

## 15. SOUTHEAST OFFSHORE ISLAND LANDFILL

### 15.1 Basic Information

#### *Project Title*

15.1.1 Southeast Offshore Island Landfill (SEOIL) – marine site M.10.

#### *Nature of Project*

15.1.2 The Project would form a new marine based waste disposal site in the remote Eastern Waters to the southeast of Hong Kong (*Figure 15.1*).

15.1.3 The SEOIL would require the construction of an artificial island of approximately 850ha in size. The site would be designated as a public filling area for the receipt of inert C&D material; once the reclamation is completed, the site would be developed as a landfill for subsequent operation for the disposal of waste. Construction works would be as described in Part A; Section 3.2.

#### *Location and Scale of Project*

15.1.4 The SEOIL is located adjacent to the eastern boundary of SAR waters, approximately 18km east of Po Toi Island. Approximately 370Mcum of fill material will be required to construct the artificial island, with a final site formation level to +6mPD. The capacity of the landfill site would be in the order of 140Mcum.

15.1.5 Seabed levels in this area vary from 20 to 30m below Chart Datum. There would be a requirement to dredge some 15Mcum of muds to facilitate seawall construction.

#### *History of Site*

15.1.6 The SEOIL is located within open marine waters and is to be formed entirely as part of this project. There has been no previous development activity within the site area.

#### *Number and Types of Designated Projects Covered*

15.1.7 This proposal would qualify as a Designated Project under the five categories listed in Part A; Section 2.1.

### 15.2 Outline of Planning and Implementation Programme

15.2.1 An outline for the planning and implementation of this site is summarised in Part A; Section 3.3 and an outline programme is shown in *Figure 15.2*. Assuming landfill operations start in 2021, SEOIL would be full during the period 2040 to 2050, depending upon the rate of waste arisings and the number of other landfills operating concurrently.

15.2.2 As described in Section 3.3, the site is currently not covered by any statutory town plans, Town Planning Ordinance procedures to cover the site would be required and the reclamation would need to be gazetted under the Foreshore & Sea-bed (Reclamations) Ordinance.

15.2.3 According to the Territorial Development Strategy Review, the general area where the site would be located is of recreational value, although in this context these waters in the southeast quadrant of Hong Kong are considered too remote to be of any high value. There are no other identified uses in this area.

### 15.3 Possible Impacts on the Environment

15.3.1 Possible impacts on the environment during the construction, operation and aftercare phases of the SEOIL are outlined below. *Figure 15.1* provides details of identified sensitive receivers. The individual assessments are summarised in *Tables 15.1 and 15.2*.

### ***Air Quality***

- 15.3.2 The reclamation and landfill development has the potential to cause the following air quality impacts:
- Dust (TSP / RSP) and exhaust emissions from on-site plant during construction and operation.
  - Gaseous emissions during landfill operation and aftercare arising from non-point source emissions and gas flaring / utilisation (including emissions of methane, carbon dioxide, carbon monoxide, sulphur dioxide, nitrous oxides, etc.).
  - Odours arising during the operation of the landfill from waste decomposition and leachate treatment.
- 15.3.3 No Air Sensitive Receivers (ASRs) are found within a 500m radius from the boundary of this site. Thus, no significant air quality impacts associated with reclamation, operation and construction of the landfill facility within the site are anticipated.
- 15.3.4 No existing or planned developments that emit similar gaseous emissions are found within 3km from the site boundary. Moreover, there are no existing or planned ASRs in the vicinity of the artificial island. Cumulative air quality impacts are not anticipated.
- 15.3.5 This is a marine site and so marine vessel will be the mode of transportation for waste delivery to the site. The amount of air pollutants emitted from the territory-wide waste delivery to the site will be less compared to a land based site that solely relies on road transport. However, the estimated cumulative distance to be travelled from the existing and planned (South East Kowloon RTS to be commissioned in 2012) marine RTSs to the site is approximately 450km, the regional air quality impacts related to waste delivery is considered to be moderate.

### ***Noise***

- 15.3.6 The reclamation and landfill development has the potential to cause the following noise impacts:
- Construction – from dredging, tipping, piling works and general construction activities;
  - Operation – from the use of fixed plant, marine vessels, waste reception area, pumping plant, possible helicopter noise etc.
- 15.3.7 No noise sensitive receivers are found within a 300m radius from the boundary of this site. Thus, no significant noise impacts associated with reclamation, operation and construction of the landfill facility within the site are anticipated.
- 15.3.8 Although not anticipated at this stage, it is possible that activities could continue beyond normal working hours during the construction and operation phases. This would depend upon working arrangements for fill delivery, day-to-day landfill operations and the overall construction programme. However, as this is an offshore site with no NSRs in the vicinity, the more stringent requirements for noise emissions during the evening and night-time periods are not expected to be an issue for this site.
- 15.3.9 Potential operational phase noise impacts would need to be considered in subsequent studies in the event that the island reclamation is used for other land uses (in addition to landfill) or a separate afteruse is developed on top of the landfill following completion of the landfilling operations.
- 15.3.10 The site can only be accessed by marine traffic during both operation and construction phase. Noise from land based waste delivery vehicles is not a concern for this site.

