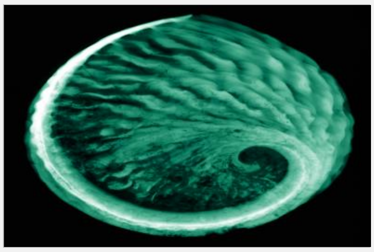
ANNEX A

ENVIRONMENTAL REVIEW REPORT FOR THE BPPS PIPELINE CONSTRUCTION OPTIONS



Capco 青山發電有限公司 Castle Peak Power Co. Ltd.

Hong Kong Offshore LNG Terminal Project

Environmental Review Report for the BPPS Pipeline Construction Options

27 July 2020

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Hong Kong Offshore LNG Terminal Project

Environmental Review Report for the BPPS Pipeline Construction Options

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1. INTRODUCTION

1.1 Background

To support the increased use of natural gas in Hong Kong from 2020 onwards, CLP Power Hong Kong Limited (CLP) and The Hongkong Electric Co., Ltd. (HK Electric) have identified that the development of an offshore liquefied natural gas (LNG) receiving terminal in Hong Kong using Floating Storage and Regasification Unit (FSRU) technology ('the Project') presents a viable additional gas supply option that can access competitive gas supplies from world markets. The Project will involve the construction and operation of an offshore LNG import facility to be located in the southern waters of Hong Kong, a double berth jetty, and subsea pipelines that connect to the gas receiving stations (GRS) at the Black Point Power Station (BPPS) and the Lamma Power Station (LPS).

According to the approved Environmental Impact Assessment (EIA) Report (EIAO Register No. AEIAR-218/2018), the installation of subsea gas pipeline will involve primarily jetting, supplemented by dredging with grab dredgers and potentially trailing suction dredger hopper (TSHD). The jetting and dredging areas of the BPPS Pipeline and LPS Pipeline proposed in the approved EIA Report are shown in *Figure 1.1*. Sediment dispersion modelling study and assessments were conducted in the EIA to evaluate the potential environmental impact as a result of subsea pipeline installation. With the implementation of proposed mitigation measures, no unacceptable residual environmental impact from subsea pipeline installation works is expected.

As the BPPS Pipeline design progresses and in further discussion with relevant Subsea Cable Owners on subsea pipeline / cable crossings as mentioned in Section 2.3.3 and Section 3.4.3 of the approved EIA Report, the construction methods of the BPPS Pipeline have been reviewed and the latest construction methods at different sections of the BPPS pipeline route is shown in *Figure 1.2*. Some potential options of BPPS Pipeline construction methods have been proposed:

- Jetting at Sha Chau to Lung Kwu Chau (KP36.0 - 37.5);
- Jetting at Southwest Lantau (KP15.6 - 21.3); and
- Dredging and/or jetting two segments ("subsea cable sterile corridors") within the Jetty Approach (KP1.49 to KP2.75 and KP3.55 to KP4.43) (*Figure 1.3*).

The above construction options are not covered in the assessments and water quality modelling scenarios included in the approved EIA Report. Therefore quantitative modelling have been completed and supplementary assessments conducted to confirm the environmental acceptability of these options making reference to the approved EIA Report.

1.2 Purpose of this Report

This *Environmental Review Report* (ERR) is prepared to provide the details for the above options of BPPS Pipeline construction methods, and review the likely environmental impacts assessed in the approved EIA Report based on these options. In particular, it outlines the corresponding water quality modelling scenarios and assumptions to assess water quality impacts, as well as the results of the modelling assessment. Unless otherwise specified, the water quality model, modelling assumptions, water quality sensitive receivers and assessment criteria adopted in the approved EIA Report are followed. This ERR also provides recommendations as to whether any modification and/or refinement of proposed mitigation measures and monitoring and audit requirements is needed.

1.3 Structure of this Report

Following this introductory section, the remainder of this ERR is organized as follows:

- Section 2 describes the BPPS Pipeline construction methods proposed in the approved EIA Report, and the corresponding modelling assumptions and scenarios adopted;

- Section 3 presents the proposed construction options for selected sections of the BPPS Pipeline, and the modelling assumptions and scenarios for these proposed construction options;
- Section 4 describes the potential impacts associated with the proposed construction options, presents the results of water quality modelling, and provides the results of supplementary environmental assessments;
- Section 5 includes a review of the environmental monitoring and audit requirements for the construction of the BPPS Pipeline; and
- Section 6 provides the conclusions of this environmental review.

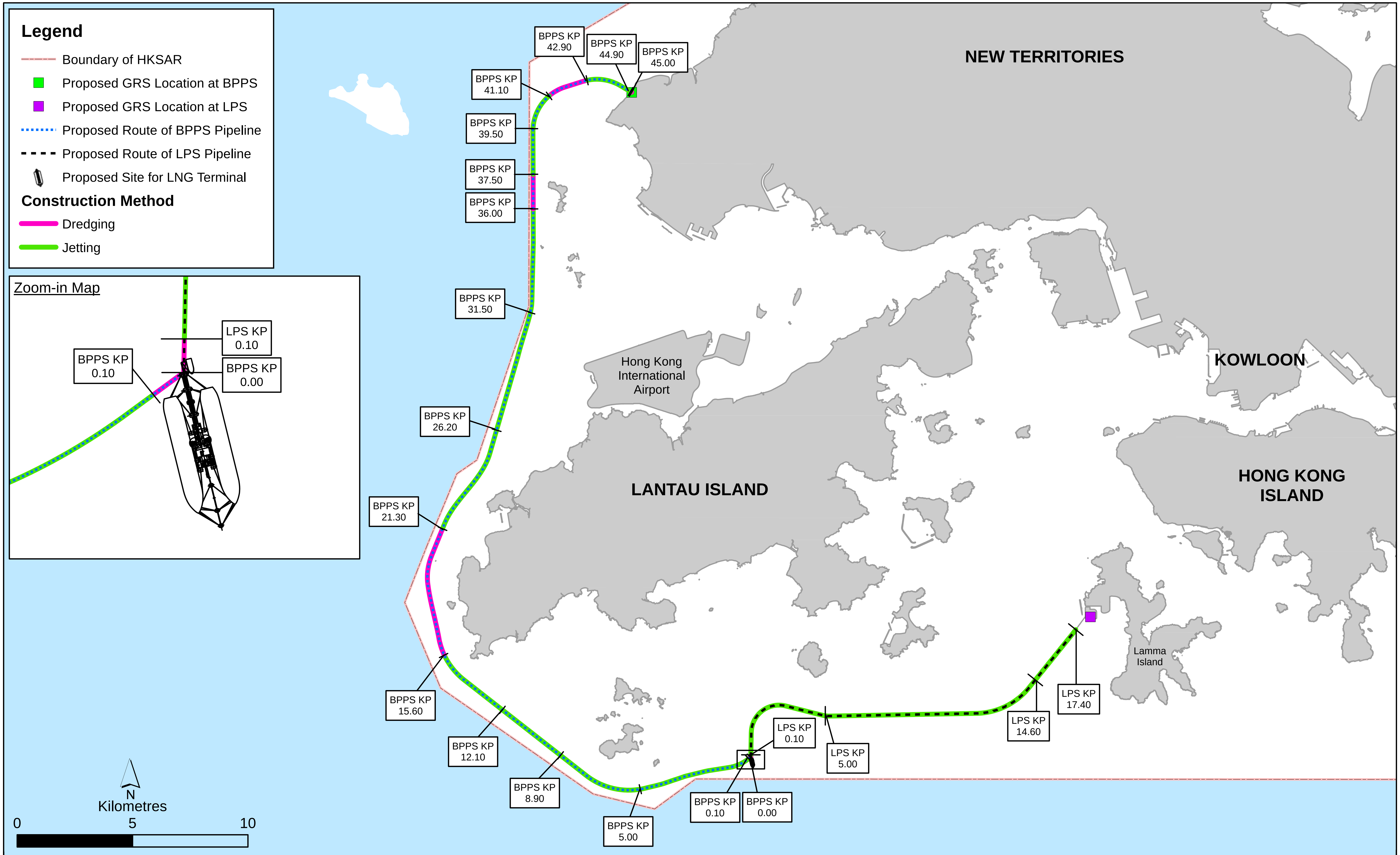

Figure 1.1

Overview of Project Pipeline Construction Methods proposed in the Approved EIA Report

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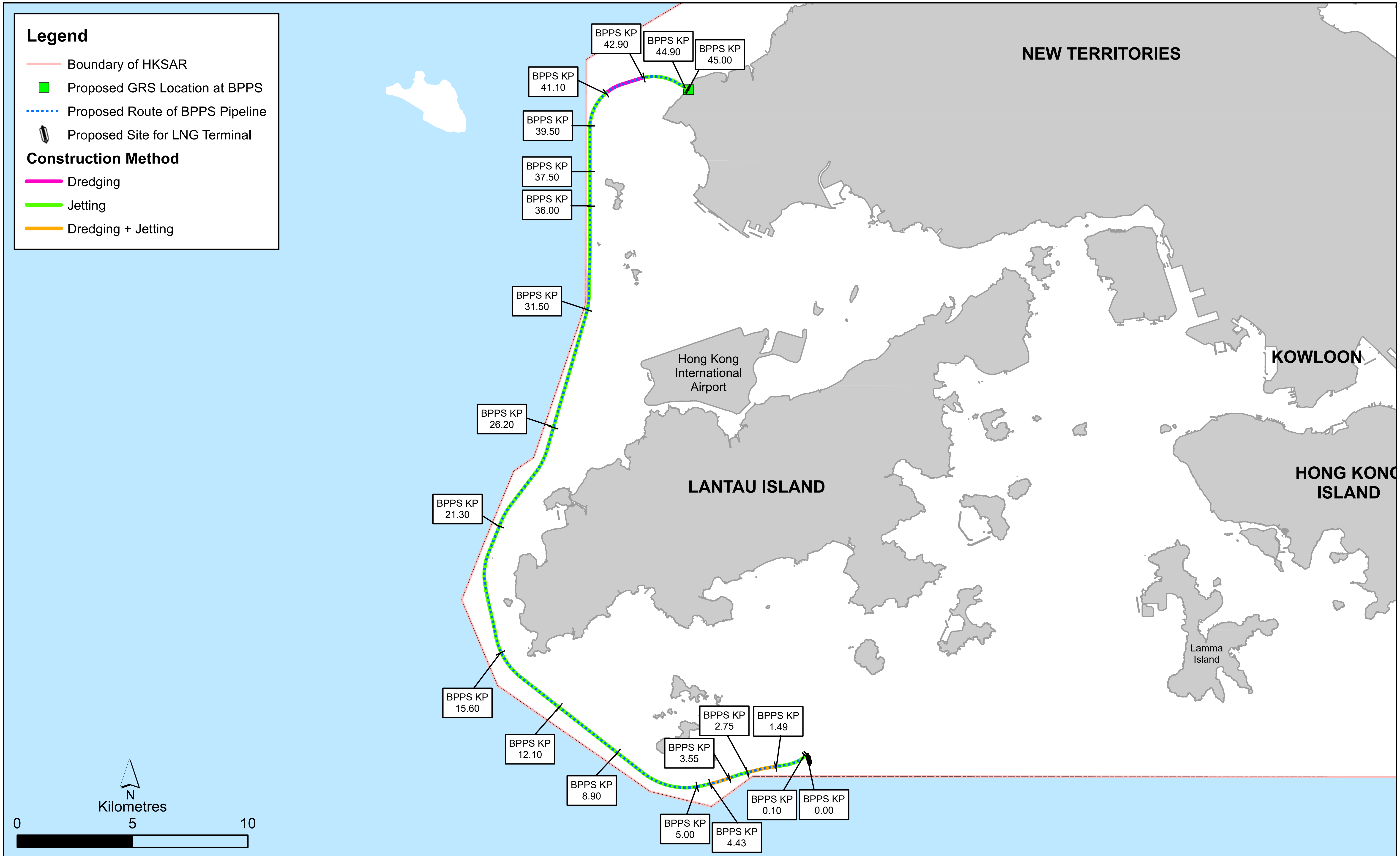

Figure 1.2

Latest Construction Methods for the BPPS Pipeline Route

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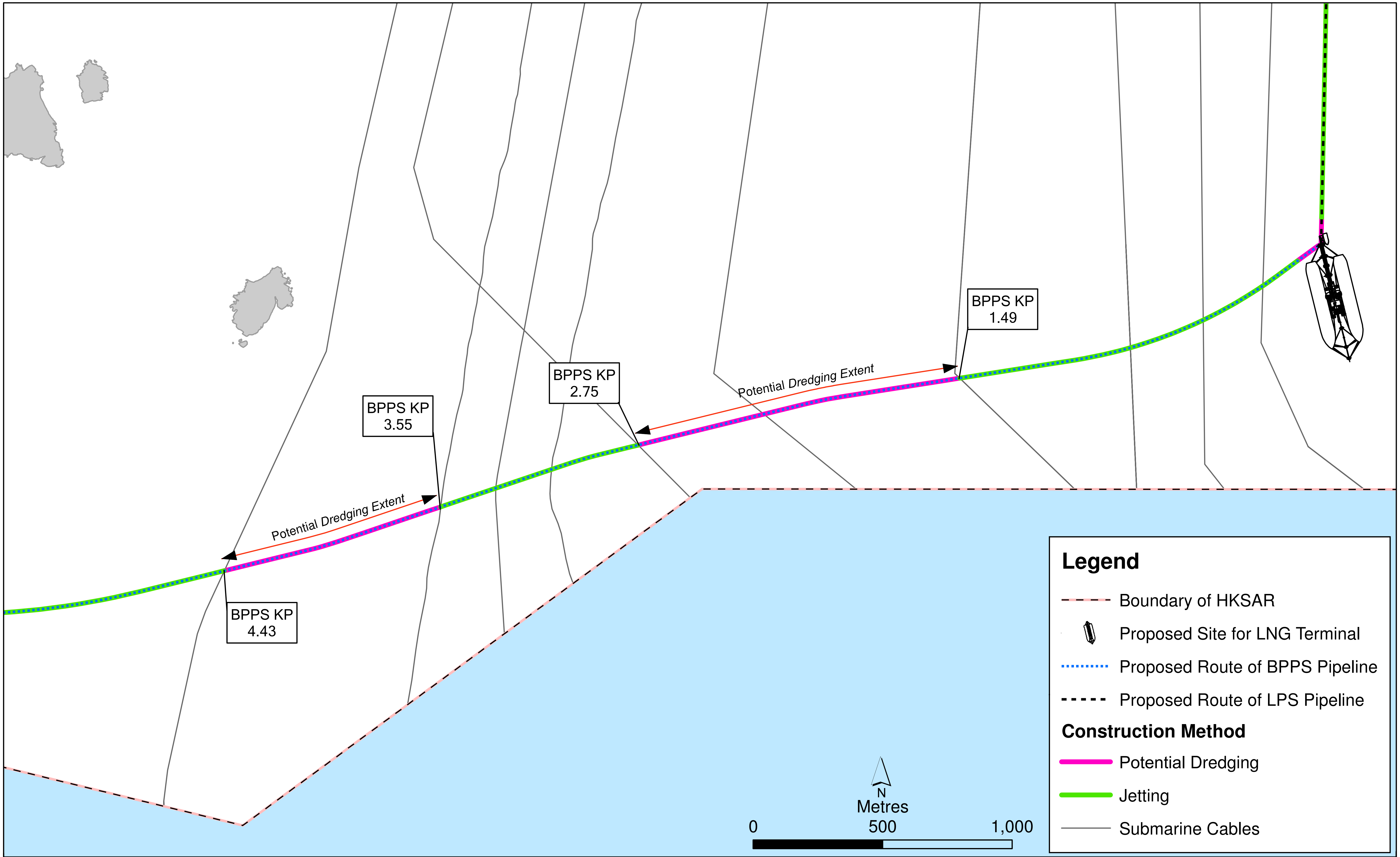

