

15 Archaeology and Cultural Heritage

- 15.1 Introduction
- 15.2 Assessment Methodology
- 15.3 Baseline Conditions
- 15.4 Predicted Impacts
- 15.5 Mitigation Measures
- 15.6 Residual Impacts
- 15.7 Cumulative Effects
- 15.8 Transboundary Effects
- 15.9 Uncertainty
- 15.10 Summary

15 Archaeology & Cultural Heritage

15.1 *Introduction*

This chapter of the Environmental Statement (ES) considers the potential for the proposed Eastside development to affect interests concerning archaeology and cultural heritage. The key features in the study area include cave archaeology to the south of the development site, heritage features in and around the development site, and wrecks situated offshore from the development site. As identified in the Town Planner's Scoping Opinion (Government of Gibraltar (GoG) June 2005 - see Appendix A), the EIA process needs to assess whether Eastside affects coastal processes to the detriment of archaeological sites on the east coast.

15.2 *Methodology*

15.2.1 *Data Collection*

Information regarding archaeology and cultural heritage has been collected with reference to the Gibraltar Museum's website and published information, and through consultation undertaken with representatives of the Gibraltar Museum and the Gibraltar Heritage Trust.

15.2.2 *Assessment Methodology*

The potential effect on archaeological sites along Gibraltar's east coast has been assessed using numerical modelling of coastal hydrodynamics and morphology. The specific methodologies used are described in Sections 5.2 and 6.2, with more detail presented in Appendices B, C and D.

15.3 *Baseline Conditions*

15.3.1 *Archaeology*

Consultation with the Gibraltar Museum revealed no archaeological features and interests at the site of the proposed Eastside development (Halcrow, 2004).

Gibraltar's archaeological sites of importance are situated within a series of caves to the south of Eastside, between Sandy Bay and Europa Point on the shoreline, at a point just north of the Ammunition Jetty. These caves have been the subject of extensive archaeological investigation (including the Gibraltar Caves Project) headed by the Gibraltar Museum.

A brief overview of recent archaeological activity and interpretation from the cave investigations is given below. The following quote is taken from the Gibraltar Museum's website where more information is provided about cave archaeology (see www.gib/gi/museum/arch.htm):

"Since 1995 annual excavations have been conducted by an international disciplinary team in Gorham's and Vanguard Caves...on the east side but at sea level. These sites were occupied by Neanderthals during the Middle Palaeolithic from at least 90 thousand years ago until around 31 thousand years ago, making this site one of very late occupation. Deposits above those of Neanderthal occupation show evidence of more recent occupation by Modern Humans during the Upper Palaeolithic, Neolithic and eventually from the 8th to the 3rd Centuries BC by Phoenicians and Carthaginians."

It is believed that Gorham's Cave was used by Phoenicians as a shrine to the deity Melkart.

Data from the Gibraltar caves is being used to study the effects of climate-induced environmental change on the Palaeolithic populations of southern Iberia. In the past, lower sea levels meant that the caves were fronted by a large plain inhabited by a range of

herbivores and carnivores. According to www.gib/gi/museum/arch.htm, studies to date have revealed the constancy of the species composition of the region's large mammal community during the Late Pleistocene and its similarity to the contemporary fauna with the exception of the loss of several of the larger carnivores and rare megafaunal species.

15.3.2 *Cultural Heritage*

There are no monuments or buildings in the study area that are listed under the Gibraltar Heritage Ordinance 1989.

There are two features in the area around the proposed Eastside development that the Gibraltar Heritage Trust identifies to be of heritage value. These are:

- The Sikorski memorial - a memorial to General Sikorski, which is situated along the stretch of Devil's Tower Road that backs onto the existing reclamation area (in front of the MOT centre). The memorial takes the form of a propeller set on a rock plinth with a commemorative plaque (see Figure 15.1); and
- The Black Watch Cairn – a memorial to the soldiers of the Black Watch, which is also situated along the stretch of Devil's Tower Road that backs onto the existing reclamation area (opposite Macfarlane Gallery). The memorial takes the form of a traditional Scottish cairn and stands more than two metres high (see Figure 15.2). The memorial was recently refurbished by the Gibraltar Heritage Trust.