## *Water Quality*

### *Baseline Conditions at the Site*

- 15.3.11 The site is located in the Eastern Waters of Hong Kong, some 18km east of Po Toi Island and 12km to the southeast of Ninepin Group, and falls within the Mirs Bay Water Control Zone (WCZ). The generalised current pattern in the area is from west to east / southeast on the ebb tide, with the result that the artificial island site is only very slightly exposed to water quality influence from more westerly waters. On the flood tide the current direction is from the northeast to west / northwest during the dry season, and from the south during the wet season. Apart from the dry season flood tide when the current flows across the site, the current around the site is generally very weak. However, with the weak currents the arrival of the southwest monsoon (wet season) around late April will have the effect of driving surface waters to the northeast.
- 15.3.12 Marine water and sediment quality data for the area is available from EPD's routine monitoring station in Mirs Bay: MM13 and MS13. These stations are located approximately 2km north of the site. The quality of the marine waters in the area is good, with full compliance to the WQO for dissolved oxygen (DO), total inorganic nitrogen (TIN), un-ionised ammonia and *E-Coli* for the past three years.<sup>1</sup> EPD's routine sediment quality data for the afore-mentioned locations shows no breach of the Lower Chemical Exceedance Level for any of the parameters tested. Excavated sediment from dredging activities would thus be suitable for open sea disposal.

### *Key Issues and Sensitive Receivers*

- 15.3.13 The project has the potential to cause the following water quality impacts:
- Sediment loss to the water column during dredging / reclamation;
  - Runoff with elevated levels of suspended solids from the site during landfill construction (post-reclamation); and
  - Change in the hydrodynamic regime (i.e., change in flushing capacity and sediment deposition / erosion patterns).
- 15.3.14 There are no Water Sensitive Receivers (WSRs) in the immediate vicinity of the site. Those WSRs most susceptible are common to the area around the East Tung Lung Chau artificial island and include:
- Secondary contact recreation subzone around the Po Toi islands and the east and southeast coasts of Hong Kong Island;
  - Gazetted beaches at Shek O; and
  - Seawater abstraction point at Cape D'Aguilar
- 15.3.15 In addition, there are a range of aquatic ecological receivers in the vicinity of the site that would be sensitive to any decline or change in the water quality or sediment deposition / erosion patterns. Impacts upon these are discussed under the "Ecology" and "Fisheries" subsections. The sensitive receivers include:
- Cape D'Aguilar Marine Reserve and SSSI;
  - Ninepin Group SSSI;
  - Finless Porpoise Area near Po Toi and Wong Ma Kok; and
  - Coral and Green Turtle habitats near Po Toi, Sun Kong Island and Beaufort Island.

<sup>1</sup> EPD, *Marine Water Quality in Hong Kong for 2000*, (EPD 2000)

### *Reclamation and Site Formation*

- 15.3.16 Dredging of some 15Mcum of uncontaminated sediment is proposed for the site development, and there will be reclamation works to create a site footprint of around 850ha. Sediment handling for these activities may give rise to potential water quality impacts from increased suspended solids and reduced dissolved oxygen levels. Whilst dredging is proposed for this site, EPD data shows that the sediment quality in this area is uncontaminated with no potential for contaminant release.
- 15.3.17 The placement of fill for island construction may lead to localised increases in suspended solid levels. The water quality and hydrodynamic modelling indicated that the impacts of island construction on SS levels at sensitive receivers would be fairly small and at no time would the predicted levels approach or exceed WQO. In addition, the predicted sedimentation rates at the surveyed corals would be well below the assessment criterion of 100/m<sup>2</sup>/day. The highest SS level increase is predicted to occur at FP9 (4.94%) in the Phase 3 construction wet season.

### *Hydrodynamic and Water Quality Impacts Following Island Formation*

- 15.3.18 The site would be located 12km offshore, with the nearest landfall being the Ninepin Group of islands. The site would be large, with a surface area of some 850ha, and would require a fill volume of approximately 370Mcum to develop. The site would also be located in waters some 20-30m deep and would be a new 'barrier' to the oceanic current from the south. No significant impact on accumulated flow in major channels was predicted in the modelling which indicated that all changes would be between -0.98% and 0.28%. The flow velocity fields indicated a significant decrease to the immediate northeast of the island during the wet season, however the overall reduction in current magnitude was only predicted to be 2.65% to the north east, and no overall change in current magnitude was predicted to the north.
- 15.3.19 In the hydrodynamics and water quality modelling, 46 sensitive receivers that are close to the site were selected for presentation. Of the 46 chosen indicator points, 12 are located in the Port Shelter WCZ (FC6-11, GB7-10, MP7 & SC16), 22 in the Mirs Bay WCZ (FP9, SC5-8, FN1a-d, MP4, 8-11, 8b, GT3 and SC12-14, 15, 17, 21), 1 in the Eastern Buffer WCZ (FC5), 1 in the Mainland waters (MF) and the remaining 10 in the Southern WCZ (NS6-7, SC3-4, 11, MR1, GB6, FP6, SC18 & GT2).
- 15.3.20 According to the dry season water quality modelling results, the predicted 90%ile DO for depth average and bottom layer ranged from 5.92 to 7.06mg/L which complied with the WQO of ≥4mg/L for depth averaged DO and ≥2mg/L for bottom layer DO as well as the Mainland sea water quality standard of >5mg/L.
- 15.3.21 The predicted average dry season salinity ranged from 33.96 to 34.00ppt. Compared to the baseline water quality results, the percentage changes in salinity caused by the presence of the island would be minimal (the largest difference is only 0.03%).
- 15.3.22 The predicted dry season SS levels at the indicator points would be in the range of 1.47 to 4.46mg/L. The increases in the SS level caused by the presence of the island would be minimal (less than 1%). Recognising that the WQO requires that any waste discharge should not raise the natural ambient level by 30% as well as the Mainland standard that man-made increment should not exceed 100mg/L, the difference is considered very small.
- 15.3.23 The predicted *E.coli* levels in the dry season ranged from 1 to 232count/100mL that complied with the WQO of 610cfu/100mL. The predicted *E.coli* level at the Mainland station MR (1count/100mL) also complied with the Mainland standard of 200count/100mL. The island would not cause any changes in *E.coli* levels at all the indicator points.

