is likely to be reduced in the case of the proposed option.

4.4.9 Mitigation measures and use of best practice design, such as the use of a passive wedge-wire cylinder (PWWC) with an appropriate mesh size would be able to greatly minimise the impacts of impingement and entertainment. At the detailed design stage, consideration will be given to use of a surface or sub-surface intake, capped intake to reduce vertical flow, low velocities through the screens, sizing of the screens and deflection technologies.

Mitigation

4.4.10 Incorporate best practice technologies for intake to minimise impingement and entrainment issues of prey features, such as PWWC with an appropriate mesh size.

Disturbance

4.4.11 The operation of the desalination plant may produce a long-term noise and visual disturbance impact on the qualifying bird species of the SPA (principally plover that may use agricultural land near to the site).

4.4.12 The operational site is considered likely to produce low levels of constant noise as it processes water. In addition, operation of the site will require human presence, but likely to be at low levels.

4.4.13 The majority of the plant will be housed in units and, therefore, operational noise is unlikely to be an issue as impulse noise will not generally occur. It is anticipated that qualifying features of the site would become accustomed to such noise sources over time and no significant disturbance is envisaged. Effects can also be attenuated through design, if required.

Mitigation

4.4.14 Screening of the plant with a landscape bund or additional planting should be considered as part of the detailed design if appropriate. Lighting of the site could increase the displacement of the bird species and will therefore need to be positioned to avoid light spill on any potential adjacent habitats. An operational noise assessment should be completed to ensure the plant does not impact the bird species, and where necessary additional measures incorporated (e.g. specific sets of louvres that reduce noise).

4.5 In combination effects

4.5.1 Plans, programmes and projects that have been considered within the in-combination assessment are detailed below.

Other WRMP options

4.5.2 The potential for these European sites to be affected by two or more WRMP options (either options within the SWS rdWRMP, or options in the rdWRMPs of neighbouring water companies) is set out in Appendix F and Appendix G.

4.5.3 In summary, the principal in combination risk relates to effects with the proposed Reculver Desalination plant (SEW). The Reculver Desalination option (SEW) is located close to the proposed East Thanet Desalination option (SWS). Both will require outfalls that will need to cross the Thanet Coast SAC and Thanet Coast and Sandwich Bay SPA / Ramsar, although construction impacts are likely avoidable with engineering solutions. It is likely that adverse effects can be avoided through appropriate design of these facilities, and evidence from other desalination plants suggests that the environmental changes will

associated with operation will be relatively small magnitude (with the interest features having low sensitivity to these changes) and unlikely to adversely affect these sites.

Other Water Company Plans

Drought Plans

4.5.4 The Drought Plan will be revised several times before this WRMP option is implemented, and following option delivery, and so a meaningful in combination assessment arguably cannot be undertaken at this point. Furthermore, a future Drought Plan will necessarily reflect the abstraction baseline at that point (i.e. it will account for options implemented at that point in time) and be subject to HRA when revised, which provides a mechanism to ensure that in combination effects do not occur.

4.5.5 No drought options identified in SWS's revised draft **Drought Plan 2022**[9], or the plans of neighbouring water companies, will affect these sites.

Drainage and Wastewater Management Plans

4.5.6 The interaction of the WRMP options with specific schemes derived from the emerging Drainage and Wastewater Management Plan (DWMP) can only be assessed at the project level due to the generic nature of the DWMP options.

Other projects 'in combination'

Minor projects

4.5.7 It has not been possible to produce a definitive list of existing (minor) planning applications near this option's zone of influence, and generating a list at this stage would be of little value given the lead times for the option. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the ACWG guidance on cumulative/in combination assessments.

Major projects

4.5.8 Reference has been made to the Planning Inspectorate's National Infrastructure Projects website[10] which includes major projects.

4.5.9 A review of that status of major projects that are located within or in close proximity to this European site has been undertaken to assess the potential for in-combination effect with this option. The following summarises the findings of this review:

- Extension to Kentish Flats Wind Farm (located west and south of the first Kentish Flats Wind Farm) – the DCO was granted in February 2013 and the project was constructed

[9] Southern Water (2021). Draft Drought Plan 2022 Main report. 31 March 2021, Version 1.0.

[10] https://infrastructure.planninginspectorate.gov.uk/projects/

in 2015. Given this is a completed project, it is not relevant to an assessment of in-combination effect.

- Thanet Extension Offshore Wind Farm (located approximately 8km off the east coast of Kent) - the Secretary of State refused development consent in June 2020 and, therefore, this project is not relevant to an assessment of in-combination effect.
- Manston Airport (located less than 5km from the north Kent coast) - the Secretary of State granted the DCO in July 2022; the HRA report[11] concludes that '*given the relative scale and magnitude of the identified effects on the qualifying features of these European sites and where relevant, the measures in place to avoid and reduce the potential harmful effects, there would not be any implications for the achievement of the conservation objectives for those European sites.'* Assessment considered, Sandwich Bay SAC, The Swale SPA and Ramsar, and Thanet Coast and Sandwich Bay SPA and Ramsar.

4.5.10 Given the current status of the major projects reviewed above, it can be concluded that there is no potential for in-combination effects with the proposed option.

4.6 Conclusion: Thanet Coast and Sandwich Bay SPA/Ramsar

4.6.1 In light of the predicted effect of this option both alone and in-combination with other plans and projects, it is considered that there is sufficient confidence that appropriate mitigation measures are available at the project level and can be implemented to enable a conclusion of no adverse effect on the integrity of the Thanet Coast and Sandwich Bay SPA/Ramsar to be drawn.

4.6.2 In addition, it is recognised that several desalination plants are proposed for the north Kent area by the SWS and SEW WRMPs; given the planning horizons for all of these schemes it is very likely that additional investigations in future WRMP cycles would be able to identify 'no adverse effect' alternative locations for larger combined desalination plants – for example a plant between Deal and Folkstone could almost certainly be delivered without adverse effects on marine European sites from operation.

5. Assessment: Thanet Coast SAC

5.1 Core Designation Information

5.1.1 Thanet Coast in the extreme south-east of England has been selected on account of the unusual communities that are found on this, the longest continuous stretch of coastal chalk in the UK. It represents approximately 20% of the UK resource of this type and 12% of the EU resource. Thanet Coast provides the second most extensive representation of chalk caves in the UK on the extreme south-east coast of England. The site is bordered by about 23 km of chalk cliffs with many caves and stack and arch formations.

[11] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR020002/TR020002-006363-220818%20-%20Manston%20Airport%20HRA.pdf

5.1.2 Table 5.1 provides links to the key documents and information relating to the designation. Specific information that may be relevant to the assessment of effects is noted as necessary. Relevant information in these documents necessary in the assessment sections below (e.g. known areas of functional land identified in the supplementary advice documentation).

Table 5.1 Thanet Coast SAC site-specific details

Aspect	Notes
Qualifying features	• H1170 Reefs • H8330 Submerged or partially submerged sea caves
Conservation Objectives	Available at: European Site Conservation Objectives for Thanet Coast SAC - UK0013107 (naturalengland.org.uk)
Site Improvement Plan	Available at: Site Improvement Plan: North East Kent (Thanet) - SIP240 (naturalengland.org.uk)
Supplementary advice	Available at: http://publications.naturalengland.org.uk/publication/5766780467281920?category=6528471664689152
Associated SSSIs	• Thanet Coast and Sandwich Bay SSSI

Interest Feature Exposure

5.1.3 The submerged or partially submerged sea caves interest feature of the site are located primarily in the bases of the chalk cliffs, which are characteristic of the Thanet coastline (Natural England, 2022d). As no construction activities are proposed to be conducted in the vicinity of the cliffs in the region, the sea cave interest feature will not be affected by the proposed option.

5.1.4 The coastal area of Kingsgate, North Foreland, Dumpton and Pegwell is of primary importance for the reef interest feature within the site (Natural England, 2022d). As construction activities will be located approximately 3km inland from this area, there will be no effect on these important reef habitats. A potential effect on other smaller areas of reef on the northern coast cannot, however, be ruled out.

5.2 Mitigation Assumptions

Standard Measures / Best-practice

5.2.1 Appendix C identifies standard and established measures that are known to be available, achievable and likely to be effective in avoiding or mitigating potentially adverse effects on European sites and interest features. These are based on best- and case-practice from similar schemes, and so there can be high confidence in their deliverability and

effectiveness. These measures would be applied unless project-level HRAs or project-specific environmental studies demonstrate that they are not required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate.

Bespoke measures

5.2.2 Site- or feature-specific mitigation that may be required for specific atypical effects are identified in the assessment sections.

5.3 Assessment – Construction

Physical Damage

5.3.1 Despite the important reef habitat for the SAC being located predominantly on the eastern coast, away from any proposed construction activities, construction of the new intake and outfall could lead to the loss of habitat along the northern coastline. However, the indicative location of the intake and outfall is outside the SAC and, therefore, there is no potential for direct physical damage to the qualifying habitats of the SAC. Indirect effects (e.g. smothering) can be avoided with established measures.

Water Quality

5.3.2 Due to the proposed intake and outfall being located in close proximity to the SAC, there is the potential for indirect effects of pollution such as excess sediment discharge and accidental oil spill. Best practice mitigation measures, summarised below and further detailed in Appendix C, will be followed during construction to ensure no adverse effects on the water quality of the SAC occur as a result of construction activities.

Mitigation

5.3.3 Adherence to EA Pollution Prevention Guidelines (now archived) and NRW, SEPA's Guidance on Pollution Prevention including Works and Maintenance in or near Water (2017).

5.3.4 No water should be discharged directly to the river network connecting to the marine environment. A drainage strategy including treatment measures will need to be agreed with the relevant regulators (EA and NE). If the measures to removed silt and contaminations do not satisfy the EA and NE to allow discharge to a watercourse (likely to lead into the marine environment) then an alternative discharge arrangement will need to be made (e.g. to sewer or tankered off site).

5.4 Assessment – Operation

Saline discharge

5.4.1 The saline discharge may lead to a very minor increase in salinity in the in the vicinity of the outfall, although this will be located over 1.5km from this boundary of this site.

5.4.2 Assessments of other desalination plants of a similar scale to the proposed option indicate that any increase in salinity would extend over a small area (up to 10m) (EDF, 2021). This area of effect was predicted for a site located on an open coastline, which is similar in nature to the location of the proposed discharge for this desalination option. The reef within the SAC is considered to have a low sensitivity to increases in salinity, providing the spatial and temporal scale of the increase is minimal (Natural England, 2022c).

5.4.3 During operation, a number of chemicals will be required in the operational processes (e.g. biocides and anti-scalants). The settlement stage of the process will use an inlet storage tank to provide settlement of solids and to balance salinity. It is anticipated that any solids that are settled out (without treatment aid – see below) would be discharged in a controlled manner with the brine, ensuring that the suspended sediment load is not too high for the receiving waters. The pre-filtration stage will remove solids that are not settled in first stage and it is anticipated that backwash water would be discharged with the brine.

5.4.4 These discharges will encompass a very limited spatial extent, and it is not anticipated that the reef habitat of this site will be exposed to potentially notable environmental changes from exposure to any contaminants.

5.4.5 Dispersion modelling would be carried out to take account of the final plant capacity. This would inform assessment of percentage increase in salinity and temperature against established baseline conditions and using agreed significance threshold.

Mitigation

5.4.6 Residual chemicals from treatment process to be neutralised before release with brine discharge

5.5 In combination effects

5.5.1 Plans, programmes and projects that have been considered within the in-combination assessment are detailed below.

Other WRMP options

5.5.2 The potential for these European sites to be affected by two or more WRMP options (either options within the SWS rdWRMP, or options in the rdWRMPs of neighbouring water companies) is set out in Appendix F and Appendix G.

5.5.3 In summary, the principal in combination risk relates to effects with the proposed Reculver Desalination plant (SEW). The Reculver Desalination option (SEW) is located

close to the proposed East Thanet Desalination option (SWS). Both will require outfalls that will need to cross the Thanet Coast SAC and Thanet Coast and Sandwich Bay SPA / Ramsar, although construction impacts are likely avoidable with engineering solutions. It is likely that adverse effects can be avoided through appropriate design of these facilities, and evidence from other desalination plants suggests that the environmental changes will associated with operation will be relatively small magnitude (with the interest features having low sensitivity to these changes) and unlikely to adversely affect these sites.

Other Water Company Plans

Drought Plans

5.5.4 The Drought Plan will be revised several times before this WRMP option is implemented, and following option delivery, and so a meaningful in combination assessment arguably cannot be undertaken at this point. Furthermore, a future Drought Plan will necessarily reflect the abstraction baseline at that point (i.e. it will account for options implemented at that point in time) and be subject to HRA when revised, which provides a mechanism to ensure that in combination effects do not occur.

5.5.5 No drought options identified in SWS's revised draft **Drought Plan 2022**[12], or the plans of neighbouring water companies, will affect these sites.

Other projects 'in combination'

Minor projects

5.5.6 It has not been possible to produce a definitive list of existing (minor) planning applications near this option's zone of influence, and generating a list at this stage would be of little value given the lead times for the option. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the ACWG guidance on cumulative/in combination assessments.

Major projects

5.5.7 Reference has been made to the Planning Inspectorate's National Infrastructure Projects website[13] which includes major projects.

5.5.8 A review of that status of major projects that are located within or in close proximity to this European site has been undertaken to assess the potential for in-combination effect with this option. The following summarises the findings of this review:

- Extension to Kentish Flats Wind Farm (located west and south of the first Kentish Flats Wind Farm) – the DCO was granted in February 2013 and the project was constructed

[12] Southern Water (2021). Draft Drought Plan 2022 Main report. 31 March 2021, Version 1.0.

[13] https://infrastructure.planninginspectorate.gov.uk/projects/

in 2015. Given this is a completed project, it is not relevant to an assessment of in-combination effect.

- Thanet Extension Offshore Wind Farm (located approximately 8km off the east coast of Kent) - the Secretary of State refused development consent in June 2020 and, therefore, this project is not relevant to an assessment of in-combination effect.
- Manston Airport (located less than 5km from the north Kent coast) - the Secretary of State granted the DCO in July 2022; the HRA report[14] concludes that '*given the relative scale and magnitude of the identified effects on the qualifying features of these European sites and where relevant, the measures in place to avoid and reduce the potential harmful effects, there would not be any implications for the achievement of the conservation objectives for those European sites.'* Assessment considered, Sandwich Bay SAC, The Swale SPA and Ramsar, and Thanet Coast and Sandwich Bay SPA and Ramsar.

5.5.9 Given the current status of the major projects reviewed above, it can be concluded that in-combination effects with the proposed option are not likely.

5.6 Conclusion: Thanet Coast SAC

5.6.1 In light of the predicted effect of this option both alone and in-combination with other plans and projects, it is considered that there is sufficient confidence that appropriate mitigation measures are available at the project level and can be implemented to enable a conclusion of no adverse effect on the integrity of the Thanet Coast SAC to be drawn.

5.6.2 In addition, it is recognised that several desalination plants are proposed for the north Kent area by the SWS and SEW WRMPs; given the planning horizons for all of these schemes it is very likely that additional investigations in future WRMP cycles would be able to identify 'no adverse effect' alternative locations for larger combined desalination plants – for example a plant between Deal and Folkstone could almost certainly be delivered without adverse effects on marine European sites from operation.

6. Assessment: Margate and Long Sands SAC

6.1 Core Designation Information

6.1.1 Margate and Long Sands SAC starts to the north of the Thanet coast of Kent and proceeds in a north-easterly direction to the outer reaches of the Thames Estuary. It contains a number of Annex I 'Sandbanks slightly covered by seawater at all times', the largest of which is Long Sands itself. The sandbanks are composed of well-sorted sandy sediments, with muddier and more gravelly sediments in the troughs between banks.

[14] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR020002/TR020002-006363-220818%20-%20Manston%20Airport%20HRA.pdf

6.1.2 Table 6.1 provides links to the key documents and information relating to the designation. Specific information that may be relevant to the assessment of effects is noted as necessary. Relevant information in these documents necessary in the assessment sections below (e.g. known areas of functional land identified in the supplementary advice documentation).

Table 6.1 Margate and Long Sands SAC site-specific details

Aspect	Notes
Qualifying features	-H110 Sandbanks which are slightly covered by sea water all the time
Conservation Objectives	Available at: Margate LongSands regulation 35.pdf
Site Improvement Plan	Available at: Site Improvement Plan: Margate and Long Sands - SIP132 (naturalengland.org.uk)
Supplementary advice	Available at: http://publications.naturalengland.org.uk/publication/6706064372269056?category=6528471664689152
Associated SSSIs	N/A

Interest Feature Exposure

6.1.3 Although the precise location of the intake and outfall is uncertain, these structures may be located within the SAC, based on current plans. With reference to the mapping showing the broad distribution of the qualifying feature that accompanied the information prepared during the designation process for the SAC, the intake and outfall are likely to be within the extreme southern area of the qualifying feature (referred to as Margate Sands and Margate Hook on the mapping). Direct impact to the '*sandbanks which are slightly covered by sea water all the time'* interest feature is, therefore, likely.

6.2 Mitigation Assumptions

Standard Measures / Best-practice

6.2.1 Appendix C identifies standard and established measures that are known to be available, achievable and likely to be effective in avoiding or mitigating potentially adverse effects on European sites and interest features. These are based on best- and case-practice from similar schemes, and so there can be high confidence in their deliverability and effectiveness. These measures would be applied unless project-level HRAs or project-specific environmental studies demonstrate that they are not required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate.

Bespoke measures

6.2.2 Site- or feature-specific mitigation that may be required for specific atypical effects are identified in the assessment sections.

6.3 Assessment – Construction

Loss of Habitat

6.3.1 The outfall for the plant is likely to be located in or close to this site (although location outside the site will be possible). The interest features of the site are likely to have a low sensitivity to construction, being essentially low-biodiversity highly-mobile sandbank habitats that will be resilient to short-term perturbance associated with construction. The precise long-term effects of installation will depend on the construction techniques and detailed design (e.g. whether the outfall pipe in the far off-shore areas is buried or surface-laid and armoured; sediment deposition and hydrodynamics may be locally affected if the pipeline is not buried), but the habitats will be resilient to these changes (various other pipelines and cables have been laid within the site) and adverse effects on integrity would not be expected on this basis.

Mitigation

6.3.2 Avoidance of impacts through detailed design.

Water Quality

6.3.3 Due to the proposed intake and outfall being located within the SAC, there is the potential for direct effects of pollution such as excess sediment discharge and accidental oil spill. Best practice mitigation measures, summarised below and further detailed in Appendix C, will be followed during construction to ensure no adverse effects on the water quality of the SAC occur as a result of construction activities.

Mitigation

6.3.4 Adherence to EA Pollution Prevention Guidelines (now archived) and NRW, SEPA's Guidance on Pollution Prevention including Works and Maintenance in or near Water (2017).

6.3.5 No water should be discharged directly to the river network connecting to the marine environment. A drainage strategy including treatment measures will need to be agreed with the relevant regulators (EA and NE). If the measures to removed silt and contaminations do not satisfy the EA and NE to allow discharge to a watercourse (likely to lead into the marine environment) then an alternative discharge arrangement will need to be made (e.g. to sewer or tankered off site).

6.4 Assessment – Operation

Saline discharge

6.4.1 The saline discharge may lead to a very minor increase in salinity in the in the vicinity of the outfall.

6.4.2 Assessments of other desalination plants of a similar scale to the proposed option indicate that any increase in salinity would extend over a small area (up to 10m) (EDF, 2021). This area of effect was predicted for a site located on an open coastline, which is similar in nature to the location of the proposed discharge for this desalination option. The discharge is likely to have direct effects on the SAC habitats, although the habitats and typical species of the site will have a very low sensitivity to the anticipated magnitude of change in salinity; furthermore, the area potentially affected by marginally elevated salinity levels will be a very small proportion of the total habitat resource at the site, and this combination of low sensitivity and limited spatial extent suggest that adverse effects are not an unavoidable outcome with appropriate scheme design and mitigation.

6.4.3 During operation, a number of chemicals will be required in the operational processes (e.g. biocides and anti-scalants). The settlement stage of the process will use an inlet storage tank to provide settlement of solids and to balance salinity. It is anticipated that any solids that are settled out (without treatment aid – see below) would be discharged in a controlled manner with the brine, ensuring that the suspended sediment load is not too high for the receiving waters. The pre-filtration stage will remove solids that are not settled in first stage and it is anticipated that backwash water would be discharged with the brine. These discharges will encompass a very limited spatial extent.

6.4.4 Dispersion modelling would be carried out to take account of the final plant capacity. This would inform assessment of percentage increase in salinity and temperature against established baseline conditions and using agreed significance threshold.

Mitigation

6.4.5 Residual chemicals from treatment process to be neutralised before release with brine discharge.

6.5 In combination effects

6.5.1 Plans, programmes and projects that have been considered within the in-combination assessment are detailed below.

Other WRMP options

6.5.2 The potential for this European site to be affected by two or more WRMP options (either options within the SWS rdWRMP, or options in the rdWRMPs of neighbouring water companies) is set out in Appendix F and Appendix G.

6.5.3 In summary, the principal in combination risk relates to effects with the proposed Reculver Desalination plant (SEW). The Reculver Desalination option (SEW) is located

close to the proposed East Thanet Desalination option (SWS). Both will require outfalls that will require permanent outfall structures in or near Margate and Long Sands SAC (impacts depend on the nature of the installation, although features will have low sensitivity) and operational discharges within or close to the Margate and Long Sands SAC. It is likely that adverse effects can be avoided through appropriate design of these facilities, and evidence from other desalination plants suggests that the environmental changes will be relatively small magnitude (with the interest features having low sensitivity to these changes), however there remains uncertainty over in combination effects due to the proximity of the options and the likelihood of spatially coincident environmental changes that cannot be quantified at the plan-level.

Other Water Company Plans

Drought Plans

6.5.4 The Drought Plan will be revised several times before this WRMP option is implemented, and following option delivery, and so a meaningful in combination assessment arguably cannot be undertaken at this point. Furthermore, a future Drought Plan will necessarily reflect the abstraction baseline at that point (i.e. it will account for options implemented at that point in time) and be subject to HRA when revised, which provides a mechanism to ensure that in combination effects do not occur.

6.5.5 No drought options identified in SWS's revised draft **Drought Plan 2022**[15], or the plans of neighbouring water companies, will affect these sites based on the HRA of the Drought Plan.

Drainage and Wastewater Management Plans

6.5.6 The interaction of the WRMP options with specific schemes derived from the emerging Drainage and Wastewater Management Plan (DWMP) can only be assessed at the project level due to the generic nature of the DWMP options.

Other projects 'in combination'

Minor projects

6.5.7 It has not been possible to produce a definitive list of existing (minor) planning applications near this option's zone of influence, and generating a list at this stage would be of little value given the lead times for the option. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the ACWG guidance on cumulative/in combination assessments.

[15] Southern Water (2021). Draft Drought Plan 2022 Main report. 31 March 2021, Version 1.0.

Major projects

6.5.8 Reference has been made to the Planning Inspectorate's National Infrastructure Projects website[16] which includes major projects.

6.5.9 A review of that status of major projects that are located within or in close proximity to this European site has been undertaken to assess the potential for in-combination effect with this option. The following summarises the findings of this review:

- Extension to Kentish Flats Wind Farm (located west and south of the first Kentish Flats Wind Farm) – the DCO was granted in February 2013 and the project was constructed in 2015. Given this is a completed project, it is not relevant to an assessment of in-combination effect.
- Thanet Extension Offshore Wind Farm (located approximately 8km off the east coast of Kent) - the Secretary of State refused development consent in June 2020 and, therefore, this project is not relevant to an assessment of in-combination effect.
- Galloper Offshore Wind Farm (located approximately 27km off the coast of Suffolk) – the DCO was granted in May 2013 and the project is now constructed. Given this is a completed project, it is not relevant to an assessment of in-combination effect.
- Sea Link (a converter station within 5km of the proposed Friston substation, HVAC underground cables between the substation a converter station and the coast, an offshore HVDC cable between Suffolk and Kent, a new converter station within 5km of the existing Richborough substation with HVDC underground cables between the converter station and the coast at Pegwell Bay) - the application was submitted 27th March 2025. The information to inform HRA concludes that the project can be managed without an adverse effect either alone, or in-combination, upon the integrity of relevant Habitat sites.
- North Falls Offshore Wind Farm (approximately 24.5km from its nearest point at the Port of Lowestoft) - the application is currently at examination. Supporting assessment documents[17] without prejudice, set out the case for derogation relevant to the Alde Ore Estuary SPA, Flamborough and Filey Coast SPA and the Outer Thames Estuary SPA. The indicative export cable corridor passes through the Outer Thames Estuary SPA, but this is located approximately 50km to the north of the location of the intake / discharge for the new desalination plant.

6.5.10 Given the nature, location and/or current status of the environmental information relating to the major projects reviewed above, it can be concluded that there is either no realistic potential for in-combination effects with the proposed option, or the environmental assessment of the major projects is not sufficiently advanced to enable in-combination assessment to be undertaken.

[16] https://infrastructure.planninginspectorate.gov.uk/projects/

[17] https://national-infrastructure-consenting.planninginspectorate.gov.uk/projects/EN010119

6.6 Conclusion: Margate and Long Sands SAC

6.6.1 In light of the predicted effect of this option both alone and in-combination with other plans and projects, it is considered that there is sufficient confidence that appropriate mitigation measures are available at the project level and can be implemented to enable a conclusion of no adverse effect on the integrity of the Margate and Long Sands SAC to be drawn.

6.6.2 In addition, it is recognised that several desalination plants are proposed for the north Kent area by the SWS and SEW WRMPs; given the planning horizons for all of these schemes it is very likely that additional investigations in future WRMP cycles would be able to identify 'no adverse effect' alternative locations for larger combined desalination plants – for example a plant between Deal and Folkstone could almost certainly be delivered without adverse effects on marine European sites from operation.

7. Assessment: Stodmarsh SPA

7.1 Core Designation Information

7.1.1 Stodmarsh SPA is a wetland of international importance. Stodmarsh is marshland habitat with open water (ditches), a rare plant assemblage, neutral grassland, breeding and wintering birds.

7.1.2 Table 7.1 provides links to the key documents and information relating to the designation. Specific information that may be relevant to the assessment of effects is noted as necessary. Relevant information in these documents necessary in the assessment sections below (e.g. known areas of functional land identified in the supplementary advice documentation).

Table 7.1 Stodmarsh SPA site-specific details

Aspect	Notes
Qualifying features	SPA: • A050w: Eurasian wigeon *Anas penelope* • A056w: Northern shoveler *Anas clypeata* • A394w: Greater white-fronted goose *Anser albifrons* • A153w: Common snipe *Gallinago* • A142w: Northern lapwing *Vanellus* • A082w: Hen harrier *Circus cyaneus* • A021w: Great bittern *Botaurus stellaris* • A051r: Gadwall *Anas strepera* • A059w: Common pochard *Aythya ferina* • A053w: Mallard *Anas platyrhynchos* • A051w: Gadwall *Anas strepera* • A118w: Water rail *Rallus aquaticus* • A061w: Tufted duck *Aythya fuligula* • BBA: Breeding bird assemblage • A048w: Common shelduck *Tadorna*

Aspect	Notes
	Ramsar: -Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities
Conservation Objectives	Available at: European Site Conservation Objectives for Stodmarsh SPA - UK9012121 (naturalengland.org.uk)
Site Improvement Plan	Available at: Site Improvement Plan: Stodmarsh - SIP231 (naturalengland.org.uk)
Supplementary advice	Available at: http://publications.naturalengland.org.uk/publication/6543516511502336?category=6528471664689152
Associated SSSIs	Stodmarsh SSSI
Functional land	Open water bodies, reedbeds, grazing marshes and alder-carr.

Interest Feature Exposure

7.1.3 This site is too distant from the proposed desalination plant to be directly affected by construction or operation. The qualifying features of the Stodmarsh SPA will not make substantive use of the coastal habitats of the Thanet Coast and Sandwich Bay SPA/Ramsar based on typical habitat preferences, although some of the terrestrial wetland habitats near Birchington (hence potentially affected by the transfer to Fleete, or the desalination plant itself) may be periodically used by species associated with Stodmarsh, although these areas are unlikely to be critical to the functional integrity of Stodmarsh SPA.

7.1.4 As a wetland of international importance, the qualifying features of the SPA are drawn to the wide existing areas of open water bodies, reedbeds, grazing marshes and alder-carr (Natural England, 1993). Such habitats are not present within the proposed location of the desalination plant or pipeline route, and so are unlikely to be of significant importance to the qualifying overwintering bird features of the SPA. However, there still exists the potential for individuals from the site to be found foraging within the vicinity of construction activities for pipeline, and in the case of the qualifying duck species in the vicinity of the intake.

7.2 Mitigation Assumptions

Standard Measures / Best-practice

7.2.1 Appendix C identifies standard and established measures that are known to be available, achievable and likely to be effective in avoiding or mitigating potentially adverse effects

on European sites and interest features. These are based on best- and case-practice from similar schemes, and so there can be high confidence in their deliverability and effectiveness. These measures would be applied unless project-level HRAs or project-specific environmental studies demonstrate that they are not required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate.

Bespoke measures

7.2.2 Site- or feature-specific mitigation that may be required for specific atypical effects are identified in the assessment sections.

7.3 Assessment – Construction

Impacts on birds using functional habitat

7.3.1 The qualifying features of the Stodmarsh SPA will not make substantive use of the coastal habitats of the Thanet Coast and Sandwich Bay SPA/Ramsar based on typical habitat preferences; some of the terrestrial wetland habitats near Birchington (hence potentially affected by the transfer to Fleete, or the desalination plant itself) may be periodically used by species associated with Stodmarsh, although these areas are unlikely to be critical to the functional integrity of Stodmarsh SPA.

7.3.2 Construction of the new desalination plant, associated pipeline, intake and outfall will affect arable land onshore. However, most of this area will be only temporarily affected (for pipelines) and the permanent loss of arable habitat (i.e. to the desalination plant) will be very small in proportion to the available arable habitat within a similar distance of the Stodmarsh SPA. Most other potential effects will be temporary during construction and avoidable with established measures (e.g. timing works). Residual effects after mitigation (etc.) are likely to be nil or very small, so there is a low risk of in combination effects.

7.3.3 As such, there will be no significant loss of functional on/offsite habitat for the qualifying features from the SPA from construction of the desalination plant, and this aspect can be mitigated through habitat provision if potentially notable areas of functional land are identified by pre-development surveys.

7.3.4 Similarly, the potential for Stodmarsh SPA qualifying features to be disturbed whilst using habitats near the proposed construction areas is likely to be low, and can be avoided with established measures.

Mitigation

7.3.5 Conduct summer and winter bird surveys to determine if the land within 1km of the desalination plant and onward pipeline route is utilised by significant numbers of foraging bird species.

7.3.6 Produce working method for noise and visual stimuli and complete assessment to determine impacts and effectiveness of mitigation (e.g. hoarding, silencers, no working at dawn or dusk, limit use of onsite lighting). This should be completed with reference to the

Waterbirds Disturbance Mitigation Toolkit (TIDE Tools, 2022) which details likely thresholds for noise and visual stimuli.

7.4 Assessment – Operation

7.4.1 The site itself will not be affected by operation of the scheme. The qualifying features will not utilise offshore areas (no exposure to these aspects) and effects on birds using areas that might be considered 'functional land' near Birchington (e.g. from plant noise or lighting) can be avoided with normal design measures. Adverse effects will not therefore occur due to operation of the plant.

7.5 In combination effects

7.5.1 Plans, programmes and projects that have been considered within the in-combination assessment are detailed below.

Other WRMP options

7.5.2 The potential for this European site to be affected by two or more WRMP options (either options within the SWS rdWRMP, or options in the rdWRMPs of neighbouring water companies) is set out in Appendix F and Appendix G.

7.5.3 In summary, the principal in combination risk relates to effects with the proposed Reculver Desalination plant (SEW) and other construction schemes locally, and effects on functional land, although these potential effects can be avoided with normal measures. There will be no operational in combination effects.

Other Water Company Plans

Drought Plans

7.5.4 The Drought Plan will be revised several times before this WRMP option is implemented, and following option delivery, and so a meaningful in combination assessment arguably cannot be undertaken at this point. Furthermore, a future Drought Plan will necessarily reflect the abstraction baseline at that point (i.e. it will account for options implemented at that point in time) and be subject to HRA when revised, which provides a mechanism to ensure that in combination effects do not occur.

7.5.5 No drought options identified in SWS's revised draft **Drought Plan 2022**[18], or the plans of neighbouring water companies, will affect these sites.

[18] Southern Water (2021). Draft Drought Plan 2022 Main report. 31 March 2021, Version 1.0.

Drainage and Wastewater Management Plans

7.5.6 The interaction of the WRMP options with specific schemes derived from the emerging Drainage and Wastewater Management Plan (DWMP) can only be assessed at the project level due to the generic nature of the DWMP options.

Other projects 'in combination'

Minor projects

7.5.7 It has not been possible to produce a definitive list of existing (minor) planning applications near this option's zone of influence, and generating a list at this stage would be of little value given the lead times for the option. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the ACWG guidance on cumulative/in combination assessments.

Major projects

7.5.8 Reference has been made to the Planning Inspectorate's National Infrastructure Projects website19 which includes major projects.

7.5.9 A review of that status of major projects that are located within or in close proximity to this European site has been undertaken to assess the potential for in-combination effect with this option. The following summarises the findings of this review:

- Manston Airport (located less than 5km from the north Kent coast) - the Secretary of State granted the DCO in July 2022; the HRA report concludes that '*given the relative scale and magnitude of the identified effects on the qualifying features of these European sites and where relevant, the measures in place to avoid and reduce the potential harmful effects, there would not be any implications for the achievement of the conservation objectives for those European sites.*' Assessment considered, Sandwich Bay SAC, The Swale SPA and Ramsar, and Thanet Coast and Sandwich Bay SPA and Ramsar.

7.5.10 Given the current status of the major projects reviewed above, it can be concluded that there is no potential for in-combination effects upon Stodmarsh SPA with the proposed option.

7.6 Conclusion: Stodmarsh SPA

7.6.1 In light of the predicted effect of this option both alone and in-combination with other plans and projects, it is considered that there is sufficient confidence that appropriate mitigation measures are available at the project level and can be implemented to enable a conclusion of no adverse effect on the integrity of the Stodmarsh SPA to be drawn.

7.6.2 In addition, it is recognised that several desalination plants are proposed for the north Kent area by the SWS and SEW WRMPs; given the planning horizons for all of these

[19] https://infrastructure.planninginspectorate.gov.uk/projects/

schemes it is very likely that additional investigations in future WRMP cycles would be able to identify ‘no adverse effect’ alternative locations for larger combined desalination plants – for example a plant between Deal and Folkstone could almost certainly be delivered without adverse effects on marine European sites from operation.

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Appendix E7: Appropriate Assessment: Desalination (KME): Isle of Sheppey

1. Option Summary

1.1 Overview and European site context

1.1.1 The Isle of Sheppey is experiencing difficulties in meeting water demand. This option will require a combination of two (of four) phased options that involve the construction of a new reverse osmosis (RO) modular desalination plant on the Isle of Sheppey on land south of Sheerness Docks, supplying potable water direct to the Isle of Sheppey. This would reduce the need to pump water from the mainland, benefitting the entire Kent Medway East WRZ. This would allow local demand to be met whilst significantly reducing the need for transfers along the main from Deans Hill BPT.

1.1.2 Currently the BVP is selecting two options to provide a total of 30Ml/d (i.e., a 10Ml/d plant and a 20Ml/d plant, with the order of these to be determined). Most of the construction, including the intake and outfall, would be associated with the first phase / module).

1.1.3 The options would be delivered by 2046.

1.1.4 These options would require:

- New abstraction (pipeline, pumping station, abstraction infrastructure).
- Raw water balancing tank.
- Microfiltration pretreatment and filtered water balancing tank.
- RO membrane treatment plant (membrane plant, building to house same, interstage pumping etc.).
- Clean water storage, remineralisation and disinfection tank.
- Brine discharge pumping station, pipeline and diffuser arrangement.
- CIP and remineralisation chemical storage.
- Distribution pumping station, pipeline and discharge structure.
- Site infrastructure (parking, fencing, roads etc.).
- Additional power infrastructure.

- Additional pipeline from Spur to Southdown WSR.
- Additional pipeline, booster station Deans Hill BS to Supply Mainland.

1.1.5 During the operation of this options, hypersaline brine will be discharged in the Medway estuary, increasing over time as the capacity is increased, as described above.

1.1.6 The proposed Isle of Sheppey option is within the The Swale SPA and The Swale Ramsar, the Medway Estuary and Marshes SPA and Medway Estuary and Marshes Ramsar. The Thames Estuary and Marshes SPA and The Thames Estuary and Marshes Ramsar are located within 2km, with The Outer Thames Estuary SPA being 2.5km away.

1.2 Environmental changes and option assumptions / uncertainties

Potential construction-related environmental changes

1.2.1 The proposed site of the desalination plant and associated intake/outfall and pipeline are located within and in close proximity to a number of European sites.

1.2.2 In addition, the proposed pipeline connecting the desalination plant to the supply network would follow the Sheppey Road and hence cross the Ferry Reach section of The Swale at Kingsferry Bridge (i.e., immediately adjacent to the The Swale SPA and The Swale Ramsar, the Medway Estuary and Marshes SPA and Medway Estuary and Marshes Ramsar).