Figure 1.3

Location of Potential Dredging Extent at the Subsea Cable Sterile Corridors

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2. BPPS PIPELINE CONSTRUCTION METHODS IN THE APPROVED EIA REPORT

2.1 Introduction

Major water quality modelling scenarios and assumptions adopted in the EIA study were provided in *Annex 7B* of the approved EIA Report. The following sections highlight the key assumptions adopted and modelling scenarios assessed for the construction of the BPPS Pipeline.

2.2 Proposed Construction Methods

In the approved EIA Report, marine construction works for the installation of the BPPS Pipeline was assumed to be conducted using jetting, grab dredging as well as TSHD dredging. The use of different construction methods are summarized in *Table 3.3* of the *Annex 7B* of the approved EIA Report and the relevant information for the BPPS Pipeline is recapped in *Table 2.1*.

Table 2.1 Works Programme at Different Sections of the BPPS Pipeline

Location (Kilometer Point)	Plant Used	Work Rate (m^3/day) (1)	Working Hours per Day assumed for modelling
Pipeline Riser Sections at Double Berth Jetty			
Pipeline Riser (KP0.0 – 0.1 for both pipelines)	1 Grab Dredger	8,000	24
From Double Berth Jetty to BPPS			
Jetty Approach (KP0.1 – 5.0)	1 Jetting Machine	1,000m/day	24
South of Soko Islands (KP5.0 – 8.9)	1 Jetting Machine	1,000m/day	24
Southwest of Soko Islands (KP8.9 - 12.1)	1 Jetting Machine	1,000m/day	24
Adamasta Channel (KP12.1 - 15.6)	1 Jetting Machine	1,000m/day	24
Southwest Lantau (KP15.6 - 21.3)	2 Grab Dredgers OR 1 TSHD (2)	Total 16,000 OR 57,600	24
West of Tai O to West of HKIA (KP21.3 – 31.5)	1 Jetting Machine	1,500m/day	24
Sha Chau to Lung Kwu Chau (KP31.5 - 36.0)	1 Jetting Machine	720m/day	24
Sha Chau to Lung Kwu Chau (KP36.0 – 37.5)	1 Grab Dredger	8,000	24
Lung Kwu Chau to Urmston Anchorage (37.5 - 41.1)	1 Jetting Machine	1,000m/day	24
Urmston Road (KP41.1 – 42.9)	1 Grab Dredger OR 1 TSHD (2)	8,000 OR 64,800	24
West of BPPS (KP42.9 - 44.9)	1 Jetting Machine	1,000m/day	24
Pipeline shore approach at BPPS (KP44.9 - 45.0)	1 Grab Dredger	1,500	24

Note:
(1) For jetting, the values provided are in m/day.
(2) TSHD: trailing suction hopper dredger

2.3 Modelling Assumptions and Scenario Adopted

Sediment loss rate and discharge behaviour for sediment dispersion modelling were determined based on the proposed construction methods and plants used. Major modelling assumptions adopted for modelling scenarios are summarized in *Table 3.5* of the *Annex 7B* of the approved EIA Report and the relevant information for the BPPS Pipeline is recapped in *Table 2.2*.

Table 2.2 Summary of Modelling Sediment Sources for the BPPS Pipeline – Unmitigated Scenarios of the Approved EIA Report

Sediment Source ID	Location (Kilometer Point)	Plant Used	Work Rate (m^3/day) (1)	Sediment Loss Rate (kg/s) (2)
	Pipeline Riser Sections at Double Berth Jetty			
03_G	Pipeline Riser (KP0.0 – 0.1 for both pipelines)	Grab Dredger	8,000	1.8519
	From Double Berth Jetty to BPPS			
04_J_A	Jetty Approach (KP0.1 - 5.0)	Jetting Machine	1,000m/day	25.9259
04_J_B	South of Soko Islands (KP5.0 - 8.9)	Jetting Machine	1,000m/day	25.9259
04_J_C	Southwest of Soko Islands (KP8.9 - 12.1)	Jetting Machine	1,000m/day	25.9259
04_J_D	Adamasta Channel (KP12.1 - 15.6)	Jetting Machine	1,000m/day	25.9259
05_G	Southwest Lantau (KP15.6 - 21.3) – Location 1	Grab Dredger	8,000	1.8519
06_G	Southwest Lantau (KP15.6 - 21.3) – Location 2	Grab Dredger	8,000	1.8519
05_T	Southwest Lantau (KP15.6 - 21.3)	TSHD	57,600	10.6667
07_J	West of Tai O to West of HKIA (KP21.3 – 31.5)	Jetting Machine	1,500m/day	38.8889
08_J	Sha Chau to Lung Kwu Chau (KP31.5 - 36.0)	Jetting Machine	720m/day	18.6667
09_G	Sha Chau to Lung Kwu Chau (KP36.0 - 37.5)	Grab Dredger	8,000	1.8519
10_J	Lung Kwu Chau to Urmston Anchorage (KP37.5 - 41.1)	Jetting Machine	1,000m/day	25.9259
11_G	Urmston Road (KP41.1 – 42.9)	Grab Dredger	8,000	1.8519
11_T	Urmston Road (KP41.1 – 42.9)	TSHD	64,800	10.6667
12_J	West of BPPS (KP42.9 - 44.9)	Jetting Machine	1,000m/day	25.9259
13_G	Pipeline landing at BPPS (KP44.9 - 45.0)	Grab Dredger	1,500	0.3472

Note:
(1) For jetting, the values provided are in m/day.
(2) Effect of mitigation measures not taken into account.

Water quality modelling predicted that, without mitigation, dredging and jetting works of the BPPS Pipeline would result in suspended solids (SS) level that would exceed the corresponding assessment criterion based on the Water Quality Objectives (WQO) at certain water sensitive receivers (WSRs). Mitigation measures, such as work rate reduction, provision of silt curtain at sediment sources and WSRs are recommended to manage water quality impacts to within acceptable levels. In addition, to mitigate potential impacts on marine mammals/ marine parks, pipeline dredging/ jetting works between North of Tai O and Fan Lau will avoid the peak months of Chinese White Dolphin (CWD) calving (May and June), and pipeline dredging / jetting works between South of Soko Islands and the Offshore LNG Terminal will be restricted to a daily maximum of 12 hours with daytime (0700 – 1900) operations. Key mitigation measures as well as working rates are summarized in *Table 7.18* of the approved EIA Report and the relevant information for the BPPS Pipeline is recapped in *Table 2.3*.

Table 2.3 Mitigation Measures for the BPPS Pipeline Construction Works

Work Location	Plants Involved	Allowed Maximum Work Rate	Silt Curtain at Plants	Silt Curtain at WSRs	Other Measures
Pipeline Riser (KP0.0 – 0.1)	1 Grab Dredger	8,000 m^3 day^{-1} for 24 hours each day	Yes	Not required	Daily maximum of 12 hours with daylight (0700 – 1900)
Jetty Approach (KP0.1 – 5.0)	1 Jetting Machine	1,000 m day^{-1} for 24 hours each day	Yes	Two layers at Southern Boundary of the Proposed South Lantau MP (KP0.1-8.9)	Daily maximum of 12 hours with daylight (0700 – 1900)
South of Soko Islands (KP5.0 – 8.9)	1 Jetting Machine	1,000 m day^{-1} for 24 hours each day	Yes		
Southwest of Soko Islands (KP8.9 - 12.1)	1 Jetting Machine	1,000 m day^{-1} for 24 hours each day	Yes	Not required	
Adamasta Channel (KP12.1 - 15.6)	1 Jetting Machine	1,000 m day^{-1} for 24 hours each day	Yes	Not required	
Southwest Lantau (KP15.6 - 21.3)	2 Grab Dredgers	Total 16,000 m^3 day^{-1} for 24 hours each day 8,000 m^3 day^{-1} for each plant	Yes	Not required	Avoid the peak months of CWD calving (May and June)
	1 TSHD (Alternative)	57,600 m^3 day^{-1} for 24 hours each day	Not required	Not required	
West of Tai O to West of HKIA (KP21.3 – 31.5)	1 Jetting Machine	1,500 m day^{-1} for 24 hours each day from KP KP26.2 to 21.3 720 m day^{-1} for 24 hours each day from KP31.5 to 26.2	Yes	Not required	
Sha Chau to Lung Kwu Chau (KP31.5 – 36.0)	1 Jetting Machine	720 m day^{-1} for 24 hours each day	Yes	Two layers at Western Boundary of the Sha Chau and Lung Kwu Chau MP (KP31.5-36.0)	
Sha Chau to Lung Kwu Chau (KP36.0 - 37.5)	1 Grab Dredger	8,000 m^3 day^{-1} for 24 hours each day	Yes	Not required	
Lung Kwu Chau to Urmston Anchorage (37.5 - 41.1)	1 Jetting Machine	1,000 m day^{-1} for 24 hours each day	Yes	Two layers at NW corner of Sha Chau and Lung Kwu Chau MP (KP37.5-41.1)	
Urmston Road (KP41.1 – 42.9)	1 Grab Dredger	8,000 m^3 day^{-1} for 24 hours each day	Yes	Not required	
	1 TSHD (Alternative)	64,800 m^3 day^{-1} for 24 hours each day	Not required	Not required *	
West of BPPS (KP42.9 - 44.9)	1 Jetting Machine	1,000 m day^{-1} for 24 hours each day	Yes	Two layers at CR1, CR2	
Pipeline shore approach at BPPS (KP44.9 - 45.0)	1 Grab Dredger	1,500 m^3 day^{-1} for 24 hours each day	Yes	Two layers at CR1, CR2	

* The predicted sediment plume from grab dredging/ TSHD at this section would not reach CR1 and CR2 at the BPPS seawall, therefore additional silt curtain at CR1 and CR2 is not required.

3. PROPOSED CONSTRUCTION OPTIONS FOR SELECTED SECTIONS OF THE BPPS PIPELINE

3.1 Subsea Cable Sterile Corridors

In further discussion with relevant Subsea Cable Owners on subsea pipeline / cable crossings as mentioned in Section 2.3.3 and Section 3.4.3 of the approved EIA Report, two segments (KP1.49 to KP2.75 and KP3.55 to KP4.43) within the Jetty Approach Section of the BPPS Pipeline are proposed to be provided as "subsea cable sterile corridors" to cater for installation of future new subsea telecommunications cables. It is understood that future cables shall be buried at about 5m below the existing seabed level. Consequently along the subsea cable sterile corridors the BPPS Pipeline is required to be buried at about 8m (bottom of pipe) below the existing seabed level.

A number of construction options have been proposed to achieve the required burial depth at the subsea cable sterile corridors (*Table 3.1*):

- Option 1 involves jetting only to bury the pipeline to the required burial depth (about 8 m below seabed level); and
- Option 2 involves grab dredging to remove the sediment near the seabed (down to 1.5 m below seabed level), followed by jetting to install the pipeline to the required burial depth (about 8.5 m below seabed level).

Table 3.1 Works Programme at Selected Sections of the BPPS Pipeline

Location (Kilometer Point)	Plant Used	Work Rate (m^3/day) (1)	Working Hours per Day assumed for modelling
Subsea Cable Sterile Corridors			
Jetty Approach (KP0.1 - 1.49, KP2.75 - 3.55 and KP4.43 - 5.0)	1 Jetting Machine	1,000m/day	24
Cable sterile corridors (KP1.49 - 2.75 and KP3.55 - 4.43)	Option 1: 1 Jetting Machine OR	720m/day	24
	Option 2: 2 Grab Dredgers, followed by 1 Jetting Machine	8,000 for each dredger; 720m/day for jetting machine	
South of Soko Islands (KP5.0 – 8.9)	1 Jetting Machine	1,000m/day	24
Southwest of Soko Islands (KP8.9 - 12.1)	1 Jetting Machine	1,000m/day	24
Adamasta Channel (KP12.1 - 15.6)	1 Jetting Machine	1,000m/day	24
Alternative Construction Method			
Southwest Lantau (KP15.6 - 21.3)	1 Jetting Machine	1,500m/day	24
Sha Chau to Lung Kwu Chau (KP36.0 - 37.5)	1 Jetting Machine	720m/day	24

Note:
(1) For jetting, the values provided are in m/day.

