

Chelson Meadow Leachate Treatment Plant: Permit Variation, Plymouth City Council Habitat Assessment

1 SITE, OPERATIONAL & REGULATORY SUMMARY

- 1.1 Chelson Meadow Landfill Leachate Treatment Plant (LTP) is part of the Chelson Meadow waste facility operated by Plymouth City Council. It is located east of the River Plym Estuary. The National Grid Reference for the centre of the site is SX50612 54476 (Figure 1.1 & Plate 1).

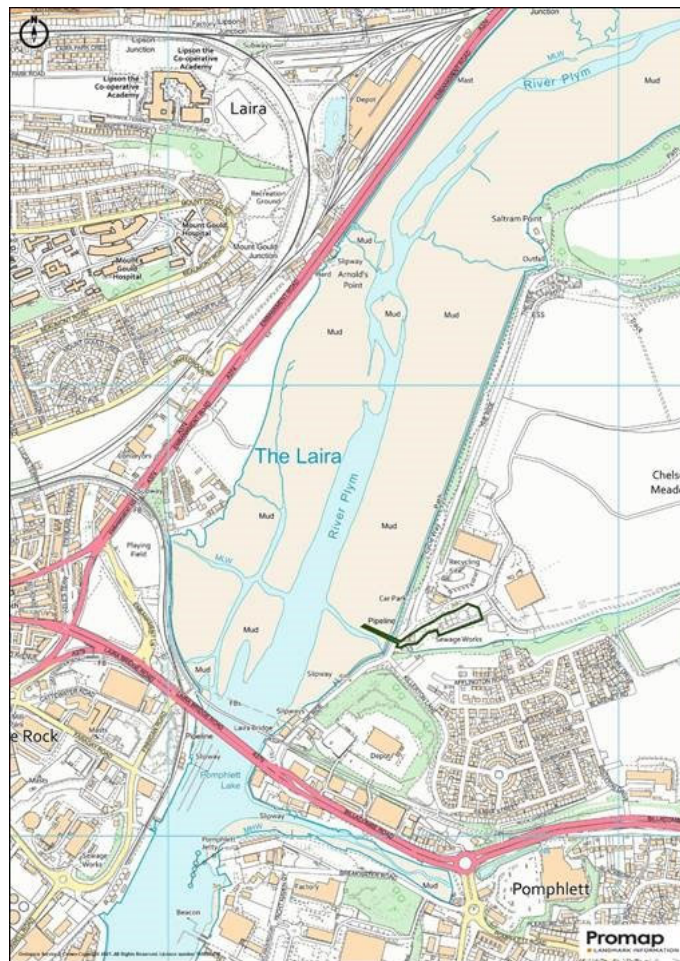


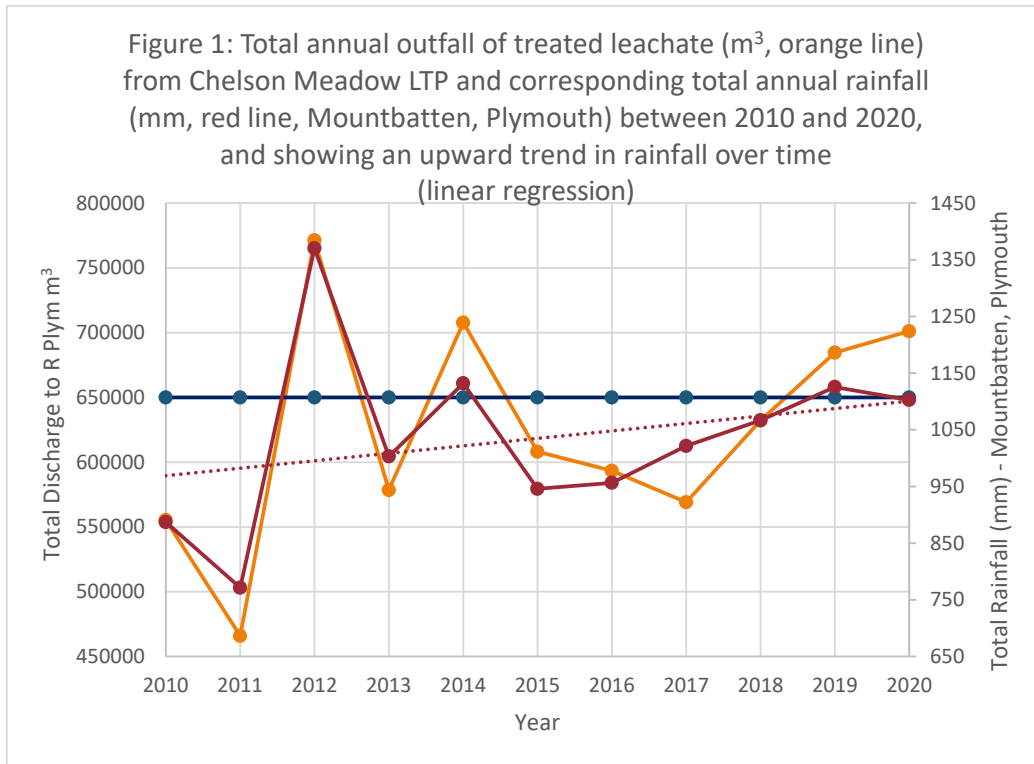
Figure 1.1: Location of Chelson Meadow LTP, showing the permit boundary in green, including the outfall pipe extending into the River Plym.



Plate 1.1: Aerial view (2017) showing entire Chelson Meadow LTP permit boundary in green, with the outfall to the River Plym, four Sequential Batch Reactors (SBRs) and two storage tanks.

- 1.2 The LTP collects and treats leachate generated by the Chelson Meadow municipal landfill, which ceased accepting waste in 2007 and is fully capped and restored. The LTP uses an automated and programable biological treatment system to reduce to limits specified in the current Environmental Permit ammoniacal-nitrogen (N), suspended solids (SS 105°C), and Biological Oxygen Demand (BOD).
- 1.3 Treated effluent from the LTP is discharged to the River Plym via an outfall pipe (Plate 1.1). Under normal conditions this occurs within a 2-hour period commencing half an hour after high tide is detected by a sensor (i.e release is to an out-going tide). Release during the high tide window was a requirement of the original Water Discharge Activity consent (1983) for the site, but it was not regularized during the upgrade to an Environmental Permit and 2011 variation.
- 1.4 The volume of discharge from the LTP is determined continuously by an MCERTS flow meter in the outfall channel and recorded by PC so that the total output can be quantified for any specified period. The permitted total annual discharge volume is currently 650,000m³: the variation seeks to increase this to 850,000m³.
- 1.5 During times of high rainfall, the inflow of leachate to the LTP increases significantly because of greater infiltration through the waste mass. Eventually, the rate of inflow to the LTP may prompt an operational shift to Emergency mode, whereby normal reaction and settling times within the SBRs are reduced to accommodate increased throughput, and both storage tanks are used for containment of treated effluent.
- 1.6 In Emergency mode, large volumes of dilute incoming leachate are still treated to permit compliance, but effluent discharge is no longer restricted to the high tide window. However, the height and seaward flow rate of the River Plym is likely to be substantially higher than normal as water is discharged from the catchment during heavy or prolonged rainfall.

- 1.7 Figure 1 illustrates trends in leachate production (orange line) and rainfall (red line) from 2010-2020, with the current volume condition shown for reference in blue.



- 1.8 The quality of outfall effluent must be monitored weekly for ammoniacal-N, SS and BOD, and reported to the EA in fulfilment of permit conditions. A periodic Direct Toxicity Assessment for fish is also required but the variation application seeks to remove this on ethical grounds.
- 1.9 Monthly monitoring is undertaken to quantify a range of heavy metals, potassium, phosphate and other determinands. In addition, a comprehensive List 1 suite is evaluated periodically; it includes organic pollutants such as Mecoprop and hexachlorocyclohexane, as well as transition and post-transition metals such as thallium and vanadium. Monthly and List 1 monitoring are not a permit requirement.

2 RECEPTORS

- 2.1 The output from the Nature and Heritage Conservation screening request to the Environment Agency (EA) is provided in Appendix A.
- 2.2 The Plymouth Sound and Estuaries Special Area of Conservation (SAC) lies within 10km of the site centre: the citation sheet is provided in Appendix B (Natural England 2005). The primary reasons for designation are:

Annex I Habitats

- 1110 Sandbanks which are slightly covered by seawater at all times
- 1130 Estuaries
- 1160 Large shallow inlets and bays
- 1170 Reefs
- 1330 Atlantic salt meadows.

Annex II Species

- Shore Dock *Rumex rupestris*

2.3 Qualifying features, but not a primary reason for selection of the site are:

- Annex I habitats: 1140 Mudflats and sandflats not covered by seawater at low tide
- Annex II species: 1102 Allis Shad *Alosa alosa* (Natural England 2005)

2.4 Conservation Objectives for the sites are to *‘Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;*

- The extent and distribution of qualifying natural habitats and habitats of qualifying species
- The structure and function (including typical species) of qualifying natural habitats
- The structure and function of the habitats of qualifying species
- The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely
- The populations of qualifying species, and,
- The distribution of qualifying species within the site’ (Natural England 2018).

Uncontrolled emissions from the LTP have the potential to have a negative impact on all of the objectives.

2.5 The Plym Estuary County Wildlife Site (CWS) lies within 2km of the permit boundary. The CWS is comprised of the section of the Plym Estuary upgradient of Laira bridge, Saltram Saltmarsh and the Crabtree Reclaim. Both Saltram Saltmarsh and Crabtree Reclaim are upgradient of the outfall discharge pipe.

2.6 The CWS is designated for several Devon notable plant species (including Brookweed, Glasswort, Sea aster, Wild celery and Lesser sea-spurrey). It also supports unusual combinations of estuarine and terrestrial habitats at Crabtree Reclaim¹, and new areas of saltmarsh developing on the area enclosed by the Saltram sea wall through which ingress of tidal saline water is controlled by a sluice gate (Devon Records Centre 2021).

