## Sizewell C Project

# Construction Water Discharge Activity Permit Application MCA/CWDA/78 (Desalination Plant)

# DOCUMENT CONTROL

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# 1 NON-TECHNICAL SUMMARY

## 1.1 Purpose

This technical supporting document accompanies the application for a Construction Water Discharge Activity (CWDA) environmental permit, which is required for a proposed discharge to sea associated with the development of the Sizewell C (SZC) power station, hereinafter referred to as "the project". The project itself and associated schemes are subject to the SZC (Nuclear Generating Station) Development Consent Order 2022 (referred to throughout this document as the 'DCO').

This permit application is referred to as MCA/CWDA/78 within the SZC project.

### 1.1.1 Project and Site Description

The site of the SZC development currently under construction is centred at UK National Grid Reference (NGR) TM 47355 64128. It is located on the Suffolk coast, approximately mid-way between Felixstowe and Lowestoft, to the north-east of Leiston. The site address being used for the construction works is Sizewell B power station, near Leiston, Suffolk, IP16 4UR (as the nearest operational facility).

## 1.2 Scope of Permit Application

A temporary desalination plant is required as part of the project, to provide a source of private water supply to the site during the construction period. Desalination is the process of removing salt and other minerals from seawater. The desalination plant will intake seawater, treat it to enable it to be used for multiple purposes across the construction site, and will then discharge wastewater from the process back to sea. The discharge of the process wastewater from the desalination plant therefore requires a CWDA environmental permit under the Environmental Permitting (England and Wales) Regulations 2016, as amended.

The composition of the process wastewater from the desalination plant is explained in more detail in **Section 4** of this technical supporting document.

There is only one CWDA being applied for in the scope of this permit application: the discharge of process wastewater from the desalination plant to the North Sea. The number of activities included in the application has been reflected in the fees for the permit application which are to be made payable to the Environment Agency (EA) as the regulator for the proposed discharge activity.

The proposed CWDA is anticipated to begin from October 2025 when it is intended that the plant will begin commissioning. Once operational, the desalination plant will be required, temporarily, until a permanent mains water connection is in place. Currently this is anticipated to be by 2032 (at the earliest), however this is dependent on several factors beyond the scope of this permit application and this date could therefore change. Therefore, the temporary desalination plant has been designed to operate for a 15-year lifespan, meaning that, if required, it could remain operational until 2040.

Requirements for any further licences or consents associated with the operation of the desalination plant are beyond the scope of this permit application and are being managed under a separate process.

## 1.3 Structure of Permit Application

This permit application sets out the background, context and relevant design information in relation to the proposed temporary desalination plant and CWDA. This technical supporting document is intended to be read in conjunction with the completed GOV.UK permit application forms and other supporting documents submitted as part of the application.

The technical supporting document is structured as follows:

Section 1 – Non-Technical Summary (this section).

Section 2 – Introduction and Context. This section introduces the proposed discharge activity and summarises relevant contextual, background information from the project.

Section 3 – Scope of Permit. This section summarises the overall scope of the permit being applied for.

Section 4 – Proposed Construction Water Discharge Activity. This section provides detail with regards to the proposed CWDA, including the anticipated discharge effluent composition, flow rate, volume and duration, and information on how these aspects have been predicted / calculated.

Section 5 – Supporting Risk Assessments and Modelling. Risk assessments have been undertaken, as per the relevant GOV.UK guidance for Surface Water Pollution Risk Assessments,[1] to support the proposed discharge activity and ensure that any potential impacts to the receiving receptor (the North Sea) have been identified and appropriately considered. A qualitative environmental risk assessment has also been undertaken as per the GOV.UK risk assessment guidance[2] for bespoke permit applications that has considered source-pathways-receptors likely to be present on site in relation to the proposed discharge activity specifically.

Section 6 – Proposed Monitoring and Sampling Arrangements. Ultimately any monitoring and / or sampling arrangements will be dependent upon the requirements set out in the environmental permit, however this section has been included in the technical supporting document to provide an indicative overview of what arrangements are considered likely to be required.

Section 7 – Environmental Management System (EMS) Arrangements. The proposed CWDA will be subject to the requirements of the SZC EMS. This will ensure that there are effective processes and / or procedures in place regarding management of the discharge activity. As part of the management requirements, monitoring and sampling will be undertaken to ensure the discharge activity does not cause pollution. A summary of the SZC EMS has been included within this technical supporting document.

## 1.4 Provision of additional information

Sufficient information is contained within this technical supporting document to support the permit application being made. However, the document identifies certain areas where information may still be subject to change, for example because the final design of the desalination plant and specifications of supporting components are still in development, or where further information is required once the implementation programme has been further progressed. The contractor responsible for the final design and build, supply and operation of the desalination plant has only just been appointed (November 2024) therefore further information to support this application is anticipated to be available throughout the permit determination period. This will be made available to the EA as requested.

## 1.5 Definitions

The below table includes the acronyms used throughout this technical supporting document.

| Term / Abbreviation | Definition |
|---|---|
| AA | Annual Average |
| AOD | Above Ordnance Datum |

[1] Surface water pollution risk assessment for your environmental permit - GOV.UK (www.gov.uk)
[2] Risk assessments for your environmental permit - GOV.UK (www.gov.uk)

| Term / Abbreviation | Definition |
|---|---|
| CDO | Combined drainage outfall |
| CEFAS | Centre for Environment, Fisheries and Aquaculture Science |
| CEMP | Construction Environmental Management Plan |
| CIP | Clean-in-Place |
| CoCP | Code of Construction Practice |
| CRoW | Countryside Rights of Way |
| CWDA | Construction Water Discharge Activity |
| DCO | Development Consent Order |
| DBNPA | 2,2-dibromo-3-nitrilopropionamide - biocide |
| EA | Environment Agency |
| EDRMS | Electronic Document and Records Management System |
| EMS | Environmental Management System |
| EQS | Ecological Quality Standards |
| ERA | Environmental Risk Assessment |
| ERD | Energy Recovery Device |
| ES | Environmental Statement |
| E&S | Environmental and Sustainability |
| ESGC | Environmental, Social and Governance Committee |
| Fe | Iron |
| HDD | Horizontal Directional Drilling |
| HDPE | High-Density Polyethylene |
| HRA | Habitats Regulations Assessment |
| IMS | Integrated Management System |
| LoD | Limit of Detection |
| MAC | Maximum allowable concentration |
| MCA | Main Construction Area |
| MCERTS | Monitoring Certification Scheme |
| MMO | Marine Management Organisation |
| MMP | Materials Management Plan |
| NaCl | Sodium Chloride |
| NGR | National Grid Reference |
| OD | Outer Diameter |
| PAH | Polycyclic aromatic hydrocarbons |
| PCS | Process Control System |
| PE | Polyethylene |
| PPT | Parts per thousand |




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| Term / Abbreviation | Definition |
|---|---|
| PSU | Practical Salinity Unit |
| RAMS | Risk Assessment and Method Statements |
| RO | Reverse Osmosis |
| SAC | Special Area of Conservation |
| SDR | Standard Dimension Ratio |
| SPA | Special Protection Area |
| SSSI | Site of Special Scientific Interest |
| SWMP | Site Waste Management Plan |
| SWRO / RO | Sea Water Reverse Osmosis / Reverse Osmosis |
| SZC | Sizewell C |
| TCA | Temporary Construction Area |
| TDS | Total dissolved salinity / total dissolved solids |
| TRaC | Transitional and coastal waters |
| TSS | Total suspended solids |
| VOC | Volatile organic compounds |
| WFD | Water Framework Directive |

## 1.6 Appendices

| Ref | Title | Document Reference (Revision) | Summary |
|---|---|---|---|
| 1 | Appendix A – Environmental Permit Application Forms (Part B2 and B6) | 101357876 (001) | Required GOV.UK application forms to support permit application. |
| 2 | Appendix A2 – Environmental Permit Application Forms (Part A and F1) | 101388344 (001) | Required GOV.UK application forms to support permit application. |
| 3 | Appendix B – Site Plans and Design Drawings | 101357880 (001) | A compilation of drawings showing the proposed desalination plant and pumping station compound layout and a process flow diagram showing the key components of the proposed desalination plant. |
| 4 | Appendix C – Cefas Report TR552 Sizewell C Desalination Plant Construction Discharge Assessment | 100906975 (004) | Surface water pollution risk assessment. |
| 5 | Appendix D – Qualitative Bespoke Environmental Risk Assessment | 101357893 (001) | Qualitative environmental risk assessment considering the hazards, source, pathways and receptors associated with the proposed discharge activity. Includes proposed control measures. |
| 6 | Appendix E – Construction Water Discharge Activity Permit Application MCA/CWDA/78 (Desalination Plant) Water Environment Regulations Compliance | 101357901 (001) | Water Framework Directive risk assessment (updated from previous assessment submitted as part of DCO submission). |

| Ref | Title | Document Reference (Revision) | Summary |
|---|---|---|---|
| 7 | Appendix F – Package to Inform Countryside Rights of Way (CRoW) Act Assessment and Habitats Regulations Assessment (HRA) Permit MCA/CWDA/78 – Water Discharge Activity Permit for Desalination Plant Discharge | 101357904 (001) | Package of supporting information provided to support the Environment Agency HRA and further information pertaining to CRoW. |
| 8 | Appendix G – Extract from SZC DCO ES Chapter 21 Baseline Marine Water Quality | 101357907 (001) | An extract taken from the SZC DCO Environmental Statement (ES), Chapter 21, which summarised the baseline marine water quality. This has been included as this data has been used to inform wider supporting assessments, notably Appendix C and E. |
| 9 | Appendix H – Extract from SZC DCO ES Chapter 21 Appendix 21E Baseline Marine Water Quality Summary | 101357908 (001) | As above – with specific appendices that show baseline marine water quality characteristics. |
| 10 | Appendix I – WFD Summary Extract from DCO | 101357969 (001) | An extract of the original Water Framework Directive assessment that was completed for the project at DCO stage. This has been used to inform Appendix E. |
| 11 | List of Directors | 101295874 | List of Sizewell C Limited Directors to inform Permit Application form Part A. |

# 2 INTRODUCTION AND CONTEXT

This section of the technical supporting document introduces the CWDA that is proposed to be undertaken that will result in a discharge to the sea. It introduces the project and site where the CWDA is to take place before outlining the regulatory requirements that apply to the proposed activity. This section also sets out where the relevant information pertaining to the required GOV.UK permit application forms has been included, either within this document or on the application forms themselves to aid the permit Duly Making process.

## 2.1 Background to Desalination Plant Requirements

This permit application relates to the discharge of effluent to the North Sea from a temporary desalination plant. The need for the temporary desalination plant was introduced during the DCO examination phase of the SZC project because of expected delays in the availability of a piped permanent mains water supply. This was recorded, within the DCO, as Change 19, which requested a change to the Water Supply Strategy (published in September 2021) for the project, which has since been accepted. The desalination plant will treat seawater to a potable standard for domestic and industrial use across the project site during the construction period.

The approximate location of the proposed desalination plant and other supporting infrastructure is indicated in **Figure 1** further below.

## 2.2 Site Setting and Surroundings

As described above, this permit application relates to a specific discharge activity that is required to support the construction works for the SZC project: the discharge of process effluent from a temporary desalination plant to the North Sea.

The site of the SZC development currently under construction is centred at UK National Grid Reference (NGR) TM 47355 64128. It is located on the Suffolk coast, approximately mid-way between Felixstowe and Lowestoft, to the north-east of Leiston. The site address being used for the construction works is Sizewell B power station, near Leiston, Suffolk, IP16 4UR (as the nearest operational facility).

The project site is split into several different areas. Those which relate specifically to the proposed water discharge activity and therefore this environmental permit application are:

- The Main Construction Area (MCA); and
- The Temporary Construction Area (TCA).

The MCA comprises the part of the site where, in the future, the main nuclear reactors and buildings will be located for the completed, operational SZC nuclear power plant. During construction, this area will house the compound area for the desalination pumping station infrastructure, which is where the seawater intake shaft and outfall pipeline will come ashore (**Section 3** below includes more detail on the infrastructure elements associated with the desalination plant and supporting infrastructure). The desalination plant itself will be in the TCA, which is located to the north and west of the MCA. This area, as the name implies, is to be used for temporary construction purposes only and will house various aspects including contractor / worker campus accommodation and welfare facilities, haul roads, construction laydown areas and stockpiles, concrete batching plant and other treatment plants (e.g., for foul, surface and ground water). The desalination plant is expected to be located within the south-east of the TCA, where there is suitable space available on site.

There will be two marine head structures associated with the desalination plant. Both will be located offshore in the North Sea. One will comprise the seawater intake point and the other the 'brine reject' dispersion point. Both will be connected to the desalination plant pumping station compound via pipeline. The pipelines will run below sea-level and ground-level (below the Sizewell Foreshore) and will come ashore at the desalination pumping station compound in the MCA, within the site boundary. These elements are described in more detail in **Section 3** below.

The project site lies within a flood risk zone, with parts, including the proposed location of the desalination plant in the TCA, falling within Flood Risk Zone 3, which is described as having a higher probability of flooding from rivers and the sea. Parts of the site are protected by existing flood defences. A separate Flood Risk Assessment was completed as part of the DCO stage (Volume 5.2 Main Development Site Flood Risk Assessment, May 2020, PINS Reference Number EN010012[3]); this has been used to inform both construction and operational design elements of the SZC project.

The underlying geology and hydrogeology of the site was considered during the DCO planning process and outlined in detail within the supporting Environment Statement. This is publicly available information,[4] however, to provide context, the project is being sited upon a bedrock geology of Crag Formation underlain by chalk, with superficial geology comprising marine beach deposits (sands and gravels), tidal flat deposits (clay and silt), Lowestoft Formation (sand and gravel), peat deposits and Lowestoft Formation (diamicton), and made ground (within the MCA). The bedrock is classed as a Principal Aquifer, with part of the superficial geology designated as a Secondary A Aquifer. The site is not located within a groundwater source protection zone.

### 2.2.1 Site Surroundings

There are several areas subject to statutory designations either within the vicinity of the discharge point, or within close proximity, to the proposed temporary desalination plant itself, namely:

- Sizewell Marshes Site of Special Scientific Interest (SSSI)
- Outer Thames Estuary Special Protection Area (SPA)
- Southern North Sea Special Area of Conservation (SAC) and Suffolk Coastal waterbody
- Minsmere-Walberswick Ramsar site
- Minsmere to Walberswick Heaths & Marshes SAC, and
- Suffolk Coast and Heaths Area National Landscape, which the site falls within.

The impacts of the project, including associated construction works, on the site settings and surrounding features were considered in a Habitats Regulations Assessment (HRA) undertaken as part of the DCO planning requirements. However, a separate HRA and Countryside and Rights of Way (CRoW) assessment will need to be undertaken specifically in relation to this permit application and the proposed discharge activity from the temporary desalination plant (see Section 5 below).

## 2.3 Regulatory Context

In accordance with the Environmental Permitting (England and Wales) Regulations 2016, as amended, a bespoke CWDA permit will be required for the proposed discharge activity to take place. Under Schedule 21[5] of the Permitting Regulations, the definition of the activity being applied for is ‘the discharge or entry to inland freshwaters, **coastal waters**, or relevant territorial waters of any:

(i) poisonous, noxious or polluting matter,

[3] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010012/EN010012-001707-SZC_Bk5_5.2_Main_Development_Site_Flood_Risk_Assessment.pdf
[4] EN010012-001912-SZC_Bk6_ES_V2_Ch19_Groundwater_and_Surface_Water.pdf (planninginspectorate.gov.uk)
[5] The Environmental Permitting (England and Wales) Regulations 2016 (legislation.gov.uk)

(ii) waste matter, or

(iii) trade effluent or sewage effluent'

The discharge will comprise effluent from the desalination plant treatment processes and concentrated seawater (or concentrated saline effluent). This type of discharge is sometimes referred to as 'brine reject'. The discharge will, on occasions, also contain treated water from maintenance activities (see **Section 4.1.3** below) undertaken to parts of the plant's supporting infrastructure. The discharge will not contain any other sources of effluent (e.g. no surface water, foul water or groundwater).

The discharge activity type under the Permitting Regulations is:

- 1.3.12 Trade effluent and / or non-sewage effluent and / or rainfall-related discharges to surface water or groundwater with a volume greater than $5m^3$ a day.

The permit application is being referenced as MCA/CWDA/78 within the SZC project.

As part of the permit application process, the following GOV.UK guidance has been followed as a minimum:

- GOV.UK guidance Surface water pollution risk assessment for your environmental permit[1]
- GOV.UK guidance Risk assessments for your environmental permit[2]
- GOV.UK guidance Discharges to surface water and groundwater: environmental permits[6]

Further applicable guidance is referenced as footnotes throughout this application.

In addition to this technical supporting document, the following application forms have been completed (please refer to **Appendix A**):

- Part A About you
- Part B2 New bespoke permit
- Part B6 Bespoke water discharge activity (including Section 1: Discharges to tidal river, tidal stream, estuary or coastal waters)
- Part F1 Charges and declarations

The company applying for the permit, and which will act as 'legal operator', is Sizewell C Limited. A permit reference number is to be assigned to this application upon submission.

### 2.3.1 Pre-application regulatory engagement

Regular Pre-application discussion with the EA, as the regulator responsible for CWDA permits, has taken place since an initial Regulatory Engagement session which was held in May 2024. The Pre-application discussions have enabled specific aspects of the application to be shared and reviewed to ensure that all relevant regulatory requirements and other considerations (where applicable) have been appropriately addressed. The Centre for Environmental, Fisheries and Aquaculture Science (CEFAS) were also involved in Pre-application discussions specifically in relation to the Surface Water Pollution Risk Assessment that has been completed to support the permit application. These have helped to ensure all required information is contained within the permit application and this technical supporting document.

[6] Discharges to surface water and groundwater: environmental permits - GOV.UK (www.gov.uk)

### 2.3.2 Duly Making Information

The below section outlines the questions from the GOV.UK application forms described above and pinpoints which section of this technical supporting document (where relevant) contains information to support the permit duly making process. The application forms themselves also cross-reference to the relevant sections of this technical supporting document.