Based on the results of the pipeline bending stress analysis, the maximum burial depth for a single jetting pass is limited to 3m. It is not possible to achieve the required pipeline burial depth (~ 8m bottom of pipe) with a single jetting pass. Hence, multiple passes of jetting will be necessary to bury the pipeline to 8m and each jetting pass will be kept within the limits of pipeline bending stress to protect the pipeline from breakage. Considering the maximum jetting depth for a single pass due to pipeline stress:

- Option 1 involves five (Option 1a) to seven (Option 1b) jetting passes to achieve the proposed pipeline burial depth; and
- The jetting portion of Option 2 involves seven passes to achieve the proposed pipeline burial depth.

The proposed trench configuration for each jetting pass has also been developed for the potential construction options. This is to allow for a more realistic presentation of sediment loss among successive jetting passes. For water quality modelling, the sediment loss rates associated with jetting along the subsea cable sterile corridors are calculated based on successive increase in trench cross section area per pass, assuming 100% fluidization of the trench per pass. Jetting cross-section areas and the sediment loss rates for modelling are listed in *Table 3.2*. Based on the modelling results from the approved EIA Report, mitigation measures in form of silt curtain at the jetting machine would be required to manage water quality impacts. The same sediment removal efficiency as the approved EIA Report (85% removal) has been adopted for the calculation in *Table 3.2*.

Table 3.2 Jetting Trench Cross-sectional Area and Associated Sediment Loss Rate at the Subsea Cable Sterile Corridors

Option	Data	Jetting Pass #						
		1	2	3	4	5	6	7
Option 1a (Jetting only, 5 passes)	Cross-sectional Area (m^2)	13.5	27.0	40.3	52.3	64.0	N/A	N/A
	Sediment Loss Rate (kg/s)	2.363	4.725	7.053	9.153	11.200	N/A	N/A
Option 1b (Jetting only, 7 passes)	Cross-sectional Area (m^2)	8.0	17.5	30.0	43.4	52.1	57.8	64.0
	Sediment Loss Rate (kg/s)	1.400	3.063	5.250	7.595	9.118	10.115	11.200
Option 2 (Grab Dredging followed by Jetting)	Cross-sectional Area (m^2)	7.0 (1)	15.5	23.3	30.7	38.1	44.9	50.8
	Sediment Loss Rate (kg/s)	1.225 (1)	2.713	4.078	5.373	6.668	7.858	8.890

Note:

(1) Sample calculation for sediment loss rate: Jetting Rate (m/s) × Cross Section of Jetting Trench (m^3/m) × % Mud Entrained × Dry Mud Density (kg/m^3) × (1 - Silt Curtain Efficiency) = 0.00833 m/s × 7 m^3/m × 20% × 700 (kg/m^3) × (1 – 85%) = 1.225 kg/s

(2) Design drawings showing the trench designs of Options 1a, 1b and 2 are provided in *Appendix C*.

3.2 Alternative Construction Method

Further engineering study of the BPPS Pipeline has identified that along the West of Lung Kwu Chau and Southwest Lantau pipeline segments, besides dredging, the use of jetting is also considered feasible from engineering perspective (1). The use of jetting along these two segments can further reduce the dredged sediment volumes associated with the construction of the Project, and may be preferred where allowable in the context of WQO compliance. The proposed jetting rates for pipeline installation in these two segments are summarised in *Table 3.1.*

3.3 Proposed Modelling Assumptions and Scenarios

The assumptions and scenarios for water quality modelling related to the subsea cable sterile corridors and alternative construction method of the BPPS Pipeline are summarized in *Table 3.3*. The locations of these pipeline segments for modelling are presented in *Figures 3.1* to *3.4*.

Table 3.3 Summary of Modelling Sediment Sources *

Sediment Source ID	Location (Kilometer Point)	Plant Used	Work Rate (m^3/day) (1)	Sediment Loss Rate (kg/s)
	Scenario C05G Option 1a (with Silt Curtain at jetting machine)			
04_J_A	Jetty Approach (KP0.1 – 5.0) excluding Subsea Cable Sterile Corridors	Jetting Machine	1,000m/day	3.889
	Subsea Cable Sterile Corridors (KP1.49 - 2.75 and KP3.55 - 4.43)	Jetting Machine	720m/day	See Table 3.2
04_J_B	South of Soko Islands (KP5.0 – 8.9)	Jetting Machine	1,000m/day	3.889
04_J_C	Southwest of Soko Islands (KP8.9 – 12.1)	Jetting Machine	1,000m/day	3.889
04_J_D	Adamasta Channel (KP12.1 – 15.6)	Jetting Machine	1,000m/day	3.889
	Scenario C05F Option 1b (with Silt Curtain at jetting machine)			
04_J_A	Jetty Approach (KP0.1 – 5.0) excluding Subsea Cable Sterile Corridors	Jetting Machine	1,000m/day	3.889
	Subsea Cable Sterile Corridors (KP1.49 - 2.75 and KP3.55 - 4.43)	Jetting Machine	720m/day	See Table 3.2
04_J_B	South of Soko Islands (KP5.0 – 8.9)	Jetting Machine	1,000m/day	3.889
04_J_C	Southwest of Soko Islands (KP8.9 – 12.1)	Jetting Machine	1,000m/day	3.889
04_J_D	Adamasta Channel (KP12.1 – 15.6)	Jetting Machine	1,000m/day	3.889
	Scenario C01D Option 2 – Dredging (with Silt Curtain) #			
04_G_A	Subsea Cable Sterile Corridor 1 (KP1.49 – 2.75)	Grab Dredger	8,000	0.463 (2)
04_G_B	Subsea Cable Sterile Corridor 2 (KP3.55 – 4.43)	Grab Dredger	8,000	0.463
	Scenario C05E Option 2 – Jetting (with Silt Curtain at jetting machine)			
04_J_A	Jetty Approach (KP0.1 – 5.0) excluding Subsea Cable Sterile Corridors	Jetting Machine	1,000m/day	3.889 (3)
	Subsea Cable Sterile Corridors (KP1.49 - 2.75 and KP3.55 - 4.43)	Jetting Machine	720m/day	See Table 3.2
04_J_B	South of Soko Islands (KP5.0 – 8.9)	Jetting Machine	1,000m/day	3.889
04_J_C	Southwest of Soko Islands (KP8.9 – 12.1)	Jetting Machine	1,000m/day	3.889
04_J_D	Adamasta Channel (KP12.1 – 15.6)	Jetting Machine	1,000m/day	3.889

(1) As the Project progressed to Front End Engineering Design (FEED), further information has been gathered for optimization of the BPPS Pipeline trench design. The information includes latest marine traffic consideration to confirm pipeline protection design requirement, further Site Investigation (Vibrocoring) to identify soil characteristic, Finite Element Analysis on proposed trench designs and results of anchor model test, dredging volume reduction and pipeline burial depth requirements as indicated by local authorities (Marine Department and CEDD). The outcome from FEED is that the trench design for the West of Lung Kwu Chau and Southwest Lantau segments of the BPPS Pipeline can be optimized such that jetting is also an engineering feasible option besides dredging.

Sediment Source ID	Location (Kilometer Point)	Plant Used	Work Rate (m^3/day) (1)	Sediment Loss Rate (kg/s)
	Scenario C09A Southwest Lantau (with Silt Curtain at jetting machine)			
05_J	Southwest Lantau (KP15.6 – 21.3)	Jetting Machine	1,500m/day	5.833 (4)
	Scenario C08 Sha Chau to Lung Kwu Chau (with Silt Curtain at jetting machine)			
09_J	Sha Chau to Lung Kwu Chau (KP36.0 - 37.5)	Jetting Machine	720m/day	2.800 (5)

Note:

(1) For jetting, the values provided are in m/day.

(2) Sample calculation for sediment loss rate: Dredging Rate (m^3/s) × Loss Rate (kg/m^3) × (1 - Silt Curtain Efficiency) = 0.09259 m^3/s × 20 kg/m^3 × (1 – 75%) = 0.463 kg/s

(3) Sample calculation for sediment loss rate: Jetting Rate (m/s) × Cross Section of Jetting Trench (m3/m) × % Mud Entrained × Dry Mud Density (kg/m3) × (1 - Silt Curtain Efficiency) = 0.01157 m/s × 16 m3/m × 20% × 700 (kg/m3) × (1 – 75%) = 3.889 kg/s

(4) Sample calculation for sediment loss rate: Jetting Rate (m/s) × Cross Section of Jetting Trench (m3/m) × % Mud Entrained × Dry Mud Density (kg/m3) × (1 - Silt Curtain Efficiency) = 0.01736 m/s × 16 m3/m × 20% × 700 (kg/m3) × (1 – 85%) = 5.833 kg/s

(5) Sample calculation for sediment loss rate: Jetting Rate (m/s) × Cross Section of Jetting Trench (m3/m) × % Mud Entrained × Dry Mud Density (kg/m3) × (1 - Silt Curtain Efficiency) = 0.00833 m/s × 16 m3/m × 20% × 700 (kg/m3) × (1 – 85%) = 2.800 kg/s

* For jetting along non-subsea cable sterile corridors, a total of three passes would be modelled, and the sediment loss rate would remain to be the highest loss rate calculated based on the entire cross-section (16m^2).

For grab dredging under Option 2, all other concurrent grab dredging activities assessed in scenario C01A of the approved EIA Report were also included in the modelling exercise for cumulative impact assessment.

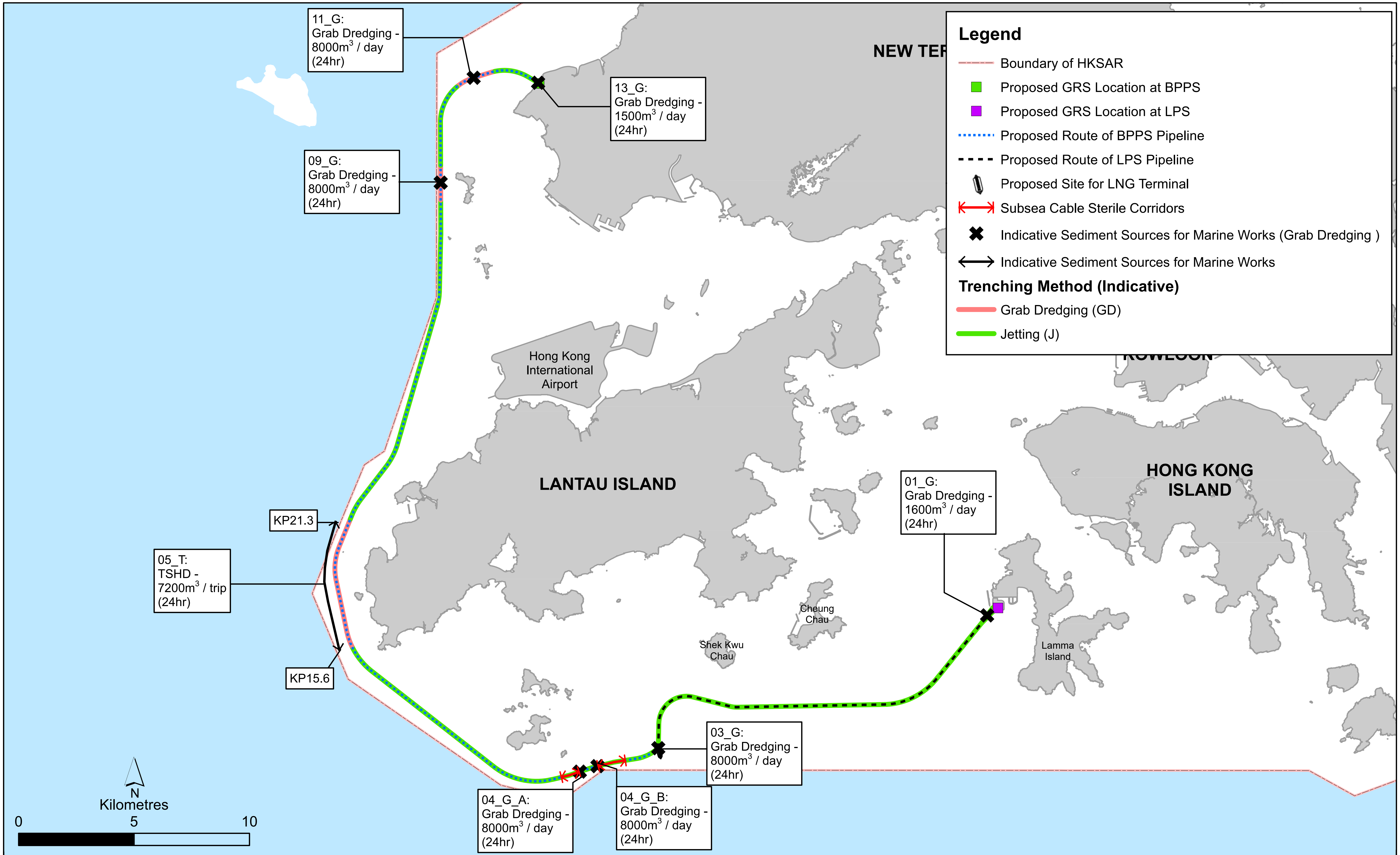


Figure 3.1

Indicative Sediment Sources for Marine Works to be Modelled - Scenario 1D

File: T:\GIS\CONTRACT\0505354\mxd\0505354_Sediment_Marine_Work_Scn_1A_v2.mxd
Date: 16/12/2019