Figure 15.1 The Sikorski Memorial



Figure 15.2 The Black Watch Cairn



There are three other features in the development area that the Gibraltar Heritage Trust identifies to be of potential heritage interest. These are:

- A World War II pillbox situated at the junction of Devil's Tower Road and Eastern Beach Road;
- A World War II pillbox situated along Eastern Beach Road near the northern access to the existing reclamation area; and
- A commemorative plaque situated along the stretch of Devil's Tower Road that backs onto the existing reclamation area that is currently used as a car park for visitors to Catalan Bay. The plaque commemorates the residents of San Roque who sheltered in Gibraltar following an invasion of their city by French soldiers during the Napoleonic War.

15.3.3 *Gibraltar Defences World Heritage Site*

The Gibraltar Defences World Heritage Site is currently listed under UNESCO's Tentative List. The Tentative is an inventory of sites that states are intending to consider for nomination to the World Heritage List in future years. The site's description by UNESCO, where relevant to Eastside, is quoted from www.whc.unesco.org in the following paragraphs:

"The boundaries of the proposed Site are delineated as follows. The north is delimited by the towering cliffs of Gibraltar, popularly known as the North Face. The eastern boundary is the coastline of the peninsula, backed by cliffs. The boundary starts in the north, close to the old Genoese fishing village of Catalan Bay and extends south to the apex of the peninsula at Europa Point. From Europa Point northwards the Site's western boundaries follow the coast up to and including the dry docks and then follows a straight line eastwards to South Jumper's Bastion. From there northwards it follows the western defensive walls to the North Face."

"The Site's focus is one in which the natural resources and geological position of the Rock are seen as forming the basis for its continued occupation by humans since the Middle Palaeolithic and in which the natural defences, complemented by a unique system of walls, bastions and tunnels, together form the Fortress of Gibraltar."

"A massive block of Jurassic limestone rising to 426 metres above sea level creating a spectacular scenery and a unique coastal cliff vegetation which includes several endemic species. Its northern and eastern walls have provided the basis of its successful defence, having endured a total of fourteen sieges in its history. Within this karstic block, a large part of which is a natural reserve, over 140 caves have been listed and these include Gorham's Cave which has a 17 metre deep stratigraphy with occupation commencing 100,000 years ago and ending with a Carthaginian shrine in the 3rd century BC. This site, which is the subject of an international research project, has revealed Neanderthal occupation 1000 years ago making it one of the last sites in which these hominids survived in the world. The entire cave system, which includes five Neanderthal and at least ten Neolithic sites, is included in the nomination."

Gorham's Cave is situated along Gibraltar's east coast, near the Ammunition Jetty, to the south of L2 on Figure 15.3.

15.3.4 *Wrecks*

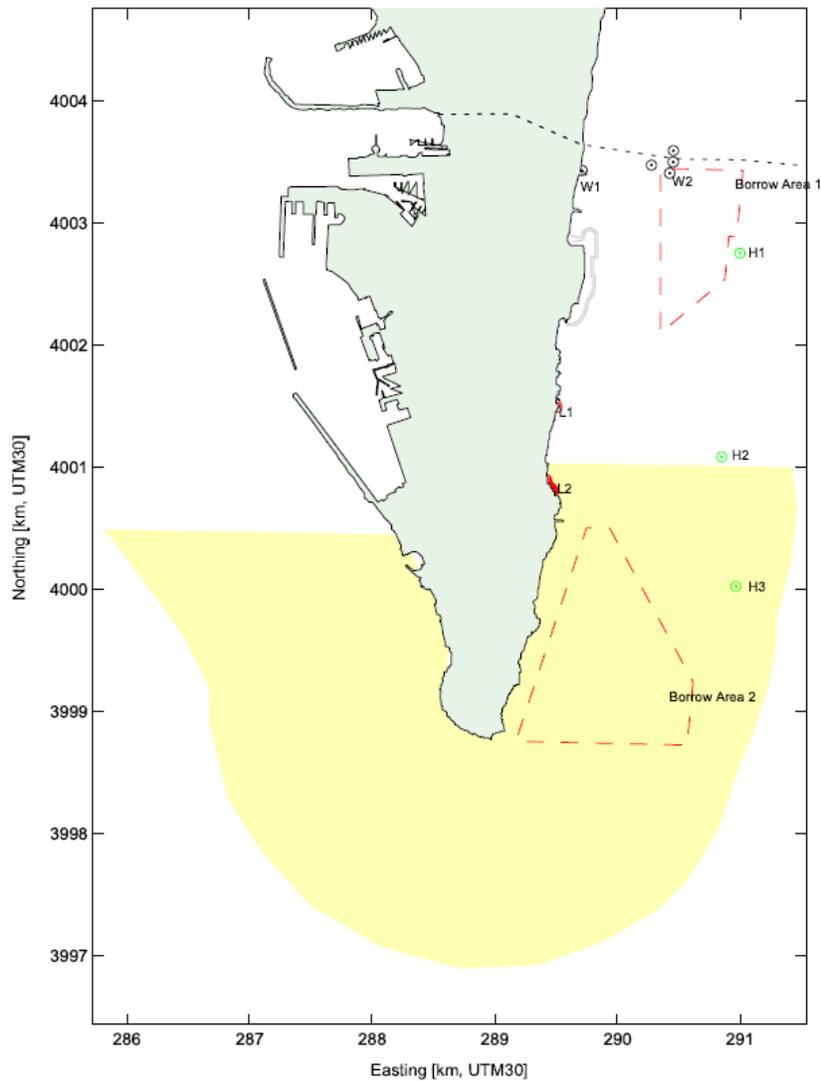
There are a number of wreck sites in the waters off Gibraltar's east coast. The following sites are identified in Smith and Fa (2004):