**Table 1 - Duly Making Information**

| Application Form Question Reference | Location of Required Information (within this technical supporting document or application form) |
|---|---|
| **Part A About you** | Refer to application form and List of Directors document. |
| **Part B2 New bespoke permit** | |
| 1 About the permit | 1a. See **Section 2.3.1** above.<br>1b – 1d. Refer to application form. |
| 2 About the site | 2a. Refer to application form and **Section 2.2 and 3.2** above / below.<br>2b. Refer to application form and **Section 3.2**.<br>2c. Not applicable.<br>2d – 2g. Refer to application form. |
| 3 Your ability as an operator | 3a – 3c. Not applicable.<br>3d. Refer to application form and **Section 7** below. |
| 4 Consultation | 4a – 4d. Not applicable. |
| 5 Supporting Information | 5a. Refer to **Appendix B**.<br>5b. Not applicable.<br>5c. Refer to **Section 1** above.<br>5d. Not applicable. |
| 6 Environmental Risk Assessment | Refer to **Section 5** below and **Appendices C, D and E**. |
| **Part B6: New bespoke water discharge activity** | |
| 1a – 1d About the effluent – details and type | Refer to application form.<br>Note that a lease will be applied for from the Crown Estate for the desalination plant intake and outfall pipeline. |
| 2a – 2e About the effluent – how long will you need to discharge the effluent for? | Refer to application form. |
| 3 How much do you want to discharge? | 3a. Not applicable as the discharge does not relate to a discharge of sewage effluent containing rainwater.<br>3b – 3d. See **Section 4.3 and 4.4** below and application form.<br>3e. – Not applicable as the application does not relate to rainfall dependent discharge. |
| 4 Intermittent sewage discharges | Section not applicable to proposed discharge activity. |
| 5 Should your discharge be made to the foul sewer? | Refer to **Section 4.4** below and application form. |
| 6 Nutrient neutral | N/A – the proposed discharge activity is not located within a nutrient neutral catchment. |
| 7 How will the effluent be treated? | 7a - 7b. Refer to **Sections 3 and 4** below and application form.<br>7c. Refer to application form.<br>7d. Not applicable.<br>7e. Not applicable.<br>7f. Not applicable.<br>7g. Refer to **Section 6** below. |
| 8 What will be in the effluent? | 8a. Does not apply |

| Application Form Question Reference | Location of Required Information (within this technical supporting document or application form) |
|---|---|
| | 8b – 8c. Refer to application form and **Sections 4.2, 5.2 and 6.2** below.<br>8d. Not applicable as have not answered 'no' to any of 8a-8c.<br>8e - 8f. Refer to application form. |
| 9 Environmental risk assessments and modelling | 9a. Not applicable.<br>9b. Refer to **Section 5** below and **Appendix C**.<br>9c. Not applicable.<br>9d. Not applicable.<br>9e. Not applicable.<br>9f. Refer to **Section 5** below and **Appendix D.** |
| 10 Monitoring arrangements | 10a – 10b. Refer to application form and Section 6 below.<br>10c. Not applicable.<br>10d. Refer to **Section 6** below.<br>10e. Refer to **Section 6** below.<br>10f. Not applicable.<br>10g. Not applicable.<br>10h. Not applicable.<br>10i. Not applicable.<br>10j. Refer to **Section 3** below.<br>10k. Refer to application form and **Section 6** below. |
| 11 Where will the effluent discharge to? | 11a. Refer to application form.<br>11b. Refer to application form.<br>11c. Not applicable. |
| **Part B6 Section 1: Discharges to tidal river, tidal stream, estuary or coastal waters** | Refer to completed form. |
| **Part F1 – Charges and Declarations** | Based on the relevant activity references (in accordance with the June 2024 Environmental Permits and Abstraction Licences: tables of charges[7]) the fee for the proposed discharge activity amounts to £13,492.<br>This has been confirmed with the EA during Pre-Application and is based on the following discharge activity references:<br>1.3.12 – Trade effluent and / or non-sewage effluent and / or rainfall related discharges to surface water with a volume greater than 5 $m^3$/day at £7,183.<br>1.19.10 – Habitats assessment for discharges to water and groundwater activities at £2,035.<br>1.19.11 – Specific substances assessment for a water discharge activity to surface water at £3,774.<br>Application charges additional charges - £500 for costs associated with advertisement of the application.<br>Alternative payment arrangements have been made (as identified on the application form – see added text). These Activity references and charges have been agreed with the EA during Pre-Application. |

[7] Environmental permits and abstraction licences: tables of charges - GOV.UK (www.gov.uk)

# 3 SCOPE OF PERMIT – DISCHARGE FROM DESALINATION PLANT

## 3.1 Permit scope

This permit application relates to the discharge of effluent into the North Sea from a temporary desalination plant. The need for the desalination plant was introduced during the DCO examination phase of the SZC project because of expected delays in the availability of a piped permanent mains water supply. This was recorded as Change 19 which requested a change to the Water Supply Strategy for the project. The plant will treat seawater to a potable standard for domestic and industrial use across the project site.

Works to construct SZC power station are taking place under the DCO granted by the Secretary of State following examination by the Planning Inspectorate. Construction is anticipated to take between 9-12 years and will be undertaken in planned phases. The temporary desalination plant, expected to be operating from October 2025, is to be implemented as part of the enabling works and site establishment programme, which is defined as all works necessary to prepare the main development site (which houses the MCA and TCA) for the execution of the main civil works and marine works construction. It is currently anticipated to be operational up until 2032, however this date will ultimately depend upon the readiness of a connection to the mains water supply to provide resilience to the project in terms of water availability. The EA will be kept updated of any changes to the proposed discharge cessation date.

This permit application does not relate to any aspects of the commissioning, operational and / or decommissioning phase(s) of the SZC power plant itself. Separate applications for other CWDA permits (in addition to this one) have been made and may be required in the future in relation to the SZC project. These have not been included in the scope of this permit application.

## 3.2 Desalination plant key components and infrastructure

The desalination plant location is planned to be located at the TCA, whereas the desalination pumping station compound, housing the intake shaft, pumping station and outfall pipeline, is planned to be situated within the MCA (adjacent to the Sizewell Foreshore).

### 3.2.1 Site Plans and Reference Locations

The below figures have been included to provide an indication of the location of the desalination plant and pumping station compound in comparison to the main site elements during construction. In summary:

- **Figure 1** shows the approximate location of the desalination plant within the TCA and the desalination pumping station compound in the MCA. The red line in the drawing represents the DCO Red Line Boundary for the project.
- **Figure 2** shows the location of the desalination pumping station compound within the MCA as well as the approximate locations of the marine intake shaft and the outfall pipeline.
- **Figure 3** is a profile engineering drawing of the desalination plant pumping station compound and associated infrastructure.
- **Figure 4** shows the location of the marine head structures alongside the seawater intake and dispersion head from the outfall pipeline.

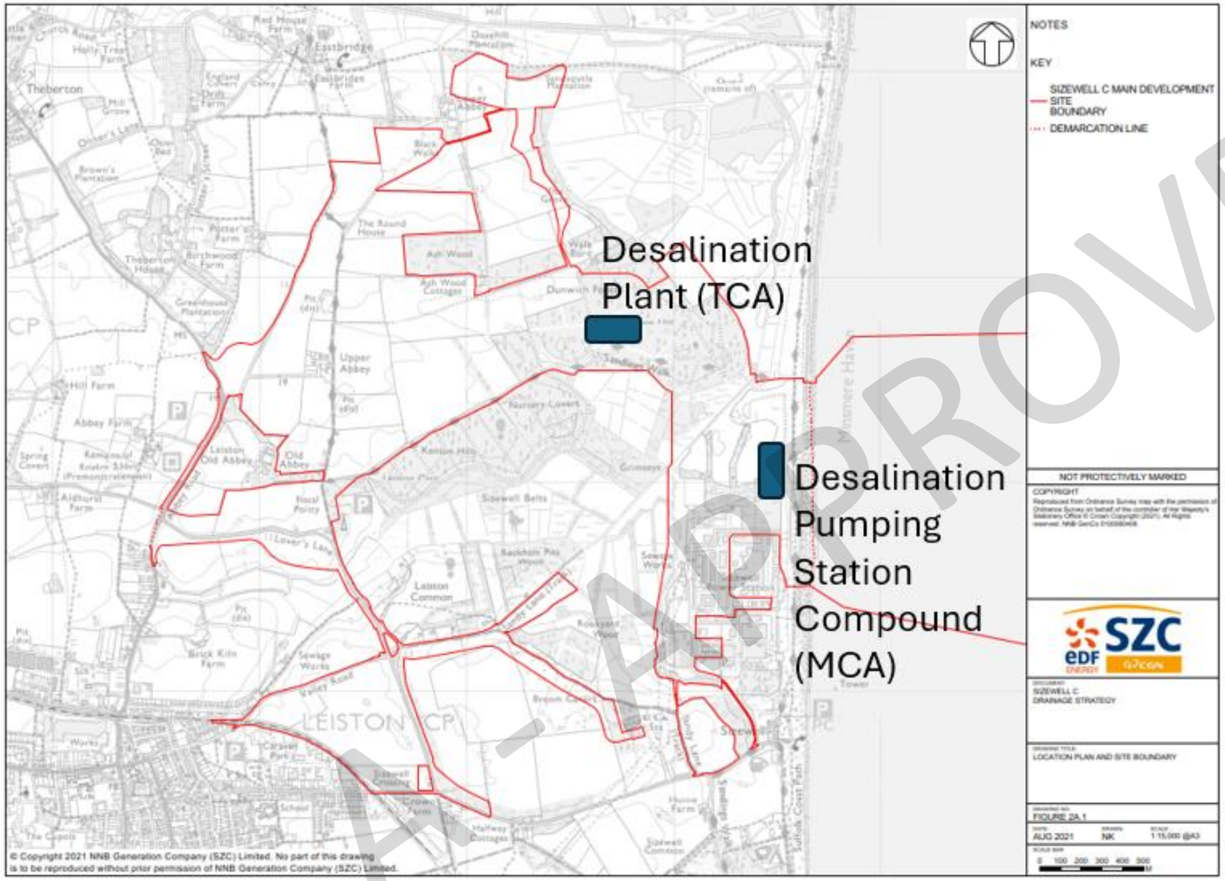


**Figure 1 - Desalination Plant and Pumping Station Compound Locations (approximate)**









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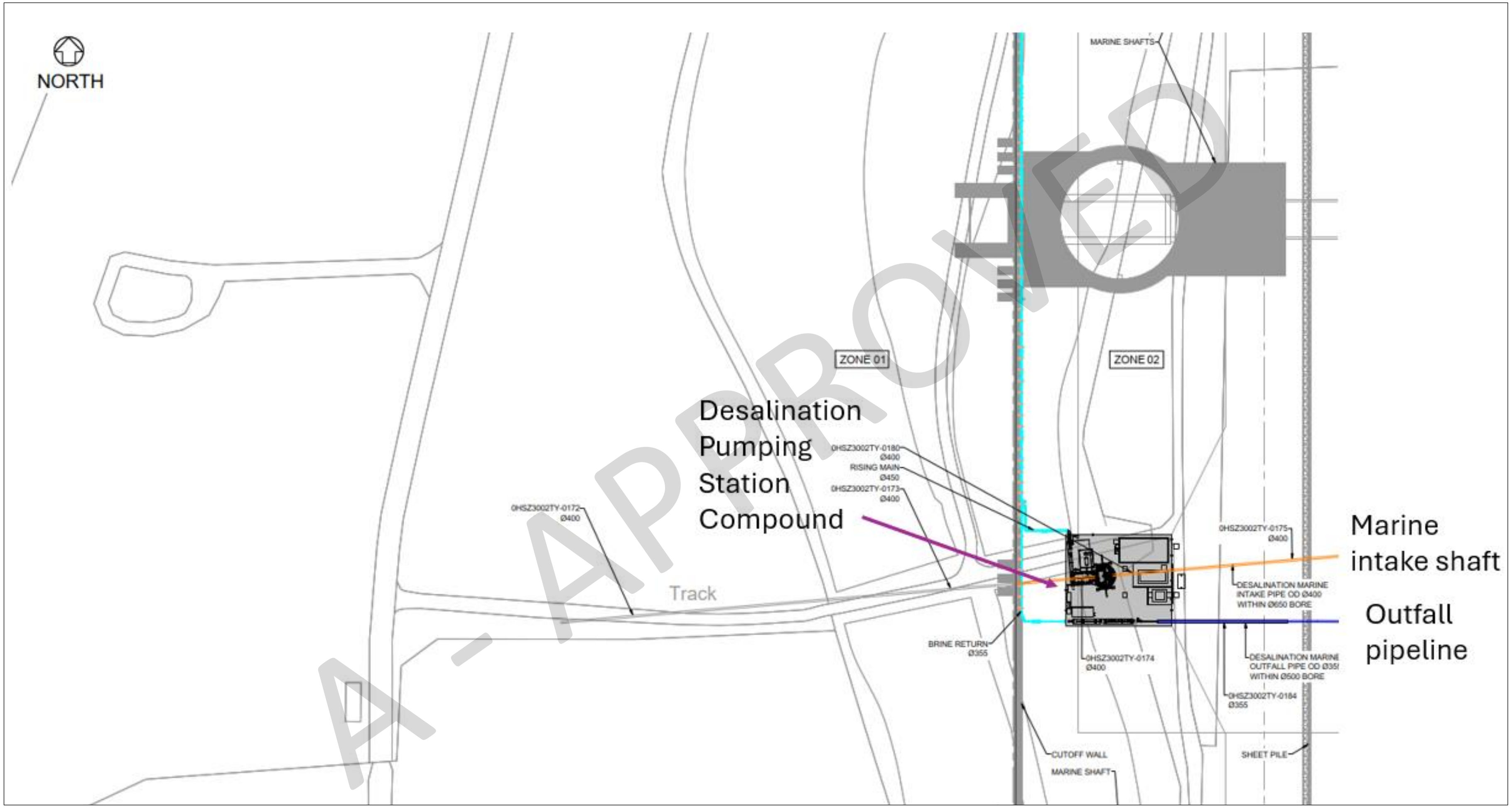


**Figure 2 - Desalination Plant Pumping Station Compound, Intake Shaft and Outfall Pipeline (MCA)**







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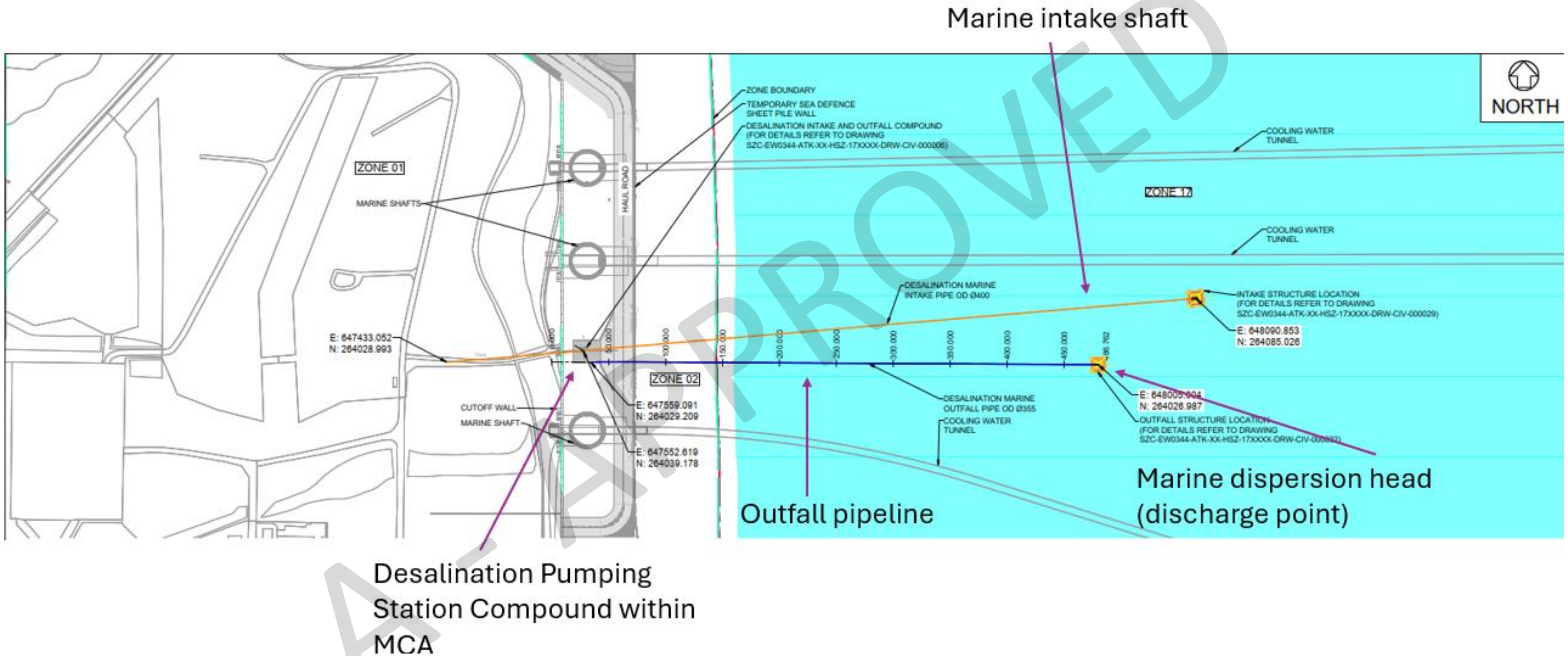




**Figure 3 - Desalination Plant Engineering Profile Drawing**





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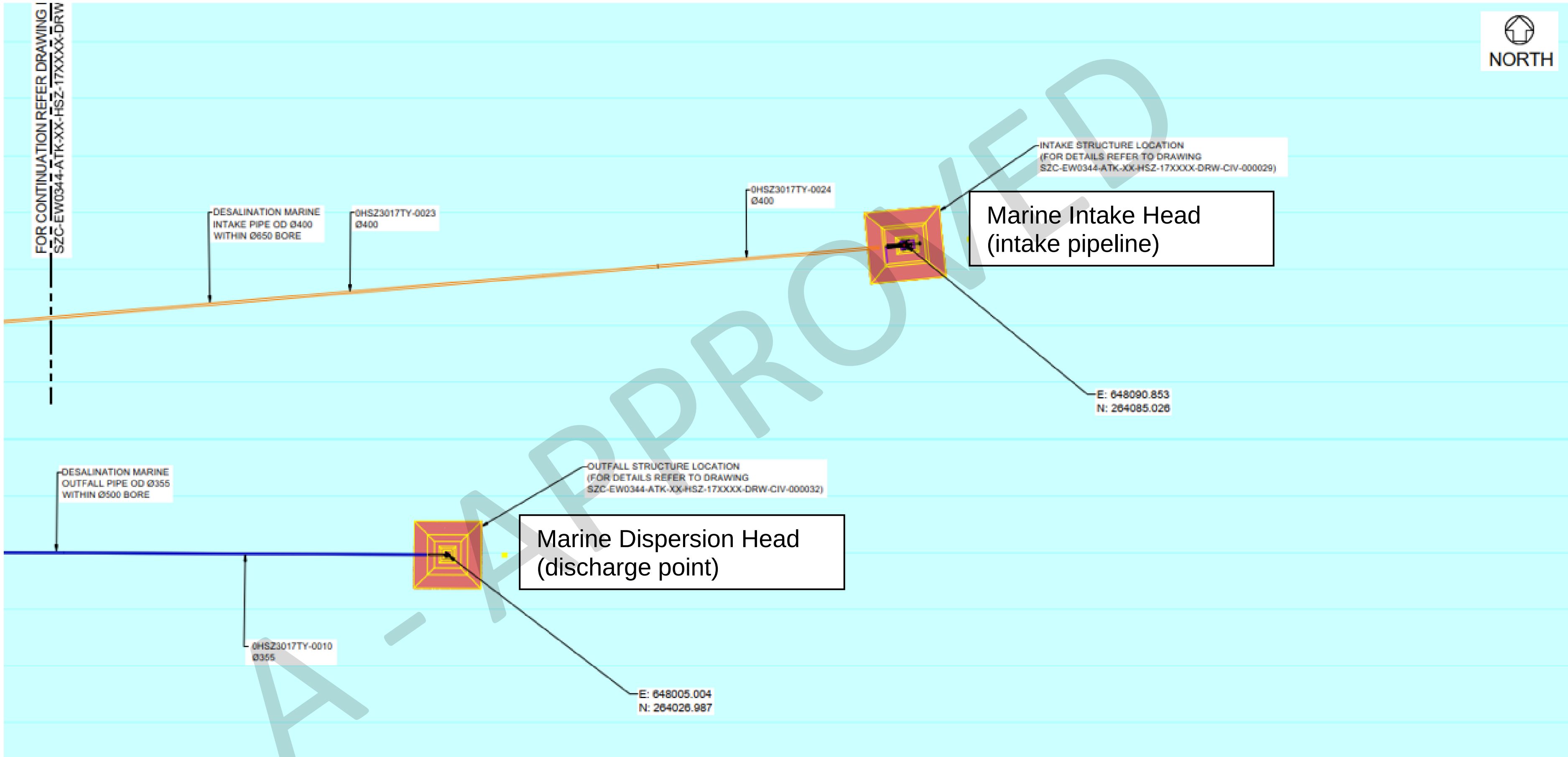




**Figure 4 - Marine Intake and Dispersion Head Locations**

The above figures have been included to provide outline locations for context. Please also refer to the design drawings provided in **Appendix B** to this technical supporting document which provide the following:

- Desalination plant intake and out-take profile drawing
- Desalination plant marine head structure locations
- Desalination plant process flow diagram and
- Desalination plant general arrangement design drawing.