- 15.3.24 The predicted average dry season UIA (0.00176 – 0.00348mg/L) at all indicator points would be low and well below the WQOs of 0.021mg/L as well as the Mainland standard of 0.02mg/L.
- 15.3.25 The dry season TIN levels ranged from 0.0476 to 0.0956mg/L that would be very small but the wet season data would be significantly higher. Since the WQO of TIN is an annual mean value, the predicted mean TIN levels for both the dry and wet seasons were averaged to represent the annual mean values. The calculated annual mean values ranged from 0.1278 - 0.1549mg/L for NS6-7, SC3-4, 11, MR1, GB6, FP6, SC18 & GT2 (Southern WCZ), 0.119mg/L for FC5 (Eastern Buffer WCZ), 0.0768 - 0.1178mg/L for FP9, SC5-8, FN1a-d, MP4, 8-11, 8b, GT3 and SC12-14, 15, 17, 21 (Mirs Bay WCZ) and 0.0704 – 0.1059mg/L for FC6-11, GB7-10, MP7 & SC16 (Port Shelter WCZ). The annual mean WQO for TIN would be 0.1mg/L for both Southern WCZ and Port Shelter WCZ, and 0.3 and 0.4mg/L for Mirs Bay WCZ and Eastern Buffer WCZ respectively. As a result, exceedances of the annual mean WQO were found at all selected indicator points in the Southern WCZ (NS6-7, SC3-4, 11, MR1, GB6, FP6, SC18 & GT2) as well as Station FC6 in Port Shelter WCZ. It should be noted that the annual mean baseline values predicted at these 11 stations (0.1026 to 0.1546mg/L) also exceeded the relevant WQO of 0.1mg/L. The largest increase caused by the island was found at FP9 of 4.22%. The TIN levels for MF complied with the Mainland standard of 0.3mg/L for both the dry and wet seasons.
- 15.3.26 According to the wet season water quality modelling results, the predicted 90%ile DO for depth average at the indicator points within Hong Kong waters ranged from 4.27 to 5.50mg/L which complied with the WQO of  $\geq 4$ mg/L. The predicted depth averaged DO at MF (4.75 – 5.10mg/L) breached the Mainland standard of 5mg/L but the exceedance was not caused by the presence of the island as the baseline values at MF (4.68 – 4.99mg/L) also breached the relevant standard.
- 15.3.27 For 90%ile bottom DO, the values ranged from 2.33 to 5.19mg/L which complied with the WQO of  $\geq 2$ mg/L. Meanwhile, the bottom DO at MF (ranged from 3.69 – 4.43mg/L) exceeded the Mainland standard of 5mg/L. However, the baseline value of bottom DO at MF (ranged from 3.56 – 4.29mg/L) also exceeded the Mainland standard.
- 15.3.28 The predicted average in the wet season salinity ranged from 24.60 to 31.14ppt. Compared to the baseline water quality results, the percentage changes in salinity caused by the presence of the island would be minimal with the largest difference at FP9 of –1.08%. Recognising the WQO requires that change due to any waste discharge should not exceed 10% of natural ambient level, the differences are considered very small.
- 15.3.29 The predicted wet season SS levels at the indicator points were in the range of 1.76 to 4.63mg/L. The largest increase in the SS level caused by the site was found at GB9 of 17.54%. Recognising the WQO requires that any waste discharge should not raise the natural ambient level by 30% as well as the Mainland standard that man-made increment should not exceed 100mg/L, the difference is considered acceptable.
- 15.3.30 The predicted *E.coli* wet season levels ranged from 1 to 132count/100mL would be low and well below the WQO of 610cfu/100mL and the Mainland standard of 200count/100mL.
- 15.3.31 The predicted average wet season UIA (0.00298 – 0.00644mg/L) at all indicator points would be low and well below the WQO of 0.021mg/L and the Mainland standard of 0.02mg/L.
- 15.3.32 The wet season TIN levels ranged from 0.0674 to 0.2174mg/L which was quite high as compared to the relevant WQO. Since the WQO of TIN is an annual mean value, the predicted mean TIN levels for both the dry and wet seasons were averaged to represent the annual mean values. Compliance of the annual mean WQO for TIN is discussed in Section 15.3.25 above.

### *Cumulative Impacts*

- 15.3.33 It is understood that a submarine pipeline is soon to be installed through Mirs Bay to carry LPG from Cheng Tou Jiao (northeast Mirs Bay) to the Lamma Island power station. The pipeline will run southwards towards the artificial island site but will veer southwest several km before the site is reached. These works however are due to be complete within two years of commencement and would not give rise to any potential for cumulative effects.
- 15.3.34 Marine disposal areas and sand borrow pits in the area include the East of Ninepin open sea mud disposal area, the East Tung Lung Chau marine disposal area, sand deposit at South of Victor Rock and Marine Borrow Area at West Po Toi. From generalised information on water currents in the area there is some potential for a cumulative effect on sediment levels in the water column should work at any of these sites be concurrent with dredging or reclamation activities at the artificial island site.

