DATE:	02/04/2020	**REFERENCE:**	T190115
TO:	Neil Dixon		
FROM:	Chris Lane		
	Russel Hanley		
SUBJECT	**Mardie Project – Expert advice on the significance of the BCH impacted by the Proposal from a local and regional perspective.**		

O2 Marine commissioned Dr Russell Hanley to provide expert advice on the significance of the benthic communities and habitat impacted by the proposed Mardie Project from a local and regional perspective. This technical memorandum has been prepared by Dr Hanley.

About the Author

Dr Russell Hanley has spent 38 years working as tropical marine biologist throughout northern Australia and the wider Indo-Pacific region. He has strong expertise in the ecology of intertidal and subtidal flora and fauna, especially in macrotidal settings from the Pilbara to the NT. He has undertaken numerous field surveys in all the major habitat types present in the Pilbara region including mangroves, samphires, Algal Mats, intertidal and subtidal reefs, seagrasses, macroalgae and sediments. Russell has strong skills in the classification and mapping of intertidal and subtidal habitats. He has worked on environmental impact assessment associated with ports and capital dredging in Australia, NZ and Indonesia. Since 2007 He has been engaged on 13 of the Port development/expansion projects which required capital dredging in the Pilbara, Kimberley and NT. He has provided technical leadership and advice on marine baseline and marine impact monitoring programs at Port Hedland, Onslow, Cape Lambert, Dampier, Barrow Island, James Price, and Darwin.

1 Background

Mardie Minerals is seeking to develop a greenfields high-quality salt and Sulphate of Potash (SOP) project and associated export facility at Mardie, approximately 80 km south west of Karratha, in the Pilbara region of WA. The proposal will utilise seawater, solar energy and wind energy to produce a high purity salt product, SOP and potentially other products derived from the sea water.

The proposal includes the development of seawater intake, concentrator and crystalliser ponds, processing plant, bitterns disposal pipeline and outfall, trestle jetty export facility, transhipment channel, administration buildings, drainage channels and sea walls, access / haul roads, desalination (reverse osmosis) plant, borrow pits, freshwater supply bores and pipelines, and associated infrastructure (power supply, communications equipment, workshops, laydown areas, sewage treatment plant, landfill facility, etc.).

The EPA identified seven key environmental factors for the environmental review required for assessment of the project. One of the key environmental factors identified is Benthic Communities and Habitats and the EPA Objective for this factor is to protect benthic communities and habitats (BCH) so that biological diversity and ecological integrity are maintained.

The Environmental Scoping Document prepared by the proponent lists the required work to be undertaken to develop assessments of the BCH types present within the project area. Within appropriate Local Assessment Units (LAUs) field surveys were to be undertaken to allow:

- Broadscale mapping of intertidal and subtidal BCH,
- detailed mapping of boundaries between key habitat types,
- assessment of ecological and functional values,
- seasonality of distribution of some BCH types,
- health assessment of current status of BCH type.

For both intertidal and subtidal BCH there was also a requirement to provide:

Expert advice on the significance of the habitats impacted by the Proposal from a local and regional perspective.

This report addresses the requirement for expert advice and is based on reviews of the documentation and maps produced by the proponent to characterise both intertidal and subtidal BCH. Other available information on BCH within the region has been assessed where relevant for local and regional comparisons with BCH within the project area.

2 Intertidal Benthic Communities and Habitat

The report: Mardi Project - Intertidal Benthic Communities and Habitat identifies a range of benthic communities and habitat within the project area. These were characterised as:

- Algal Mats
- Foreshore Mudflat/Tidal Creeks
- Mangroves
- Rocky Shores
- Samphire/Samphire Mudflats
- Mudflat/Saltflats
- Sandy Beach
- Sand Dune

Six Local Area Units (LAUs) have been delineated based primarily on coastal geomorphology, aspect (direction the coastline faces), and habitat types, including previously identified 'regionally significant' mangrove management areas. Some of the listed habitat classes are not present in all the LAUs.

The mangrove habitat class was further subdivided into a series of vegetation associations based on canopy cover, position on the shoreline and species composition.

2.1 Methodology

The methods, techniques and analyses used to produce the habitat classification system and its application to the mapping of each intertidal BCH is considered appropriate and comprises best practice (much of it following relevant EPA guidance statements and guidelines) thereby providing a high degree of confidence.