The national grid references (NGR) for the desalination plant's key components are as follows:

**Table 2 - National Grid References**

| **Desalination Plant Feature:** | **NGR:** |
|---|---|
| Desalination plant corners (TCA) | TM 46655 64797<br>TM 46755 64795<br>TM 46755 64712<br>TM 46655 64713 |
| Desalination plant compound corners (MCA) | TM 47544 64048<br>TM 47544 64028<br>TM 47568 64028<br>TM 47568 64048 |
| Marine intake head | TM 48091 64085 |
| Marine dispersion head | TM 48005 64027 |
| Effluent sampling point<br>*(see **Section 6** below)* | TM 47557 64029 |

Based on the current design, the desalination plant and associated infrastructure is expected to comprise of the following key elements:

1. Marine intake (comprising the intake head, intake pipeline and intake shaft)
2. Desalination plant pumping station compound
3. Seawater transfer pipe, from the pumping station compound to the desalination plant
4. Desalination plant (comprising a seawater reverse osmosis (SWRO / RO) process including waste solids treatment)
5. Outfall (brine return) pipeline and
6. Marine outfall (comprising a diffuser dispersion head and supporting civils infrastructure).

The paragraphs below summarise the key elements listed above based on the current design (which is still subject to finalisation by the appointed plant contractor):

**Marine Intake:** A seafloor mounted marine intake head will be constructed in the North Sea which will supply the intake shaft (or feed pipe) with seawater by force of gravity. This is to be located approximately 405m out to sea from the pumping station compound location where the intake shaft comes ashore. The marine intake is to be constructed through horizontal directional drilling (HDD). The intake pipe is approximately 660m in length.

**Desalination Pumping Station Compound:** The pumping station compound will be located in the MCA and will house the marine intake shaft, the pumping station itself and will form the source of the transfer pipeline which will take the abstracted seawater to the desalination plant in the TCA (see below). The compound will also house associated building structures, a transformer area, emergency generator set area, chlorine dosing pump system, lockable chemical storage kiosk, monitoring equipment and other operation and maintenance facilities as required.

**Seawater Transfer Pipe:** The transfer pipe from the inlet shaft pumping station compound in the MCA to the desalination plant is anticipated to be comprised of Standard Dimension Ratio (SDR) 11 Polyethylene (PE). The total length of the intake pipeline is expected to be in the region of 1,664m with around 679m above ground and 985m below ground (based on current design). From the MCA, the pipe will be predominantly above ground and then below ground for approximately 300m immediately before entry to the desalination plant in the TCA. The above ground pipe is anticipated to be rack mounted, and the route will pass along a coordinated service corridor over a bridge crossing the Sizewell Marshes SSSI.

In the initial construction phase, before a majority of the MCA site has been set up, approximately 625m of flexible pipe is to be routed to the west of the desalination pumping station compound and the SSSI bridge. The use of flexible pipe is to enable a diversion which is coordinated with development in active construction areas. Once the MCA site is established, the pipe will then be re-routed to the east of the desalination pumping station compound, using a racking system.

**Desalination Plant:** The desalination plant itself will be in the TCA. See the below section for further detail on the plant itself.

**Outfall (Brine Return) Pipeline:** The desalination plant process effluent will be returned to the pumping station in the MCA compound via a SDR 11 PE pipe. This is referred to as the brine return pipeline. This then becomes the outfall pipeline once it leaves the pumping station compound and transfers the effluent to the marine dispersion head (see below).

The total length of the brine return and outfall pipeline is approximately 1,711m, comprising approximately 735m above ground and 976m below ground. From the pumping station compound, the process effluent will be discharged to a seafloor mounted diffuser, located approximately 320m out to sea (see Marine Dispersion Head below). The land-based section of the brine return pipeline route is the same as the seawater transfer pipe described above. Between the desalination pumping station compound and the SSSI bridge, the pipe will be of flexible design until major elements are in place. The permanent configuration for above ground sections of the brine return pipe will be installed on racking from the SSSI to the desalination pumping station compound and sections of the pipeline will be installed below ground. The length of the outfall pipe from the pumping station compound in the MCA (surface connection point) and the outfall marine head is approximately 440m in length. Effluent to be discharged via the outfall will gravitate when tidal conditions allow with pumping to assist across the tidal cycle.

Hydraulic analysis of the intake shaft and outfall pipeline has been undertaken which incorporated modelling to determine the minimum required levels in the brine reject tanks for discharge to take place to sea. The modelling assessment undertaken as part of the design process for the desalination plant has identified that, although under certain conditions gravity flow may be possible, it is necessary to pump waste flows from the plant to the outfall pipe to cover all levels and tide situations for required flows. The outfall pipe is therefore gravity fed with pumping arrangements to pump in times where the demands on the system may not permit gravity flow only.

**Marine Dispersion Head:** The marine dispersion head forms the structure through which the final effluent will be dispersed out to sea. It comprises the outfall head and diffuser. The current design includes for rockfill, scour protection, and a stabilising concrete block. The head will comprise of a pipework assembly and three duckbill valves directly connected to the outfall pipeline. The duck bill valves have been designed to be angled at 45 degrees to help aid dispersion (as the process effluent discharge stream will be denser than the natural seawater).

Multiple aspects were taken into consideration during the design of the marine structures associated with the plant including, for example: tidal current, tide levels, sea temperature, seabed level variation, wave conditions and height, scour protection analysis and wave forces. Furthermore, hydraulic assessments were undertaken to determine minimum internal diameters for the intake and outfall pipes.

The marine dispersion outfall head is approximately 100m to the south-west of the marine intake head.

In addition to the above elements, another aspect of the desalination plant infrastructure worth noting in this permit application is a temporary de-siltation pipeline. A bauer connection has been included as part of the design of the outfall pipeline which will allow temporary connections to be made to the outfall pipeline if required. At present, this is anticipated to be limited to the use of a temporary pipeline connection from a sediment-treatment system (i.e., Siltbuster or similar) to the outfall pipeline for discharge of treated sediment-laden water from the desalination plant intake shaft (which will be removed periodically as part of plant maintenance, see **Section 4.1** below).

## 3.3 Desalination Plant Treatment Process Description

The desalination plant will remove suspended sediments, dissolved salts and minerals from seawater pumped from the intake shaft to make the seawater appropriate for use on site during construction. The process comprises of multiple stages which can be categorised as pre-treatment, desalination, post-treatment and waste handling. Waste streams from the desalination process will comprise the process effluent to be discharged, the composition of which is described further below within this technical supporting document, and sludge from the clarification / filtration processes. This will be managed separately to the liquid process effluent and is beyond the scope of this permit application which is for the proposed CWDA only.

Each stage, based on the current plant design, is summarised below in **Table 3**:

**Table 3 - Desalination Plant Process Description**

| Treatment Stage | Sub-Process | Description |
|---|---|---|
| **1. Pre-Treatment** | Intake Seawater Quality Monitoring | The incoming seawater will be quality-monitored prior to it entering seawater balance tanks. Alarms are to be provided for abnormal baseline marine water quality levels and for the detection of certain pollutants that could compromise treatment equipment or intended water quality. Trigger limits for the alarms are to be determined as part of final plant design.<br>The following parameters will be monitored at the intake (inlet sampling point):<br>• Residual chlorine (dual validation)<br>• pH<br>• Volatile Organic Compounds (VOC) / Oil in Water<br>• Oxidation Reduction Potential<br>• Turbidity<br>• Conductivity<br>• Temperature |
| | Seawater Balance Tanks | For seawater storage and primary settling, seawater balancing tanks will include de-gritting and sediment removal facilities. Each tank is to provide a buffer storage of a minimum of 1 hour storage at maximum flow (600m$^3$) and either tank will be able to be isolated for maintenance purposes. Ultrasonic level sensors will be installed in each tank such that if both tanks reach high level the pumps at |

| Treatment Stage | Sub-Process | Description |
|---|---|---|
| | | the marine pumping station will stop (which will essentially restrict the volume of abstracted seawater and discharged process effluent). |
| | *S*ea Water Lift Pumps | Sea water lift pumps will transfer the incoming seawater from the balance tanks into a flocculation tank by a rising main. The rising main is expected to include static mixers for the dosing of coagulant and acid pH adjustment if required. |
| | Flocculation Tanks | Flocculation tanks will provide the residence time required for the development of floc and coagulation of particles into heavier floc to aid settling. The floc formation process is promoted by the addition of coagulant together with sufficient agitation to encourage the particles to collide without sheering. |
| | Clarifiers | Sedimentation clarifiers will then be used to remove the suspended solids formed in the flocculation tanks using a series of inclined plates, lamella, to encourage rapid settlement. The suspended solids will accumulate at the bottom of the clarifiers and be removed as sludge for further thickening and dewatering in the waste solids treatment process. There is sufficient redundancy to allow one clarifier to be removed from service without impacting on plant production. |
| | Clarified Water Buffer Tank | The clarified water buffer tank receives water from the lamella clarifiers and provides buffer storage for the media filter pumping station. |
| | Multimedia Filters | The clarified seawater is further treated by multi-media filters. The filters will provide a fine filtration step to further reduce the suspended solids. The sand and anthracite media will be periodically backwashed to remove trapped solids and maintain filter efficiency and capacity. |
| | Clean Backwash Tank | The clean backwash tank will receive and store a side stream of filtrate from the multi-media filters, this clean filtrate will then be used to backwash the filters. |
| | Dirty Backwash Tank | The waste backwash water and suspended solids produced in the filter backwash process will be received and stored in the dirty backwash tank before further settling and dewatering in the waste solids treatment process. |
| | Chemical Dosing* (Bisulphite) | To protect the seawater reverse osmosis (SWRO) membranes against oxidation, sodium bisulphite (or similar) is likely to be added to the filtrate from the multi-media filters to remove any residual chlorine. |
| **2. Desalination** | Cartridge Filters | Cartridge filters will be used to protect the SWRO membranes against particles which could block the membrane interspace. |
| | First Pass Seawater Reverse Osmosis (SWRO / RO) | A single stage SWRO plant is used to remove >99% of the total dissolved solids (TDS) from the seawater. The plant will use a semipermeable membrane which has been selected to operate with seawater under high pressure (greater than 53bar). The system is divided into a number of identical streams which each have a fixed output, the variation in demand is managed by the placing of the required number of streams in service and by using the buffer capacity of the intermediate and final storage tanks. The number of streams allows for one stream to be taken out of service for cleaning of maintenance without a reduction in the maximum design capacity of the plant. The mineral and salt content of the seawater is increased as pure water is extracted and the reject brine is generated. The concentration of the reject brine can lead |

| Treatment Stage | Sub-Process | Description |
|---|---|---|
| | | to scaling and a loss of output, therefore an anti-scalant chemical will be added to the seawater feed (via continuous flow proportional dosing) to the SWRO which limits the fouling potential of the reject brine. |
| | Energy Recovery Device (ERD) | An ERD device installed on the first pass brine stream of each membrane train will be used to recover energy and reduce the power requirement of the RO feed pumps. Low-pressure seawater passes through the ERD device and its pressure is boosted using the energy available from the reject high-pressure brine, rather than electrical energy from the RO feed pumps. |
| | Intermediate Permeate (Equalisation) Tank | The permeate from the first pass SWRO is to be stored in an intermediate permeate storage tank. The tank provides a buffer between the first pass and the second pass RO systems. The intermediate permeate tank will also provide a store of clean water required for flushing the membranes on each shutdown. |
| | Sodium Hydroxide Dosing | Sodium hydroxide (or similar) will be added to increase the pH of the feed water to the second pass RO to increase the removal of boron. |
| | Second Pass SWRO | A two-stage SWRO plant further purifies the permeate generated by the first pass SWRO stage. A second antiscalant is applied to the second pass feed and passed through the second stage RO membrane operating under medium pressure (less than 18bar). The system is divided into several identical streams which each have a fixed output, the variation in demand is again managed by the placing the required number of streams in service and by using the buffer capacity of the intermediate and final storage tanks. The reject from the second pass RO plant is returned to the feed of the first pass SWRO to minimise water loss from the system. |
| | Permeate Blending | Permeate (i.e., water that has passed through the SWRO membrane) from the SWRO can be bypassed and be blended with the permeate from the 2nd pass RO to deliver a target final permeate quality. |
| | SWRO Membrane Clean-in-Place (CIP) | The SWRO membranes will require intermittent chemical cleaning (known as a "Clean in Place") to remove accumulated fouling material. This is expected to be required 2-3 times a year. During the clean, each membrane train is taken off-line and cleaned independently from the other trains to allow continuous production.<br>The chemical solution is made up within a small CIP tank and heated to 35°C. The warm chemical solution is then recirculated around the RO membrane train for 30-60 minutes. to remove foulants. On the completion of cleaning of all trains, the chemical solution is neutralised before discharge to the sea outfall tank where it blends with the brine reject before discharge to sea.<br>A combination of chemicals are used for cleaning which may include citric acid, sodium hydroxide, biocide and detergents. The nature of the chemical clean and the chemical applied is dependent on the type of fouling being experienced by the membranes. Before return to service following a CIP, the membrane train is flushed with clean (permeate) water and the spent flushing is likewise discharge to the sea outfall tank. |
| **3. Post-Treatment** | Carbon Dioxide Dosing | Gaseous carbon dioxide will be dosed into the RO permeate to reduce pH prior to remineralisation. Liquid $CO_2$ is vapourised prior to injection and blending with the permeate. |

| Treatment Stage | Sub-Process | Description |
|---|---|---|
| | Remineralisation | A proportion of the permeate blend is fed to limestone contact vessels after $CO_2$ injection to increase the pH, mineral content and palatability. The remineralised water and permeate bypass are blended to achieve the desired final water quality. |
| | Disinfection | Sodium hypochlorite (or similar) will then be dosed into the blended water before passing to a series chlorine contact tanks which will provide the residence time for disinfection. |
| | Potable Water Storage | 2 potable storage tanks will be in place to store potable water prior to distribution to the SZC construction network as required.<br>The potable water tanks are provided with water quality monitoring<br>• Turbidity<br>• Chlorine (dual validation)<br>• pH<br>• Conductivity<br>• Temperature<br>Any out-of-specification treated water (i.e., not to potable standard) detected either before or after the contact tanks is to be discharged to the sea outfall tank. |
| | Potable Water Pumping Station | The delivery to the potable network main is from a manifold of variable speed potable water booster pumps. |
| **4. Waste Handling** | Dirty Water Backwash Tanks | The dirty water backwash tanks receive the waste backwash flows from the multi-media filters. The backwash flow is to be dosed with polyelectrolyte on entering the dirty backwash tank to promote settling. After a settlement period, the supernatant will be drawn off from the side of the tank and transferred to the seawater outfall tank. |
| | Clarifier Sludge Storage Tank | The clarifier sludge tank will receive settled sludge from the clarifiers and the dirty backwash tanks. From the tank, homogenised sludge will then be forwarded to the lamella thickeners. |
| | Lamella Thickeners | The clarifier sludge is dosed with polymer before flowing up through lamella plates. The supernatant overflows into the outlet and to the outfall lift pumping station. Sludge transfer pumps withdraw sludge sequentially from each thickener to the thickened sludge storage tanks. |
| | Thickened Sludge Storage Tanks | Sludge from the lamella thickeners is pumped to centrifuges from the thickened sludge storage tanks. The tanks will provide buffering capacity in the event the centrifuges are not available. |
| | Decanter Centrifuges or filter press | The thickened sludge will be dewatered by decanter centrifuges or a filter press. Thickened, dewatered sludge will then be disposed of off-site by a registered waste carrier to a suitably licensed facility. |
| | Seawater Outfall Tank | The seawater outfall tank will receive the process effluent streams (described in **Section 4** below) and will have sufficient capacity to allow a controlled discharge to the sea outfall. |
| | Sea Outfall Pumping Station | The sea outfall pumping station will transfer the process wastewater (or effluent to be discharged) from the sea outfall tank to the marine outfall. The outfall water quality will be monitored (as part of the plant process control system (PCS), SCADA) for the following parameters.<br>• Turbidity |

| Treatment Stage | Sub-Process | Description |
|---|---|---|
| | | • Chlorine<br>• pH<br>• Conductivity<br>Note that these are the parameters included as part of the plant's PCS for the design performance specification. Additional monitoring / sampling may be required, refer to **Section 6** further below. |
| | RO Clean-in-Place (CIP) | CIP is required periodically to maintain the output from the first and/or second pass RO membranes. The type of chemical cleaning required is determined by the predominant type of membrane fouling and is operator selected. The used cleaning solution shall be collected and transferred to adequate neutralisation facilities.<br>The CIP system consists of the following:<br>• CIP tank<br>• CIP pumps<br>• Cartridge filter<br>• CIP flowmeter<br>• Acid/Sodium Hydroxide/Biocide/Detergent chemical makeup stations. |

**Note: The exact chemicals to be used within the desalination plant will be dependent on the final design of the plant itself; the design has not yet been finalised given that the plant contractors have only just been appointed (at the time of permit submission). Confirmation can be provided to the EA with regards to the exact chemicals to be used once the final plant design is known, if requested. This will include Safety Data Sheets of the relevant chemicals.*

The waste sludge generated will be tested (if deemed required by the plant contractor) and removed from site by a licensed waste contractor to an appropriately authorised facility. In addition to the waste sludge, there is a need to dispose of treated water containing settled sediment from the desalination plant intake shaft. This essentially comprises sediment that has settled in the shaft over time from the incoming raw seawater. This will require periodic removal for maintenance purposes, and the current proposal is to use a sediment treatment system to treat the discharge stream (silty water), prior to transferring to the desalination plant outfall pipeline, via Bauer connection, to discharge into the sea. See **Section 4.1.3** below with regards to maintenance operations required.

The desalination plant and associated infrastructure have pumped / pressurised elements. Energy efficiency measures will include the specification of low-energy pumps, high-efficiency SWRO membranes and membrane configuration, high-efficiency energy recovery devices able to recover 95% energy from the brine reject stream, high water recovery efficiencies and selection of low-energy fittings where possible.

The plant has been designed to operate from a fixed electrical supply however, if the fixed electrical supply is not in place upon the plant need-by operation date, diesel-powered generators are likely to be used initially.

The proposed system, based on current project design information, is anticipated to provide a potable water supply ranging from 1.0 – 4.95 Ml/d, depending on site demand. This equates approximately to a seawater abstraction rate of 12,650 $m^3$/day.