### *Waste Management*

- 15.3.35 For construction of the “island” on which the landfill would be located, inert C&D material would be brought in exclusively by marine vessel, from a network of barging points in the SAR. The location of barging points would vary during the filling process, according to the source of materials at any given time.
- 15.3.36 Whilst various options for construction that avoid dredging have been investigated, it is anticipated that muds would need to be excavated to facilitate construction of the outer seawall, prior to public filling. Excavated muds would then be disposed of within the area to be reclaimed with public fill. Following this, the “island” would act as a major recipient of municipal solid waste and other landfilled waste streams.
- 15.3.37 Anticipated volumes of materials are as follows:
- Volume of public fill that could be accepted for island construction: 370Mcum
  - Volume of muds be dredged for outer sea wall: 15Mcum
- 15.3.38 Various potentially polluting materials may be stored, handled and transported to / from the site. Examples may include chemicals for waste water/leachate treatment, waste oils, fuel for plant working on the site, etc. These would be managed as described in Section 5.5.
- 15.3.39 Waste delivery to the site will be by marine vessel, which is preferable in terms of GHG emission. However, as the cumulative distance between marine RTSs and the site is around 450km (referred to the Preliminary Marine Review (March 2002)), the potential GHG emissions could still be moderate.

### *Ecology*

#### *Baseline Conditions*

- 15.3.40 The SEOIL is remote, with the nearest landfall being at the Ninepin Group of islands some 12km to the northwest. No marine ecology studies have been identified specifically at the site location, although several studies have been undertaken in waters nearby. Dive surveys indicate that the seabed habitat would likely be dominated by burrowing polychaete worms, with echinoderms and crustaceans also occasionally present. The scavenging gastropod *Nassarius siquijorensis* was recorded from seabed areas around Basalt Island, and polychaetes dominated the benthic infauna in the same area.<sup>2</sup> The disturbed seabed area east of the Ninepin Group is dominated by spionid polychaetes.<sup>3</sup> Regular trawling in the broader area has resulted in a uniformly disturbed habitat and, given the consistency in

<sup>2</sup> ERM (1997). Seabed Ecology Studies: Basalt Island – Final Report. March 1997.

<sup>3</sup> ERM-Hong Kong Ltd (1997d) Seabed Ecology Studies: East of Ninepins Final Report, Civil Engineering Department, Hong Kong Government.

sediment character and water column depth, benthic community assemblages are not expected to vary much across the general area.

- 15.3.41 The high value of the coral reef community at the Ninepin Group was documented following the underwater surveys in the area in the early 1990s. The coral communities at Victor Rock some 14km north and at the south coast of Basalt Island some 17km to the northwest are also of high conservation value. These sites are characterised by diverse communities of hard and soft coral, gorgonians, sponges, holothurians, sea urchins, sea fans and fish species.
- 15.3.42 The marine environment south and west of the Ninepin Group towards the Cape D'Aguilar Marine Reserve, Po Toi and associated islands also supports coral communities of high conservation value. The more open marine waters at the south of this area are habitat to the Black Finless Porpoise *Neophocaena phocaenoides*, with the waters to east of Po Toi forming part of this species' core habitat through summer and autumn.
- 15.3.43 The Green Turtle *Chelonia mydas* has been observed in coastal waters between Tung Lung Chau, Ching Chau and the Ninepin Group of islands, and is reported to use the waters off southwest Po Toi. Both the Finless Porpoise and the Green Turtle are protected under the Wild Animals Protection Ordinance (Cap. 170) and are listed in CITES Appendix I.

#### *Direct Habitat Loss*

- 15.3.44 Around 935ha of benthic habitat and some 20-30m of water column over this seabed area will be lost to the development. Although the area is large, the ecological value of the seabed is not expected to be significant. The loss of water column would be reflected in loss of fisheries habitat.
- 15.3.45 From available data, the area does not appear to be of particular ecological value to the Finless Porpoise or Green Turtle. However, it is also noted that the site is far from coastal waters and there has been no little study as to the utilization of the area by these species.

#### *Water Quality / Hydrodynamics*

- 15.3.46 As the baseline water quality conditions in the area are good, the potential for water quality decline is related to increased suspended sediment / sediment deposition and turbidity during dredging and reclamation works, and the associated potential for decreased dissolved oxygen levels.
- 15.3.47 Whilst there are no coral communities in the immediate vicinity of the site there is potential for sediment plumes to be transported westwards towards the coastline around Po Toi, Sun Kong and Waglan Island where coral communities of high conservation value exist. Settlement of sediment may occur in more sheltered coastal waters where corals thrive, thereby potentially leading to smothering effects. Likewise, there is some potential for impact on the nearby Cape D'Aguilar Marine Reserve. Given the existing hydrodynamics of the area no impacts upon the coral communities at east Tung Lung Chau, Ching Chau and the Ninepin Group are anticipated.
- 15.3.48 Modelling predicted that as a worst case scenario (Phase 3 construction wet season;), only a minor elevation (< 0.2mg/L) of suspended solids levels above baseline would occur in the vicinity of the potential island site (FP9). No operational impacts were predicted by the model.