1.2.3 Construction activities have the potential to result in the following impacts:

- Loss of functional offsite habitat – use of undeveloped land adjacent to the proposed desalination plant and along the pipeline route which could support qualifying features;
- Physical damage to habitats (e.g., tidal flats/salt marshes) – damage to existing habitat within European sites that is utilised by qualifying features (e.g., for foraging);
- Water quality – issues with accidental oil spills and pollution incidents when working at the main site of the desalination plant south of Sheerness Docks on the intake/outfall. In addition, there is potential for increases in turbidity in adjacent waterbodies from sediment laden runoff and seabed scour during intake and outfall construction;
- Disturbance – qualifying features could be disturbed and displaced by noise, vibration and visual (including light pollution);
- Contamination – smothering of habitats that support the qualifying features through dust generation, and increase nutrient nitrogen loading of supporting habitats through HGV/plant and vehicle movements; and
- Introduction of Invasive/Non-Native Species (INNS).

Potential operation-related environmental changes

1.2.4 ‘Generic’ environmental risks typically associated with new infrastructure may be realised (e.g., additional noise or lighting) although these cannot be reliably scoped or assessed at

the plan-level as they are entirely dependent on the detailed design. However, the operational plant required is not inherently high-impact in this regard, and potentially notable environmental changes can almost certainly be avoided through scheme-design.

1.2.5 The principal environmental changes from operation will therefore relate to:

- the discharge of wastewater from the reverse osmosis process via the newly constructed outfall;
- the entrainment of marine species (i.e., prey items) at the intake; and
- the presence of a new desalination plant and any potential increases in disturbance relating to its operation.

1.2.6 Assessments of other desalination plants of a similar scale to the proposed option indicate that any increase in salinity would extend over a small area (up to 10m) (EDF, 2021). This area of effect was predicted for a site located on an open coastline, which is similar in nature to the location of the proposed discharge for this desalination option. Many other studies have demonstrated that near-field dilution of brine to ambient levels typically occurs within a relatively short distance (tens or hundreds of metres rather than kilometres), and that impacts to benthic communities from concentrate discharges can be reliably minimised by using properly designed diffuser systems.

1.2.7 Research from California suggests that a desalination plant of ~200Ml/d capacity will impinge approximately 1kg/day of marine biota (Water Reuse Association, 2011). Given the smaller scale of the proposed desalination plant proposed as part of this option, this figure is likely to be less for the proposed option.

1.2.8 It should be noted that the desalination scheme will be relatively small-scale (i.e., up to 30Ml/d, compared to (for example) 75Ml/d proposed for the Fawley desalination scheme considered at WRMP19) and designed to operate intermittently during periods of supply stress, rather than continuously.

Assumptions and uncertainties

1.2.9 Option-specific wastewater dispersion modelling cannot be conducted without detailed designs. As such, modelling from previous desalination plants of a similar scale to the proposed option has been used to provide an approximate zone of influence for any wastewater discharge.

2. Screening Summary

2.1.1 The screening assessment is outlined in Table 2.1. In summary, significant effects cannot be self-evidently excluded for the following sites:

Table 2.1 Sites for which significant effects cannot be self-evidently excluded

Site	Location (km)*	LSE?		Rationale
		Cons	Oper	
Medway Estuary and Marshes SPA and Ramsar	0/DS	U	Y	Construction: Phase 1 Option: The intake and outfall will be located just outside this site, so effects on site habitats possible depending on construction approach; mobile features will be vulnerable to disturbance etc. Pipeline to Southdown WSR would cross this site; this will almost certainly follow existing roads in this area although disturbance effects are possible. Phase 2 option The intake and outfall and pipeline to Southdown WSR will have been constructed under SW022 and so effects would be limited to construction effects (including disturbance effects) associated construction at the desalination plant location, although these are likely to be avoidable with established measures. Operation: Operation will discharge hypersaline brine offshore from this site; potential to affect supporting habitats.
The Swale SPA and Ramsar	0	U*	U	Construction: Phase 1 Option: Pipeline to Southdown WSR would cross this site; this will almost certainly follow existing roads in this area although disturbance effects are possible. Phase 2 option: Pipeline to Southdown WSR would cross this site but would already have been constructed under SW022. Potential risk of disturbance effects associated construction at the desalination plant location, although avoidable with established measures. Operation: Operation will discharge hypersaline brine in the Medway estuary, although the exposure of the site itself to this is likely to be low; effects are possible for species utilising the Medway, however.
Thames Estuary and Marshes SPA and Ramsar	1.8	U*	U	Construction: A small proportion of this site will be within 2km of the likely intake / outfall location in the Medway estuary; construction effects on site habitats likely to be limited but mobile features will be vulnerable to disturbance etc. Operation: Operation will discharge hypersaline brine offshore from this site; potential to affect supporting habitats.

Site	Location (km)*	LSE?		Rationale
		Cons	Oper	
Outer Thames Estuary SPA	2.5	U*	U	Construction: The site itself will not be exposed / affected by environmental changes associated with construction (distance, attenuation provided by the tidal flux of the Thames estuary) although the mobile species may be exposed if utilising habitats closer to the construction areas; however, this can almost certainly be avoided with established measures. Operation: Operational effects are arguably unlikely due to designated site location relative to assumed location of intake / outfall and probability of dilution (noting that many studies have demonstrated that near-field dilution of brine to ambient levels typically occurs within a relatively short distance (tens or hundreds of metres rather than kilometres), plus the proportion of the site potentially affected would be very small; however, additional investigation relating to the plume is appropriate.

2.1.2 Some of the potential effects noted above will be clearly avoidable with established measures, which are accounted for at the appropriate assessment stage in accordance with People over Wind.

3. Assessment: Medway Estuary and Marshes SPA/Ramsar

3.1 Core Designation Information

3.1.1 The site is a complex of rain-fed, brackish, floodplain grazing marsh with ditches and intertidal marsh and mudflat. It is of international importance for its diverse assemblage of wetland plants and invertebrates.

3.1.2 Table 3.1 provides links to the key documents and information relating to the designation. Specific information that may be relevant to the assessment of effects is noted as necessary, and in the assessment sections below (e.g., known areas of functional land identified in the SACO documentation).

Table 3.1: Designation information for the Medway Estuary and Marshes SPA/Ramsar

Aspect	Notes
Qualifying features	SPA: • A130w: Eurasian oystercatcher *Haematopus ostralegus* • A056w: Northern shoveler *Anas clypeata*

Aspect	Notes
	• A052w: Eurasian teal *Anas crecca* • A143w: Red knot *Calidris canutus* • A137w: Ringed plover *Charadrius hiaticula* • A132r: Pied avocet *Recurvirostra avosetta* • A082w: Hen harrier *Circus cyaneus* • A616w: Black-tailed godwit *Limosa limosa islandica* • A001w: Red-throated diver *Gavia stellata* • A169w: Ruddy turnstone *Arenaria interpres* • A054w: Northern pintail *Anas acuta* • A164w: Common greenshank *Tringa nebularia* • A053w: Mallard *Anas platyrhynchos* • A017w: Great cormorant *Phalacrocorax carbo* • A195r: Little tern *Sterna albifrons* • A141w: Grey plover *Pluvialis squatarola* • A050w: Eurasian wigeon *Anas penelope* • A048w: Common shelduck *Tadorna tadorna* • A672w: Dunlin *Calidris alpina alpina* • A162w: Common redshank *Tringa totanus* • A098w: Merlin *Falco columbarius* • A059w: Common pochard *Aythya ferina* • A037w: Tundra swan Cygnus columbianus bewickii • A132w: Pied avocet *Recurvirostra avosetta* • A160w: Eurasian curlew *Numenius arquata* • A005w: Great crested grebe *Podiceps cristatus* • A193r: Common tern *Sterna hirundo* • A675w: Dark-bellied brent goose *Branta bernicla bernicla* • WATR: Waterbird assemblage • BBA: Breeding bird assemblage • A162c: Common redshank *Tringa totanus* Ramsar: • Crit 2: Supports vulnerable, endangered or critically endangered species or threatened eco communities • Crit 5: Regularly supports 20,000 or more waterbirds • Crit 6: Regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
Conservation Objectives	Available at: European Site Conservation Objectives for Medway Estuary & Marshes SPA - UK9012031 (naturalengland.org.uk)
Site Improvement Plan	Available at: Site Improvement Plan: Greater Thames Complex - SIP134 (naturalengland.org.uk)
Supplementary advice	Available at: European Site Conservation Objectives for Medway Estuary & Marshes SPA - UK9012031 (naturalengland.org.uk)
Associated SSSIs	• Medway Estuary & Marshes SSSI
Functional land	Breeding bird assemblage: mudflat, saltmarsh, grazing marsh, coastal lagoons, shallow coastal waters, intertidal sand and muddy sand, intertidal coarse sediment and intertidal mixed sediments.

Aspect	Notes
	Waterbird assemblage, non-breeding: intertidal mud, intertidal sand and muddy sand, saltmarsh, grazing marsh.

3.2 Mitigation Assumptions

Standard Measures / Best-practice

3.2.1 Appendix C identifies standard and established measures that are known to be available, achievable and likely to be effective in avoiding or mitigating potentially adverse effects on European sites and interest features. These are based on best- and case-practice from similar schemes, and so there can be high confidence in their deliverability and effectiveness. These measures would be applied unless project-level HRAs or project-specific environmental studies demonstrate that they are not required (i.e., the anticipated effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate.

Bespoke measures

3.2.2 Site- or feature-specific mitigation that may be required for specific atypical effects are identified in the assessment sections.

3.3 Interest Feature Exposure

3.3.1 Little tern are typically found breeding on the islands within the Medway Estuary such as Burntwick Island (Natural England, 2020) between the months of April and August (Natural England, 2022a), with the pied avocet breeding season also typically occurring between the months of March and August (Natural England, 2022a).

3.3.2 The non-breeding species and waterbird assemblage are all over-wintering species, being found in peak numbers within the SPA and Ramsar site between the months of October and March (Natural England, 2022a). There is, however, some variation in this peak presence between species, such as pied avocet being present earlier in September and shelduck being present in high numbers up until May (Natural England, 2022a).

3.3.3 No breeding sites are present in the vicinity of the proposed option. However, there is the potential for breeding and non-breeding birds to be found foraging within the vicinity of the proposed option.

3.3.4 The mean-max foraging range for little tern is approximately 6km (Woodward *et al*., 2019) and, therefore, given the proximity of some of their breeding locations, this species may be found foraging within the vicinity of the proposed option. As such, all non-breeding interest-features and breeding interest features (when foraging) are considered in the following assessment.

3.4 Assessment – Construction

Loss of Functional Habitat (Offsite)

3.4.1 The site selected for the desalination plant and onward pipeline route is located near an area of open grassland which could be used for foraging or roosting by the over-wintering qualifying species of the SPA and Ramsar. Whilst this area may be subject to existing anthropogenic disturbance due to its close proximity to residential and industrial uses, the use of this area may result in a loss of functionally associated off-site habitat, depending on the final specification for the plant and design details.

3.4.2 Breeding and non-breeding bird surveys will need to be completed to establish the use of this area by the site's qualifying features. However, it should be noted that the habitat is outside the SPA and Ramsar boundary and is a very small area in the context of the surrounding supporting habitat as a whole; unless it is used by significant aggregations of the qualifying species it is unlikely that the loss of this area would constitute an adverse effect. The effects can only be fully assessed with scheme-level surveys (which it would not be appropriate to undertake for several years given the lead time for the proposals; however, mitigation will be available for the loss of small areas of non-designated habitat such as this.

Physical Damage

3.4.3 While the pipeline is proposed to follow the existing road crossing across Kingsferry Bridge, thus avoiding direct interactions with habitats, there is the potential for physical damage to occur to tidal flat and saltmarsh habitat located within the SPA and Ramsar as a result of construction activities associated with pipeline construction. Such habitat is utilised for foraging purposes by the qualifying features of the SPA and Ramsar.

3.4.4 Any sediment or contamination run-off from construction compounds at either side of the Kingsferry Bridge could result in damage to, and reduction in of, available foraging habitat. However, through the use of best practice construction measures and adherence to appropriate pollution prevention guidelines, such effects can be avoided or effectively mitigated during the construction phase. As such, the extent, distribution, structure and function of the habitat on which the qualifying features of the site rely will not be affected and no adverse effects on site integrity can be concluded. In addition, the use of alternative construction methods such as horizontal directional drilling (HDD) should be considered, as such methods would further reduce the potential for adverse effect to occur.

Mitigation

- The use of alternative construction methods, such as horizontal directional drilling (HDD), should be considered, as such methods would further reduce the potential for adverse effect to occur.

Water quality

3.4.5 Due to the proposed intake and outfall being located within the River Medway and the proposed pipeline route crossing The Swale, there is the potential for indirect effects of pollution such as excess sediment discharge and accidental oil spill. Best practice mitigation measures, summarised below and further detailed in Appendix C, will be followed during construction to ensure no adverse effects on the water quality of the SPA and Ramsar occur as a result of construction activities.

Mitigation

- Adherence to EA Pollution Prevention Guidelines (now archived) and NRW, SEPA's Guidance on Pollution Prevention including Works and Maintenance in or near Water (2017).
- No water should be discharged directly to the river network connecting to The Swale. A drainage strategy including treatment measures will need to be agreed with the relevant regulators (EA and NE). If the measures to removed silt and contaminations do not satisfy the EA and NE to allow discharge to a watercourse (likely to lead into The Swale) then an alternative discharge arrangement will need to be made (e.g., to sewer or tankered off site).

Disturbance

Desalination Plant

3.4.6 The proposed site for the desalination plant is located in an area of existing anthropogenic disturbance, with the towns of Sheerness (and associated docks), Queenborough and Minster on Sea being located in close proximity to the proposed site of works. As such, ambient noise and lighting levels in the area are already likely to be high, with strategic noise mapping indicating that existing baseline noise levels of 60-65 dB during the day and 55-50 dB at night (Extrium, 2022).

3.4.7 Best available evidence indicates that sudden, irregular, noise above c.70 dB(A) may present a flight response or anxiety behaviour in some estuarine bird species (Cutts, Phelps and Burdon, 2009; Wright, Goodman and Cameron, 2013). While the precise construction methodology for the desalination plant is not yet available, there exists the potential for any nearby birds to be disturbed by any construction activities that produce noise above the existing baseline levels. As such, surveys will be required to determine the potential presence of qualifying bird species and confirm the need for any mitigation measures, such as hoardings, no working at dawn or dusk or to limit the use of onsite lighting.

Intake and Outfall

3.4.8 The intake/outfall location for the proposed option is located approximately 0.2km north of the Medway Estuary and Marshes SPA and Ramsar. This is within the 1km range at

which it is predicted that onshore works may disturb ornithological features (Ruddock and Whitfield, 2007).

3.4.9 While construction of a new intake and outfall is required for the new desalination plant, due to the proposed works location within the existing Sheerness Docks (a location of significant anthropogenic disturbance), it is unlikely that the zone potentially affected by construction works is important in supporting the qualifying features of the SPA/Ramsar. However, due to the proximity to the SPA and Ramsar, this will need to be confirmed by surveys to determine the potential presence of qualifying bird species and confirm the need for any mitigation measures.

Transfer Pipeline

3.4.10 As the pipeline routes directly through the SPA and Ramsar when crossing the Swale, there exists the potential for disturbance of foraging birds within the tidal flats and saltmarsh to occur during construction activities for the pipeline across the Kingsferry Bridge.

3.4.11 Previous surveys in the area have indicated the significant presence of mallard and curlew (Dalcour Maclaren, 2022) during winter months in the vicinity of the Kingsferry Bridge, species which are listed as qualifying features for the SPA and Ramsar. As construction activities for the pipeline are proposed to follow the main road across the Kingsferry Bridge, any birds foraging below the bridge during construction could be subject to disturbance. To mitigate against such effects, a working method for noise and visual stimuli should be produced to determine what mitigation measures (such as hoardings, limits on lights during works at night) would be most effective to reduce the disturbance effects.

Mitigation

- Conduct summer and winter bird surveys to determine if the land within 1km of the desalination plant and onward pipeline route is utilised by significant numbers of qualifying bird species (e.g., foraging, roosting).
- Produce working method for noise and visual stimuli and complete assessment to determine impacts and effectiveness of mitigation (e.g., hoarding, silencers, no working at dawn or dusk, limit use of onsite lighting). This should be completed with reference to the Waterbirds Disturbance Mitigation Toolkit (TIDE Tools, 2022) which details likely thresholds for noise and visual stimuli.

Contamination – dust and NOx

3.4.12 The habitats in the SPA and Ramsar site are considered to be sensitive to nitrogen (N) deposition, particularly the salt marsh located in the vicinity of the Kingsferry Bridge. The Air Pollution Information System (APIS) estimates that the critical loading (i.e. over which effects of N deposition would start to occur) for salt marsh is 20-30Kg N/ha/year (APIS, 2022).

3.4.13 The number of HGV movements could exceed the threshold set in the National Highways Design Manual for Roads and Bridges of 1000 HGV movements within 200m of the designated site. As such, although dust generating activities are considered to be minimal (no demolition is required in the vicinity of the salt marsh habitat), a detailed air quality assessment will be needed to confirm whether there will be any issues from N loading in the vicinity of the Kingsferry Bridge. Once the detailed construction plan for the pipeline is known, the impacts can be further assessed.

Invasive/ Non-Native Species

3.4.14 The works may have the potential to spread invasive non-native species. The introduction of non-native species may affect prey species for the qualifying bird species through introduction of disease, predation or competition.

3.4.15 Habitat surveys in the terrestrial and marine environments should be conducted to indicate the presence of invasive species and any sensitive areas. Works, particularly in aquatic habitats should follow best practice biosecurity measures as standard (see Appendix C for further detail).

Mitigation

- Best practice biosecurity measures, as recommended by the GB Non-Native Species Secretariat (http://www.nonnativespecies.org/index.cfm?sectionid=58) would guard against any potential for spreading invasive species as a result of construction.

3.5 Assessment – Operation

Saline discharge

3.5.1 The saline discharge to the River Medway may lead to a very minor increase in salinity in the vicinity of the outfall. Assessments of other desalination plants of a similar scale to the proposed option indicate that any increase in salinity would extend over a small area (up to 10m) (EDF, 2021). While this area of effect was predicted for a site located on an open coastline, it provides a reasonable proxy estimate for the potential zone of influence of increased salinity for the proposed option.

3.5.2 As a guide, modelling undertaken for a proposed desalination plant near Southampton Water indicated that the plume would be at 5% of ambient salinity within 250m from the outfall for a 75 Mld plant, and within 150m for a 15 Ml/d plant. The Medway estuary obviously has different characteristics to Southampton Water and the Solent, although the closest habitats of the Medway Estuary and Marshes SPA / Ramsar are approximately 600m from the indicative location of the outfall; and there are clearly opportunities to move the discharge point to the north of Sheppey (i.e. further into the Thames estuary) where dispersal will be more rapid and the designated sites and interest features (Outer Thames Estuary SPA) are relatively insensitive to the likely magnitude of change from brine discharges.

3.5.3 As the closest potential breeding habitat for little tern is located approximately 3km from the source of the outfall, this area would be within the mean-max foraging range of little tern (6km) (Woodward et al., 2019). However, this area of increased salinity would represent a very small proportion of the total foraging range of the qualifying features of the SPA and Ramsar. No higher sensitivity habitats such as tidal flats or saltmarshes are located in the vicinity of the proposed outfall location; however, dispersion modelling should be conducted to ensure that no areas of habitat further afield from the outfall could be subject to increased salinity.

3.5.4 During operation, a number of chemicals will be required in the operational processes (e.g., biocides and anti-scalants). The settlement stage of the process will use an inlet storage tank to provide settlement of solids and to balance salinity. It is anticipated that any solids that are settled out (without treatment aid – see below) would be discharged in a controlled manner with the brine, ensuring that the suspended sediment load is not too high for the receiving waters. The pre-filtration stage will remove solids that are not settled in first stage, and it is anticipated that backwash water would be discharged with the brine. These discharges will encompass a very limited spatial extent, representing a very small proportion of the predicted foraging ranges for any of the qualifying features of the SPA or Ramsar, and as such there is limited chance for these features to be exposed directly to any contaminants.

3.5.5 Dispersion modelling would be carried out to take account of the final plant capacity. This would inform assessment of percentage increase in salinity and temperature against established baseline conditions and using agreed significance threshold.

Mitigation

- Residual chemicals from treatment process to be neutralised before release with brine discharge.

Impingement and entrainment

3.5.6 The intake for the desalination plant could lead to impingement of organisms (organisms trapped on filter screens), entrainment (organisms drawn into the intake structure) and/or entrapment (organisms trapped within offshore intake pipeline structure). These impacts to marine biota could change the food availability, distribution and density in the area immediately around the intake and therefore impact the feeding patterns of the qualifying bird species.

3.5.7 Research from California suggests that a desalination plant of ~200Ml/d capacity will impinge approximately 1kg/day of marine biota (Water Reuse Association, 2011). Given the smaller scale of the proposed desalination plant on the Isle of Sheppey, this figure is likely to be reduced in the case of the proposed option.

3.5.8 Mitigation measures and use of best practice design, such as the use of a passive wedge-wire cylinder (PWWC) with an appropriate mesh size would be able to greatly minimise the impacts of impingement and entertainment. At the detailed design stage, consideration

will be given to use of a surface or sub-surface intake, capped intake to reduce vertical flow, low velocities through the screens, sizing of the screens and deflection technologies.

Mitigation

- Incorporate best practice technologies for intake to minimise impingement and entrainment issues of prey features, such as PWWC with an appropriate mesh size.

Disturbance

3.5.9 The operation of the desalination plant may produce a long-term noise and visual disturbance impact on the qualifying bird species of the SPA and Ramsar.

3.5.10 The operational site is considered likely to produce low levels of constant noise as it processes water. In addition, operation of the site will require human presence, but likely to be at low levels.

3.5.11 The majority of the plant will be housed in units and, therefore, operational noise is unlikely to be an issue as impulse noise will not generally occur. It is anticipated that qualifying features of the site would become accustomed to such noise sources over time and no significant disturbance is envisaged.

Mitigation

- Screening of the plant with a landscape bund or additional planting should be considered as part of the detailed design if appropriate. Lighting of the site could increase the displacement of the bird species and will therefore need to be positioned to avoid light spill on any potential adjacent habitats.
- Any significant maintenance works within 1km of the SPA (and any potential off-site functional habitat) would require the use of plant silencers and visual screening would be necessary within 250m so as to prevent a significant disturbance impact on the SPA qualifying features. An operational noise assessment should be completed to ensure the plant does not impact the bird species, and where necessary additional measures incorporated (e.g., specific sets of louvres that reduce noise).

3.6 In combination effects

Other WRMP options

3.6.1 The potential for this European site to be affected by two or more WRMP options (either options within the SWS rdWRMP, or options in the rdWRMPs of neighbouring water companies) is set out in Appendix F and Appendix G.

3.6.2 In summary the principal in combination risk relates to effects with:

- Recycling: Medway WwTW - Eccles Lake (SWS)
- Recycling: Sittingbourne industrial reuse (SWS).

3.6.3 Environmental changes associated with the operation of this option and the Recycling: Medway WwTW - Eccles Lake and Recycling: Sittingbourne industrial reuse options are expected to be highly localised. Although there are residual uncertainties that cannot be fully assessed at the WRMP level with the available data, it is considered that mitigation options are available that can reliably be applied through scheme detailed design (e.g., location of outfalls).

Other Water Company Plans

Drought Plans

3.6.4 The Drought Plan will be revised several times before this WRMP option is implemented, and following option delivery, and so a meaningful in combination assessment arguably cannot be undertaken at this point. Furthermore, a future Drought Plan will necessarily reflect the abstraction baseline at that point (i.e., it will account for options implemented at that point in time) and be subject to HRA when revised, which provides a mechanism to ensure that in combination effects do not occur.

3.6.5 The DP HRA concluded that the DP options would require mitigation to avoid adverse effects, including investigating the potential for alternative operation of flows from the Allington locks at low tide to reduce the potential for lower water levels at low tide; improving water quality in the Teise through WwWT upgrades (already commenced in AMP7), and other resilience work on the River Bewl (see DP HRA for details).

3.6.6 The only option likely to interact spatially with the DP options is the Medway WTW Recycling option; however, the HRA of WRMP19 concluded that this option would have no adverse effect on the Medway Estuary sites and ongoing investigative work for the delivery of this scheme suggests that this will remain the case due to the distance down-estuary to the closest point of the SPA/Ramsar and the small magnitude of change relative to the dominant marine / tidal influences at this location. No adverse effects would therefore be expected (particularly given the short timescales of an DP implementation and likelihood of recovery in the short-term) although this would necessarily be reviewed through future revisions of the Drought Plan. Conclusion: No AE in combination.

Drainage and Wastewater Management Plans

3.6.7 The interaction of the WRMP options with specific schemes derived from the emerging Drainage and Wastewater Management Plan (DWMP) can only be assessed at the project level due to the generic nature of the DWMP options.

Minor projects

3.6.8 It has not been possible to produce a definitive list of existing (minor) planning applications near this option's zone of influence and generating a list at this stage would be of little value given the lead times for the option. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the ACWG guidance on cumulative/in combination assessments.

Major projects

3.6.9 Reference has been made to the Planning Inspectorate's National Infrastructure Projects website[1] which includes major projects.

3.6.10 A review of that status of major projects that are located within or in close proximity to this European site has been undertaken to assess the potential for in-combination effect with this option. The following summarises the findings of this review:

- Cleve Hill Solar Park (approximately 2 km north-east of Faversham and 5 km west of Whitstable on the North Kent Coast) – the DCO was granted in May 2020. The Secretary of State's HRA does not make reference to the Medway Estuary and Marshes SPA and Ramsar site and, therefore, it can be concluded that this European site is not affected by this proposed scheme.
- Kemsley Paper Mill (K4) Combined Heat and Power Plant (located on land within the boundary of the Kemsley Paper Mill, near Sittingbourne in Kent) – a DCO for the project was granted in July 2019. The Secretary of State's HRA concludes that there would be no LSE on the Medway Estuary and Marshes SPA and Ramsar site (the only potential pathway for effect on the SPA and Ramsar site appeared to be emissions to air, and it was concluded that relevant thresholds would either not be exceeded or, if an exceedance was predicted, there would be no LSE).
- Wheelabrator Kemsley Generating Station (K3) and Wheelabrator Kemsley North (WKN) Waste to Energy Facility (a power upgrade and increase in tonnage throughput to the existing Kemsley Generating Station and a new waste to energy facility, located adjacent to and immediately north-east of the Kemsley Paper Mill, in Kemsley, Sittingbourne, Kent) – a DCO was granted to Wheelabrator Kemsley K3 Generating Station only in February 2021. Wheelabrator Kemsley North Waste to Energy Facility was not granted development consent. The Secretary of State's HRA concludes that there would be no LSE on the Medway Estuary and Marshes SPA and Ramsar site.

3.6.11 Given the nature, location, current status of the environmental information and/or conclusion of the Secretary of State's HRA relating to the major projects reviewed above, it can be concluded that there is either no realistic potential for in-combination effects with the proposed option, or the environmental assessment of the major projects is not sufficiently advanced to enable in-combination assessment to be undertaken.

3.7 Conclusion: Medway Estuary and Marshes SPA/Ramsar

3.7.1 In light of the predicted effect of this option both alone and in-combination with other plans and projects, it is considered that there is sufficient confidence that appropriate mitigation measures are available at the project level and can be implemented to enable a conclusion of no adverse effect on the integrity of the Medway Estuary and Marshes SPA/Ramsar to be drawn for the WRMP HRA.

[1] https://infrastructure.planninginspectorate.gov.uk/projects/

4. Assessment: The Swale SPA/Ramsar

4.1 Core Designation Information

4.1.1 The site is a complex of brackish and freshwater, floodplain grazing marsh with ditches, and intertidal saltmarsh and mudflat. These habitats together support internationally important numbers of wintering waterfowl. Rare wetland birds breed in important numbers. The saltmarsh and grazing marsh are of international importance for their diverse assemblages of wetland plants and invertebrates.

4.1.2 Table 4.1 provides links to the key documents and information relating to the designation. Specific information that may be relevant to the assessment of effects is noted as necessary, and in the assessment sections below (e.g., known areas of functional land identified in the SACO documentation).

Table 4.1: The Swale SPA and Ramsar site-specific details

Aspect	Notes
Qualifying features	SPA: • A137w: Ringed plover *Charadrius hiaticula* • A130w: Eurasian oystercatcher *Haematopus ostralegus* • A052w: Eurasian teal *Anas crecca* • A672w: Dunlin *Calidris alpina alpina* • A160w: Eurasian curlew *Numenius arquata* • A051w: Gadwall *Anas strepera* • A141w: Grey plover *Pluvialis squatarola* • A162w: Common redshank *Tringa totanus* • A675w: Dark-bellied brent goose *Branta bernicla bernicla* • WATR: Waterbird assemblage • BBA: Breeding bird assemblage • A616w: Black-tailed godwit *Limosa limosa islandica* Ramsar: • Crit 2: Supports vulnerable, endangered or critically endangered species or threatened eco communities • Crit 5: Regularly supports 20,000 or more waterbirds • Crit 6: Regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
Conservation Objectives	Available at: European Site Conservation Objectives for The Swale SPA - UK9012011 (naturalengland.org.uk)
Site Improvement Plan	Available at: Site Improvement Plan: Greater Thames Complex - SIP134 (naturalengland.org.uk)
Supplementary advice	Available at: http://publications.naturalengland.org.uk/publication/5745862701481984?category=6528471664689152

Aspect	Notes
Associated SSSIs	• The Swale SSSI
Functional land	Breeding bird assemblage: Intertidal mud, intertidal sand and muddy sand, saltmarsh and grazing marsh for Shelduck (*Tadorna tadorna*), mallard (*Anas platyrhynchos*), moorhen (*Gallinula chloropus*), coot (*Fulica atra*), lapwing (*Vanellus vanellus*), redshank (*Tringa totanus*), reed warbler (*Acrocephalus scirpaceus*) and reed bunting (*Emberiza schoeniclus*) (Natural England, 2014). Waterbird assemblage (non-breeding): The current extent and distribution of suitable habitat (intertidal mud, intertidal sand and muddy sand, saltmarsh, grazing marsh, seagrass beds, intertidal mussel beds) is thought to support the feature for all the necessary stages of the non-breeding/wintering period for Oyster catcher (*Haematopus ostralegus*), ringed plover (Charadrius hiaticula), grey plover (Pluvialis squatarola), curlew (*Numenius arquata*) and redshank (Tringa totanus), shelduck (*Tadorna tadorna*), Wigeon (*Anas penelope*), Teal (*Anas creca*) and curlew (*Numenius arquata*) (Natural England, 2014).

Interest Feature Exposure

4.1.3 Due to the proposed route of the pipeline crossing the Kingsferry Bridge in close proximity to important foraging habitat for the qualifying features of the site, all qualifying features will be considered in the following assessment. Features may also be exposed if using the Medway sites, or non-designated areas on the Isle of Sheppey that may be used for construction.

4.2 Mitigation Assumptions

Standard Measures / Best-practice

4.2.1 Appendix C identifies standard and established measures that are known to be available, achievable and likely to be effective in avoiding or mitigating potentially adverse effects on European sites and interest features. These are based on best- and case-practice from similar schemes, and so there can be high confidence in their deliverability and effectiveness. These measures would be applied unless project-level HRAs or project-specific environmental studies demonstrate that they are not required (i.e., the anticipated effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate.

Bespoke measures

4.2.2 Site- or feature-specific mitigation that may be required for specific atypical effects are identified in the assessment sections.

4.3 Assessment – Construction

Loss of Functional Habitat (Offsite)

4.3.1 The site selected for the desalination plant and onward pipeline route is located near an area of open grassland which could be used for foraging or roosting by the over-wintering qualifying species of the SPA and Ramsar. Whilst this area may be subject to existing anthropogenic disturbance due to its close proximity to residential and industrial uses, the use of this area may result in a loss of functionally associated off-site habitat, depending on the final specification for the plant and design details.

4.3.2 Breeding and non-breeding bird surveys will need to be completed to establish the use of this area by the site's qualifying features. However, it should be noted that the habitat is outside the SPA and Ramsar boundary and is a very small area in the context of the surrounding supporting habitat as a whole; unless it is used by significant aggregations of the qualifying species it is unlikely that the loss of this area would constitute an adverse effect. The effects can only be fully assessed with scheme-level surveys (which it would not be appropriate to undertake for several years given the lead time for the proposals (i.e., 2037 delivery for phase 1); however, mitigation will be available for the loss of small areas of non-designated habitat such as this.

Physical Damage

4.3.3 While the pipeline is proposed to follow the existing road crossing across Kingsferry Bridge, thus avoiding direct interactions with habitats, there is the potential for physical damage to occur to tidal flat and saltmarsh habitat located within the SPA and Ramsar as a result of construction activities associated with pipeline construction. Such habitat is utilised for foraging purposes by the qualifying features of the SPA and Ramsar.

4.3.4 Any sediment or contamination run-off from construction compounds at either side of the Kingsferry Bridge could result in damage to, and reduction in of, available foraging habitat. However, through the use of best practice construction measures and adherence to appropriate pollution prevention guidelines, such effects can be avoided or effectively mitigated during the construction phase. As such, the extent, distribution, structure and function of the habitat on which the qualifying features of the site rely will not be affected and no adverse effects on site integrity can be concluded. In addition, the use of alternative construction methods such as horizontal directional drilling (HDD) should be considered, as such methods would further reduce the potential for adverse effect to occur.

Mitigation

- The use of alternative construction methods, such as horizontal directional drilling (HDD), should be considered, as such methods would further reduce the potential for adverse effect to occur.

Water Quality

4.3.5 Due to the proposed pipeline route crossing The Swale, there is the potential for indirect effects of pollution such as excess sediment discharge and accidental oil spill. Best practice mitigation measures, summarised below and further detailed in Appendix C, will be followed during construction to ensure no adverse effects on the water quality of the SPA and Ramsar occur as a result of construction activities.

Mitigation

- Adherence to EA Pollution Prevention Guidelines (now archived) and NRW, SEPA's Guidance on Pollution Prevention including Works and Maintenance in or near Water (2017).
- No water should be discharged directly to the river network connecting to The Swale. A drainage strategy including treatment measures will need to be agreed with the relevant regulators (EA and NE). If the measures to removed silt and contaminations do not satisfy the EA and NE to allow discharge to a watercourse (likely to lead into The Swale) then an alternative discharge arrangement will need to be made (e.g., to sewer or tankered off site).

Disturbance

Desalination Plant

4.3.6 The proposed site for the desalination plant is located in an area of existing anthropogenic disturbance, with the towns of Sheerness (and associated docks), Queenborough and Minster on Sea being located in close proximity to the proposed site of works. As such, ambient noise and lighting levels in the area are already likely to be high, with strategic noise mapping indicating that existing baseline noise levels of 60-65 dB during the day and 55-50 dB at night (Extrium, 2022).

4.3.7 Best available evidence indicates that sudden, irregular, noise above c.70 dB(A) may present a flight response or anxiety behaviour in some estuarine bird species (Cutts, Phelps and Burdon, 2009; Wright, Goodman and Cameron, 2013). While the precise construction methodology for the desalination plant is not yet available, there exists the potential for any nearby birds to be disturbed by any construction activities that produce noise above the existing baseline levels. As such, surveys will be required to determine the potential presence of qualifying bird species and confirm the need for any mitigation measures, such as hoardings, no working at dawn or dusk or to limit the use of onsite lighting.

Intake and Outfall

4.3.8 The intake/outfall location for the proposed option is located approximately 4.73km north of the Swale SPA and Ramsar. This is outside the 1km range at which it is predicted that onshore works may disturb ornithological features (Ruddock and Whitfield, 2007). As such,

no disturbance will occur to individuals within the site itself. However, individuals foraging outside of the site within the River Medway may still be subject to disturbance events.

4.3.9 While construction of a new intake and outfall is required for the new desalination plant, due to the proposed works location within the existing Sheerness Docks (a location of significant anthropogenic disturbance) it is unlikely that the zone potentially affected by construction works is important in supporting the qualifying features of the SPA/Ramsar. However, due to the proximity to the SPA and Ramsar this will need to be confirmed by surveys to determine the potential presence of qualifying bird species and confirm the need for any mitigation measures.

Pipeline

4.3.10 As the pipeline routes directly through the SPA and Ramsar when crossing the Swale, there exists the potential for disturbance of foraging birds within the tidal flats and saltmarsh to occur during construction activities for the pipeline across the Kingsferry Bridge.

4.3.11 As construction activities for the pipeline are proposed to follow the main road across the Kingsferry Bridge, any birds foraging below the bridge during construction could be subject to disturbance. To mitigate against such effects, a working method for noise and visual stimuli should be produced to determine what mitigation measures (such as hoardings, limits on lights during works at night) would be most effective to reduce the disturbance effects.

Mitigation

- Conduct summer and winter bird surveys to determine if the land within 1km of the desalination plant and onward pipeline route is utilised by significant numbers of qualifying bird species (e.g., foraging, roosting).
- Produce working method for noise and visual stimuli and complete assessment to determine impacts and effectiveness of mitigation (e.g., hoarding, silencers, no working at dawn or dusk, limit use of onsite lighting). This should be completed with reference to the Waterbirds Disturbance Mitigation Toolkit (TIDE Tools, 2022) which details likely thresholds for noise and visual stimuli.

Contamination – dust and NOx

4.3.12 The habitats in the SPA and Ramsar site are considered to be sensitive to nitrogen (N) deposition, particularly the salt marsh located in the vicinity of the Kingsferry Bridge. The Air Pollution Information System (APIS) estimates that the critical loading (i.e., over which effects of N deposition would start to occur) for salt marsh is 20-30Kg N/ha/year (APIS, 2022).