A process flow diagram is included below to provide a high-level overview of the current proposed desalination plant outline design. It should be noted that some elements of the plant design and therefore information contained within this permit application are still subject to change as the programme for installation of the plant commences. If any changes are made that could impact the final proposed discharge effluent (e.g., flow rate, maximum volume, discharge characteristics), these will be made known to the EA during the permit determination phase.

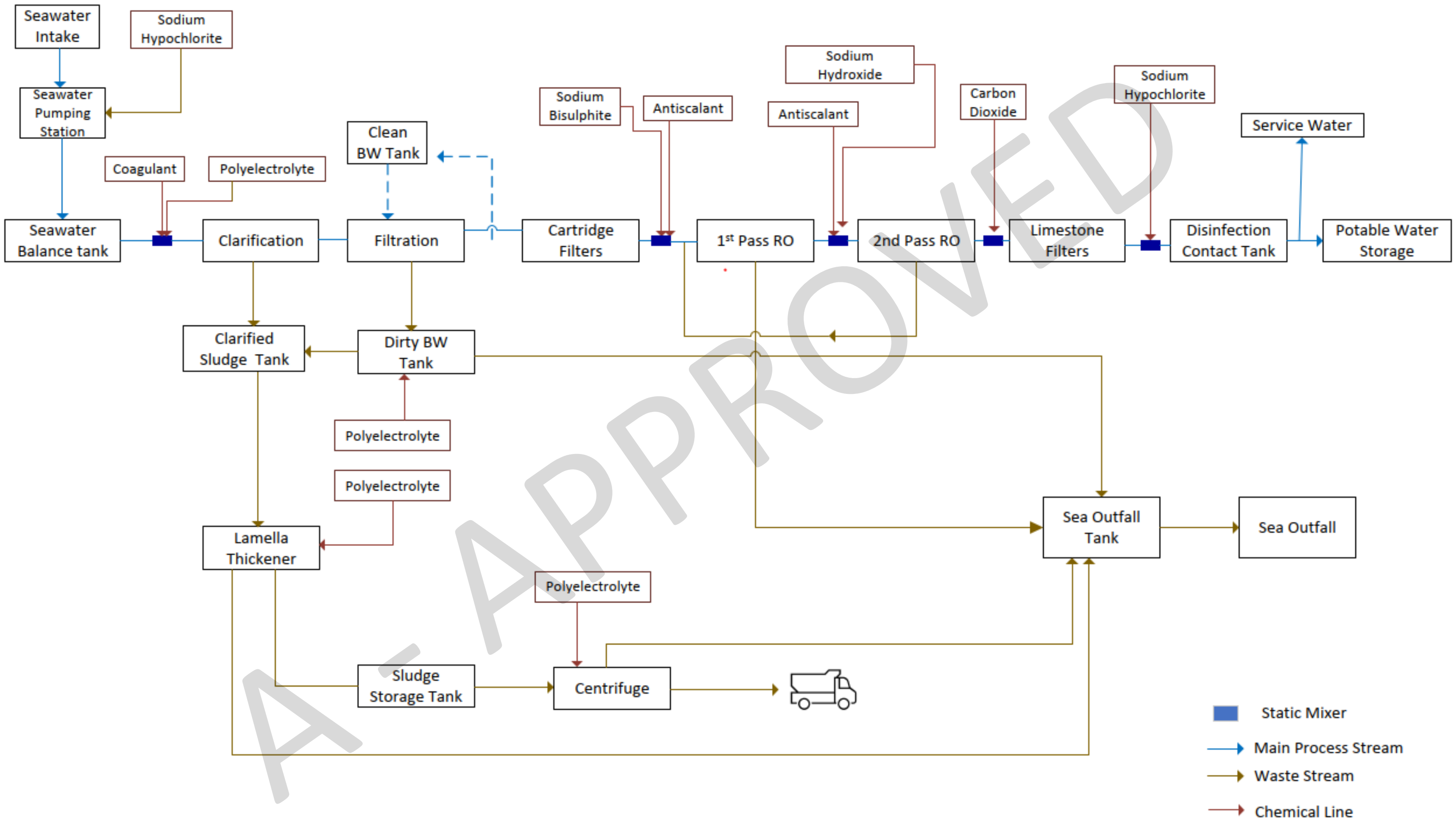


**Figure 5 - Desalination Plant Process Flow Diagram**





NOT PROTECTIVELY MARKED

# 4 PROPOSED CONSTRUCTION WATER DISCHARGE ACTIVITY (CWDA)

## 4.1 Timeframe of Proposed CWDA

### 4.1.1 Commissioning

Commissioning of the temporary desalination plant is anticipated to begin in October 2025, with a planned normal operation date of 1st November 2025, at the earliest. During commissioning, it is currently proposed that the discharge will be made to the North Sea, via the outfall pipeline. This could present a period where the anticipated composition of the discharge effluent is different to that reflected in **Section 6.2** below, which sets out the anticipated effluent quality under normal operating conditions. During the commissioning period, there will be 'performance testing' undertaken in short 24-hour duration test runs, and then a period of 'reliability testing', which is anticipated to comprise a 28-day period. During these periods, monitoring will be undertaken by the plant contractor to assess the composition of the effluent quality, however this is likely to comprise a different make-up to the effluent quality expected once the plant is fully operational. Further information on the proposed commissioning arrangements will be provided once the implementation programme has progressed. This has been discussed with the EA as part of Pre-Application discussions. It is expected that any further requirements with regards to monitoring / sampling during the commissioning period would be set out in the environmental permit itself.

### 4.1.2 Normal Operation

The plant will be designed to operate constantly to be able to meet highest potential water demand on site. The proposed discharge is therefore likely to be continuous, but there may be periods when it is intermittent, depending upon how site demand for water use fluctuates during construction periods.

The temporary desalination plant is currently anticipated to be required up until the end of 2032, at which point it would be decommissioned and removed offsite. However, this timeframe is subject to the progress of the wider project construction programme and therefore the plant could be required for longer. The EA will be notified if there are any changes to the proposed discharge end date and the point at which the permit will be surrendered. The plant itself has been designed with a lifetime of up to 15 years (2040).

### 4.1.3 Maintenance Operations

During the operation of the desalination plant, there will be a need to periodically undertake a 'de-siltation' maintenance exercise to the seawater intake shaft. This is required as, over time, larger sediment particles contained in the incoming raw seawater will settle into the shaft and need to be removed to prevent any hinderance to the operation of the overall desalination treatment process. To remove the sediment-laden water, a sump pump will be utilised when required (when the main pumps controlling the flow of incoming seawater to the desalination plant are turned off). The sump pump will transfer the water, via a temporary pipeline connection to the Bauer connection at the top of the sump pump riser, to a sediment treatment plant for removal of suspended solids prior to discharge. The treated water will then be transferred to the outfall pipeline for discharge to sea, via the same route as the operational discharge from the desalination plant (the process effluent). The sediment treatment plant may be temporary and only brought to site as and when the maintenance operation is required to be undertaken, or it may be installed on site permanently. This activity will temporarily increase the discharge flow rate when being undertaken, which is anticipated to occur on a periodic basis (see **Section 4.3** below). The exact frequency is not yet known, due to the plant not yet being operational. However, current predictions indicate that this could occur on average once a month. Ultimately the frequency is dependent on the suspended solids rate of abstracted seawater, the desalination demand flow rate and at what volume of sedimentation the maintenance regime is proposed to be undertaken. The maintenance activity is not expected to last longer than 60 minutes at any one time (although this will be dependent on the amount of sediment requiring removal). Sludge generated via the sediment treatment system process will be removed and tankered to the clarified sludge tank which forms part of the desalination plant treatment system. From here it will be determined whether further testing / clarification is required prior to the waste sludge being removed offsite by a registered waste carrier to a suitably permitted facility accompanied with the correct waste documentation.

In addition to the de-siltation activity, drain down of the seawater intake shaft will be required for maintenance activities which require access into the shaft. The pumps will drain the shaft down to a level close to the bottom of the pumps, at which point the pumps will switch off and the remaining water will be removed by the sump pump. The methodology to discharge of this water is to be considered and could be discharged in a similar fashion to the de-siltation activity, i.e. via a sediment treatment system such as a batching Siltbuster (or similar) prior to draining to the outfall. Due to the volume of water that will need de-silting, the drain down activity will probably need to be completed in 3 or more batches (depending on the batch tank capacity).

### 4.1.4 Seawater Recirculation

There will be periods when seawater is required to be recirculated through the desalination treatment system to prevent stagnation. This would only occur when the plant is offline and it would only comprise raw incoming seawater being circulated through the system and back out the outfall pipeline to prevent any stagnation. This would not therefore impact the proposed discharge stream. There would be no intervening use or chemical alteration of the incoming seawater before it is passed back out to the sea.

## 4.2 Source and Composition of Desalination Plant Process Effluent

**Section 3** above has described the process undertaken by the desalination plant to convert raw abstracted seawater into potable water on site. As a result of this process, effluent is generated which is required to be discharged from the plant to a receiving waterbody (in this case, the North Sea). The effluent to be discharged from the plant is being referred to as 'desalination plant process effluent', however it is also commonly known as 'brine reject', as the effluent will primarily comprise concentrated seawater with a high salinity compared to the incoming raw seawater. This occurs as water is removed from the salt water, leaving behind a concentrated saline waste stream. This is derived from the 1st pass SWRO stage. The brine reject has elevated concentrations of total dissolved salts (TDS), with the majority as sodium chloride (NaCl), together with other minerals and trace metals found in raw seawater. The high salinity brine reject will be transferred to the sea outfall tank as part of the process, which will be sized with sufficient capacity to allow a controlled discharge to sea.

In addition to the saline brine reject, there will be a lesser quantity of process wastewater generated by the plant pre-treatment stages which are required to remove contaminants such as silt, fine solids and other impurities that may be present in the abstracted seawater. This wastewater will be treated through settlement and dewatering before being discharged along with the brine reject from the sea outfall tank.

The process wastewaters to be discharged from the pre-treatment comprise of the following:

- **Backwash water supernatant (from dirty backwash tank following filtration):** Polymer dosing will take place to treat dirty backwash water and instrument drains from the multi-media filters which is collected in a dual cell dirty backwash tank. Upon entering the dirty backwash tank, polyelectrolyte (polymer) is added to the water and it is allowed to settle. Following a period of settlement, the supernatant wastewater (the liquid that lies above solid residue) will be drawn off from a series of ports located at varying heights on the side of the tank. Each port is anticipated to be fitted with an actuated valve, which, following the required settlement duration (manual input variable), the highest port on the tank will open and decant the supernatant to the pre-treatment collection sump. From here, the sump pumps will deliver the supernatant to the sea outfall tank. Remaining sludge is transferred by the dirty backwash sludge pumps to the clarified sludge tank.

- **Lamella thickener supernatant wastewater:** Sludge from the clarification process will be sent to a clarified sludge tank. This also collects settled sludge from the dirty backwash tank. When the sludge reaches a certain level in the clarified sludge tank, it is transferred to the lamella thickeners, where it is dosed with polyelectrolyte. Supernatant wastewater from the lamella thickeners (the upper layer of liquid developed following solids settlement) is then transferred to the sea outfall tank for discharge.
- **Centrate:** The sludge which accumulates in the base of the lamella is to be transferred to a sludge holding tank by the lamella sludge pumps. Sludge will accumulate in the tank until a pre-set level is reached at which point the valve will open, and pumps will transfer the sludge to the centrifuge or filter press for dewatering. Polyelectrolyte is also dosed at this stage. The centrifuge cake will be passed on to a conveyor to skips, for removal offsite as described earlier in this application. The centrate (the liquor removed by the rotary action of the centrifuge) from this process is transferred to the sea outfall tank for discharge.
- **Clean in Place (CIP) and SWRO membrane flushing water:** Periodically each train of SWRO membranes undergoes CIP to remove the layer of fouling which builds up over time on the membrane surface. Typical chemicals employed include sodium hydroxide, citric acid or biocide such as 2,2-Dibromo-3-nitrilopropionamide (DBNPA), the latter degrades rapidly to carbon dioxide, ammonia and bromide ion when in an aqueous environment. CIP is anticipated to occur on average 2-3 times a year. A CIP involves recirculating a volume of dilute chemical heated to approximately 35-40°C. After each CIP the membrane is flushed with permeate water (SWRO filtered water at ambient seawater temperature) and all spent chemical is transferred to a neutralising tank for chemical neutralisation. Once neutralisation is complete, the CIP / flushing effluent is discharged to the sea outfall tank where it is further diluted by the brine reject.

  A membrane flush will also be implemented in the event of a system shutdown for any reason. The flush uses non-saline permeate water to flush seawater / brine from the membranes and the immediate pipework, the spent flushing water is diverted to the sea outfall tank for discharge with the brine reject. It is anticipated that the chemicals used for the CIP and flushing processes will be reacted out / neutralised and therefore not present in the final discharge, with potentially the exception of phosphate from antiscalant use (described further below). Chemical waste will be pH tested and discharged following pH correction to an appropriate pH value (as per permit limits).

As described in **Section 4.1** above, there will also be periodic maintenance operations undertaken to remove larger settled sediment particles from the desalination plant intake shaft. These, when undertaken, will provide an additional source of wastewater proposed to be discharged via the desalination plant outfall pipeline in the form of treated sediment-laden water. The treated water is proposed to be discharged via the desalination plant outfall pipeline to sea to prevent the need to identify another effluent disposal stream. The treated water is not anticipated to contain any specific substances as it will have been treated to remove larger particles of sediment (or total suspended solids, TSS), collected in the desalination plant intake shaft, only. Certain sediment treatment systems may incorporate dosing agents (e.g., coagulants / flocculants) to help reduce levels of suspended solids, which may contain iron (Fe). If this is required, there is not expected to be any carry-over of these substances and therefore iron in the final treated water effluent stream from the sediment treatment system, as the systems proposed to be used are designed to ensure there is no over-dosing of chemicals and those which are dosed, will be bound (by the flocculant) and subsequently removed within the sludge that is removed from the treatment system. However, it has been suggested by the project design team that monitoring is incorporated for iron (as Fe) anyway as the desalination plant pre-treatment stages involve coagulant use.

### 4.2.1 Specific Substances

As described above, most of the final process effluent will comprise the brine reject, which is essentially concentrated seawater which has higher levels of salinity than the original raw seawater abstracted for treatment. In addition to the brine reject, there will be elements of process wastewater from pre-treatment processes, and occasional discharge of treated water from maintenance activities.

The specific substances anticipated to be present in the discharge are those which are already present in the incoming seawater (which will be discharged at concentrated or elevated levels) and potentially phosphate, which could be present in the process wastewater effluent due to its presence in antiscalent applied to the SWRO membranes, in addition to already being present in the abstracted seawater. An assessment of nitrogen and the predicted loading of added phosphorus has been considered in the Surface Water Pollution Risk assessment and modelling undertaken by CEFAS to support the proposed discharge activity (**Appendix C**). This has been shown not to be significant in terms of its potential to impact marine primary production (phytoplankton growth) (refer to **Section 5.2** below).

Table 10-1 in **Appendix C** presents the priority hazardous substances and specific pollutants identified as present in the baseline seawater, which could therefore be present in the final process effluent discharge at a concentrated level, and at what concentrations. In summary these include arsenic, boron, cadmium, chromium, cobalt, copper, iron, lead, mercury, nickel, zinc, ammoniacal nitrogen / un-ionised ammonia and salinity (as described above).

As part of the pre-treatment processes, certain chemicals will be used within the desalination plant which are in line with those used on any other drinking water treatment plant, for example ferric chloride as coagulant, polyelectrolyte (polymer), sodium hypochlorite, sodium hydroxide, sodium bisulphite, carbon dioxide, hydrochloric acid and antiscalants, which may be phosphonates or sulphonates. All chlorinated waste streams will be neutralised to ensure chlorine is not detectable in the final process effluent (e.g., less than 0.05 mg/l as Cl). Chemicals specific to the SWRO cleaning may only be used once or twice a year and may include citric acid, sodium hydroxide, proprietary biocides and cleaners. These will be neutralised prior to discharge. Polyelectrolyte-dosing and recycle of poly-dosed waters within the plant will be controlled as per standard UK municipal drinking water plant designs to avoid any issues (as per how they are managed at municipal drinking water treatment plants).

The polyelectrolyte is likely to be a synthetic polyacrylamide, a chemical used within the water treatment industry. For the desalination plant, the polyelectrolyte will be used during seawater pre-treatment at low concentrations (exact concentrations to be determined as part of the final plant design) to aid the action of inorganic coagulants in removing impurities and secondly, during treatment of the waste streams to remove the solid fraction and allow relatively clean supernatant to be discharged to the sea outfall tank where further dilution by the brine reject stream occurs before being released to the marine environment. The polyelectrolyte will be delivered to site as a dry powder and made up on site as a solution for dosing as a coagulant aid. The exact nature and selection of the polyelectrolyte will be determined during commissioning as this entails site-specific settlement tests with the feed water. Application efficiency depends upon the polymer properties including the type of charge, charge density and molecular weight and their reaction with the source water. The polyelectrolyte will be dosed at:

1. As a coagulant aid alongside ferric chloride to aid in flocculation prior to clarification by the initial pre-treatment clarifiers. A typical applied dose is anticipated to be 0.05 mg/l as product. Drinking Water Inspectorate requirements will be observed to ensure that the concentration of acrylamide monomer shall not exceed 0.1 µg/l at any time. Settled sludge from the clarifiers shall pass to the waste treatment dewatering (as described above in 3.3).

2. As a settlement aid to the dirty backwash water from filter washing, where the applied typical dose as polyelectrolyte shall be 0.25 mg/l.
3. Applied to the sludge thickening and dewatering at a typical dose of 2-4 kg/tonne of sludge.

Please note that the above are *indicative* amounts only at this stage based on the plant outline design.

Generally, the polyelectrolyte, and hence the polyacrylamide monomer, will be concentrated and retained within the solids fraction cumulating in the dewatered centrifuge cake which will be disposed of off-site.

As indicated in the above paragraph, coagulant / flocculant will be used (likely to be ferric chloride) as part of the pre-treatment stage, and potentially as part of the settlement treatment system to be used for treating sediment-laden water derived from the maintenance operations. This is added to promote settlement of suspended solids in the seawater / sediment-laden water in the intake shaft. The total iron in the pre-treatment wastewater stream could be slightly elevated above seawater background levels therefore it has been recommended by the project design team that iron is included in periodic sampling of the discharge.

Dechlorination will take place as part of the SWRO pre-treatment stage and the treated potable water is chlorinated to control biological activity, therefore any wastewater or process stream from the pre-treatment or treated water requires dechlorination before disposal. Dechlorination is achieved by the addition of sodium bisulphite to the sea outfall tank and the removal of chlorine is confirmed by the outfall effluent quality monitoring instrumentation. Dosing will be flow controlled and monitored.

Safety data sheets for all chemicals to be used within the plant can be provided once the final design, testing and selection has been completed.

### 4.2.2 Process Effluent Temperature

The maximum temperature of the process effluent will be the same as the raw seawater with at most approximately a +/- 0.5°C difference, due to cooling or heating by ambient weather conditions while the process effluent is held in above ground storage tanks. Based on background marine water quality data, the raw seawater range is minimum 3°C, average 12°C, maximum 20°C. The maximum discharge temperature is therefore anticipated to be 20.5°C.