### *Marine Vessel Disturbance*

- 15.3.49 From available data, the site area does not appear to be particularly important as a habitat for the Finless Porpoise. However, if marine vessels approach the site via the south of Po Toi group of islands there will be some potential for vessel collision with the Finless Porpoise and possibly the Green Turtle. There would also be greater likelihood for general disturbance from vessel movements through this area (e.g., vessel engine noise and vibration).

### *Fisheries*

- 15.3.50 The broader the Eastern Waters area is of ecological and commercial fisheries importance, although it is the inland waters between Port Shelter, Tung Lung Chau, Cape D'Aguilar and Po Toi that are by far the most productive.<sup>4</sup> This area has been proposed as a fisheries spawning area. The inland waters are an important spawning ground for a number of commercially species, including *Apogon quadrifasciatus* (broadbanded cardinalfish), *Parapristipoma trilineatum* (chicken grunt), *Sebasticus marmoratus* (scorpionfish), *Trichiurus haumela*, *Upeneus sulphureus* (sulphur goatfish) and *U. tragula* (freckled goatfish). Accordingly it is in this area that commercial fishing activities are concentrated. The spawning period for most of the commercially valuable fish species is between June and September.
- 15.3.51 Port Shelter to the northwest of the site is an important nursery area for *P.trilineatum* as well as fry and juveniles of the high value red pargo *Chrysophrys major* and gold lined seabream *Rhabdosargus sarba*. Commercially valuable species in the South East Hong Kong zone that includes the coastal waters around the Po Toi group of islands include *Cynoglossus macrolepidotus* (tonguefish) and *Pseudosciaena crocea* (yellow croaker).
- 15.3.52 In the offshore waters that are more characteristic of the artificial island site there is still fishing activity, albeit less concentrated. The fisheries value of this area is not known, as fishing effort tends to be concentrated in inland waters, although the area is likely to be of importance for natural fisheries recruitment.
- 15.3.53 The key concern with respect to fisheries activities is the potential for sediment plume formation and transport from the dredging and reclamation activities towards sensitive areas to the west. In particular, the hydrodynamics for the area indicate that any sediment plume may be carried towards the fisheries spawning area at between Po Toi / Sun Kong and south of Tung Lung Chau. The Tung Lung Chau Fish Culture Zone and the Po Toi O Fish Culture Zones are located approximately 16km to the northwest of the artificial island site and in relatively sheltered waters. No impact on these zones is anticipated. Likewise, the Po Toi FCZ is located on the leeward side of Po Toi Island some 18km west of the site and is not anticipated to be exposed to any sediment plume.

### *Cultural Heritage*

- 15.3.54 This site is located some distance offshore. There is no immediate evidence of archaeological remains in this area or in the near vicinity. The nearest sites of known archaeological interest are land based, at Tung Lung Chau and Fat Tong Chau, (as discussed in Chapter 12 (East Tung Lung Island Landfill)).
- 15.3.55 Given the remoteness of this site from known land based sites of cultural heritage interest, and the fact that it is not in a area frequented by merchant vessels the likelihood of archaeological remains in this area appear limited. However, given the lack of archaeological data currently available for this site a detailed marine archaeological investigation should be carried out in any future studies.

<sup>4</sup> ERM (1998). Fisheries Resources and Fisheries Operations in Hong Kong Waters. For AFCD, Govt. of HKSAR.



### ***Landscape and Visual***

- 15.3.56 *Landscape Planning Designations* - This area of landscape is not covered by any planning designations reflecting landscape/landscape values and so there will be no impact on these values.
- 15.3.57 *Landscape Resources* - the site lies in a marine area, so that the only landscape resource affected will be an area of offshore water. Given the low sensitivity of this resource, there will be no significant impacts on landscape resources.
- 15.3.58 *Landscape Character* - The island landfill site falls within the Eastern Coastal Waters Landscape Character Area (*Figure 15.4*). The landscape of this part of Hong Kong lies offshore and is an expansive area of open offshore water (*Figure 15.3*). There are neither islands / landforms in this area nor any major shipping channels in the vicinity of the SEOIL. This means that its character is open, exposed, tranquil and remote.
- 15.3.59 There exists potential for slight impacts on landscape character resulting from construction/operation works that will introduce new artificial elements that are incompatible with the existing landscape. The character of the island during afteruse will be inconsistent with the natural and tranquil character of the landscape. However, the distance of the island from other landforms will mean that its artificial characteristics will not be unduly emphasised and resulting long-term impact on the landscape character would be slight.
- 15.3.60 *VSRs* - *VSRs* affected by the island landfill are identified in *Tables 15.3 and 15.4* the extent of the project visual envelopes is shown in *Figure 15.5*. The island landfill site is approximately 25km from Stanley and Shek O, and the landfill island will have almost no impact on those *VSRs*.
- 15.3.61 There are very few *VSRs* who will see the site from short range. Such *VSRs* will include visitors to the area for boating, fishing, or other water sports activities. Other *VSRs*, such as travellers on vessels using the shipping route, are transient. These *VSRs* will experience works on the landfill (shipping, marine vessels and partially constructed island) as relatively close artificial elements contrasting with the simple, open and tranquil qualities of the existing landscape. However, given the small number of these *VSRs*, visual impacts will be insubstantial during both the operation/construction phase and the afteruse phase.