2.7 Saltram Saltmarsh is the only component of the Saltram Estate CWS relevant to this assessment since the remaining fully terrestrial habitats have no hydraulic connection with the site (but see Section 3 and Appendix C).

2.8 The Plym Estuary CWS supports Priority Habitat mudflats, which are sedimentary intertidal habitats created by deposition in low energy coastal environments. Mudflats are intimately

¹ N.B. The site report was compiled in 2006 and current aerial views suggest the more interesting, open mosaic habitats may have succeeded to scrub in the absence of appropriate management

linked by physical processes to, and may be dependent on, other coastal habitats such as soft cliffs and saltmarshes; they dissipate wave energy and reduce the erosion risk to saltmarshes as well as protecting coastal defences and alleviating flooding of low-lying land (UK BAP 2008).

- 2.8.1 Mudflats are characterised by high biological productivity and abundance of organisms, but low diversity with few rare species: they are a critical resource for important populations of migrant and overwintering birds, for which the Plym Estuary CWS is designated. It supports 0.5% of the British wintering population of Mandarin, Little egret, Greenshank, Common sandpiper, Mediterranean gull, Herring gull, Glaucous gull, Iceland gull, and 0.1 per cent of the British wintering population of Avocet, Red-breasted merganser, Dunlin, Curlew, Redshank and Green sandpiper ([Plym Estuary \(CWS\) | PLYMOUTH.GOV.UK](#)).
- 2.8.2 The mud surface (which plays an important role in nutrient chemistry) often appears devoid of vegetation, although mats of benthic microalgae are common and important for producing sediment-binding mucilage. In areas receiving pollution, organic sediments in the mud surface sequester contaminants and may contain high concentrations of heavy metals (UK BAP 2008).
- 2.8.3 Current and potential threats to mudflat habitat integrity include diffuse and point source discharges from agriculture, industry and urban areas, including polluted storm-water run-off. These inputs can create abiotic areas or produce algal mats which may affect invertebrate communities. They can also remove embedded fauna and destabilise sediments thus making them liable to erode (UK BAP 2008).
- 2.9 The migratory routes for six protected fish species are recorded within 500m of the permit boundary, namely Smelt, European eel, Atlantic salmon, Allis shad, unidentified shad and Sea lamprey (EA screening report 2021, Appendix A).

3 HABITAT RISK ASSESSMENT – GENERIC FACTORS

- 3.1 A full Habitat Risk Assessment (HRA) for all operations at the LTP is provided in Appendix C. As well as the designated habitats and species identified as potential receptors (Section 2), it considers:
- Priority Habitats not included on the EA screening report (see Appendix A)
 - other habitats of ecological importance, and specifically the restored landfill immediately adjacent to the permit area which supports an important breeding population of Skylarks as well as other birds of conservation concern
 - the temporary surface water body on the south landfill boundary, known as the South Leat.
- 3.2 The HRA includes a summary assessment (relevant to 2050) of the potential impact of climate change, based on changes to climate variables proposed by the Environment Agency as part of the spatial planning process (<https://environment.data.gov.uk/catchment-planning/data-download>).
- 3.3 Considering the permitted LTP outfall only, key generic threats to the Plymouth Sound and Estuaries SAC and Plym Estuary CWS (receptors with hydraulic connection) are:

- Physical damage from siltation (inputs of suspended solids) and local erosion of sediments – expected to be confined to the Plym CWS
 - Toxic contamination from the introduction of synthetic (e.g. Tributyl-tin, mecoprop, lindane) and non-synthetic (e.g. heavy metals, hydrocarbons) compounds, and radionucleotides
 - Non-toxic contamination via: nutrient (e.g. ammoniacal-nitrogen) and organic enrichment (leading to increased BOD); turbidity from the addition of suspended solids and as a result of physical disruption of surface sediments; and changes to salinity.
- 3.4 Physical damage and increased turbidity are most likely when the LTP is in Emergency mode because discharge may be outside the 2-hour tidal window. However, because Emergency mode occurs during periods of heavy and/or prolonged rainfall, the height and flow rate of the river will exceed the normal range such that any negative effects are likely to be small and localised within the Plym Estuary CWS.
- 3.5 The risk of most likely sources of non-toxic contamination is essentially regulated by the current permit since this specifies emissions limits for ammoniacal-nitrogen, BOD and suspended solids (but see Section 4).

4 CONTROLLED (RECEIVING) WATERS RISK ASSESSMENT

- 4.1 The potential risk to sensitive habitat receptors from toxic contamination was evaluated from long term monthly and List 1 monitoring data for 2013-2021 by Arcadis Consulting (UK) Ltd ('Arcadis') in 2020 as part of a Controlled Waters Risk Assessment in preparation for formal landfill closure.
- 4.2 The 2020 report was updated in 2021 at the request of the EA in a pre-app response regarding the proposed increased treated effluent discharge volume because the EA consider the River Plym as the primary receptor of concern.
- 4.3 Arcadis used a sequential 4-Tier assessment process to determine substances that may require control through a numeric emission limit specified in this permit variation. In the context of the outfall pipe, the River Plym is defined as a transitional water rather than coastal or estuarine, which defines the screening tests applied.
- [Surface water pollution risk assessment for your environmental permit - GOV.UK \(www.gov.uk\)](https://www.gov.uk/guidance/surface-water-pollution-risk-assessment-for-your-environmental-permit).
- 4.4 Test 1 compares substances detected above the laboratory method detection limit (MDL) against the appropriate Water Quality Standard (WQS). Where possible, values were also compared with the Annual Average (AA) Environmental Quality Standard (EQS) and the Maximum Acceptable Concentration (MAC) EQS.
- 4.5 For Test 2, the Process Contribution (PC) was calculated for substances exceeding the WQS (or other relevant Standards). The PC takes account of the effect of dilution within the River Plym of effluent released during the high tide window (i.e. at times of high flow rate).
- 4.6 Test 3 was applied to substances whose PC exceeded 4% of the WQS. In Test 3 the Predicted Environmental Concentration (PEC) is calculated by including the Background Concentration (BC) of a substance in the River Plym. Further modelling is likely to be required when the difference between the PEC and BC is greater than 10% of the WQS.

- 4.7 Test 4 identifies substances for which the PEC exceeds the EQS, and for which further modelling may be required.
- 4.8 Additional screening was applied to Priority Hazardous Pollutants (PHPs) for coastal and estuarine waters, by comparing the annual limit in the discharge, expressed as the total kg/yr of a listed substance (estimated from known concentrations and the proposed increased outfall volume of 850,000m³), with the tabulated significant load limit (see link in 4.2 above). Total cadmium, total mercury and hexachlorocyclohexane (HCH) were all screened and shown as within the significant load limit (Arcadis 2021).
- 4.9 For completeness, tests were applied according to AA and MAC WQS criteria for both low and mean flow conditions in the River. Most test failures occurred at low flow rates (Arcadis 2021) and therefore represent conservatism in the assessment.
- 4.10 A summary of the outcomes is provided in Table 1 (Arcadis 2021), in which the laboratory MDL is provided along with the total number of samples events available and the number of these that exceeded the MDL.

Table 1: Summary of determinands exceeding criteria for screening Tests 3 & 4 of the Pollution Risk Assessment for treated effluent from the LTP (Arcadis 2021)

Compound	Failure at Test 3	Failure at Test 4	No of detects above MDL*	No of samples analysed*	Laboratory MDL* (µg/l)	Estuarine EQS (µg/l)	
						AA	MAC
Total Ammonia	Yes	No	73	472	200 - 500	1,100	8,000
Total Iron	Yes	No	91	92	1,100	1,000	NA
Total Copper	Yes	Yes	18	92	10 - 85	3.76	NA
Total Zinc	Yes	No	8	92	40 - 100	6.8	NA
Total Lead	Yes	Yes	19	91	20 - 50	1.3	14
Total Cadmium	Yes	Yes	0	91	2 - 5	0.2	NA
Total Chromium	Yes	Yes	0	92	5 - 30	0.6	32 (95 th)
Total Nickel	Yes	No	4	92	10 – 70	8.6	34
Total Mercury	Yes	No	1	6	0.1 – 0.2	NA	0.07
Alpha-HCH	Yes	Yes	1	5	0.003 – 0.004	0.0002	0.02
EH>C16-C24	Yes	No	5	6	10	90*	
EH>C24-C40	Yes	No	5	6	10	90*	

* Based on data collected between October 2013 and June 2021

- 4.11 Arcadis (2021) consider the assessment results are highly conservative because:
 - the laboratory analyses determined total metal concentrations in treated effluent whereas comparator WQS/EQS are dissolved concentrations. In most situations, total metal concentrations can be expected to be greater than dissolved concentrations.

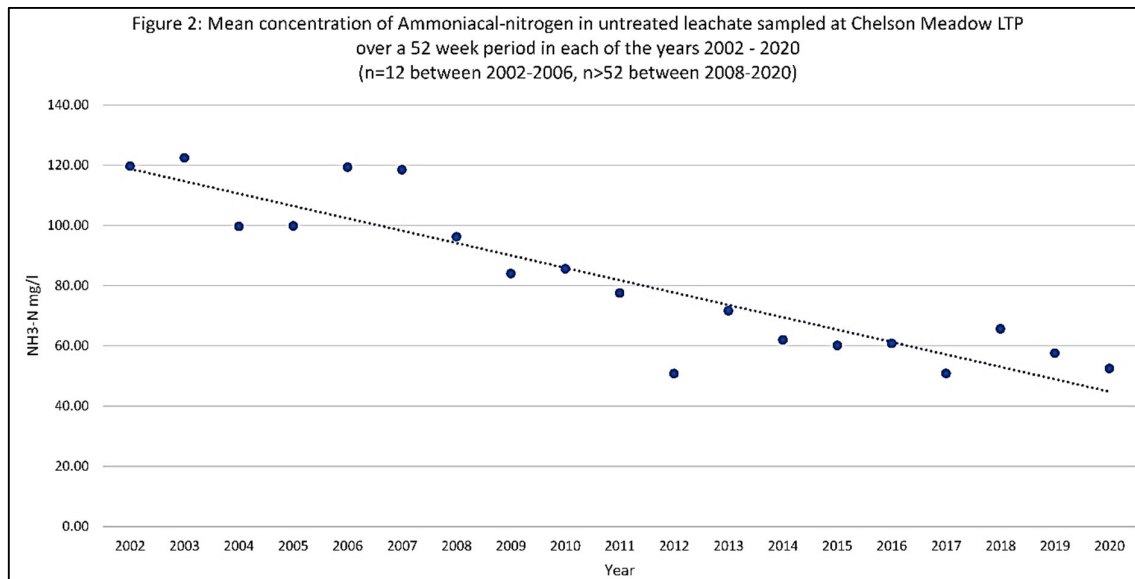
- the laboratory MDL for metals failing tests 3 & 4 is an order of magnitude higher than the comparator EQS. Other than iron, metals were not detected in most samples analysed and accordingly the PEC is likely to be a significant over-estimate.
- Only a small number of samples were available for alpha-HCH and mercury, limiting confidence in the outcome of the screening tests.
- If 95th percentile rather than maximum concentrations are applied to the MAC EQS comparison, ammonia does not exceed the criterion for test 3.