4.3.13 The number of HGV movements could exceed the threshold set in the National Highways Design Manual for Roads and Bridges of 1000 HGV movements within 200m of the designated site. As such, although dust generating activities are considered to be minimal (no demolition is required in the vicinity of the salt marsh habitat), a detailed air quality

assessment will be needed to confirm whether there will be any issues from N loading in the vicinity of the Kingsferry Bridge. Once the detailed construction plan for the pipeline is known, the impacts can be further assessed.

Invasive/Non-Native Species

4.3.14 The works may have the potential to spread invasive non-native species. The introduction of non-native species may affect prey species for the qualifying bird species through introduction of disease, predation or competition.

4.3.15 Habitat surveys in the terrestrial and marine environments should be conducted to indicate the presence of invasive species and any sensitive areas. Works, particularly in aquatic habitats should follow best practice biosecurity measures as standard (see Appendix C for further detail).

Mitigation

- Best practice biosecurity measures, as recommended by the GB Non-Native Species Secretariat (http://www.nonnativespecies.org/index.cfm?sectionid=58) would guard against any potential for spreading invasive species as a result of construction

4.4 Assessment – Operation

Saline discharge

4.4.1 The saline discharge to the Medway estuary may lead to a very minor increase in salinity in the vicinity of the intake/outfall. Assessments of other desalination plants of a similar scale to the proposed option indicate that any increase in salinity would extend over a small area (up to 10m) (e.g., EDF, 2021). While this area of effect was predicted for a site located on an open coastline, it provides a reasonable proxy estimate for the potential zone of influence of increased salinity for the proposed option.

4.4.2 This area of increased salinity would represent a very small proportion of the total foraging range of the qualifying features of the SPA and Ramsar. No higher sensitivity habitats such as tidal flats or saltmarshes are located in the vicinity of the proposed intake/outfall location, and as the Swale SPA and Ramsar is separated from the discharge location by the Isle of Sheppey it is considered that there will be no direct interaction between the discharge and the site itself.

4.4.3 During operation, a number of chemicals will be required in the operational processes (e.g., biocides and anti-scalants). The settlement stage of the process will use an inlet storage tank to provide settlement of solids and to balance salinity. It is anticipated that any solids that are settled out (without treatment aid – see below) would be discharged in a controlled manner with the brine, ensuring that the suspended sediment load is not too high for the receiving waters. The pre-filtration stage will remove solids that are not settled in first stage, and it is anticipated that backwash water would be discharged with the brine. These discharges will encompass a very limited spatial extent, representing a very small proportion of the predicted foraging ranges for any of the qualifying features of

the SPA or Ramsar, and as such there is limited chance for these features to be exposed directly to any contaminants.

4.4.4 Dispersion modelling would be carried out to take account of the final plant capacity. This would inform assessment of percentage increase in salinity and temperature against established baseline conditions and using agreed significance threshold.

Mitigation

- Residual chemicals from treatment process to be neutralised before release with brine discharge.

Impingement and entrainment

4.4.5 The intake for the desalination plant could lead to impingement of organisms (organisms trapped on filter screens), entrainment (organisms drawn into the intake structure) and/or entrapment (organisms trapped within offshore intake pipeline structure). These impacts to marine biota could change the food availability, distribution and density in the area immediately around the intake and therefore impact the feeding patterns of the qualifying bird species.

4.4.6 Research from California suggests that a desalination plant of ~200Ml/d capacity will impinge approximately 1kg/day of marine biota (Water Reuse Association, 2011). Given the smaller scale of the proposed desalination plant on the Isle of Sheppey, this figure is likely to be reduced in the case of the proposed option.

4.4.7 Mitigation measures and use of best practice design, such as the use of a PWWC with an appropriate mesh size would be able to greatly minimise the impacts of impingement and entertainment. At the detailed design stage, consideration will be given to use of a surface or sub-surface intake, capped intake to reduce vertical flow, low velocities through the screens, sizing of the screens and deflection technologies.

Mitigation

- Incorporate best practice technologies for intake to minimise impingement and entrainment issues of prey features, such as PWWC with an appropriate mesh size.

Disturbance

4.4.8 The operation of the desalination plant may produce a long-term noise and visual disturbance impact on the qualifying bird species of the SPA and Ramsar.

4.4.9 The operational site is considered likely to produce low levels of constant noise as it processes water. In addition, operation of the site will require human presence, but likely to be at low levels.

4.4.10 The majority of the plant will be housed in units and, therefore, operational noise is unlikely to be an issue as impulse noise will not generally occur. It is anticipated that

qualifying features of the site would become accustomed to such noise sources over time and no significant disturbance is envisaged.

Mitigation

4.4.11 Screening of the plant with a landscape bund or additional planting should be considered as part of the detailed design if appropriate. Lighting of the site could increase the displacement of the bird species and will therefore need to be positioned to avoid light spill on any potential adjacent habitats.

4.4.12 Any significant maintenance works within 1km of the SPA (and any potential off-site functional habitat) would require the use of plant silencers and visual screening would be necessary within 250m so as to prevent a significant disturbance impact on the SPA qualifying features. An operational noise assessment should be completed to ensure the plant does not impact the bird species, and where necessary additional measures incorporated (e.g., specific sets of louvres that reduce noise).

4.5 In combination effects

Other WRMP options

4.5.1 The potential for this European site to be affected by two or more WRMP options (either options within the SWS rdWRMP, or options in the rdWRMPs of neighbouring water companies) is set out in Appendix F and Appendix G.

4.5.2 In summary the principal in combination risk relates to effects with:

- Recycling: Sittingbourne industrial reuse (7.5Mld).

4.5.3 Environmental changes associated with the operation of this option and the Recycling: Sittingbourne industrial reuse option are expected to be highly localised. Although there are residual uncertainties that cannot be fully assessed at the WRMP level with the available data, it is considered that mitigation options are available that can reliably be applied through scheme detailed design (e.g., location of outfalls).

Other Water Company Plans

Drought Plans

4.5.4 The Drought Plan will be revised several times before this WRMP option is implemented, and following option delivery, and so a meaningful in combination assessment arguably cannot be undertaken at this point. Furthermore, a future Drought Plan will necessarily reflect the abstraction baseline at that point (i.e., it will account for options implemented at that point in time) and be subject to HRA when revised, which provides a mechanism to ensure that in combination effects do not occur.

4.5.5 There is one SWS Drought Option at Favershame, although the options will not interact to affect the same areas of this site, and the operational effects of the IoS Desalination option

on the Swale are expected to be effectively nil. The DP HRA concludes no AE for the Faversham sources option, although it is recognised that there are uncertainties in the North Kent Groundwater Model which are being resolved through WINEP (note, this in. However, given the short-term nature of the drought option impacts adverse effects in combination are not expected.

Drainage and Wastewater Management Plans

4.5.6 The interaction of the WRMP options with specific schemes derived from the emerging Drainage and Wastewater Management Plan (DWMP) can only be assessed at the project level due to the generic nature of the DWMP options.

Minor projects

4.5.7 It has not been possible to produce a definitive list of existing (minor) planning applications near this option's zone of influence and generating a list at this stage would be of little value given the lead times for the option. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the ACWG guidance on cumulative/in combination assessments.

Major projects

4.5.8 Reference has been made to the Planning Inspectorate's National Infrastructure Projects website[2] which includes major projects.

4.5.9 A review of that status of major projects that are located within or in close proximity to this European site has been undertaken to assess the potential for in-combination effect with this option. The following summarises the findings of this review:

- Cleve Hill Solar Park (approximately 2 km north-east of Faversham and 5 km west of Whitstable on the North Kent Coast) – the DCO was granted in May 2020. For The Swale SPA and Ramsar site, the Secretary of State's HRA concludes that, subject to the mitigation secured in the DCO, the effects of the project, either alone or in-combination with other plans and projects, would not lead to an adverse effect on the integrity of the sites. According to the developer's website, construction of the Cleve Hill Solar Park was scheduled to commence in summer 2022. Consequently, there is no potential for the construction phase to coincide with the construction of the desalination plant. The Secretary of State's HRA for the Cleve Hill Solar Park concludes that the only pathway for effect during the operational phase is 'loss/change in habitats' for the breeding and non-breeding bird species and the overall assemblage of the SPA and Ramsar site, and this effect could be effectively mitigated, with no adverse effect on integrity predicted.

[2] https://infrastructure.planninginspectorate.gov.uk/projects/

- Kemsley Paper Mill (K4) Combined Heat and Power Plant (located on land within the boundary of the Kemsley Paper Mill, near Sittingbourne in Kent) – a DCO for the project was granted in July 2019. The Secretary of State's HRA concludes that the project is likely to have a significant effect on the Swale SPA and Ramsar site when considered alone and in-combination with other plans or projects and that appropriate assessment was required to determine if changes to water quality, increased levels of dust during construction and increased disturbance during construction will have an adverse effect on these sites.

  Based on the Secretary of State's HRA, it appears that the issues were largely related to the construction phase and could be effectively mitigated. Water quality effects were relevant to the construction and operational phases, but could be effectively mitigated through appropriate drainage, treatment, bunding of chemical storage and neutralising and treating process water. As a result, the HRA concludes that adverse effect on integrity of the sites can be excluded.

- Wheelabrator Kemsley Generating Station (K3) and Wheelabrator Kemsley North (WKN) Waste to Energy Facility (a power upgrade and increase in tonnage throughput to the existing Kemsley Generating Station and a new waste to energy facility, located adjacent to and immediately north-east of the Kemsley Paper Mill, in Kemsley, Sittingbourne, Kent) – a DCO was granted to Wheelabrator Kemsley K3 Generating Station only in February 2021. Wheelabrator Kemsley North Waste to Energy Facility was not granted development consent.

  The Secretary of State's HRA concludes that LSE cannot be excluded for the Swale SPA and Ramsar site. However, no LSE during construction was concluded for the K3 development, with all likely significant construction effects limited to the Waste to Energy Facility for which development consent was refused. The LSE during operation was limited to noise and visual disturbance and changes to water quality, and both effect pathways can be effectively mitigated, resulting in a conclusion of no adverse effect on integrity.

4.5.10 Given the nature, location, current status of the environmental information and/or conclusion of the Secretary of State's HRA relating to the major projects reviewed above, it can be concluded that there is either no realistic potential for in-combination effects with the proposed option, or the environmental assessment of the major projects is not sufficiently advanced to enable in-combination assessment to be undertaken.

4.6 Conclusion: The Swale SPA/Ramsar

4.6.1 In light of the predicted effect of this option both alone and in-combination with other plans and projects, it is considered that there is sufficient confidence that appropriate mitigation measures are available at the project level and can be implemented to enable a conclusion of no adverse effect on the integrity of The Swale SPA/Ramsar to be drawn for the WRMP HRA.

5. Assessment: Thames Estuary and Marshes SPA/Ramsar

5.1 Core Designation Information

5.1.1 The site comprises a complex of brackish, floodplain grazing marsh ditches, saline lagoons and intertidal saltmarsh and mudflat along the River Thames between Gravesend and Sheerness in Essex and Kent. The habitats support internationally important numbers of wintering waterfowl, and the saltmarsh and grazing marsh are of international importance for their diverse assemblages of wetland plants and invertebrates. The site performs important hydrological functions, including shoreline stabilisation, sediment trapping, flood water storage and desynchronization of flood peaks, and maintenance of water quality by removal of nutrients.

5.1.2 Table 5.1 provides links to the key documents and information relating to the designation. Specific information that may be relevant to the assessment of effects is noted as necessary, and in the assessment sections below (e.g., known areas of functional land identified in the SACO documentation).

Table 5.1 The Thames Estuary and Marshes SPA and Ramsar site-specific details

Aspect	Notes
Qualifying features	SPA: • A149 Dunlin *Calidris alpina* • A143 Red knot *Calidris canutus* • A137 Ringed plover *Charadrius hiaticula* • A082 Hen harrier *Circus cyaneus* • A156 Black-tailed godwit *Limosa islandica* • A141 Grey plover *Pluvialis squatarola* • A132 Avocet *Recurvirostra avosetta* • A162 Redshank *Tringa totanus* Ramsar: • Crit 2: Supports vulnerable, endangered or critically endangered species or threatened eco communities • Crit 5: Regularly supports 20,000 or more waterbirds • Crit 6: Regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
Conservation Objectives	Available at: Thames Estuary and Marshes SPA - UK9012021A (naturalengland.org.uk)
Site Improvement Plan	Available at: Site Improvement Plan: Greater Thames Complex - SIP134 (naturalengland.org.uk)
Supplementary advice	Available at: Thames Estuary and Marshes SPA - UK9012021A (naturalengland.org.uk)
Associated SSSIs	• Thames Estuary and Marshes SSSI

Aspect	Notes
Functional land	Waterbird assemblage, Non-breeding: Intertidal mud; Intertidal sand and muddy sand; Intertidal mixed sediment; Intertidal seagrass; Coastal reedbeds; Coastal lagoons; Freshwater and coastal grazing marsh; Saltmarsh.

Interest Feature Exposure

5.1.3 As the SPA and Ramsar is located approximately 1.85km north of the proposed option, there exists the potential for the waterbird qualifying features of the site to be found foraging within the vicinity of the construction and operational effects of the proposed option.

5.2 Mitigation Assumptions

Standard Measures / Best-practice

5.2.1 Appendix C identifies standard and established measures that are known to be available, achievable and likely to be effective in avoiding or mitigating potentially adverse effects on European sites and interest features. These are based on best- and case-practice from similar schemes, and so there can be high confidence in their deliverability and effectiveness. These measures would be applied unless project-level HRAs or project-specific environmental studies demonstrate that they are not required (i.e., the anticipated effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate.

Bespoke measures

5.2.2 Site- or feature-specific mitigation that may be required for specific atypical effects are identified in the assessment sections.

Interest Feature Exposure

5.2.3 As the SPA and Ramsar is located approximately 1.85km north of the proposed option, there exists the potential for the waterbird qualifying features of the site to be found foraging within the vicinity of the construction and operational effects of the proposed option. Exposure to environmental changes within the site boundary is likely to be limited, however.

5.3 Assessment – Construction

Loss of Functional Habitat (Offsite)

5.3.1 The site selected for the desalination plant and onward pipeline route is located near an area of open grassland which could be used for foraging or roosting by the over-wintering qualifying species of the SPA and Ramsar. Whilst this area may be subject to existing

anthropogenic disturbance due to its close proximity to residential and industrial uses, the use of this area may result in a loss of functionally associated off-site habitat, depending on the final specification for the plant and design details.

5.3.2 Breeding and non-breeding bird surveys will need to be completed to establish the use of this area by the site's qualifying features. However, it should be noted that the habitat is outside the SPA and Ramsar boundary and is a very small area in the context of the surrounding supporting habitat as a whole; unless it is used by significant aggregations of the qualifying species it is unlikely that the loss of this area would constitute an adverse effect. The effects can only be fully assessed with scheme-level surveys (which it would not be appropriate to undertake for several years given the lead time for the proposals; however, mitigation will be available for the loss of small areas of non-designated habitat such as this.

Water Quality

5.3.3 Due to the proposed intake/outfall being located within the river Medway, there is the potential for indirect effects of pollution such as excess sediment discharge and accidental oil spill. Best practice mitigation measures, summarised below and further detailed in Appendix C, will be followed during construction to ensure no adverse effects on the water quality of the SPA and Ramsar occur as a result of construction activities.

Mitigation

- Adherence to EA Pollution Prevention Guidelines (now archived) and NRW, SEPA's Guidance on Pollution Prevention including Works and Maintenance in or near Water (2017).
- No water should be discharged directly to the river network connecting to The Swale. A drainage strategy including treatment measures will need to be agreed with the relevant regulators (EA and NE). If the measures to removed silt and contaminations do not satisfy the EA and NE to allow discharge to a watercourse (likely to lead into The Swale) then an alternative discharge arrangement will need to be made (e.g., to sewer or tankered off site).

Disturbance

Desalination Plant

5.3.4 The proposed site for the desalination plant is located in an area of existing anthropogenic disturbance, with the towns of Sheerness (and associated docks), Queenborough and Minster on Sea being located in close proximity to the proposed site of works. As such, ambient noise and lighting levels in the area are already likely to be high, with strategic noise mapping indicating that existing baseline noise levels of 60-65 dB during the day and 55-50 dB at night (Extrium, 2022).

5.3.5 Best available evidence indicates that sudden, irregular, noise above c.70 dB(A) may present a flight response or anxiety behaviour in some estuarine bird species (Cutts,

Phelps and Burdon, 2009; Wright, Goodman and Cameron, 2013). While the precise construction methodology for the desalination plant is not yet available, there exists the potential for any nearby birds to be disturbed by any construction activities that produce noise above the existing baseline levels. As such, surveys will be required to determine the potential presence of qualifying bird species and confirm the need for any mitigation measures, such as hoardings, no working at dawn or dusk or to limit the use of onsite lighting.

Intake and Outfall

5.3.6 The intake/outfall location for the proposed option is located approximately 1.85km south of the Thames Estuary and Marshes SPA and Ramsar. This is outside the 1km range at which it is predicted that onshore works may disturb ornithological features (Ruddock and Whitfield, 2007). As such, no disturbance will occur to individuals within the site itself. However, individuals foraging outside of the site within the River Medway may still be subject to disturbance events.

5.3.7 While construction of a new intake and outfall is required for the new desalination plant, due to the proposed works location within the existing Sheerness Docks (a location of significant anthropogenic disturbance), it is unlikely that the zone potentially affected by construction works is important in supporting the qualifying features of the SPA/Ramsar. However, due to the proximity to the SPA and Ramsar this will need to be confirmed by surveys to determine the potential presence of qualifying bird species and confirm the need for any mitigation measures.

Pipeline

5.3.8 Due to the distance of the SPA and Ramsar from the onward pipeline route and availability of alternative foraging habitat in the wider surrounding area, the potential for disturbance of significant numbers of the qualifying features of this SPA and Ramsar is negligible.

Mitigation

- Conduct summer and winter bird surveys to determine if the land within 1km of the desalination plant and onward pipeline route is utilised by significant numbers of qualifying bird species (e.g., foraging, roosting).
- Produce working method for noise and visual stimuli and complete assessment to determine impacts and effectiveness of mitigation (e.g., hoarding, silencers, no working at dawn or dusk, limit use of onsite lighting). This should be completed with reference to the Waterbirds Disturbance Mitigation Toolkit (TIDE Tools, 2022) which details likely thresholds for noise and visual stimuli.

Contamination – dust and NOx

5.3.9 Due to the distance of the construction works from the SPA and Ramsar and lack of dust generating activities to be required for the proposed option, there is no potential for

contamination of the SPA and Ramsar from construction activities for the proposed option.

Invasive/Non-Native Species

5.3.10 The works may have the potential to spread invasive non-native species. The introduction of non-native species may affect prey species for the qualifying bird species through introduction of disease, predation or competition.

5.3.11 Habitat surveys in the terrestrial and marine environments should be conducted to indicate the presence of invasive species and any sensitive areas. Works, particularly in aquatic habitats should follow best practice biosecurity measures as standard (see Appendix C for further detail).

Mitigation

- Best practice biosecurity measures, as recommended by the GB Non-Native Species Secretariat (http://www.nonnativespecies.org/index.cfm?sectionid=58) would guard against any potential for spreading invasive species as a result of construction

5.4 Assessment – Operation

Saline discharge

5.4.1 The saline discharge to the River Medway may lead to a very minor increase in salinity in the vicinity of the outfall. Assessments of other desalination plants of a similar scale to the proposed option indicate that any increase in salinity would extend over a small area (up to 10m) (e.g., EDF, 2021). While this area of effect was predicted for a site located on an open coastline, it provides a reasonable proxy estimate for the potential zone of influence of increased salinity for the proposed option.

5.4.2 As a guide, modelling undertaken for a proposed desalination plant near Southampton Water indicated that the plume would be at 5% of ambient salinity within 250m from the outfall for a 75 Mld plant, and within 150m for a 15 Ml/d plant. The Medway estuary obviously has different characteristics to Southampton Water and the Solent, although the closest habitats of the Medway Estuary and Marshes SPA / Ramsar are approximately 600m from the indicative location of the outfall; and there are clearly opportunities to move the discharge point to the north of Sheppey (i.e. further into the Thames estuary) where dispersal will be more rapid and the designated sites and interest features (Outer Thames Estuary SPA) are relatively insensitive to the likely magnitude of change from brine discharges.

5.4.3 This area of increased salinity would represent a very small proportion of the total foraging range of the qualifying features of the SPA and Ramsar, and would not occur in habitats likely to be of high value for the qualifying features. While this figure was derived from a site located on an open coastline, it provides a reasonable estimate for the potential spread of increased salinity for the proposed option. No higher sensitivity habitats such as tidal flats or saltmarshes are located in the vicinity of the proposed outfall

location; however, dispersion modelling should be conducted to ensure that no areas of habitat further afield from the intake/outfall could be subject to increased salinity.

5.4.4 During operation, a number of chemicals will be required in the operational processes (e.g., biocides and anti-scalants). The settlement stage of the process will use an inlet storage tank to provide settlement of solids and to balance salinity. It is anticipated that any solids that are settled out (without treatment aid – see below) would be discharged in a controlled manner with the brine, ensuring that the suspended sediment load is not too high for the receiving waters. The pre-filtration stage will remove solids that are not settled in first stage, and it is anticipated that backwash water would be discharged with the brine. These discharges will encompass a very limited spatial extent, representing a very small proportion of the predicted foraging ranges for any of the qualifying features of the SPA or Ramsar, and as such there is limited chance for these features to be exposed directly to any contaminants.

5.4.5 Dispersion modelling would be carried out to take account of the final plant capacity. This would inform assessment of percentage increase in salinity and temperature against established baseline conditions and using agreed significance threshold.

5.4.6 In summary, the local changes in salinity are considered unlikely to affect the habitats of this site due to the distance and likely dispersal characteristics.

Mitigation

- Residual chemicals from treatment process to be neutralised before release with brine discharge.

Impingement and entrainment

5.4.7 The intake for the desalination plant could lead to impingement of organisms (organisms trapped on filter screens), entrainment (organisms drawn into the intake structure) and/or entrapment (organisms trapped within offshore intake pipeline structure). These impacts to marine biota could change the food availability, distribution and density in the area immediately around the intake and therefore impact the feeding patterns of the qualifying bird species.

5.4.8 Research from California suggests that a desalination plant of ~200Ml/d capacity will impinge approximately 1kg/day of marine biota (Water Reuse Association, 2011). Given the smaller scale of the proposed desalination plant on the Isle of Sheppey, this figure is likely to be reduced in the case of the proposed option.

5.4.9 Mitigation measures and use of best practice design, such as the use of a passive wedge-wire cylinder (PWWC) with an appropriate mesh size would be able to greatly minimise the impacts of impingement and entertainment. At the detailed design stage, consideration will be given to use of a surface or sub-surface intake, capped intake to reduce vertical flow, low velocities through the screens, sizing of the screens and deflection technologies.

Mitigation

- Incorporate best practice technologies for intake to minimise impingement and entrainment issues of prey features, such as PWWC with an appropriate mesh size.

Disturbance

5.4.10 The operation of the desalination plant may produce a long-term noise and visual disturbance impact on the qualifying bird species of the SPA and Ramsar.

5.4.11 The operational site is considered likely to produce low levels of constant noise as it processes water. In addition, operation of the site will require human presence, but likely to be at low levels.

5.4.12 The majority of the plant will be housed in units and, therefore, operational noise is unlikely to be an issue as impulse noise will not generally occur. It is anticipated that qualifying features of the site would become accustomed to such noise sources over time and no significant disturbance is envisaged.

Mitigation

- Screening of the plant with a landscape bund or additional planting should be considered as part of the detailed design if appropriate. Lighting of the site could increase the displacement of the bird species and will therefore need to be positioned to avoid light spill on any potential adjacent habitats. An operational noise assessment should be completed to ensure the plant does not impact the bird species, and where necessary additional measures incorporated (e.g., specific sets of louvres that reduce noise).

5.5 In combination effects

Other WRMP options

5.5.1 The potential for these European sites to be affected by two or more WRMP options (either options within the SWS rdWRMP, or options in the rdWRMPs of neighbouring water companies) is set out in Appendix F and Appendix G.

5.5.2 In summary the principal in combination risk relates to effects with:

- Desalination: River Thames estuary.

5.5.3 Environmental changes associated with the operation of this option and the Desalination: River Thames estuary option are expected to be highly localised. Although there are residual uncertainties that cannot be fully assessed at the WRMP level with the available data, it is considered that mitigation options are available that can reliably be applied through scheme detailed design (e.g., location of outfalls) and coincident additive effects would not be anticipated.

Other Water Company Plans

Drought Plans

5.5.4 The Drought Plan will be revised several times before this WRMP option is implemented, and following option delivery, and so a meaningful in combination assessment arguably cannot be undertaken at this point. Furthermore, a future Drought Plan will necessarily reflect the abstraction baseline at that point (i.e., it will account for options implemented at that point in time) and be subject to HRA when revised, which provides a mechanism to ensure that in combination effects do not occur.

5.5.5 No drought options identified in SW's revised draft Drought Plan 2022[3], or the plans of neighbouring water companies, will affect these sites based on the HRA of the Drought Plan.

Drainage and Wastewater Management Plans

5.5.6 The interaction of the WRMP options with specific schemes derived from the emerging Drainage and Wastewater Management Plan (DWMP) can only be assessed at the project level due to the generic nature of the DWMP options.

Minor projects

5.5.7 It has not been possible to produce a definitive list of existing (minor) planning applications near this option's zone of influence and generating a list at this stage would be of little value given the lead times for the option. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the ACWG guidance on cumulative/in combination assessments.

Minor projects

5.5.8 It has not been possible to produce a definitive list of existing (minor) planning applications near this option's zone of influence and generating a list at this stage would be of little value given the lead times for the option. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the ACWG guidance on cumulative/in combination assessments.

Major Projects

5.5.9 A review of that status of major projects that are located within or in close proximity to this European site has been undertaken to assess the potential for in-combination effect with this option. The following summarises the findings of this review:

[3] Southern Water (2021). Draft Drought Plan 2022 Main report. 31 March 2021, Version 1.0.

- Lower Thames Crossing (a new road crossing connecting Kent, Thurrock and Essex)- a DCO for the project was granted in March 2025. The Secretary of State's HRA concludes the absence of adverse effects upon the integrity of the Thames Estuary and Marshes SPA and Ramsar subject to implementation of proposed mitigation measures.
- Kemsley Paper Mill (K4) Combined Heat and Power Plant (located on land within the boundary of the Kemsley Paper Mill, near Sittingbourne in Kent) – a DCO for the project was granted in July 2019. The Secretary of State's HRA concludes that there would be no LSE on the Thames Estuary and Marshes SPA and Ramsar site (the only potential pathway for effect on the SPA and Ramsar site appeared to be emissions to air, and it was concluded that relevant thresholds would either not be exceeded).
- Wheelabrator Kemsley Generating Station (K3) and Wheelabrator Kemsley North (WKN) Waste to Energy Facility (a power upgrade and increase in tonnage throughput to the existing Kemsley Generating Station and a new waste to energy facility, located adjacent to and immediately north-east of the Kemsley Paper Mill, in Kemsley, Sittingbourne, Kent) – a DCO was granted to Wheelabrator Kemsley K3 Generating Station only in February 2021. Wheelabrator Kemsley North Waste to Energy Facility was not granted development consent. The Secretary of State's HRA concludes that there would be no LSE on the Thames Estuary and Marshes SPA and Ramsar site.

5.5.10 Given the nature, location, current status of the environmental information and/or conclusion of the Secretary of State's HRA relating to the major projects reviewed above, it can be concluded that there is either no realistic potential for in-combination effects with the proposed option, or the environmental assessment of the major projects is not sufficiently advanced to enable in-combination assessment to be undertaken.

5.6 Conclusion: Thames Estuary and Marshes SPA/Ramsar

5.6.1 In light of the predicted effect of this option both alone and in-combination with other plans and projects, it is considered that there is sufficient confidence that appropriate mitigation measures are available at the project level and can be implemented to enable a conclusion of no adverse effect on the integrity of the Thames Estuary and Marshes SPA/Ramsar to be drawn for the HRA of the WRMP.

6. Assessment: Outer Thames Estuary SPA

6.1 Core Designation Information

6.1.1 The Outer Thames Estuary SPA consists of areas of shallow and deeper water, high tidal current streams and a range of mobile sediments. Large areas of mud, silt and gravelly sediments form the deeper water channels, the main ones of which form the approach route to the ports of London and as such are continually disturbed by shipping and maintenance dredging. Sand in the form of sandbanks separated by troughs predominates in the remaining areas and the crests of some of the banks are exposed at mean low water.

6.1.2 The core information relating to the designation (i.e., qualifying features, conservation objectives, supplementary advice documents, information on typical species, supporting habitats and known functional land) is available online and so not replicated here in detail, to minimise repetition and over-simplification of freely available data.

6.1.3 Table 6.1 provides links to the key documents and information relating to the designation. Specific information that may be relevant to the assessment of effects is noted as necessary, and in the assessment sections below (e.g., known areas of functional land identified in the SACO documentation).

Table 6.1 Designation information for the Outer Thames Estuary SPA

Aspect	Notes
Qualifying features	• Red-throated diver, *Gavia stellata* • Common tern, *Sterna hirundo* • Little tern, *Sternula albifrons*
Conservation Objectives	Available at: ThamesSPAConsObsVersion3 7 Mar2013FINAL.pdf
Site Improvement Plan	Available at: Site Improvement Plan: Outer Thames Estuary - SIP238 (naturalengland.org.uk)
Supplementary advice	Available at: Thames-brief_tcm6-21728.pdf
Associated SSSIs	• N/A
Functional land	Subtidal sand; Subtidal coarse sediment; Subtidal mixed sediments; Subtidal mud; Circalittoral rock; Water column; Shallow subtidal waters; Sandbanks

Interest Feature Exposure

6.1.4 The red-throated diver population within the Outer Thames Estuary SPA is typically found foraging within the sandbanks of the site, as they provide suitable hunting depths and support many of the prey species and their nursery grounds (Natural England, 2022b). As such, these areas are located over 10km from the areas of construction for the proposed option, and as the species mean-max foraging range red-throated diver is approximately 9km, the species will not be exposed to construction or operational effects of the proposed option.

6.1.5 With regard to little tern and common tern, both species are known to breed on the sandbanks associated with the coastal sites around the SPA (Natural England, 2022b), including at Foulness. Impacts on the habitats of the Outer Thames Estuary SPA itself are likely to be minimal (due to distance and attenuation), and although common tern has a mean-max foraging range of 26.9km (and so could interact with the construction and/or operational effects of the proposed option depending on the precise location of the breeding colony) it should be recognised that the Outer Thames Estuary SPA is essentially designated as foraging habitat for these species (i.e. if the area directly affected by the desalination works were functionally critical for tern species associated with nearby breeding colonies, then the Outer Thames Estuary would likely extend to cover it).

However, there is a small risk of tern species being affected whilst using designated and non-designated habitats close to the outfall / intake or desalination plant itself. The mean-max foraging range of little tern is only 5km, and thus all known colonies dependent on the Outer Thames Estuary SPA will be outside the range for this species to be exposed to environmental changes.

6.2 Mitigation Assumptions

Standard Measures / Best-practice

6.2.1 Appendix C identifies standard and established measures that are known to be available, achievable and likely to be effective in avoiding or mitigating potentially adverse effects on European sites and interest features. These are based on best- and case-practice from similar schemes, and so there can be high confidence in their deliverability and effectiveness. These measures would be applied unless project-level HRAs or project-specific environmental studies demonstrate that they are not required (i.e., the anticipated effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate.

Bespoke measures

6.2.2 Site- or feature-specific mitigation that may be required for specific atypical effects are identified in the assessment sections.

6.3 Assessment – Construction

Impacts on Functional Habitat

6.3.1 Common tern feed primarily in shallow coastal or estuarine waters (Eglington and Perrow, 2014). As such, there will be no significant loss of functional offsite habitat for common tern from the SPA from construction of the desalination plant.

6.3.2 While a small area of habitat will be lost due to the construction of the intake/outfall pipeline into the River Medway, this area is inconsequential in comparison to the wide surrounding area available to the species for feeding purposes. It is extremely unlikely that that area affected by the scheme will be functionally critical to birds associated with this SPA; and even if this were the case, mitigation would be achievable.

Water Quality

6.3.3 Due to the proposed intake/outfall being located within the River Medway, and the SPA being downstream of the intake/outfall, there is the potential for indirect effects of pollution such as excess sediment discharge and accidental oil spill. Best practice mitigation measures, summarised below and further detailed in Appendix C, will be followed during construction to ensure no adverse effects on the water quality of the SPA occur as a result of construction activities.

Mitigation

- Adherence to EA Pollution Prevention Guidelines (now archived) and NRW, SEPA's Guidance on Pollution Prevention including Works and Maintenance in or near Water (2017).
- No water should be discharged directly to the river network connecting to The Swale. A drainage strategy including treatment measures will need to be agreed with the relevant regulators (EA and NE). If the measures to removed silt and contaminations do not satisfy the EA and NE to allow discharge to a watercourse (likely to lead into The Swale) then an alternative discharge arrangement will need to be made (e.g., to sewer or tankered off site).

Disturbance

Desalination Plant

6.3.4 The proposed site for the desalination plant is located in an area of existing anthropogenic disturbance, with the towns of Sheerness (and associated docks), Queenborough and Minster on Sea being located in close proximity to the proposed site of works. Given the inland location of the desalination plant, the qualifying features of the SPA are highly unlikely to be exposed to construction phase disturbance effects.

Intake and Outfall

6.3.5 The intake/outfall location for the proposed option is located approximately 4.35km south (around the coast) of the Outer Thames Estuary SPA. This is outside the 1km range at which it is predicted that onshore works may disturb ornithological features (Ruddock and Whitfield, 2007). As such, no disturbance will occur to individuals within the site itself. However, individuals foraging outside of the site within the River Medway may still be subject to disturbance events.

6.3.6 As noted, although common tern has a mean-max foraging range of 26.9km (and so could interact with the construction and/or operational effects of the proposed option depending on the precise location of the breeding colony) it should be recognised that the Outer Thames Estuary SPA is essentially designated as foraging habitat for these species (i.e. if the area directly affected by the desalination works were functionally critical for tern species associated with nearby breeding colonies, then the Outer Thames Estuary would likely extend to cover it). However, there is a small risk of tern species being affected whilst using designated and non-designated habitats close to the outfall / intake or desalination plant itself, although this can clearly be avoided / mitigated using established measures.

Pipeline

6.3.7 Due to the qualifying features of the SPA not being species that rely on terrestrial habitats for foraging, there is no realistic potential for any disturbance of SPA qualifying features during pipeline construction.

Mitigation

- Conduct summer and winter bird surveys to determine if the land within 1km of the desalination plant and onward pipeline route is utilised by significant numbers of foraging bird species.
- Produce working method for noise and visual stimuli and complete assessment to determine impacts and effectiveness of mitigation (e.g., hoarding, silencers, no working at dawn or dusk, limit use of onsite lighting). This should be completed with reference to the Waterbirds Disturbance Mitigation Toolkit (TIDE Tools, 2022) which details likely thresholds for noise and visual stimuli.

Contamination – dust and NOx

6.3.8 Due to the distance of the construction works from the SPA and lack of dust generating activities to be required for the proposed option, there is no potential for contamination of the SPA from construction activities for the proposed option.

Invasive/Non-Native Species

6.3.9 The works may have the potential to spread invasive non-native species. The introduction of non-native species may affect prey species for the qualifying bird species through introduction of disease, predation or competition.

6.3.10 Habitat surveys in the terrestrial and marine environments should be conducted to indicate the presence of invasive species and any sensitive areas. Works, particularly in aquatic habitats should follow best practice biosecurity measures as standard (see Appendix C for further detail).

Mitigation

- Best practice biosecurity measures, as recommended by the GB Non-Native Species Secretariat (http://www.nonnativespecies.org/index.cfm?sectionid=58) would guard against any potential for spreading invasive species as a result of construction.

6.4 Assessment – Operation

Saline discharge

6.4.1 The saline discharge to the River Medway may lead to a very minor increase in salinity in the in the vicinity of the outfall.

6.4.2 Assessments of other desalination plants of a similar scale to the proposed option indicate that any increase in salinity would extend over a small area (up to 10m) (e.g., EDF, 2021). While this area of effect was predicted for a site located on an open coastline, it provides a reasonable proxy estimate for the potential zone of influence of increased salinity for the proposed option.

6.4.3 This area of increased salinity would represent a very small proportion of the mean-max foraging range of common tern from colonies associated with the Outer Thames Estuary SPA; and, as noted, it is unlikely that the area affected will be functionally critical to tern species from local colonies (or the Outer Thames Estuary SPA would arguably have been extended to cover these areas). No higher sensitivity habitats such as tidal flats or saltmarshes are located in the vicinity of the proposed outfall location; however, dispersion modelling should be conducted to ensure that no areas of habitat further afield from the intake/outfall could be subject to increased salinity.

6.4.4 During operation, a number of chemicals will be required in the operational processes (e.g., biocides and anti-scalants). The settlement stage of the process will use an inlet storage tank to provide settlement of solids and to balance salinity. It is anticipated that any solids that are settled out (without treatment aid – see below) would be discharged in a controlled manner with the brine, ensuring that the suspended sediment load is not too high for the receiving waters. The pre-filtration stage will remove solids that are not settled in first stage, and it is anticipated that backwash water would be discharged with the brine. These discharges will encompass a very limited spatial extent, representing a very small proportion of the predicted foraging ranges for any of the qualifying features of the SPA, and as such there is limited chance for these features to be exposed directly to any contaminants.