## 4.3 Process Effluent Discharge Flow Rate and Volume

To provide approximate figures with regards to the proposed discharge volume and flow rate from the desalination plant, and to inform the final plant design, a mass balance exercise has been undertaken which was based on a demand forecast for potable water use requirements across the construction site. This has enabled both average and maximum daily flow rates and discharge volumes to be calculated, and the water discharge quality to be understood further. The key outputs of the mass balance exercise are described in the following paragraphs and tables.

The design demand forecast for the plant is set out in **Table 4** below. This is based on the anticipated potable water demand for the project construction phase (required production output).

**Table 4 - Mass Balance Abstracted Flows**

| Abstracted Seawater Flow | Unit | Seawater Intake | Required Production Output |
|---|---|---|---|
| Peak maximum flow | $m^3/d$ | 12,650 | 4,950 |
| | l/s | 146 | |
| Maximum | $m^3/d$ | 10,400 | 4,100 |
| | $m^3/h$ | 433 | |
| Average flow | $m^3/d$ | 8,250 | 3,300 |
| | $m^3/h$ | 344 | |

| | | | |
|---|---|---|---|
| Minium flow | $m^3/d$ | 2,680 | 1,000 |
| | $m^3/h$ | 112 | |

The peak maximum flow for the production output (4,950 $m^3$/day) refers to the maximum flow of potable water that the plant is required to be capable of producing (the demand of the water that will then be used on site). This equates to a peak maximum seawater abstraction rate of 12,650 $m^3$/day.

The below table indicates the desalination plant process effluent streams that are anticipated to make up the final combined discharge. These have also been calculated in the mass balance exercise that was undertaken using the figures above in **Table 4**.

**Table 5 – Mass Balance Process Effluent Flow Rates Under Normal Operating Conditions**

| Scenario | Unit | Lamella Thickener Supernatant | 1st Pass Brine Reject | Centrate | Backwash Supernatant | Final Process Effluent Discharge to Sea |
|---|---|---|---|---|---|---|
| Average Maximum (peak) flow | $m^3$/day | 633 | 6,920 | 115 | 221 | **7,889** |
| | l/s | 7.33 | 80 | 1.33 | 2.55 | **91.31** |
| Maximum flow | $m^3/d$ | 458 | 5748 | 66 | 221 | 6493 |
| | $m^3/h$ | 19.1 | 240 | 2.8 | 9 | 271 |
| Average flow | $m^3/d$ | 289 | 4631 | 20 | 221 | 5160 |
| | $m^3/h$ | 12.0 | 193 | 0.8 | 9 | 215 |
| Minimum flow | $m^3/d$ | 222 | 1449 | 1 | 221 | 1892 |
| | $m^3/h$ | 9.2 | 60 | 0.0 | 9 | 79 |

As shown in the above table, the average peak maximum flow rate from the desalination plant into the outfall will be 91 l/s (which will be intermittent). This, upon occurrence, would equate to a daily discharge volume of 7,889 $m^3$/day (based on a seawater abstraction rate of 12,650 $m^3$/day). This is based on the desalination plant's normal operating conditions but the highest possible maximum water demand on site. Approximately 6,920 $m^3$/day of this is anticipated to be derived from the brine reject component of the process effluent stream. In terms of controlling the flow rate of discharge, ultrasonic level sensors will be installed in each incoming seawater balance tank such that if both tanks reach high level, the pumps at the marine pumping station compound will stop (which will essentially restrict the volume of abstracted seawater and therefore the amount of process effluent generated which requires discharging). These are the figures that have been used to support the Surface Water Pollution Risk Assessment and marine modelling undertaken to assess the impact of the discharge on the receiving receptor, as described later in this application. The reason for this is to ensure that the assessment reflects the worst-case scenario from a discharging perspective, which would be at the lowest flow rate (and without dilution from the maintenance activities).

When maintenance activities are undertaken, as described in **Section 4.1** above, the average daily flow rate and discharge volume from the desalination plant will temporarily increase. At the time of permit submission, based on the current proposed plant design and performance parameters (which as described above are still subject to final contractor design), it is anticipated that the **average** peak maximum instantaneous flow from the desalination plant outfall could be 91.45 l/s, when the maintenance activities are undertaken giving rise to a maximum average daily discharge volume of 7,901 $m^3$/day.

The **absolute maximum** instantaneous peak flow could, theoretically, be up to 160 l/s, if all maintenance activities were being undertaken simultaneously alongside the discharge from the normal operating conditions. This is based on the instantaneous outfall flow rate being up to 113 l/s (based on the outfall pump selection and tide levels). Therefore, with the sump pump pumping during maintenance activities (at up to 30 l/s), this is 143 l/s. An element of contingency has then been added on, in case of contractors' different pump selection, to bring the maximum up to 160 l/s. This is unlikely to occur however as described further below.

The below table sets out the anticipated peak maximum average flow rates and discharge volumes from the desalination plant, during both normal operating conditions and during periods when maintenance activities are undertaken:

**Table 6 - Desalination Plant Proposed Flow Rates and Discharge Volumes**

| Desalination Plant Operation Phase | Peak Maximum Average Daily Flow Rate (l/s) | Maximum Average Discharge Volume ($m^3$/day) (intermittent) |
|---|---|---|
| Normal operating conditions | 91.31 | 7,889 |
| Maintenance (intake shaft de-siltation / draining) conditions | 91.45 | 7,901 |

Over a 24-hour period, the pumped flow from the outfall tank, based on the pump specification used for the outline design, is anticipated to be in the range of 100 to 113 l/s. This will fluctuate as it is dependent on tide levels and the overall level of effluent in the outfall tank (or 'head'). The pump will not pump continuously as it is a 'fill and draw' system, i.e., the pump starts when the tank level is high and stops when the tank level reaches a low level. Thus, over a 24-hour period, the average flow rate is 91 l/s and the peak maximum volume down the outfall will not exceed 7,901 $m^3$, including if maintenance activities were being undertaken.

It is worth noting that the theoretical absolute maximum instantaneous peak of 160 l/s would only occur if the desalination plant outfall pump were pumping **at its maximum** and the pumping station sump pump (for the maintenance activities) is also pumping **at its maximum.** This is therefore an absolute maximum instantaneous flow, whereas the normal peak maximum average flow is 91.45 l/s (including the maintenance operations). It is also worth stating that the maintenance operations will only occur for short durations, so this is not anticipated to impact significantly on the total volumetric daily flow as detailed in the mass balance calculations and Table 6 above. Based on current anticipated plant performance, it is expected that the sump pump (required for use during maintenance operations) would not pump for more than 5 minutes per day (and up to 30 minutes once per year when the sump is drained down for maintenance).

The 160 l/s has been calculated as the maximum flow pumped from the outfall tank into the outfall pipeline of 113 l/s (based on current pump design specification) plus a pumping station sump pump maximum flow of 30 l/s, to give 143 l/s. A 10% contingency has then been allowed for (as the final pump design specification is subject to contractor decision) which gives 157 l/s, then rounded up to 160 l/s. As explained above, this is an instantaneous theoretical maximum flow that is unlikely to occur.

As described further below, the supporting Surface Water Pollution Risk Assessment for this permit application, has utilised the peak maximum average instantaneous daily flow rate of 91.31 l/s to reflect the plant under normal operating conditions (as the maintenance activities would only be undertaken intermittently.

As the desalination plant outfall feed is a pumped system, the actual flow is dependent on the below factors:

- the levels in the desalination outfall balance tank (that the outfall pump draws from)
- the desalination outfall pump characteristics that the contractors select as part of the final desalination plant design, and
- tide levels.

The flow rate will, in general, be limited by the operating limits of the equipment used at the desalination plant intake (i.e., the pumps selected will not be capable of exceeding equipment design limits) while pipe diameters will also throttle to an extent. There will also be flow controls on flow rates into, within and produced by the desalination plant set on instantaneous max as well as cumulative daily max volumes. These will be based on accurate electromagnetic flowmeters connected to the process control system (PCS) and actuated valves that will close to throttle in the event a pre-set max flow rate is exceeded. A series of assumptions were made in relation to the plant operation to complete the mass balance exercise, therefore the exercise may be updated if required following final contractor plant design.

It is anticipated that, in the permit for the proposed CWDA, the peak maximum average flow rate and daily discharge volume provided above will be used. As these are based on indicative values used to inform the outline plant design, if the figures proposed here change from the time that the permit application is submitted to the EA, for example during the duly making or determination phase when final plant design is provided by appointed contractor, the SZC project team will contact the Permitting Centre to update and amend the application as required.

## 4.4 Receiving Receptor

The receptor proposed to receive the desalination plant process effluent is the North Sea. As explained above, the outfall pipeline will be submerged (below ground) within the MCA pumping station compound from where it will run beneath the Sizewell Foreshore and below sea level until it emerges above the seabed at the marine dispersion head in a single riser. This is located approximately 320 m out to sea. From here, the process effluent will be discharged, via a three-duckbill diffuser structure, into the North Sea. The diffuser heads will be angled at 45° upwards to aid further dispersion. The seabed level, or water depth, at the marine outfall head location is 6.2 m above ordnance datum (AOD). The level at top of the diffuser heads is 4.403 m AOD. Therefore, the discharge activity is anticipated to take place at approximately 1.8 m above the seabed.

As the marine head will have a diffuser, mixing will be enhanced upon point of discharge into the North Sea. This is anticipated to reduce impacts of the discharge plume on the seabed, which will have a higher density than the receiving seawater and will therefore sink to the seabed. The diffuser heads facilitate rapid mixing and will therefore help limit the area at the seabed that is influenced by the plume.

The Surface Water Pollution Risk Assessment undertaken as part of this permit application explains the anticipated impact on the receiving receptor in more detail (**Appendix C**).

### 4.4.1 Discharge to Foul Sewer

As per the permit application form, Part B6, there is a requirement to consider whether the proposed discharge could be made to foul sewer. This requirement was discussed with the EA during Pre-Application discussions, and it was clarified that the discharge from the desalination plant (process effluent) is not suited to be connected to the foul sewer network due to the composition of the discharge effluent stream itself and the fact it mostly comprises high salinity brine reject. Foul wastewater treatment plants are not typically designed to treat this type of discharge and therefore it is not considered appropriate, from both a treatment plant infrastructure and water quality perspective, to discharge this type of effluent to foul sewer. For this same reason, it is not considered feasible to discharge the desalination plant process effluent into inland freshwaters as the high salinity will have a significantly adverse effect on the receiving waterbody, from both a water quality and ecological perspective. Therefore, the most appropriate discharge option is to send the process effluent into the North Sea (back to its original source). Please note it was discussed during the Pre-application with the EA that this decision therefore means Section 5 of form Part B6 is not required to be completed in full.

### 4.4.2 Future Marine Discharges

Another discharge activity is being proposed in association with the project which will also be made to the North Sea. This is anticipated to commence after the desalination plant discharge activity to which this permit application relates too, but still during the construction phase of the project. The other future discharge activity will relate to the discharge of combined treated process effluent, foul water, groundwater and surface water from the ‘combined drainage outfall’ (or ‘CDO’, which is essentially a pipeline transporting the combined effluent sources from the site). The easting NGR of the desalination plant outfall places it in line with the current proposed location for the CDO, but 300 m to the south, meaning the discharges from both outfalls will follow the same hydrodynamic streamline. The desalination intake shaft is offset from the CDO by approximately 100 m east, meaning the risk of recirculation from the CDO discharges into the desalination plant are minimal. The Surface Water Pollution Risk Assessments undertaken to inform this permit application, and the subsequent expected permit application for the CDO discharge activity, have (and will) considered the potential interaction of both discharges into the North Sea, taking into account potential combined effects of both discharges on environmental quality standards (EQS) thresholds. Refer to **Section 5** below for further information on the Surface Water Pollution Risk Assessment undertaken to support the proposed discharge activity.

# 5 SUPPORTING RISK ASSESSMENTS AND MODELLING

## 5.1 Summary of Supporting Assessments and Modelling Undertaken

The following supporting assessments and modelling have been undertaken to support this permit application for the proposed discharge from the desalination plant:

- A Surface Water Pollution Risk Assessment and subsequent marine modelling, including CORMIX (described below), by CEFAS, in accordance with the GOV.UK guidance for Surface Water Pollution Risk Assessments[1] (formerly H1 assessments) (**Appendix C**).
- A qualitative Environmental Risk Assessment for a bespoke permit application to consider the proposed discharge from a source-pathway-receptor approach, in accordance with the GOV.UK guidance for Risk Assessments for your Environmental Permit[2] (**Appendix D**).
- An updated Water Framework Directive (WFD) Assessment (**Appendix E**).

Refer to **Appendices C, D and E** for the above-listed assessments in full, complete with any further relevant supporting documentation. These should be read in conjunction with this main technical supporting document.

The approach undertaken with regards to supporting assessments and modelling was discussed with the EA during Pre-Application meetings to ensure that the most adequate and appropriate methods were utilised and to ensure that the assessments considered all potential pollution risks from the proposed discharge activity.

In addition to the assessments listed above and described below, a Habitats Regulations Assessment (HRA) and Countryside and Rights of Way (CRoW) assessment will be undertaken by the EA in relation to the proposed discharge activity. As agreed with the EA during Pre-Application discussions, relevant background information has been collated in an 'information package' in **Appendix F** to help inform these assessments. These will be undertaken once this permit application has been formally submitted to the EA for determination.

The below-described supporting risk assessments and HRA and CRoW information package have taken into consideration the proposed operation of the desalination plant up to 2032, when a potable mains water supply is anticipated to be available. However, there is the potential that this date could change, therefore the plant has been designed to operate for up to 15 years. If, in the event that the desalination plant, is still operational when the operational WDA permit for the nuclear power station, commences, there may be a need to re-visit the supporting assessments and information package.

## 5.2 Surface Water Pollution Risk Assessment

CEFAS were commissioned by SZC to undertake a risk assessment and marine modelling in accordance with the GOV.UK guidance for Surface Water Pollution Risk Assessments[1] to coastal waters. The risk assessment is required because the process wastewater discharge stream from the desalination plant comprises what is essentially concentrated seawater. This therefore has a higher salinity (dissolved salts) than the receiving seawater and it can also potentially contain higher concentrations of naturally occurring metals and trace elements compared to what was present in the incoming raw seawater (specific substances). The assessment also considered potential impacts from concentrated and added nutrients. As there are currently no measurements of the efficacy of the treatment, a precautionary approach was taken which assumed no dissolved metals (from the incoming seawater) are removed.

The values and data used to inform the risk assessment are described in the supporting assessment report (TR552), which is contained in **Appendix C** of this permit application. The average maximum peak flow rate under normal operating conditions of 91 l/s was used, based on the seawater abstraction rate of 12,650 $m^3$/day. This approach was used as it reflects the normal operating conditions of the plant and also a worst-case scenario approach from a discharging perspective with the lower flow rate and no dilution of the brine reject, the latter of which would occur when the periodic maintenance activities are being undertaken due to the additional flow of treated seawater. Furthermore, while the maintenance activities would add to TSS (or suspended sediment) concentrations (temporarily), this is not a parameter with an EQS that could be assessed in the modelling. **Section 6** further below sets out the TSS concentrations that are considered achievable based on the current plant design.

The approach undertaken to inform the Surface Water Pollution Risk Assessment and modelling (including supporting calculations) were provided to the EA for review and comment during the Pre-Application phase. CEFAS originally conducted the risk assessment and modelling during the DCO phase of the project, producing two revisions of the accompanying report. However, a third revision of the report has now been produced following more information becoming available in relation to the desalination plant design. Therefore, please refer to Section 10, Appendix B of **Appendix C** to this report for the current assessment which is based on the Phase 2 outline design for the desalination plant. The below paragraphs have been included to provide a high-level summary only of the scope of the assessment and key outcomes.

### 5.2.1 Screening

In accordance with the GOV.UK guidance, CEFAS conducted initial screening (Test 1) to determine if there were likely to be any concentrations of priority substances and specific pollutants in the discharge which exceeded their respective coastal and estuarine EQS', due to the concentration of the seawater and the proposed desalination treatment process. Tests were completed for both annual average (AA) and maximum allowable concentration (MAC), where the chemical / element has both types of EQS. To conduct the tests required as part of the risk assessment, CEFAS used baseline marine water quality data that had been collected originally to inform the wider risk assessments and marine modelling undertaken at the DCO stage of the project. Refer to **Section 5.6** below and **Appendices G and H** which provide a summary of the baseline marine water quality that was presented in the Environmental Statement (Chapter 21) that was submitted as part of the DCO. The substances that were identified as being present in the background seawater included:

- Arsenic (dissolved), boron (dissolved), cadmium (dissolved), chromium (dissolved), cobalt (dissolved), copper (dissolved), iron (dissolved), lead (dissolved), mercury (dissolved), nickel (dissolved), zinc (dissolved), ammoniacal nitrogen and salinity.

The proposed design of the desalination plant specifies that abstracted seawater will be treated with coagulants, settled and filtered prior to RO. This process will remove suspended and particulate matter, alongside some dissolved metals. The CEFAS screening assessment has however taken a precautionary approach, assuming no dissolved metals are removed from the effluent, as there are no measurements of the efficacy of the treatment. The screening assessment therefore applies the concentrations of dissolved metals only. As part of the updated assessment for this permit application, CEFAS also re-reviewed the baseline marine data that was used to inform the original assessment and, in the revised version, utilised the raw data from the nearest sampling station only (to the proposed marine dispersion head). This is located nearby to the Sizewell B outfall.

The screening results from the revised assessment are presented in Appendix C of the CEFAS TR552 report. Salinity is greater than 5% above ambient (35.7 PSU) at the point of discharge and was therefore taken forward for detailed modelling. Several metals also concentrate to levels greater than their corresponding EQS values (chromium, cobalt, copper, lead, mercury and zinc). For chromium, zinc and cobalt, the background marine levels were also greater than the EQS level, so it is not possible to mix the discharge below the EQS. This was discussed with the EA during Pre-application and the agreed approach for these substances was to undertake the assessment based on the background level plus 3% of the respective EQS.




NOT PROTECTIVELY MARKED

As a conservative approach, modelled mixing zones have been determined for all substances which failed the EQS screening test (Test 1) in the updated assessment (chromium, cobalt, copper, lead, mercury, zinc and salinity).

### 5.2.2 Modelling

CORMIX modelling was applied to the proposed discharge scenario which enables the assessment of the release and mixing of chemicals and trace metals in the desalination plant discharge stream. The model used was CORMIX US EPA supported mixing zone model. It should be noted that the CORMIX modelling does not allow for the exact design of the single riser with a 3-port diffuser head to be replicated, however. Therefore, the modelling was based on a single port outfall which is considered precautionary as the entire discharge is released in a single direction (which will not reflect reality based on the current design of the three, angled, duckbill diffusers).

Ten tidal states, for both neap and spring tides, have been modelled to characterise the plume under different tidal conditions.

For salinity, the modelling assessment summary provided the dilution required to reach three different thresholds. The maximum dilution required is 19-fold, to be within 1 practical salinity unit (PSU) of background. Under the most conservative threshold (1 PSU uplift), the maximum range of the plume is 42.38 m. The range of the plume varies with the tidal conditions modelled from a minimum of 10.18 m to a maximum of 42.38 m.