4.12 Overall, Arcadis (2021) conclude that:

Based on the calculations undertaken, and taking into consideration the large number of conservatisms within the screening assessment (including those relating to assumptions around effluent flow parameters), it is considered unlikely that the proposed increase in treated effluent discharge volumes would result in a significant deterioration in water quality in the River Plym.

4.13 For completeness, the rationale used by Arcadis (2021) for parameter input selection is provided in Appendix D.

4.14 Figure 2 illustrates the temporal trend from 2002 to 2020 for the concentration of ammoniacal-nitrogen in leachate entering the LTP, and the pronounced linear decline over this period. Given that the LTP does not breach the permit condition for outfall ammoniacal-nitrogen, there is a decreasing risk to sensitive receptors from this specific contaminant even if the discharge volume limit is increased.



5 CONCLUSIONS

- 5.1 This report identifies features of the Plymouth Sound and Estuaries SAC and Plym Estuary CWS that are potentially sensitive receptors to putative negative impacts that may arise from an increase in the volume of treated effluent discharged to the River Plym from the Chelson Meadow LTP.
- 5.2 A comprehensive, generic risk assessment is provided detailing hazards associated with operation of the LTP and how these may impact ecological receptors in the locality. The predicted impact from modelled climate change (to 2050) on these risks is included, based on changes to key climatic parameters.
- 5.3 A Controlled Waters Risk Assessment concludes that the proposed maximum total discharge of 850,000m³ is unlikely to cause a deterioration in water quality in the River Plym, based on four sequential tests and additional screening for PHPs applied to long-term monitoring data for potentially polluting substances in treated effluent sampled at the outfall.
- 5.4 Provided that current operational controls (as stated in the Habitats Risk Assessment, Appendix C) and monitoring protocols are adhered to, these risk assessments suggest that the proposed increased total annual discharge is unlikely to have a measurable negative impact on the integrity of the SAC and/or CWS.

6 REFERENCES

Arcadis Consulting (UK) Ltd., 2021. Supplementary information and letter to Plymouth City Council (14.09.2021) regarding: Arcadis, 2020. Chelson Meadow Landfill, Controlled Waters Risk Assessment, Arcadis report ref: 008-UA004894-UP32R-03, September 2020.

Devon records Centre, 2021: Site Report for Crabtree Reclaim Plym Estuary CWS

Devon Records Centre, 2021: Site Report for Saltram Saltmarsh CWS

Natural England, 2005. EC Directive 92/43 on the Conservation of Natural Habitats and of Wild Fauna and Flora Citation for Special Area of Conservation (SAC)

Natural England, 2018 (Version 3). European Site Conservation Objectives for Plymouth Sound and Estuaries Special Area of Conservation Site Code: UK0013111

UK Biodiversity Action Plan [BAP]; Priority Habitat Descriptions. BRIG (ed. Ant Maddock) 2008. (Updated 2011). Intertidal mudflats.

APPENDIX A:
**EA NATURE & HERITAGE CONSERVATION SCREENING REPORT (Bespoke
installations)**

Nature and Heritage Conservation

Screening Report: Bespoke installations

Reference	EPR/CP3731LZ/V005
NGR	SX5043054460
Buffer (m)	0
Date report produced	28/01/2021
Number of maps enclosed	4

The nature conservation sites identified in the table below must be considered in your application.

Nature and heritage conservation sites	Screening distance (km)	Further information
Special Areas of Conservation (cSAC or SAC) Plymouth Sound & Estuaries	10	Joint Nature Conservation Committee
Local Wildlife Sites (LWS) Plym Estuary	2	Appropriate Local Record Centre (LRC) Appropriate Wildlife Trust

Protected Species	Screening distance (m)	Further Information
Smelt migratory route European eel migratory route Atlantic salmon migratory route Allis shad migratory route Unidentified shad migratory route Sea lamprey migratory route	up to 500m	Environment Agency. Dial 03708 506 506 for your local Fisheries and Biodiversity team



Protected Habitats

Screening distance (m)

Further Information

Mudflats

up to 500m

[Natural England](#)


Where protected species are present, a licence may be required from Natural England or the Welsh Government to handle the species or undertake the proposed works.

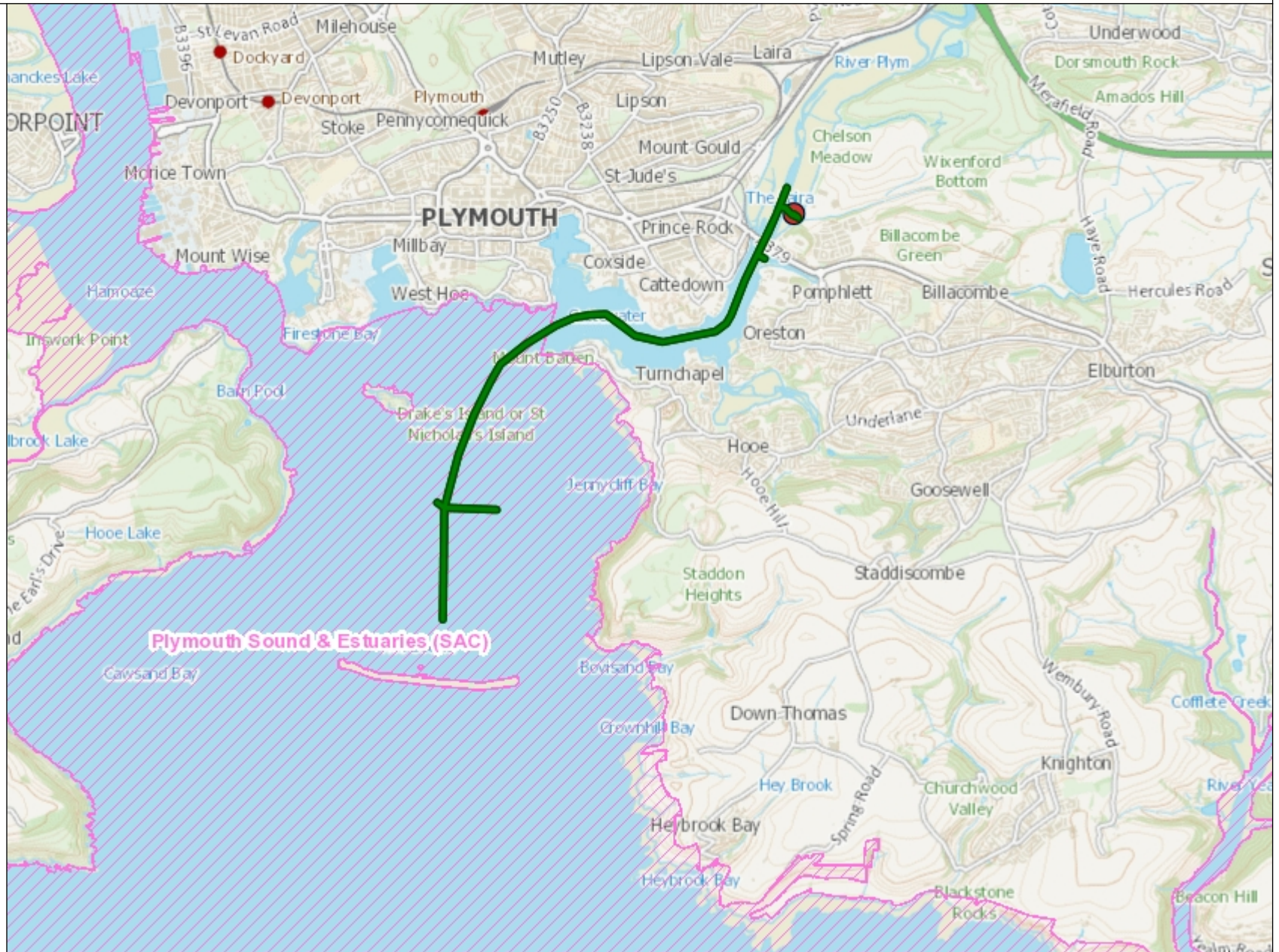
The relevant Local Records Centre must be contacted for information on the features within local wildlife sites. A small administration charge may also be incurred for this service.

Please note we have screened this application for protected and priority sites, habitats and species for which we have information. It is however your responsibility to comply with all environmental and planning legislation, this information does not imply that no other checks or permissions will be required.

Please note, the enclosed pre-application map(s) is valid for a period of **6 months**. If you plan to submit your application more than 6 months after the map(s) was generated, you must request that the screen is re-run. This will ensure that you have used the most current information on heritage and nature conservation interests in your application.