- East side aircraft (36°09.056N, 005°20.324W) – wreck of a World War II four-engine aircraft lying in 2m of water some 20m east of the runway, just north of the existing rock groyne, covered to various degrees by sand (see W1 on Figure 15.3);
- Four other wreck sites further out from the airport runway (36°09.153N, 005°19.830W and 36°09.103N, 005°19.830W and 36°09.087N, 005°19.947W and

36°09.053N, 005°19.847W) – marked on the Admiralty Chart as wrecks and believed to be aircraft remains in up to 11m of water, but not found during searches in 2002 (see W2 on Figure 15.3);

- Weaver’s Pinnacle ((36°08.609N, 005°19.552W) – marked on the Admiralty Chart as a wreck but reported by Smith and Fa (2004) to be a rock pinnacle up to 10m in height in 32m of water (see H1 on Figure 15.3);
- Peter Ives’ Pinnacle or El Cortijo - (36°07.803N, 005°19.528W) – marked on the Admiralty Chart as a wreck but reported by Smith and Fa (2004) to comprise two large boulders of 8m and 10m in height in 32m of water (see H2 on Figure 15.3);
- Fred Flintstone’s Submarine or El Lomo (36°07.231N, 005°19.433W) – originally believed to be a wreck of a submarine in 32-38m of water, but actually a scattering of rocks on the sandy seabed (see H3 on Figure 15.3).

Figure 15.3 Locations of Wreck Sites



Key: W = wreck sites

15.4 ***Predicted Impacts***

15.4.1 *Construction Phase: Impact of Sediment Deposition on Cave Archaeology and World Heritage Status*

It is possible that dredging and marine works for Eastside could cause sediment deposition at a thickness that is to the detriment of the archaeologically important sea caves (Gorham's Cave) along Gibraltar's east coast (near Ammunition Jetty, located just south of L2 on Figure 15.3) and the status of the World Heritage Site to which the caves contribute.

The caves could be affected by sediment deposition due to dredging and marine works such as land reclamation. As identified in Section 5.4, the suspended sediment released during dredging is transported by hydrodynamic conditions and eventually settles back onto the seabed. In this case, an impact relates to the deposition of sediment at the caves and the potential burial of the archaeological features. While burial may not necessarily adversely affect the archaeological resource, it would adversely affect archaeological studies and research programmes, and could compromise the cave's value as a feature of the World Heritage Site.

This impact has been assessed using the results of the numerical modelling described in Chapter 5 and Appendix D.

The dredging and marine works that are likely to take place for Eastside are described in Section 5.4, with an indicative timeframe for the activities shown in Figure 5.8.

Two impact scenarios were used to assess the dredging and reclamation activities during the construction phase of Eastside (identified as sc1 and sc2 in Figure 5.8).