Environmental Resources Management

ERM

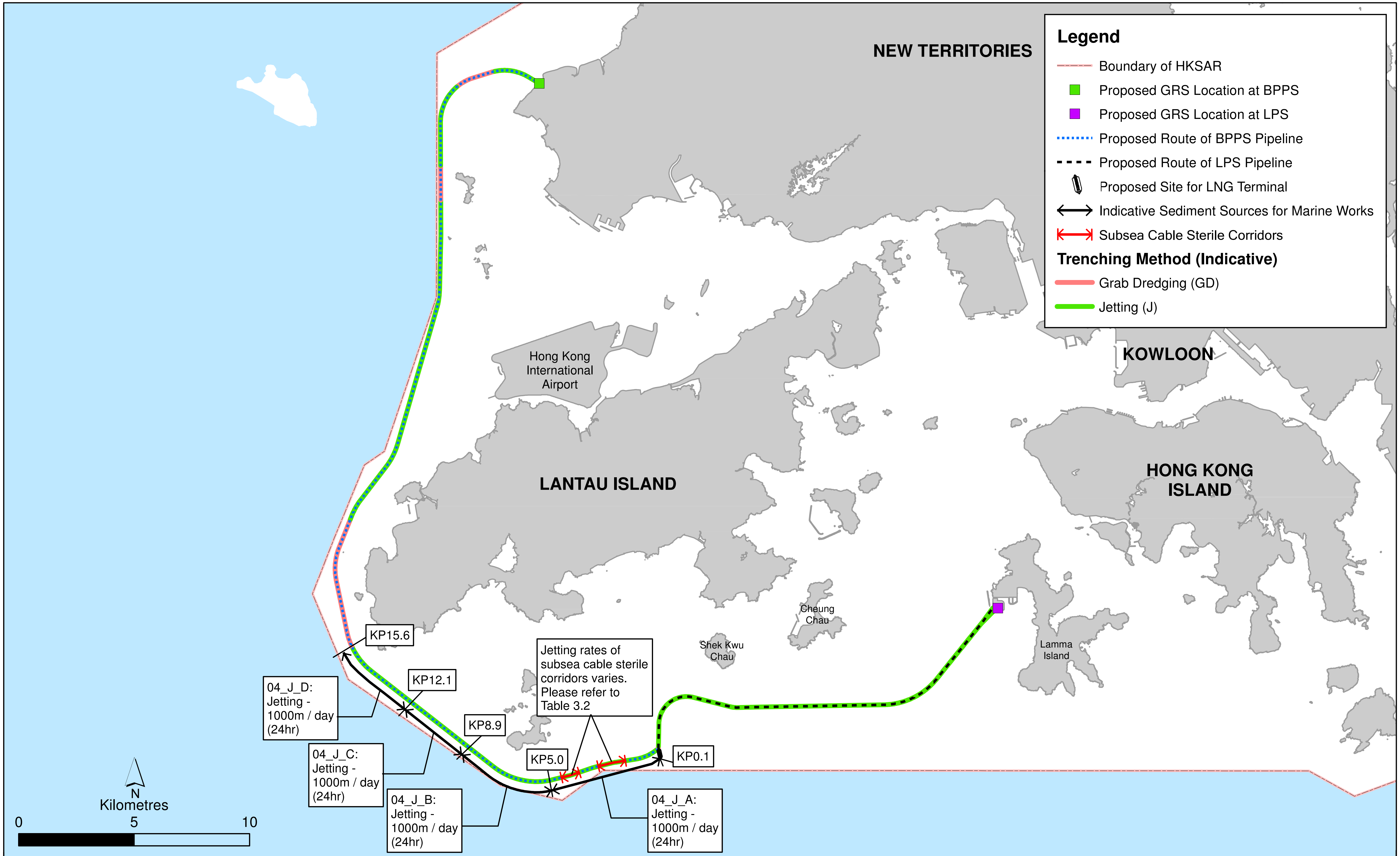


Figure 3.2

Indicative Sediment Sources for Marine Works to be Modelled - Scenario 5E / 5F / 5G

File: T:\GIS\CONTRACT\0505354\mxd\0505354_Sediment_Marine_Work_Scn_5_v2.mxd
Date: 20/11/2019

Environmental Resources Management

ERM

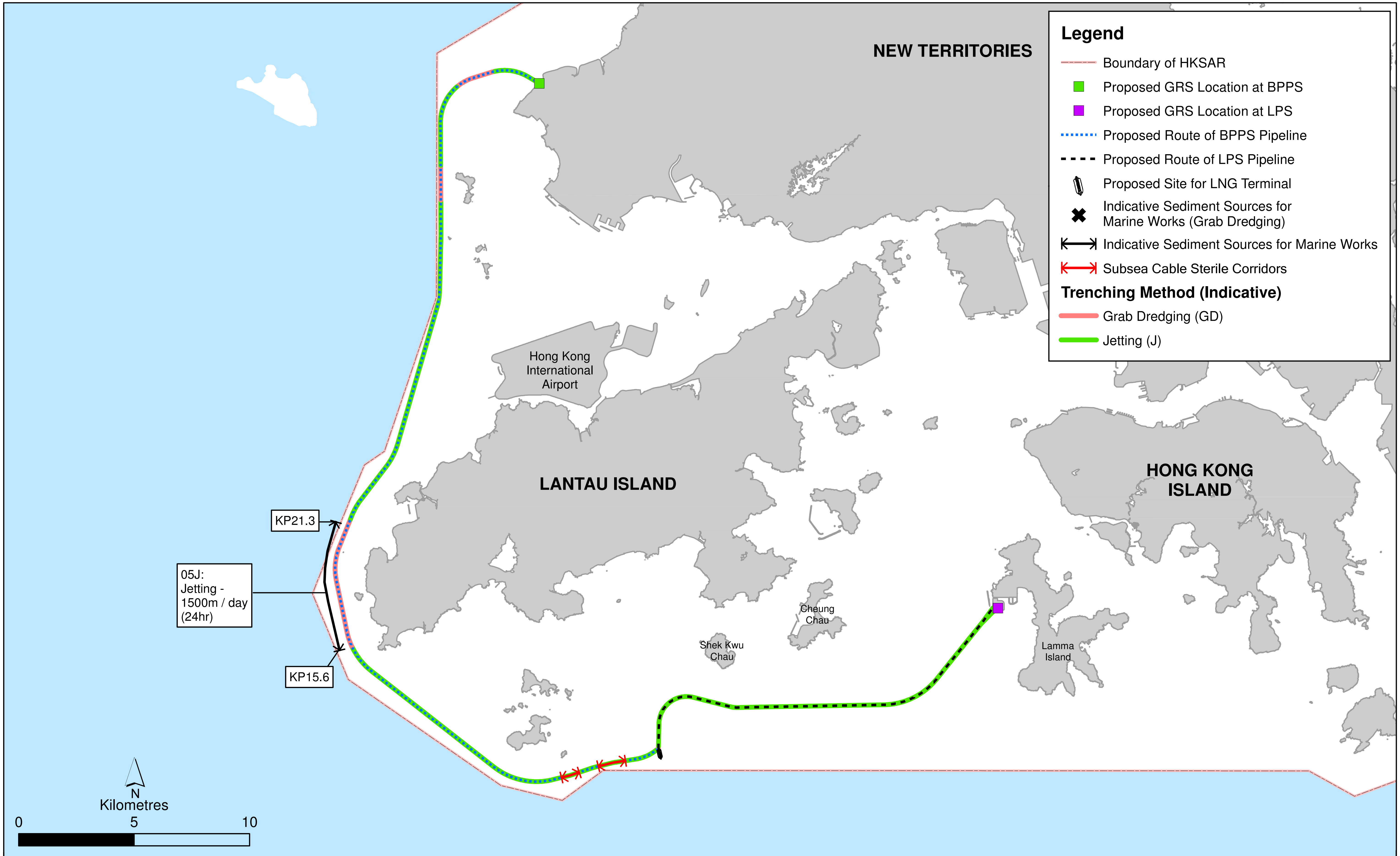


Figure 3.3

Indicative Sediment Sources for Marine Works to be Modelled - Scenario 9A

File: T:\GIS\CONTRACT\0505354\mxd\0505354_Sediment_Marine_Work_Scn_1B_v2.mxd
Date: 19/11/2019

Environmental Resources Management

ERM

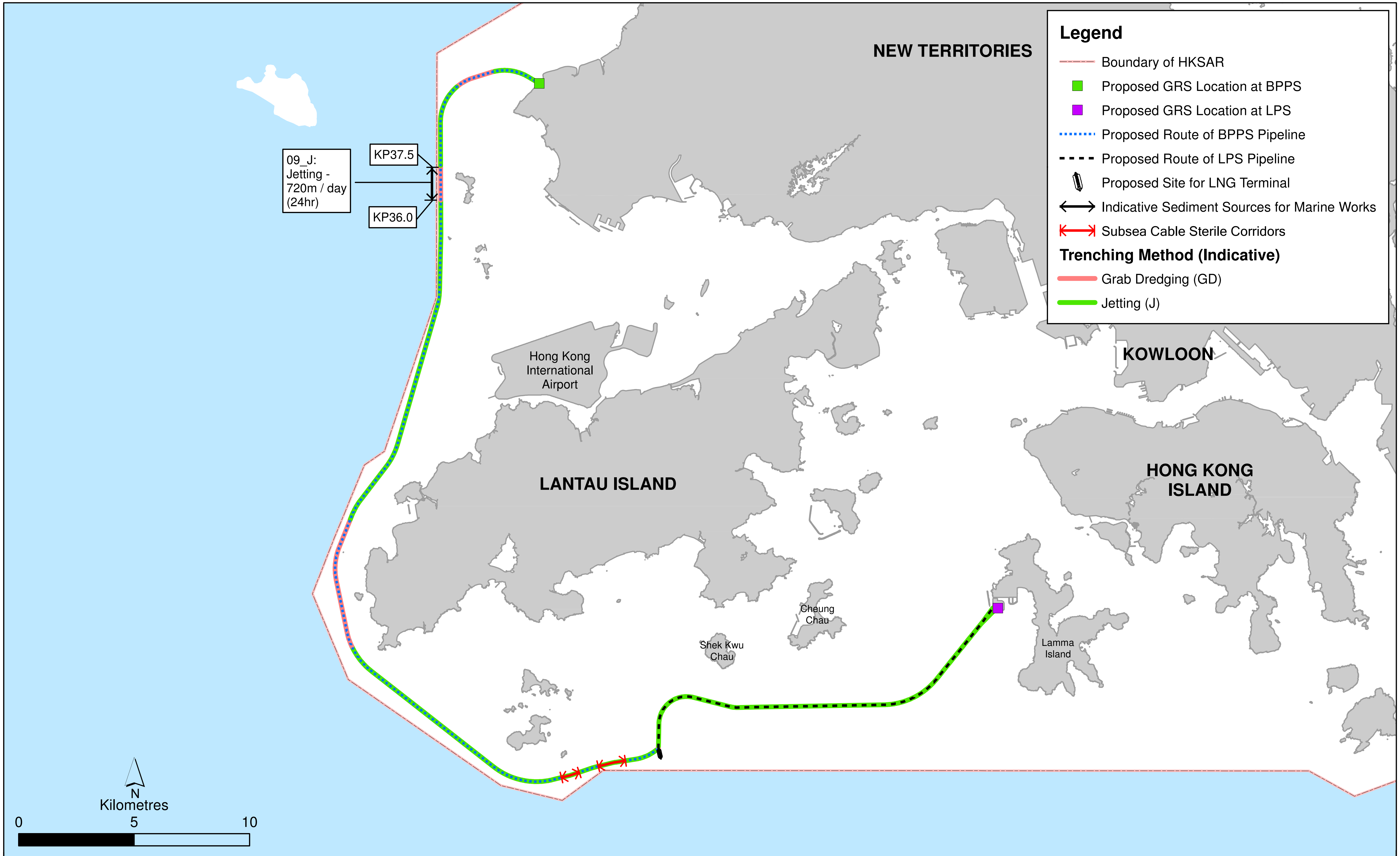


Figure 3.4

Indicative Sediment Sources for Marine Works to be Modelled - Scenario 8

File: T:\GIS\CONTRACT\0505354\mxd\0505354_Sediment_Marine_Work_Scn_3_v2.mxd
Date: 20/11/2019

Environmental Resources Management

ERM

4. POTENTIAL IMPACTS ON THE ENVIRONMENT

4.1 Key Environmental Issues Associated with the Proposed BPPS Pipeline Construction Options

Table 4.1 identifies the potential environmental impacts associated with the proposed construction options for selected sections of the BPPS Pipeline. It should be noted that the proposed construction options will not affect the operation of the pipeline, and hence no operation phase impact is anticipated.

Table 4.1 Potential Environmental Issues for Construction Phase

Aspect	Any Potential Impact?	Remarks
Air Quality	×	Pipeline dredging/ jetting works are not expected to generate fugitive dust given the marine nature of these activities. As discussed in Sections 4.6 and 4.8 of the approved EIA Report, in view of the marine nature of pipeline construction works and as there is no air sensitive receivers (ASR) within 500m along the subsea pipeline route, no adverse dust impact is anticipated and no unacceptable impact on air quality is expected.
Hazard to Life	×	For the subsea pipeline construction, LNG, natural gas and other dangerous goods will not be present; therefore, as discussed in Section 5.3 of the approved EIA Report, no hazard to life is expected during the construction of the subsea gas pipeline.
Noise	×	Potential noise sources during pipeline construction will mainly arise from Powered Mechanical Equipment (PME) operating at the marine barges. No noise sensitive receivers (NSRs) were identified within the 300m Assessment Area along the subsea pipeline route; therefore, as discussed in Sections 6.5 and 6.6 of the approved EIA Report, unacceptable adverse noise impacts due to the pipeline construction activities are not anticipated.
Water Quality	✓	
Waste Management Implications	✓	
Ecology	✓	As discussed in Section 9.9.1 of the approved EIA Report, unacceptable impacts on avifauna due to noise and light emissions from construction activities are also not expected.
Fisheries	✓	
Visual	×	According to Section 11.6 of the approved EIA report, the construction of subsea pipeline is not identified as one of the construction visual impacts of the Project.
Cultural and Heritage	×	As discussed in Section 12.4 of the approved EIA Report, the Marine Archaeological Investigation (MAI) concluded that there are no potential archaeological materials within the proposed pipeline dredging/ jetting areas, therefore no marine archaeological impact is expected to occur during the Project construction.

Notes:
(a) '✓'=Possible, '×' = Not Expected

A description and evaluation, where appropriate, of potential impacts on water quality, waste management implications, marine ecology and fisheries, the environmental changes arising from the proposed variations, and how the environment and the community might be affected by the proposed variations, are provided in the following sections.