Legend

 SAC (England)



1: 50,000

0 1,250

Metres

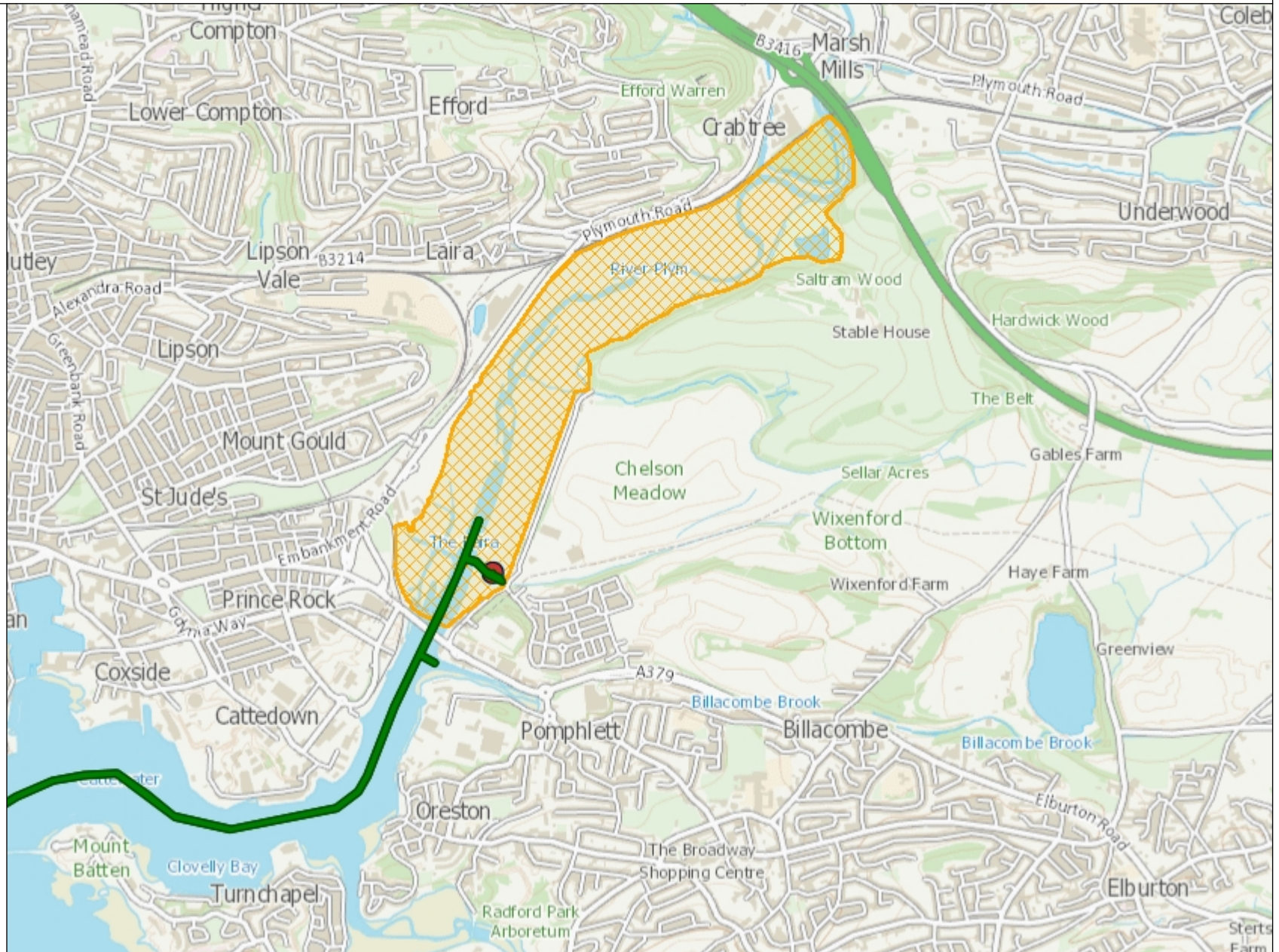


Local Wildlife Site



Legend

 Local Wildlife Sites






1: 25,000

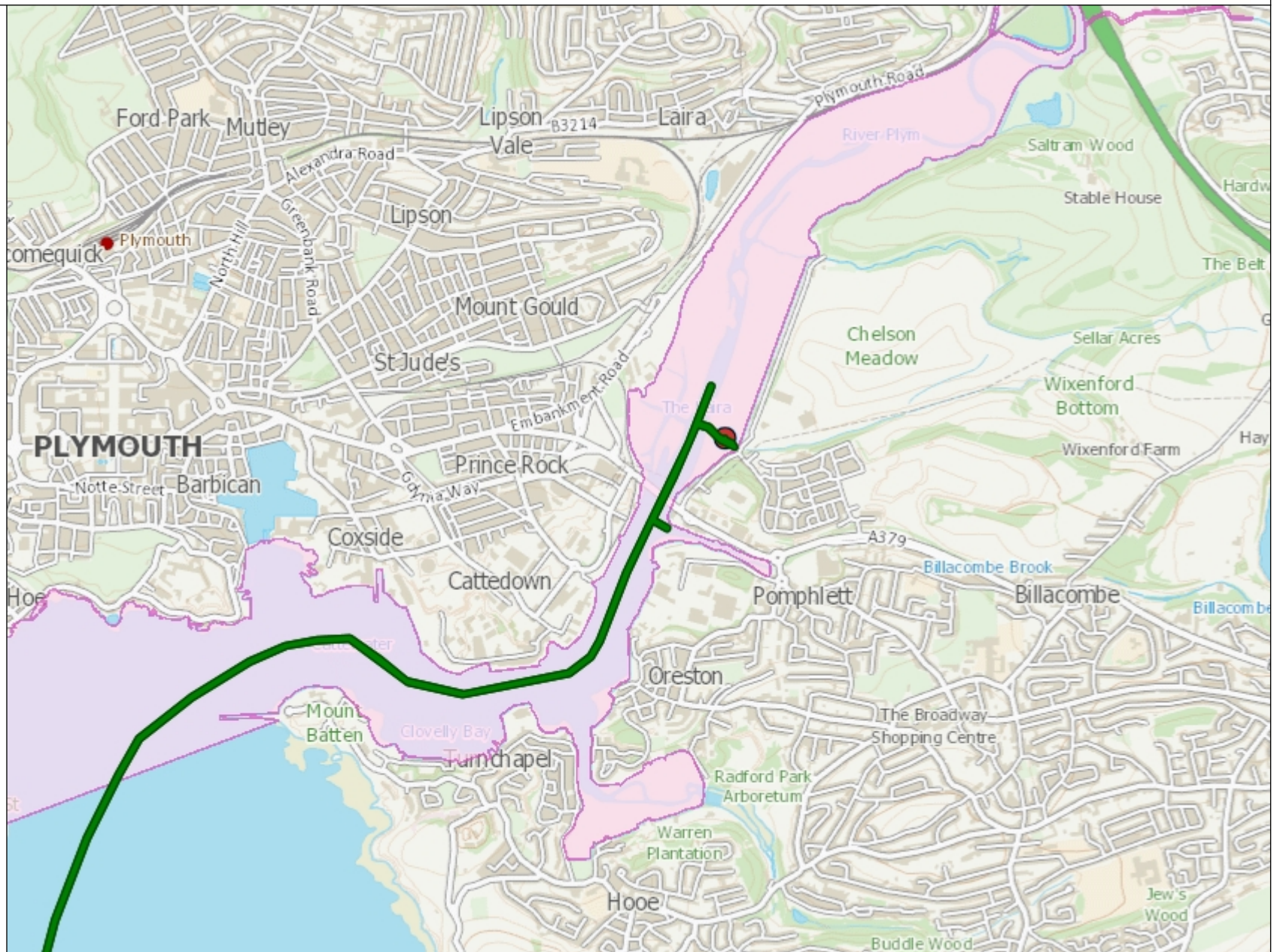


Protected Species

Legend

Protected species screened for Env Permits - complete set

-  Protected species, non fish
-  Protected fish
-  Protected fish migratory route