### ***Landfill Gas***

- 15.3.62 There are no sensitive receivers (targets) or pathways within 500m of the site and therefore no potential off-site landfill gas hazards. Landfill gas would have safety implications for those working on the site. In the event that the reclamation on which the landfill would be constructed is also developed for other afteruses, the potential operational phase landfill gas hazards would need to be considered for those developments.
- 15.3.63 Given the remote location of the site and the lack of any sizeable population nearby, the direct off-site use of LFG as an energy source in surrounding communities, is not considered practical. However it will be used as an on-site energy source.

## **15.4 Environmental Protection Measures to be Incorporated into Design and Further Environmental Implications**

- 15.4.1 Environmental design measures have been identified in Part A (Section 3.8) and generic approaches to mitigating impacts on different environmental parameters are outlined in Part A (Section 5). Whilst the specific requirement for environmental mitigation would be dependent upon the findings of an EIA, the following environmental protection measures are site-specific to Southeast Offshore artificial island site.

### ***Air Quality***

- 15.4.2 No specific air quality mitigation measures are recommended at this stage, other than good site practice as described in Part A (Section 5).

### ***Noise***

- 15.4.3 No specific noise mitigation measures are recommended at this stage, other than good site practice as described in Part A (Section 5).

### ***Water Quality***

- 15.4.4 No specific water quality mitigation measures are recommended at this site. However, this site is located in a position that is exposed to significant wind and wave action. In the event that they are required, application of mitigation measures such as silt curtains (as described in Part A - Section 5) would prove difficult.

### ***Waste Management / Disposal Impacts***

- 15.4.5 No specific waste management mitigation measures are recommended at this stage, other than good site practice as described in Part A (Section 5).

### ***Ecology***

- 15.4.6 It is proposed that marine vessel movements are controlled to avoid passage through areas of high Finless Porpoise utilization to the east of Po Toi.

### ***Fisheries***

- 15.4.7 There are no particular measures that are proposed for fisheries resource protection.

### ***Cultural Heritage***

- 15.4.8 There are no particular measures that are proposed for protection of cultural heritage resources.

### ***Landscape & Visual***

- 15.4.9 Landscape and visual mitigation measures are outlined in Part A.

## 15.5 Summary

15.5.1 A summary of the SEA for the SEOIL is provided in *Tables 15.1 and 15.2*:

**Table 15.1: Southeast Offshore Island Landfill SEA**

	Impacts	Score	Commentary
<b><i>Air Quality Assessment</i></b>			
1	Distance to areas of air sensitive land use	<b>O</b>	There are no air sensitive receivers (ASRs) within 500m of the artificial island site.
2	Presence of topographic features which could decrease or exacerbate impacts	<b>O</b>	The site does not lie within any airshed and generally experiences wind. It is unlikely that dust or odours would accumulate around the site.
3	Occurrence of meteorological conditions which could exacerbate impacts	<b>O</b>	Winds blow both towards and away from ASRs. No prevailing wind direction has been identified.
4	Cumulative Impacts of relevant emissions (TSP (construction), NO <sub>x</sub> , CO, SO <sub>2</sub> – LFG Flare) taking into account ambient conditions	<b>O</b>	The site is located in open marine waters to the southeastern of the HKSAR waters fringe, with no known developments that have relevant emissions within 5km from the site.
5	Total Emissions of Air Pollutants from the territory-wide waste transportation between the RTs and the site	-	Waste will be delivered to the site by marine vessel and the cumulative distance to be travelled is estimated to be 450km.
6	Overall Impact	<b>O / -</b>	Overall air quality impacts is considered to be ' <b>Neutral / Negative – Low</b> '. This is because local impacts are not anticipated due to the absence of ASRs within 500m from the site but there are potential for regional impacts (from waste delivery).
<b><i>Noise Assessment</i></b>			
1	Distance to areas of noise sensitive land use	<b>O</b>	There are no noise sensitive receivers (NSRs) within 300m of the artificial island site.
2	Topographic Features (Only applicable if there are NSRs within 300m)	<b>O</b>	The site is located within open marine waters with no NSRs located within 300m from the site boundary. Therefore, this criterion is not applicable.
3	Cumulative Impacts of developments within 300m	<b>O</b>	There are no known developments (existing or planned) within 300m of the site.
4	Overall Impact	<b>O</b>	<b>'Neutral'</b> .

	Impacts	Score	Commentary
<b>Water Quality Assessment</b>			
1	Water Course Diversion	0	As a marine site, no watercourse diversions are required.
2	Potential for sediment contaminant release	0	The sediment in the area has been proved to be uncontaminated as part of EPD routine monitoring programme. As such, the potential impact from the release of sediment bound contaminants associated with the dredging work is considered to be limited.
3	Potential impacts on WSRs	0 / -	No WQO exceedances were predicted in the construction phases. Although exceedances in DO and TIN were predicted in the operational phase, their standards were also breached in the baseline scenario and the elevations in DO and TIN in the presence of island were not considered high.  Therefore, the island would not be the cause of the exceedances and the impact is not considered high.
4	Potential Impacts on Groundwater	0	A marine site, so there are no groundwater issues.
5	Potential Cumulative Impacts (Potential for concurrent projects to exacerbate preceding impacts)	0 / -	Installation of the LPG submarine pipeline through Mirs Bay to Lamma Island will be complete before any work starts for the artificial island site.  The site is isolated and the anticipated track of any sediment plume would be to the southeast of the site. As such, whilst there may be concurrent works in the broader area from fill management activities at East of Ninepin, East Tung Lung Chau, South of Victor Rock and / or West Po Toi, the likelihood of cumulative effects on the secondary recreational contact sub-zone around the Po Toi group of islands is remote.
6	Overall Impact	0 / -	The isolation of this site means there is little potential for impact on WSRs to the west. Likewise, although there may be concurrent works with fill management activities in the general area of Eastern Waters, the potential for cumulative effects is considered marginal. Whilst impacts are not anticipated to be significant, the exposed nature of the site could present difficulties in implementing mitigation measures. Overall impact considered to be <b>'Neutral / Negative – Low'</b> .