2.2 Loss Assessment

The potential impact of the proposed project on each of the intertidal habitat classes is provided in the report: Mardie Project- BCH Cumulative Loss Assessment. The report closely adheres to the relevant guidance statements prepared by the EPA for calculations and assessment of BCH loss.

An assessment of the local and regional significance of any impacts to each of the intertidal benthic communities and habitats is provided below.

2.3 Algal Mats

A total of 3,459 ha of algal mats was identified from the project area, comprising 10% of the total area of the six intertidal LAUs, although the bulk of the mats occur within LAU 1, LAU3 and LAU 5.

The estimate of direct loss of algal mats from the project is 880 ha or 25% of the total of this habitat class distributed across the three LAU. Most of the losses would be within LAU 1 (10 ha or 1% of the total in that LAU), LAU 3 (452 ha or 35% of the total in that LAU) and LAU5 (479 ha or 36% of the total in that LAU) with negligible losses in LAU 6.

The report on the distribution and composition of mats undertaken by Stantec (2018) concluded that mats were either contiguous or fragmented communities but there was little variation among assemblages across the entire project area. Stantec (2018) also considered that the algal mats surveyed within the intertidal zone for the Mardie Project are representative of algal mat habitats assessed through studies occurring in similar sites within the Pilbara region, including Exmouth Gulf (Biota 2005) and south of Onslow (Paling 1990, URS 2010).

Studies from the Pilbara region have concluded that Algal Mats do not support any particular species solely reliant upon them, although opportunistic grazing on the seaward boundary by crabs and some fish species during high tides is likely to occur within the Mardie Project study area (Paling 1990, Biota 2005, URS 2010). Live algal mat communities were observed by SKM (2011) within Port Hedland to have no evidence of grazing and live samples analysed under microscope provided no evidence of micro-invertebrates. The absence of invertebrates is consistent with findings made elsewhere by Stahl (2000) that as soil salinities increase, invertebrate species diversity decreases.

2.3.1 Significance of impact

As noted, substantial percentages of the total area of mats present within each of LAU 1 (1%), LAU 3 (35%) and LAU 5 (36%) will be lost but the overall loss of mats across all six LAU is 25% of the total present.

The loss of 880 ha is not considered to be a significant impact at either local or regional scales because:

- assemblages comprising the algal mats are widespread across the project area and more broadly throughout the Pilbara region;
- algal mats remaining in LAU 1, LAU 3, LAU 5 and LAU 6 will maintain connectivity and a large contiguous area;
- mats are not likely to be significant in the context of local or regional contributions to primary productivity and nutrient export due to periods of dormancy, low primary productivity, low level of use by secondary producers and absence of physical pathways for transport of nutrients; and
- Mats do not appear to provide significant habitat for other flora or fauna primarily because the mats are typically associated with very high soil salinities.

2.4 Foreshore Mudflat/Tidal Creeks

Foreshore Mudflats/Tidal Creeks occur over 5,013 ha and comprise 14% of the total mapped intertidal BCH area. Tidal creeks are typically well established within the southern coastal LAUs (Robe River Delta) and become sparser in the northern coastal LAUs. Foreshore mudflats extend over a wider area through the central coastal LAUs with subtidal area much closer to the coastline in the northern and southern LAUs. A variety of benthic habitat types from flat fine to coarse sands, flat mud, sparse to high macroalgae, and low to moderate seagrasses were identified occurring within Foreshore Mudflats/Tidal Creeks.

The areas of Foreshore Mudflat/Tidal creeks to be lost are small (<1%) relative to the total area of this habitat class within the six LAU with 2 ha within LAU 1.

2.4.1 Significance of impact

The loss of 2 ha is not considered to be a significant impact at either local or regional scales because:

- It is a very small proportion of the total area of this habitat class present within the six LAU and also within each of the two LAU where losses will occur;
- In a regional context there are very large areas of similar habitat types both north and south of the project area;
- Most of the loss is confined to Foreshore Mudflat and this habitat type present within the footprint of the development in LAU 1 is not considered to be unique or poorly represented elsewhere either locally or regionally;
- Tidal Creek habitat type is, in a local context, a smaller component of the habitat class but the development footprint has largely avoided this habitat type; and
- Examples of Tidal Creek habitat type are present and widespread throughout the region.