6.4.5 Dispersion modelling would be carried out to take account of the final plant capacity. This would inform assessment of percentage increase in salinity and temperature against established baseline conditions and using agreed significance threshold.

Mitigation

- Residual chemicals from treatment process to be neutralised before release with brine discharge.

Impingement and entrainment

6.4.6 The intake for the desalination plant could lead to impingement of organisms (organisms trapped on filter screens), entrainment (organisms drawn into the intake structure) and/or entrapment (organisms trapped within offshore intake pipeline structure). These impacts to marine biota could change the food availability, distribution and density in the area immediately around the intake and therefore impact the feeding patterns of the qualifying bird species.

6.4.7 Research from California suggests that a desalination plant of ~200Ml/d capacity will impinge approximately 1kg/day of marine biota (Water Reuse Association, 2011). Given the smaller scale of the proposed desalination plant on the Isle of Sheppey, this figure is likely to be reduced in the case of the proposed option.

6.4.8 Mitigation measures and use of best practice design, such as the use of a PWWC with an appropriate mesh size would be able to greatly minimise the impacts of impingement and entertainment. At the detailed design stage, consideration will be given to use of a surface

or sub-surface intake, capped intake to reduce vertical flow, low velocities through the screens, sizing of the screens and deflection technologies.

Mitigation

- Incorporate best practice technologies for intake to minimise impingement and entrainment issues of prey features, such as PWWC with an appropriate mesh size.

Disturbance

6.4.9 The qualifying species of this site will not be exposed to disturbance effects from operation that cannot be mitigated / avoided through design.

Mitigation

6.4.10 Screening of the plant with a landscape bund or additional planting should be considered as part of the detailed design if appropriate. Lighting of the site could increase the displacement of the bird species and will therefore need to be positioned to avoid light spill on any potential adjacent habitats. An operational noise assessment should be completed to ensure the plant does not impact the bird species, and where necessary additional measures incorporated (e.g., specific sets of louvres that reduce noise).

6.5 In combination effects

Other WRMP options

6.5.1 The potential for these European sites to be affected by two or more WRMP options (either options within the SWS rdWRMP, or options in the rdWRMPs of neighbouring water companies) is set out in Appendix F and Appendix G.

6.5.2 In summary the principal in combination risk relates to effects with:

- Desalination: East Thanet coast & transfer to Manston1 WSR.
- Reculver Desalination (SEW)

6.5.3 Environmental changes associated with the operation of this option and the Desalination: East Thanet coast & transfer to Manston1 WSR option are expected to be highly localised. Although there are residual uncertainties that cannot be fully assessed at the WRMP level with the available data, it is considered that mitigation options are available that can reliably be applied through scheme detailed design (e.g. location of outfalls) to ensure that spatially coincident (hence additive etc.) in combination effects do not occur; disparate in combination effects (i.e. ‘alone’ effects on different parts of the site that together affect site integrity, particularly in relation to the use of different parts of the site by qualifying mobile features) are conceivable, but unlikely given the magnitude of the expected effects alone.

Other Water Company Plans

Drought Plans

6.5.4 The Drought Plan will be revised several times before this WRMP option is implemented, and following option delivery, and so a meaningful in combination assessment arguably cannot be undertaken at this point. Furthermore, a future Drought Plan will necessarily reflect the abstraction baseline at that point (i.e., it will account for options implemented at that point in time) and be subject to HRA when revised, which provides a mechanism to ensure that in combination effects do not occur.

6.5.5 No drought options identified in SW's revised draft Drought Plan 2022[4], or the plans of neighbouring water companies, will affect these sites based on the HRA of the Drought Plan.

Drainage and Wastewater Management Plans

6.5.6 The interaction of the WRMP options with specific schemes derived from the emerging Drainage and Wastewater Management Plan (DWMP) can only be assessed at the project level due to the generic nature of the DWMP options.

Minor projects

6.5.7 It has not been possible to produce a definitive list of existing (minor) planning applications near this option's zone of influence and generating a list at this stage would be of little value given the lead times for the option. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the ACWG guidance on cumulative/in combination assessments.

Major projects

6.5.8 Reference has been made to the Planning Inspectorate's National Infrastructure Projects website[5] which includes major projects.

6.5.9 A review of that status of major projects that are located within or in close proximity to this European site has been undertaken to assess the potential for in-combination effect with this option. It should be noted that the Outer Thames Estuary SPA comprises two separate areas; the review of major projects has focussed on those within or in close proximity to the southern portion of the SPA given this is the part of the SPA within which the option is located. The following summarises the findings of this review:

- Cleve Hill Solar Park (approximately 2 km north-east of Faversham and 5 km west of Whitstable on the North Kent Coast) – the DCO was granted in May 2020. The Secretary of State's HRA does not make reference to the Outer Thames Estuary SPA

[4] Southern Water (2021). Draft Drought Plan 2022 Main report. 31 March 2021, Version 1.0.

[5] https://infrastructure.planninginspectorate.gov.uk/projects/

and, therefore, it can be concluded that this European site is not affected by this proposed scheme.

- Extension to Kentish Flats Wind Farm (located west and south of the first Kentish Flats Wind Farm) – the DCO was granted in February 2013 and the project was constructed in 2015. Given this is a completed project, it is not relevant to an assessment of in-combination effect.
- Thanet Extension Offshore Wind Farm (located approximately 8km off the east coast of Kent) - the Secretary of State refused development consent in June 2020 and, therefore, this project is not relevant to an assessment of in-combination effect.
- Galloper Offshore Wind Farm (located approximately 27km off the coast of Suffolk) – the DCO was granted in May 2013 and the project is now constructed. Given this is a completed project, it is not relevant to an assessment of in-combination effect.
- Sea Link (a converter station within 5km of the proposed Friston substation, HVAC underground cables between the substation a converter station and the coast, an offshore HVDC cable between Suffolk and Kent, a new converter station within 5km of the existing Richborough substation with HVDC underground cables between the converter station and the coast at Pegwell Bay) - the application was submitted 27th March 2025. The information to inform HRA concludes that the project can be managed without an adverse effect either alone, or in-combination, upon the integrity of relevant Habitat sites.
- North Falls Offshore Wind Farm (approximately 24.5km from its nearest point at the Port of Lowestoft) - the application is currently at examination. Supporting assessment documents[6] without prejudice, set out the case for derogation relevant to the Alde Ore Estuary SPA, Flamborough and Filey Coast SPA and the Outer Thames Estuary SPA. The indicative export cable corridor passes through the Outer Thames Estuary SPA, but this is located approximately 50km to the north of the location of the intake / discharge for the new desalination plant.

6.5.10 Given the nature, location and/or current status of the environmental information relating to the major projects reviewed above, it can be concluded that there is either no realistic potential for in-combination effects with the proposed option, or the environmental assessment of the major projects is not sufficiently advanced to enable in-combination assessment to be undertaken.

6.5.11 It is known that there are other major projects that are located further north, within or in close proximity to the northern area of the Outer Thames Estuary SPA (e.g., the Sizewell C new nuclear build project). However, because the option is located approximately 66km to the south of the closest point of the northern area of this SPA, it is concluded that there is no realistic potential for in-combination effect between the option and major projects that could potentially affect the northern area of the Outer Thames Estuary SPA.

[6] https://national-infrastructure-consenting.planninginspectorate.gov.uk/projects/EN010119

6.6 Conclusion: Outer Thames Estuary SPA

6.6.1 In light of the predicted effect of this option both alone and in-combination with other plans and projects, it is considered that there is sufficient confidence that appropriate mitigation measures are available and can be implemented at the project level to enable a conclusion of no adverse effect on the integrity of the Outer Thames Estuary SPA to be drawn for the WRMP HRA in relation to this option.

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Appendix E8: Appropriate Assessment: Desalination (KMW): Thames Estuary

1. Option Summary

1.1 Overview and European site context

1.1.1 This option proposes the phased development of two 20 Ml/d desalination plants adjacent to Britannia Refined Metal on the Swanscombe Peninsula, which would combine discharge with Swanscombe WwTW's existing outfall. Treated water would be transferred to Singlewell WSR for distribution to the Kent Medway WRZ.

1.1.2 This option would require:

- Construction of a reverse osmosis desalination plant and buildings including pre- and post-treatment facilities and delivery and storage facilities for chemicals and consumables.
- A new abstraction point.
- Connections to Swanscombe WwTW existing outfall pipe and potential modifications Hyper-saline effluent discharges.
- Mains connection (up to 8 km) to Singlewell WSR.
- Screened intake and pumping station on the coast and a pipeline to the works inlet.

1.1.3 The site is within 3.8km of the Thames Estuary and Marshes Ramsar and 5.2km of the Thames Estuary and Marshes SPA.

1.1.4 The scheme would initially be required by 2040.

1.2 Environmental changes and option assumptions / uncertainties

Potential construction-related environmental changes

1.2.1 The proposed site of the desalination plant and associated intake and outfall and pipeline is close to two European sites.

1.2.2 Construction activities have the potential to result in the following impacts:

- Loss of functional offsite habitat – use of undeveloped land adjacent to the proposed desalination plant and along the pipeline route which could support qualifying features;
- Physical damage – e.g., tidal flats/salt marshes – damage to existing tidal flat/salt habitat within European sites that is utilised by qualifying features for foraging;
- Water quality – issues with accidental oil spills and pollution incidents when working at the main site of the desalination plant on the intake and outfalls. In addition, there is potential for increases in turbidity in adjacent waterbodies from sediment laden runoff and seabed scour during outfall construction;
- Disturbance – qualifying features could be disturbed and displaced by noise, vibration and visual (including light pollution);
- Contamination – smothering of habitats that support the qualifying features through dust generation, and increase nutrient nitrogen loading of supporting habitats through HGV/plant and vehicle movements; and
- Introduction of Invasive/Non-Native Species (INNS).

Potential operation-related environmental changes

1.2.3 'Generic' environmental risks typically associated with new infrastructure may be realised (e.g., additional noise or lighting) although these cannot be reliably scoped or assessed at the plan-level as they are entirely dependent on the detailed design. However, the operational plant required is not inherently high-impact in this regard, and potentially notable environmental changes can almost certainly be avoided through scheme-design.

1.2.4 The principal environmental changes from operation will therefore relate to:

- the discharge of wastewater from the RO process via the existing WwTW outfall;
- the entrainment of marine species (i.e., prey items) at the intake; and
- the presence of a new desalination plant on the Swanscombe peninsula and any potential increases in disturbance relating to its operation.

1.2.5 Assessments of other desalination plants of a similar scale to the proposed option indicate that any increase in salinity would extend over a small area (up to 10m) (EDF, 2021). This area of effect was predicted for a site located on an open coastline, however, rather than an enclosed tidal estuary. Many other studies have demonstrated that near-field dilution of brine to ambient levels typically occurs within a relatively short distance (tens or hundreds of metres rather than kilometres), and that impacts to benthic communities from concentrate discharges can be reliably minimised by using properly designed diffuser systems.

1.2.6 Research from California suggests that a desalination plant of ~200Ml/d capacity will impinge approximately 1kg/day of marine biota (Water Reuse Association, 2011). Given the smaller scale of the proposed desalination plant proposed as part of this option, this figure is likely to be less for the proposed option.

Assumptions and uncertainties

1.2.7 Option-specific wastewater dispersion modelling cannot be conducted without detailed designs. As such, modelling from previous desalination plants of a similar scale to the proposed option has been used to provide an approximate zone of influence for any wastewater discharge.

2. Screening Summary

2.1.1 The screening assessment is outlined in Table 2.1. In summary, significant effects cannot be self-evidently excluded for the following sites:

Table 2.1: Potential construction and operational effects on European sites

Site	Location (km)*	LSE?		Rationale
		Cons	Oper	
Thames Estuary and Marshes Ramsar	3.8/DS	U*	U	Construction: This site is a down-estuary receptor; construction effects on site habitats likely to be limited but mobile features may be vulnerable to disturbance etc. Operation: Operation will discharge hypersaline brine upstream of this site, and although the distance and dilution provided by the estuary is likely to limit effects (noting that many studies have demonstrated that near-field dilution of brine to ambient levels typically occurs within a relatively short distance (tens or hundreds of metres rather than kilometres)), this may need additional contextual information or plume investigations to confirm this.
Thames Estuary and Marshes SPA	5.2/DS	U*	U	Construction: This site is a down-estuary receptor; construction effects on site habitats likely to be limited but mobile features may be vulnerable to disturbance etc. Operation: Operation will discharge hypersaline brine upstream of this site, and although the distance and dilution provided by the estuary is likely to limit effects (noting that many studies have demonstrated that near-field dilution of brine to ambient levels typically occurs within a relatively short distance (tens or hundreds of metres rather than kilometres)), this may need additional contextual information or plume investigations to confirm this.

2.1.2 Some of the potential effects noted above will be clearly avoidable with established measures, which are accounted for at the appropriate assessment stage in accordance with People over Wind.

3. Assessment: Thames Estuary and Marshes SPA/Ramsar

3.1 Core Designation Information

3.1.1 The site comprises a complex of brackish, floodplain grazing marsh ditches, saline lagoons and intertidal saltmarsh and mudflat along the River Thames between Gravesend and Sheerness in Essex and Kent. The habitats support internationally important numbers of wintering waterfowl, and the saltmarsh and grazing marsh are of international importance for their diverse assemblages of wetland plants and invertebrates. The site performs important hydrological functions, including shoreline stabilisation, sediment trapping, flood water storage and desynchronization of flood peaks, and maintenance of water quality by removal of nutrients.

3.1.2 Table 4.1 provides links to the key documents and information relating to the designation. Specific information that may be relevant to the assessment of effects is noted as necessary, and in the assessment sections below (e.g., known areas of functional land identified in the SACO documentation).

Table 4.1 Designation information for the Thames Estuary and Marshes SPA/Ramsar

Aspect	Notes
Qualifying features	SPA: • A672w: Dunlin *Calidris alpina* • A143w: Red knot *Calidris canutus* • A082w: Hen harrier *Circus cyaneus* • A616w: Black-tailed godwit *Limosa islandica* • A141w: Grey plover *Pluvialis squatarola* • A132w: Pied avocet *Recurvirostra avosetta* • A137c: Ringed plover *Charadrius hiaticula* • A162w: Common redshank *Tringa totanus* • WATR: Waterbird assemblage Ramsar: • Crit 2: Supports vulnerable, endangered or critically endangered species or threatened eco communities • Crit 5: Regularly supports 20,000 or more waterbirds • Crit 6: Regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
Conservation Objectives	Available at: Thames Estuary and Marshes SPA - UK9012021A (naturalengland.org.uk)
Site Improvement Plan	Available at: Site Improvement Plan: Greater Thames Complex - SIP134 (naturalengland.org.uk)
Supplementary advice	Available at: http://publications.naturalengland.org.uk/publication/4698344811134976?category=6581547796791296

Aspect	Notes
Associated SSSIs	• Thames Estuary and Marshes SSSI
Functional land	Waterbird assemblage, Non-breeding: Intertidal mud; Intertidal sand and muddy sand; Intertidal mixed sediment; Intertidal seagrass; Coastal reedbeds; Coastal lagoons; Freshwater and coastal grazing marsh; Saltmarsh.

3.2 Mitigation Assumptions

Standard Measures / Best-practice

3.2.1 Appendix C identifies standard and established measures that are known to be available, achievable and likely to be effective in avoiding or mitigating potentially adverse effects on European sites and interest features. These are based on best- and case-practice from similar schemes, and so there can be high confidence in their deliverability and effectiveness. These measures would be applied unless project-level HRAs or project-specific environmental studies demonstrate that they are not required (i.e., the anticipated effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate.

Bespoke measures

3.2.2 Site- or feature-specific mitigation that may be required for specific atypical effects are identified in the assessment sections.

3.3 Interest Feature Exposure

3.3.1 As the SPA and Ramsar are located approximately 5km and 4km respectively east and downstream of the proposed option, there exists the potential for the waterbird qualifying features of the sites to forage / roost etc. within the zone of influence of the construction and operational effects of the proposed option. It is also possible that areas of the sites may be exposed to environmental changes associated with brine (etc.) discharges depending on dispersion (which cannot be modelled at this stage). However, the qualifying features of the sites will not be directly impacted when within the SPA/Ramsar boundaries (e.g., through disturbance) due to the separation distance.

3.4 Assessment – Construction

Impacts on birds using functional habitat

3.4.1 The site selected for the desalination plant is located near an area of open grassland and the Swanscombe Marshes SSSI, which could be used for foraging or roosting purposes by the over-wintering qualifying species of the SPA and Ramsar. While this area may be subject to existing anthropogenic disturbance due to its close proximity to residential and industrial uses, it is possible that these areas may be used by birds associated with the SPA

(e.g., for foraging or roosting). There may therefore be effects through permanent loss of functional habitat (due to the desalination plant), temporary impacts on such habitat, or disturbance of birds using this.

3.4.2 Breeding and non-breeding bird surveys will need to be completed to establish the use of this area by the site's qualifying features. However, it should be noted that the habitat is outside the SPA and Ramsar boundary and a very small area in the context of the surrounding supporting habitat as a whole, and so no effects that cannot be avoided or mitigated at the project level would be expected.

Mitigation

- Conduct summer and winter bird surveys to determine if the land within 1km of the desalination plant and onward pipeline route is utilised by significant numbers of foraging bird species.
- Produce working method for noise and visual stimuli and complete assessment to determine impacts and effectiveness of mitigation (e.g., hoarding, silencers, no working at dawn or dusk, limit use of onsite lighting). This should be completed with reference to the Waterbirds Disturbance Mitigation Toolkit (TIDE Tools, 2022) which details likely thresholds for noise and visual stimuli.

3.4.3

Water quality

3.4.4 Due to the proposed intake and outfall being located within the River Thames and upstream of the SPA and Ramsar, there is the potential for indirect effects of pollution such as excess sediment discharge and accidental oil spill. Best practice mitigation measures, summarised below and further detailed in Appendix C, will be followed during construction to ensure no adverse effects on the water quality of the SPA and Ramsar occur as a result of construction activities.

Mitigation

- Adherence to EA Pollution Prevention Guidelines (now archived) and NRW, SEPA's Guidance on Pollution Prevention including Works and Maintenance in or near Water (2017).
- No water should be discharged directly to the river network connecting to the River Thames. A drainage strategy including treatment measures will need to be agreed with the relevant regulators (EA and NE). If the measures to removed silt and contaminations do not satisfy the EA and NE to allow discharge to a watercourse (likely to lead into the River Thames) then an alternative discharge arrangement will need to be made (e.g., to sewer or tankered off site).

Contamination

3.4.5 Due to the distance of the construction works from the SPA and Ramsar and lack of dust generating activities to be required for the proposed option, there is no potential for contamination of the SPA and Ramsar from construction activities for the proposed option.

Invasive/Non-Native Species

3.4.6 The works may have the potential to spread INNS. The introduction of INNS may affect prey species for the qualifying bird species through introduction of disease, predation or competition.

3.4.7 Habitat surveys in the terrestrial and marine environments should be conducted to indicate the presence of invasive species and any sensitive areas. Works, particularly in aquatic habitats should follow best practice biosecurity measures as standard (see Appendix C for further detail).

Mitigation

- Best practice biosecurity measures, as recommended by the GB Non-Native Species Secretariat (http://www.nonnativespecies.org/index.cfm?sectionid=58) would guard against any potential for spreading invasive species as a result of construction

3.5 Assessment – Operation

Saline / Process discharge

3.5.1 The saline discharge to the River Thames may lead to a minor increase in salinity in the vicinity of the intake and outfall. There is some uncertainty over the extent of any salinity changes and the behaviour of plumes within the somewhat confined estuary, although evidence from Beckton would suggest that changes in salinity will not necessarily lead to material impacts on biological elements given the hydrographic regime and ambient salinity of this part of the Thames estuary. Assessments of other desalination plants of a similar scale to the proposed option indicate that any increase in salinity would extend over a small area (EDF, 2021), although this this area of effect was predicted for a site located on an open coastline.

3.5.2 It is unlikely that potentially notable changes in salinity would be experienced within the tidal waters at the boundary of the SPA/Ramsar, although dispersion models will be required to confirm this. Note that the areas of the Thames Estuary close to the WwTW outfall (which will be used for discharges) are unlikely to provide potentially notable areas of functionally associated habitat, and so the exposure of the bird interest features in this location will be low.

3.5.3 During operation, a number of chemicals will be required in the operational processes (e.g., biocides and anti-scalants). The settlement stage of the process will use an inlet storage tank to provide settlement of solids and to balance salinity. It is anticipated that

any solids that are settled out (without treatment aid – see below) would be discharged in a controlled manner with the brine, ensuring that the suspended sediment load is not too high for the receiving waters. The pre-filtration stage will remove solids that are not settled in first stage, and it is anticipated that backwash water would be discharged with the brine. These discharges will encompass a very limited spatial extent, representing a very small proportion of the predicted foraging ranges for any of the qualifying features of the SPA or Ramsar, and as such there is limited chance for these features to be exposed directly to any contaminants.

Intake / Entrainment

3.5.4 The intake for the desalination plant could lead to impingement of organisms (organisms trapped on filter screens), entrainment (organisms drawn into the intake structure) and/or entrapment (organisms trapped within offshore intake pipeline structure). These impacts to marine biota could change the food availability, distribution and density in the area immediately around the intake and therefore impact the feeding patterns of the qualifying bird species, if they utilise this area.

3.5.5 Research from California suggests that a desalination plant of ~200Ml/d capacity will impinge approximately 1kg/day of marine biota (Water Reuse Association, 2011). Given the smaller scale of the proposed desalination plant on the Isle of Sheppey, this figure is likely to be reduced in the case of the proposed option.

3.5.6 Mitigation measures and use of best practice design, such as the use of a passive wedge-wire cylinder (PWWC) with an appropriate mesh size would be able to greatly minimise the impacts of impingement and entertainment. At the detailed design stage, consideration will be given to use of a surface or sub-surface intake, capped intake to reduce vertical flow, low velocities through the screens, sizing of the screens and deflection technologies.

Mitigation

- Carry out desalination dispersion modelling to take account of the final plant capacity.
- Assess percentage increase in salinity and temperature against established baseline and using agreed significance threshold.
- Residual chemicals from treatment process to be neutralised before release with brine discharge
- Incorporate best practice technologies for intake to minimise impingement and entrainment issues of prey features, such as PWWC with an appropriate mesh size.

Disturbance

3.5.7 The operational site is considered likely to produce low levels of constant noise as it processes water. In addition, operation of the site will require human presence, but likely to be at low levels.

3.5.8 The majority of the plant will be housed in units and, therefore, operational noise is unlikely to be an issue as impulse noise will not generally occur. The site selected for the

desalination plant is located near an area of open grassland and the Swanscombe Marshes SSSI, which could be used for foraging or roosting purposes by the over-wintering qualifying species of the SPA and Ramsar. While this area may be subject to existing anthropogenic disturbance due to its close proximity to residential and industrial uses, it is possible that these areas may be used by birds associated with the SPA (e.g., for foraging or roosting).

3.5.9 Breeding and non-breeding bird surveys will need to be completed to establish the use of this area by the site's qualifying features. However, it should be noted that the habitat is outside the SPA and Ramsar boundary and a very small area in the context of the surrounding supporting habitat as a whole, and so no effects that cannot be avoided or mitigated at the project level would be expected.

Mitigation

3.5.10 Screening of the plant with a landscape bund or additional planting should be considered as part of the detailed design if appropriate. Lighting of the site could increase the displacement of the bird species and will therefore need to be positioned to avoid light spill on any potential adjacent habitats. An operational noise assessment should be completed to ensure the plant does not impact the bird species, and where necessary additional measures incorporated (e.g., specific sets of louvres that reduce noise).

3.6 In combination effects

Other WRMP options

3.6.1 The potential for these European sites to be affected by two or more WRMP options (either options within the SWS rdWRMP, or options in the rdWRMPs of neighbouring water companies) is set out in Appendix F and Appendix G.

3.6.2 In summary the principal in combination risk relates to effects with:

- Desalination: Isle of Sheppey (10Ml/d, 20Ml/d & 20Ml/d Phase 2).

3.6.3 Environmental changes associated with the operation of this option and the Desalination: Isle of Sheppey option are expected to be highly localised. Although there are residual uncertainties that cannot be fully assessed at the WRMP level with the available data, it is considered that mitigation options are available that can reliably be applied through scheme detailed design (e.g. location of outfalls) to ensure that spatially coincident (hence additive etc.) in combination effects do not occur; disparate in combination effects (i.e. 'alone' effects on different parts of the site that together affect site integrity, particularly in relation to the use of different parts of the site by qualifying mobile features) are conceivable, but unlikely given the magnitude of the expected effects alone.

Other Water Company Plans

Drought Plans

3.6.4 The Drought Plan will be revised several times before this WRMP option is implemented, and following option delivery, and so a meaningful in combination assessment arguably cannot be undertaken at this point. Furthermore, a future Drought Plan will necessarily reflect the abstraction baseline at that point (i.e., it will account for options implemented at that point in time) and be subject to HRA when revised, which provides a mechanism to ensure that in combination effects do not occur.

3.6.5 No drought options identified in SW's revised draft Drought Plan 2022[1], or the plans of neighbouring water companies, will affect these sites based on the HRA of the Drought Plan.

Drainage and Wastewater Management Plans

3.6.6 The interaction of the WRMP options with specific schemes derived from the emerging Drainage and Wastewater Management Plan (DWMP) can only be assessed at the project level due to the generic nature of the DWMP options.

Minor projects

3.6.7 It has not been possible to produce a definitive list of existing (minor) planning applications near this option's zone of influence and generating a list at this stage would be of little value given the lead times for the option. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the ACWG guidance on cumulative/in combination assessments.

Major projects

3.6.8 Reference has been made to the Planning Inspectorate's National Infrastructure Projects website[2] which includes major projects.

3.6.9 A review of that status of major projects that are located within or in close proximity to this European site has been undertaken to assess the potential for in-combination effect with this option. The following summarises the findings of this review:

- Lower Thames Crossing (a new road crossing connecting Kent, Thurrock and Essex)- a DCO for the project was granted in March 2025. The Secretary of State's HRA concludes the absence of adverse effects upon the integrity of the Thames Estuary and Marshes SPA and Ramsar subject to implementation of proposed mitigation measures.

[1] Southern Water (2021). Draft Drought Plan 2022 Main report. 31 March 2021, Version 1.0.

[2] https://infrastructure.planninginspectorate.gov.uk/projects/

- Kemsley Paper Mill (K4) Combined Heat and Power Plant (located on land within the boundary of the Kemsley Paper Mill, near Sittingbourne in Kent) – a DCO for the project was granted in July 2019. The Secretary of State's HRA concludes that there would be no LSE on the Thames Estuary and Marshes SPA and Ramsar site (the only potential pathway for effect on the SPA and Ramsar site appeared to be emissions to air, and it was concluded that relevant thresholds would either not be exceeded).
- Wheelabrator Kemsley Generating Station (K3) and Wheelabrator Kemsley North (WKN) Waste to Energy Facility (a power upgrade and increase in tonnage throughput to the existing Kemsley Generating Station and a new waste to energy facility, located adjacent to and immediately north-east of the Kemsley Paper Mill, in Kemsley, Sittingbourne, Kent) – a DCO was granted to Wheelabrator Kemsley K3 Generating Station only in February 2021. Wheelabrator Kemsley North Waste to Energy Facility was not granted development consent. The Secretary of State's HRA concludes that there would be no LSE on the Thames Estuary and Marshes SPA and Ramsar site.

3.6.10 Given the nature, location, current status of the environmental information and/or conclusion of the Secretary of State's HRA relating to the major projects reviewed above, it can be concluded that there is either no realistic potential for in-combination effects with the proposed option, or the environmental assessment of the major projects is not sufficiently advanced to enable in-combination assessment to be undertaken.

3.7 Conclusion: Thames Estuary and Marshes SPA/Ramsar

3.7.1 In light of the predicted effect of this option both alone and in-combination with other plans and projects, it is considered that there is sufficient confidence that appropriate mitigation measures are available at the project level and can be implemented to enable a conclusion of no adverse effect on the integrity of the Thames Estuary and Marshes SPA/Ramsar to be drawn for the WRMP HRA.

4. References

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Appendix E9:
Appropriate Assessment: Recycling (KMW): Medway WTW to lake (14Ml/d)

Option Summary

Overview and European site context

1.1.1 This option involves the transfer of 18Ml/d of treated effluent from Medway WwTW to near Rochester WSW's raw sewage storage reservoir, Eccles Lake. This would reduce freshwater inputs to the tidal River Medway as water is extracted from effluent that would otherwise be discharged to the estuary.

1.1.2 This option would require:

- Construction of a tertiary wastewater treatment plant, buildings and pumping station at Medway WwTW;
- Necessary site facilities and service connections (power connection, fencing, etc.);
- Treated effluent transfer pipe to Eccles Lake (approximately 2.5km);
- A discharge structure to Eccles Lake; and,
- Potential improvements to the near Rochester WSW treatment stream.

1.1.3 The scheme would be required by 2031.

1.1.4 The proposed option and pipeline location are in close proximity (within 10km) or hydrologically linked to the Medway Estuary and Marshes SPA, Medway Estuary and Marshes Ramsar, Peters Pit SAC, North Downs Woodlands SAC and Queendown Warren SAC.

Environmental changes and option assumptions / uncertainties

Potential construction-related environmental changes

1.1.5 The proposed site of the recycling plant and pipeline is located approximately 1.4km from the nearest European site. Construction activities are, therefore, unlikely to have any direct effect on habitats within the European sites. However, environmental changes associated with construction may occur through the following mechanisms:

- Water quality – issues with accidental oil spills and pollution incidents when close to the Medway. In addition, there is potential for increases in turbidity in adjacent waterbodies from sediment laden runoff and seabed scour during outfall construction.
- Introduction of Invasive/Non-Native Species (INNS).

Potential operation-related environmental changes

1.1.6 'Generic' environmental risks typically associated with new infrastructure may be realised (e.g. additional noise or lighting) although these cannot be reliably scoped or assessed at the plan-level as they are entirely dependent on the detailed design; however, the operational plant required is not inherently high-impact in this regard, and potentially notable environmental changes can almost certainly be avoided through scheme-design.

1.1.7 The principal environmental changes from operation will therefore relate to:

- the effective reduction in freshwater inputs to the Medway due to the effluent transfer process (12.8Ml/d[1]); and
- the discharge of wastewater to Eccles Lake.

Assumptions and uncertainties

1.1.8 It is assumed that the discharge of wastewater will be within the existing permitting / compliance requirements for the WwTW discharges (this is technologically possible), and/or that amended discharge consents will be approved by the EA (i.e. the quality of discharges from the WwTW will not decrease as a direct result of the option). This aspect requires confirmation, however.

Screening Summary

1.1.9 The screening assessment is outlined in Table 2.1. In summary, significant effects cannot be self-evidently excluded for the following sites:

- Medway Estuary and Marshes SPA.
- Medway Estuary and Marshes Ramsar.

1.1.10 The following sites were screened out of further assessment due to there being no potential for likely significant effects as a result of construction/operational activities;

- Peters Pit SAC;
- North Downs Woodlands SAC; and

[1] 12.8Ml/d represents the average utilisation which enables a realistic assessment.

- Queendown Warren SAC.

Table 2.1: Sites for which significant effects cannot be self-evidently excluded.

Site	Location (km)*	LSE?		Rationale
		Cons	Oper	
Medway Estuary and Marshes SPA	10.4/DS	U*	U	Construction: Works required close to the River Medway are unlikely to have any direct effect on habitats within the European site or on functionally linked land, but the site may be vulnerable to site-derived pollutants. Likely significant effect (LSE) almost certainly avoidable with established measures / normal best-practice, although these must necessarily be accounted for at the appropriate assessment stage (hence 'screened in'). Operation: Option will reduce freshwater inputs to the tidal River Medway as water is extracted from effluent that would otherwise be discharged to the estuary; however, the effect of this on the designated site (approximately 20km downstream) is likely to be limited, particularly in relation to the tidal influx / turnover, within the estuary.
Medway Estuary and Marshes Ramsar	10.4/DS	U*	U	Construction: Works required close to the River Medway are unlikely to have any direct effect on habitats within the European site or on functionally linked land, but the site may be vulnerable to site-derived pollutants. LSE almost certainly avoidable with established measures / normal best-practice, although these must necessarily be accounted for at AA (hence 'screened in'). Operation: Option will reduce freshwater inputs to the tidal River Medway as water is extracted from effluent that would otherwise be discharged to the estuary; however, the effect of this on the designated site (approximately 20km downstream) is likely to be limited, particularly in relation to the tidal influx / turnover, within the estuary.

1.1.11 Some of the potential effects noted above will be clearly avoidable with established measures, which are accounted for at the appropriate assessment stage, in accordance with People over Wind.

Assessment: Medway Estuary and Marshes SPA/Ramsar

Core Designation Information

1.1.12 Medway Estuary and Marshes is a complex of rain-fed, brackish, floodplain grazing marsh with ditches and intertidal marsh and mudflat. It is of international importance for its diverse assemblage of wetland plants and invertebrates.

1.1.13 The core information relating to the designation (i.e. qualifying features, conservation objectives, supplementary advice documents, information on typical species, supporting habitats and known functional land) is available online and so not replicated here in detail, to minimise repetition and over-simplification of freely available data.

1.1.14 Table 3.1 provides links to the key documents and information relating to the designation. Specific information that may be relevant to the assessment of effects is noted as necessary, and in the assessment sections below (e.g. known areas of functional land identified in the SACO documentation).

Table 0.1: Designation information for the Medway Estuary and Marshes SPA/Ramsar

Aspect	Notes
Qualifying features	SPA: • A130w: Eurasian oystercatcher *Haematopus ostralegus* • A056w: Northern shoveler *Anas clypeata* • A052w: Eurasian teal *Anas crecca* • A143w: Red knot *Calidris canutus* • A137w: Ringed plover *Charadrius hiaticula* • A132r: Pied avocet *Recurvirostra avosetta* • A082w: Hen harrier *Circus cyaneus* • A616w: Black-tailed godwit *Limosa limosa islandica* • A001w: Red-throated diver *Gavia stellata* • A169w: Ruddy turnstone *Arenaria interpres* • A054w: Northern pintail *Anas acuta* • A164w: Common greenshank *Tringa nebularia* • A053w: Mallard *Anas platyrhynchos* • A017w: Great cormorant *Phalacrocorax carbo* • A195r: Little tern *Sterna albifrons* • A141w: Grey plover *Pluvialis squatarola* • A050w: Eurasian wigeon *Anas penelope* • A048w: Common shelduck *Tadorna tadorna* • A672w: Dunlin *Calidris alpina alpina* • A162w: Common redshank *Tringa totanus* • A098w: Merlin *Falco columbarius* • A059w: Common pochard *Aythya ferina* • A037w: Tundra swan Cygnus columbianus bewickii • A132w: Pied avocet *Recurvirostra avosetta* • A160w: Eurasian curlew *Numenius arquata* • A005w: Great crested grebe *Podiceps cristatus*

Aspect	Notes
	• A193r: Common tern *Sterna hirundo* • A675w: Dark-bellied brent goose *Branta bernicla bernicla* • WATR: Waterbird assemblage • BBA: Breeding bird assemblage • A162c: Common redshank *Tringa totanus* Ramsar: • Crit 2: Supports vulnerable, endangered or critically endangered species or threatened eco communities • Crit 5: Regularly supports 20,000 or more waterbirds • Crit 6: Regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
Conservation Objectives	Available at: European Site Conservation Objectives for Medway Estuary & Marshes SPA - UK9012031 (naturalengland.org.uk)
Site Improvement Plan	Available at: Site Improvement Plan: Greater Thames Complex - SIP134 (naturalengland.org.uk)
Supplementary advice	Available at: European Site Conservation Objectives for Medway Estuary & Marshes SPA - UK9012031 (naturalengland.org.uk)
Associated SSSIs	• Medway Estuary & Marshes SSSI
Functional land	Breeding bird assemblage: mudflat, saltmarsh, grazing marsh, coastal lagoons, shallow coastal waters, intertidal sand and muddy sand, intertidal coarse sediment and intertidal mixed sediments. Waterbird assemblage, non-breeding: intertidal mud, intertidal sand and muddy sand, saltmarsh, grazing marsh.

Mitigation Assumptions

Standard Measures / Best-practice

1.1.15 Appendix C identifies standard and established measures that are known to be available, achievable and likely to be effective in avoiding or mitigating potentially adverse effects on European sites and interest features. These are based on best- and case-practice from similar schemes, and so there can be high confidence in their deliverability and effectiveness. These measures would be applied unless project-level HRAs or project-specific environmental studies demonstrate that they are not required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate.

Bespoke measures

1.1.16 Site- or feature-specific mitigation that may be required for specific atypical effects are identified in the assessment sections.

Interest Feature Exposure

1.1.17 The location of the 'maximum' impact is approximately 20km upstream of the closest point of the Medway Estuary and Marshes SPA/Ramsar, which will be overwhelmingly influenced by tidal dynamics and local non-saline inputs from the local catchment. As a result the magnitude of the environmental change at the site boundary is expected to be small and so the site habitats and qualifying species (when within the site) will have a limited exposure to the environmental changes anticipated as a result of the scheme.