1: 25,000


0 625

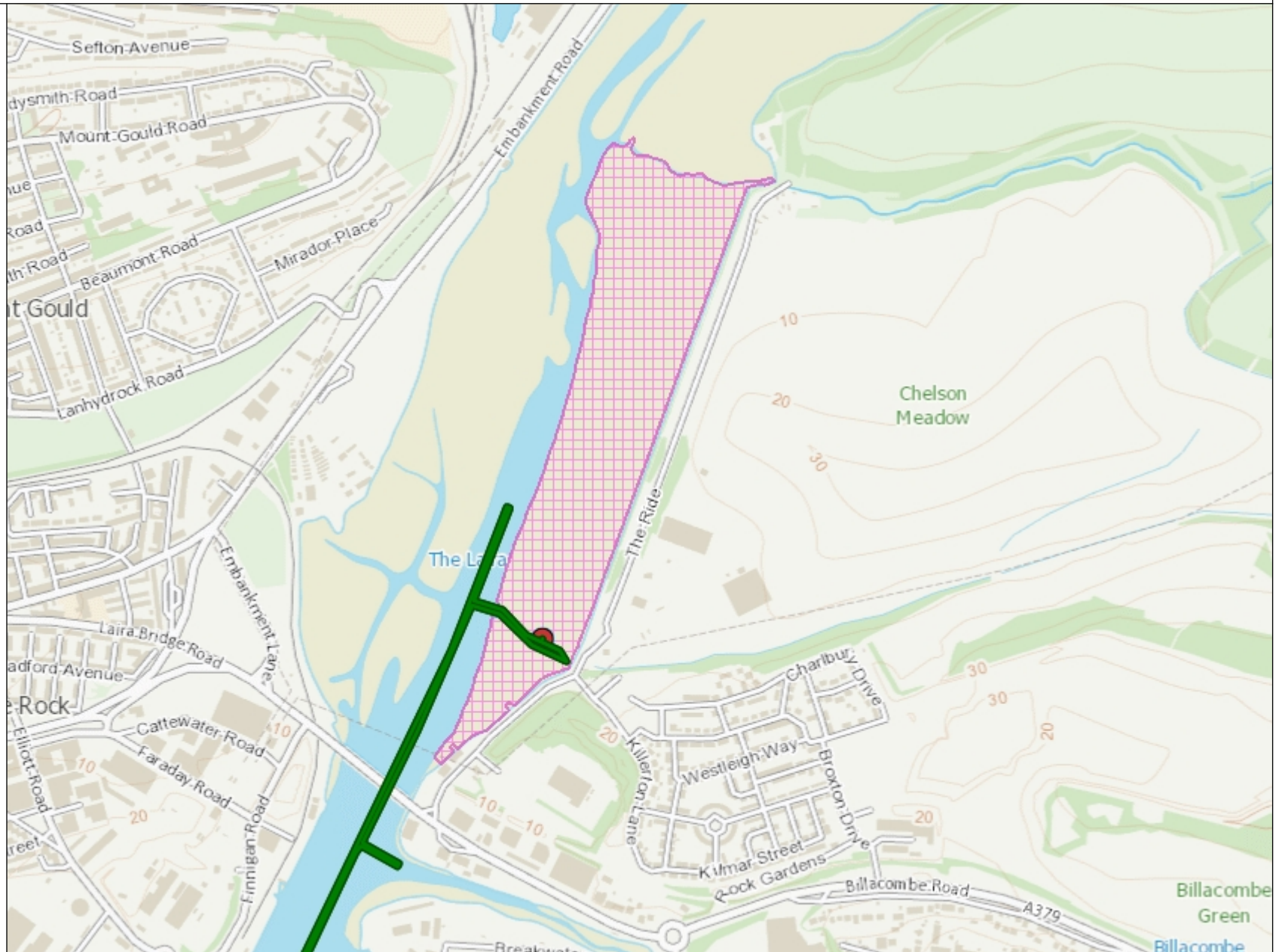
Metres



Protected Habitats

Legend

-  Protected Habitats screened for En Permits



APPENDIX B:
PLYMOUTH SOUND & ESTUARIES SAC CITATION

EC Directive 92/43 on the Conservation of Natural Habitats and of Wild Fauna and Flora

Citation for Special Area of Conservation (SAC)

Name:	Plymouth Sound and Estuaries
Unitary Authority/County:	Cornwall, Devon, Plymouth
SAC status:	Designated on 1 April 2005
Grid reference:	SX472506
SAC EU code:	UK0013111
Area (ha):	6402.03
Component SSSI:	Lynher Estuary SSSI, Rame Head to Whitsand Bay SSSI, St John's Lake SSSI, Tamar-Tavy Estuary SSSI, Wembury Point SSSI, Yealm Estuary and Plymouth Sound Shores and Cliffs SSSI

Site description:

Plymouth Sound and Estuaries on the south-west coast of England includes the rias (drowned river valleys) of the rivers Tavy, Tamar, Lynher and Yealm. The first three of these join at the wide, rocky inlet of Plymouth Sound and the Yealm enters the adjacent Wembury Bay. The Yealm has good examples of habitats and communities that are characteristic of sheltered marine inlets with little freshwater input, including a range of sponge- and worm-dominated communities on lower shore mixed sediments. The upper parts of the Tamar and Lynher include a very well-developed estuarine salinity gradient. As a consequence, they exhibit one of the finest examples in the UK of changing estuarine communities with changing salinity regime. Rocky reefs in low salinity estuarine conditions far inland on the Tamar are very unusual and support species such as the hydroid *Cordylophora caspia*. The Plymouth Sound complex has a high diversity of habitats and communities characteristic of different salinities. Some of these support extremely rich marine flora and fauna, which include abundant southern Mediterranean-Atlantic species rarely found in Britain, such as the carpet coral *Hoplangia durotrix*. Notable habitats include intertidal and subtidal limestone reefs; offshore sub-tidal tide-swept reefs; tide-swept limestone channels; and subtidal sediments. The site is one of the chief rocky-shore strongholds for shore dock *Rumex rupestris* on the UK mainland.

Of particular importance are the Devonian limestone reefs running along the northern shore from West Hoe to Batten Bay. This relatively soft rock is extensively bored by the bivalve *Hiatella arctica* and the spionid worms *Polydora* spp., and harbours a rich fauna. In the subtidal zone this steep-sided, wave-sheltered reef is dominated by a dense hydroid and bryozoan turf with anemones and ascidians. The subtidal area is of particular importance for its kelp- and animal-dominated habitats. The area off Batten Bay contains the south-western kelp *Laminaria ochroleuca*, together with other uncommon species including the rare sea slug *Okenia elegans* and trumpet anemone *Aiptasia mutabilis*. In the approaches to Plymouth Sound, abundant populations of the slow-growing, long-lived, nationally important pink sea-fan *Eunicella verrucosa* occur.

The site contains large subtidal sandbanks, which consist of a range of sandy sediments within the inlet and on the open coast. These sediments include tide-swept sandy banks in estuarine habitats, sandy muds north of the Breakwater, muddy sands in Jennycliff Bay, fine sands with eelgrass *Zostera marina* and a rich associated flora and fauna in the Yealm entrance, as well as tide-swept sandy sediments with associated hard substrates colonised by distinctive communities of algae and invertebrates.

The well-developed salinity gradient supports Atlantic salt meadow together with natural transitions to brackish and freshwater communities, including reedbeds supporting the only UK population of triangular club-rush *Schoenoplectus triqueter*. Some stands of salt meadow are structurally and botanically diverse and include sea club-rush *Scirpus maritimus* and saltmarsh rush *Juncus gerardii*, with red fescue *Festuca rubra*, sea rush *J. maritimus* and thrift *Armeria maritima* at higher levels. The locally common parsley water-dropwort *Oenanthe lachenalii* is also found in some parts of the site, and there are stands of sea-purslane *Halimione portulacoides*, which is unusual in Cornwall.

Qualifying habitats: The site is designated under **article 4(4)** of the Directive (92/43/EEC) as it hosts the following habitats listed in Annex I:

- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- Estuaries
- Large shallow inlets and bays
- Mudflats and sandflats not covered by seawater at low tide. (Intertidal mudflats and sandflats)
- Reefs
- Sandbanks which are slightly covered by sea water all the time. (Subtidal sandbanks)

Qualifying species: The site is designated under **article 4(4)** of the Directive (92/43/EEC) as it hosts the following species listed in Annex II:

- Allis shad *Alosa alosa*
- Shore dock *Rumex rupestris*

This citation relates to a site entered in the Register of European Sites for Great Britain.

Register reference number: UK0013111

Date of registration: 14 June 2005

Signed: *Trevor Salmon*

On behalf of the Secretary of State for Environment, Food and Rural Affairs

APPENDIX C:

HABITAT RISK ASSESSMENT

HABITAT RISK ASSESSMENT - WASTE OPERATIONS

LOCATION: Chelson Meadow Leachate Treatment Plant (LTP)					DATE: 09.11.2021		ASSESSOR: Leppitt Associates			
OPERATION: Biological Treatment of Non Hazardous Landfill Leachate					WASTE CATEGORY: Landfill Leachate					
ITEM	HAZARD/SOURCE	PATHWAY	RISK/HARM	RECEPTOR HABITAT	SEVERITY (H/M/L)	PROBABILITY (H/M/L)	RISK (H/M/L)	JUSTIFICATION OF RISK	GENERIC CONTROLS/PRECAUTIONS	OVERALL RESIDUAL RISK
1	Litter <i>Non-hazardous (plastics & man-made fibres) windblown material moving off site, including from vandalism</i>	Airborne material	Visual & physical impact Ingestion Physical impact Smothering	<i>Plymouth Sound & Estuaries SAC River Plym CWS Mud Flats Priority Habitat (PH) Woodland PH Saltram estate CWS Restored landfill South Leat Billacombe Field grassland SSSI</i>	H H H H H H H	L L L L L L L	M M M M M M M	Site stores liquid waste (landfill leachate) derived from landfill drainage system. Susceptible to blown wastes from large waste facility immediately adjacent Proximity and direction of receptor: South Leat 70m S; capped landfill, River Plym & mud flats at permit boundary; PH woodland 125m ESE; Saltram estate ca. 750m NNE. SAC boundary >3km via estuary; SSSI 1km SE. Prevailing wind from SW to W, plus some E	Boundary fence to intercept litter. TCM on site and inspecting regularly. 24 hour CCTV Closed waste bins provided outside control room Litter removal as required and transfer to residual container.	L
2	Noise & Vibration <i>Vehicle movements on & off site</i> <i>LTP mechanical and electrical infrastructure operating 24/7</i>	Airborne noise Ground vibration	Noise levels disruptive to animal/bird behaviour	<i>Plymouth Sound & Estuaries SAC River Plym CWS Mud Flats Priority Habitat (PH) Woodland PH Saltram estate CWS Restored landfill</i>	M H H H H H	L H H H H H	M H H H H H	Small numbers of vehicles visiting regularly. Tanker movements occasional Treatment operations 24/7. No contemporary noise increase Aging blowers inherently noisy Landfill supports high number of breeding skylark territories Overwintering birds on Plym estuary Proximity and direction of receptor: capped landfill, River Plym & mud flats at permit boundary; PH woodland 125m ESE; Saltram estate ca. 750m NNE; SAC boundary >3km via estuary; SSSI 1km SE. Prevailing wind from SW to W, plus some E	24hr repeating treatment Regular servicing of all infrastructure. Blowers to be replaced 2022, to conform to requirements of noise risk assessment TCM on site	L
GUIDANCE NOTES		SEVERITY * PROBABILITY = RISK								
H = HIGH M = MEDIUM L = LOW		H * H = H L * M = M H * M = H L * L = L M * M = M L * H = M								