For metals not screened out (chromium, cobalt, copper, lead, mercury and zinc), the dilution required to reach the EQS level (or background plus 3% of the relevant EQS) where the background conditions already exceed the EQS) is calculated in the assessment alongside the range to reach the relevant threshold. The highest dilution requirement is for zinc, with 70-fold dilution required to reach the near background conditions. Dilution to near background conditions is achieved within a maximum range of 109 m (low tide + 1 hours) and on average across all tidal conditions within 65 m.

Cobalt potentially requires 65-fold dilution to reach near background concentration, however the assessment notes that, for cobalt, all measured background concentrations were below the LOD. Refer to Section 10.3.2 for further information pertaining to the assessment of cobalt. Other metals (chromium, copper, lead and mercury) are mixed down to their respective EQS levels within 10 m of the discharge under all tidal conditions and on average within 5 m.

### 5.2.3 Other Considerations

The assessment undertaken by CEFAS also considered discharges that will overlap with the desalination discharge which may include relatively small quantities of nitrate and phosphate (nutrients), primarily from the discharge of groundwater and treated foul domestic sewage, which are planned to be discharged via the Combined Drainage Outfall. From the desalination plant discharge activity, the only conditioning chemical expected in the discharge concentrate is phosphorus, derived from the use of a membrane descaling chemical.

The assessment explains that the amount of phosphate in the discharge will potentially be up to 22.9 kg/day. It states that this change is negligible compared to the overall daily exchange of phosphate, however. Phytoplankton modelling undertaken as part of the original CEFAS assessment is therefore concluded to remain representative of the current desalination plant design (refer to section 4 of **Appendix C**).

The assessment also considered the application of the significant load test, dissolved oxygen and interaction with other construction discharges (see section 10.4 in Appendix B of the assessment report).

### 5.2.4 Summary of Surface Water Pollution Risk Assessment

The CEFAS assessment concludes that the revised screening shows that salinity and selected metals would be discharged at levels above their respective standards or EQS levels. CORMIX modelling shows that salinity is expected to dilute to within 1 PSU of background within a maximum of 42.38 m and on average (of all tidal conditions modelled) within 14.8 m. The revised assessment therefore shows an increase in the maximum plume size (in comparison to the original assessment undertaken for the DCO), however, it demonstrates that the plume remains highly localised within tens of metres around the discharge location. The assessment affirms that the discharge remains highly localised within the nearfield capabilities of CORMIX and that wide-scale GETM modelling is not appropriate due to the small scale of the mixing zone.

The assessment states that, when compared to the draft salinity standards provided by the EA during the development of the permit application and supporting assessments (refer to **Section 6.2** below), of 5% uplift, the mixing zone is estimated to extend up to 30.2 m as a maximum and on average be 8.62 m, which is lower than the maximum mixing zone range of 250 m.

Revised modelling of metals in the discharge shows a maximum range of 109 m for zinc to dilute to near background conditions. Cobalt was measured in baseline surveys as below the limit of detection, however the EQS for cobalt is lower than the available tests. Utilising a precautionary assessment, based on assuming cobalt levels are at the limit of detection showed that concentrated cobalt in the discharge would dilute to near background conditions with a maximum range of 55 m. Other metals which were not screened out (chromium, copper, lead and mercury) were shown to dilute with relevant EQS levels within a maximum range of 10 m.

The assessment concludes that the Phase 2 design would have a negligible difference to the existing assessment (that was produced at DCO stage) and therefore the conclusions that 'a discharge plume of brine and concentrated metals would be highly localised, mixing below environmental thresholds within tens of metres from the marine dispersion head discharge point', still stand.

## 5.3 Qualitative Environmental Risk Assessment for Bespoke Application

In accordance with the GOV.UK guidance for undertaking risk assessments[2] to support bespoke permit applications, a qualitative environmental risk assessment (ERA) has also been undertaken. This has considered the hazards and risks that could arise from the proposed discharge activity only, not the hazards and risks from the overall operation of the desalination plant (as this is not what the permit application relates too). Some considerations of generic environmental risks have however been incorporated where appropriate. It will be the responsibility of the desalination plant contractor to provide further risk assessments as part of their scope of works (refer to **Section 7** below which outlines management system arrangements). Refer to **Appendix D** for the qualitative ERA for the discharge activity.

The approach undertaken for the ERA comprised the following stages:

1. Identification of the hazards (defined as the activity or event with potential to cause environmental risk) which might be posed by the proposed discharge activity.
2. Identification of receptors. The North Sea will be the direct receptor of the proposed discharge of process effluent from the desalination plant; however, there may be some other receptors in the areas surrounding the desalination plant itself or the desalination pumping station compound. These are also considered where relevant.
3. Identification of the pathways or routes by which the hazard might come into contact with the receptor.
4. Provide a summary of the potential harm that could be caused should contact occur.
5. Impact assessment through consideration of the probability of exposure (likelihood of the risk occurring, hazard coming into contact with the receptor), the level of harm (consequence) that could occur and the

subsequent magnitude of the risk (harm that could be caused). The below sub-paragraphs explain the ratings used in the impact assessment.

6. Description of the expected mitigation (or control) measures that may be implemented to reduce the risk, noting that final control measures will ultimately be dependent upon the appointed contractor methodologies.
7. Residual impact (after mitigation measures have been implemented).

The criteria used for the impact assessment as part of the ERA is defined in the below table. The nature of these assessments, being qualitative, is that they are subjective, and the methodology and criteria used to complete the ERA can therefore vary. The criteria developed and applied to this ERA has been based on the professional judgement and expertise of the SZC permitting team responsible for this application.

**Table 7 – Qualitative Environmental Risk Assessment Criteria**

| **Impact Assessment Rating** | **Criteria** |
|---|---|
| **Probability of Exposure** | *Defined as the likelihood of the receptor(s) being exposed to the hazard.* |
| High | Exposure is probable. Direct exposure is likely with no distance or barriers between hazard source and receptor. |
| Medium | Exposure is possible. Barriers to exposure are less controllable. |
| Low | Exposure is unlikely. Several barriers exist between hazard source and receptor to mitigate against exposure. |
| Very Low | Exposure is very unlikely. There are effective, multiple barriers in place to mitigate against exposure. |
| **Consequence** | *Potential level of harm that could be caused to the receptor(s) if exposed to the hazard.* |
| High | Consequences are likely to be long-lasting and / or affect a large area or number of receptors. Effects require intervention to address and are difficult to reverse. |
| Medium | Consequences are likely to be medium-duration and / or affect a considerable sized area or number of receptors. Effects require intervention to address but are reversible. |
| Low | Consequences are short-term duration and unlikely to impact a considerable sized area or number of receptors. Requires some level of intervention to address. |
| Very Low | Consequences are minimal in terms of duration and have limited lasting effects. Requires no to little intervention to address. |
| **Magnitude of Risk** | *Determined by combining the probability of exposure with the level of the potential consequences – refer to the below Magnitude Rating Grid Box. The below explanations provide a summary of what the magnitude means from a practical perspective. These very much depend on the hazard and risks identified.* |
| High | Identified risks will require stringent monitoring and formal methods of recording / reporting. Reportable to external stakeholders (e.g., regulators). |
| Medium | Identified risks will require some level of regular monitoring and recording or reporting. Not necessarily reportable to external stakeholders. |
| Low | Identified risks require some level of monitoring / checking but this is not necessarily reportable / recorded. |
| Very Low | Identified risk require minimal monitoring / checking. |

The below grid box summarises how the overall magnitude has been determined for each identified hazard and risk within the qualitative ERA. Note that the ERA methodology has been developed using a professional and subjective opinion; it is therefore open to some element of interpretation. However, the overall purpose of the ERA is to identify the key risks from the proposed discharge activity, in accordance with the source-pathway-receptor methodology, and outline what control measures will therefore be implemented to reduce the overall level of risk. The level of consequence is adopted as the key indicator of overall risk magnitude to reflect a worse-case scenario.






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**Table 8 - Qualitative Environmental Risk Assessment Risk Magnitude Rating**

| Probability of Exposure (below) / Level of Consequence (right) | High | Medium | Low | Very Low |
|---|---|---|---|---|
| **High** | High | High | Medium | Medium |
| **Medium** | High | Medium | Medium | Low |
| **Low** | Medium | Medium | Low | Low |
| **Very Low** | Medium | Low | Low | Very Low |

## 5.4 Water Framework Directive Assessment

The Water Framework Directive (WFD), as implemented in English law, imposes legal requirements to protect and improve the water environment. Compliance with the WFD is relevant to activities in the marine environment up to 1 nautical mile out to sea and therefore the proposed discharge activity.[8]

A WFD Compliance Assessment was produced for the project at DCO stage (May 2020). This assessment was then revisited, and an amended assessment report produced in September 2021 following the introduction for the need for a temporary desalination plant to the project, which was recorded as a change to the original DCO (Change 19). The amended assessment followed 3 stages: screening, scoping and detailed assessment (which mirrored the approach undertaken for the original compliance assessment and complies with the current EA guidance for completing WFD assessments for estuarine and coastal waters[8]). A summary of this is provided in **Appendix I**.

The Stage 1 screening assessment found that the proposed change (the operation of the desalination plant) could potentially impact upon two river water bodies (Leiston Beck and Minsmere Old River), a coastal water body (Suffolk) and a groundwater body (Waveney and East Suffolk Chalk and Crag).

The Stage 2 scoping assessment concluded that the construction and operation of the temporary desalination plant would not affect the status of the Leiston Beck, Minsmere Old River or Waveney and East Suffolk Chalk and Crag water bodies. No mechanisms were identified that could impact upon the Suffolk coastal water body during construction (of the plant), however potential impacts to the water body resulting from operational discharges from the plant were progressed to the Stage 3 detailed assessment.

The Stage 3 detailed assessment considered potential impacts on the chemistry, physico-chemistry (salinity and nutrient loading), biology resulting from the discharge, and also considered the potential for cumulative impacts with other components of the project (e.g., discharge from the CDO). However, the assessment did not identify any parameters at risk of deterioration such that the WFD class status for any of the parameters would decrease. In summary, the amended WFD assessment therefore concluded that: 'the proposed activities alone and in combination with other construction-stage activities, are considered to be compliant with the requirements of the WFD' (p.30). Furthermore, the assessment noted that the proposed addition of the temporary desalination plant would not alter the findings of the original WFD compliance assessment submitted in May 2020 as part of the DCO.

A separate exercise has been undertaken specifically as part of this permit application to review the original and the amended WFD Compliance Assessment, submitted under Change 19 to the DCO, and update where applicable. This approach was confirmed as suitable with the EA during Pre-Application discussions as a full WFD Compliance Assessment had already been undertaken for the proposed desalination plant; and the majority of the information in this remains relevant. In summary, the latest assessment demonstrates that the Stage 3 Further Assessment did not identify any parameters at risk of deterioration such that the WFD class status for any of the parameters would decrease. Refer to **Appendix E** for the full assessment. The WFD

[8] Water Framework Directive assessment: estuarine and coastal waters - GOV.UK (www.gov.uk)

assessment utilised the values identified from the Cefas marine modelling undertaken as part of the permit application (as described in the above section).

## 5.5 Habitats Regulations Assessment (HRA) and Countryside and Rights of Way Assessment (CRoW)

As explained in **Section 2** earlier, a HRA and CRoW assessment were undertaken as part of the DCO planning requirements for the wider SZC project. However, to inform this permit application and the proposed discharge activity from the desalination plant, more specific information is required to enable the EA to assess the impact of the activity on surrounding features. The information needed to support the assessments is provided as a package in **Appendix F** to this technical supporting document. This has been provided in accordance with advice and guidance provided by the EA during Pre-Application discussions and has considered the potential risks and impacts from the proposed water discharge activity specifically in relation to the following risks:

- Turbidity
- Toxic contamination
- Siltation
- Physical damage
- Changes in pH
- Nutrient enrichment
- Changes in thermal regime
- Changes in salinity regime

Please refer to **Appendix F** for the full HRA / CRoW information package.

## 5.6 Background Marine Water Quality Baselining

To help inform the required supporting assessments for this permit application (described above) which consider the potential impact of the proposed discharge from the desalination plant, baseline data reflective of the receiving marine environment (the North Sea in the Sizewell Bay area) were utilised. This information was already available from data that was gathered on the baseline marine water environment to inform surveys and assessments that were required as part of the DCO planning requirements. Data that were gathered to inform the DCO surveys related specifically to the water quality of the marine environment in the Sizewell Bay area and sediment. These data were used to inform project-wide environmental-related assessments, including Environmental Impact Assessments (EIAs), the shadow HRA and the original WFD assessment, among others, that were required as part of the DCO submission. Where appropriate, this baseline data has therefore been utilised to inform the assessments undertaken to support this permit application. A summary of the baseline data, discharge estimates and screening data used is presented in Section 11 Appendix C of the CEFAS Surface Water Pollution Risk Assessment (**Appendix C**).

A useful overall summary of the existing marine baseline conditions, derived from the surveys and reports undertaken at the DCO stage, is provided in Section 21.4 of Section 6.3 Volume 2 Main Development Site Chapter 21 of the Environmental Statement (ES) for the project[9]. Namely, this section summarises the baseline environment with regards to physical environment, temperature, salinity, dissolved oxygen, suspended sediments concentration, nutrient status, unionised ammonia, sediment quality, trace metal concentrations in

[9] EN010012-001931-SZC_Bk6_ES_V2_Ch21_ Marine_Water_Quality_and_Sediments.pdf (planninginspectorate.gov.uk)

the water and sediment and polycyclic aromatic hydrocarbons (PAH) and contaminants. Part of this section of the ES has been extracted and provided as **Appendix G** to this permit application for ease of reference should the reader wish to familiarise themselves with the overall marine baseline conditions in the Sizewell Bay area. Furthermore, **Appendix H** provides a copy of part of Appendix 21E that was submitted in relation to the marine aspects discussed in Chapter 21 of the DCO ES, which further explains how marine baseline conditions were identified and what the data from the surveys undertaken show. Note that both are extracts from publicly available information that was produced in relation to the potential marine impacts resulting from the wider project (not just the proposed discharge activity); hence why the information and key outcomes have not been repeated in full here. The extracts are merely provided to help portray a picture of the baseline marine conditions and aid understanding and transparency with regards to how this baseline data has been utilised to support this permit application.

This baseline information and data that was compiled as part of the marine surveys has been shared with the EA during Pre-Application discussions, where requested, and where relevant to the assessments supporting this specific water discharge activity permit.

# 6 MONITORING AND SAMPLING ARRANGEMENTS

Monitoring and sampling will be required for certain discharge effluent quality parameters, as well as for flow rate. Monitoring and sampling arrangements in relation to the proposed discharge activity will ultimately be dependent upon limits and conditions that are set out in the environmental permit, for example what parameters need to be monitored, how and how often. However, this section of the technical supporting document is intended to set out the current proposed monitoring and sampling arrangements for the discharge activity based on the design performance specifications that have been developed and wider professional expertise within the permitting team and Cefas. Ultimately, the desalination plant contractor is anticipated to be overall responsible for adhering to any permit requirements regarding monitoring and sampling arrangements. The final monitoring and sampling arrangements will be signed off by the SZC Environmental Services and Assurance Team and communicated to the regulator, if required. It is acknowledged that there may be additional requirements in relation to MCERTS Compliance which are expected to be set out in the permit.

## 6.1 Monitoring and Sampling of Process Effluent

It has been recommended as part of the desalination plant outline design that the following parameters are continuously monitored as part of the online SCADA system of the plant:

- Turbidity
- Conductivity (which helps to derive salinity and total dissolved solids)
- Chlorine (free)
- pH
- Temperature

Periodic sampling may also be required for further parameters, i.e., in addition to those listed above. It is expected that this will be set out as a requirement in the permit itself. It is anticipated that periodic sampling will require manual samples of the effluent being obtained, from a representative point, and then sent for laboratory analysis for certain parameters at a UKAS-accredited lab. An effluent sample point will be incorporated as part of the design of the desalination plant for physical samples of the effluent to be obtained. For flow, based on the current outline design, there will be a 25 mm ball valve located just after the flow meter on the outfall pipeline within the desalination pumping station compound. The plant will also incorporate an effluent water quality manual sampling tap located downstream from the sea outfall tank (where the brine reject and other process wastewater is stored prior to discharge); this is expected to be the sample point that is used to assess compliance with any periodic discharge effluent quality limits. This will allow a representative sample of the discharge from the desalination plant outfall going into the North Sea to be obtained. There will be a permanent means of access provided for the sampling point and access will be maintained as required. The precise location of the sampling point will not be determined until the programme for the implementation of the desalination plant itself has progressed further. The anticipated NGR based upon current outline design is TM 47557 64029 however.

As described in **Section 4.2** above, certain chemicals will be used within the plant, which are in line with those used on any other drinking water treatment plant. Of these, there is not expected to be significant, if any, carry over in the final process effluent however there may be iron present in the discharge from the lamella thickener supernatant and from the centrate (centrifuge liquor). The concentration will be substantially diluted by the brine reject flow from the sea outfall tank, however it is anticipated that sampling for iron (residual) may be required. Due to the use of certain chemicals for SWRO maintenance, it is also anticipated that phosphate sampling may also be required as part of routine periodic manual sampling. Any other parameters which require periodic sampling are anticipated to be set out by the EA in the permit. Measures will then be taken on site as part of management system arrangements to ensure that these conditions are met.

The frequency and methods for the required effluent quality sampling is expected to be set out in the environmental permit. It was discussed with the EA during Pre-Application that there may be a requirement to obtain more frequent samples of the final process effluent in the initial weeks or months following the plant becoming operational. The purpose of this will be to ensure that a suitable number of samples can be obtained (usually 12) to demonstrate the actual composition of the final effluent being discharged and confirm that this is in accordance with permit limits.

For the flow rate and effluent quality parameters which will be continuously monitored (as expected based on the current plant design) (turbidity, conductivity, pH, free chlorine and temperature), alarms will form part of the plant's PCS which will sound when pre-determined high levels are met. These will be set manually to align with permit limits where applicable (anticipated to be set just below permit limits which will help indicate if the discharge is nearing exceedance). When an alarm is raised, operator intervention will be instigated to respond to and resolve the issue. Refer to the ERA provided in **Appendix D**.

With regard to the periodic manual sampling, depending on the methods and frequency of sampling set out in the permit, these are likely to be required to be sent for off-site testing and analysis at a UKAS-accredited laboratory. If this is the case, there may be a period of time whereby potential exceedances in other parameters (not continuously monitored) are not identified until results are received. However, if the plant is operating as intended, and the continuous monitoring of the other parameters described above has not indicated any issues, it is considered unlikely that this should occur. As described in the above paragraph, it is expected that there may be a requirement to obtain more frequent samples during initial operation of the plant.

All monitoring and sampling equipment will be subject to a programme of preventive maintenance. Records of all maintenance and calibration of any sampling equipment will be kept secure and made available to regulators as and when required. Sampling methods and equipment will be in accordance with relevant British Standards (or other industry standards / best practice) where applicable. This will in accordance with any conditions set out in the permit.

### 6.1.1 Environmental Field Monitoring

As the discharge is being made into the North Sea, it is anticipated that there could be requirements with regards to field monitoring of the receiving environment (i.e., in addition to the above-described monitoring and sampling of the process effluent prior to this entering the sea). This was discussed with the Environment Agency during Pre-Application, and it is not anticipated that this will be required however it is acknowledged that it cannot be fully ruled out and may be dependent on the sampling and monitoring results that are obtained once the plant is operational. Therefore, at present no further information is available in relation to this. It is likely that the need for this will be considered alongside the Surface Water Pollution Risk Assessment undertaken (**Appendix C**) as this specifically considers the anticipated impact of the discharge on the receiving marine environment.