	Impacts	Score	Commentary
<b>Waste Management Assessment</b>			
1	Balance of Materials (surplus/deficit of public fill needed for landfill development)	+	The site could accommodate significant amounts of public fill (370Mcum) negating the need to import filling material for site formation. Dredged muds will be incorporated with the fill materials within the island footprint.
2	GHG emissions from mode of transport for delivery of waste to the site from RTSs	-	Waste will be delivered to the site via marine vessel. The distance travelled from marine RTS(s) to the site has been estimated to be 450km.
3	Overall Waste Impact	<b>O</b>	<b>'Neutral'</b> . Overall the site is considered to have neutral impact due to the balance of the benefit of being able to accommodate C&D surplus materials and the relatively larger amount of GHG emissions from the long distance travelled.
<b>Ecological Assessment</b>			
1	Potential for secondary environmental impacts on "Areas of Absolute Exclusion"	<b>O</b>	The nearest marine based "Area of Absolute Exclusion" is the Bluff / Basalt Island SSSI (17km northwest). The distance is such that adverse impacts are not anticipated.
2	Affects an important habitat	<b>O / -</b>	Any sediment plume that may form has the potential to affect pelagic and inter-tidal resources of ecological value around the Po Toi group of islands. These particularly include the coral reef communities at the Cape D'Aguiar Marine Reserve and Po Toi, Beaufort Island, Sun Kong Island and Fury Rocks. The open waters around the artificial island site are habitat to fishes and possibly the Finless Porpoise and Green Turtle, albeit not a significant one.
3	Affects a species of conservation importance	<b>O / -</b>	The Finless Porpoise and the Green Turtle have both been observed in the broader area, although sightings suggest that neither species has any significant use of the waters within and adjacent to the site.
4	Potential for Cumulative Ecological impacts on sites of recognised value	<b>O / -</b>	Installation of the LPG submarine pipeline through Mirs Bay to Lamma Island will be complete before any work starts for the artificial island site.  The site is isolated and the anticipated track of any sediment plume would be to the southeast of the site. As such, whilst there may be concurrent works in the broader area from fill management activities at East of Ninepin, East Tung Lung Chau, South of Victor Rock and / or West Po Toi, the likelihood of cumulative effects on ecological receivers around the Po Toi group is slight.
5	Overall Ecological Impact	<b>O / -</b>	There is marginal potential for impact under each of the evaluation criteria, and hence <b>'Neutral / Negative – Low'</b> overall.

	Impacts	Score	Commentary
<b>Fisheries Assessment</b>			
1	Potential for secondary environmental impacts on "Areas of Absolute Exclusion"	O / -	There is a Fisheries Protection Area (FPA) and an artificial reef (AR) deployment area at Port Shelter. The potential for any sediment plume to be carried towards this area is remote given the distance and the hydrodynamics across the area.
2	Affects an important mariculture / fisheries resources (including spawning / nursery ground)	-	The site is not an important spawning or nursery ground, but any sediment plume that may form could be transported west of the site and through an important spawning area for commercially valuable fish species.
3	Potential for Cumulative Fisheries Impacts on sites of recognised value	O / -	As with ecology, there would be potential for adverse cumulative impacts (sediment induced) should concurrent fill management related marine works be in progress.
4	Overall Impact	O / -	There is potential for adverse impact on the fisheries spawning area west of the site, and marginal potential for impact upon the FPA and AR deployment area at Port Shelter. The cumulative impact potential is marginal, so overall: ' <b>Neutral / Negative – Low</b> '.
<b>Cultural Heritage Assessment</b>			
1	Important cultural (Declared, Deemed or Graded sites) / archaeological sites	O	There are no known sites of cultural heritage significance.
2	Potential for archaeological value	-	The site is remote from land based archaeological sites with links to maritime activities. Notwithstanding the lack of archaeological data currently available at the site, it is considered that the likelihood of archaeological remains in this area is low. A detailed marine archaeological investigation should be carried out in any future studies.
3	Potential for Cumulative Heritage Impacts on sites of recognised value	O	There are no planned or confirmed projects, which may cause cumulative heritage impacts.
4	Overall Impact	O	' <b>Neutral</b> '. The potential impacts on cultural heritage are considered to be negligible. The site is remote from land based archaeological sites with links to maritime activities. A detailed marine archaeological investigation should be carried out in any future studies.