1.1.18 Some of the qualifying bird features may utilise functionally associated habitats close to the WwTW and proposed pipeline construction areas, including Leybourne Lakes, although these areas and habitats are likely to be of relatively low value to the qualifying features of the SPA/Ramsar due to the habitat characteristics, distance from the sites, and availability of preferred habitats closer to the SPA/Ramsar (so exposure would be low).

Assessment – Construction

Pollutants

1.1.19 With regard to site-derived pollutants affecting this site itself, this pathway can be reliably prevented using established project-level measures (see Appendix C); application of these measures will ensure that the scheme has 'no effect' on the habitats of the SPA / Ramsar or its interest features.

Functional land

1.1.20 With regard to non-designated functional land (i.e. functionally linked land), the proposed option is located over 10km away from the Medway Estuary & Marshes SPA and Ramsar. Based on aerial photos the areas of land affected by the pipeline are very unlikely to support potentially notable numbers of the qualifying features of the European site and, therefore, the risk of effect is generally very low. While there is anecdotal evidence of species designated under the SPA/Ramsar (such as great-crested grebe and cormorant) being found within the Leybourne Lakes Country Park[2] (located approximately 700m west of the potential pipeline route), there is no evidence of the waterbodies within the Park or Eccles Lake being utilised by significant numbers of birds from the SPA/Ramsar (such that disturbance of these birds during construction might affect the integrity of the SPA/Ramsar populations).

1.1.21 No potential effects on qualifying features using habitats near the construction area are likely to be of a scale that cannot be reliably mitigated / avoided at the project level using standard measures.

[2] Leybourne Lakes Country Park – rspbgravesend

Assessment – Operation

1.1.22 The assessment of this option is largely as per the 2019 HRA, which concluded no likely significant effects would occur, either alone or in combination with other plans/projects. Investigations are currently ongoing for this scheme but have not yet reported; however, these investigations are not identifying any substantive concerns relating to impacts on the SPA/Ramser (although there are potential issues associated with salinity and water quality changes in the upper estuary near the WwTW, these are essentially attenuated by the boundary of the SPA/Ramsar due to the distance downstream and the dominance of tidal turnover at the SPA/Ramsar boundary).

Flow regime

1.1.23 The River Medway is the main source of freshwater inflow into the Medway Estuary. The annual average Q95 mean daily flow value for the Medway is ~135 Ml/d (based on data from Teston gauging station located approximately 10.13km upstream of the transitional waterbody) – these are measured flows upstream of the Medway WwTW discharge and will not be reduced by the reuse scheme. Downstream of this gauging station, the River Len also provides flow contributions to the River Medway upstream of the Southern Water Springfield abstraction intake location. Downstream of the tidal limit at Allington Locks, the transitional Medway has a confluence with the Ditton Stream (which has a catchment area of 13.72km^2) and the Leybourne Stream (catchment area of 50.24km^2). At the mouth of the estuary, there is the confluence with the Swale, an open-ended estuary but with limited freshwater influence.

1.1.24 As the River Medway is the major freshwater flow contribution into the Medway estuary, the impact of the transfer of 12.8Ml/d (average utilisation for this option) has been assessed based on the impact on Q95 flows, taking account of UKTAG guidance which recommends use of Q95 flow as the appropriate flow percentile to assess impacts of reduced freshwater flows to estuaries (no alternative method for assessment is provided in the FCT for the underlying SSSI). For the purposes of the assessment, it is assumed that 100% of the freshwater flows to the estuary are from the River Medway at Allington Locks plus the remaining residual DWF at the WWTW.

1.1.25 The Q95 flows at Allington Locks are calculated to be approximately 178.5Ml/d (this assumes Springfield abstraction is supported by Bewl Releases at a release factor of 1.1 as per new licence conditions); this is based on

- Q95 flow at Teston (135 Ml/d) x 1.09 (to pick up remaining catchment from Teston to Allington);
- 27Ml/d (Remaining DWF at the Medway WWTW and another small WwTW nearby);
- 4.4Ml/d (10% of the Flow Support from Bewl Reservoir)

1.1.26 Therefore a 12.8 Ml/d reduction to flow will reduce total Q95 flows to the estuary by no greater than 7.2%. However, the location of this 'maximum' impact is approximately 20km upstream of the closest point of the Medway Estuary and Marshes SPA/Ramsar,

which will be overwhelmingly influenced by tidal dynamics and local non-saline inputs from the local catchment.

1.1.27 The supplementary advice on the conservation objectives (SACO) for the site provides detail on the mechanisms through which the qualifying features may be affected. In particular, given the potential for effects on functional habitat within / outside of the SPA, the SACO states that "*Changes in source, depth, duration, frequency, magnitude and timing of water supply or flow can have important implications for this feature. Such changes may affect the quality and suitability of habitats used by birds for drinking, preening, feeding or roosting*".

1.1.28 A reduction in freshwater flow to the estuary could lead to changes to the supporting habitat of the site through changes in salinity or the position of the saline wedge. However, the location of this 'maximum' impact is approximately 20km upstream of the closest point of the Medway Estuary and Marshes SPA/Ramsar, which will be overwhelmingly influenced by tidal dynamics and local non-saline inputs from the local catchment. As a result the magnitude of the environmental change is expected to be too small to adversely affect the SPA/Ramsar site or its qualifying features.

Water characteristics

1.1.29 The salinity regime and the mixing characteristics of the upper estuary may be altered by the reduced freshwater influx arising from the 12.8 Ml/d (average utilisation) reduction to dry weather flow discharges from the WwTW to the estuary. Specifically, a very minor upstream migration of the saline intrusion distance may arise, and therefore the turbidity maximum resulting from changes to stratification of the water column, may occur alongside a very small increase in the flushing time of the estuary. This change in saline intrusion distance and turbidity maximum will not however lead to significant changes to the supporting habitat or prey availability within the European sites, and will be restricted to the upper Medway estuary (which will not provide potentially notable functional habitat for the site qualifying features). As such no adverse effects are anticipated as a result of the changes to the water characteristics.

Channel width and wave exposure

1.1.30 A very small reduction to the wetted width of the main channel at low tide would also arise in the extreme upstream reaches of the estuary. No change in wave exposure at any point in the estuary is expected. As such no effects on the qualifying features of the site or the supporting habitat/prey availability will occur as a result of the changes to channel width and wave exposure.

Water quality

1.1.31 The impact on water quality will depend on the precise operation of the scheme. It is likely that operation will increase the concentration of some determinands in the recovered effluent discharges (assuming that it is discharged via the WwTW outfall and not subject to further processing and (e.g.) disposal to land), although the total load will

remain the same. The risk of DO concentration deterioration is assessed as low. The risk of water quality deterioration linked to dissolved inorganic nitrogen (DIN) is also assessed as low.

1.1.32 Given distance downstream of the European sites, and low sensitivity to changes in freshwater inputs given the heavy influence of tidal dynamics, a change in 10Ml/d or less is considered to be negligible (based on UKTAG guidance; no conditions are specified in the estuaries CSMG or the underlying SSSI Favourable Condition Table). As such no LSE on the qualifying features of the site or the supporting habitat/prey availability are anticipated as a result of the changes to water quality.

Mitigation

1.1.33 As part of the options embedded design, the treatment of effluent prior to discharge will be designed so that the quality of the receiving waterbody will not be negatively impacted in line with WFD objectives.

In combination effects

Other WRMP options

1.1.34 The potential for these European sites to be affected by two or more WRMP options (either options within the SWS rdWRMP, or options in the rdWRMPs of neighbouring water companies) is set out in Appendix F and Appendix G.

1.1.35 In summary the principal in combination risk relates to effects with:

- Medway WwTW recycling scheme;
- Desalination: Isle of Sheppey.

1.1.36 Environmental changes associated with the operation of this option and the Medway WwTW recycling scheme and the Desalination: Isle of Sheppey options are expected to be highly localised. Although there are residual uncertainties that cannot be fully assessed at the WRMP level with the available data, it is considered that mitigation options are available that can reliably be applied through scheme detailed design (e.g. location of outfalls).

Other Water Company Plans

Drought Plans

1.1.37 The Drought Plan will be revised several times before this WRMP option is implemented, and following option delivery, and so a meaningful in combination assessment arguably cannot be undertaken at this point. Furthermore, a future Drought Plan will necessarily reflect the abstraction baseline at that point (i.e. it will account for options implemented at that point in time) and be subject to HRA when revised, which provides a mechanism to ensure that in combination effects do not occur.

1.1.38 The Drought Plan will be revised several times before this WRMP option is implemented, and following option delivery, and so a meaningful in combination assessment arguably cannot be undertaken at this point. Furthermore, a future Drought Plan will necessarily reflect the abstraction baseline at that point (i.e. it will account for options implemented at that point in time) and be subject to HRA when revised, which provides a mechanism to ensure that in combination effects do not occur.

1.1.39 The DP HRA concluded that the DP options would require mitigation to avoid adverse effects, including investigating the potential for alternative operation of flows from the Allington locks at low tide to reduce the potential for lower water levels at low tide; improving water quality in the Teise through WwWT upgrades (already commenced in AMP7), and other resilience work on the River Bewl (see DP HRA for details).

1.1.40 The only option likely to interact spatially with the DP options is the Medway WTW Recycling option; however, the HRA of WRMP19 concluded that this option would have no adverse effect on the Medway Estuary sites and ongoing investigative work for the delivery of this scheme suggests that this will remain the case due to the distance down-estuary to the closest point of the SPA/Ramsar and the small magnitude of change relative to the dominant marine / tidal influences at this location. No adverse effects would therefore be expected (particularly given the short timescales of an DP implementation and likelihood of recovery in the short-term) although this would necessarily be reviewed through future revisions of the Drought Plan. Conclusion: No AE in combination.

Drainage and Wastewater Management Plans

1.1.41 The interaction of the WRMP options with specific schemes derived from the emerging Drainage and Wastewater Management Plan (DWMP) can only be assessed at the project level due to the generic nature of the DWMP options.

Minor projects

1.1.42 It has not been possible to produce a definitive list of existing (minor) planning applications near this option's zone of influence, and generating a list at this stage would be of little value given the lead times for the option. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the ACWG guidance on cumulative/in combination assessments.

Major Projects

1.1.43 Reference has been made to the Planning Inspectorate's National Infrastructure Projects website.[3] which includes major projects.

[3] https://infrastructure.planninginspectorate.gov.uk/projects/

1.1.44 A review of that status of major projects that are located within or in close proximity to this European site has been undertaken to assess the potential for in-combination effect with this option. The following summarises the findings of this review:

- Cleve Hill Solar Park (approximately 2 km north-east of Faversham and 5 km west of Whitstable on the North Kent Coast) – the DCO was granted in May 2020. The Secretary of State's HRA does not make reference to the Medway Estuary and Marshes SPA and Ramsar site and, therefore, it can be concluded that this European site is not affected by this proposed scheme.
- Kemsley Paper Mill (K4) Combined Heat and Power Plant (located on land within the boundary of the Kemsley Paper Mill, near Sittingbourne in Kent) – a DCO for the project was granted in July 2019. The Secretary of State's HRA concludes that there would be no LSE on the Medway Estuary and Marshes SPA and Ramsar site (the only potential pathway for effect on the SPA and Ramsar site appeared to be emissions to air, and it was concluded that relevant thresholds would either not be exceeded or, if an exceedance was predicted, there would be no LSE).
- Wheelabrator Kemsley Generating Station (K3) and Wheelabrator Kemsley North (WKN) Waste to Energy Facility (a power upgrade and increase in tonnage throughput to the existing Kemsley Generating Station and a new waste to energy facility, located adjacent to and immediately north-east of the Kemsley Paper Mill, in Kemsley, Sittingbourne, Kent) – a DCO was granted to Wheelabrator Kemsley K3 Generating Station only in February 2021. Wheelabrator Kemsley North Waste to Energy Facility was not granted development consent. The Secretary of State's HRA concludes that there would be no LSE on the Medway Estuary and Marshes SPA and Ramsar site.

1.1.45 Given the nature, location, current status of the environmental information and/or conclusion of the Secretary of State's HRA relating to the major projects reviewed above, it can be concluded that there is either no realistic potential for in-combination effects with the proposed option, or the environmental assessment of the major projects is not sufficiently advanced to enable in-combination assessment to be undertaken.

Conclusion: Medway Estuary and Marshes SPA/Ramsar

1.1.46 In light of the predicted effect of this option both alone and in-combination with other plans and projects, it is considered that there is sufficient confidence that appropriate mitigation measures are available at the project level and can be implemented to enable a conclusion of no adverse effect on the integrity of the Medway Estuary and Marshes SPA/Ramsar to be drawn for the WRMP HRA.

Appendix E10: Appropriate Assessment: Recycling: Sittingbourne industrial reuse (7.5Mld)

1. Option Summary

1.1 Overview and European site context

1.1.1 DS Smith (paper and board manufacturers) currently have a licence to extract groundwater for its industrial processes. This option would replace groundwater abstracted by DS Smith with water recovered from Sittingbourne WwTW, allowing the groundwater abstraction to be utilised for PWS through licence trading. There would be no increase in abstraction from the aquifer.

1.1.2 This option would require:

- effluent recovery / tertiary treatment plant at Sittingbourne WwTW (assumed to be reverse osmosis plant, sized to deliver 7.5Ml/d to DS Smith);
- a pipeline to transfer treated water from Sittingbourne WwTW to the DS Smith site (approximately 1.3km);
- groundwater treatment plant (assumed to be located at the DS Smith site);
- a pipeline (approximately 6.5km) to transfer treated groundwater to Sittingbourne WSR and hence supply.

1.1.3 Typically, waste products from the effluent recovery process will be returned to the head of the works for treatment and discharge from the WwTW's outfall, or sometimes disposed of in landfill.

1.1.4 The DS Smith site is within 100m of the The Swale SPA and The Swale Ramsar at Milton Creek and 2.8km from the Medway Estuary and Marshes SPA and Medway Estuary and Marshes Ramsar. Wastewater from Sittingbourne WwTW currently discharges to Milton Creek, and it has been assumed that wastewater from the recovery process can be discharged through this outfall.

1.1.5 The scheme would be required by 2031.

1.2 Environmental changes and option assumptions / uncertainties

Potential construction-related environmental changes

1.2.1 The proposed site of the recycling pipeline is located in close proximity to The Swale SPA/Ramsar.

1.2.2 Construction activities have the potential to result in the following impacts:

- Loss of functional offsite habitat – use of undeveloped land along the pipeline route which could support qualifying features;
- Water quality – topsoil stripping and excavation works have potential for indirect adverse effects from pollution from site run-off and accidental pollution, such as oil spills, which could cause habitat degradation in the short-term;
- Disturbance – qualifying features could be disturbed and displaced by noise, vibration and visual (including light pollution) due to the proximity of the works to The Swale;
- Contamination – topsoil stripping and excavation works have potential for indirect adverse effects from dust pollution with smothering of the heath habitats;
- Introduction of Invasive/Non-Native Species (INNS).

Potential operation-related environmental changes

1.2.3 The option will not alter abstraction volumes from the aquifer.

1.2.4 'Generic' environmental risks typically associated with new infrastructure may be realised (e.g. additional noise or lighting) although these cannot be reliably scoped or assessed at the plan-level as they are entirely dependent on the detailed design; however, the operational plant required is not inherently high-impact in this regard, and potentially notable environmental changes can almost certainly be avoided through scheme-design.

1.2.5 The principal environmental changes from operation will therefore relate to:

- the effective reduction in treated effluent volumes in Milton Creek due to the recovery process (approximately 7.5Ml/d plus minor process losses); and
- the discharge of wastewater from the RO process via the existing WwTW outfall.

Assumptions and uncertainties

1.2.6 It is assumed that the discharge of wastewater will be within the existing permitting / compliance requirements for the WwTW discharges (this is technologically possible), and/or that amended discharge consents will be approved by the EA (i.e. the quality of discharges from the WwTW is will not decrease as a direct result of the option). This aspect requires confirmation, however.

2. Screening Summary

2.1.1 The screening assessment is outlined in Table 2.1: Potential construction and operational effects on European sites. In summary, significant effects cannot be self-evidently excluded for the following sites:

Table 2.1: Potential construction and operational effects on European sites.

Site	Location (km)*	LSE?		Rationale
		Cons	Oper	
The Swale SPA/Ramsar	0.1/DS	U*	Y	Construction: Works are required close to this site but site features are unlikely to have any direct effect on habitats within the European site or on functionally linked land. The site may however be vulnerable to site-derived pollutants. Likely significant effect (LSE) almost certainly avoidable with established measures / normal best-practice, although these must necessarily be accounted for at the appropriate assessment stage (hence 'screened in'). Operation: The scheme would supply DS Smith with reuse water from Sittingbourne WwTW (discharges to Milton Creek), freeing up an equivalent volume for SWS to abstract from groundwater. There would be no increase in abstraction. A new tertiary treatment plant and groundwater treatment plant would be required, including distribution pipelines and a new discharge. There is a risk of adverse impacts to flows, as a consequence of 7.5Ml/d effluent being re-directed for industrial use. Some freshwater invertebrate taxa are more responsive to changes in flow than others. Relative abundance of certain groups may change locally in response to decreased freshwater flow, although the nature of the invertebrate community in this part of the tidal river is assumed to be strongly linked to the ambient salinity profile and tidal influence. However, the impact of these changes in invertebrate on the qualifying features of the SPA, and how the change in flows could impact the Ramsar features is uncertain. Therefore, adopting the precautionary principle, LSEs are anticipated.

Site	Location (km)*	LSE?		Rationale
		Cons	Oper	
Medway Estuary and Marshes SPA/Ramsar	2.8/DS	U*	0	Construction: Works required close to this site are unlikely to have any direct effect on habitats within the European site or on functionally linked land but the site may be vulnerable to site-derived pollutants. LSE almost certainly avoidable with established measures / normal best-practice, although these must necessarily be accounted for at the appropriate assessment stage (hence 'screened in'). Operation: The change in freshwater flows is considered to be limited to effects within Milton Creek only, therefore given the distance to the Medway SPA and Ramsar and size of waterbodies in between, no likely significant effects are anticipated.

2.1.2 Some of the potential effects noted above will be clearly avoidable with established measures, which are accounted for at the appropriate assessment stage in accordance with People over Wind.

3. Assessment: Medway Estuary and Marshes SPA/Ramsar

3.1 Core Designation Information

3.1.1 Medway Estuary and Marshes is a complex of rain-fed, brackish, floodplain grazing marsh with ditches and intertidal marsh and mudflat. It is of international importance for its diverse assemblage of wetland plants and invertebrates.

3.1.2 The core information relating to the designation (i.e. qualifying features, conservation objectives, supplementary advice documents, information on typical species, supporting habitats and known functional land) is available online and so not replicated here in detail, to minimise repetition and over-simplification of freely available data.

3.1.3 Table 3.1: Designation information for the Medway Estuary and Marshes SPA/Ramsar provides links to the key documents and information relating to the designation. Specific information that may be relevant to the assessment of effects is noted as necessary, and in the assessment sections below (e.g. known areas of functional land identified in the SACO documentation).

Table 3.1: Designation information for the Medway Estuary and Marshes SPA/Ramsar

Aspect	Notes
Qualifying features	SPA: • A130w: Eurasian oystercatcher *Haematopus ostralegus* • A056w: Northern shoveler *Anas clypeata* • A052w: Eurasian teal *Anas crecca* • A143w: Red knot *Calidris canutus* • A137w: Ringed plover *Charadrius hiaticula* • A132r: Pied avocet *Recurvirostra avosetta* • A082w: Hen harrier *Circus cyaneus* • A616w: Black-tailed godwit *Limosa limosa islandica* • A001w: Red-throated diver *Gavia stellata* • A169w: Ruddy turnstone *Arenaria interpres* • A054w: Northern pintail *Anas acuta* • A164w: Common greenshank *Tringa nebularia* • A053w: Mallard *Anas platyrhynchos* • A017w: Great cormorant *Phalacrocorax carbo* • A195r: Little tern *Sterna albifrons* • A141w: Grey plover *Pluvialis squatarola* • A050w: Eurasian wigeon *Anas penelope* • A048w: Common shelduck *Tadorna tadorna* • A672w: Dunlin *Calidris alpina alpina* • A162w: Common redshank *Tringa totanus* • A098w: Merlin *Falco columbarius* • A059w: Common pochard *Aythya ferina* • A037w: Tundra swan *Cygnus columbianus bewickii* • A132w: Pied avocet *Recurvirostra avosetta* • A160w: Eurasian curlew *Numenius arquata* • A005w: Great crested grebe *Podiceps cristatus* • A193r: Common tern *Sterna hirundo* • A675w: Dark-bellied brent goose *Branta bernicla bernicla* • WATR: Waterbird assemblage • BBA: Breeding bird assemblage • A162c: Common redshank *Tringa totanus* Ramsar: • Crit 2: Supports vulnerable, endangered or critically endangered species or threatened eco communities • Crit 5: Regularly supports 20,000 or more waterbirds • Crit 6: Regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
Conservation Objectives	Available at: European Site Conservation Objectives for Medway Estuary & Marshes SPA - UK9012031 (naturalengland.org.uk)
Site Improvement Plan	Available at: Site Improvement Plan: Greater Thames Complex - SIP134 (naturalengland.org.uk)
Supplementary advice	Available at: European Site Conservation Objectives for Medway Estuary & Marshes SPA - UK9012031 (naturalengland.org.uk)
Associated SSSIs	• Medway Estuary & Marshes SSSI

Aspect	Notes
Functional land	Breeding bird assemblage: mudflat, saltmarsh, grazing marsh, coastal lagoons, shallow coastal waters, intertidal sand and muddy sand, intertidal coarse sediment and intertidal mixed sediments.

3.2 Mitigation Assumptions

Standard Measures / Best-practice

3.2.1 Appendix C identifies standard and established measures that are known to be available, achievable and likely to be effective in avoiding or mitigating potentially adverse effects on European sites and interest features. These are based on best- and case-practice from similar schemes, and so there can be high confidence in their deliverability and effectiveness. These measures would be applied unless project-level HRAs or project-specific environmental studies demonstrate that they are not required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate.

Bespoke measures

3.2.2 Site- or feature-specific mitigation that may be required for specific atypical effects are identified in the assessment sections.

3.3 Interest Feature Exposure

Breeding and Non-breeding Birds

3.3.1 Due to the proposed option being located 2.8km away from the SPA and Ramsar, there is a low potential for breeding and non-breeding birds associated with the European site to be found foraging within the vicinity of the proposed option during both the construction and operational phases.

3.3.2 The value of these areas to breeding and wintering birds associated with the sites cannot be determined without scheme-specific survey data, and so there is some residual uncertainty; however, it is clear that effects on the bird interest of the sites can be avoided or substantially minimised through established best-practice and avoidance measures outlined in Appendix C, including:

- pre-development surveys;
- avoiding construction during the winter period;
- monitoring construction works and pausing if significant aggregations of qualifying bird species are present close to the construction area;
- construction management measures (e.g. ‘soft-start’ of machinery).

3.4 Assessment – Construction

3.4.1 The SPA and Ramsar are located 2.8km to the north west of the DS Smith site. Given the distance between the designated site and that of construction no direct or indirect effects on the qualifying features are expected that cannot be avoided or mitigated through the application of best practice measures, as listed in Appendix C.

3.5 Assessment – Operation

3.5.1 The alteration in freshwater flows is considered to be limited to effects within Milton Creek only, therefore given the distance to the Medway SPA and Ramsar and size of waterbodies in between, no likely significant effects are anticipated during the operational phase.

3.6 In combination effects

Other WRMP options

3.6.1 The potential for these European sites to be affected by two or more WRMP options (either options within the SWS rdWRMP, or options in the rdWRMPs of neighbouring water companies) is set out in Appendix F and Appendix G.

3.6.2 In summary the principal in combination risk relates to effects with:

- Medway WwTW recycling scheme;
- Desalination: Isle of Sheppey.

3.6.3 Environmental changes associated with the operation of this option and the Medway WwTW recycling scheme and the Desalination: Isle of Sheppey options are expected to be highly localised. Although there are residual uncertainties that cannot be fully assessed at the WRMP level with the available data, it is considered that mitigation options are available that can reliably be applied through scheme detailed design (e.g. location of outfalls).

Other Water Company Plans

Drought Plans

3.6.4 The Drought Plan will be revised several times before this WRMP option is implemented, and following option delivery, and so a meaningful in combination assessment arguably cannot be undertaken at this point. Furthermore, a future Drought Plan will necessarily reflect the abstraction baseline at that point (i.e. it will account for options implemented at that point in time) and be subject to HRA when revised, which provides a mechanism to ensure that in combination effects do not occur.

3.6.5 The DP HRA concluded that the DP options would require mitigation to avoid adverse effects, including investigating the potential for alternative operation of flows from the Allington locks at low tide to reduce the potential for lower water levels at low tide;

improving water quality in the Teise through WwWT upgrades (already commenced in AMP7), and other resilience work on the River Bewl (see DP HRA for details).

3.6.6 The only option likely to interact spatially with the DP options is the Medway WTW Recycling option; however, the HRA of WRMP19 concluded that this option would have no adverse effect on the Medway Estuary sites and ongoing investigative work for the delivery of this scheme suggests that this will remain the case due to the distance down-estuary to the closest point of the SPA/Ramsar and the small magnitude of change relative to the dominant marine / tidal influences at this location. No adverse effects would therefore be expected (particularly given the short timescales of an DP implementation and likelihood of recovery in the short-term) although this would necessarily be reviewed through future revisions of the Drought Plan. Conclusion: No AE in combination.

Drainage and Wastewater Management Plans

3.6.7 The interaction of the WRMP options with specific schemes derived from the emerging Drainage and Wastewater Management Plan (DWMP) can only be assessed at the project level due to the generic nature of the DWMP options.

Minor projects

3.6.8 It has not been possible to produce a definitive list of existing (minor) planning applications near this option's zone of influence, and generating a list at this stage would be of little value given the lead times for the option. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the ACWG guidance on cumulative/in combination assessments.

Major Projects

3.6.9 Reference has been made to the Planning Inspectorate's National Infrastructure Projects website[1] which includes major projects.

3.6.10 A review of that status of major projects that are located within or in close proximity to this European site has been undertaken to assess the potential for in-combination effect with this option. The following summarises the findings of this review:

- Cleve Hill Solar Park (approximately 2 km north-east of Faversham and 5 km west of Whitstable on the North Kent Coast) – the DCO was granted in May 2020. The Secretary of State's HRA does not make reference to the Medway Estuary and Marshes SPA and Ramsar site and, therefore, it can be concluded that this European site is not affected by this proposed scheme.
- Kemsley Paper Mill (K4) Combined Heat and Power Plant (located on land within the boundary of the Kemsley Paper Mill, near Sittingbourne in Kent) – a DCO for the project was granted in July 2019. The Secretary of State's HRA concludes that there

[1] https://infrastructure.planninginspectorate.gov.uk/projects/

would be no LSE on the Medway Estuary and Marshes SPA and Ramsar site (the only potential pathway for effect on the SPA and Ramsar site appeared to be emissions to air, and it was concluded that relevant thresholds would either not be exceeded or, if an exceedance was predicted, there would be no LSE).

- Wheelabrator Kemsley Generating Station (K3) and Wheelabrator Kemsley North (WKN) Waste to Energy Facility (a power upgrade and increase in tonnage throughput to the existing Kemsley Generating Station and a new waste to energy facility, located adjacent to and immediately north-east of the Kemsley Paper Mill, in Kemsley, Sittingbourne, Kent) – a DCO was granted to Wheelabrator Kemsley K3 Generating Station only in February 2021. Wheelabrator Kemsley North Waste to Energy Facility was not granted development consent. The Secretary of State's HRA concludes that there would be no LSE on the Medway Estuary and Marshes SPA and Ramsar site.

3.6.11 Given the nature, location, current status of the environmental information and/or conclusion of the Secretary of State's HRA relating to the major projects reviewed above, it can be concluded that there is either no realistic potential for in-combination effects with the proposed option, or the environmental assessment of the major projects is not sufficiently advanced to enable in-combination assessment to be undertaken.

3.7 Conclusion: Medway Estuary and Marshes SPA/Ramsar

3.7.1 In light of the predicted effect of this option both alone and in-combination with other plans and projects, it is considered that there is sufficient confidence that appropriate mitigation measures are available at the project level and can be implemented to enable a conclusion of no adverse effect on the integrity of the Medway Estuary and Marshes SPA/Ramsar to be drawn for the WRMP HRA.

4. Assessment: The Swale SPA/Ramsar

4.1 Core Designation Information

4.1.1 The Swale is a complex of brackish and freshwater, floodplain grazing marsh with ditches, and intertidal saltmarsh and mudflat. These habitats together support internationally important numbers of wintering waterfowl, with rare wetland birds breeding in important numbers. The saltmarsh and grazing marsh are of international importance for their diverse assemblages of wetland plants and invertebrates.

4.1.2 The core information relating to the designation (i.e. qualifying features, conservation objectives, supplementary advice documents, information on typical species, supporting habitats and known functional land) is available online and so not replicated here in detail, to minimise repetition and over-simplification of freely available data.

4.1.3 Table 4.1: The Swale SPA and Ramsar site-specific details provides links to the key documents and information relating to the designation. Specific information that may be

relevant to the assessment of effects is noted as necessary, and in the assessment sections below (e.g. known areas of functional land identified in the SACO documentation).

Table 4.1: The Swale SPA and Ramsar site-specific details

Aspect	Notes
Qualifying features	SPA: • A137w: Ringed plover *Charadrius hiaticula* • A130w: Eurasian oystercatcher *Haematopus ostralegus* • A052w: Eurasian teal *Anas crecca* • A672w: Dunlin *Calidris alpina alpina* • A160w: Eurasian curlew *Numenius arquata* • A051w: Gadwall *Anas strepera* • A141w: Grey plover *Pluvialis squatarola* • A162w: Common redshank *Tringa totanus* • A675w: Dark-bellied brent goose *Branta bernicla bernicla* • WATR: Waterbird assemblage • BBA: Breeding bird assemblage • A616w: Black-tailed godwit *Limosa limosa islandica* Ramsar: • Crit 2: Supports vulnerable, endangered or critically endangered species or threatened eco communities • Crit 5: Regularly supports 20,000 or more waterbirds • Crit 6: Regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
Conservation Objectives	Available at: European Site Conservation Objectives for The Swale SPA - UK9012011 (naturalengland.org.uk)
Site Improvement Plan	Available at: Site Improvement Plan: Greater Thames Complex - SIP134 (naturalengland.org.uk)
Supplementary advice	Available at: http://publications.naturalengland.org.uk/publication/5745862701481984?category=6528471664689152
Associated SSSIs	• The Swale SSSI
Functional land	Breeding bird assemblage: Intertidal mud, intertidal sand and muddy sand, saltmarsh and grazing marsh for Shelduck (*Tadorna tadorna*), mallard (*Anas platyrhynchos*), moorhen (*Gallinula chloropus*), coot (*Fulica atra*), lapwing (*Vanellus vanellus*), redshank (*Tringa totanus*), reed warbler (*Acrocephalus scirpaceus*) and reed bunting (*Emberiza schoeniclus*) (Natural England, 2014)[2]. Waterbird assemblage (non-breeding): The current extent and distribution of suitable habitat (intertidal mud, intertidal sand and muddy sand, saltmarsh, grazing marsh, seagrass beds, intertidal mussel beds) is thought to support the feature for all the necessary stages of the non-breeding/wintering period for Oyster catcher (*Haematopus ostralegus*), ringed plover (*Charadrius hiaticula*), grey plover (*Pluvialis squatarola*), curlew (*Numenius arquata*) and redshank (*Tringa totanus*),

[2] Designated Sites View (naturalengland.org.uk)

shelduck (*Tadorna tadorna*), Wigeon (*Anas penelope*), Teal (*Anas creca*) and curlew (*Numenius arquata*) (Natural England, 2014).

4.2 Mitigation Assumptions

Standard Measures / Best-practice

4.2.1 Appendix C identifies standard and established measures that are known to be available, achievable and likely to be effective in avoiding or mitigating potentially adverse effects on European sites and interest features. These are based on best- and case-practice from similar schemes, and so there can be high confidence in their deliverability and effectiveness. These measures would be applied unless project-level HRAs or project-specific environmental studies demonstrate that they are not required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate.

Bespoke measures

4.2.2 Site- or feature-specific mitigation that may be required for specific atypical effects are identified in the assessment sections.

4.3 Interest Feature Exposure

4.3.1 Due to the proposed route of the pipeline crossing potential functional land for the qualifying features of the site, all qualifying features will be scoped in the following assessment, although impacts are unlikely.

4.3.2 In addition, the area associated with the WwTW and Milton Creek is highly urbanised with a number of housing estates and industrial areas; the creek is also relatively narrow, with industrial development on either side. As a result usage of Milton Creek by SPA/Ramsar species will be relatively low due to these characteristics (disturbance, short sightlines, etc.).

4.4 Assessment: Construction

Pipeline: Loss of functional offsite habitat

4.4.1 The upper and middle reaches of the Milton Creek are outside the boundaries of the SPA, but could serve as functional habitat for foraging. Use of Milton Creek by the qualifying bird species is unknown.

Mitigation

4.4.2 Breeding and non-breeding bird surveys will need to be completed to establish the use of this area by the site's qualifying features. However, it should be noted that the habitat is

outside the SPA and Ramsar boundary and a very small area in the context of the surrounding supporting habitat as a whole.

Disturbance – noise and visual

4.4.3 The use of heavy plant and road transport during the construction phase may lead to increased noise and visual disturbance to qualifying bird species within the SPA. Birds are known to be potentially vulnerable to noise disturbance within 1km of its source. According to a report from the Institute of Estuarine and Coastal Studies in 2009, if noise levels at the SPA can be kept at 70dB(A) or lower and visible human presence is hidden, or in excess of 250m from the SPA, then there should be no significant disturbance effect on bird behaviour. It should be noted that the functional habitat associated with the Milton Creek is located within residential and industrial areas.

Mitigation

- As the works will be within 100m of the SPA at certain sections of the pipeline, exclusion for a 250m radius around the proposed construction corridor is likely, with birds displaced from within this.
- A bird survey should determine the value of habitat within 250m of the proposed pipeline corridor and whether any further mitigation measures are required. A working method whereby noise and visual stimuli are reduced will need to prepared. This should include the use of silencers and hoarding.
- A noise assessment with reference to the Waterbird Disturbance Mitigation Toolkit will need to be completed to demonstrate the mitigation measure are effective avoid disturbance before works take place outside the restricted timings.
- Produce working method for noise and visual stimuli and complete assessment to determine impacts and effectiveness of mitigation (e.g. hoarding, silencers, no working at dawn or dusk, limit use of onsite lighting). This should be completed with reference to the Waterbirds Disturbance Mitigation Toolkit (TIDE Tools, 2022) which details likely thresholds for noise and visual stimuli.
- Use of hoarding and best practice technologies to minimise noise and vibration disturbance.

Water quality

4.4.4 Topsoil stripping and excavation works have potential for indirect adverse effects from pollution from site run-off and accidental pollution, such as oil spills, which could cause habitat degradation in the short-term.

Mitigation

- In order to mitigate for such effects all petrochemicals will be stored within designated areas located a suitable distance from the SPA. All refuelling of vehicles will also be

undertaken off site and works will ensure appropriate spill kits are available to ensure accidental spills are intercepted prior to reaching the designated site.

- Appropriate measures will also be employed to ensure excess sediment is not released into the designated site, this may include (but is not limited to) installation of silt fencing in-between works areas and the watercourse, use of silt busters to capture and filter surface water run-off. No surface water runoff will be discharged directly in to designated site.
- Adherence to EA Pollution Prevention Guidelines (now archived) and NRW, SEPA's Guidance on Pollution Prevention including Works and Maintenance in or near Water (2017)[3].
- No water should be discharged directly to the river network connecting to the Swale. A drainage strategy including treatment measures will need to be agreed with the relevant regulators (EA and NE). If the measures to remove silt and contamination do not satisfy the EA and NE to allow discharge to a watercourse then an alternative discharge arrangement will need to be made e.g. to sewer or tankered off site.

4.4.5 A best-practice pipeline construction drainage strategy for the SPA will be developed and implemented with the input of hydrologists and ecologists, and will be agreed with Natural England in advance of construction works. This will deal with temporary site drainage, trench excavation, backfill, storage and soil compaction issues.

Contamination – dust and NOx

4.4.6 Topsoil stripping and excavation works have potential for indirect adverse effects from dust pollution with smothering of the heath habitats predicted in the absence of mitigation. This is will only effect habitats within 100m as identified through the commonly applied distance thresholds of dust from large construction sites[4,5].

4.4.7 The use of heavy plant and vehicles during the construction phase may alter the air quality in the proximity of the site with increased concentrations of nitrogen oxides (NOx), thereby impacting offsite functional habitat. Such increases may directly interfere with site improvement plans to control, reduce and ameliorate atmospheric nitrogen impacts.

4.4.8 Increased nitrogen can lead to increased fertility leading to changes in plant community, including a reduction in heather species and an increased dominance of grasses. The Air Pollution Information System estimates that the current critical loading (i.e. over which effects of N deposition would start to occur) for saltmarsh is 20-30 kg N ha-1 year-1.

[3] Pollution prevention and control | Scottish Environment Protection Agency (SEPA)

[4] Institute of Air Quality Management, 2014, Guidance on the assessment of dust from demolition and construction. IAQM, London

[5] Technical Statement TS/AQ1, Association of British Ports (ABP), 2000

Recent guidance published by Natural England notes that designated sites within 200m of roads to be used as part of a plan or project need to be assessed for nitrogen loading[6].