4.2 Water Quality

Based on the construction options for the subsea cable sterile corridors, as well as the pipeline segments along Southwest Lantau and West of Lung Kwu Chau, a total of six sediment dispersion modelling scenarios were conducted. Results of the modelling exercise are discussed below. Statistics of modelling results are presented in *Tables 4.2* to *4.7* and contour plots of the modelling results are presented in Appendices A and B. It should be noted that the key WSRs that would be affected by the proposed pipeline construction works are identified in Table 7C.10 to 7C.18 of Annex 7C of the approved EIA Report. WSRs which are far away from these pipeline segments are minimally affected and hence are not included in *Tables 4.2* to *4.7*.

4.2.1 Suspended Solids (SS) Dispersion and Sedimentation

4.2.1.1 Subsea Cable Sterile Corridors – Option 1a

This scenario assesses the proposed five passes of jetting operation at the subsea cable sterile corridors (720 m/day, with silt curtain), together with the jetting for the rest of the BPPS Pipeline in South Lantau (1,000 m/day, with silt curtain). It is assumed silt curtain would be implemented at the southern boundary of the proposed South Lantau Marine Park. Results of this scenario are shown in *Table 4.2*. Contour plots of maximum SS elevation are provided in Appendix A-4 and A-10. Full compliance with the applicable WQO suspended solids (SS) criteria is predicted at all WSRs. No unacceptable water quality impact from the proposed jetting operation for construction of the subsea cable sterile corridors under Option 1a is expected.

4.2.1.2 Subsea Cable Sterile Corridors – Option 1b

This scenario assesses the proposed seven passes of jetting operation at the subsea cable sterile corridors (720 m/day, with silt curtain), together with the jetting for the rest of the BPPS Pipeline in South Lantau (1,000 m/day, with silt curtain). It is assumed silt curtain would be implemented at the southern boundary of the proposed South Lantau Marine Park. Results of this scenario are shown in *Table 4.3*. Contour plots of maximum SS elevation are provided in Appendix A-3 and A-9. Full compliance with the applicable WQO SS criteria is predicted at all WSRs. No unacceptable water quality impact from the proposed jetting operation for construction of the subsea cable sterile corridors under Option 1b is expected.

4.2.1.3 Subsea Cable Sterile Corridors – Option 2 Dredging

This scenario assesses the use of two grab dredgers for removing the top layer of sediment at the proposed subsea cable sterile corridors, together with other concurrent grab dredging works considered in the approved EIA Report Scenario C01B. The jetting part of the marine works is assessed separately considering the sequential works nature. Results of sediment dispersion modelling are shown in *Table 4.4* and show that two grab dredgers working concurrently at the nearest point to WSRs MPD-3 and MPD-4 (with silt curtains at grab dredgers) would result in limited level of SS elevation. Predicted maximum SS elevation would be below 1 mg L^{-1} at MPD-3 and MPD-4. There is no exceedance of applicable WQO SS criteria at other WSRs as well. As shown in Appendix A-1 and A-7, the sediment plume from these two grab dredgers working at the subsea cable sterile corridors is very localized. No unacceptable water quality impact from the proposed dredging operation at the subsea cable sterile corridors under Option 2 is expected.

4.2.1.4 Subsea Cable Sterile Corridors – Option 2 Jetting

This scenario assesses the proposed seven passes of jetting operation at the subsea cable sterile corridors (720 m/day, with silt curtain), together with the jetting for the rest of the BPPS Pipeline in South Lantau (1,000 m/day, with silt curtain) after the dredging works assessed in the previous paragraph. Similar to that of the approved EIA Report, it is assumed silt curtain would be implemented at the southern boundary of the proposed South Lantau Marine Park. Results of sediment dispersion modelling are shown in *Table 4.5*. Contour plots of maximum SS elevation are provided in Appendix A-2 and A-8. Full compliance with the applicable WQO SS criteria is predicted at all WSRs. No unacceptable water quality impact from the proposed jetting operation for construction of the subsea cable sterile corridors under Option 2 is expected.

4.2.1.5 Southwest Lantau Pipeline Section

This scenario assesses the proposed three passes of jetting operation at the pipeline segment along Southwest Lantau (1,500 m/day, with silt curtain). Maximum SS elevations of 5.2 mg L^{-1} and 4.9 mg L^{-1} were predicted at the nearest WSR (MPC-2), which are both below the corresponding WQO SS criteria. Full compliance with the applicable WQO SS criteria is predicted at all other WSRs. Results of this scenario are shown in *Table 4.6*. Contour plots of maximum SS elevation are provided in Appendix A-5 and A-11. No unacceptable water quality impact from the proposed jetting operation for the installation of the BPPS Pipeline at Southwest Lantau is expected.

4.2.1.6 Sha Chau to Lung Kwu Chau Pipeline Section

This scenario assesses the proposed three passes of jetting operation at the pipeline segment west of Lung Kwu Chau (720 m/day, with silt curtain). Maximum SS elevation of 0.3 mg L^{-1} was predicted at the few nearest WSRs, which is below the corresponding WQO SS criterion. Full compliance with the applicable WQO SS criteria is predicted at all other WSRs. Maximum sedimentation flux of 6.4 g m^{-2} day^{-1} at the nearest coral WSR CR3 was predicted, which is well below the relevant assessment criterion. Results of this scenario are shown in *Table 4.7*. Contour plots of maximum SS elevation are provided in Appendix A-6 and A-12. No unacceptable water quality impact from the proposed jetting operation for the installation of the BPPS Pipeline at Sha Chau to Lung Kwu Chau is expected.

Table 4.2 Predicted Maximum Elevation in Suspended Solid and Sediment Deposition at WSRs and Observation Points from Marine Construction of the Subsea Cable Sterile Corridors: Option 1a (Mitigated) (Scenario C05G)

Silt curtain at source (85% reduction in sediment dispersion): 04_J_A, 04_J_B, 04_J_C, 04_J_D
Two layers of silt curtain at WSRs (80% reduction in SS elevation): Southern Boundary of the Proposed South Lantau MP for MPD-2, MPD-3, MPD-4, MPD-5, MPD-9 (KP0.1-8.9)
Rate reduction: None

Sensitive Receivers	Model Output Location	SS Elevation (mg L^{-1})						Sediment Deposition (g m^{-2} day^{-1})		
		Dry Season (5 Passes)			Wet Season (5 Passes)			Criteria	Dry Season	Wet Season
		Allowable Increase	Max. Increase	Compliance Time %	Allowable Increase	Max. Increase	Compliance Time %		Max.	Max.
Observation Points (Depth-averaged) (for reference)										
Boundary of Existing & Proposed Marine Parks	MPD-2	6.0	0.8	100.0%	6.3	2.1	100.0%	-	-	-
	MPD-3	3.9	2.4	100.0%	3.1	1.0	100.0%	-	-	-
	MPD-4	3.9	0.7	100.0%	3.1	1.9	100.0%	-	-	-
	MPD-5	3.9	2.1	100.0%	3.1	1.9	100.0%	-	-	-

Table 4.3 Predicted Maximum Elevation in Suspended Solid and Sediment Deposition at WSRs and Observation Points from Marine Construction of the Subsea Cable Sterile Corridors: Option 1b (Mitigated) (Scenario C05F)

Silt curtain at source (85% reduction in sediment dispersion): 04_J_A, 04_J_B, 04_J_C, 04_J_D
Two layers of silt curtain at WSRs (80% reduction in SS elevation): Southern Boundary of the Proposed South Lantau MP for MPD-2, MPD-3, MPD-4, MPD-5, MPD-9 (KP0.1-8.9)
Rate reduction: None

Sensitive Receivers	Model Output Location	SS Elevation (mg L^{-1})						Sediment Deposition (g m^{-2} day^{-1})		
		Dry Season (7 Passes)			Wet Season (7 Passes)			Criteria	Dry Season	Wet Season
		Allowable Increase	Max. Increase	Compliance Time %	Allowable Increase	Max. Increase	Compliance Time %		Max.	Max.
Observation Points (Depth-averaged) (for reference)										
Boundary of Existing & Proposed Marine Parks	MPD-2	6.0	0.8	100.0%	6.3	2.1	100.0%	-	-	-
	MPD-3	3.9	2.3	100.0%	3.1	1.0	100.0%	-	-	-
	MPD-4	3.9	0.9	100.0%	3.1	1.5	100.0%	-	-	-
	MPD-5	3.9	2.1	100.0%	3.1	1.9	100.0%	-	-	-

Table 4.4 Predicted Maximum Elevation in Suspended Solid and Sediment Deposition at WSRs and Observation Points from Marine Construction of the Subsea Cable Sterile Corridors: Option 2 – Dredging (Mitigated) (Scenario C01D)

Silt curtain at source (75% reduction in sediment dispersion): 01_G, 03_G, 04_G_A, 04_G_B, 09_G, 13_G
Two layers of silt curtain at WSRs (80% reduction in SS elevation): None
Rate reduction: None

Sensitive Receivers	Model Output Location	SS Elevation (mg L^{-1})						Sediment Deposition (g m^{-2} day^{-1})		
		Dry Season			Wet Season			Criteria	Dry Season	Wet Season
		Allowable Increase	Max. Increase	Compliance Time %	Allowable Increase	Max. Increase	Compliance Time %		Max.	Max.
Observation Points (Depth-averaged) (for reference)										
Boundary of Existing & Proposed Marine Parks	MPD-3	3.9	0.7	100.0%	3.1	0.1	100.0%	-	-	-
	MPD-4	3.9	0.3	100.0%	3.1	0.4	100.0%	-	-	-

Table 4.5 Predicted Maximum Elevation in Suspended Solid and Sediment Deposition at WSRs and Observation Points from Marine Construction of the Subsea Cable Sterile Corridors: Option 2 – Jetting (Mitigated) (Scenario C05E)

Silt curtain at source (85% reduction in sediment dispersion): 04_J_A, 04_J_B, 04_J_C, 04_J_D
Two layers of silt curtain at WSRs (80% reduction in SS elevation): Southern Boundary of the Proposed South Lantau MP for MPD-2, MPD-3, MPD-4, MPD-5, MPD-9 (KP0.1-8.9)
Rate reduction: None

Sensitive Receivers	Model Output Location	SS Elevation (mg L^{-1})						Sediment Deposition (g m^{-2} day^{-1})		
		Dry Season (7 Passes)			Wet Season (7 Passes)			Criteria	Dry Season	Wet Season
		Allowable Increase	Max. Increase	Compliance Time %	Allowable Increase	Max. Increase	Compliance Time %		Max.	Max.
Observation Points (Depth-averaged) (for reference)										
Boundary of Existing & Proposed Marine Parks	MPD-2	6.0	0.6	100.0%	6.3	2.1	100.0%	-	-	-
	MPD-3	3.9	1.7	100.0%	3.1	0.9	100.0%	-	-	-
	MPD-4	3.9	0.8	100.0%	3.1	1.1	100.0%	-	-	-
	MPD-5	3.9	2.1	100.0%	3.1	1.9	100.0%	-	-	-

Table 4.6 Predicted Maximum Elevation in Suspended Solid and Sediment Deposition at WSRs and Observation Points from Marine Construction at Southwest Lantau (Mitigated) (Scenario C09A)

Silt curtain at source (85% reduction in sediment dispersion): 05_J
Two layers of silt curtain at WSRs (80% reduction in SS elevation): None;
Rate reduction: None

Sensitive Receivers	Model Output Location	SS Elevation (mg L^{-1})						Sediment Deposition (g m^{-2} day^{-1})		
		Dry Season			Wet Season			Criteria	Dry Season	Wet Season
		Allowable Increase	Max. Increase	Compliance Time %	Allowable Increase	Max. Increase	Compliance Time %		Max.	Max.
Observation Points (Depth-averaged) (for reference)										
Boundary of Existing & Proposed Marine Parks	MPC-1	8.5	0.9	100.0%	6.3	1.1	100.0%	-	-	-
	MPC-2	8.5	5.2	100.0%	6.3	4.9	100.0%	-	-	-
	MPC-3	6.0	2.1	100.0%	6.3	1.9	100.0%	-	-	-

Table 4.7 Predicted Maximum Elevation in Suspended Solid and Sediment Deposition at WSRs and Observation Points from Marine Construction at Sha Chau to Lung Kwu Chau (Mitigated) (Scenario C08)

Silt curtain at source (85% reduction in sediment dispersion): 09_J
Two layers of silt curtain at WSRs (80% reduction in SS elevation): Two layers at Western Boundary of the Sha Chau to Lung Kwu Chau MP for MPA-2, MPA-3, AR1, CR3 (KP36.0 – 37.5)
Rate reduction: None

Sensitive Receivers	Model Output Location	SS Elevation (mg L^{-1})						Sediment Deposition (g m^{-2} day^{-1})		
		Dry Season			Wet Season			Criteria	Dry Season	Wet Season
		Allowable Increase	Max. Increase	Compliance Time %	Allowable Increase	Max. Increase	Compliance Time %		Max.	Max.
Spawning/Nursery Grounds (Depth-averaged)										
Fisheries Spawning Ground in North Lantau	AR1	7.8	0.2	100.0%	4.3	0.1	100.0%	-	-	-
	CR3	6.6	0.2	100.0%	6.0	0.2	100.0%	-	-	-
Corals (Bottom)										
Pak Chau	CR3	10.4	0.3	100.0%	12.1	0.2	100.0%	200	6.4	5.9
Observation Points (Depth-averaged) (for reference)										
Boundary of Existing & Proposed Marine Parks	MPA-2	6.6	0.3	100.0%	6.0	0.0	100.0%	-	-	-
	MPA-3	7.8	0.1	100.0%	4.3	0.0	100.0%	-	-	-

4.2.2 *Oxygen Depletion*

In accordance with the approved EIA Report, potential oxygen depletion from sediment release was estimated based on maximum SS elevation and sediment oxygen demand (15,342 mg kg^{-1} adopted in the approved EIA Report). Given the maximum SS elevation predicted based on the proposed construction options is only 5.2 mg L^{-1}, the potential maximum DO depletion is calculated to be:

DO (mg O_2 L^{-1}) = DO (g O_2/m^3)

= SS (g DW/m^3) × fraction of organic matter in sediment (g C/g DW) × 2.67 (g O_2/gC)

= 5.2 (g DW/m^3) × 15,342 ÷ 1,000,000 (g C/g DW) × 2.67 (g O_2/gC)

= 0.213 mg L^{-1}

Results of DO depletion due to the proposed construction options are provided in *Table 4.8*. The predicted maximum DO depletion is only 0.2 mg L^{-1}, while the corresponding allowed DO depletion is 0.8 mg L^{-1}. No unacceptable water quality impact on oxygen depletion is predicted.