HABITAT RISK ASSESSMENT - WASTE OPERATIONS

LOCATION: Chelson Meadow Leachate Treatment Plant					DATE: 09.11.2021		ASSESSOR: Leppitt Associates			
OPERATION: Biological Treatment of Non Hazardous Landfill Leachate						WASTE CATEGORY: Landfill Leachate				
ITEM	HAZARD/SOURCE	PATHWAY	RISK/HARM	RECEPTOR HABITAT	SEVERITY (H/M/L)	PROBABILITY (H/M/L)	RISK (H/M/L)	JUSTIFICATION OF RISK	GENERIC CONTROLS/PRECAUTIONS	OVERALL RESIDUAL RISK
3	Dust & Particulate matter <i>Vehicle movements</i>	Airborne	Smothering Eutrophication/contamination (including changes to mudflat nutrient chemistry) Inhalation	<i>Plymouth Sound & Estuaries SAC River Plym CWS Mud Flats Priority Habitat (PH) Woodland PH Saltram estate CWS Restored landfill South Leat Billacombe Field grassland SSSI</i>	H H H H M H H	L L L L L L L	M M M M M M M	Small numbers of vehicles visiting regularly. Tanker movements occasional Treatment process does not generate dust/particles South Leat has seasonal water flow Proximity and direction of receptor: South Leat 70m S; capped landfill, River Plym & mud flats at permit boundary; PH woodland 125m ESE; Saltram estate ca. 750m NNE. SAC boundary >3km via estuary; SSSI 1km SE Prevailing wind from SW to W, plus some E	Access route and site base engineered. Dampening down of engineered surfaces as required TCM on site and inspecting regularly including regular infrastructure checks. Management System and Emergency Procedure in place.	L
GUIDANCE NOTES		SEVERITY * PROBABILITY = RISK								
H = HIGH M = MEDIUM L = LOW		H * H = H L * M = M H * M = H L * L = L M * M = M L * H = M								

HABITAT RISK ASSESSMENT - WASTE OPERATIONS

LOCATION: Chelson Meadow Leachate Treatment Plant

DATE: 09.11.2021

ASSESSOR: Leppitt Associates

OPERATION: Biological Treatment of Non Hazardous Landfill Leachate

WASTE CATEGORY: Landfill Leachate

ITEM	HAZARD/SOURCE	PATHWAY	RISK/HARM	RECEPTOR HABITAT	SEVERITY (H/M/L)	PROBABILITY (H/M/L)	RISK (H/M/L)	JUSTIFICATION OF RISK	GENERIC CONTROLS/PRECAUTIONS	OVERALL RESIDUAL RISK
4	Mud on roads <i>Vehicle movements</i>	Surface water bodies Highway	Oxygen depletion in surface water bodies Generation of dust on drying (see 3 above)	<i>Plymouth Sound & Estuaries SAC</i> <i>River Plym CWS</i> <i>Mud Flats Priority Habitat (PH)</i> <i>Woodland PH</i> <i>Saltram estate CWS</i> <i>Restored landfill</i> <i>South Leat</i> <i>Billacombe Field grassland SSSI</i>	M M M M M L H H	L L L L L L L L	M M M M M L M M	Approach road and site base of engineered construction No soils etc. accepted South Leat has seasonal water flow Proximity and direction of receptor: South Leat 70m S up-gradient; capped landfill, River Plym & mud flats at permit boundary, other CWS elements up-gradient; PH woodland 125m ESE up-gradient; Saltram estate ca. 750m NNE up-gradient. SAC boundary >3km via estuary; SSSI 1km SE up-gradient	Good housekeeping policy. TCM on site and inspecting regularly. Cleaning of engineered site base and adjacent highway as required.	L
5	Noxious Weeds & Pests (Birds, Vermin & Insects) <i>Perching points & open tank with liquor</i> <i>General waste</i>	Airborne	Spread of disease Disruption to predator/prey relationships	<i>River Plym CWS</i> <i>Mud Flats Priority Habitat (PH)</i> <i>Woodland PH</i> <i>Saltram estate CWS</i> <i>Restored landfill</i> <i>Billacombe Field grassland SSSI</i>	M M L L H L	L L L L L L	M M L L M L	Site only manages liquid waste (landfill leachate) derived from landfill drainage system. Large waste facility immediately adjacent as potential pest reservoir Storage tanks utilised for roosting and bathing by sea birds (gulls) Impact of rats on ground nesting birds Landfill supports high number of breeding skylark territories Disruption to composition of wintering bird communities from enhanced gull numbers Proximity and direction of receptor: South Leat 70m S; capped landfill, River Plym & mud flats at permit boundary; PH woodland 125m ESE; Saltram estate ca. 750m NNE; SSSI 1km SE	Pest inspection and control if required. Waste bins provided, secure and emptied regularly TCM on site undertaking regular site inspection. Management System in place	L
GUIDANCE NOTES		SEVERITY * PROBABILITY = RISK								
H = HIGH M = MEDIUM L = LOW		H * H = H L * M = M H * M = H L * L = L M * M = M L * H = M								

HABITAT RISK ASSESSMENT - WASTE OPERATIONS

LOCATION: Chelson Meadow Leachate Treatment Plant		DATE: 09.11.2021		ASSESSOR: Leppitt Associates						
OPERATION: Biological Treatment of Non Hazardous Landfill Leachate					WASTE CATEGORY: Landfill Leachate					
ITEM	HAZARD/SOURCE	PATHWAY	RISK/HARM	RECEPTOR HABITAT	SEVERITY (H/M/L)	PROBABILITY (H/M/L)	RISK (H/M/L)	JUSTIFICATION OF RISK	GENERIC CONTROLS/PRECAUTIONS	OVERALL RESIDUAL RISK
7	Fire <i>Vehicle fires</i> <i>Equipment/ Process fire</i> <i>Fire Water</i> <i>Smoke</i> <i>Arson - Waste/Plant</i> <i>Dissolved methane gas explosion (DSEAR)</i>	Convection Radiation Conduction	Loss of vegetation Asphyxiation Contamination of treatment process and outfall effluent Increased effluent volume with sediment scouring and associated turbidity Hazardous substances	<i>Plymouth Sound & Estuaries SAC</i> <i>River Plym CWS</i> <i>Mud Flats Priority Habitat (PH)</i> <i>Woodland PH</i> <i>Saltram estate CWS</i> <i>Restored landfill</i> <i>South Leat</i> <i>Billacombe Field grassland SSSI</i> <i>Groundwater</i>	H H H H H H H H	L L L L L L L M	M M M M M M M H	Site drainage connected to treatment system Acute toxicity response Chronic sediment contamination leading to sub-lethal effects on protected migratory fish and overwintering birds Proximity and direction of receptor: South Leat 70m S up-gradient; capped landfill, River Plym & mud flats at permit boundary, other CWS elements up-gradient; PH woodland 125m ESE up-gradient; Saltram estate ca. 750m NNE up-gradient. SAC boundary >3km via estuary; SSSI 1km SE upgradient Prevailing wind from SW to W, plus some E	Engineered site base with site drainage Gas and fire detection systems in control room and pump lifting station DSEAR RA for LTP Chemical cabinet storage Regular monitoring of mixed liquor and bacterial health Fire extinguishers Fire water can be isolated from incoming leachate storage tank Oils spills contained and cleaned immediately 24 hour CCTV Fire prohibition & no smoking policy Mains water on site Site mechanical and electrical infrastructure serviced to manufacturers specification. TCM on site and inspecting regularly.	L
GUIDANCE NOTES		SEVERITY * PROBABILITY = RISK H * H = H L * M = M H * M = H L * L = L M * M = M L * H = M								
H = HIGH M = MEDIUM L = LOW										

HABITAT RISK ASSESSMENT - WASTE OPERATIONS

LOCATION: Chelson Meadow Leachate Treatment Plant				DATE: 09.11.2021		ASSESSOR: Leppitt Associates				
OPERATION: Biological Treatment of Non Hazardous Landfill Leachate						WASTE CATEGORY: Landfill Leachate				
ITEM	HAZARD/SOURCE	PATHWAY	RISK/HARM	RECEPTOR HABITAT	SEVERITY (H/M/L)	PROBABILITY (H/M/L)	RISK (H/M/L)	JUSTIFICATION OF RISK	GENERIC CONTROLS/PRECAUTIONS	OVERALL RESIDUAL RISK
8	<p>Surface and ground water pollution</p> <p><i>Noxious liquid emanating from:</i></p> <ul style="list-style-type: none"> - leaks of hydraulic fluids & fuel -uncontrolled emission of leachate - fire water 	<p>Direct run-off from site</p> <p>Percolation into ground water</p>	Contamination of ground and surface water	<p><i>Plymouth Sound & Estuaries SAC</i></p> <p><i>River Plym CWS</i></p> <p><i>Mud Flats Priority Habitat (PH)</i></p> <p><i>Woodland PH</i></p> <p><i>Saltram estate CWS</i></p> <p><i>Restored landfill</i></p> <p><i>South Leat</i></p> <p><i>Billacombe Field grassland SSSI</i></p> <p><i>Groundwater</i></p>	<p>H</p> <p>H</p> <p>H</p> <p>H</p> <p>H</p> <p>H</p> <p>H</p> <p>H</p>	<p>M</p> <p>M</p> <p>M</p> <p>L</p> <p>M</p> <p>L</p> <p>L</p> <p>M</p>	<p>H</p> <p>H</p> <p>H</p> <p>M</p> <p>H</p> <p>M</p> <p>M</p> <p>H</p>	<p>Small numbers of vehicles visiting regularly.</p> <p>Tanker movements occasional</p> <p>LTP constructed on historic landfill (contaminated land).</p> <p>Acute toxicity effects</p> <p>Chronic toxicity through sediment contamination - sub-lethal effects on protected migratory fish and overwintering birds</p> <p>Proximity and direction of receptor: South Leat 70m S up-gradient; capped landfill, River Plym & mud flats at permit boundary, other CWS elements up-gradient; PH woodland 125m ESE up-gradient; Saltram estate ca. 750m NNE up-gradient. SAC boundary >3km via estuary; SSSI 1km SE up-gradient</p>	<p>Hydraulic fluids etc. stored in locked container/store</p> <p>Site base of engineered construction with site drainage</p> <p>Periodic infrastructure monitoring and maintenance</p> <p>Incoming leachate volume measured by flow meter - unusual decline should trigger investigation</p> <p>Monitoring of South Leat water composition</p> <p>All spillages contained, see Emergency Procedure.</p> <p>TCM on site and inspecting regularly</p> <p>Site operated under Environmental Permit with Management System in place.</p> <p>Site mechanical and electrical infrastructure serviced to manufacturers specification.</p>	L
GUIDANCE NOTES		SEVERITY * PROBABILITY = RISK								
<p>H = HIGH</p> <p>M = MEDIUM</p> <p>L = LOW</p>		<p>H * H = H L * M = M</p> <p>H * M = H L * L = L</p> <p>M * M = M</p> <p>L * H = M</p>								