Mitigation

4.4.9 Complete an air quality assessment of potential for N loading on sensitive habitats once details of plant and construction programme have been confirmed (e.g. using method outlined in DMRB Air Quality Appendix F).

4.4.10 Dust suppression measures including dampening and dust screens to be applied.

Non-native Invasive Species (INNS)

4.4.11 Working within wetlands where there is a risk of run-off poses a risk of spreading aquatic non-native invasive species, which will be avoided by implementing good practice biosecurity measures.

Mitigation

4.4.12 Best practice biosecurity measures, as recommended by the GB Non-Native Species Secretariat[7] would guard against any potential for spreading invasive species as a result of construction.

4.5 Assessment: Operation

Pathways

4.5.1 The net effect of the scheme operation would be to reduce non-saline inputs to Milton Creek from Sittingbourne WwTW by ~7.5Mld; discharges from the WwTW are likely to form a significant component of the non-saline flows in this creek (the permitted discharge of recycled water is ~118Ml/d) and the volumes recovered through recycling will typically be proportion of this (note, a proportion of this water would still enter the Swale via the paper mill post-process discharge, although the paper-making process will to some extent be consumptive). However, the average measured Q80 DWF (i.e. lowest flows) from the WwTW over three year period 2019 to 2021 has been ~13.4Ml/d, which would suggest that the option would utilise a relatively large proportion of the flows that would otherwise be discharged to the Milton Creek when flows through the WwTW (and hence Milton Creek) are at their lowest. However, it must be noted that the entire creek is inundated on each tidal cycle, and so the influence of non-saline flows on creek habitats will be moderated by this.

[6] NE Internal Guidance – Approach to Advising Competent Authorities on Road Traffic Emissions and HRAs V1.4 Final - June 2018

[7] Non Native Species - National Biodiversity Network (nbn.org.uk)

4.5.2 The principal issues for The Swale SPA/Ramsar are the potential effects on Milton Creek as 'functional habitat'; and the small reduction in non-saline inputs to The Swale via Milton Creek (hence possible minor changes in biotopes at the mouth of the creek where it enters the Swale). Although the reduction of effluent input could impact on the mudflats locally, it should be noted that the Milton Creek is strongly influenced by tidal processes.

Effects on Milton Creek and Functional Habitat

Effluent discharges and foraging

4.5.3 The upper and middle reaches of the Milton Creek are outside the boundaries of the SPA, but could serve as functional habitat for foraging. Priority mapping indicate that the Sittingbourne outfall in the Milton Creek is associated with mudflat habitats. The food available directly from sewage and industrial discharges and the changes in invertebrate densities resultant from organic inputs, may have an influence on the populations of waterbirds that the local coastal areas are able to support.

4.5.4 A number of species may feed directly on waste matter released in the discharge[8]. Ravenscroft (1998) studied the association between wintering waterbirds and freshwater inputs on the mudflats of East Anglian estuaries. Inputs included natural flows from streams and ditches as well as discharges from storm-drains and pipes[9]. The study found a positive relationship between most waders and the rate of discharge of flows into some estuaries. These associations were attributed to the increased nutrient and freshwater flow into the mudflat.

4.5.5 Close to outfalls, the extreme levels of nutrient and organic enrichment cause sediments to become deoxygenated and unsuitable for most benthic invertebrates.

4.5.6 It is assumed that the discharge of wastewater from the recovery process will be within the existing permitting / compliance requirements for the WwTW discharges (this is technologically possible), and/or that amended discharge consents will be approved by the EA (i.e. the quality of discharges from the WwTW will not decrease as a direct result of the option). The recovery process may result in increased concentrations of some determinands in the discharges, although the total load released to the Milton Creek will remain the same. Nutrient neutrality has not been identified by NE as an issue or requirement for The Swale sites. This aspect requires confirmation, but on this basis substantive effects on the habitats of the Milton Creek through changes in water quality from effluent discharges would not be expected.

[8] NHK, Maskell JM, Armitage MJS, Hutchings CJ and Rehfisch MM, 2001, Effects of Reductions in Organic and Nutrient Loading on Bird Populations in Estuaries and Coastal Waters of England and Wales. British Trust for Ornithology. Interim Report

[9] Ravenscroft, N.O.M., 1998, Associations of Wintering Waterfowl with Freshwater on the Mudflats of East Anglian Estuaries. Report to The Environment Agency, English Nature & Suffolk Wildlife Trust.

Estuarine birds and freshwater flows

4.5.7 Several studies have suggested that the number and densities of wintering waterbirds around estuarine freshwater channels are consistently greater than across associated mudflats, and that several bird species show significant preferences for freshwater flow areas over mudflats (e.g. Ravenscroft et al. (1997), Ravenscroft (1998, 1999), Ravenscroft & Beardall (2002) & Ravenscroft & Emes (2004)), although other studies have indicated that deeply incised channels associated with large volume inflows are less attractive to birds (Ravenscroft & Beardall, 2002).

4.5.8 There are a number of possible mechanisms for this. Correlations between freshwater flow and particle size (e.g. Ravenscroft & Emes (2004)), and substrate particle size distribution and invertebrate distribution have been recognised (e.g. Goss-Custard et al. (1991), Colwell and Landrum (1993), Yates et al. (1993)). Freshwater flow, salinity and invertebrate distribution have also been correlated (Kelly (2001)).

4.5.9 These physical relationships between invertebrate distributions and freshwater flows are important since there are numerous studies detailing relationships between overwintering waterbirds and the densities or distributions of their invertebrate prey (e.g. Goss-Custard et al. (1991), Colwell (1993), Colwell and Landrum (1993), Yates et al. (1993), Dierschke et al. (1999), Ravenscroft et al. (2002, 2004). Associations between bird densities and particle size (Granadeiro et al. 2004) have also been recognised.

4.5.10 Possible relationships between birds and freshwater flows were investigated in detail through a series of studies in The Swale SPA/Ramsar and the Medway Estuary and Marshes SPA/Ramsar (RPS 2004a, 2004b, 2004c, 2005a; Humpheryes & Kellett 2003). These studies found few consistent patterns, however; for example:

- Whilst the general relationship of birds and creek corridors (rather than channels) was usually replicated between watercourses and embayments, the species assemblage was variable between creeks and years, suggesting that creek-specific variables may be less important for determining the community composition than environmental or community processes operating in the wider estuary or beyond. Most species (67%) displayed no, or a negative, association with creeks (70% when feeding behaviour only was considered).
- Latitudinal relationships between creeks and invertebrates were inconsistent, with only a slight tendency for invertebrate biomass to be higher within the creek corridor than the channel or surrounding mudflats.
- Significant decreases in invertebrate abundance and biomass down longitudinal gradients (potentially related to greater exposure to tidal processes) were recorded, although bird numbers showed the opposite (i.e. greater numbers towards the sea), perhaps reflecting greater foraging accessibility due to interstitial water, or less disturbance.

4.5.11 Furthermore, no significant differences in the usage of creeks by birds were recorded between freshwater creeks and those that were predominantly saline.

4.5.12 A broad consensus position appears to be that it is not freshwater flow volumes *per se* that are critical to the bird / intertidal channel relationship, rather the presence of some flows within channels to maintain morphology, and that bird distributions are often influenced instead by estuary-wide factors (e.g. changes in disturbance levels, reductions in bird populations altering estuary usage, proximity of roost sites), local factors (e.g. the role of creek morphology or substrate penetrability) and small-scale interactions (e.g. inter and intra-specific bird relationships, or prey availability associated with behavioural or physiological responses to intertidal exposure).

4.5.13 Sittingbourne is drained by soakaways that collect surface water and discharge into the ground and surface water sewers that collect surface water and convey it towards Milton Creek, and so non-saline inputs from the WwTW will only be a proportion of the non-saline (low tide flows) within the creek. Furthermore, Milton Creek is dominated by the tidal influx, with the entire creek inundated in each cycle.

4.5.14 Consequently, whilst the reduction in non-saline discharges to Milton Creek may result in minor local alterations to the benthic communities, the low exposure and sensitivity of the qualifying features to these changes will ensure that adverse effects on the site integrity would not be expected (although residual uncertainties will need to be explored prior to project delivery).

Value as functional habitat

4.5.15 The value of the Milton Creek as functional habitat[10] for the bird populations associated with the Swale cannot be precisely determined without field investigations. It is certain that individual birds associated with the SPA/Ramsar will periodically utilise the creek habitats, although the characteristics of the creek (including the urbanised nature of much of the surrounding area, the topography, and the relative proximity of the shoreline to all parts of the creek) will ensure that it is of somewhat limited value for most of the bird interest features associated with the SPA/Ramsar, and it is very unlikely that significant aggregations of bird interest features will be reliant on the creek (such that potentially significant numbers of birds might be exposed to the consequences of the changes in water quality and non-saline discharges that are anticipated (which are expected to be small), sufficient for this to then affect the integrity of the SPA/Ramsar populations).

[10] Functional linkage defined here as '*the role or 'function' that land or sea beyond the boundary of a European site might fulfil in terms of supporting the populations for which the site was designated or classified. Such an area of land or sea is therefore 'linked' to the site in question because it provides a (potentially important) role in maintaining or restoring a protected population at favourable conservation status*' see Natural England Commissioned Report NECR207.

4.6 In combination effects

Other WRMP options

4.6.1 The potential for these European sites to be affected by two or more WRMP options (either options within the SWS rdWRMP, or options in the rdWRMPs of neighbouring water companies) is set out in Appendix F and Appendix G.

4.6.2 In summary the principal in combination risk relates to effects with:

- Isle of Sheppey Desalination.

4.6.3 Environmental changes associated with the operation of this option and the Desalination: Isle of Sheppey option are expected to be highly localised. Although there are residual uncertainties that cannot be fully assessed at the WRMP level with the available data, it is considered that mitigation options are available that can reliably be applied through scheme detailed design (e.g. location of outfalls).

Other Water Company Plans

Drought Plans

4.6.4 The Drought Plan will be revised several times before this WRMP option is implemented, and following option delivery, and so a meaningful in combination assessment arguably cannot be undertaken at this point. Furthermore, a future Drought Plan will necessarily reflect the abstraction baseline at that point (i.e. it will account for options implemented at that point in time) and be subject to HRA when revised, which provides a mechanism to ensure that in combination effects do not occur.

4.6.5 There is a Drought Option at Faversham; this option will not interact to affect the same areas of this site, and the operational effects of the IoS Desalination option on the Swale are expected to be effectively nil. The DP HRA concludes no AE for the Faversham sources option, although it is recognised that there are uncertainties in the North Kent Groundwater Model which are being resolved through WINEP (note, this in. However, given the short-term nature of the drought option impacts adverse effects in combination are not expected. Conclusion: No AE in combination

Drainage and Wastewater Management Plans

4.6.6 The interaction of the WRMP options with specific schemes derived from the emerging Drainage and Wastewater Management Plan (DWMP) can only be assessed at the project level due to the generic nature of the DWMP options.

Minor projects

4.6.7 It has not been possible to produce a definitive list of existing (minor) planning applications near this option's zone of influence, and generating a list at this stage would be of little value given the lead times for the option. It is possible that there will be 'in

combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the ACWG guidance on cumulative/in combination assessments.

Major Projects

4.6.8 Reference has been made to the Planning Inspectorate's National Infrastructure Projects website[11] which includes major projects.

4.6.9 A review of that status of major projects that are located within or in close proximity to this European site has been undertaken to assess the potential for in-combination effect with this option. The following summarises the findings of this review:

- Cleve Hill Solar Park (approximately 2 km north-east of Faversham and 5 km west of Whitstable on the North Kent Coast) – the DCO was granted in May 2020. For The Swale SPA and Ramsar site, the Secretary of State's HRA concludes that, subject to the mitigation secured in the DCO, the effects of the project, either alone or in-combination with other plans and projects, would not lead to an adverse effect on the integrity of the sites.

  According to the developer's website, construction of the Cleve Hill Solar Park was scheduled to commence in summer 2022. Consequently, there is no potential for the construction phase to coincide with the construction of the desalination plant. The Secretary of State's HRA for the Cleve Hill Solar Park concludes that the only pathway for effect during the operational phase is 'loss/change in habitats' for the breeding and non-breeding bird species and the overall assemblage of the SPA and Ramsar site, and this effect could be effectively mitigated, with no adverse effect on integrity predicted.

- Kemsley Paper Mill (K4) Combined Heat and Power Plant (located on land within the boundary of the Kemsley Paper Mill, near Sittingbourne in Kent) – a DCO for the project was granted in July 2019. The Secretary of State's HRA concludes that the project is likely to have a significant effect on the Swale SPA and Ramsar site when considered alone and in-combination with other plans or projects and that appropriate assessment was required to determine if changes to water quality, increased levels of dust during construction and increased disturbance during construction will have an adverse effect on these sites.

  Based on the Secretary of State's HRA, it appears that the issues were largely related to the construction phase, and could be effectively mitigated. Water quality effects were relevant to the construction and operational phases, but could be effectively mitigated through appropriate drainage, treatment, bunding of chemical storage and neutralising and treating process water. As a result, the HRA concludes that adverse effect on integrity of the sites can be excluded.

- Wheelabrator Kemsley Generating Station (K3) and Wheelabrator Kemsley North (WKN) Waste to Energy Facility (a power upgrade and increase in tonnage throughput

[11] https://infrastructure.planninginspectorate.gov.uk/projects/

to the existing Kemsley Generating Station and a new waste to energy facility, located adjacent to and immediately north-east of the Kemsley Paper Mill, in Kemsley, Sittingbourne, Kent) – a DCO was granted to Wheelabrator Kemsley K3 Generating Station only in February 2021. Wheelabrator Kemsley North Waste to Energy Facility was not granted development consent.

The Secretary of State's HRA concludes that LSE cannot be excluded for the Swale SPA and Ramsar site. However, no LSE during construction was concluded for the K3 development, with all likely significant construction effects limited to the Waste to Energy Facility for which development consent was refused. The LSE during operation was limited to noise and visual disturbance and changes to water quality, and both effect pathways can be effectively mitigated, resulting in a conclusion of no adverse effect in integrity.

4.6.10 Given the nature, location, current status of the environmental information and/or conclusion of the Secretary of State's HRA relating to the major projects reviewed above, it can be concluded that there is either no realistic potential for in-combination effects with the proposed option, or the environmental assessment of the major projects is not sufficiently advanced to enable in-combination assessment to be undertaken.

4.7 Conclusion: The Swale SPA/Ramsar

4.7.1 The principal issues for The Swale SPA/Ramsar are the potential effects on Milton Creek as potential 'functional habitat'; and the small reduction in non-saline inputs to The Swale via Milton Creek (note, all potential construction effects can be avoided with established measures).

4.7.2 With regard to functional habitat, Milton Creek is highly unlikely to represent functionally linked habitat. It is of low value in this regard as (a) it is a constrained creek / channel in a high-disturbance urban / industrial area that will inherently have a low attractiveness for the qualifying features (assuming there are no dominating non-natural attractants) and (b) is substantially lower value than the extensive areas of equivalent mud-flat and creek habitat available in the SPA/Ramsar; it is therefore very unlikely that the creek is critical to the functional integrity of the site, and environmental changes in this location would not be expected to adversely affect these sites.

4.7.3 With regard to effects on habitats in The Swale itself, the possibility of localised and minor changes to the invertebrate fauna as a result of reductions in non-saline inputs around the confluence with Milton Creek cannot be excluded; however, the reduction of ~7.5Ml/d will be small relative to the inputs from the creek (from the WwTW and surface water catchment in Sittingbourne), and likely inconsequential in relation to the tidal turnover and dominance of saline inputs in the Swale; furthermore, any minor and localised shifts in biotope would not fundamentally alter the value of the area to the qualifying features; however, aspects of this can only be confirmed with the benefit of project-level survey and modelling, hence minor residual uncertainties remain.

4.7.4 In light of the predicted effect of this option both alone and in-combination with other plans and projects, it is considered that there is sufficient confidence that appropriate

mitigation measures are available at the project level and can be implemented to enable a conclusion of no adverse effect on the integrity of the Swale SPA/Ramsar to be drawn for the WRMP HRA. There are residual uncertainties that can only be explored through project-level investigations and addressed through mitigation at the project level.

Appendix E11:

Recycling (HSE): Recharge of Havant Thicket from recycled water from Portsmouth Water (60Ml/d)

1. Option Summary

1.1 Summary of Option Components

1.1.1 This option comprises the construction, operation, and maintenance of the following components:

- A proposed Water Recycling Plant (WRP) in the vicinity of Portsmouth Water Wastewater Treatment Works (WTW) with an initial first phase peak output of approximately 20 Ml/d and a second phase peak output of approximately 40 Ml/d. Following the completion of both phases the total WRP peak output would be approximately 60 Ml/d. There will be three pumping stations at the WRP site including the High Lift Pumping Station (HLPS).
- Proposed underground pipelines between Portsmouth Water WTW and the WRP to accommodate approximately 60Ml/d peak transfer volumes in each direction.
- A proposed underground pipeline to transfer at peak operation approximately 60Ml/d of recycled water from the WRP to Havant Thicket Reservoir. The underground pipeline will either be located within a single tunnel from the WRP to Havant Thicket Reservoir, or within two separate tunnels from the WRP to Havant Thicket Reservoir with a connection at Bedhampton Springs.
- Proposed underground pipeline from Havant Thicket Reservoir to Lower Itchen WSW via the HLPS to transfer approximately 90Ml/d during peak operation (i.e. during severe drought conditions). The underground pipeline from Havant Thicket Reservoir to the HLPS (located at the WRP) will either be located within a single tunnel from Havant Thicket Reservoir to the HLPS, or within two separate tunnels from Havant Thicket Reservoir to the HLPS with a connection at Bedhampton Springs.
- Additional above ground plant, including second stage intermediate pumping stations (Intermediate Pumping Stations) and break pressure tanks (BPT) located along the underground water transfer pipeline between Havant Thicket Reservoir and Lower Itchen WSW.

1.1.2 The option will also comprise:

- Use of the Havant Thicket Reservoir for the storage of recycled water.
- Use of the Eastney Tunnel, Eastney Pumping Station (PS) and Eastney Long Sea Outfall (LSO) for the release of reject water, but to which no physical works are proposed.

1.1.3 The location of the components described above is shown in Figure 1.1.

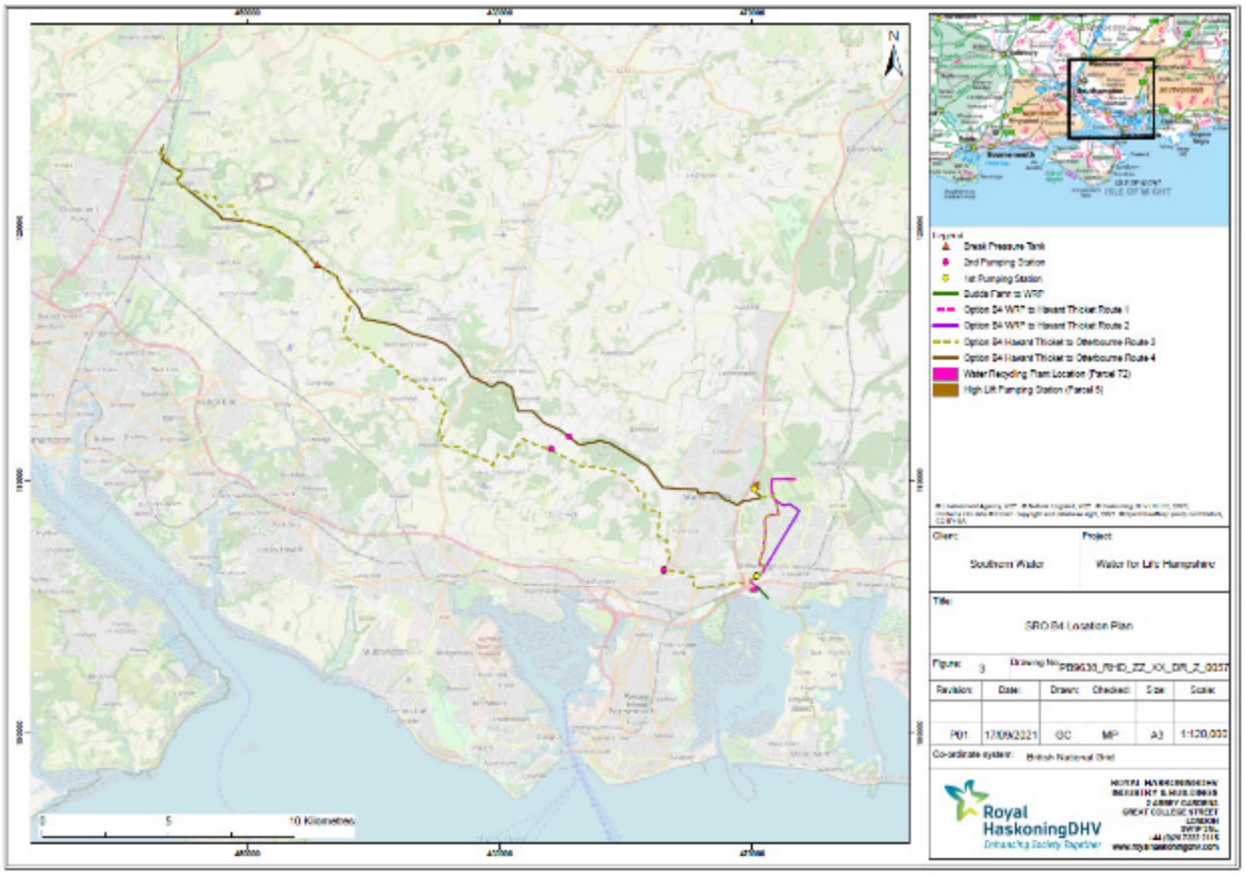

Figure 1.1 Option Component Location Plan

1.2 Summary of Construction

Water Recycling Plant

1.2.1 The proposed WRP is anticipated to occupy a site of approximately 2.5ha. The site of the proposed WRP is a former domestic landfill site, and the wider area is typified by light industrial units, as well as commercial and office space using steel framed construction.

1.2.2 Construction of the proposed WRP is likely to involve laying reinforced concrete slabs, founded on piled foundations. Given that the piled foundations will be within land which was previously a domestic landfill, particular requirements for piling will be informed by an assessment of ground conditions and will need to ensure that the integrity of the landfill is not affected. Piled foundations which breach the landfill capping and lining are assumed to be cast in situ. This method will ensure a seal is formed between the pile and capping / lining to prevent leachate.

1.2.3 Constructing the proposed WRP is expected to consist of the construction of pumping stations, a main process building, kiosks for control equipment, administration buildings and parking facilities. Several large holding tanks and chemical storage units would be required for operation of the proposed WRP. These are expected to be placed above ground and would be pre-cast concrete tanks or glass fused to steel construction.

Pipeline Construction Techniques

1.2.4 There are a number of techniques that are expected to be used for constructing the proposed pipeline:

- Trenched open-cut method: It is anticipated that the installation of the majority of the proposed pipeline will be constructed using open-cut excavation in open areas such as fields. This involves digging a trench and laying the pipeline within the trench. The trench is then backfilled, recycling as much of the excavated material as possible. A typical working area for this method is anticipated to be approximately 40m wide which allows for sufficient space for digging the trench, storing the pipeline and other equipment alongside the trench before installation, and storing excavated soil during installation. The working width will also include the temporary construction traffic haul route needed to construct the proposed pipeline.
- Trenchless methods: For some sections of the proposed pipeline route there will be crossings that will not be generally suited to open cut excavation. Examples of these could be roads, railways, Main Rivers and other sensitive watercourses, sensitive environmental areas and other areas where construction could be restricted. Trenchless methods that could be used include tunnelling, horizontal directional drilling, and microtunnelling.

Above Ground Plant

1.2.5 The main above ground plant will be constructed as follows:

- Intermediate Pumping Stations: Depending on the topography of the sites associated with each IPS location, the ground may have to be levelled or terraced to accommodate all the components required for each IPS. In doing this, the aim would be to undertake a cut and fill operation, where site won material from the cut exercise would balance the fill, to ensure any waste generated is minimised. Once the levels are correct the foundations for the main structures will be installed which is envisaged to be piled foundations for the main structures with simple strip of pad foundations for the ancillary structures. Particular requirements for piling will be informed by an assessment of ground conditions at each location.
- Break Pressure Tanks: Depending on the topography of the sites associates with each BPT location, the ground may have to be levelled to accommodate the tank and all ancillaries. In doing this, the aim would be to undertake a cut and fill operation, where site won material from the cut exercise would balance the fill so no waste will be generated. Once the level of the site is as required, the foundations for the tank and

main structures will be installed. This is anticipated to be piled foundations with simple strip or pad foundations for the ancillary structures.

- High Lift Pumping Station: The proposed HLPS is expected to be located at the site of the proposed WRP and therefore the construction methodology for the proposed HLPS is anticipated to be similar as that of the proposed WRP. Construction of the WRP is likely to involve laying reinforced concrete slabs which will be founded on piled foundations. Given that the piled foundations will be within land which was previously a domestic landfill, particular requirements for piling will be needed to ensure that the integrity of the landfill is not affected. Piled foundations which breach the landfill capping and lining are assumed to be cast in situ. This method will ensure a seal is formed between the pile and capping / lining to prevent leachate.

1.3 Operation of Option

1.3.1 This option is designed to optimise the usage of the Havant Thicket raw water source through introducing pipeline connectivity with Lower Itchen WSW. Final effluent (FE) from Portsmouth Water WTW would be treated using Reverse Osmosis (RO) technology at a new WRP located near Portsmouth Water. The WRP would discharge recycled water via a connecting pipeline and pumping station to Havant Thicket Reservoir. Recycled water would be mixed in the reservoir with Spring source water prior to abstraction and transferred to Lower Itchen WSW.

1.3.2 The WRP would house a multi-barrier treatment process plant comprising Microfiltration Reverse Osmosis (MF-RO) membranes and disinfection using an Ultra Violet Advanced Oxidation Process (UV-AOP) prior to remineralisation and transfer to an environmental buffer (i.e. Havant Thicket Reservoir). MF backwash waste will be blended with RO concentrate and discharged to Portsmouth Water WTW.

1.3.3 A pumping station, located adjacent to the final effluent channel at Portsmouth Water, would receive flow under gravity from a new offtake from the FE channel and pump it to the WRP via a rising main installed under Langstone Harbour. To discharge waste flows to the Eastney LSO, a pumping station located on the WRP site would pump a combined waste stream from the MF Reject /RO Concentrate buffer tank via a rising main to discharge into the existing Eastney Tunnel shaft located at Portsmouth Water. The design would not allow any discharges to Langstone Harbour under operating or storm conditions.

1.3.4 Incoming flows from Portsmouth Water would discharge into above ground buffer tanks, and these would feed the main process train, which is predominantly located inside a building. Flows will be conveyed from south to north, with clear water tanks providing holding volume before being pumped to Lower Itchen. Liquid chemical storage would be located on the west face of the building, ensuring segregation of incompatible chemicals and appropriate delivery bunding. CO_2 and lime would be stored in the north-east corner of the site to suit the process flow.

1.3.5 Because the RO process reduces pH significantly and strips the water of its mineral content, remineralisation is also required to stabilise the water prior to transfer to Havant Thicket Reservoir.

1.3.6 The WRP includes several liquid waste streams that require disposal. MF reject water would be blended with RO concentrate and pumped to the Solent via the Eastney LSO outfall. The WRP will also produce the following waste flows:

- Following quenching of any residual chlorine with sodium bisulphate, the RO system brine will be blended with MF backwash waste and discharged to the Solent via Eastney LSO.
- Minor waste flows such as compressor cooling water, sample drains, and trench/slab drains would be discharged to the sanitary sewer.
- Chemical sumps will be tankered off site in the event of a chemical spill.

2. HRA Screening – Identifying Pathway for Effect

2.1.1 The principal components of this option, including details of construction, are discussed in Section 1.1 and Section 1.2.

2.1.2 Table 2.1 outlines the potential effects as a result of this option. The LSE screening exercise is presented in Section 3.

Table 2.1 Potential Effect Pathways during Construction and Operation

Effect Category	Construction Effects	Operational Effects
Subtidal	N/A	Indirect effects: • Changes to water quality
Terrestrial	Direct habitat loss if located within a European site Indirect effects: • Temporary disturbance due to noise, vibration, human activity and light • Temporary changes to air quality • Changes to ground water and surface water • Introduction of INNS • Barrier to species migration	Direct long term habitat loss if located within a European site Indirect effects: • Disturbance due to noise, vibration, human activity and light • Changes to air quality
Ornithological	Direct habitat loss if located within a European site Indirect effects: • Temporary disturbance due to noise, vibration, human activity and light • Change in supporting habitat quality due to release in sediment during river crossing construction • Barrier to species migration/movement • Changes to prey resource • Changes to air quality	Direct habitat loss if located within a European site Indirect effects: • Disturbance due to noise, vibration, human activity and light • Barrier to species migration/movement
Freshwater	Direct habitat loss if located within a European site Direct disturbance of surface water habitats resulting from watercourse crossings and associated temporary works Indirect effects: • Temporary disturbance of freshwater habitats during construction due to noise, vibration and other human activity resulting from construction activities near freshwater receptors, including the supply of fine sediment from excavations • Changes in water quality • Introduction of INNS	Connectivity with subtidal effects for migratory species Changes to water quality due to potential emergency overflow from Havant Thicket Reservoir

Effect Category	Construction Effects	Operational Effects
	• Barrier to species migration due to watercourse crossings and associated temporary works	

2.1.3 Table 2.2 identifies the European sites for consideration in the LSE Screening exercise. These sites have a potential pathway for effect due to this option, based on the qualifying features of the sites and the potential zone of influence.

Table 2.2 European sites in the vicinity, with summary of the potential pathway for effect due to this option

Sites	Qualifying Features	Potential Pathway for Effect	Summary
Briddlesford Copse SAC	Bechstein's bat *Myotis bechsteinii*	No	Briddlesford Copse SAC is located on the Isle of Wight at Wootton Bridge. There are no pathways for an impact to occur based on the supporting habitat buffers for the SAC which indicate that the Bechstein's bat feature of the SAC do not forage this far afield and therefore there is no pathway for LSE upon the bat population or any other supporting habitats associated with the SAC.
Butser Hill SAC	*Taxus baccata* woods of the British Isles (Yew-dominated woodland)(priority habitat) Semi-natural dry grasslands and scrubland facies: on calcareous substrates (*Festuco Brometalia*) (Dry grasslands and scrublands on chalk or limestone)	Yes	The option is sufficiently distant, with the urban areas of Waterlooville and Horndean in between, and the SAC does not support groundwater features. As such, no pathway for effect is identified from the option infrastructure. However, air quality effects are screened in due to the SAC being adjacent to the A3, which could be used for some construction traffic.
Woolmer Forest SAC	Depressions on peat substrates of the *Rhynchosporion* European dry heaths Natural dystrophic lakes and ponds (Acid peat-stained lakes and ponds) Northern Atlantic wet heaths with *Erica tetralix* (Wet heathland with crossleaved heath) Transition mires and quaking bogs (Very wet mires often identified by an unstable 'quaking' surface)	Yes	The option is sufficiently distant with the urban areas of Waterlooville and Horndean in between, and does not support groundwater features. As such, no pathway for effect is identified from the option infrastructure. However, air quality effects are screened in due to the SAC being adjacent to the A3, which could be used for some construction traffic.

Sites	Qualifying Features	Potential Pathway for Effect	Summary
Kingley Vale SAC	*Taxus baccata* woods of the British Isles (Yew-dominated woodland) (priority habitat) Semi-natural dry grasslands and scrubland facies: on calcareous substrates (*Festuco Brometalia*).	No	The SAC is situated 10.9km to the north-east of the proposed pipeline routes. As such, no pathway for effect is identified from the option infrastructure and the SAC is not located within 200m of any roads likely to be affected by construction traffic.
Emer Bog SAC	Transition mires and quaking bogs	No	Emer Bog SAC is located 6.4km to the west of Lower Itchen WTW, and to the west of the River Itchen and Eastleigh and Chandlers Littlehampton urban areas. At this distance, no impacts from construction will occur. The proposed pipeline will be sufficiently distant and separated by significant areas of urban development from the SAC and its associated groundwater and surface water buffer zones (shown in Emer Bog and Baddesley Common Hydrological Desk Study 2017; accessed via the Test Valley Borough Council website) such that there is no pathway for LSE. The SAC is not situated within 200m of any roads likely to be utilised by construction traffic for the works.
Mottisfont Bats SAC	Barbastelle *Barbastella barbastellus*	No	The works at, and in proximity to Lower Itchen WSW are approximately 15km from the SAC and outside the 6km buffer zone identified for the SAC based on foraging and commuting distance of the bats (BCT, 2020). Therefore, there is no pathway for effect.

Sites	Qualifying Features	Potential Pathway for Effect	Summary
River Itchen SAC	Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation (Rivers with floating vegetation often dominated by water-crowfoot) Atlantic salmon *Salmo salar* Brook lamprey *Lampetra planeri* Bullhead *Cottus gobio* Otter *Lutra lutra* Southern damselfly *Coenagrion mercurial* White-clawed (or Atlantic stream) crayfish *Austropotamobius pallipes*	Yes	Construction of the transfer pipeline from WRP to the Lower Itchen WSW has the potential to impact water quality and habitats as a result of watercourse crossings, construction traffic, mobilisation of sediments from haul roads, open-cut excavations, pumping operations, and potential washout events. The pipeline is required to cross the river and as such a pathway for effect is screened in. The discharge for water recycling is a substantial distance from the mouth of the compensatory SAC habitat and therefore there is no pathway for the localised effect of discharge on subtidal water quality to interact with the River Itchen.

Sites	Qualifying Features	Potential Pathway for Effect	Summary
River Test Compensatory SAC Habitat (River Meon)	Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation. (Rivers with floating vegetation often dominated by water-crowfoot) Atlantic salmon *Salmo salar*	Yes	While the River Meon is not a designated site, it forms part of the River Test Compensatory SAC Habitat for adverse effects on the integrity of Atlantic salmon from other schemes (e.g. the Lower Itchen Sources Drought Order). In order to maintain the effectiveness of the River Meon compensatory measures in maintaining the overall coherence of the Habitats site network, it is important to assess the effects on Atlantic salmon using the river. The pipeline is required to cross the river and as such a pathway for effect is screened in. The discharge for water recycling is approximately 16km from the mouth of the compensatory SAC habitat and therefore there is no pathway for the localised effect of discharge on subtidal water quality to interact with the River Meon.
River Test Compensatory SAC Habitat (River Test)	Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation. (Rivers with floating vegetation often dominated by water-crowfoot) Southern damselfly *Coenagrion mercurial*	No	The River Test is approximately 13.5km from the onshore works for the option, in a different hydrological catchment and separated by major roads, railway and housing. As a result, there is no pathway for effect on the compensatory habitat for damselfly and chalk river.

Sites	Qualifying Features	Potential Pathway for Effect	Summary
Singleton and Cocking Tunnels SAC	Barbastelle *Barbastella barbastellus* Bechstein's bat *Myotis bechsteinii*	No	The works and pipeline routes are 18.7km from the SAC. The SACO references the Sussex Bat Special Area of Conservation Planning and Landscape Scale Enhancement Protocol (South Downs National Park & Natural England, 2015) which has identified key flight lines and foraging areas for the bat species. The following impact zones are recommended around the SAC: • 6.5km key conservation area –all impacts assessed. • 12km wider conservation area –significant impacts or severance to flight lines to be considered. The proposed works are outside the wider conservation area, and the pipelines have been routed to avoid removal of ancient woodland and woodland priority habitat where possible. In addition, the presence of the major A3(M) road network is likely to hinder movement from east to west. A core sustenance zone (CSZ) (BCT, 2020), as applied to bats, refers to the area surrounding a communal bat roost within which habitat availability and quality will have a significant influence on the resilience and conservation status of the colony using the roost. The CSZ for Bechstein's bat is 3km and for Barbastelle is 6km. There will be no overlap between the CSZ for either species and the wider conservation area and therefore no indirect impact to either of the qualifying species. As such, no pathway for effect is identified.

Sites	Qualifying Features	Potential Pathway for Effect	Summary
Solent and Isle of Wight Lagoons SAC	Coastal lagoons (*Priority feature*)	Yes	The WRP is located 2.2km from the SAC and has been identified to have the potential to impact the coastal lagoons designated feature. Changes in water quality due to the construction of the pipeline from Portsmouth Water crosses a tributary in proximity to the lagoon at Farlington Marshes. Farlington Marshes is part of the Solent and Isle of Wight Lagoons SAC and comprises the Shut Lake waterbody. Potential run-off of sediment and contaminants, has potential to cause changes to water quality within the SAC. There is currently insufficient information to rule out an AEoI at this stage. In-combination with the following projects are screened in as having potential to interact with receptors of relevance to this SAC: • Aquind Interconnector • Portsmouth coastal defence • Portsmouth Water Farlington Water Treatment Works • Havant Thicket reservoir • Fawley Waterside

Sites	Qualifying Features	Potential Pathway for Effect	Summary
Solent Maritime SAC	Annual vegetation of drift lines Atlantic salt meadows (*Glauco Puccinellietalia maritimae*) Coastal lagoons* Spartina swards (*Spartinion maritimae*) (Cord-grass swards) Estuaries Mudflats and sandflats not covered by seawater at low tide (Intertidal mudflats and sandflats) Perennial vegetation of stony banks (Coastal shingle vegetation outside the reach of waves) *Salicornia* and other annuals colonising mud and sand (Glasswort and other annuals colonising mud and sand) Sandbanks which are slightly covered by sea water all the time (Subtidal sandbanks) Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) (Shifting dunes with marram) Desmoulin's whorl snail *Vertigo moulinsiana*	Yes	The WRP is located 5km from the SAC and the pipeline would be required to cross the River Hamble which runs into the SAC. Therefore, a pathway for potential effect is identified.