Table 4.8 Predicted Maximum Annual Dissolved Oxygen Depletion among all Modelling Scenarios

Sensitive Receivers	Model Output Location	Dissolved Oxygen (mg L^{-1}) Annual	
		Allowable DO Depletion	Maximum DO Depletion
Fisheries Spawning Ground in North Lantau	AR1	0.9	0.0
	CR3	0.2	0.0
Pak Chau	CR3	0.3	0.0
Boundary of Existing & Proposed Marine Parks	MPA-2	0.2	0.0
	MPA-3	0.9	0.0
	MPC-1	0.8	0.0
	MPC-2	0.8	0.2
	MPC-3	0.8	0.1
	MPD-2	0.8	0.1
	MPD-3	1.1	0.1
	MPD-4	1.1	0.1
	MPD-5	1.1	0.1

4.2.3 *Release of Sediment-bounded Contaminants*

Following the approach in the approved EIA Report, assessment of potential release of sediment-bounded contaminants is conducted based on conservative tracer. Contaminants of concern include total polychlorinated biphenyls (PCBs), total inorganic nitrogen (TIN) and unionized ammonia (UIA).

4.2.3.1 Total PCBs

As stated in the approved EIA Report, based on the worst case results of elutriate test of sediment, 1.0286 µg of total PCBs can be released from 1 kg of sediment. The predicted maximum tracer concentration under the modelled mitigated scenario is only 8 mg L^{-1} (shown below in *Table 4.9*), which translates to 8.23×10^{-6} µg L^{-1} of total PCBs. This predicted maximum total PCBs level is well below the corresponding assessment criterion of 0.03 µg L^{-1}. No unacceptable elevation of total PCBs is therefore anticipated at all WSRs in both dry and wet seasons.

Total PCBs at WSRs (µg L^{-1})= Tracer at WSRs (mg L^{-1}) [from model] ×Tracer released per unit Sediment Loss [set to 1 in model]

× Total PCBs released per unit Sediment Loss (µg kg^{-1}) [from elutriate test results]

4.2.3.2 TIN and UIA

As stated in the approved EIA Report, based on the worst case results of elutriate test of sediment, 18.1143 mg of TN can be released from 1 kg of sediment, of which 100% is assumed to be in the form of ammonia (NH_3-N, which also count as TIN) and 7.8% would be in the form of UIA. As shown in the calculation in *Table 4.9*, the estimated level of TIN and UIA are both below 0.001 mg L^{-1} (round down and shown as "0.000" in the table). No unacceptable change in water quality would be expected at all WSRs in both dry and wet seasons.

For TIN:

Total TIN at WSRs (mg L^{-1})=	*Tracer at WSRs (mg L^{-1}) [from model]* *×Tracer released per unit Sediment Loss [set to 1 in model]* *×TN released per unit Sediment Loss (mg kg^{-1}) [from elutriate test results]*

For UIA:

Total UIA at WSRs (mg L^{-1})=	*Total TIN at WSRs (mg L^{-1})* *× UIA/NH3-N ratio in marine water*

Table 4.9 Predicted Maximum Nutrient Elevations (mg L^{-1}) based on Maximum Conservative Tracer Concentration at Water Quality Sensitive Receivers

Sensitive Receivers	Model Output Location	MAX Conservative Tracer Concentration		TIN Elevation		WQO Criteria for TIN	UIA		UIA WQO Allowable Elevation	
		Dry	Wet	Dry	Wet		Dry	Wet	Dry	Wet
Spawning/Nursery Grounds (Depth-averaged)										
Fisheries Spawning Ground in North Lantau	AR1	5.9	2.9	0.000	0.000	0.5	0.000	0.000	0.018	0.016
	CR3	4.7	2.5	0.000	0.000	0.5	0.000	0.000	0.016	0.015
Corals (Bottom)										
Pak Chau	CR3	4.7	2.7	0.000	0.000	0.5	0.000	0.000	0.017	0.016
Observation Points (Depth-averaged) (for reference)										
Boundary of Proposed Marine Parks	MPA-2	2.4	0.9	0.000	0.000	0.5	0.000	0.000	0.016	0.015
	MPA-3	7.6	4.4	0.000	0.000	0.5	0.000	0.000	0.016	0.015
	MPC-1	3.0	2.4	0.000	0.000	0.5	0.000	0.000	0.019	0.017
	MPC-2	2.8	2.1	0.000	0.000	0.5	0.000	0.000	0.019	0.017
	MPC-3	2.0	4.7	0.000	0.000	0.1	0.000	0.000	0.020	0.018
	MPD-2	2.3	4.8	0.000	0.000	0.1	0.000	0.000	0.020	0.018
	MPD-3	4.8	5.9	0.000	0.000	0.1	0.000	0.000	0.020	0.019
	MPD-4	4.3	7.1	0.000	0.000	0.1	0.000	0.000	0.020	0.019
	MPD-5	4.0	8.0	0.000	0.000	0.1	0.000	0.000	0.020	0.019

Note: Mitigation measures listed under *Table 4.2* to *Table 4.7* are taken into account (Same as approved EIA).

4.2.4 Summary

Additional modelling has been conducted to examine potential impact on water quality from dredging/ jetting activities associated with the construction options for the subsea cable sterile corridors, as well as the pipeline segments along Southwest Lantau and West of Lung Kwu Chau. Full compliance in terms of SS elevation and sedimentation flux, oxygen depletion and release of sediment-bound contaminants is predicted at all WSRs under the mitigated scenarios. No unacceptable water quality impact on the nearby WSRs identified, including but not limited to the existing, planned or potential Marine Parks, corals, marine mammal habitat, fisheries spawning ground, etc., is expected for all modelled scenarios. The use of silt curtain has been recommended in these pipeline construction scenarios to reduce sediment dispersion from grab dredging and jetting, as well as to protect nearby WSRs from sediment plume. Deployment of the silt curtain will be checked regularly to reduce secondary impact on water quality. Given that the forward speed for jetting machine and the associated silt curtain enclosing it is generally low near sensitive areas such as marine parks, disturbance to seabed, if any, would be very limited. As such, no unacceptable secondary water quality impact associated with the deployment of silt curtain under this Project would be anticipated.

Construction management measures will be implemented during pipeline jetting to confirm that the specific trench configuration is acceptable for each jetting pass. After each jetting pass, a sonar scanning or diver survey will be conducted to confirm the trench configuration and depth of burial and the survey result will be presented in order to ensure the trench profile and depth are achieved.

In addition, the whole segments of the subsea cable sterile corridors shall be covered by rock armour or concrete saddle to protect the pipeline from the installation of future cables. The placement of these protection measures on subsea utilities as additional protection is a common practice. Rock armour placement has been assessed in the approved in the EIA Report and no unacceptable impact is expected. The concrete saddle will be installed after the pipeline is jetted to the required burial depth, and it will be lowered down slowly to reduce disturbance to the seabed sediment. As such, no unacceptable water quality impact associated with the deployment of pipeline protection measures would be anticipated.

4.3 Waste Management

Based on the information presented in the approved EIA Report, the seabed sediments at the pipeline segments along Southwest Lantau and West of Lung Kwu Chau are category M contaminated. Consequently the use of jetting method for these pipeline segments is expected to reduce the generation of ~ 0.168 Mm^3 of dredged sediment that requires marine disposal. For the construction of the subsea cable sterile corridors under Option 2, it would generate about ~ 0.078 Mm^3 of dredged sediment (in situ volume) that are likely to be uncontaminated making reference to the sediment quality results of samples collected in the vicinity as presented in the approved EIA Report. Based on the latest engineering design information, it is expected that the overall total dredging volume for the Project would not exceed the total dredging volume presented in the approved EIA Report resulting from the proposed potential changes.

While there is the potential of a slight increase in the dredging and disposal of uncontaminated sediment should Option 2 for subsea cable sterile corridors be adopted, considering the potential reduction in the dredging and disposal of contaminated sediment from the potential change of construction method from dredging to jetting at the pipeline segments along Southwest Lantau and West of Lung Kwu Chau, and with no increase in overall total dredging volume, no unacceptable adverse environmental impacts arising from the management and disposal of dredged sediment is anticipated.

In accordance with PNAP ADV-21, the project proponent will continue to liaise with Marine Fill Committee (MFC) and EPD as to the allocation arrangement for sediment disposal. Marine sediment sampling, testing and reporting in accordance with the requirement stated in PNAP ADV-21 for EPD approval as required under the Dumping at Sea Ordinance will be undertaken prior to the commencement of dredging and sediment disposal. The Project Proponent will continue to liaise with the relevant authorities to ensure compliance with PNAP ADV-21.

4.4 Marine Ecology

4.4.1 Temporary Habitat Loss and Disturbance

The use of jetting for the pipeline segments along Southwest Lantau and West of Lung Kwu Chau would increase the use of narrower trenches (~ 2-8 m) for ~7.2 km of the BPPS Pipeline, which would result in a reduction in the area of seabed habitats (by ~ 8.4 ha) that will be temporarily lost or disturbed due to subsea pipeline installation activities. Conversely, the construction of the subsea cable sterile corridors would require pipeline trenches of ~ 20 m wide along ~ 2.14 km of the BPPS Pipeline, and there would be a slight increase in the area of seabed habitats (by ~ 2.6 ha) that will be temporarily lost or disturbed. Given the low ecological value of the associated benthic assemblages (EIA Report Section 9.5.1, Table 9.23), and the recolonization of similar organisms following completion of the pipeline installation works, unacceptable impacts on the ecological resources are not expected.

The use of different pipeline construction options and methods is not expected to change the number and size of works areas and total duration of marine works for the construction of the BPPS Pipeline, and hence the potential impact of short-term behavioural disturbance and / or displacement of marine mammals is similar to that assessed in the approved EIA Report. It is important to note that not the entire lengths of the BPPS Pipeline route would be disturbed at any one time because pipeline dredging, pipe-laying, jetting and rock armour placement activities would be undertaken at discrete work fronts (each within a few hundred metres from the pipeline centreline), and these activities would be carried out in sequence, i.e. phased. The mitigation measures proposed in the approved EIA Report, i.e. pipeline dredging/ jetting works between North of Tai O and Fan Lau will avoid the peak months of CWD calving (May and June), and pipeline dredging / jetting works between South of Soko Islands and the Offshore LNG Terminal will be restricted to a daily maximum of 12 hours with daytime (0700 – 1900) operations, and the implementation of marine mammal exclusion zone monitoring would be effective in reducing disturbance to marine mammals to within acceptable levels.

4.4.2 Increased Marine Traffic

For the construction of the subsea cable sterile corridors, as well as the pipeline segments along Southwest Lantau and West of Lung Kwu Chau by jetting, it is expected that the same marine works vessels deployed elsewhere for the construction of other pipeline segments would be used, and similar level of marine traffic in terms of numbers of vessels, and works duration etc. would be maintained for the overall construction of the BPPS Pipeline. As recommended in the approved EIA Report, the vessel operators of this Project will be required to use predefined and regular routes (that do not encroach into existing and proposed marine parks), make use of designated fairways to access the works areas, and would avoid traversing sensitive habitats such as existing and proposed marine parks. Given the slow-moving nature of the relatively small number of works vessels involved in the construction of the Project, unacceptable adverse impacts of increased marine traffic on marine mammals and marine parks are not anticipated.

4.4.3 Underwater Sound

As discussed in Section 4.4.2, it is expected that the same marine works vessels deployed elsewhere for the construction of other pipeline segments would be used for the construction of the proposed construction options for select segments of the BPPS Pipeline. Underwater sound generated by these vessels is not expected to acoustically interfere significantly with dolphins or porpoises. Marine mammals may have short-term avoidance of the immediate works areas of sound generating activities, but are expected to return when the disturbance ceases. Unacceptable adverse impacts of increased underwater sound level on marine mammals and marine mammals are not anticipated.

4.4.4 Short-Term Changes in Water Quality

Results of the supplementary assessment on water quality (Section 4.2) indicate that with proper implementation of the proposed mitigation measures, unacceptable impacts to water quality are unlikely to occur. It is therefore predicted that there will be no unacceptable indirect impacts to marine ecological resources, marine mammals and marine parks as a result of the proposed construction options.

4.5 Fisheries

4.5.1 Habitat Disturbance & Loss of Access to Fishing Ground

As discussed in Section 4.4.1, the use of jetting for the pipeline segments along Southwest Lantau and West of Lung Kwu Chau would reduce the area of fisheries habitats and potential fishing ground (by ~ 8.4 ha) that will be temporarily disturbed due to subsea pipeline installation activities, and the construction of the subsea cable sterile corridors would slightly increase in the area of fisheries habitats and potential fishing ground (by ~ 2.6 ha) that will be temporarily disturbed. No disturbance to the fisheries sensitive receivers and reported fish fry area at Pak Tso Wan of Tai A Chau (South Soko) is expected. Also, the use of different pipeline construction options and methods is not expected to change the number and size of works areas and total duration of marine works for the construction of the BPPS Pipeline. Not the entire lengths of the BPPS Pipeline route would be disturbed at any one time because pipeline dredging, pipe-laying, jetting and rock armour placement activities would be undertaken at discrete work fronts (each within a few hundred metres from the pipeline centreline), and these activities would be carried out in sequence, i.e. phased. Considering the temporary nature of the disturbance and with management of work fronts/sequence, no unacceptable impacts on fisheries resources, habitats and fishing activities are hence expected.