## 6.2 Proposed Process Effluent Water Quality

The expected quality of the effluent expected from the desalination plant has been calculated within the Surface Water Pollution Risk Assessment undertaken by Cefas (**Appendix C**), and within modelling which has been undertaken by the incoming plant contractor to inform the required plant performance projections. This information has been used to support the permit application and is summarised below.

To inform the anticipated effluent quality, which is set out in **Table 10** further below, baseline marine water quality data was used. A summary of how this baseline data was obtained, when, and what elements (parameters) it covered has been described in **Section 5.6** above and in **Appendices G and H**. In summary however, the baseline data provided minimum, average and maximum values for a number of parameters experienced over a certain period in time in the North Sea at certain monitoring locations. The values from the baseline data used to inform the Surface Water Pollution Risk Assessment and marine modelling is provided in Table 11-2 of **Appendix C**. The values used by the plant contractor are presented in **Table 9** below.

**Table 9 - Baseline Data Values used by Plant Contractor to Inform Performance Specification**

| Parameter | Units | Minimum | Average | Maximum |
|---|---|---|---|---|
| Temperature | °C | 3 | 12 | 20 |
| Salinity | mg/l | 28,000 | 35,000 | 40,400 |
| Turbidity | NTU | 1.0 | 20.0 | 100 |
| Suspended Solids | mg/l | 9 | 109 | 426 |
| pH | pH units | 7.8 | 8.0 | 8.1 |
| Boron (total) | mg/l | 3.9 | 4.3 | 5.0 |
| Total petroleum hydrocarbons (FTIRPER) | mg/l | 0.1 | 1.5 | 15.0 |
| Total Organic Carbon | mg/l | 0.4 | 0.6 | 0.9 |
| Dissolved Organic Carbon | mg/l | 0.7 | 1.0 | 1.5 |

This data was originally presented in Report TR193 Sizewell C Discharges H1 type assessment – supporting data report Edition 5 Volume 2 Appendix 21F, which was submitted as part of the DCO. This can be supplied if required however it is publicly available information.

The contractor that has been appointed to supply, build and maintain the desalination plant has predicted the anticipated effluent quality based on the **maximum values** presented in the above table. These were the maximum values that were obtained from all outfalls included in the baseline monitoring. Furthermore, the contractor, in their modelling, has also only considered the brine reject component of the proposed desalination plant discharge (i.e., what the discharge would be without any dilution effect of the other process wastewater sources from the plant). To get from the marine baseline data values to the proposed maximum effluent values (presented in **Table 10** below), the data from the above table was subject to a reverse osmosis projection performed in Hydranautics software which considers standard seawater composition data from the proposed SWRO membrane manufacturer's technical handbook and also the maximum total dissolved salinity (TDS) from the local (SZC) marine baseline data. This utilised a SWRO concentration factor and recovery rate % of 47%, as set out in the below calculation:

Recovery rate: 47%

Concentration factor (CF): CF = 1/ 1-0.47 = 1.887

Feedwater TDS: 40.4 ppt

Brine TDS: 40.4 ppt x 1.887 = approximately 76.3 ppt

Result: Brine concentration is approximately 76.3 ppt

Since a small percentage of salt passes to the permeate side and the SWRO feed is mixed with recycled second-pass brine, the anticipated brine concentration will be slightly lower. The maximum TDS values of brine is therefore anticipated to be in the region of 74,181 mg/l.

This approach to the modelling reflects a precautionary, worst-case approach that could be experienced during periods where only brine reject is being discharged, across all marine conditions experienced in the baseline monitoring. Brine from the first-pass SWRO is continuously discharged back into the sea. All wastewater flows are disposed of intermittently, depending on the backwash frequency and treatment operations. The maximum TDS in the outfall therefore occurs when the outfall stream consists primarily of the brine reject, with no mixing of other process wastewater streams. This reason for this approach being undertaken by the plant contractors is because they need to ensure that the final design of the plant, and importantly the performance specification of the SWRO membranes, can meet anticipated performance specification requirements across a range of baseline marine conditions. Please see the third column to the left of **Table 10,** for the expected maximum values. The contractor has also applied the calculations to predict the 95%ile values that could be experienced based on the marine baseline data across all outfalls in the scope of the baseline monitoring, again these are also presented in **Table 10** below.

The Surface Water Pollution Risk Assessment undertaken by Cefas has however undertaken a slightly different approach with regards to the modelling to inform proposed process effluent quality parameters. This has been reviewed by the EA as part of the permit Pre-Application phase and the approach undertaken is described in detail in **Appendix C**. In summary however, this has identified the estimated discharge maximum and average effluent quality in relation to various substances, including dissolved metals present in the incoming seawater, based on the 95%ile baseline marine water quality data for just one of the outfalls included in the scope of the baseline monitoring program (that which is the closest to the proposed desalination plant marine dispersion head location). Therefore, different values from the baseline marine modelling were utilised than those presented in **Table 9** above used by the plant contractor. This approach was taken by Cefas as it is considered to provide a representation of how the plant will operate in the marine baseline conditions in this specific location, 95% of the time. The expected effluent quality limits based on this approach are also summarised in **Table 10**Error! Reference source not found. below (the fifth and sixth columns from the left).

Therefore, as can be seen from **Table 10**, there are differences between the maximum expected effluent quality values which the plant will be designed to operate within and the average / maximum values based on conditions experienced 95% of the time from the baseline marine monitoring data. As the contractor responsible for the final design of the plant has anticipated the maximum effluent values, the permit should take this into account. During permit determination, further discussions around setting permit parameters would be welcomed. It is acknowledged that effluent quality limits for dissolved metal parameters may also be included in the permit. It is anticipated that these would be required to be assessed as part of periodic manual sampling (not part of the plant's continuous monitoring system).

**Table 10 - Expected Discharge Effluent Composition**

| Desalination Plant Discharge Parameters | Units | Contractor Desalination Plant Operational Design Parameters *(Maximum limits based on brine reject only)* | Contractor Desalination Plant Operational Design Parameters (95%ile) *(95%ile limits based on brine reject only)* | Cefas Surface Water Pollution Risk Assessment Estimated Discharge Maximum 95%ile* | Cefas Surface Water Pollution Assessment Estimated Discharge Average or Mean* |
|---|---|---|---|---|---|
| pH | pH | 7.0 - 8.0 | 7.0 - 8.0 | 7.0 - 8.0 | 7.0 – 8.0 |
| Free chlorine | mg/l | <0.05 | <0.05 | <0.05 | <0.05 |
| Total dissolved solids / salinity | mg/l / PSU | 74,181 | 71,276 | 53.5 PSU | 51.79 PSU |
| Turbidity | NTU | ≤20.0 | ≤20.0 | N/A** | N/A |
| Treated water total suspended solids | mg/l | ≤120 (normal operation)<br><br>250 (during maintenance activities described in 4.1.2) | ≤120 (normal operation)<br><br>250 (during maintenance activities described in 4.1.2) | N/A | N/A |
| Seawater Re-circulation TSS | mg/l | Same as abstracted | Same as abstracted | Same as abstracted | Same as abstracted |
| Aluminium | µg/l | <40 | <40 | N/A | N/A |
| Chloride | mg/l | 41,238 | 39,262 | 30,562 | 25,594 |
| Sodium | mg/l | 22,183 | 21,701 | N/A | N/A |
| Iron (total, 0% FE removal)*** | µg/l | 6,096 | 5,106 | N/A | N/A |
| Fe (iron dissolved) | µg/l | - | - | 475 | 276 |









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| | | | | | |
|---|---|---|---|---|---|
| As (arsenic) dissolved | µg/l | - | - | 2.09 | 1.76 |
| B (boron) dissolved | µg/l | - | - | 4976 | 4740 |
| Cd (cadmium) dissolved | µg/l | - | - | 0.34 | 0.12 |
| Cr (chromium) dissolved | µg/l | - | - | 2.33 | 1.02 |
| Co (cobalt) dissolved | µg/l | - | - | <16 | <16 |
| Cu (copper) dissolved | µg/l | - | - | 14.2 | 4.1 |
| Pb (lead) dissolved | µg/l | - | - | <1.6 | <1.6 |
| Hg (mercury) dissolved | µg/l | - | - | 0.15 | 0.06 |
| Ni (nickel) dissolved | µg/l | - | - | 2.09 | 1.42 |
| Zn (zinc) dissolved | µg/l | - | - | 74.61 | 31.77 |
| Ammoniacal nitrogen | µg/l | - | - | 32.74 | 17.52 |







NOT PROTECTIVELY MARKED

*N/A – not applicable as not a priority hazardous pollutant.*

**Estimated maximum based on 95%ile background concentrations and estimated averaged based on mean results recorded in the vicinity of the proposed intake over 12 months between 2014-2015. n= 57 (n=28 for ammoniacal nitrogen). Refer to **Appendix C** for details.*

***No EQS for total suspended solids so not considered in Surface Water Pollution Risk Assessment.*

**** the total amount of iron the plant is capable to treat.*

It is important to note that there will be periods when the above parameters and values may differ including:

- Periods of seawater recirculation, as described above in **Section 4.1.3** above. This is raw seawater that will be cycled through the intake direct to outfall to avoid stagnation in the plant infrastructure. This water is anticipated to be similar to or the same as that abstracted, which could mean that the values in the below table might not apply. Instead, the water is expected to reflect the known baseline conditions. There will not be any intervening use of this water.
- During periods of maintenance, as described in **Section 4.1.2** above. However, it is proposed to use a Siltbuster, or similar suspended solids treatment system, during such operations which would reduce TSS. The maximum proposed limit of 250 mg/l is therefore based on a precautionary approach.
- As explained in **Section 4.1.1**, during commissioning there will be 'performance testing' and a subsequent period of 'reliability testing'. During these times, the effluent quality will be monitored (anticipated to be based on the parameters included as part of the plant's PCS continuous monitoring but subject to contractor confirmation); this could however represent a period whereby the above parameters could be exceeded / different to those presented above while the plant is initially set up, dependent on the plant operation itself. The performance testing is short duration 24-hour test runs; the reliability testing period is expected to be around 28-days. It is acknowledged that further information may be requested with regards to the proposed commissioning arrangements; this will be provided once known as the programme progresses. It is also acknowledged that pre-operational conditions may be implemented as part of the permit in relation to the commissioning period.

Where available, and as requested, SZC will provide any further clarification on the anticipated effluent quality once the final plant design is progressed by the appointed contractor. Once the plant is operational, results from monitoring / sampling that is undertaken in accordance with permit conditions can be used to demonstrate and clarify the plant performance (with respect to the discharge quality) and treatment efficacy.

### 6.2.1 Proposed Salinity (Brine) Limits in Transitional and Coastal (TRaC) Waters

It was discussed with the EA during Pre-Application that there is currently draft guidance on proposed salinity (or brine) limits in TRaC waters. This is because, currently, there is no clearly defined consensus on the regulation of brine discharges. The draft guidance was shared by the EA with the SZC permitting and design teams as part of the development of the permit application for consideration in relation to the proposed discharge activity from the desalination plant.

The guidance shared set out draft brine targets and defined mixing zones for brine discharges to TRaC waters (which this discharge activity comprises). For awareness and to aid understanding, the guidance distributed defined mixing zone as *'the part of a body of surface water which is adjacent to the point of discharge and within which the targets may be exceeded, provided that the environmental objectives of the WFD, and other environmental standards, are met within the water body as a whole'*.

The guidance recommends the following regarding brine discharge limits:

- '*Excess salinity shall not exceed a 5% uplift (or an absolute increment of <3 parts per thousand (ppt), whichever is less) above ambient salinity levels in the receiving water body, at a mixing zone boundary* *of 250 m, and that this salinity level should not exceed 40 ppt. It is also important that surveys are undertaken, both short and long-term, to assess plume behaviour and ecological impact in real time'*.

The draft guidance was also reviewed by the SZC project team as best practice and the following conclusions drawn:

- It has been discussed with the EA that the existing data for the background raw seawater quality can periodically exceed the 40 parts per thousand (ppt) target stated in the guidance. Therefore, in this situation, the SZC project design team have assumed that the discharge would be required to meet the +3 ppt or a 5% uptake limit over background 250 m distance from the discharge point (the marine dispersion head).
- The brine reject from the proposed desalination plant is expected to have a salinity of up to 65 ppt (based on the maximum seawater salinity and highest average RO system recovery rates), prior to any dilution or mixing in the sea.

While this guidance and limits may not be published yet, it has been reviewed by CEFAS as part of the salinity modelling undertaken in the Surface Water Pollution Risk Assessment. Section 10.3.1 of Appendix B of the modelling assessment report (**Appendix C** to this technical supporting document) summarises that the limits are not expected to be exceeded by the desalination discharge at any time.

## 6.3 Flow Monitoring

An electromagnetic flowmeter has been incorporated as part of the desalination plant design to enable continuous flow monitoring to be undertaken. The approximate NGR of the outfall flow monitoring point is TM 47556 64029. The EA's monitoring certification scheme (MCERTS) guidance, Minimum requirements for self-monitoring of flows: MCERTS performance standard[10], will be adhered too, if required, as part of the monitoring arrangements. This is thought to be applicable to the proposed discharge activity as the permit may contain a condition on monitoring of liquid flow which will need to be undertaken in accordance with MCERTS certified measurement systems. Flow data will be recorded and reported to the EA as per conditions set out in the permit. This is anticipated to be undertaken by the appointed desalination plant contractor who will be responsible for managing the day-to-day operation of the plant, in conjunction with SZC.

The specific type of flow measurement system (electromagnetic flow meter) best suited to the desalination plant operations will be identified by the chosen desalination plant system supplier. This will hold suitable product certification under the MCERTS standard *'Performance standards and test procedures for continuous water monitoring equipment – part 3*[11]'. The flowmeter will be selected and sized appropriately for the application. These generally consist of 2 parts: the 'sensor' which detects the flow of discharge, and the 'transmitter' which provides calibrated measurement signals and a readout. Provision will be made in the sensor installation for either verification or secondary testing to be carried out, which is a requirement for MCERTS inspections. The location of the flow-monitoring equipment shall ensure representative measurement of the total flow.

If instantaneous flow monitoring is required (which refers to a flow-rate measurement which may be either spot reading or an average rate of flow over a period of 15 minutes or less), this will be reflected in site-specific requirements which will be developed on the basis of conditions set out in the permit.

10 https://www.gov.uk/government/publications/minimum-requirements-for-self-monitoring-of-flow-mcerts-performance-standard
11 https://www.gov.uk/government/publications/mcerts-performance-standards-and-test-procedures-for-continuous-water-monitoring-equipment-part-3

The MCERTs certificate number is not yet known as the desalination plant suppliers are still to confirm the final plant design, which includes supporting components such as the flow meter. This has been raised with the EA during Pre-application discussions and will be provided once known.

## 6.4 Monitoring and Sampling Responsibilities

Monitoring and sampling are anticipated to be undertaken by the contractor responsible for the operation (and maintenance) of the desalination plant. Assurance of the monitoring and sampling arrangements implemented will be undertaken by the SZC Environmental Services and Assurance team. Any personnel who are appointed as responsible for undertaking and recording monitoring / sampling results in relation to the desalination plant will be made aware of the specific requirements that are set out in the environmental permit, including requirements in relation to MCERTS (if applicable), and will have received any pertinent training on obtaining monitoring / sampling results as necessary. Final arrangements relating to monitoring and sampling will be detailed in a monitoring plan. Aspects of self-monitoring will be covered as required in the SZC EMS documentation and / or contractor environmental management arrangements.

Currently, it has been proposed that, as part of contractual arrangements, the appointed contractor will be responsible for conducting a 28-day ‘reliability test’ when the plant becomes operational; this will include effluent quality monitoring for parameters including iron, phosphate, biological oxygen demand, chemical oxygen demand and TSS as a minimum.

Results from any effluent sampling and monitoring will be made available if requested by and to the EA, as the regulator responsible for issuing the environmental permit. This will be reported in accordance with requirements set out in the environmental permit. Any non-conformances, e.g., exceedances of parameter limits in the discharge identified in monitoring / sampling, will be addressed as per internal Environmental Management System (EMS) arrangements (see **Section 7** below). Appropriate corrective action and the implementation of a solution to ensure that the discharge remains in-specification will be undertaken and agreed in conjunction with the advice of the EA, where required.




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# 7 ENVIRONMENTAL MANAGEMENT SYSTEM (EMS) ARRANGEMENTS

## 7.1 Environmental Management System Summary

SZC has an Environmental Management System (EMS) that is certified to the management system standard, BS EN ISO 14001:2015. The EMS provides a structured system of procedures, arrangements and associated processes and tools to ensure suitable and, importantly, effective approaches are undertaken with regards to managing environmental aspects and impacts relevant to the organisation's activities.

The main objectives of the EMS are as follows:

- To identify any potential risk posed by current site operations on the environment
- To ensure that measures required to minimise and control these risks are identified and outlined
- To ensure that on-site activities are managed to protect and where possible, enhance the environment, in accordance with this EMS document
- To ensure that performance against this EMS is periodically checked, and
- To ensure that the environmental permit and any subsequent variations (if required) are complied with, alongside any other relevant compliance obligations.

The EMS forms part of SZC's wider Integrated Management System (IMS) which also comprises the Quality Management and Health & Safety Management systems. The Quality Management System is certified to ISO 9001 and certification to ISO 45001 is expected to be achieved for the Health & Safety Management System. The SZC IMS Structure is presented below; the EMS is integrated at each one of these levels.


**Figure 6 - SZC Integrated Management System Structure**

The EMS covers all SZC-related activities in relation to design, construction and future operations and decommissioning of the SZC nuclear power station. This includes work activities, products and services involving both SZC company employees and contractors.

There is an EMS Manual in place which summarises, in detail, the processes and procedures (and associated documentation / other requirements), that constitute the full EMS, and how these ensure the organisation meets the relevant clauses set out in the 14001 EMS standard. Relevant aspects of the EMS will be applied to the discharge activity proposed in this application as appropriate, in conjunction with any additional contractor implemented measures.

The aspects of SZC's EMS that are anticipated to be relevant to the management of the discharge from the desalination plant are summarised within this section. If any new processes or procedures are identified as being required, for example in relation to specific environmental permit conditions that may be imposed, these will be developed by either the SZC site environment team or by the appointed contractor and communicated to all relevant personnel.

## 7.2 EMS Procedures Relevant to Discharge Activities

To ensure compliance with permitting requirements, there are several procedures established as part of the SZC EMS which will apply, or relate, to the proposed desalination plant discharge activity.

These include:

- SZC-HSE-PRO-032 Apply for, and Maintain Nuclear and Environmental Consent, Permit or Licence Procedure.
- An Environmental Permit, Consent and Licence Register.
- Environmental and Sustainability (E&S) Appendices, which comprise contractual mechanisms or tools used to ensure contractors are made aware of relevant environmental obligations. There are various types of E&S Appendices which are used for various types of contracts but in essence, the E&S Appendix will stipulate certain requirements that contractors must have in place, including an up to date and signed environmental policy with a commitment made for legislative compliance, pollution prevention and continual improvement in environmental performance.
- SZC Environmental Surveillance Guidance Note – details how the Environmental Consenting and Compliance Function conducts its oversight, surveillance and monitoring of the project and contractor activities, records its findings and escalates issues and risks as appropriate.
- SZC-HSE-PRO-002 Assess Environmental Aspects and Impacts Procedure
- SZC-HSE-PRO-042 Perform Environmental Monitoring Procedure.