2.5 Mangroves

The field surveys and mapping of mangroves throughout the project area used a classification system based on Paling et al (2003) which recognizes distinct assemblages based on species composition, height on the shore and canopy cover. Specifically, closed canopy mangroves occupy lower heights on the shore where more regular tidal inundation moderates soil salinities. At these lower levels trees also tend to be larger and more closely packed providing high canopy cover and there often several species present although only *A.marina* and *R.stylosa* are typically common. At higher elevations on the shoreline the mangroves become more sparsely distributed, *R.stylosa* disappears, average tree height declines and the canopy opens up with increasingly large areas of bare substrate visible moving to landward before mangroves disappear entirely as soil salinities exceed 90ppt.

This gradient across the shoreline is evident throughout the Pilbara region and throughout most of northern Australia although at lower latitudes more species are typically present (Duke 2009).

Within the project area a gradient across the shoreline is evident with recognizable closed canopy vegetation assemblages backed by open canopy scattered *A.marina* similar to those observed elsewhere in the Pilbara. However, by comparison with other locations in the Pilbara there is also high degree of heterogeneity within each of the assemblages with a closed canopy in terms of canopy height, tree size and density. A metric that can be used to quantify the potential ecological value of stands of mangroves is above ground biomass (AGB) which elsewhere in the Pilbara (SKM 2011) has been shown to strongly reflect the gradient across the shoreline with stands of larger trees at the seaward edge showing much higher AGB per hectare compared with the other closed canopy assemblages each of which shows a decline in AGB per hectare moving to landward. Primary productivity studies in mangroves have shown there is a strong gradient in leaf litter production across the shoreline with a

marked decline moving to landward. There is also a decline in the abundance and diversity of the fauna associated with mangroves (SKM 2011). The scattered open canopy *A.marina* assemblage is relatively poor in terms of AGB, primary productivity, canopy height and the diversity and abundance of mangrove fauna.

For the assessment of the impacts of mangrove losses in the four LAU the closed canopy assemblages have been combined into a single closed canopy group reflecting the high level of heterogeneity within each of the assemblages. The scattered mangrove assemblage has been treated separately as it is substantially different in terms of canopy height, AGB, primary productivity and associated fauna.

Closed Canopy mangrove communities extend over 1,282 ha and comprise 4% of the total mapped intertidal BCH area. Closed Canopy mangroves occur as ribbons along the coastline and fringing tidal creeks, with more vast forest occurring within the southern LAU, particularly LAU6 within the boundary of the Robe River Delta.

There will be no areas of closed canopy mangroves lost through the implementation of the project.

The scattered mangrove assemblage covers an area of 2,326 ha and is well represented in three of the four coastal LAU (LAU 2, LAU 4 and LAU 6). Losses of scattered mangroves will occur across all three LAU comprising 1 ha in LAU 2 (<1% of the assemblage present), 12 ha in LAU 4 (2% of the assemblage present), and 4 ha in LAU 6 (1% of the assemblage present).

2.5.1 Significance of Impact

While scattered mangrove will be lost, the 17 ha represents less than 1% of this assemblage that is present across all three LAU and will not impact on the integrity of this assemblage in terms of contributions to local and regional ecological function and connectivity.

No closed canopy mangroves are predicted to be lost, maintaining the continuity of this importance BCH type.

There will be no impact of the project footprint on either of the two regionally significant mangrove areas that adjoin the project area.

2.6 Rocky Shores

No impact on the Rocky Shores habitat class is predicted and the location of the development footprint does not impinge on areas of this habitat class.

2.7 Samphire/Samphire mudflat

Surveys of the flora and fauna associated with this BCH habitat class were undertaken by Phoenix as part of broader surveys of the terrestrial flora, vegetation associations and terrestrial fauna of the Development envelope.

Phoenix have prepared the following two reports:

- Detailed flora and vegetation survey for the Mardie Project
- Level 2 targeted terrestrial fauna survey for the Mardie Salt Project

Phoenix identified a total of nine low open *Tecticornia spp.* shrubland types present on tidal mudflats and sandy rises on tidal mudflats. One of the *Tecticornia sp.* recorded from seven locations in the study area has been deemed a significant species because it is likely a species new to science.

The boundaries between each of the *Tecticornia* spp. shrubland types could not be determined easily and therefore they have been mapped as a single mosaic class.