Sites	Qualifying Features	Potential Pathway for Effect	Summary
Solent and Dorset Coast SPA	Mediterranean gull *Larus melanocephalus* Sandwich tern *Sterna sandvicensis* Common tern *Sterna hirundo* Little tern *Sternula albifrons* Roseate tern *Sterna dougalli* Dark-bellied brent geese *Branta bernicla bernicla* Teal *Anas crecca* Ringed plover *Charadrius hiaticula* Black-tailed godwit *Limosa limosa*	Yes	The option is located approximately 2km from the SPA. Therefore, a pathway for potential effect is identified through indirect construction impacts to the ornithological features.

Chichester and Langstone Harbours SPA & Ramsar site	Bar-tailed godwit *Limosa lapponica* Common tern *Sterna hirundo* Curlew *Numenius arquata* Dark-bellied brent goose *Branta bernicla bernicla* Dunlin *Calidris alpina alpina* Grey plover *Pluvialis squatarola* Little tern *Sternula albifrons* Pintail *Anas acuta* Red-breasted merganser *Mergus serrator* Redshank *Tringa totanus* Ringed plover *Charadrius hiaticula* Sanderling *Calidris alba* Sandwich tern *Thalasseus sandvicensis* Shelduck *Tadorna tadorna* Shoveler *Spatula clypeata* Teal *Anas crecca* Turnstone *Arenaria interpres* Waterbird assemblage	Yes	The option is located close to the SPA and Ramsar site. Therefore, a pathway for potential effect is identified. All of the ornithological features of the sites, along with Criterion 5 and 6 are indirectly impacted by construction activity, these include: • Disturbance due to noise, vibration, human activity and light as the presence of people and construction activities also have the potential to affect the qualifying species and flight responses. • Temporary changes to water quality, as construction could result in potential sedimentation and accidental pollution into the watercourse and ultimately the SPA. • Changes to prey resource as a result of deoxygenation and changes in salinity. • In-combination effects with the following projects: o Aquind Interconnector o Portsmouth coastal defence o Portsmouth Water Farlington Water Treatment Works o Havant Thicket reservoir o Fawley Waterside No pathway is identified as a result of connectivity with subtidal water quality changes. The discharge for water recycling is approximately 9km from the SPA and Ramsar site and therefore there is no pathway for the localised effect of discharge on subtidal water quality to interact with the SPA and Ramsar site.

Sites	Qualifying Features	Potential Pathway for Effect	Summary
	Wigeon *Mareca penelope* The site qualifies as a Ramsar site under the following criteria: • Criterion 1 – Estuarine habitats • Criterion 5 – Assemblages of international importance and • Criterion 6 – species/populations occurring at levels of international importance including those listed above and black-tailed godwit *Limosa lapponica* (1.1% of the European/Northwest Africa population)		

Sites	Qualifying Features	Potential Pathway for Effect	Summary
Portsmouth Harbour SPA and Ramsar site	Black-tailed godwit *Limosa limosa islandica* Dark-bellied Brent goose *Branta bernicla bernicla* Dunlin *Calidris alpina alpina* Red-breasted merganser *Mergus serrator* The site qualifies as a Ramsar site under the following criteria: • Criterion 3. Presence of intertidal mudflat , saltmarsh and saline lagoons hosting nationally important species. • Criterion 6 – species/populations occurring at levels of international importance. Qualifying species/populations (as identified at designation): Species with peak counts in winter: Dark-bellied brent goose, *Branta bernicla* bernicla, 2105 individuals, representing an average of 2.1% of the GB population (5 year peak mean 1998/9-2002/3)	No	No pathway is identified due to the distance between the option and SPA/Ramsar site. There is unlikely to be disturbance from noise or visual impact at over 2km. No pathway for effect as a result of connectivity with subtidal water quality changes is identified. The discharge for water recycling is approximately 6km from the SPA and Ramsar site and therefore there is no pathway for the localised effect of discharge on subtidal water quality to interact with the SPA and Ramsar.

Sites	Qualifying Features	Potential Pathway for Effect	Summary
Solent and Southampton Water SPA and Ramsar site	Black-tailed godwit *Limosa limosa islandica* Common tern *Sterna hirundo* Dark-bellied brent goose *Branta bernicla bernicla* Little tern *Sternula albifrons* Mediterranean gull *Ichthyaetus melanocephalus* Ringed plover *Charadrius hiaticula* Roseate tern *Sterna dougallii* Sandwich tern *Thalasseus sandvicensis* Teal *Anas crecca* Waterbird assemblage	No	No pathway is identified as a result of effects on these features or their supporting habitat due to the distance between the option and SPA/Ramsar site. There is unlikely to be disturbance from noise or visual impact at over 2km. No pathway for effect as a result of connectivity with subtidal water quality changes. The discharge for water recycling is approximately 4km from the SPA and Ramsar site and therefore there is no pathway for the localised effect of discharge on subtidal water quality to interact with the SPA and Ramsar site.

3. HRA Screening - LSE

3.1.1 For sites with a potential pathway for effect, this section considers the potential for LSE. At this stage, consideration is also given to whether in-combination effects could arise with other plans and projects.

3.1.2 The following planning portals were utilised to establish a list of other projects in the region of this option to identify those with potential to act in-combination with the option:

- Southampton: https://planningpublicaccess.southampton.gov.uk/online-applications/
- Portsmouth: https://publicaccess.portsmouth.gov.uk/onlineapplications/?_ga=2.58541859.848385095.1631882968-1128160480.1631882968
- Hampshire: https://planning.hants.gov.uk/
- West Sussex: https://www.westsussex.gov.uk/planning/find-a-planning-application/
- National Infrastructure Planning website.

3.1.3 Screening of in-combination effects comprises:

- developments consented and built but not yet operating;
- developments consented but not yet constructed (or completed); and
- developments in the consenting process but no decision made.

3.1.4 Only projects which are reasonably well described and sufficiently advanced to provide information on which to base a meaningful and robust assessment can be included in the in-combination assessment.

3.1.5 The approach to the in-combination assessment is as follows:

i. The list of developments within the planning process was reviewed to screen out any small-scale developments, such as works to a house, driveway, garage, change of use or construction of a small number of buildings. There will be no or negligible interaction with these types of development.

ii. All listed projects identified during step i and their spatial location were considered in relation to the zones of influence identified for each of the receptor groups based on expert judgement (see Table 3.1) to identify plans and projects with a potential pathway to interact with this option.

iii. Plans and projects identified as having a potential pathway for effect are considered in the LSE screening exercise.

3.1.6 As with the option alone assessment, the in-combination effects assessment takes a highly precautionary approach in order to provide conservative conclusions Projects screened into in-combination assessment are included in Table 3.2. Sandown WTW was also

considered for in-combination assessment but ultimately rejected due to insufficient information to assess environmental impacts as a result of the early stages of the development.

Table 3.1 Zones of Influence used in Screening Plans and Projects for Potential In-combination Effects

Effect	Zone of Influence
Direct habitat loss/disturbance	Within the same European site
Water quality changes	<1km from subtidal works or onshore works near a watercourse/ water body
Entrainment of migratory fish	Subject to potential migration route
Underwater noise	10km
Changes to air quality	1km
Disturbance from airborne noise and vibration	
Introduction of INNS	
Barrier effects	Factor of the effects outlined above, e.g. noise disturbance
Potential connectivity with terrestrial ecology and ornithology receptors	10km

Table 3.2 Summary of Projects Screened in to In-Combination Assessment

Project Name	Status	Description
AQUIND Interconnector	Awaiting decision (re-determination)	Development of AQUIND Interconnector with a nominal net capacity of 2000MW between Great Britain and France located off the coast of Portsmouth offshore and between Portsmouth and Lovedean substation onshore.
Portsmouth City Council Coastal Management Scheme	Granted	Flood and coastal erosion management scheme comprising a combination of encasing sections of the existing sea wall with enhanced stepped revetment, construction of a new vertical sea wall with stepped revetment, improvements to 2no. existing slipways, removal of 1no. existing slipway, reconstruction and raising of the existing coastal footpath, provision of additional seating and viewing areas, creation of an offshore bird island, and all associated works, compounds, removal of trees and landscaping.

Portsmouth Water Farlington Water Treatment Works	Granted	Construction of new water treatment building (to accommodate Dissolved Air Flotation plant). Relevant to the water recycling in-combination assessment only.
Havant Thicket Reservoir	Granted	Construction of a new reservoir and associated pipeline to Bedhampton pumping station. Once constructed, the new reservoir will form an integral part of the option, receiving water from the WRC for mixing with water from the Chalk aquifer.
Fawley Waterside	Granted	Redevelopment of Fawley power station to include 1,500 homes, public amenities, a marina and improved transport connectivity for recreation and commuting.

3.1.7 The results of the LSE screening are presented in Table 3.3.

Table 3.3 LSE Screening Summary

Designation	Site name	Screening result
SAC	Butser Hill	LSE
SAC	River Itchen	LSE
SAC	River Test Compensatory Habitat (River Meon)	LSE
SAC	Solent and Isle of Wight Lagoons	LSE
SAC	Solent Maritime	LSE
SAC	Woolmer Forest	LSE
SPA	Solent and Dorset Coast	LSE
SPA and Ramsar Site	Chichester and Langstone Harbours	LSE

4. High-level Appropriate Assessment

4.1.1 A high-level appropriate assessment for this option was set out in the Water for Life Hampshire: Gate 2 Submission Habitats Regulations Assessment (Royal HaskoningDHV, 2021). That assessment concludes that at present there is insufficient project-level information to rule out adverse effect on integrity on all qualifying features of all the European sites listed in Table 3.3. However, the high-level assessment identifies various mitigation measures for all European sites that can be applied for both construction and operational phase effects, and it can be reasonably assumed that such measures would be sufficient to enable a conclusion of no adverse effect on integrity.

5. References

Bat Conservation Trust (2020) Core Sustenance Zones and habitats of importance for designing Biodiversity Net Gain for bats. Bat Conservation Trust, London. https://cdn.bats.org.uk/uploads/pdf/Bat-Species-Core-Sustenance-Zones-and-Habitats-for-Biodiversity-Net-Gain.pdf?v=1596874016

Royal HaskoningDHV (2021). Habitats Regulations Assessment - Water for Life Hampshire: Gate 2 Submission. Report for Southern Water, ref. PB9638-RHD-06-XX-RP-Z-0041).

South Downs National Park & Natural England (2015) Sussex Bat Special Area of Conservation Planning and Landscape Scale Enhancement Protocol. https://www.southdowns.gov.uk/wp-content/uploads/2018/04/TLL-15-Draft-Sussex-Bat-SAC-Protocol.pdf

Southern Water (2021) Water for Life Hampshire Coastal Modelling –Desalination Reject Water Assessment. DRAFT

Appendix E12

Recycling: Recycling (IOW): Sandown WTW (8.5Ml/d)

1. Overview

1.1.1 The Recycling (IOW): Sandown WTW (8.5Ml/d) is a WRMP19 scheme due for implementation early in the next AMP period. It is included in the rdWRMP24 for completeness although it is already proceeding through the project-level investigation and delivery stage. It has therefore been subject to plan-level HRA previously (i.e. for WRMP19) but not a formal assessment of the project against Regulation 63 as part of any planning and / or licence applications, although the data for these assessments are being collected independently of the rdWRMP. As a result the HRA of the rdWRMP24 cannot bring any additional data to bear or insight into the anticipated effects over that presented in the WRMP19 HRA or which is currently being collected. This 'appropriate assessment' section therefore provides a short overview only, reflecting the current best understanding of the scheme and recognising that the project is proceeding through design and not strictly part of the decision-making process for rdWRMP24 (since this assumes that this WRMP19 option will be delivered).

1.1.2 Note that the HRA of WRMP19 concluded that the option would have 'no LSE' on any European sites.

2. Option Summary

2.1.1 This option proposes a new water recycling plant (WRP) on the Isle of Wight. It is proposed that the final effluent from Sandown wastewater treatment works (WwTW) is used as the source of water for the further treatment and recycling process at the WRP. The treated water would then be transferred to the eastern River Yar, upstream of the Sandown water supply works (WSW) abstraction at Alverstone (i.e. the recycled water would be effectively used on a 'put-and-take' basis in the Yar, and so impacts on flows (etc.) in the Yar downstream of the abstraction at Alverstone would not be expected.

2.1.2 Treated water in excess of the local demand will be transferred through a new transfer pipeline to the Alvington High Level water supply reservoir (WSR), near Newport, for supply to much of the Isle of Wight.

2.1.3 The reject water from the WRP will be discharged together with final effluent from the WwTW through the existing Sandown Long Sea Outfall (LSO) to the south-east of the Isle

of Wight. This will form a buoyant plume given its lower salinity levels than seawater, though will be slightly more saline that the current discharge. Overall, with the introduction of the WRP in the wastewater treatment system, there will be a reduction in volume of final effluent going through the LSO though its salinity and buoyancy will change. The reduction in final effluent volumes will increase the concentrations of some determinands in the discharged effluent, although this discharge is obviously to the open sea and the total load will remain the same.

3. Screening Summary

3.1 Potential for LSE

3.1.1 The HRA of WRMP19 concluded that the option would have 'no LSE' on any European sites; this has been reviewed on a precautionary basis using a slightly lower bar (principally in relation to mitigation and People over Wind). The rdWRMP24 screening is outlined in Table 2.1.

Table 2.1: Sites for which significant effects cannot be self-evidently excluded.

Site	Location (km)*	LSE?		Rationale
		Cons	Oper	
Solent and Dorset Coast SPA	0.8/DS	U*	U	Construction: Indicative pipeline route crosses tributaries of this site and works likely required in the Yar. Significant and/or significant adverse effects almost certainly avoidable with established measures / normal best-practice, although these must necessarily be accounted for at AA (hence 'screened in'). Mobile species unlikely to be reliant on non-designated habitats affected by construction. Operation: The discharge of treated effluent into the Eastern Yar; this site is located outside Bembridge harbour and is predominantly marine at this location, and so exposure to environmental changes associated with the option operation will be low. It is understood that the treated water would be used on a put and take basis and that flows in the Yar below the abstraction would remain largely the same, and so this site would not be exposed to potentially significant changes in FW input. The discharge will be treated to tertiary standards for ammonia, phosphate and BOD, and therefore, there will be a low risk of impacting the physico-chemical quality elements of this water body (currently at high status). The proposed treatment will also include a process (either UV AOP or reverse osmosis) to remove the majority organic chemical contaminants. Therefore, there will be a low risk of organic chemicals such as endocrine disruptors causing deterioration to fish status.

Site	Location (km)*	LSE?		Rationale
		Cons	Oper	
South Wight Maritime SAC	0.9	0	U	Construction: This site is located outside Bembridge harbour and is predominantly marine at this location, and so exposure to environmental changes associated with construction will be low, such that effects would not occur irrespective of mitigation. Operation: The discharge of treated effluent into the Eastern Yar; this site is located outside Bembridge harbour and is predominantly marine at this location, and so exposure to environmental changes associated with the option operation will be low. It is understood that the treated water would be used on a put and take basis and that flows in the Yar below the abstraction would remain largely the same, and so this site would not be exposed to potentially significant changes in FW input. The discharge will be treated to tertiary standards for ammonia, phosphate and BOD, and therefore, there will be a low risk of impacting the physico-chemical quality elements of this water body (currently at high status). The proposed treatment will also include a process (either UV AOP or reverse osmosis) to remove the majority organic chemical contaminants. Therefore, there will be a low risk of organic chemicals such as endocrine disruptors causing deterioration to fish status. Effluent from Sandown is currently discharged to this SAC via a 3km LSO although all residual discharges will be in accordance with the permit for the WwTW and the LSO discharges to dispersive waters and so there will be no negative effect on this site as a result of the effluent re-use.

Site	Location (km)*	LSE?		Rationale
		Cons	Oper	
Solent and Southampton Water SPA	1.7/DS	U*	U	Construction: Indicative pipeline route crosses tributaries of this site and works likely required in the Yar. Significant and/or significant adverse effects almost certainly avoidable with established measures / normal best-practice, although these must necessarily be accounted for at AA (hence 'screened in'). Mobile species unlikely to be reliant on non-designated habitats affected by construction. Operation: The discharge of treated effluent into the Eastern Yar, approximately 9km upstream of Bembridge harbour / Brading Marshes, will need to comply with Environment Agency discharge standards to secure a permit. It is understood that the treated water would be used on a put and take basis and that flows in the Yar below the abstraction would remain largely the same, and so the estuary would not be exposed to potentially significant changes in FW input. The discharge will be treated to tertiary standards for ammonia, phosphate and BOD, and therefore, there will be a low risk of impacting the physico-chemical quality elements of this water body (currently at high status). The proposed treatment will also include a process (either UV AOP or reverse osmosis) to remove the majority organic chemical contaminants. Therefore, there will be a low risk of organic chemicals such as endocrine disruptors causing deterioration to fish status.
Solent and Southampton Water Ramsar	1.7/DS	U*	U	Construction: Indicative pipeline route crosses tributaries of this site and works likely required in the Yar. Significant and/or significant adverse effects almost certainly avoidable with established measures / normal best-practice, although these must necessarily be accounted for at AA (hence 'screened in'). Mobile species unlikely to be reliant on non-designated habitats affected by construction. Operation: The discharge of treated effluent into the Eastern Yar, approximately 9km upstream of Bembridge harbour / Brading Marshes, will need to comply with Environment Agency discharge standards to secure a permit. It is understood that the treated water would be used on a put and take basis and that flows in the Yar below the abstraction would remain largely the same, and so the estuary would not be exposed to potentially significant changes in FW input. The discharge will be treated to tertiary standards for ammonia, phosphate and BOD, and therefore, there will be a low risk of impacting the physico-chemical quality elements of this water body (currently at high status). The proposed treatment will also include a process (either UV AOP or reverse osmosis) to remove the majority organic chemical contaminants. Therefore, there will be a low risk of organic chemicals such as endocrine disruptors causing deterioration to fish status.

Site	Location (km)*	LSE?		Rationale
		Cons	Oper	
Briddlesford Copses SAC	3.6	U*	0	Construction: Site not exposed to construction effects (distance, no pollutant pathways, separate catchment); pipeline close to Core Sustenance Zone (CSZ; see Appendix B) defined for the mobile interest features of the site, and effects on supporting habitats cannot be excluded at the plan level (although the risk of significant effects would be low based on the nature of the works). Significant and/or significant adverse effects almost certainly avoidable with established measures / normal best-practice, although these must necessarily be accounted for at AA (hence 'screened in'). Operation: No pathways for operational effects (separate catchment).
Isle of Wight Downs SAC	4.3	0	0	Construction: No pathways for construction effects (distance, site up-catchment). Operation: No pathways for operational effects (distance; features not exposed to likely environmental changes associated with operation, which will be limited to the Yar).
Solent and Isle of Wight Lagoons SAC	4/DS	U*	U	Construction: Works likely required in / near the Yar. Little / no exposure to construction risks due to location of lagoon relative to Yar; significant and/or significant adverse effects almost certainly avoidable with established measures / normal best-practice, although these must necessarily be accounted for at AA (hence 'screened in'). Operation: The discharge of treated effluent into the Eastern Yar, approximately 9km upstream of Solent and Isle of Wight Lagoon SAC will need to comply with Environment Agency discharge standards to secure a permit. There is likely to be little / no exposure to operational effects due to location / relationship of lagoon relative to Yar; reduced salinity is a key risk for saline lagoons but it is understood that the treated water would be used on a put and take basis and that flows in the Yar below the abstraction would remain largely the same, and so the lagoon would not be exposed to possible increases in FW input. The discharge will be treated to tertiary standards for ammonia, phosphate and BOD, and therefore, there will be a low risk of impacting the physico-chemical quality elements of this water body (currently at high status). The proposed treatment will also include a process (either UV AOP or reverse osmosis) to remove the majority organic chemical contaminants. Therefore, there will be a low risk of organic chemicals such as endocrine disruptors causing deterioration to fish status.

Site	Location (km)*	LSE?		Rationale
		Cons	Oper	
Solent Maritime SAC	6.4	0	0	Construction: Site not a downstream receptor and not exposed to environmental changes associated with construction or operation. Operation: Site too distant to be affected by discharges to sea; not a downstream receptor and not exposed to environmental changes associated with operation.

4. Assessment

4.1 Construction

4.1.1 The indicative pipeline route crosses tributaries of the Solent and Dorset Coast SPA, Solent and Southampton Water SPA, Solent and Southampton Water Ramsar site, and is within the Core Sustenance Zone (CSZ; see Appendix B) defined for the mobile interest features of Briddlesford Copses SAC. Works will be required in the Yar. Mobile species associated with the SPA/Ramsar sites are unlikely to be reliant on non-designated habitats affected by construction.

4.1.2 These potential effects have been taken forward to Appropriate Assessment (see Appendix E1) although it is considered that all potential effects will be temporary (other than some small-scale landtake) and avoidable or mitigatable with established measures.

4.1.3 Appendix C identifies standard and established measures that are known to be available, achievable and likely to be effective in avoiding or mitigating potentially adverse effects on European sites and interest features. These are based on best- and case-practice from similar schemes, and so there can be high confidence in their deliverability and effectiveness. These measures would be applied unless project-level HRAs or project-specific environmental studies demonstrate that they are not required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate.

4.2 Operation

4.2.1 There are two principal pathways for operational effects:

- Recovered water will be discharged to the Eastern Yar approximately 9km upstream of Bembridge harbour / Brading Marshes (hence upstream of the Solent and Dorset Coast SPA, South Wight Maritime SAC, Solent and Southampton Water SPA/Ramsar and Solent and Isle of Wight Lagoons SAC.

- Wastewater from the recovery process will be discharged through the Sandown LSO, which discharges into the South Wight Maritime SAC.

4.2.2 With regard to indirect effects via inputs of recovered water to the Eastern Yar:

- The treated water would effectively be used on a put and take basis and so flows in the Yar below the abstraction would remain largely the same. The European sites referred to above would not therefore be exposed to potentially significant changes in freshwater flows in the Yar.
- The marine dominated sites (Solent and Dorset Coast SPA, South Wight Maritime SAC) would have a very low exposure and sensitivity to the expected magnitude of change in any case, being located outside Bembridge harbour.
- The connectivity of the Yar with Brading Marshes SSSI (hence terrestrial components of Solent and Southampton Water SPA/Ramsar and Solent and Isle of Wight Lagoons SAC) is low, and evidence suggests that the interest features of the SPA/Ramsar and SAC associated with Brading Marshes are not be fundamentally reliant on flows within the Yar due to the separation of the river from the marshes and the direct management of water levels across the marshes. (sluices etc.) Any effects of the option on water-supply to Brading Marshes will be negligible in any case (due to the put and take usage), and entirely moderated in any case by the interventionist water level management of the marshes and by other surface water and rainfall inputs to the marshes.

4.2.3 With regard to the discharges from the LSO:

- Natural England has previously suggested that the South Wight Maritime SAC and the Solent Maritime SAC, in addition to the other sites screened in) have the potential to be adversely impacted by the release of brine discharge into the marine environment. The existing LSO is within the South Wight Maritime SAC and in relatively close proximity to the Solent and Dorset Coast SPA.
- The discharges will be marginally more saline than the current WwTW discharges but this will be substantially below the salinity of seawater (current discharges from Sandown are ~3g/l, which is likely to increase to around ~10 g/l in the return flows; the salinity of seawater is typically between 34-36 g/l). The LSO discharge is into a high-dispersal environment. There will therefore be no meaningful environmental changes through this mechanism that might alter the suitability of the supporting habitats of these sites for the qualifying features.
- The discharges will have higher concentrations of some nutrient (etc.) determinands as a result of reduced discharge volumes (although the total load discharged will remain the same). However, this discharge will be to a high dispersal environment and so these higher concentrations would be quickly attenuated. Far-field effects from a large ‘plume’ would not therefore be anticipated (i.e. any effects would be very local to the discharge). The features of the sites closest to the discharge (South Wight Maritime SAC and Solent and Dorset Coast SPA) are likely to have a very low sensitivity to these environmental changes (it should be noted that neither site has been identified as sites requiring measures to ensure ‘nutrient neutrality’).

- NE has indicated that the in-combination effects with the discharge from proposed Hampshire Water Transfer and Water Recycling Project requires assessment; this will be completed at the project-level, but given the relative locations of the two discharges it is expected that there will be no possibility of in combination effects on any sites).

4.2.4 The reasonably anticipated conclusion is therefore that there will be no adverse effects on any European sites as a result of this option, and that potential effects can almost certainly be avoided through operational controls and measures.

Appendix E13: Appropriate Assessment: Groundwater (SNZ): Petersfield Refurbishment (1.6Ml/D)

1. Option Summary

1.1 Overview and European site context

1.1.1 This WRMP19 option involves the transfer excess water for enhanced treatment near Midhurst with refurbishment of a WSW and borehole rehabilitation. Works are likely to be located within existing SWS operational land.

1.1.2 The proposed option and pipeline location are in close proximity to (within 10km) of the following sites.

- Butser Hill SAC
- East Hampshire Hangers SAC
- Rook Clift SAC
- Wealden Heaths Phase 2 SPA
- Woolmer Forest SAC

1.1.3 The following sites are potential downstream receptors via the River Rother.

- Arun Valley SAC
- Arun Valley SPA
- Arun Valley Ramsar

1.2 Environmental changes and option assumptions / uncertainties

Potential construction-related environmental changes

1.2.1 'Generic' environmental risks typically associated with the construction of new infrastructure may be realised (e.g. site-derived pollutants; additional noise or lighting; visual disturbance; etc.) although these cannot be reliably scoped or assessed at the plan-level as they are entirely dependent on the detailed design; however, such risks can almost certainly be avoided through scheme-design and/or the established best-practice measures noted in Appendix C.

1.2.2 However:

- the works will require construction of a new borehole and WSW refurbishment, which may generate site-derived pollutants of local water courses (and hence downstream sites) i.e. Arun Valley Ramsar, Arun Valley SPA.

Potential operation-related environmental changes

1.2.3 'Generic' environmental risks typically associated with the operation of new infrastructure may be realised (e.g. additional noise or lighting, albeit minor in this instance) although these cannot be reliably scoped or assessed at the plan-level as they are entirely dependent on the detailed design; however, the operational plant required is not inherently high-impact in this regard, and potentially notable environmental changes can almost certainly be avoided through scheme-design.

1.2.4 The principal environmental changes from operation will therefore relate to:

- Abstraction from the underlying Hythe beds (Lower Greensand) and potential localised drawdown of the water table, hence potential effects on flows in the River Rother upstream of the Arun Valley Ramsar, Arun Valley SPA, and Arun Valley SAC.

Assumptions and uncertainties

1.2.5 It is assumed that the borehole and WSW will be designed according to best practice to minimise the effects on the environment; and that reduced-disturbance construction techniques are achievable if required. It is also assumed that the scheme will operate on a full-time basis for energy-efficiency reasons.

2. Screening Summary

2.1.1 The screening assessment is outlined in Table 2.1: Potential construction and operational effects on European sites. In summary, significant effects cannot be self-evidently excluded for the following sites:

Table 2.1: Potential construction and operational effects on European sites.

Site	Location (km)*	LSE?		Rationale
		Cons	Oper	
Arun Valley SAC	DS/DS	0	U	Construction: Construction works are small-scale and minor; site will not be exposed to potentially notable environmental changes irrespective of mitigation due to distance. Operation: This option may reduce flows in the River Rother downstream of Petersfield, which has the potential to affect this site - although the exposure of the site is likely to be low due to the relationship of the wetlands with the river and management of water levels within the site, and the low magnitude of abstraction. However, this requires additional data to confirm acceptability.
Arun Valley SPA	DS/DS	0	U	Construction: Construction works are small-scale and minor; site will not be exposed to potentially notable environmental changes irrespective of mitigation due to distance. Operation: This option may reduce flows in the River Rother downstream of Petersfield, which has the potential to affect this site - although the exposure of the site is likely to be low due to the relationship of the wetlands with the river and management of water levels within the site, and the low magnitude of abstraction. However, this requires additional data to confirm acceptability
Arun Valley Ramsar	DS/DS	0	U	Construction: Construction works are small-scale and minor; site will not be exposed to potentially notable environmental changes irrespective of mitigation due to distance. Operation: This option may reduce flows in the River Rother downstream of Petersfield, which has the potential to affect this site - although the exposure of the site is likely to be low due to the relationship of the wetlands with the river and management of water levels within the site, and the low magnitude of abstraction. However, this requires additional data to confirm acceptability

2.1.2 Some of the potential effects noted above will be clearly avoidable with established measures, which are accounted for at the appropriate assessment stage in accordance with People over Wind.

3. Assessment: Arun Valley SPA, Arun Valley Ramsar, Arun Valley SAC

3.1 Core Designation Information

3.1.1 Note, the Arun Valley SPA, Arun Valley Ramsar and Arun Valley SAC (collectively, the Arun Valley sites) are addressed together in the following sections as the mechanisms by which the sites might be affected by this option are largely the same (although mobile species associated with the SPA and Ramsar may be affected if using habitats outside the site boundaries).

3.1.2 The Arun Valley is located just north of the South Downs escarpment about 15 km inland from the south coast of England. It consists of low-lying grazing marsh, largely on alluvial soils, but with an area of peat derived from a relict raised bog. Southern parts of the Arun Valley are fed by calcareous springs, while to the north, where the underlying geology is Greensand, the water is more acidic. The history of management of fields, and their water levels, determines the plant communities present. The wet neutral grassland is subject to winter and occasional summer flooding. The site is dissected by a network of wet ditches which support a rich aquatic flora and invertebrate fauna. Variation in the chemical status of the water has resulted in an exceptionally high diversity of aquatic plant species in some of the ditches.

3.1.3 The core information relating to the designation (i.e. qualifying features, conservation objectives, supplementary advice documents, information on typical species, supporting habitats and known functional land) is available online and so not replicated here in detail, to minimise repetition and over-simplification of freely available data.

3.1.4 Table 3.1 to Table 3.3 provides links to the key documents and information relating to the designation. Specific information that may be relevant to the assessment of effects is noted as necessary, and in the assessment sections below (e.g. known areas of functional land identified in the SACO documentation).

Table 3.1: Designation information for Arun Valley SAC

Aspect	Notes
Site Name	• Arun Valley SAC
Site Code	• UK0030366
Qualifying features	- S4056: Ramshorn snail *Anisus vorticulus**
Standard Data Form	Available at: https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0030366.pdf
Conservation Objectives	Available at: http://publications.naturalengland.org.uk/publication/4924283725807616?category=6528471664689152

Aspect	Notes
Site Improvement Plan	Available at: http://publications.naturalengland.org.uk/publication/4924283725807616?category=6528471664689152
Supplementary advice	Available at: http://publications.naturalengland.org.uk/publication/4924283725807616?category=6528471664689152
Associated SSSIs	Available at: https://designatedsites.naturalengland.org.uk/SiteGeneralDetail.aspx?SiteCode=UK0030366
Functional land	None noted; interest features confined to site.

* Water resource sensitive features, based on Environment Agency (EA) guidance

Table 3.2: Designation information for Arun Valley SPA

Aspect	Notes
Site Name	• Arun Valley SPA
Site Code	• UK9020281
Qualifying features	- A037w: Tundra swan *Cygnus columbianus bewickii** - WATR: Waterbird assemblage*
Standard Data Form	Available at: https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0030366.pdf
Conservation Objectives	Available at: http://publications.naturalengland.org.uk/publication/4924283725807616?category=6528471664689152
Site Improvement Plan	Available at: http://publications.naturalengland.org.uk/publication/4924283725807616?category=6528471664689152
Supplementary advice	Available at: http://publications.naturalengland.org.uk/publication/4924283725807616?category=6528471664689152
Associated SSSIs	Available at: https://designatedsites.naturalengland.org.uk/SiteGeneralDetail.aspx?SiteCode=UK9020281
Functional land	Some bird features may utilise habitats outside the site boundary including farmland for foraging.

* Water resource sensitive features, based on Environment Agency (EA) guidance

Table 3.3: Designation information for Arun Valley Ramsar

Aspect	Notes
Site Name	• Arun Valley Ramsar

Aspect	Notes
Site Code	• UK11004
Qualifying features	- Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. Communities (seven RDB wetland invertebrate species; four rare / scarce plant species)* - Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity (ditch flora)* - Crit. 5 - regularly supports 20,000 or more waterbirds (wintering bird assemblage)*
Standard Data Form	Available at: https://jncc.gov.uk/jncc-assets/RIS/UK11004.pdf
Conservation Objectives	As per associated SAC / SPA, or underpinning SSSI(s)
Site Improvement Plan	As per associated SAC / SPA, or underpinning SSSI(s)
Supplementary advice	As per associated SAC / SPA, or underpinning SSSI(s)
Associated SSSIs	Available at: https://designatedsites.naturalengland.org.uk/SiteGeneralDetail.aspx?SiteCode=UK11004
Functional land	Some bird features may utilise habitats outside the site boundary including farmland for foraging.

* Water resource sensitive features, based on Environment Agency (EA) guidance

3.2 Mitigation Assumptions

Standard Measures / Best-practice

3.2.1 Appendix C identifies standard and established measures that are known to be available, achievable and likely to be effective in avoiding or mitigating potentially adverse effects on European sites and interest features. These are based on best- and case-practice from similar schemes, and so there can be high confidence in their deliverability and effectiveness. These measures would be applied unless project-level HRAs or project-specific environmental studies demonstrate that they are not required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate.

Bespoke measures

3.2.2 Site- or feature-specific mitigation that may be required for specific atypical effects are identified in the assessment sections.

3.3 Assessment – Construction

3.3.1 The habitats of the Arun Valley sites will not be directly affected by construction due to the distance from the construction area; this also applies to the mobile qualifying features of the site, based on the distance plus the scale and location of the works (i.e. within small

existing SWS assets). Works will be required relatively close to the River Rother, which joins the River Arun at Pulborough and ultimately flows past these sites, providing a potential pathway for site-derived pollutants.

3.3.2 However, these effect pathways will not be realised or can be avoided for the following reason:

- Established best-practice construction measures (including normal design practice) can reliably safeguard receptors (e.g. through pollution prevention measures; scheduling works to avoid wintering periods, if required; route design to minimise risks; controls on noise / visual disturbance etc.).

3.4 Assessment – Operation

3.4.1 Operation of the scheme may affect the River Rother, which ultimately flows past the Arun Valley sites below its confluence with the River Arun near Pulborough.

3.4.2 The sites are functionally linked to the River Arun (and Rother), being a series of wet meadows which are periodically flooded/ inundated. However, evidence from ongoing studies (i.e. conceptual models and monitoring developed as part of the Pulborough Basin Environmental Studies (HBES) being undertaken by SWS in conjunction with the EA and NE) indicates that the majority of the wetlands are not fundamentally supported fluvially (i.e. they are not reliant / dependent on (for example) winter flooding from the Arun to maintain water levels), and whilst there are inputs from the river where sluices etc. are not operating correctly (typically as part of the tidal cycle), the vast majority of the site is not supported by inward freshwater inputs from the Arun but by groundwater or other surface water inputs from the catchment (i.e. the dominant direction of non-saline flow is from the wetlands to the river). High flows or tidal locking in the river may impede discharges from the wetlands, but the hydrology of the wetlands is largely determined by groundwater inputs and subsequent interventionist management of the water levels in the ditch network.

3.4.3 The possible exception to this is a small part of Waltham Brooks SSSI (approximately 0.4ha) that is in direct connectivity with the river as it lies riverwards of the flood bank. According to the Sussex Wildlife Trust management plan the water levels on the Waltham Brooks reserve are maintained by a manually-operated steel lifting gate sluice positioned on the internal boundary of the site in front of the tidal flap. The lake is an important constituent of the Brooks and has become an area important for winter wildfowl. For the SPA interest features (wintering and passage waterfowl and waders) the Sussex Wildlife Trust Management Plan for Waltham Brooks Reserve 2012-2022 indicates the key hydrological factor to be large expanses of floodwater, no less than 50cm in depth, in Compartment C between November and February inclusive.

3.4.4 The Arun Valley sites are currently subject to sustainability studies, exploring the impact of abstractions on the designated sites; it should be noted that the abstraction licence at Petersfield has not been scoped into this assessment, as direct effects on the designated sites due to drawdown from this source are not considered likely due to the distance and geology.

3.4.5 NE has noted that "*The Arun Valley Habitats sites have deteriorated in condition where there is a current known adverse effect on integrity from groundwater abstraction, and other water-related impacts which are all likely to be significantly contributing towards this decline. Designated site condition, risk to resilience and supporting long-term environmental improvement / restoration (rather than inhibiting) must be considered in the assessment of any options that could affect these sites*".

3.4.6 With regard to the effects of the Petersfield abstraction, the degree of connection between the aquifer and the River Rother is not known. The worst-case scenario (i.e. the entirety of the additional groundwater abstraction (1.6 M/d) impacts river flows in the Rother and hence the Arun at Pulborough) is therefore assumed.

3.4.7 The approximate impact on flows in the Arun at Pulborough is summarised in Table 3.4 using data from the closest upstream gauging stations (Rother at Pulborough, Station No. 41009; and Arun at Pallingham, Station No. 41014); note, this is conservative as there are other flow inputs to the Arun below Pallingham.