## 7.3 Environmental Management-Related Roles and Responsibilities

Roles and responsibilities specifically in relation to environmental management at SZC are set out in the EMS Manual. Note that these are subject to change depending upon internal resourcing strategy and wider project requirements. The current roles are summarised below:

- SZC Ltd. Board of Directors – hold ultimate responsibility for all environmental management decision-making. The Board has approved the Environmental Policy which is communicated to the business.
- Executive Leadership Team – responsible for operational management of the business (delegated authority by the Board). In addition, the Board has established an Environmental, Social and Governance Committee (ESGC). This represents a formal board committee to provide independent advice, oversight and challenge to the project on behalf of the Board of Directors. Within the

executive team is the Safety, Security and Assurance Director who establishes and enables a culture of quality, safety and environmental management through implementation of policies and practices that set out standards. They are responsible for building and owning a resilient and capable assurance function which includes ownership of an ISO 14001 compliant EMS.

- SZC Environmental Consenting and Compliance Function – (formerly the SZC Environment, Decommissioning and Radiation Safety Function). This is part of the Safety, Security and Assurance Directorate. This function is responsible for the overall governance of this permit application and they have been responsible for overall sign-off. The function provides authoritative expertise, advice and assurance on all environmental and decommissioning aspects of the project, along with emergency preparedness. The function is responsible for environmental compliance, including the development and implementation of arrangements that form part of the SZC EMS. Key roles within the function in relation to the EMS include:
  - Head of Environmental Consenting and Compliance
  - Managers within the Environmental Consenting and Compliance Function
  - Environmental Consenting and Compliance Team Members
- Environmental, Social and Governance (ESG) & Radiation Strategy Directorate – responsibility for development and maintenance of arrangements supporting decommissioning, sustainability assurance and radiation safety. Works alongside the Environmental Consenting and Compliance Function described above.
- SZC Quality Assurance Team – Sits within the Security and Functional Assurance Function in the Safety, Security and Assurance Directorate. The team has responsibility for the project IMS, quality assurance oversight and surveillance activities and the internal audit programme. The team assures the policies, standards and written arrangements that make up the IMS to meet changing requirements throughout the project life cycle. This team is also responsible for interfacing with external certification bodies and compliance with ISO management system standards, 9001 and 14001.
- SZC Other Head of Disciplines, Team Leaders and Managers – to lead their teams to take a personal responsibility to work within the SZC EMS.
- SZC All Staff - All staff, including embedded contractors, have a personal responsibility to work within the SZC EMS and to work with the Environmental Consenting and Compliance Function to continually improve it.
- SZC Contractors – The external supply chain is to work within the SZC integrated EMS and to comply with the environmental requirements as stipulated by SZC.

An Environmental Baseline is also maintained by HR which details the key environmental resources the SZC project requires at the current phase of the project. These posts must always be maintained.

### 7.3.1 Legal Operator

Sizewell C Ltd will act as the Legal Operator of the permit and will therefore have sufficient control of the activities, in conjunction with appointed contractor. In accordance with the relevant GOV.UK guidance (Legal operator and competence requirements: environmental permits[12]), SZC Ltd will:

[12] Legal operator and competence requirements: environmental permits - GOV.UK (www.gov.uk)

- Have day-to-day control of the activity, including the manner and rate of the proposed discharge activity.
- Make sure that permit conditions are complied with.
- Decide who holds important staff positions and have incompetent staff removed, if required.
- Make investment and financial decisions that affect how the discharging activities are carried out.
- Make sure activities are controlled in an emergency.

## 7.4 Specific CWDA EMS Arrangements

The EA guidance 'Develop a management system: environmental permits'[13], does not specify that a standalone water discharge activity is required to demonstrate how it will meet all of the below EMS requirements at permit application stage, however the following information is hoped to demonstrate where considerations in accordance with this guidance have still been made as part of the project as best practice.

### 7.4.1 Site Infrastructure Plan

Relevant project design diagrams and drawings have been included as **Appendix B** to this permit application. Additional site layout drawings and construction plot plans may be developed and be available (upon request) at a later date as the desalination plant implementation programme continues.

### 7.4.2 Site Operations

The contractor appointed to manage the desalination plant will be required to implement control measures and procedures as appropriate to ensure the desalination plant and associated discharge activity does not impact adversely upon the environment. Permit-specific requirements are expected to be communicated through permit handover discussions, generation of a compliance matrix (or similar) and issue of the contract-specific E&S Appendix. Proposed control measures in relation to the desalination plant and discharge activity will be reviewed by the SZC Environment team and may be required to incorporate any additional SZC site or EMS arrangements. It is anticipated the qualitative ERA produced to support this permit application will be taken into account when these are developed (**Appendix D**).

Operational-level documents anticipated to incorporate environmental-management related arrangements (including permit requirements) may include:

- Risk assessments and method statements (RAMS) specifically in relation to the operation and maintenance of the desalination plant.
- Safe systems of work (where applicable).
- System operating procedures.
- Construction environmental management plans (CEMPs) and risk assessments.
- Site Waste Management Plans / Materials Management Plans (SWMPs / MMPs)
- Sampling / Monitoring programmes / procedures and associated reporting tools.
- Permit compliance matrices and work instructions.

The desalination plant contractor will be required to comply with the SZC Environmental Policy Statements, alongside any other relevant aspects of the EMS that might apply to the proposed discharge activity (as

[13] Develop a management system: environmental permits - GOV.UK (www.gov.uk)




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described above in **Section 7.2**). These will be communicated to the contractor, and any other relevant personnel, as appropriate, e.g., through contractual arrangements within the E&S Appendix and / or site induction processes. Any contractual changes will be initiated by early warnings and change events.

All contractors appointed to work on the site will be required to comply with the requirements set out in the SZC Code of Construction Practice (CoCP). The aim of the CoCP is to provide a clear and consistent approach to the control of SZC construction activities to minimise impacts on people and the environment. This sets out:

- Policy and principles in relation to environmental management
- Requirements around environmental mitigation, management and monitoring
- The EMS that applies to the project
- Expectations and requirements relating to stakeholder engagement and provision of information to local communities, and
- Requirements in relation to incidents and emergencies, including fire, pollution incidents and extreme weather events and Measures designed to protect the biology, hydro morphology, physico-chemistry and chemistry of surface waters.

The site will be subject to regular environmental auditing by the SZC Environmental Services and Assurance Team, as well as project-wide ISO 14001 surveillance and re-accreditation audits, carried out by an external company. Activities relating to the proposed water discharge activity will be incorporated into the scope of these audits where considered necessary.

### 7.4.3 Site and Equipment Maintenance Plan

Operation and maintenance activities are anticipated to be relatively minimal once the desalination plant has been commissioned and is in operation. Routine maintenance activities are likely to include:

- Inspection and planned preventative maintenance of the desalination plant and associated equipment and infrastructure (including the maintenance activities described in **Section 4.1.3** above).
- Removal of sludge cake for testing, classifying (if required) and disposal off-site to a suitably permitted facility.
- Replacement of SWRO membranes (as and when required).
- CIP operations on a periodic basis.
- Replacement of cartridge filters from the SWRO prefiltration system.

As described in earlier sections, the desalination plant will incorporate a PCS which will be made up of several process automation controllers, combining and acting as one centralised system. The PCS will be sourced from a well reputed and certified manufacturer. From a central control room, those with responsibility for operating the desalination plant will be able to access individual system controls, alarms and commands through a site-wide communication network. The plant will operate on an automated basis with operator oversight and input; however, daily manual attendance will be provided for essential inspection, maintenance, control, testing and calibration.

The sea outfall tank will be fitted with 'high' and 'low' level alarms. A level switch will be incorporated which will indicate when the tank is on overflow, and a separate level switch for when discharge pumps are required to operate (to initiate the discharge). If alarms are sounded, it will be the responsibility of the desalination plant contractors to respond and address the issue accordingly.

The desalination plant and associated ancillary infrastructure will be maintained and operated in accordance with the plant contractor's instructions and operating procedures. These will be provided to site operatives where required and any additional training / information supplied as considered necessary. Any faults or defects will be identified through planned preventative maintenance or more frequent periodic checks and dealt with as appropriate and as quickly as possible, e.g., replacement of parts. The EA will be notified of any issues relating to the desalination plant operation that could impact meeting permit limits or required monitoring and reporting arrangements.

Monitoring elements of the plant and any sampling equipment will be maintained in accordance with the equipment supplier's recommendations, and in accordance with MCERTS self-monitoring of flow requirements where required by the permit (as described in **Section 6** above).

Hazards which could result in an environmental risk from the operation and maintenance of the desalination plant have been considered in the qualitative environmental risk assessment produced to support this permit application (**Appendix D**). It is intended that this will be used to inform contractor-specific control measures which will be developed as the implementation programme for the plant continues. This could therefore be revised and updated where considered necessary.

### 7.4.4 Contingency Plans

If it is identified, e.g., through continuous monitoring or through periodic effluent quality sampling, that the discharge from the plant is not within the permitted limits, the plant contractor will be responsible for identifying the cause of the problem and instigating appropriate measures to respond to and resolve the problem. Any exceedances identified will be reported to the EA as soon as possible and further action undertaken as necessary (expected to be instructed by the Regulator).

The desalination plant will have a defined emergency shutdown process designed to halt operations swiftly and safely in critical situations. Example triggers might include equipment failures, pressure anomalies or other conditions that pose a risk to the plant's integrity or safety of personnel. This will be the responsibility of the contractor to implement, in accordance with SZC's EMS emergency response procedures as necessary.

There will be arrangements in place to ensure that, in the event of a mains power failure, the plant can continue to operate through use of a back-up generator.

### 7.4.5 Accident Prevention and Management Plan

There is a dedicated section within the SZC EMS Manual which sets out how environmental emergency preparedness and response is to be embedded into the project.

Namely, the following procedures are in place which may apply with respect to the proposed discharge activity from an accident prevention and response perspective:

- Construction Emergency Preparedness and Response Document - supports an integrated emergency management approach and establishes responsibilities of contractors in compliance with the SZC emergency preparedness requirements.
- Contractor Incident Management Plan Guidance & Template and Environmental Incident Control Plan (appended to contractor CEMPs).
- SZC-HSE-PRO-037 Establish, Maintain and Develop Emergency Preparedness Response Procedure - provide a strategic approach for deploying the organisation's Emergency Preparedness and Response policy.
- SZC Site Emergency Plan.

As per the second bullet point above, the desalination plant contractor's CEMP will be required to contain an environmental incident control plan. A draft of the CEMP will be subject to SZC approval prior to any construction works commencing on site. This will be required to have taken into consideration the proposed discharge activity associated with the desalination plant operation set out within this permit application.

Any environmental incidents which occur, such as exceedances of limits set in the permit, will be investigated in accordance with the SZC Investigate Incidents procedure (SZC-ACQ-PRO-011), alongside any other prevalent contractor-specific operational procedures. These will ensure that root causes are identified and both preventative and corrective actions are implemented. Investigation reports will be maintained on site. A Manage Non-Conformance procedure is also in place as part of the SZC EMS which will be applied if necessary (should any environmental non-conformances arise) (SZC-ACQ-PRO-016).

A separate procedure is also in place with regards to how continual improvement should be encouraged and facilitated within the EMS, SZC-ACQ-PRO-010. This incorporates consideration of how lessons learnt from incidents / near-misses should be used to inform continual improvement.

### 7.4.6 A Changing Climate

Although the desalination plant is a temporary feature of the project, the operation of the plant may still be subject to risks associated with a changing climate. These risks have been identified and assessed, from a high-level perspective, as part of the bespoke ERA that has been submitted as part of the permit application. Please refer to **Appendix D** to review these. Furthermore, the SZC CoCP sets out a requirement that CEMPs must consider measures to manage extreme weather events which may be derived from a changing climate.

More generally, the wider project has been subject to a climate change assessment as part of the DCO requirements. This is publicly available information if further information is required in relation to this[14].

The design of the desalination plant and associated infrastructure has incorporated consideration of the effects of a changing climate where necessary too, for example through consideration of sea-level rises and potential impacts on tidal conditions that have input into the design of the intake shaft and outfall pipeline and marine head structures.

From a corporate level perspective, the organisation has committed to making a substantial positive contribution across a range of environmental, social and governance aspects through the project. This incorporates SZC's 'Net Zero Excellence' approach which, as well as helping to deliver net zero for the UK in the most cost-effective and reliable way possible, is also about creating net positive outcomes against a number of the United Nations Sustainable Development Goals.

### 7.4.7 Complaints Procedure

There is an established complaints handling process in place as part of the wider SZC project; this will apply to any complaints which might be received in relation to the proposed discharge activity. Complaints, and the process to address these, are managed by the SCZ Communications team.

In addition, there is a walk-in centre which has been set up in the nearby town of Leiston dedicated to the project. Members of the general public can also utilise this facility to raise any complaints or concerns.

The following procedures are in place as part of the SZC management system which relate to complaints, and wider communications:

- SZC-COG-PRO-001 Manage Communications Procedure
- SZC-PMC-PRO-009 Manage Enquiries and Complaints Procedure

[14] SZC ES chapter - climate change (draft for review) (sizewellcdco.co.uk)

- SZC-COG-PRO-010 Manage Freedom of Information Requests Procedure
- SZC-ACQ-Pro-015 Manage Interfaces with Regulators Procedure

### 7.4.8 Managing Staff Competence and Training

The SZC EMS Manual sets out key requirements in relation to environmental management-related competency and training. Notably, the following are, or will be, in place:

- SZC-PEO-PRO-001 Assess Individual Competency Procedure – sets out the process for assessing SZC posts which hold a Role Training Profile, assigned either via the Environmental or Nuclear Baselines. The procedure includes identification of development or supervisory actions required to close competency gaps.
- SZC-PEO-PRO-002 Create Roles, Competencies and Development Actions Procedure – sets out the approach for analysing and defining competency requirements within all identified role training profiles within SZC. A competency area framework is used as part of the process to select the competencies required for each role.
- Environmental-related training (as appropriate – role dependent).
- Site Induction Programmes: Inductions will take the following approach in relation to environmental briefings; Initial Safety Induction will be delivered to all site personnel to give an overview of environmental issues. Second tier induction will be Operative based and will relate to contract work activities. Third tier induction will be Supervisor based and will provide information and guidance on compliance with consents, licensing, monitoring and environmental management for the site.
- E&S Appendices (as already described further above).
- SZC Code of Construction Practice (CoCP): Issued as part of the DCO, the CoCP is issued to contractors to demonstrate the environmental standards and requirements that are to be met in relation to significant environmental aspects identified as relevant to the project. This covers project wide controls, and then specific requirements in relation to the Main Development Site and then off-site Associated Developments. Specific environmental related training requirements are referred to throughout the CoCP which contractors may be required to meet. A copy of the CoCP can be provided if required as part of the permit application however it is publicly available information.

Specifically in relation to the proposed discharge activity and wider management of the desalination plant arrangements, the appointed contractor shall be responsible for completing any SZC specific training as well as identifying any further training needs of project personnel to ensure they have received, or will be provided, appropriate environmental training in relation to the specific activity.

Regular periodic training is expected to be delivered in the format of toolbox talks, site inductions (for new starters) and spill response training. SZC Daily Safety Messages are also issued which may be related to environmental aspects.

### 7.4.9 Keeping Records

There are several procedures which are implemented as part of the SZC EMS relating to document control:

- SZC-ACQ-PRO-028 Implement Company Procedure
- SZC-ACQ-PRO-009 Develop or Amend Company Procedure
- SZC-PMC-PRO-008 Manage Documents Procedure

- Interim Site Documentation Review Guidance Document (sets out SZC's process for reviewing and approver contractor RAMS, CEMPs and SWMPs)

Documents are maintained within Teamcenter across the project which ensures every document uploaded to the system is allocated a specific reference number and retains review, approval and version history.

Live trackers may be used for collaborative working across different SZC project teams and alliances.

Document control procedures will apply to all documentation and records required to be retained by SZC in relation to the proposed discharge activity, for example permit monitoring records.

### 7.4.10 EMS Review Arrangements

There is an Environmental Management Review Terms of Reference procedure in place as part of the EMS. This sets out the EMS review process that is to be undertaken, including who needs to be involved and how often reviews should be conducted.

In terms of reviewing compliance with the CWDA permit, a procedure is in the process of being developed which will focus on Handover aspects (i.e., how permit requirements are handed over to contractors once the permit is determined). This will sit alongside already-implemented procedures including the E&S Appendix and permit compliance matrices. There will essentially be two lines of assurance to ensure that contractors meet all permit compliance requirements; these will be managed by the Site Environment and Sustainability (Delivery) Team and Environmental Services and Assurance Team.

There is a procedure in place specifically targeted to help ensure compliance from an environmental perspective; the Manage Occupational Health, Safety and Environment Inspections procedure (SZC-HSE-PRO-021). The project is also subject to regular internal audits (as set out in the SZC-ACQ-PRO-020 Perform Internal Audit Procedure).

In terms of the permit application development and review process that has been undertaken, this technical supporting document has been subject to a Permit Project Plan as part of the internal development process for the application itself. This forms part of the Sizewell C Ltd EMS and is a requirement for all permits, consents and licences to follow.

The Permit Project Plan identifies the below aspects:

- The type of permit, consent or licence and Regulator
- Category of the application (in terms of whether the permit is considered as Major or Minor) (criteria forms part of internal management systems)
- Scope of the permit application
- Supporting information required
- Cost of application
- Regulatory engagement requirements
- Stakeholder engagement requirements
- Timeline / sequence of permit specific activities
- Interdependencies and risks (i.e., in relation to the wider project)
- Application process deliverables and timeline of application process
- Organisation roles and responsibilities
- Internal and external technical resource requirements

This technical supporting document has been subject to internal review processes to ensure that the relevant personnel (from an organisational perspective) have input or reviewed the document as required, depending on their specific role and responsibilities within the wider project framework.

### 7.4.11 Site Closure

Once a connection to a mains water supply has been established, expected to be in place by end of 2032 but ultimately dependent upon the water companies capacity to provide this, the desalination plant will be decommissioned. Upon this point, a plant decommissioning plan will be developed by the plant contractor and implemented. This will include for the removal of the plant offsite and any other supporting infrastructure. The limited lifespan of the desalination plant and the requirement to ensure the plant remains functional to facilitate construction should ensure that a high proportion of the plant could be re-used to desalinate water elsewhere.

The marine intake shaft and outfall pipeline will be decommissioned. The intake headworks would be decommissioned and removed once the transfer main is fully available. The buried intake pipe would be grouted (or similar), capped and would remain in-situ. Similarly, the outfall headworks shall be decommissioned and removed once the mains water supply is available and the outfall pipeline grouted, capped and left in-situ.

Once it is confirmed by which date the plant is expected to cease operation, the permit will be surrendered in accordance with the EA's guidance.

# 8 CONCLUDING REMARKS

This document has been produced to support the environmental permit application that is being made by Sizewell C Ltd. for the proposed water discharge activity associated with the use of a desalination plant within the construction phase of the SZC project. It has been prepared with input and review from all relevant technical disciplines and demonstrates compliance with the relevant regulatory requirements.

This document will be submitted to the EA, alongside the required GOV.UK permit application forms, and should be used during the regulatory determination process only.