The impact assessment scenarios for Eastside were:

- Dredging and works for the trenches and sea defences (see sc1a and sc1b in Figure 5.8 and Figure 7.3a in Appendix D); and
- Dredging and land reclamation works (see sc2 in Figure 5.8 and Figure 7.3b in Appendix D).

The two impact scenarios were modelled for spring and neap tide conditions including waves, without wind influences. Scenario sc2a was also modelled with two typical wind conditions (wind direction west-south-west at speed of 10 m/s and wind direction east-north-east at speed of 10 m/s) because this scenario represented the worst case impact since it had the longest duration.

The following paragraphs for this impact assessment report the worst case impacts for each scenario (i.e. sc1a, sc1b, sc2a and sc2b,) in terms of the resulting thickness of deposited sediment after completion of the construction works considered by each scenario.

Scenario sc1 - the dredging and works for the trenches and sea defences - represents the BHD dredging activities in combination with the SHB construction of the trenches, and includes SSDV activities. This scenario is subdivided into sc1a for the construction of the southern part of the sea defence and sc1b for the construction of the northern part of the sea defence. The following assessment is based on the worst case conditions arising during a spring tidal cycle.

The model predicts that deposition at site L2 is less than 2mm under sc1a (see Figure 5.9) and sc1b (see Figure 5.10). This is because the deposition only occurs locally around Eastside. Accordingly, a negligible impact is predicted under these scenarios.

Scenario sc2 – the dredging and land reclamation works - represents the dredging of sand from one borrow area and the placement of the material at the reclamation site, and includes

SSDV activities working on the sea defence. This scenario is subdivided into sc2a for dredging at the northern borrow area (total duration = seven weeks) and sc2b with dredging from the southern borrow area (total duration = seven weeks). The following assessment is based on the worst case conditions arising during a neap tidal cycle.

The model predicts that sediment deposition at site L2 will not exceed 2mm under sc2a with dredging at the northern borrow area (see Figure 7.18 in Appendix D) and will be 5mm under sc2b with dredging at the southern borrow area (see Figure 7.23 in Appendix D).

Overall, the modelling predicts that the maximum expected sediment deposition affecting the caves is 5mm. This deposition thickness is predicted to occur as a result of dredging at the southern borrow area under impact scenario sc2b. This low amount of deposition is expected to have a minor adverse impact on the cave archaeology and its contribution to the World Heritage Site.

15.4.2 *Construction Phase: Impact of Sediment Deposition on Offshore Wrecks*

It is possible that dredging and marine works for Eastside could cause sediment deposition at a thickness that is to the detriment of the wreck sites along Gibraltar's east coast (off Eastern Beach, located as W1 and W2 on Figure 15.3).

The wrecks could be affected by sediment deposition due to dredging. As identified in Section 5.4, the suspended sediment released during dredging is transported by hydrodynamic conditions and eventually settles back onto the seabed. In this case, an impact relates to the deposition of sediment at the wreck site and the potential burial of these archaeological features. While burial may not necessarily adversely affect the wrecks, it would adversely affect archaeological studies and research programmes.

This impact has been assessed using the results of the numerical modelling described in Chapter 5 and Appendix D.

The dredging and marine works that are likely to take place for Eastside are described in Section 5.4, with an indicative timeframe for the activities shown in Figure 5.8.

Two impact scenarios were used to assess the dredging and reclamation activities during the construction phase of Eastside, as identified in Section 15.4.1.

The model predicts deposition at sites W1 and W2 to be less than 2mm under scenarios sc1a and sc1b. This is because the deposition only occurs locally around Eastside. Accordingly, a negligible impact is predicted under these scenarios.

The model predicts the following maximum expected sediment deposition thicknesses under sc2a with dredging at the northern borrow area to be 2mm to 5mm at site W1 and 10mm to 50mm at site W2.

The model predicts deposition at sites W1 and W2 to be less than 2mm under sc2b with dredging at the southern borrow area. Accordingly, a negligible impact is predicted under these scenarios.

The modelling predicts the maximum expected sediment deposition affecting the aircraft wreck (W1) to be 2mm to 5mm. This deposition thickness is predicted to occur as a result of dredging at the northern borrow area under impact scenario sc2a. This low amount of deposition is expected to have a negligible impact on the wreck because its magnitude will be less than the sediment deposition that already occurs at this site. For example, Smith and Fa (2004) state:

“We first dived the site in 2001, when most of the front part of the aircraft was exposed and a survey of remains was started. Subsequent dives, however, found that the sand had shifted and only the tops of the propeller blades were visible.”