HABITAT RISK ASSESSMENT - WASTE OPERATIONS

LOCATION: Chelson Meadow Leachate Treatment Plant			DATE: 09.11.2021		ASSESSOR: Leppitt Associates					
OPERATION: Biological Treatment of Non Hazardous Landfill Leachate					WASTE CATEGORY: Landfill Leachate					
ITEM	HAZARD/SOURCE	PATHWAY	RISK/HARM	RECEPTOR HABITAT	SEVERITY (H/M/L)	PROBABILITY (H/M/L)	RISK (H/M/L)	JUSTIFICATION OF RISK	GENERIC CONTROLS/PRECAUTIONS	OVERALL RESIDUAL RISK
9	<p>Vandalism of Plant or Fuel & Hydraulic Oil Storage leading to leaks</p> <p><i>Noxious liquid emanating from: - leaks of hydraulic fluids & fuel from damaged site plant or fuel store</i></p>	<p>Direct run-off from site</p> <p>Percolation into ground water</p>	<p>Contamination of ground and surface water</p> <p>Contamination of treatment process</p>	<p><i>Plymouth Sound & Estuaries SAC</i></p> <p><i>River Plym CWS</i></p> <p><i>Mud Flats Priority Habitat (PH)</i></p> <p><i>Woodland PH</i></p> <p><i>Saltram estate CWS</i></p> <p><i>Restored landfill</i></p> <p><i>South Leat</i></p> <p><i>Billacombe Field grassland SSSI</i></p> <p><i>Groundwater</i></p>	<p>H</p> <p>H</p> <p>H</p> <p>H</p> <p>H</p> <p>H</p> <p>H</p> <p>H</p> <p>H</p>	<p>L</p> <p>L</p> <p>L</p> <p>L</p> <p>L</p> <p>L</p> <p>L</p> <p>L</p> <p>L</p>	<p>M</p> <p>M</p> <p>M</p> <p>M</p> <p>M</p> <p>M</p> <p>M</p> <p>M</p> <p>M</p>	<p>Site drainage connected to treatment system</p> <p>Small numbers of vehicles visiting regularly. Tanker movements occasional</p> <p>Treatment operations 24/7</p> <p>Acute toxicity effects Chronic toxicity through sediment contamination - sub-lethal effects on protected migratory fish and overwintering birds</p> <p>Proximity and direction of receptor: South Leat 70m S up-gradient; capped landfill, River Plym & mud flats at permit boundary, other CWS elements up-gradient; PH woodland 125m ESE up-gradient; Saltram estate ca. 750m NNE up-gradient. SAC boundary >3km via estuary; SSSI 1km SE up-gradient</p> <p>Prevailing wind from SW to W, plus some E</p>	<p>Site secured by fencing and gates locked out of hours</p> <p>Compound is part of a larger facility with security measures</p> <p>Intruder alarms on key infrastructure with telemetric output</p> <p>Hydraulic fluids etc. stored in locked container/store</p> <p>Site plant maintained regularly and with daily checks</p> <p>CCTV</p> <p>Regular monitoring of mixed liquor and bacterial health</p> <p>Site base of engineered construction with site drainage</p> <p>All spillages contained, see Emergency Procedure.</p> <p>TCM on site and inspecting regularly, including regular infrastructure checks</p> <p>Site operated under Environmental Permit with Management System in place.</p> <p>Site mechanical and electrical infrastructure serviced to manufacturers specification.</p>	L
GUIDANCE NOTES		SEVERITY * PROBABILITY = RISK								
<p>H = HIGH</p> <p>M = MEDIUM</p> <p>L = LOW</p>		<p>H * H = H L * M = M</p> <p>H * M = H L * L = L</p> <p>M * M = M</p> <p>L * H = M</p>								

HABITAT RISK ASSESSMENT - WASTE OPERATIONS

LOCATION: Chelson Meadow Leachate Treatment Plant		DATE: 09.11.2021		ASSESSOR: Leppitt Associates														
OPERATION: Biological Treatment of Non Hazardous Landfill Leachate					WASTE CATEGORY: Landfill Leachate													
ITEM	HAZARD/SOURCE	PATHWAY	RISK/HARM	RECEPTOR HABITAT	SEVERITY (H/M/L)	PROBABILITY (H/M/L)	RISK (H/M/L)	JUSTIFICATION OF RISK	GENERIC CONTROLS/PRECAUTIONS	OVERALL RESIDUAL RISK								
10	<p>Discharge to River Plym</p> <p><i>Permit non-compliance in one or more parameters (including volume condition) either through poor treatment efficacy or catastrophic infrastructure failure (e.g. flooding)</i></p>	<p>Direct emission to River Plym</p> <p>direct bio-uptake by mud flat ecosystem</p>	<p>Contamination of surface water (River Plym) and mud flats</p> <p>Increased effluent volume with physical impact of sediment scouring and associated turbidity</p>	<p><i>Plymouth Sound & Estuaries SAC</i></p> <p><i>River Plym CWS</i></p> <p><i>Mud Flats Priority Habitat (PH)</i></p>	<p>H</p> <p>H</p> <p>H</p>	<p>L</p> <p>L</p> <p>M</p>	<p>M</p> <p>M</p> <p>H</p>	<p>Treatment operations 24/7</p> <p>Risk to receiving water quantified formally in Controlled Waters Risk Assessment.</p> <p>Long term trends discernable from monthly and List 1 monitoring</p> <p>Maintenance of landfill cap integrity and other possible sources of water ingress to leachate collection system</p> <p>Acute toxicity effects</p> <p>Chronic toxicity through sediment contamination - sub-lethal effects on protected migratory fish and overwintering birds</p> <p>Proximity and direction of receptor: River Plym & mud flats at permit boundary, other CWS elements up-gradient; SAC boundary >3km via estuary</p>	<p>Permit specifies point source emission trigger levels</p> <p>Regular chemical monitoring of incoming leachate allowing treatment adjustment.</p> <p>Outfall monitored weekly for discharge parameters. Monthly & List 1 monitoring undertaken.</p> <p>SBR Biomass monitored weekly</p> <p>Site mechanical and electrical infrastructure serviced to manufacturers specification.</p> <p>LTP Operator or equivalent on site during the working week.</p> <p>LTP can be managed remotely</p> <p>TCM on site and inspecting regularly. Management System and Emergency Procedure in place.</p> <p>Flood risk awareness - long term plan to raise engineered site base where required</p>	<p>L</p>								
GUIDANCE NOTES		SEVERITY * PROBABILITY = RISK																
<p>H = HIGH</p> <p>M = MEDIUM</p> <p>L = LOW</p>		<table style="width: 100%; border: none;"> <tr> <td style="padding-right: 20px;">H * H = H</td> <td>L * M = M</td> </tr> <tr> <td style="padding-right: 20px;">H * M = H</td> <td>L * L = L</td> </tr> <tr> <td style="padding-right: 20px;">M * M = M</td> <td></td> </tr> <tr> <td style="padding-right: 20px;">L * H = M</td> <td></td> </tr> </table>									H * H = H	L * M = M	H * M = H	L * L = L	M * M = M		L * H = M	
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HABITAT RISK ASSESSMENT - WASTE OPERATIONS

LOCATION: Chelson Meadow Leachate Treatment Plant		DATE: 09.11.2021		ASSESSOR: Leppitt Associates														
OPERATION: Biological Treatment of Non Hazardous Landfill Leachate					WASTE CATEGORY: Landfill Leachate													
ITEM	HAZARD/SOURCE	PATHWAY	RISK/HARM	RECEPTOR HABITAT	SEVERITY (H/M/L)	PROBABILITY (H/M/L)	RISK (H/M/L)	JUSTIFICATION OF RISK	GENERIC CONTROLS/PRECAUTIONS	OVERALL RESIDUAL RISK								
11	SBR Foam <i>Permit non-compliance</i>	Direct emission from SBRs direct bio-uptake or percolation into soil and surface/ground water	Contamination of soils, ground and surface water Imperceptible contact with skin	<i>Plymouth Sound & Estuaries SAC River Plym CWS Mud Flats Priority Habitat (PH) Woodland PH Saltram estate CWS Restored landfill South Leat Billacombe Field grassland SSSI</i>	H H H H H M H M	M L M L L M L L	H M H M M M M M	Storage tanks and SBR tanks open-topped Bio-foam generated by aeration process Treatment operations 24/7 Proximity and direction of receptor: South Leat 70m S; capped landfill, River Plym mud flats at permit boundary; other CWS elements >1km distance; PH woodland 125m ESE; Saltram estate ca. 750m NNE; SAC boundary >3km via estuary; SSSI 1km SE Prevailing wind from SW to W, plus some E	Automated release of anti-foam at critical wind speed - system subject to regular servicing (monthly) TCM on site and inspecting regularly. Management System and Emergency Procedure in place. CCTV LTP Operator or equivalent on site during the working week. LTP managed remotely Telemetric alarm	L								
GUIDANCE NOTES		SEVERITY * PROBABILITY = RISK																
H = HIGH M = MEDIUM L = LOW		<table style="width: 100%; border: none;"> <tr> <td style="width: 33%;">H * H = H</td> <td style="width: 33%;">L * M = M</td> </tr> <tr> <td>H * M = H</td> <td>L * L = L</td> </tr> <tr> <td>M * M = M</td> <td></td> </tr> <tr> <td>L * H = M</td> <td></td> </tr> </table>									H * H = H	L * M = M	H * M = H	L * L = L	M * M = M		L * H = M	
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LOCATION: Chelson Meadow Leachate Treatment Plant	DATE: 01.11.2021	ASSESSOR: Leppitt Associates
OPERATION: Biological Treatment of Non Hazardous Landfill Leachate		LOCATION: Landfill Leachate