Phoenix reported the terrestrial fauna observed to be associated with the samphire (*Tecticornia*) shrublands comprised a total of 50 species. This habitat is used by migratory shorebirds for feeding and bush birds and mangrove specialists, such as Mangrove Golden Whistler and Sacred Kingfisher. It also supports Northern Coastal Free-tailed Bat (P1). Phoenix also noted that the ocean mudflats and sandbars, and tidal samphire (wetlands) mudflats were identified as the most important habitat for Migratory shorebirds in the areas surveyed but these habitat types were located almost exclusively west of the Development Envelope.

Areas of this habitat class will be impacted by the proposal and these areas are located in all six LAU. In total 954 ha of samphire/mudflat will be lost and this represents 16% of this habitat type which is present across all six LAU. In LAU 1 8ha (5% of habitat class present), LAU 2 15ha (1%), LAU 3 216ha (82%), LAU 4 57ha (4%), LAU 5 322ha (68%) and in LAU 6 335ha (22%). These are the largest areas of habitat supporting intertidal benthic primary producers that will be lost due to the development footprint.

2.7.1 Significance of Impact

The losses of this habitat type are substantial in both LAU 3 and LAU 5 comprising around two thirds of this habitat type present in those LAU. Lesser amounts of this habitat type will be lost in LAU 1 and LAU 2 (<5%), whilst LAU 6 (22%) still represents a substantial loss in a local context representing about 22% of the habitat type present in this LAU.

Such high losses of this habitat type will have significant impacts in a local context (within each LAU) as removal (flooding) of these areas will substantially diminish the biomass of this habitat type present. Relative to adjoining mangrove habitats lower on the shore, however, samphire habitats in the project area are likely to comprise much lower AGB per hectare. There will also be total loss of that component of in situ invertebrates such as crabs and molluscs that require regular tidal inundation and exposure. However, the biodiversity and abundance of these invertebrate fauna in the samphire mudflat habitat class is likely to be low - a consequence of the higher position on the shore with correspondingly higher soil salinities (SKM 2011). While tidal samphires and mudflats were designated as important to migratory shorebirds and other birds by the Phoenix surveys they also report the great majority of the birds observations were in the tidal samphires to the west of the development envelope. The tidal samphires lower on the shore, closer to the mangroves and tidal creek margins had high numbers of

birds relative to the areas of this habitat higher on the shore. This likely to be a consequence of lower soil salinities closer to the mangroves and tidal creeks due to more regular and longer inundation of the substrate with a corresponding increase in invertebrate infauna.

In terms of likely impact on ecological functions, while the removal of a large area of the habitat type will have a significant impact on the habitat itself, it is unlikely to make a significant difference to the maintenance of ecological functions and diversity across the shoreline, outside the areas where the samphire/samphire mudflat habitat is present.

While there will be removal of substantial areas of this habitat class the connectivity between the remaining areas of this habitat will be maintained both within and between adjoining LAU.

2.8 Sandy Beaches

Sandy beaches are typically flat, low energy, low profile beaches backed by gently rising dunes.

Sandy Beaches are confined to LAU 1 and LAU 2 with 32 ha of this habitat class mapped. There will be no loss of the sandy beach habitat class within the LAU.

2.8.1 Significance of Impact

Their will be no impact to the sandy beach habitat class in the two LAU.

2.9 Mudflat/Saltflat

Mudflat/Saltflats are the dominant intertidal BCH extending over 10,509 ha and comprise 29% of the total mapped BCH area. They are most dominant through LAU 1, LAU 3 and LAU 5 with smaller areas represented within the remaining LAU. They typically occur at the highest intertidal levels to landward of Samphire's or Algal Mats.

Mudflat/Saltflats are extremely low in biodiversity and support little to no associated fauna or flora due to their characteristic high salinities which often exceed 300ppt (SKM 2011). The siting of the development footprint at the higher levels of the intertidal zone will lead to the loss of substantial areas of this habitat class across LAU 3, LAU 5 and LAU 6. In total 6,412 ha, or 77% of this habitat type will be lost. This includes 5ha in LAU 1 (1% of this habitat type present), in LAU 2 a total of 45ha (13% of this habitat type), in LAU 3 1,775ha (86%), in LAU 4 a loss of 24ha (6%), LAU 5 4,355ha (89%) and in LAU 6 208ha (33%).

2.9.1 Significance of Impact

In a local context the losses of this habitat can be considered significant in terms of the removal of a substantial representative area of this habitat type from each of the LAU.

In a regional context however, there are very large tracts of this habitat class in the high intertidal throughout the Pilbara region and further north in the Kimberleys, NT and the Gulf of Carpentaria. From a regional perspective the losses are not significant.