4.5.2 Underwater Sound

As discussed in Section 4.4.2, it is expected that the same marine works vessels deployed elsewhere for the construction of other pipeline segments would be used for the construction of the proposed construction options for select segments of the BPPS Pipeline. As assessed in the approved EIA report, the vessel activity associated with the construction of this Project is not anticipated to result in unacceptable impacts on fisheries resources. No unacceptable disturbance to the fisheries sensitive receivers and reported fish fry area at Pak Tso Wan of Tai A Chau (South Soko) is expected.

4.5.3 Short-Term Changes in Water Quality

Results of the supplementary assessment on water quality (Section 4.2) indicate that with proper implementation of the proposed mitigation measures, the proposed marine construction works are predicted to be compliant with the relevant WQOs for both wet and dry seasons at all fisheries sensitive receivers. As such, unacceptable impacts from such works on fisheries resources and habitats (including spawning or nursery grounds) are not expected to occur.

4.6 Assessment of the Proposed Changes against EIAO-TM Section 6

The potential options of BPPS Pipeline construction methods have been evaluated to consider whether the change in construction methods may constitute a material change to a designated project or to an environmental impact (Section 6 of the EIAO-TM refers). In accordance with Section 6.2 of the EIAO-TM, *the environmental impact of a designated project, for which an environmental permit has been issued, is considered to be materially changed if the environmental performance requirements set out in the EIA report for this project may be exceeded or violated, even with the mitigation measures in place*.

The evaluation follows the factors listed in Section 6.1 of the EIAO-TM, including:

a. a change to physical alignment, layout or design of the project causing an environmental impact likely to affect existing or planned community, ecologically important areas or sites of cultural heritage;

b. a physical change resulting in an increase in the extent of reclamation or dredging affecting water flow or quality likely to affect ecologically important areas, or disrupting sites of cultural heritage;

c. an increase in pollution emissions or discharges or waste generation likely to violate guidelines or criteria in this technical memorandum without mitigation measures in place;

d. an increase in throughput or scale of the project leading to physical additions or alterations that are likely to violate the guidelines or criteria in this technical memorandum without mitigation measures in place; or

e. a change resulting in physical works that are likely to affect rare, endangered or protected species, or an important ecological habitat, or site of cultural heritage.

Table 4.10 summarises the results of the evaluation. It is considered that the proposed options of BPPS Pipeline construction methods will not lead to a material change to the designated project, or an environmental impact in accordance with Sections 6.1 and 6.2 of the EIAO-TM, respectively. As such, the proposed changes are considered as conforming to the information and requirements set out in the approved EIA Report.

Table 4.10 Summary of Evaluation Results against Section 6 of the EIAO-TM

Item	Requirement	Evaluation	Material Change?
6.1(a)	A change to physical alignment, layout or design of the project causing an environmental impact likely to affect existing or planned community, ecologically important areas or sites of cultural heritage.	The proposed change will not result in a change to physical alignment of the project to the extent that will affect existing or planned community, ecologically important areas or sites of cultural heritage, beyond those predicted in the approved EIA Report.	No
6.1(b)	A physical change resulting in an increase in the extent of reclamation or dredging affecting water flow or quality likely to affect ecologically important areas, or disrupting sites of cultural heritage.	The proposed change will not result in an increase in dredging extent that will affect water flow or quality likely to affect ecologically important areas, or disrupting sites of cultural heritage, beyond those predicted in the approved EIA Report.	No
6.1(c)	An increase in pollution emissions or discharges or waste generation likely to violate guidelines or criteria in this technical memorandum without mitigation measures in place.	Emissions (e.g. SS elevation, release of sediment-bounded contaminants) due to the proposed options of BPPS Pipeline construction methods are expected to be within the relevant assessment criteria as assessed in Section 4.2. No impacts beyond those predicted in approved EIA report are anticipated.	No
6.1(d)	An increase in throughput or scale of the project leading to physical additions or alterations that are likely to violate the guidelines or criteria in this technical memorandum without mitigation measures in place.	The proposed options of BPPS Pipeline construction methods will not result in a change to the throughput and scale of the Project.	No

Item	Requirement	Evaluation	Material Change?
6.1(e)	A change resulting in physical works that are likely to affect a rare, endangered or protected species, or an important ecological habitat, or a site of cultural heritage.	No impacts beyond those predicted in the approved EIA Report are anticipated to occur on rare, endangered or protected species, or an important ecological habitat, or site of cultural heritage due to proposed options of BPPS Pipeline construction methods.	No
6.2	The environmental impact of a designated project, for which an environmental permit has been issued, is considered to be materially changed if the environmental performance requirements set out in the EIA report for this project may be exceeded or violated, even with the mitigation measures in place.	An assessment of the potential environmental impacts associated with the proposed options of BPPS Pipeline construction methods is provided in detail in Sections 4.1-4.5. The potential environmental impacts associated with the proposed change are not expected to exceed those predicted in the approved EIA Report. As such, it is considered that the proposed options of BPPS Pipeline construction methods will not result in a material change under the EIAO-TM.	No

5. REVIEW OF PROPOSED MITIGATION MEASURES & ENVIRONMENTAL MONITORING AND AUDIT (EM&A) REQUIREMENTS

The findings of this review of environmental impacts associated with the proposed construction options for selected sections of the BPPS Pipeline have indicated that, with proper implementation of the proposed mitigation measures, no unacceptable adverse environmental impacts would be anticipated. It is considered that the proposed mitigation measures and EM&A requirements recommended in the approved EIA Report and outlined in the Project's EM&A Manual are adequate and no additional mitigation measures and EM&A requirements will be required.

6. CONCLUSION

As the BPPS Pipeline design progresses and in further discussion with relevant Subsea Cable Owners on subsea pipeline / cable crossings as mentioned in Section 2.3.3 and Section 3.4.3 of the approved EIA Report, some potential options of BPPS Pipeline construction methods have been proposed:

- Jetting at Sha Chau to Lung Kwu Chau (KP36.0 - 37.5);
- Jetting at Southwest Lantau (KP15.6 - 21.3); and
- Dredging and/or jetting two subsea cable sterile corridors within the Jetty Approach (KP1.49 to KP2.75 and KP3.55 to KP4.43).

An environmental review has been carried out to assess the potential environmental impacts associated with the proposed construction options of selected sections of the BPPS Pipeline. Water quality modelling and assessment have been conducted to confirm the environmental acceptability of these options making reference to the approved EIA Report. A number of pipeline construction scenarios have been assessed, and appropriate mitigation measures and their effects have been taken into account in the modelling exercise. Modelling results indicated the proposed construction options for selected sections of the BPPS Pipeline would result in full compliance of the corresponding WQO SS criteria at the nearest WSRs. Also, potential maximum DO depletion, release of contaminant and nutrients have been estimated and was found to be below the corresponding allowable DO depletion limit, assessment criteria for contaminant and WQO for nutrients. Overall, with the implementation of proposed mitigation measures, no unacceptable residual water quality impact from the BPPS Pipeline installation works is expected. The review also indicates that no unacceptable adverse impacts on waste management, marine ecology and fisheries are anticipated from the proposed construction options with respect to the assessment criteria stipulated in the EIAO-TM and relevant environmental legislation, and the same environmental performance requirements set out in the approved EIA Report will apply. The proposed options of BPPS Pipeline construction methods will not result in a material change to the designated project, or an environmental impact in accordance with Section 6 of the EIAO-TM. The Project fully complies with the EIAO-TM requirements.

It is considered that the EM&A requirements recommended in the approved EIA Report are adequate and no additional EM&A requirements will be required. Key mitigation measures and working rates for construction of the BPPS Pipeline are summarized in *Table 6.1*.

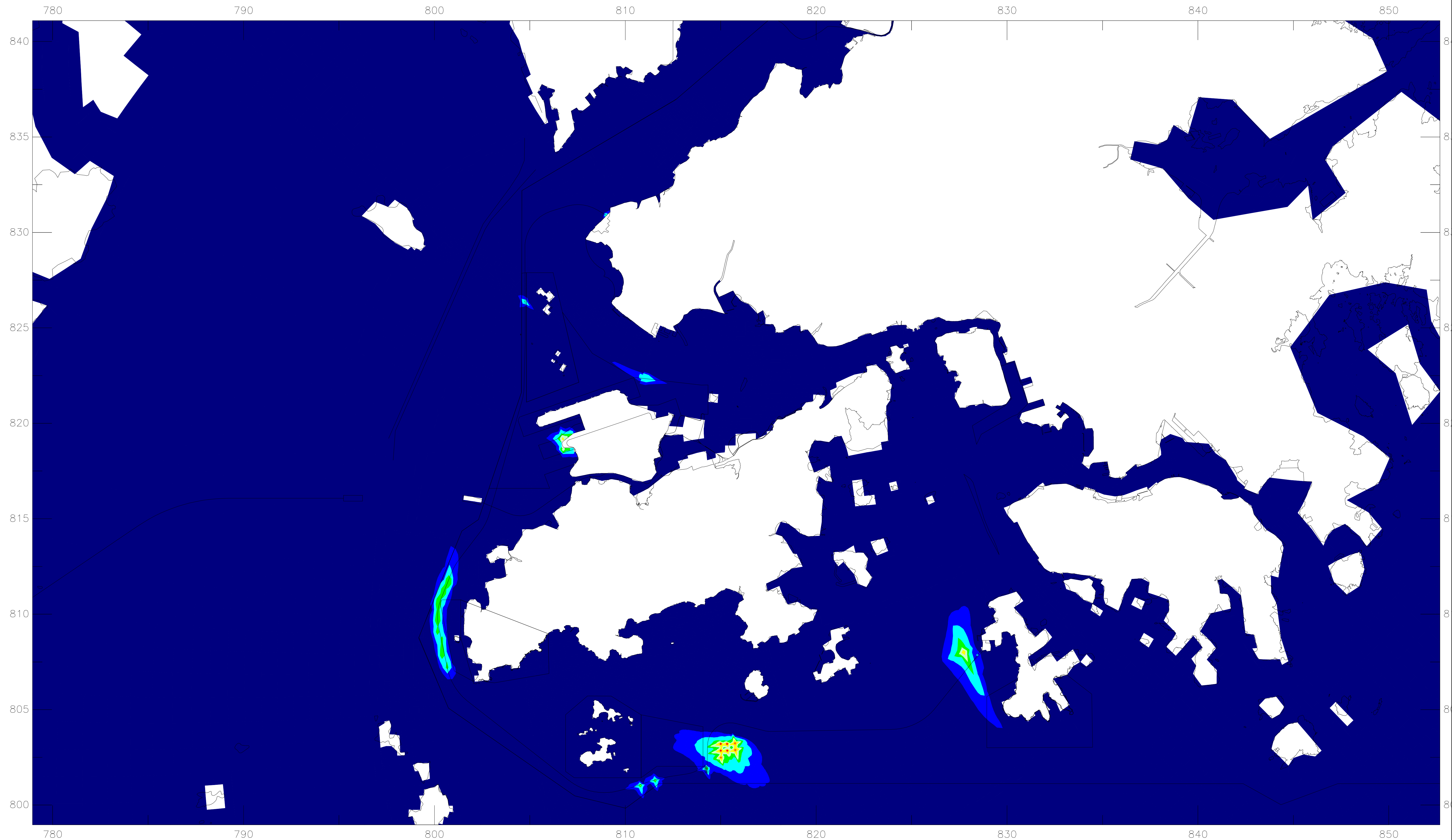
Table 6.1 Mitigation Measures for the BPPS Pipeline Construction Works

Work Location	Plants Involved	Allowed Maximum Work Rate	Silt Curtain at Plants	Silt Curtain at WSRs	Other Measures
Pipeline Riser (KP0.0 – 0.1 for both pipelines)	1 Grab Dredger	8,000 m^3 day^{-1} for 24 hours each day	Yes	Not required	Daily maximum of 12 hours with daylight (0700 – 1900)
Jetty Approach (KP0.1 – 5.0) <u>excluding Subsea Cable Sterile Corridors</u>	1 Jetting Machine	1,000 m day^{-1} for 24 hours each day	Yes	Not required for grab dredging; Two layers at Southern Boundary of the Proposed South Lantau MP (KP0.1-8.9) for jetting	Daily maximum of 12 hours with daylight (0700 – 1900)
Subsea Cable Sterile Corridors (KP1.49 - 2.75 and KP3.55 - 4.43)	1 Jetting Machine	720 m day^{-1} for 24 hours each day	Yes		
	2 Grab Dredgers, followed by 1 Jetting Machine (Alternative)	8,000m^3 day^{-1} for 24 hours each day for each dredger 720m day^{-1} for 24 hours each day jetting machine	Yes		

Work Location	Plants Involved	Allowed Maximum Work Rate	Silt Curtain at Plants	Silt Curtain at WSRs	Other Measures
South of Soko Islands (KP5.0 – 8.9)	1 Jetting Machine	1,000 m day^{-1} for 24 hours each day	Yes		
Southwest of Soko Islands (KP8.9 - 12.1)	1 Jetting Machine	1,000 m day^{-1} for 24 hours each day	Yes	Not required	
Adamasta Channel (KP12.1 - 15.6)	1 Jetting Machine	1,000 m day^{-1} for 24 hours each day	Yes	Not required	
Southwest Lantau (KP15.6 - 21.3)	2 Grab Dredgers	Total 16,000 m^3 day^{-1} for 24 hours each day 8,000 m^3 day^{-1} for each plant	Yes	Not required	Avoid the peak months of CWD calving (May and June)
	1 TSHD (Alternative)	57,600 m^3 day^{-1} for 24 hours each day	Not required	Not required	
	1 Jetting Machine (Alternative)	1,500 m day^{-1} for 24 hours each day	Yes	Not required	
West of Tai O to West of HKIA (KP21.3 – 31.5)	1 Jetting Machine	1,500 m day^{-1} for 24 hours each day from KP KP26.2 to 21.3 720 m day^{-1} for 24 hours each day from KP31.5 to 26.2	Yes	Not required	
Sha Chau to Lung Kwu Chau (KP31.5 – 36.0)	1 Jetting Machine	720 m day^{-1} for 24 hours each day	Yes	Two layers at Western Boundary of the Sha Chau and Lung Kwu Chau MP (KP31.5-36.0)	
Sha Chau to Lung Kwu Chau (KP36.0 - 37.5)	1 Grab Dredger	8,000 m^3 day^{-1} for 24 hours each day	Yes	Not required	
	1 Jetting Machine (Alternative)	720 m day^{-1} for 24 hours each day	Yes	Two layers at Western Boundary of the Sha Chau and Lung Kwu Chau MP (KP36.0-37.5)	
Lung Kwu Chau to Urmston Anchorage (37.5 - 41.1)	1 Jetting Machine	1,000 m day^{-1} for 24 hours each day	Yes	Two layers at NW corner of Sha Chau and Lung Kwu Chau MP (KP37.5-41.1)	
Urmston Road (KP41.1 – 42.9)	1 Grab Dredger	8,000 m^3 day^{-1} for 24 hours each day	Yes	Not required	
	1 TSHD (Alternative)	64,800 m^3 day^{-1} for 24 hours each day	Not required	Not required *	
West of BPPS (KP42.9 - 44.9)	1 Jetting Machine	1,000 m day^{-1} for 24 hours each day	Yes	Two layers at CR1, CR2	
Pipeline shore approach at BPPS (KP44.9 - 45.0)	1 Grab Dredger	1,500 m^3 day^{-1} for 24 hours each day	Yes	Two layers at CR1, CR2	

* The predicted sediment plume from grab dredging/ TSHD at this section would not reach CR1 and CR2 at the BPPS seawall, therefore additional silt curtain at CR1 and CR2 is not required.