Potential changing climate variable	A Impact & Change to Habitat Risks	B Likelihood	C Severity	D Risk (B x C)	E Mitigation (what will you do to mitigate this risk)	F Likelihood (after mitigation)	G Severity (after mitigation)	H Residual risk (F x G)
1. Summer daily maximum temperature may be around 7°C higher compared to average summer temperatures now.	Summer leachate production will decline Treatment efficiency will increase Habitat risks decline	1	1	1	None required			
2. Winter daily maximum temperature could be 4°C more than the current average, with the potential for more extreme temperatures, both warmer and colder than present.	Incoming leachate temperature buffered by ground temperature Treatment volume is large and aeration will buffer lower temperatures to some degree Treatment efficiency will increase with temperature increase Treatment efficiency vulnerable to prolonged extreme cold Risk of uncontrolled releases are greater - last scenario only	1	1	1	None required			
3. The biggest rainfall events are up to 20% more intense than current extremes (peak rainfall intensity)*.	Large increase in incoming leachate Risk of surface scouring at outfall and increased turbidity increases	3	3	9	Leachate very dilute so treatment more rapid Ensure no surface water drainage enters the treatment system Maintain integrity of landfill cap Investigate and prevent other sources of water ingress	2	2	4
4. Average winter rainfall may increase by 41% on today's averages.	Large increase in incoming leachate Risk of surface scouring at outfall and increased turbidity	3	3	9	Leachate very dilute so treatment more rapid Ensure no surface water drainage enters the treatment system Maintain integrity of landfill cap Investigate and prevent other sources of water ingress	2	2	4
5. Sea level could be as much as 0.6m higher compared to today's level*.	Flood risk to LTP compound increased Potential for catastrophic infrastructure failure increased	3	4	12	Ensure no surface water drainage enters the treatment system Raise the level of wet well outer wall raise the level of the engineered base in the vulnerable section of the compound Design flood protection for electrical substation and pump lifting station	2	2	4
6. Drier summers, potentially up to 45% less rain than now.	Summer leachate production will decline Habitat risks decline	1	1	1	Treatment process adjusted to stronger leachate	1	1	1
7. At its peak, the flow in watercourses could be 40% more than now, and at its lowest it could be 80% less than now.	Tidal river - see No. 5 Risks to habitats up-gradient decrease; risks to habitats at permit boundary increase, including scouring at outfall and turbidity Increased flow in South Leat but unlikely to be sufficient to breach cut-off wall	1	1	1	Maintain integrity of cut-off wall	1	1	1

*Indicates data has come from climate change allowances as part of the spatial planning process.

APPENDIX D:
**RATIONALE FOR PARAMETER INPUT SELECTION TO THE CONTROLLED
WATERS RISK ASSESSMENT (ARCADIS 2021)**

Parameter	Rationale
Screening Tests 1 – 4	
<p>The methodology for the parameter selection presented below is generally in line with the original assessment (Arcadis, 2020), although has been updated where more recent data or best practice guidance is available. This is emphasised in red in the text below.</p>	
Contaminants selected	<p>Within the original assessment, only total ammonia was considered. Based on the requirement to assess all compounds within the Site effluent, the following approach was undertaken.</p> <p>Potential contaminants that were measured above the laboratory Method Detection Limit (MDL) in the effluent outfall were selected for consideration. These are considered to be most representative of the risk to the River Plym as they represent concentrations at the point of discharge, rather than e.g. pre-treated conditions.</p>
Water Quality Standards	<p>The Water Quality Standards adopted within the original assessment for total ammonia have been retained. The approach for selection of appropriate Water Quality Standards for the remaining compounds is detailed below.</p> <p>Where available, comparison has been made to the estuarine and coastal Environmental Quality Standards (EQS), considering both the annual average and Maximum Acceptable Concentration (MAC). Where estuarine and coastal EQS were unavailable, comparison has been made (in order of preference) to freshwater EQS, Predicted No Effect Concentrations (PNEC) based on the marine environment, and finally Drinking Water Standards (DWS).</p> <p>The Water Quality Standards adopted in the assessment and their source are presented in Attachment A.</p>
Permeability of underlying natural deposits	<p>Within the original assessment, a number of permeabilities were considered (Arcadis, 2020). However, for this assessment, the worst-case literature value has been adopted for simplicity and to reduce the number of potential scenarios considered.</p> <p>Based on Site data for the cohesive silty clays encountered along the western boundary, it is considered that the estuarine silt deposits beneath the landfill are likely to have a permeability in the range of 1×10^{-8} to 1×10^{-9} m/s. As worst case however, literature values for higher permeability silt (Freeze & Cherry) have also been considered which results in a higher-end value of up to 1×10^{-6} m/s.</p>
Head gradient between landfill and estuary	<p>Within the original assessment, a number of head gradients were considered. However, for this assessment, the worst-case gradient (0.05) was adopted to reduce the number of scenarios considered.</p> <p>Several head gradients were considered which were considered to represent the likely gradients between the leachate head in the landfill and the estuary, with 0.05 (worse case based on professional judgement) and 0.02 (based on Site data and considering the average leachate head) selected within the previous assessment (Arcadis, 2020).</p>

Parameter	Rationale
Screening Tests 1 – 4	
The methodology for the parameter selection presented below is generally in line with the original assessment (Arcadis, 2020), although has been updated where more recent data or best practice guidance is available. This is emphasised in red in the text below.	
Groundwater transect area	<p>The groundwater transect area was retained from the original assessment, as detailed below.</p> <p>The transect through which groundwater flows from the Site’s western border into the River Plym has been estimated as 900 m in length (the length of the western Site boundary) and assuming a thickness of 7 m in the estuarine silts.</p>
Measured concentrations of contaminants in groundwater	<p>The approach for the selection of an appropriate measured concentration of contaminant in groundwater is in line with the approach from the original assessment, albeit has been updated to reflect more recent data. The exception was the inclusion of data from CMDG100, which was not available at the time the assessment was completed (Arcadis, 2020). Further details are provided below.</p> <p>There are three active groundwater monitoring boreholes along the western boundary (CMDG100, CMDG78, CMDG79). A worst-case concentration has been assumed based on a review of the data for these location, to maximise the input from groundwater. This is based on the maximum measured concentration from all three locations, considering data collected between October 2013 and June 2021 for CMDG78 and CMDG79. For CMDG100, data collected from December 2018 to June 2021 has been included; this is on the basis that the well was re-instated in 2018 due to collapse at depth. As such, data collected prior to December 2018 was not considered to be representative.</p>
River flow	<p>The selection of an appropriate river flow rate is in line with the methodology from the original assessment (Arcadis, 2020), albeit has been updated to reflect more recent river flow rate data, and is detailed below.</p> <p>The Q₉₅ and mean flow for the low tide / freshwater component of the Plym were estimated by factoring up the recorded Q₉₅ and mean flow at Carn Wood to reflect the increased catchment area (an additional area of approx. 44 km²) for the Plym adjacent to Chelson Meadow. Estimated Q₉₅ flow of 49,000m³/d and an estimated mean flow of 344,000m³/d have been derived by this method.</p>
Treated effluent quality	<p>Average and 95th percentile concentrations were adopted within the original assessment for total ammonia. The maximum and average concentrations have been adopted within this assessment based on a review of current best practice, as detailed below.</p> <p>The average concentration for each contaminant was calculated using data measured in the outfall from October 2013 to June 2021. The average concentration was paired with calculations that considered the AA WQS (identified as Scenario 1 within tests 2 – 4), whereas for Scenario 2 the</p>

Parameter	Rationale
Screening Tests 1 – 4	
The methodology for the parameter selection presented below is generally in line with the original assessment (Arcadis, 2020), although has been updated where more recent data or best practice guidance is available. This is emphasised in red in the text below.	
	<p>maximum measured concentration was adopted which was paired with calculations that considered the MAC WQS (identified as Scenario 2 within tests 2 – 4) .</p> <p>The effluent treatment plant is required to achieve a total ammonia, biological oxygen demand and suspended solid limits of 10mg/l, 10mg/l and 75mg/l respectively, for 95% of all measured values of periodic samples taken over one year. Review of the relevant datasets since October 2013 indicates that these have not been exceeded.</p>
Estimated effluent discharge volumes	<p>The effluent discharge volumes have been updated to reflect the proposed changes in discharged leachate, as detailed below.</p> <p>A proposed increase in the annual volume of treated effluent to be discharge to the River Plym from 650,000m³ to 850,000m³ is proposed. For the purpose of the calculations, an average and maximum treated effluent flow rate are required, where average flow is paired with AA EQS and maximum flow is paired with MAC EQS, where available. The average daily flow rate was calculated based on the assumption that 850,000m³ of effluent was discharged evenly across 365 days (i.e. 2,329m³/day).</p> <p>Monthly effluent meter readings are available from 2008 onwards, which can be used to estimate or predict maximum potential discharge volumes based on the proposed increase in total annual discharge volumes. However, substantial leachate treatment upgrades and capping works mean that the current site conditions have only prevailed since 2012. To compound matters, data collected in the first part of 2013 is influenced by the incorrect diversion of cap run off resulting in additional volumes treated.</p> <p>To estimate the future monthly discharge volumes, the previous monthly effluent meter readings were calculated as a percentage of the annual outflow for that year, and the percentage applied to the proposed new treated effluent volume to provide an estimate of the potential treated discharge volumes for a given month. Only data collected since October 2013, when run off from the cap had been rerouted away from the leachate treatment plant, was included.</p> <p>A maximum estimated monthly outflow of 170,700m³ (approximately 5,690m³/day) was calculated based on the review, representing a worst-case effluent discharge volume.</p>
Background concentrations within the River Plym	<p>The method for derivation of an appropriate background concentration have been retained from the original assessment, as detailed below (Arcadis, 2020).</p> <p>These have been assumed to be 50% of the water quality standard, in the absence of site-specific data.</p>