	Impacts	Score	Commentary
<b>Landscape and Visual Impact Assessment</b>			
1	Implications for Landscape Planning and Designations	0	This area of seascape is not covered by any planning designations reflecting landscape/seascape values and so there will be no impact on these values. Overall impacts will therefore be Neutral.
2	Impacts on Landscape Resources	0	As the site lies in a marine area, there are no impacts on landscape resources. Overall impacts will therefore be Neutral.
3	Impacts on Landscape Character	-	Construction and operation of the island will contrast with the simple, open and tranquil qualities of the area. Once completed, the afteruse mitigation will reduce the overall impact of the island somewhat. The absence of any surrounding landforms will serve to mitigate the artificial qualities of the island landform. Overall resulting impacts on landscape character will be Negative – Low.
4	Overall Visual Impacts	-	The number of VSRs affected by the island landfill is very few and most are so distant (over 20km) that the island would not affect them. The most affected VSRs are a very limited number of recreational VSRs that use the area for passive and active recreation. Generally therefore, visual impacts will be Negative – Low.
5	Overall Impact	-	Overall, landscape and visual impacts will be <b>'Negative – Low'</b> for the following reasons: <ul style="list-style-type: none"> <li>• There are no landscape designations covering the disposal site;</li> <li>• No significant landscape resources are affected;</li> <li>• The open, natural and isolated landscape character of the Eastern Coastal Waters will be slightly compromised;</li> <li>• There are very low numbers of residential VSRs within the visual envelope of the site and an extremely small number close to it.</li> </ul>
<b>Landfill Gas Assessment</b>			
1	Distance between the new / extended landfill and SRs	0	The nearest sensitive receivers are >250m from the site.
2	Number of Receivers within 250m (i.e. the LFG Consultation Zone)	0	There are no sensitive receivers within 250m of the site.
3	Man Made/Natural Pathways for LFG Migration	0	None.
4	Additional Utilisation of LFG to Reduce Greenhouse Gas Emissions	0	There are no potential users of LFG (other than on-site use)
5	Overall Landfill Gas Impact	0	<b>'Neutral'</b> .

**Table 15.2: Summary of Southeast Offshore Island Landfill SEA**

<b>Overall Impacts</b>	<b>Score</b>	<b>Commentary</b>
Overall Air Quality Impact	<b>0 / -</b>	Neutral / Negative – Low
Overall Noise Impact	<b>0</b>	Neutral
Overall Water Quality Impact	<b>0 / -</b>	Neutral / Negative – Low
Overall Waste Management Impact	<b>0</b>	Neutral
Overall Ecological Impact	<b>0 / -</b>	Neutral / Negative – Low
Overall Fisheries Impact	<b>0 / -</b>	Neutral / Negative – Low
Overall Cultural Heritage Impact	<b>0</b>	Neutral
Overall Landscape & Visual Impact	<b>-</b>	Negative – Low
Overall Landfill Gas Impact	<b>0</b>	Neutral



**Table 15.3 Assessment of Significance of Visual Impacts for Southeast Offshore Island Landfill During Construction / Operation Phase for SE Offshore Island Landfill (Note: All impacts adverse unless otherwise noted)**

Identity No. of VSR	Key Visually Sensitive Receiver (VSR)	Approx Minimum Distance Between VSR and Source(s)	No.s of Receivers (order of magnitude only)	Magnitude of Impact During Construction / Operation (Negligible, Small, Intermediate, Large)	Receptor Sensitivity (Low, Medium, High)	Impact Significance before Mitigation Measures (Insubstantial, Slight, Moderate, Substantial)	Significance of Residual Impacts (Insubstantial, Slight, Moderate, Substantial)
<i>Residential Receivers</i>							
VR65	Stanley	25km	Many	Negligible	Low	Insubstantial	Insubstantial
<i>Recreational Receivers</i>							
VR68	Shek O	21km	Many	Negligible	Medium	Insubstantial	Insubstantial
VR69	Clear Water Bay	21km	Many	Negligible	Medium	Insubstantial	Insubstantial
VR71	Leung Shuen Wan Chau (High Island)	30km	Few	Negligible	Medium	Insubstantial	Insubstantial
VR11	Area for Boating, Fishing, Diving and other Water sports activities	0.5 – 25km (Varies)	Very Few	Small	Medium	Moderate to Slight	Insubstantial
<i>Travelling Receivers</i>							
VR49	On Vessels using the Shipping Lanes	0.5 – 25km (Varies)	Very Few	Small	Low	Slight	Insubstantial

**Table 15.4 Assessment of Significance of Visual Impacts for Southeast Offshore Island Landfill During Afteruse Phase**  
(Note: All impacts adverse unless otherwise noted)

Identity No. of VSR	Key Visually Sensitive Receiver (VSR)	Approx Minimum Distance Between VSR and Source(s)	No.s of Receivers (order of magnitude only)	Magnitude of Impact During Afteruse (Negligible, Small, Intermediate, Large)	Receptor Sensitivity (Low, Medium, High)	Impact Significance before Mitigation Measures (Insubstantial, Slight, Moderate, Substantial)	Significance of Residual Impacts (Insubstantial, Slight, Moderate, Substantial)
<i>Residential Receivers</i>							
VR65	Stanley	25km	Many	Negligible	Low	Insubstantial	Insubstantial
<i>Recreational Receivers</i>							
VR68	Shek O	21km	Many	Negligible	Medium	Insubstantial	Insubstantial
VR69	Clear Water Bay	21km	Many	Negligible	Medium	Insubstantial	Insubstantial
VR71	Leung Shuen Wan Chau (High Island)	30km	Few	Negligible	Medium	Insubstantial	Insubstantial
VR11	Area for Boating, Fishing, Diving and other Water sports activities	0.5 – 25km (Varies)	Very Few	Small	Medium	Moderate to Slight	Insubstantial
<i>Travelling Receivers</i>							
VR49	On Vessels using the Shipping Lanes	0.5 – 25km (Varies)	Very Few	Small	Low	Slight	Insubstantial