The modelling predicts the maximum expected sediment deposition affecting the four wreck sites (W2) to be 10mm to 50mm. This deposition thickness is predicted to occur as a result of dredging at the northern borrow area under impact scenario sc2a. This moderate amount of deposition is expected to have a negligible impact on the wrecks because the wrecks are already buried beneath sand. For example, Smith and Fa (2004) state:

“...circular searches were carried out...in 2002, but only sand was seen at the time.”

15.4.3 *Construction Phase: Impact of Land Development on Cultural Heritage Features*

There are a number of heritage features within the vicinity of Eastside that could be impacted by land works (see Section 15.3).

It is believed that construction of Eastside will require the moving of the Sikorski memorial, the Cairn to the Black Watch, and the plaque to San Roque residents. From a heritage perspective, it is preferable to leave these features in their original position. However, this does not appear to be possible given the layout of Eastside as proposed in the master plan. Accordingly, it will be necessary to move these features and so there will be a minor adverse impact on heritage.

It is believed that construction for Eastside will leave the two pill boxes in place and therefore there will be no direct impact (e.g. demolition) of these heritage features. However, there is a risk of accidental damage occurring during construction of Eastside (e.g. collision damage by large construction plant, damage to a small metal plaque regarding the Caledonian Canal on one of the pill boxes), which could have a minor adverse impact.

15.4.4 *Operation Phase: Impact of Coastal Morphology Changes on Cave Archaeology and World Heritage Status*

It is possible that Eastside could affect coastal hydrodynamic and morphological processes in such a way that is to the detriment of the archaeologically important sea caves (Gorham's Cave) along Gibraltar's east coast (near Ammunition Jetty, located just south of L2 on Figure 15.3) and the status of the World Heritage Site to which the caves contribute.

The caves could be affected by changes to the coastal morphology due to altered sediment dynamics (i.e. erosion and accretion patterns along the coast). In this case, an impact relates to the deposition of sediment at the caves and the potential burial of the archaeological features. While burial may not necessarily adversely affect the archaeological resource, it would adversely affect archaeological studies and research programmes, and could compromise the cave's value as a feature of the World Heritage Site.

This impact has been assessed using the results of the numerical modelling described in Chapter 5 and Appendix D.

As identified in Section 5.4, it is possible that the construction of Eastside could interrupt the along-shore sediment transport, cross-shore sediment transport, cross-shore profiles and offshore sediment movement characteristics of this stretch of coast.

With the Eastside development in place, the main geomorphology changes to the south of Eastside are expected to be caused partly by a significant re-orientation of the shoreline of Catalan Bay. No significant shoreline orientation is predicted south of Catalan Bay, for example, in Sandy Bay (see Section 5.4). This means that the impact of Eastside on coastal morphology will not extend south along Gibraltar's east coast as far as the caves near Ammunition Jetty. Therefore, no impact on cave archaeology or the World Heritage Site is predicted.

15.4.5 *Operation Phase: Impact of Coastal Morphology Changes on Offshore Wrecks*

It is possible that Eastside could affect coastal hydrodynamic and morphological processes in such a way that is to the detriment of the wreck sites along Gibraltar's east coast (off Eastern Beach, located as W1 and W2 on Figure 15.3).

The wreck sites could be affected by changes to the coastal morphology due to altered sediment dynamics (i.e. erosion and accretion patterns along the coast). In this case, an impact relates to the deposition of sediment at the wreck sites and the potential burial of the archaeological features. While burial may not necessarily adversely affect the wrecks, it would adversely affect archaeological studies and research programmes.

This impact has been assessed using the results of the numerical modelling described in Chapter 5 and Appendix D.

As identified in Section 5.4, it is possible that the construction of Eastside could interrupt the along-shore sediment transport, cross-shore sediment transport, cross-shore profiles and offshore sediment movement characteristics of this stretch of coast.