In the context of the maintenance of local ecological functions, the Mudflat/Saltflat habitat class contributes very little to local primary productivity, biomass, biodiversity and nutrient transport. The very high soil salinities preclude colonization by both flora and fauna.

Therefore, in the context of local supply of ecological services and connectivity the loss of these areas of habitat is not considered significant.

3 Subtidal Benthic Communities and Habitat

The report: Mardi Project - Subtidal Benthic Communities and Habitat identifies a range of benthic communities and habitat within the project area. These were characterised as:

- Bare (Bioturbated) Sand
- Filter Feeder / Macroalgae / Seagrass
- Coral / Macroalgae

These broad habitat classes were further divided into 8 subclasses based primarily on presence/absence of key habitat components and percentage cover of key assemblages.

A single LAU 7 has been delineated to encompass the areas of subtidal habitat that may be affected by the development footprint. Unlike the intertidal BCH, the impacts predicted for subtidal BCH are all located at the northern end of the project area and are associated with the development of the port infrastructure.

3.1 Methodology

The methods, techniques and analyses used to produce the habitat classification system and its application to the mapping of each subtidal BCH is considered appropriate and comprises best practice (much of it following relevant EPA guidance statements and guidelines) thereby providing a high degree of confidence.

3.2 Loss Assessment

The potential impact of the proposed project on each of the subtidal habitat classes is provided in the report: Mardie Project- BCH Cumulative Loss Assessment. The report closely adheres to the relevant guidance statements prepared by the EPA for calculations and assessment of BCH loss.

An assessment of the local and regional significance of any impacts to each of the subtidal benthic communities and habitats is provided below.

3.3 Bare (Bioturbated) Sand

There is a total of 6,827 ha of this habitat type within LAU 7 and it comprises 89% of the total area of the seabed in the LAU. The substrate is typically comprised of silt or sand with no or occasional very sparse macroalgae. Silty areas often feature extensive bioturbation (burrows formed by living organisms). Sandy areas often contain traces of shell grit.

Two subclasses were recognized in the mapping, consisting of bare sand (6,745ha) and sand with sparse macroalgae (82ha). The development footprint will lead to the loss of 104ha of the bare sand habitat class which represents 1% of the total of this habitat class present in the LAU.

3.3.1 Significance of Impact

Bare sand substrate is the dominant subtidal habitat class both locally and throughout the region (Chevron 2014, Scott et al 2006). In general there is limited contribution to primary production and the habitat has low relative value for supporting marine fauna. Consequently the loss of 63ha of the bare sand component of this habitat class within LAU 7 is not considered significant in a local or regional context.

3.4 Filter Feeder / Macroalgae / Seagrass

Two habitat subclasses were delineated in the survey and mapping comprising:

- Sand / Sparse (<5%) Filter Feeder Cover
- Low (5-10%) Cover Macroalgae / Filter Feeders

The Sand/Sparse filter feeder habitat occurs where the relief is flat and is associated with fine to coarse sands. Although only present in sparse densities (<5% Cover), hydroids are most common where there is no bedform, whilst sponges occur where there is some bioturbation.

This habitat comprises 113ha (1%) of the subtidal BCH within LAU 7 and is widely dispersed throughout the region. The development footprint will not impact on this habitat type and no losses are predicted.

Low (5-10%) Cover Macroalgae / Filter Feeders also occurs on flat to low relief substrates constituting either fine to coarse sands, including shell grit on occasions. Macroalgae, hydrozoan and sponge species are equally dispersed throughout this habitat although benthic cover is low (3-10%). Occasional very sparse (<1%) cover of *Halophila sp*. seagrass was also observed at some locations.

This habitat comprises 445ha (6%) of the subtidal BCH within LAU5 and follows a patchy distribution throughout the region. A total of 35ha of this habitat will be lost due to the development footprint and this comprises 6% of the total of this habitat type within LAU 7.

3.4.1 Significance of Impact

For the habitat subclass Sand / Sparse (<5%) Filter Feeder Cover no impact is predicted.