Table 3.4: Approximate flows in the River Arun at Pulborough

Flow percentile	Gauged flows (Ml/d)			Max. % impact on cumulative flows (1.6Ml/d abstr.)
	Rother at Pulborough	Arun at Pallingham	Cumulative	
Mean	386.6	484.5	871.2	0.18
Q95	94.2	23.5	117.7	1.36
Q70	174.5	48.7	223.3	0.72
Q50	249.7	97.9	347.6	0.46
Q10	907.2	1339.2	2246.4	0.07
Q5	1304.6	2531.5	3836.2	0.04

3.4.8 Based on this:

- Under the worst-case scenario (i.e. assuming the entirety of the groundwater abstraction (1.6 Ml/d) impacts river flows) the maximum impact on very low flows in the Arun adjacent to the designated sites would be approximately 1.36%. However, the potential impact of the abstraction on low flows in the Arun arguably has limited relevance to the condition of the European site, as at very low flows the river is not directly supporting the adjacent wetlands (either through direct supply or by impeding drainage).
- At high / flood flows the estimated impact is <0.1% (0.07 – 0.04% at Q10 and Q5 respectively). It is therefore arguable that the effect of the abstraction on high / flood flows in the Arun will be inconsequential (essentially within normal variability) and will not meaningfully affect the volume of water entering the sites or its residence time within the site.

- The Waltham Brooks SSSI unit of the SPA/Ramsar has greater connectivity to the river and is partially reliant on winter flooding; the option will not substantively affect this (flooding will still occur, and water will be retained by the existing management regime) although mitigation measures proposed for the Pulborough Stages 1 to 3 drought option in SWS's revised draft Drought Plan 2022[1] would also be effective and potentially appropriate for the WRMP option (these mitigation measures include partial removal of embankments to re-connect river to the floodplain sooner, creation of new ditches that connect the floodplain with the river at different water levels).
- Consequently, the hydrological impact of the abstraction on the Arun Valley sites alone is considered to be negligible, particularly in relation to the dominant effect of groundwater supply to the designated sites and the active management of water levels within the sites, and in relation to the tidal cycle and inputs associated with this. The predicted flow reductions in the Arun will not be of sufficient magnitude to adversely affect the site alone either directly or through secondary mechanisms such as via impacts on water quality; and the anticipated magnitude of effects can almost certainly be mitigated with the mitigation interventions identified for the Drought Plan, if required.
- It is recognised that the existing groundwater abstractions from Pulborough and other sources may be adversely affecting the Arun Valley sites. It is assumed that these sources will be subject to sustainability reductions (this underpins the modelling of the supply demand balance for the WRMP) and that these reductions will be made before this option is required. As a result, this option will not operate in combination with the existing abstraction regime; the nature of the option and magnitude of impacts from the option will ensure that it will not affect the future recovery and achievement of Favourable Conservation Status (FCS) at the Arun Valley sites.

3.5 In combination effects

Other WRMP options

3.5.1 No other water company options will affect these sites. With regard to other SWS options, the principal in combination risk will relate to the operation of the following options (note, no unavoidable in alone or in combination effects are anticipated from construction of any options):

- Recycling (SNZ): Horsham WTW with storage at Pulborough (6.8Ml/d) option
- Groundwater (SNZ): New borehole at Petworth (4Ml/d)
- Groundwater (SNZ): Reinstate West Chiltington (3.1Ml/d)

3.5.2 The cumulative impact of these options on flows in the Arun would be as follows:

[1] Southern Water (2021). Draft Drought Plan 2022 Main report. 31 March 2021, Version 1.0.

Table 3.5: Cumulative Impact of Horsham Recycling (~9.5Ml/d), Petworth (4Ml/d), West Chiltington (see Appendix E14) and Petersfield (this option) on flows in the River Arun at Pulborough

Flow percentile	Gauged flows (Ml/d)			Max. % impact on cumulative flows (18.2Ml/d abstr.)
	Rother at Pulborough	Arun at Pallingham	Cumulative	
Mean	386.6	484.5	871.2	2.09
Q95	94.2	23.5	117.7	15.46
Q70	174.5	48.7	223.3	8.15
Q50	249.7	97.9	347.6	5.24
Q10	907.2	1339.2	2246.4	0.81
Q5	1304.6	2531.5	3836.2	0.47

3.5.3 Low (Q95) flows in the river will be reduced by up to 15.46%, although as noted the integrity of the SPA/Ramsar is not influenced by the lowest flows in the river. As with the alone assessment, although the Waltham Brooks SSSI unit of the SPA/Ramsar has greater connectivity to the river and is partially reliant on winter flooding the cumulative operation of the options will not substantively affect this (flooding will still occur, and water will be retained by the existing management regime) although mitigation measures proposed for the Pulborough Stages 1 to 3 drought option in SWS's revised draft Drought Plan 2022[2] would also be effective and potentially appropriate for the WRMP option (these mitigation measures include partial removal of embankments to re-connect river to the floodplain sooner, creation of new ditches that connect the floodplain with the river at different water levels). In summary, no unavoidable adverse in combination effects are anticipated.

Other Water Company Plans

Drought Plans

3.5.4 The Drought Plan will be revised several times before this WRMP option is implemented, and following option delivery, and so a meaningful in combination assessment arguably cannot be undertaken at this point. Furthermore, a future Drought Plan will necessarily reflect the abstraction baseline at that point (i.e. it will account for options implemented at that point in time) and be subject to HRA when revised, which provides a mechanism to ensure that in combination effects do not occur.

3.5.5 One drought option identified in SWS's revised draft Drought Plan 2022, or the plans of neighbouring water companies, has the potential to affect these sites (Pulborough Stages 1 to 3). The HRA of the Drought Plan concluded that this drought option would have no adverse effects on these sites (absence of pathways for the SAC; with the benefit of

[2] Southern Water (2021). Draft Drought Plan 2022 Main report. 31 March 2021, Version 1.0.

interventionist mitigation to support water levels in some drains for particular units of the SPA/Ramsar). The mitigation proposed for the drought option is in the process of being finalised, although the measures proposed will also effectively mitigate any residual effects that may result from the WRMP option implementation. Adverse in combination effects would not therefore be expected.

Drainage and Wastewater Management Plans

3.5.6 The interaction of the WRMP options with specific schemes derived from the emerging Drainage and Wastewater Management Plan (DWMP) can only be assessed at the project level due to the generic nature of the DWMP options.

Minor projects

3.5.7 It has not been possible to produce a definitive list of existing (minor) planning applications near this option's zone of influence, and generating a list at this stage would be of little value given the lead times for the option. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the ACWG guidance on cumulative/in combination assessments.

Major Projects

3.5.8 Reference has been made to the Planning Inspectorate's National Infrastructure Projects database[3] which includes major projects; no major projects are identified that are likely to affect these European sites.

3.6 Conclusion: Arun Valley SPA, Arun Valley Ramsar, Arun Valley SAC

3.6.1 The hydrological impact of this option on the Arun Valley sites alone is considered to be negligible, particularly in relation to the dominant effect of groundwater supply to the designated sites and the active management of water levels within the sites; the predicted flow reductions in the Arun will not be of sufficient magnitude to adversely affect the site alone either directly or through secondary mechanisms such as via impacts on water quality.

3.6.2 It is considered that there is sufficient confidence to enable a conclusion of no adverse effect on the integrity of the Arun Valley SPA, Arun Valley Ramsar and Arun Valley SAC to be drawn for the WRMP HRA in relation to this option, alone and in combination.

[3] Available at: https://infrastructure.planninginspectorate.gov.uk/projects/

Appendix E14:
Appropriate Assessment: Groundwater (SNZ): Reinstate West Chiltington (3.1Ml/D)

1. Option Summary

1.1 Overview and European site context

1.1.1 This WRMP19 option involves bringing the West Chiltington groundwater source back into service by constructing a new borehole, new treatment plant and flood resilience measures at the site. Works are likely to be located within existing SWS operational land.

1.1.2 The scheme will require:

- construction of a new stainless-steel borehole;
- replace Rapid Gravity Filters with new pressure filtration plant;
- decommissioning of the old RGF plant; and
- flood resilience measures.

1.1.3 The proposed option is in close proximity to (within 10km) of the following sites.

- The Mens SAC
- Arun Valley SAC
- Arun Valley SPA
- Arun Valley Ramsar

1.2 Environmental changes and option assumptions / uncertainties

Potential construction-related environmental changes

1.2.1 'Generic' environmental risks typically associated with the construction of new infrastructure may be realised (e.g. site-derived pollutants; additional noise or lighting; visual disturbance; etc.) although these cannot be reliably scoped or assessed at the plan-level as they are entirely dependent on the detailed design; however, such risks can almost certainly be avoided through scheme-design and/or the established best-practice measures noted in Appendix C.

1.2.2 However:

- The works will require construction of a new borehole and WSW refurbishment, which may generate site-derived pollutants of local water courses (and hence downstream sites) i.e. Arun Valley Ramsar, Arun Valley SPA.
- The works will involve construction works near agricultural land at West Chiltington, which will likely result in increased noise (etc); theoretically the nearby agricultural land could be functionally associated with some species from Arun Valley Ramsar and Arun Valley SPA given the proximity to these sites, although the risk of this is very low (operational site is surrounded by woodland).

Potential operation-related environmental changes

1.2.3 'Generic' environmental risks typically associated with the operation of new infrastructure may be realised (e.g. additional noise or lighting, albeit minor in this instance) although these cannot be reliably scoped or assessed at the plan-level as they are entirely dependent on the detailed design; however, the operational plant required is not inherently high-impact in this regard, and potentially notable environmental changes can almost certainly be avoided through scheme-design.

1.2.4 The principal environmental changes from operation will therefore relate to:

- Abstraction from the aquifer and possible localised drawdown of the water table, hence potential impacts on flows in the River Chilt and hence the River Stor and River Arun where these watercourses flow adjacent to the Arun Valley Ramsar, Arun Valley SPA, and Arun Valley SAC.
- Abstraction from the aquifer and potential localised drawdown of the water table directly affecting springs / upwellings within the Arun Valley Ramsar, Arun Valley SPA, and Arun Valley SAC themselves

Assumptions and uncertainties

1.2.5 It is assumed that the borehole and WSW will be designed according to best practice to minimise the effects on the environment; and that reduced-disturbance construction techniques are achievable if required. It is also assumed that the scheme will operate on a full-time basis for energy-efficiency reasons.

2. Screening Summary

2.1.1 The screening assessment is outlined in Table 2.1: Potential construction and operational effects on European sites. In summary, significant effects cannot be self-evidently excluded for the following sites:

Table 2.1: Potential construction and operational effects on European sites.

Site	Location (km)*	LSE?		Rationale
		Cons	Oper	
Arun Valley SAC	3.1/DS	U*	U	Construction: Site may be affected by site-derived pollutants from construction, in the absence of mitigation. Operation: Site habitats are hydrologically linked to the River Arun
Arun Valley SPA	3.1/DS	U*	U	Construction: Site may be affected by site-derived pollutants from construction, in the absence of mitigation. Operation: Site habitats are hydrologically linked to the River Arun
Arun Valley Ramsar	3.1/DS	U*	U	Construction: Site may be affected by site-derived pollutants from construction, in the absence of mitigation. Operation: Site habitats are hydrologically linked to the River Arun

2.1.2 Some of the potential effects noted above will be clearly avoidable with established measures, which are accounted for at the appropriate assessment stage in accordance with People over Wind.

3. Assessment: Arun Valley SPA, Arun Valley Ramsar, Arun Valley SAC

3.1 Core Designation Information

3.1.1 Note, the Arun Valley SPA, Arun Valley Ramsar and Arun Valley SAC (collectively, the Arun Valley sites) are addressed together in the following sections as the mechanisms by which the sites might be affected by this option are largely the same (although mobile species associated with the SPA and Ramsar may be affected if using habitats outside the site boundaries).

3.1.2 The Arun Valley is located just north of the South Downs escarpment about 15 km inland from the south coast of England. It consists of low-lying grazing marsh, largely on alluvial soils, but with an area of peat derived from a relict raised bog. Southern parts of the Arun Valley are fed by calcareous springs, while to the north, where the underlying geology is Greensand, the water is more acidic. The history of management of fields, and their water levels, determines the plant communities present. The wet neutral grassland is subject to winter and occasional summer flooding. The site is dissected by a network of wet ditches

which support a rich aquatic flora and invertebrate fauna. Variation in the chemical status of the water has resulted in an exceptionally high diversity of aquatic plant species in some of the ditches.

3.1.3 The core information relating to the designation (i.e. qualifying features, conservation objectives, supplementary advice documents, information on typical species, supporting habitats and known functional land) is available online and so not replicated here in detail, to minimise repetition and over-simplification of freely available data.

3.1.4 Table 3.1 to Table 3.3 provides links to the key documents and information relating to the designation. Specific information that may be relevant to the assessment of effects is noted as necessary, and in the assessment sections below (e.g. known areas of functional land identified in the SACO documentation).

Table 3.1: Designation information for Arun Valley SAC

Aspect	Notes
Site Name	• Arun Valley SAC
Site Code	• UK0030366
Qualifying features	- S4056: Ramshorn snail *Anisus vorticulus**
Standard Data Form	Available at: https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0030366.pdf
Conservation Objectives	Available at: http://publications.naturalengland.org.uk/publication/4924283725807616?category=6528471664689152
Site Improvement Plan	Available at: http://publications.naturalengland.org.uk/publication/4924283725807616?category=6528471664689152
Supplementary advice	Available at: http://publications.naturalengland.org.uk/publication/4924283725807616?category=6528471664689152
Associated SSSIs	Available at: https://designatedsites.naturalengland.org.uk/SiteGeneralDetail.aspx?SiteCode=UK0030366
Functional land	None noted; interest features confined to site.

* Water resource sensitive features, based on Environment Agency (EA) guidance

Table 3.2: Designation information for Arun Valley SPA

Aspect	Notes
Site Name	• Arun Valley SPA
Site Code	• UK9020281

Aspect	Notes
Qualifying features	- A037w: Tundra swan *Cygnus columbianus bewickii** - WATR: Waterbird assemblage*
Standard Data Form	Available at: https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0030366.pdf
Conservation Objectives	Available at: http://publications.naturalengland.org.uk/publication/4924283725807616?category=6528471664689152
Site Improvement Plan	Available at: http://publications.naturalengland.org.uk/publication/4924283725807616?category=6528471664689152
Supplementary advice	Available at: http://publications.naturalengland.org.uk/publication/4924283725807616?category=6528471664689152
Associated SSSIs	Available at: https://designatedsites.naturalengland.org.uk/SiteGeneralDetail.aspx?SiteCode=UK9020281
Functional land	Some bird features may utilise habitats outside the site boundary including farmland for foraging.

* Water resource sensitive features, based on Environment Agency (EA) guidance

Table 3.3: Designation information for Arun Valley Ramsar

Aspect	Notes
Site Name	• Arun Valley Ramsar
Site Code	• UK11004
Qualifying features	- Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. Communities (seven RDB wetland invertebrate species; four rare / scarce plant species)* - Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity (ditch flora)* - Crit. 5 - regularly supports 20,000 or more waterbirds (wintering bird assemblage)*
Standard Data Form	Available at: https://jncc.gov.uk/jncc-assets/RIS/UK11004.pdf
Conservation Objectives	As per associated SAC / SPA, or underpinning SSSI(s)
Site Improvement Plan	As per associated SAC / SPA, or underpinning SSSI(s)
Supplementary advice	As per associated SAC / SPA, or underpinning SSSI(s)
Associated SSSIs	Available at: https://designatedsites.naturalengland.org.uk/SiteGeneralDetail.aspx?SiteCode=UK11004
Functional land	Some bird features may utilise habitats outside the site boundary including farmland for foraging.

* Water resource sensitive features, based on Environment Agency (EA) guidance

3.2 Mitigation Assumptions

Standard Measures / Best-practice

3.2.1 Appendix C identifies standard and established measures that are known to be available, achievable and likely to be effective in avoiding or mitigating potentially adverse effects on European sites and interest features. These are based on best- and case-practice from similar schemes, and so there can be high confidence in their deliverability and effectiveness. These measures would be applied unless project-level HRAs or project-specific environmental studies demonstrate that they are not required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate.

Bespoke measures

3.2.2 Site- or feature-specific mitigation that may be required for specific atypical effects are identified in the assessment sections.

3.3 Assessment – Construction

3.3.1 The habitats of the Arun Valley sites will not be directly affected by construction due to the distance from the construction area; this also applies to the mobile qualifying features of the site, based on the distance plus the scale and location of the works (i.e. within small existing SWS assets). Works will be required relatively close to a tributary of the River Stor, which flows past the northern boundary of these designated sites before joining the River Arun at Pulborough, providing a potential pathway for site-derived pollutants. In addition the works will involve construction works near agricultural land at West Chiltington, which will likely result in increased noise (etc) that may affect nearby agricultural land.

3.3.2 However, these effect pathways will not be realised or can be avoided for the following reasons:

- Established best-practice construction measures (including normal design practice) can reliably safeguard receptors (e.g. through pollution prevention measures; scheduling works to avoid wintering periods, if required; design to minimise risks; controls on noise / visual disturbance etc.).
- The habitats close to the site will be indirectly affected only, and are not (based on aerial photographs) likely to be particularly attractive to the qualifying features of the European site (WSW site is surrounded by woodland and urban edge habitats; fields are small with sightlines affected by hedges and treelines along field boundaries).

3.3.3 On this basis there are unlikely to be any effects that cannot be avoided with normal best practice measures, and so adverse effects from construction would not be expected.

3.4 Assessment – Operation

3.4.1 The operation of the scheme may affect flows in the River Chilt and hence the River Stor, which runs along the northern boundary of the designated sites, and the River Arun below its confluence with the Stor. Note that these reaches are tidal. However, it is not considered possible for the abstraction to directly influence spring flows within the European sites and hence GWDTEs[1].

Flows in the River Arun (alone and in combination)

3.4.2 Tables 3.4 and 3.5 indicate the anticipated impact on flows in the Arun assuming a worst-case (i.e. the entirety of the additional groundwater abstraction (3.1 M/d) affects river flows in the Stor and hence the Arun at Pulborough), alone and in combination; however it should be noted that the table below does not account for any flows from the Stor (as there is no CEH gauging station data available) and so over-estimates the impact on flows in the Arun.

Table 3.4: Approximate flows in the River Arun at Pulborough

Flow percentile	Gauged flows (Ml/d)			Max. % impact on cumulative flows (3.1Ml/d abstr.)
	Rother at Pulborough	Arun at Pallingham	Cumulative	
Mean	386.6	484.5	871.2	0.36
Q95	94.2	23.5	117.7	2.63
Q70	174.5	48.7	223.3	1.39
Q50	249.7	97.9	347.6	0.89
Q10	907.2	1339.2	2246.4	0.14
Q5	1304.6	2531.5	3836.2	0.08

[1] Southern Water is currently undertaking WINEP investigations into the impact of groundwater abstractions from Pulborough on the GWDTEs of the Arun Valley sites, including the development of groundwater models. The consented abstraction from West Chiltington was initially considered during the scoping phases of this study, but was excluded as there is no pathway for groundwater abstractions from this source to directly affect GWTDEs within the Arun Valley sites due to the absence of connectivity (in summary, the Pulborough abstractions and the GWTDEs of the Arun Valley sites are associated with groundwater in the Folkestone Lower Greensand formations, whereas West Chiltington abstracts from the Hythe beds).

Table 3.5: Cumulative Impact of Horsham Recycling (~9.5Ml/d), Petworth (4Ml/d), West Chiltington (this option) and Petersfield (see Appendix E13) on flows in the River Arun at Pulborough

Flow percentile	Gauged flows (Ml/d)			Max. % impact on cumulative flows (18.2Ml/d abstr.)
	Rother at Pulborough	Arun at Pallingham	Cumulative	
Mean	386.6	484.5	871.2	2.09
Q95	94.2	23.5	117.7	15.46
Q70	174.5	48.7	223.3	8.15
Q50	249.7	97.9	347.6	5.24
Q10	907.2	1339.2	2246.4	0.81
Q5	1304.6	2531.5	3836.2	0.47

3.4.3 The assessment, alone and in combination, is therefore as per the Groundwater (SNZ): Petersfield Refurbishment (1.6Ml/D) option (Appendix E13), i.e. flows in the Arun will be affected, but this will be marginal and will not adversely affect the European sites.

Flows in the River Stor

3.4.4 The option may affect flows in the River Chilt and hence the River Stor as it passes the northern boundary of the designated sites. The potential for non-saline flows in the Stor to support habitats within the Arun Valley sites has been considered as part of the HBES investigation, with conceptual models of this developed. In summary, hydrological connectivity between the designated sites and the River Stor is limited, separated by flood embankments; consequently, the wetlands adjacent to the Stor are not fundamentally supported by non-saline inputs from the river, and impacts on flows in the Stor due to this option will not adversely affect the integrity of the SPA/Ramsar.

3.5 In combination effects

Other WRMP options

3.5.1 No other water company options will affect these sites. With regard to other SWS options, the potential 'in combination' effects of these on flows in the Arun are outlined in Table 3.4 above.

3.5.2 These options will not combine to affect the River Stor, and so there will be no spatially coincident cumulative changes to flows that might affect the SAC/SPA/Ramsar where these are adjacent to the Stor. Non-coincident synergistic effects would not be expected (i.e. 'not adverse' effects on two different areas of the site nevertheless combining to affect the site features which considered holistically) given the nature and scale of the potential environmental changes, and the role of active water level management in the maintenance

of the site. Note that mitigation measures proposed for the Pulborough Surface Water - reduce Western Rother MRF drought option in SWS's revised draft Drought Plan 2022[2] would also be effective and potentially appropriate for the WRMP option (these mitigation measures include partial removal of embankments to re-connect river to the floodplain sooner, creation of new ditches that connect the floodplain with the river at different water levels).

Other Water Company Plans

Drought Plans

3.5.3 A future Drought Plan will necessarily reflect the abstraction baseline at that point (i.e. it will account for options implemented at that point in time) and be subject to HRA when revised, which provides a mechanism to ensure that in combination effects do not occur.

3.5.4 One drought option identified in SWS's revised draft Drought Plan 2022, or the plans of neighbouring water companies, has the potential to affect these sites (Pulborough Surface Water - reduce Western Rother MRF). The HRA of the Drought Plan concluded that this drought option would have no adverse effects on these sites (absence of pathways for the SAC; with the benefit of interventionist mitigation to support water levels in some drains for particular units of the SPA/Ramsar). The mitigation proposed for the drought option is in the process of being finalised, although the measures proposed will also effectively mitigate any residual effects that may result from the WRMP option implementation. Adverse in combination effects would not therefore be expected.

Drainage and Wastewater Management Plans

3.5.5 The interaction of the WRMP options with specific schemes derived from the emerging Drainage and Wastewater Management Plan (DWMP) can only be assessed at the project level due to the generic nature of the DWMP options.

Minor projects

3.5.6 It has not been possible to produce a definitive list of existing (minor) planning applications near this option's zone of influence, and generating a list at this stage would be of little value given the lead times for the option. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the ACWG guidance on cumulative/in combination assessments.

[2] Southern Water (2021). Draft Drought Plan 2022 Main report. 31 March 2021, Version 1.0.

Major Projects

3.5.7 Reference has been made to the Planning Inspectorate's National Infrastructure Projects database[3] which includes major projects; no major projects are identified that are likely to affect these European sites.

3.6 Conclusion: Arun Valley SPA, Arun Valley Ramsar, Arun Valley SAC

3.6.1 The hydrological impact of this option on the Arun Valley sites alone is considered to be negligible, particularly in relation to the dominant effect of groundwater supply to the designated sites and the active management of water levels within the sites; the predicted flow reductions in the Arun will not be of sufficient magnitude to adversely affect the site alone either directly or through secondary mechanisms such as via impacts on water quality.

3.6.2 It is considered that there is sufficient confidence to enable a conclusion of no adverse effect on the integrity of the Arun Valley SPA, Arun Valley Ramsar and Arun Valley SAC to be drawn for the WRMP HRA in relation to this option, alone and in combination.

[3] Available at: https://infrastructure.planninginspectorate.gov.uk/projects/

Appendix E15: Appropriate Assessment: Groundwater (KME): Recommission Gravesend (2.7Ml/d)

1. Option Summary

1.1 Overview and European site context

1.1.1 This option proposes the recommissioning of Gravesend, a well and adit system that was previously decommissioned in 2007 due to high nitrate levels.

1.1.2 A new nitrate treatment plant was constructed on site in 2006. A Source Investigation and Optimisation Study (SIOS) suggested that the nitrate problem was likely to be a faulty nitrate monitor. The report recommended the source could be recommissioned through:

a) Undertaking a long-term step test with steps of seven days duration at rates of 3.0Ml/d, 3.3Ml/d and maximum pump capacity (approximately 3.66Ml/d) subject to stabilisation of pumping water levels during each step

b) Recalibration or repair of the online raw water nitrate monitor; or

c) Modify the headworks to the satellite well chamber to facilitate improved access.

1.1.3 Refurbishment of the existing nitrate plant will also be required to achieve a scheme output of 5Ml/d.

1.1.4 The site is within 2.1km of the Thames Estuary and Marshes Ramsar and 3.3km of the Thames Estuary and Marshes SPA.

1.1.5 The scheme would initially be required by 2031.

1.2 Environmental changes and option assumptions / uncertainties

Potential construction-related environmental changes

1.2.1 Gravesend is an existing well and adit system located in an urban location in Gravesend. There is no plausible pathway for construction activities associated with refurbishment of the existing nitrate plant and recommissioning activities, to lead to adverse effects upon the Thames Estuary and Marshes Ramsar / SPA.

Potential operation-related environmental changes

1.2.2 'Generic' environmental risks typically associated with the operation of new infrastructure may be realised (e.g. additional noise or lighting) although these cannot be reliably scoped or assessed at the plan-level as they are entirely dependent on the detailed design; however, the operational plant required is not inherently high-impact in this regard, and potentially notable environmental changes can almost certainly be avoided through scheme-design.

1.2.3 Environmental changes from operation are not anticipated as the option would operate within licence, although about recent actual abstraction. On a precautionary basis, there is a plausible, although unlikely, impact pathway resulting from groundwater drawdown adversely affecting the Thames Estuary and Marshes Ramsar / SPA.

Assumptions and uncertainties

1.2.4 It is assumed that the refurbishment works will be designed according to best practice and that the scheme will operate on a full-time basis for energy-efficiency reasons.

2. Screening Summary

2.1.1 The screening assessment is outlined in Table 2.1. In summary, significant effects cannot be self-evidently excluded for the following sites:

- Thames Estuary and Marshes Ramsar; and
- Thames Estuary and Marshes SPA.

Table 2.1: Potential construction and operational effects on European sites

Site	Location (km)*	LSE?		Rationale
		Cons	Oper	
Thames Estuary and Marshes Ramsar	2.1/DS	0	U	Construction: Minor works at existing operational site with no risk of effects on this site. Operation: The option would operate within licence, although above recent actual abstraction given the current decommissioned status of the site. On a precautionary basis, there is a plausible, although unlikely, impact pathway resulting from groundwater drawdown adversely affecting the Thames Estuary and Marshes Ramsar / SPA.

Site	Location (km)*	LSE?		Rationale
		Cons	Oper	
Thames Estuary and Marshes SPA	3.3/DS	0	U	Construction: Minor works at existing operational site with no risk of effects on this site. Operation: The option would operate within licence, although above recent actual abstraction given the current decommissioned status of the site. On a precautionary basis, there is a plausible, although unlikely, impact pathway resulting from groundwater drawdown adversely affecting the Thames Estuary and Marshes Ramsar / SPA.
North Downs Woodlands SAC	7.9	0	0	Construction: Site not exposed to construction effects (distance, no pollutant pathways, site up-catchment). Operation: No operational effects (features not water resource sensitive).

2.1.2 Some of the potential effects noted above will be clearly avoidable with established measures, which are accounted for at the appropriate assessment stage in accordance with People over Wind.

3. Assessment: Thames Estuary and Marshes SPA/Ramsar

3.1 Core Designation Information

3.1.1 The site comprises a complex of brackish, floodplain grazing marsh ditches, saline lagoons and intertidal saltmarsh and mudflat along the River Thames between Gravesend and Sheerness in Essex and Kent. The habitats support internationally important numbers of wintering waterfowl, and the saltmarsh and grazing marsh are of international importance for their diverse assemblages of wetland plants and invertebrates. The site performs important hydrological functions, including shoreline stabilisation, sediment trapping, flood water storage and desynchronization of flood peaks, and maintenance of water quality by removal of nutrients.

3.1.2 Table 3.1 provides links to the key documents and information relating to the designation. Specific information that may be relevant to the assessment of effects is noted as necessary, and in the assessment sections below (e.g., known areas of functional land identified in the SACO documentation).

Table 3.1 Designation information for the Thames Estuary and Marshes SPA/Ramsar

Aspect	Notes
Qualifying features	SPA: • A672w: Dunlin *Calidris alpina* • A143w: Red knot *Calidris canutus* • A082w: Hen harrier *Circus cyaneus* • A616w: Black-tailed godwit *Limosa islandica* • A141w: Grey plover *Pluvialis squatarola* • A132w: Pied avocet *Recurvirostra avosetta* • A137c: Ringed plover *Charadrius hiaticula* • A162w: Common redshank *Tringa totanus* • WATR: Waterbird assemblage Ramsar: • Crit 2: Supports vulnerable, endangered or critically endangered species or threatened eco communities • Crit 5: Regularly supports 20,000 or more waterbirds • Crit 6: Regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
Conservation Objectives	Available at: Thames Estuary and Marshes SPA - UK9012021A (naturalengland.org.uk)
Site Improvement Plan	Available at: Site Improvement Plan: Greater Thames Complex - SIP134 (naturalengland.org.uk)
Supplementary advice	Available at: http://publications.naturalengland.org.uk/publication/4698344811134976?category=6581547796791296
Associated SSSIs	• Thames Estuary and Marshes SSSI
Functional land	Waterbird assemblage, Non-breeding: Intertidal mud; Intertidal sand and muddy sand; Intertidal mixed sediment; Intertidal seagrass; Coastal reedbeds; Coastal lagoons; Freshwater and coastal grazing marsh; Saltmarsh.

3.2 Mitigation Assumptions

Standard Measures / Best-practice

3.2.1 Appendix C identifies standard and established measures that are known to be available, achievable and likely to be effective in avoiding or mitigating potentially adverse effects on European sites and interest features. These are based on best- and case-practice from similar schemes, and so there can be high confidence in their deliverability and effectiveness. These measures would be applied unless project-level HRAs or project-specific environmental studies demonstrate that they are not required (i.e., the anticipated effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate.

Bespoke measures

3.2.2 Site- or feature-specific mitigation that may be required for specific atypical effects are identified in the assessment sections.

3.3 Interest Feature Exposure

3.3.1 As the Ramsar and SPA are located approximately 2.1km and 3.3km respectively east of the proposed option, there exists the potential for the waterbird qualifying features of the sites to forage / roost etc. within the zone of influence of the operational effects of the proposed option. It is also plausible that areas of the sites may be exposed to environmental changes associated with groundwater drawdown that are not quantified at this stage (see assessment below). However, the qualifying features of the sites will not be directly impacted when within the SPA/Ramsar boundaries (e.g., through disturbance) due to the separation distance.

3.4 Assessment – Construction

3.4.1 Initial screening indicated that there are no pathways for construction effects, as the works are small scale and confined to the existing site construction impacts would therefore not be anticipated, irrespective of any additional mitigation measures.

3.5 Assessment – Operation

3.5.1 This option proposes recommissioning the existing well and adit system so that the site can operate to its licensed capacity. The ALS indicates that there is water available for licensing in this unit.

3.5.2 The site is located on unconfined chalk, with overlying Thanet Sand and Alluvium. There is no direct surface water connection between the site and nearest Habitat sites. The effect upon groundwater drawdown cannot be quantified at this stage, however initial results from the ongoing North Kent Marshes WINEP investigation timetabled to complete in 2026, suggest the impact upon levels may be small in relation to other factors.

3.5.3 There is likely to be some contribution of groundwater baseflow to Shorne Marshes, the nearest SSSI component (South Thames Estuary and Marshes SSSI), most likely being fed from the southern edge (nearest Gravesend). However, the water level within the marshes is mainly controlled by the use of weirs, sluices and outfalls. This active management is a primary factor determining the quality of habitat for bird species/assemblages for which the SPA/Ramsar is designated and unaffected by the proposed option.

3.5.4 Although there is some uncertainty regarding the impact of groundwater upon this component of the SPA/Ramsar, the active management of water levels provides a clear mechanism by which to avoid any adverse effect upon habitat utilised by the qualifying bird species/assemblages. For this reason, adverse effects upon the integrity of the Thames Estuary and Marshes SPA/Ramsar are not likely as a result of this option alone.

3.6 In combination effects

Other WRMP options

3.6.1 The potential for these European sites to be affected by two or more WRMP options (either options within the SWS rdWRMP, or options in the rdWRMPs of neighbouring water companies) is set out in Appendix F and Appendix G.

3.6.2 In summary the principal in combination risk relates to effects associated with:

- Desalination: Isle of Sheppey (10Ml/d, 20Ml/d & 20Ml/d Phase 2); and
- Desalination (KMW): Thames Estuary

3.6.3 Environmental changes associated with the Desalination: Isle of Sheppey option and Desalination (KMW): Thames Estuary are expected to be highly localised. Although there are residual uncertainties that cannot be fully assessed at the WRMP level with the available data, it is considered that mitigation options are available that can reliably be applied through scheme detailed design (e.g. location of outfalls) to ensure that spatially coincident (hence additive etc.) in combination effects do not occur; disparate in combination effects (i.e. 'alone' effects on different parts of the site that together affect site integrity, particularly in relation to the use of different parts of the site by qualifying mobile features) are conceivable, but unlikely given the magnitude of the expected effects alone.

Other Water Company Plans

Drought Plans

3.6.4 The Drought Plan will be revised several times before this WRMP option is implemented, and following option delivery, and so a meaningful in combination assessment arguably cannot be undertaken at this point. Furthermore, a future Drought Plan will necessarily reflect the abstraction baseline at that point (i.e., it will account for options implemented at that point in time) and be subject to HRA when revised, which provides a mechanism to ensure that in combination effects do not occur.

3.6.5 No drought options identified in SW's revised draft Drought Plan 2022[1], or the plans of neighbouring water companies, will affect these sites based on the HRA of the Drought Plan.

Drainage and Wastewater Management Plans

3.6.6 The interaction of the WRMP options with specific schemes derived from the emerging Drainage and Wastewater Management Plan (DWMP) can only be assessed at the project level due to the generic nature of the DWMP options.

[1] Southern Water (2021). Draft Drought Plan 2022 Main report. 31 March 2021, Version 1.0.

Minor projects

3.6.7 It has not been possible to produce a definitive list of existing (minor) planning applications near this option's zone of influence and generating a list at this stage would be of little value given the lead times for the option. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the ACWG guidance on cumulative/in combination assessments.

Major projects

3.6.8 Reference has been made to the Planning Inspectorate's National Infrastructure Projects website[2] which includes major projects.

3.6.9 A review of that status of major projects that are located within or in close proximity to this European site has been undertaken to assess the potential for in-combination effect with this option. The following summarises the findings of this review:

- Lower Thames Crossing (a new road crossing connecting Kent, Thurrock and Essex)- a DCO for the project was granted in March 2025. The Secretary of State's HRA concludes the absence of adverse effects upon the integrity of the Thames Estuary and Marshes SPA and Ramsar subject to implementation of proposed mitigation measures.
- Kemsley Paper Mill (K4) Combined Heat and Power Plant (located on land within the boundary of the Kemsley Paper Mill, near Sittingbourne in Kent) – a DCO for the project was granted in July 2019. The Secretary of State's HRA concludes that there would be no LSE on the Thames Estuary and Marshes SPA and Ramsar site (the only potential pathway for effect on the SPA and Ramsar site appeared to be emissions to air, and it was concluded that relevant thresholds would either not be exceeded).
- Wheelabrator Kemsley Generating Station (K3) and Wheelabrator Kemsley North (WKN) Waste to Energy Facility (a power upgrade and increase in tonnage throughput to the existing Kemsley Generating Station and a new waste to energy facility, located adjacent to and immediately north-east of the Kemsley Paper Mill, in Kemsley, Sittingbourne, Kent) – a DCO was granted to Wheelabrator Kemsley K3 Generating Station only in February 2021. Wheelabrator Kemsley North Waste to Energy Facility was not granted development consent. The Secretary of State's HRA concludes that there would be no LSE on the Thames Estuary and Marshes SPA and Ramsar site.

3.6.10 Given the nature, location, current status of the environmental information and/or conclusion of the Secretary of State's HRA relating to the major projects reviewed above, it can be concluded that there is either no realistic potential for in-combination effects with the proposed option, or the environmental assessment of the major projects is not sufficiently advanced to enable in-combination assessment to be undertaken.

[2] https://infrastructure.planninginspectorate.gov.uk/projects/

3.7 Conclusion: Thames Estuary and Marshes SPA/Ramsar

3.7.1 Whilst there are some uncertainties regarding the precise hydrological impact of the abstraction, based on information available this is likely to be small or negligible, and at the plan level there is a clear mechanism by which any minor changes can be mitigated should this be necessary. For this reason, it can be concluded with sufficient confidence, that there will be no adverse effect on the integrity of the Thames Estuary and Marshes SPA/Ramsar.

3.7.2 At the project level, additional investigation will be necessary likely drawing upon the results of the current WINEP investigation, to confirm any requirement for mitigation to avoid adverse effects.