With the Eastside development in place, the main geomorphology changes to Eastern Beach are expected to be caused partly by a significant re-orientation of the shoreline at the southern end of Eastern Beach. Further along Eastern Beach, to the north of the central groyne, the morphological impact is much smaller and consists of a maximum accretion of at most some metres near the central groyne and a shoreline retreat of similar magnitude near the northern groyne. No significant shoreline orientation is predicted north of the northern groyne of Eastern Beach or south of Catalan Bay (see Section 5.4). This means that the impact of Eastside on coastal morphology will extend north along Gibraltar's east coast as far as the north groyne, where changes to beach morphology will be constrained by the north groyne. Since the site of the aircraft (see W1 on Figure 15.3) is just north of the north groyne, a negligible impact on the wreck site is predicted.

The impact of Eastside on coastal morphology will not extend offshore as far as the other wrecks off Eastern Beach (see W2 on Figure 15.3), so there will be no impact on these wrecks.

15.4.6 *Operation Phase: Impact of Land Development on Cultural Heritage Features*

No impact is assessed for the operation phase of Eastside, although reference should be made to the impact on cultural heritage features assessed earlier in this section, since the outcome of this impact will materialise post-construction.

15.5 ***Mitigation Measures*****15.5.1** *Construction Phase: Impact of Sediment Deposition on Cave Archaeology and World Heritage Status*

In order to reduce the risk of impact of sediment deposition at the caves, it is recommended that consideration is given to either undertaking more dredging from the northern borrow area, or undertaking dredging at the southern borrow area when prevailing currents and/or winds limit the transport of sediment plumes towards the shore.

15.5.2 *Construction Phase: Impact of Sediment Deposition on Offshore Wrecks*

No mitigation measures are recommended to offset impacts on wrecks.

15.5.3 *Construction Phase: Impact of Land Development on Cultural Heritage Features*

In order to mitigate this impact, consultation with the Gibraltar Heritage Trust was undertaken and the Trust advised that the following approach should be taken if the features are moved:

- Liaise with the Trust to find a consensus approach to re-siting the features;
- Do not dismantle features (e.g. the Sikorski memorial) unless this poses a risk to the features;
- Re-site as close as possible to their current position to maintain the connections to their sites;
- Re-site in a publicly accessible location;
- Re-site in a location with suitable cultural prominence (i.e. not next to rubbish bins); and
- Re-site in a way that adds value to the surroundings (e.g. as part of a heritage trail with interpretation boards).

To mitigate against the risk of accidental damage to the pill boxes, it is recommended that provisions are included within the contract conditions for appointed contractors that provide simple protection measures for these features (e.g. awareness of construction workers, fencing off pill boxes).

15.5.4 *Operation Phase: Impact of Coastal Morphology Changes on Cave Archaeology and World Heritage Status*
No impact on cave archaeology or the World Heritage Site is predicted and so no mitigation measures are recommended.

15.5.5 *Operation Phase: Coastal Morphology Changes on Offshore Wrecks*
There will be only a negligible impact on wreck site W1, so no mitigation measures are recommended.

15.5.6 *Operation Phase: Impact of Land Development on Cultural Heritage Features*
No impact is assessed for the operation phase of Eastside and therefore no mitigation measures can be required.

15.6 **Residual Impacts**

15.6.1 *Construction Phase: Impact of Sediment Deposition on Cave Archaeology and World Heritage Status*
With the mitigation in place, the potential for a minor adverse impact on cave archaeology will have been addressed and there should remain a negligible residual impact.

15.6.2 *Construction Phase: Impact of Sediment Deposition on Offshore Wrecks*
There will be a negligible residual impact due to sediment deposition on wrecks.

15.6.3 *Construction Phase: Impact of Land Development on Cultural Heritage Features*
With mitigation measures in place, there will remain a minor adverse residual impact, but the features will have been re-sited in the most appropriate manner.

To mitigate against the risk of accidental damage to the pill boxes, it is recommended that provisions are included within the contract conditions for appointed contractors that provide simple protection measures for these features (e.g. awareness of construction workers, fencing off pill boxes).

With these measures in place, there should be no residual impact to the pill boxes.

15.6.4 *Operation Phase: Impact of Coastal Morphology Changes on Cave Archaeology and World Heritage Status*
The impact is predicted to be insignificant and there will be no residual impact.

15.6.5 *Operation Phase: Impact of Coastal Morphology Changes on Offshore Wrecks*
There will remain a negligible residual impact on wreck site W1.