The loss of an area of 35ha of Low (5-10%) Cover Macroalgae / Filter Feeders habitat subclass is not considered significant in a local or regional context because:

- The proportion of this habitat to be lost within LAU 7 is small (6%)
- This habitat type is widespread elsewhere in the region
- The extent and spatial distribution of this habitat type is often dynamic in response to natural sources of disturbance

3.5 Coral / Macroalgae

Four habitat subclasses have been delineated within this habitat class, each defined by the percent cover of the dominant primary producer type:

- Low (5-10%) Cover Coral
- Moderate (10-25%) Cover
- Dense (>25%) Cover Macroalgae
- Dense (>25%) Cover Coral Dominated

Low (5-10%) Cover Coral occurs on flat to low relief rock and rubble with coarse sand. Low (3-10%) cover of soft and hard corals, including *Faviidae, Dendrophyllidae, Mussidae and Octocorals*. Sparse macroalgae was also present. This habitat comprises 71ha (<1%) of the subtidal BCH within LAU 7. There will be negligible impact (6ha 4%) on this habitat subclass from the development footprint.

Moderate (10-25%) Cover is found on low to moderate relief rock and rubble/coarse sand. Low to moderate cover comprises (3 – 25%) of soft and hard corals with macroalgae. Corals largely consisted of *Faviidae, Poritidae*, and Octocorals, while *Phaeophyceae* dominated the macroalgae communities. This habitat class comprises 92ha (<1%) of the subtidal BCH within LAU 7. There will be a loss of less than 40ha of this habitat subclass from the development footprint. A loss of 17% of the total of this habitat subclass within LAU 7.

Dense (>25%) Cover Macroalgae dominated habitat class occurs on low relief substrate with fine to coarse sands and areas of exposed limestone reef. Dense assemblages (>75%) of macroalgae and hydrozoan species are predominately in waters at depths of 2.2m-4.0m. This habitat also supported sparse juvenile corals (*Faviidae, Dendrophyllidae, Mussidae)* with occasional larger coral (*Poritidae*) bommies (1-2m diameter). This habitat class comprised less than 1ha (<1%) of the subtidal BCH in LAU 7. There will be no negligible impacts (<1ha) on this habitat subclass from the development footprint.

Dense (>25%) Cover Coral Dominated habitat subclass is associated with low relief limestone reef and rubble substrate which supports high coral cover (25%-75%) of diverse coral species, including *Faviidae, Dendrophyllidae, Mussidae, Portitidae*, and Octocoral species. This habitat class was only recorded at one location in LAU 7 and comprises and area of 25ha (<1%) of the subtidal BCH within LAU 7. There will be no impact on this habitat subclass from the development footprint.

3.5.1 Significance of Impact

Three of the four subclasses will be impacted. There will be no loss of Dense (>25% Coral) and only a loss of less than 1ha of the Dense (>25% Macroalgae) habitat subclass representing less than 1% cumulatively. Moderate (10-25%) Cover is represented by a 17% loss and Low (5-10%) Cover representing 4% of the total of this habitat type within the LAU. The loss of this small amount of BCH type is not significant in a local or regional context given the widespread (patchy) distribution of similar BCH within the LAU and the region.

4 Conclusion

The nature of the project means there is a large development footprint. The proponent has taken care to ensure that more sensitive and high value BCH (mangroves, corals, macroalgae) has been avoided with very small losses of these BCH from the development footprint.

More substantial losses of high intertidal zone BCH are required in order to construct the ponds. The BCH that will be lost in these areas is dominated by mudflat/saltflat habitat which is largely devoid of either primary producers or associated faunal communities.

There will also be losses of areas of samphire and associated mudflats. These losses, while substantial in terms of total area, and as percentages of this habitat class present in the respective LAUs are not considered to be significant in the context of the maintenance of local ecological functions such as primary productivity, biodiversity and nutrient transport.

There will also be losses of areas of Algal Mats comprising some 25% of the total of this habitat class across all LAU. This loss is not considered to be significant as there is unlikely to be substantial impairment of the range of ecological functions provided by Algal Mats either locally or regionally.

Across the shoreline gradient the higher value habitat classes are lower on the shoreline where primary productivity, biodiversity and biomass are much higher principally because of more regular tidal inundation which keeps soil salinities lower. The primary productivity, biodiversity and biomass of the scattered mangroves, samphires and algal mats is much lower due to high salinities that rise with increasing elevation in the tidal zone. Any contribution of nutrients and organic carbon (leaf litter, DOC, POC, secondary producers) from these higher elevation habitat classes to habitats lower on the shoreline is considered to be negligible.

All types of BCH where losses will occur are found elsewhere nearby and are also widespread throughout the region.

Consequently, the project is not considered likely to have significant impacts on BCH from a local or regional perspective.

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