15.6.6 *Operation Phase: Impact of Land Development on Cultural Heritage Features*

No impact is predicted for the operation phase of Eastside and therefore no residual impact is possible.

15.7 ***Cumulative Effects*****15.7.1** *Construction Phase: Cumulative Effect of Sediment Deposition on Cave Archaeology and World Heritage Status*

The cumulative effect of Eastside in combination with other plans or projects (see Section 4.10) has been assessed for cave archaeology by using the same approach as described in Section 15.4.

The Both Worlds Project is not expected to involve dredging and reclamation that coincides with the dredging and reclamation for Eastside, and therefore no cumulative effect is predicted on cave archaeology and World Heritage Site status due to sediment deposition.

Accordingly, no mitigation measures are recommended and therefore there will be no residual cumulative effect.

15.7.2 *Construction Phase: Cumulative Effect of Sediment Deposition on Offshore Wrecks*

The cumulative effect of Eastside in combination with other plans or projects (see Section 4.10) has been assessed for offshore wrecks by using the same approach as described in Section 15.4.

The Both Worlds Project is not expected to involve dredging and reclamation that coincides with the dredging and reclamation for Eastside, and therefore no cumulative effect is predicted on the offshore wrecks due to sediment deposition.

Accordingly, no mitigation measures are recommended and therefore there will be no residual cumulative effect.

15.8 ***Transboundary Effects*****15.8.1** *Transboundary Effect of Sediment Deposition on Offshore Wrecks*

The only known archaeological resource in Spanish territory that could be affected by Eastside is a wreck site shown on the Admiralty Chart 1448 at a depth of -4.9mCD. The wreck site is located a few hundred metres north of the wrecks at location W2, which suggests that this wreck may also be an aircraft since it is known that aircraft remains exist in the water east of the runway.

The transboundary effect of Eastside has been assessed for offshore wrecks by using the same approach as described in Section 15.4.

It is possible that dredging and marine works for Eastside could cause sediment deposition at a thickness that is to the detriment of the wreck site in Spanish water. In this case, an impact relates to the deposition of sediment at the wreck site and the potential burial of the archaeological features. While burial may not necessarily adversely affect the archaeological resource, it would adversely affect archaeological studies and research programmes. For this transboundary effect assessment, the sediment deposition predicted to occur at the wrecks at W2 (see Figure 15.3) has been used to conservatively identify the magnitude of sediment deposition at the wreck site in nearby Spanish waters.

Overall, the modelling predicts the maximum expected sediment deposition affecting the wreck sites to be 10mm to 50mm. This deposition thickness is predicted to occur as a result of dredging at the northern borrow area under impact scenario sc2a. This moderate amount of deposition is expected to have a negligible transboundary effect on the wreck site because

the wreck appears from the Admiralty Chart to be standing several metres above the seabed level. No mitigation measures are recommended and there will be a negligible residual transboundary effect.

15.9 ***Uncertainty***

The results of the modelling studies are valid given the applied assumptions and conditions, including the positions of wreck sites. It should be noted, however, that when there is a (significant) change in these assumptions, the results may change. For example, the results of the sediment deposition modelling may change with different dredging methods, different dredging locations and/or different sediment particle size distribution. Uncertainty has been addressed by using the best available data to inform the modelling.

15.10 ***Summary***

This chapter has assessed the potential impacts, cumulative effects and transboundary effects of Eastside associated with archaeology and cultural heritage, with reference to coastal cave archaeology (and World Heritage Site status), offshore wreck sites and heritage features on land.

During construction, the principal impact is related to re-siting the Sikorski memorial, the Cairn to the Black Watch, and the plaque to San Roque residents. A list of mitigation measures, including liaison with the Gibraltar Heritage Trust, have been recommended. Numerical modelling has predicted minor adverse and/or negligible impacts on cave archaeology and offshore wrecks as a result of sediment plume deposition after dredging (particularly at the southern borrow area), so mitigation measures have been recommended to reduce the discharges of sediment during dredging.

During operation, numerical modelling has predicted negligible and/or no significant impacts on cave archaeology and offshore wrecks as a result of coastal morphology changes, so no mitigation measures have been recommended. There will be no impacts on land based heritage features.