Appendix A Contour Plots for Sediment Plume Modelling - SS Elevation



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Offshore LNG Terminal EIA

Construction Phase Sediment Plume Modelling – Scenario C01D – mitigated

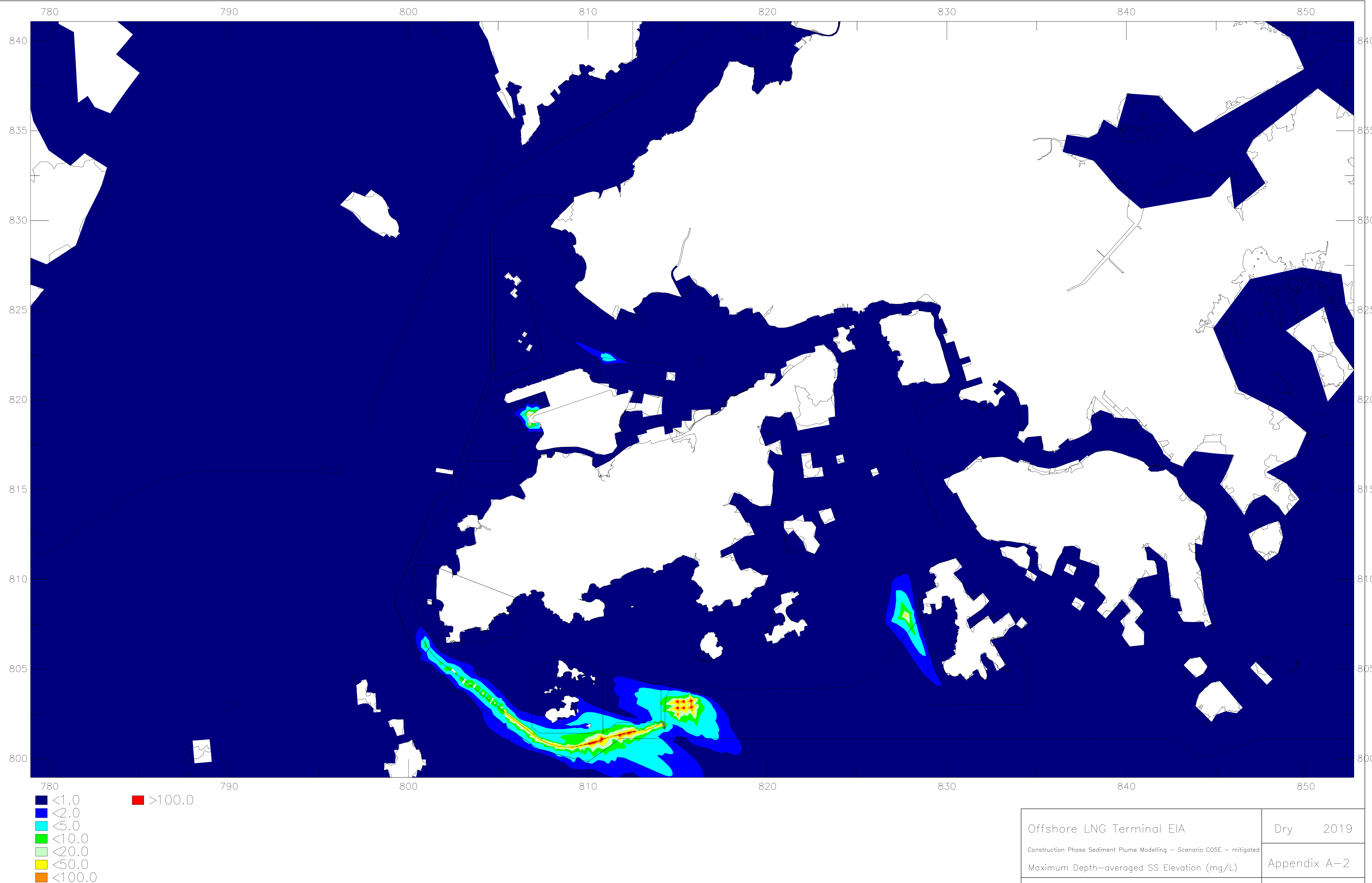
Maximum Depth–averaged SS Elevation (mg/L)

Dry 2019

Appendix A–1

ERM

Appendix A.ssn



Offshore LNG Terminal EIA

Construction Phase Sediment Plume Modelling – Scenario C05E – mitigated

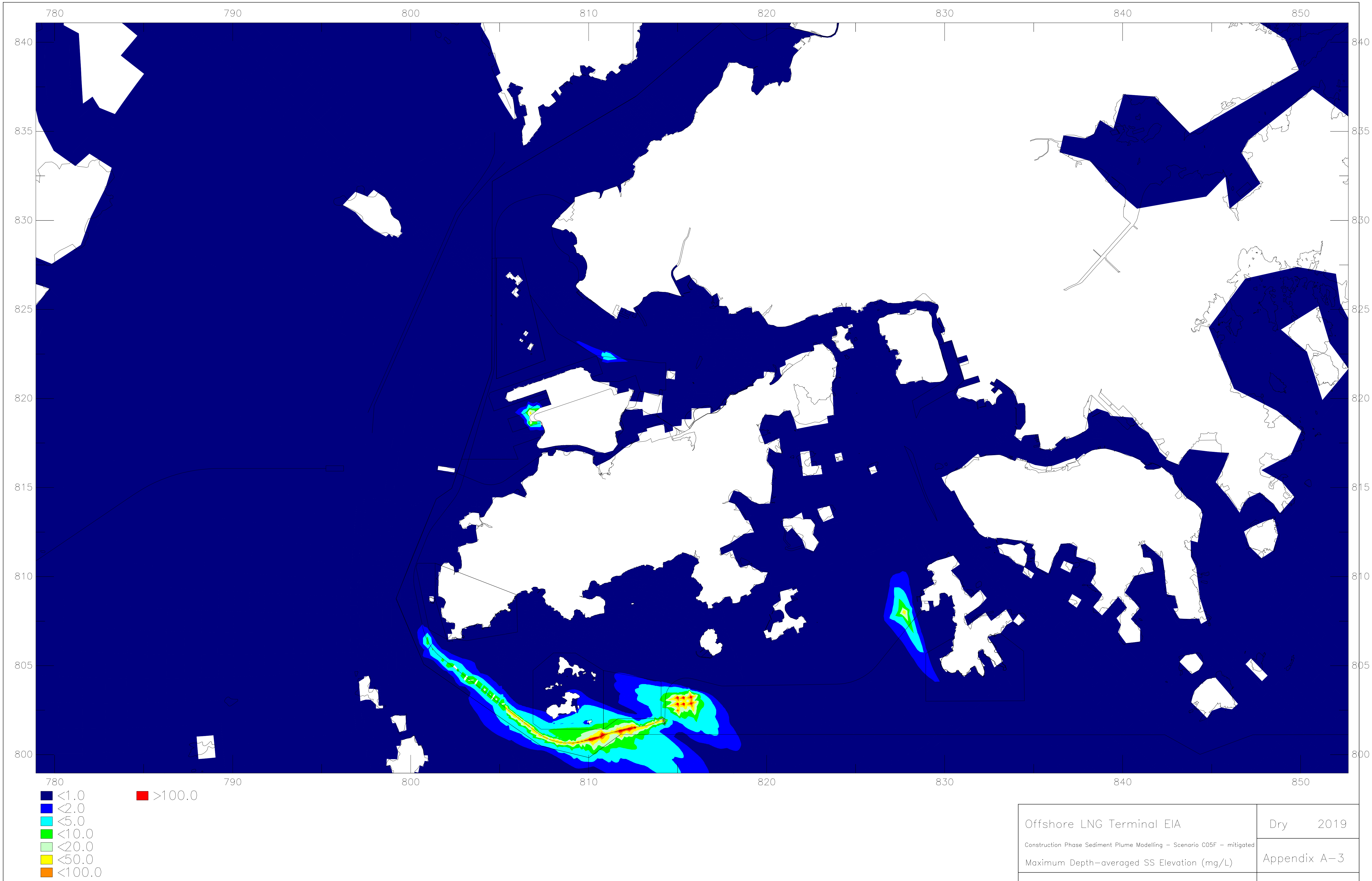
Maximum Depth–averaged SS Elevation (mg/L)

ERM

Dry 2019

Appendix A–2

Appendix A.ssn



Offshore LNG Terminal EIA

Construction Phase Sediment Plume Modelling – Scenario C05F – mitigated

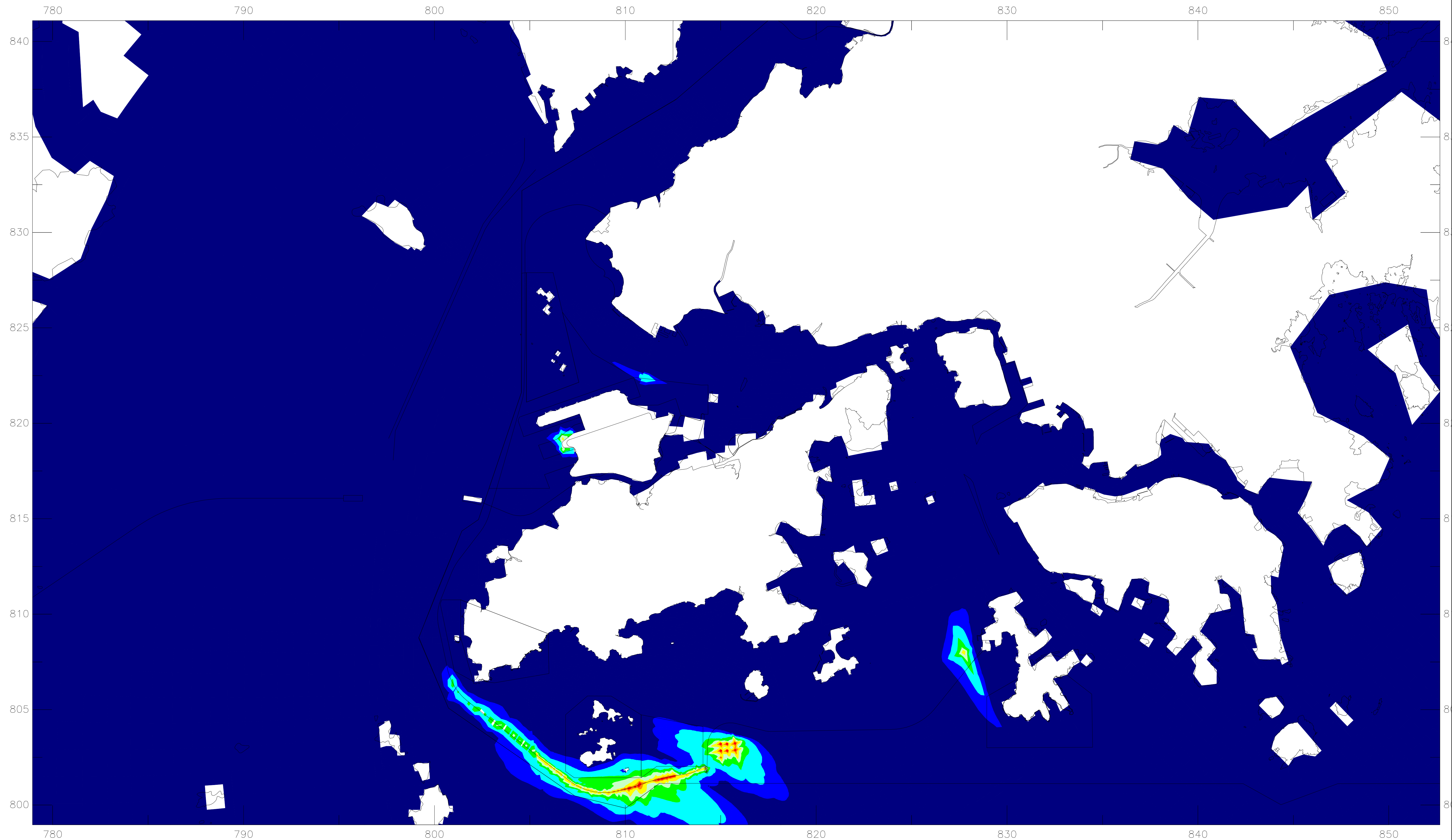
Maximum Depth–averaged SS Elevation (mg/L)

ERM

Dry 2019

Appendix A–3

Appendix A.ssn



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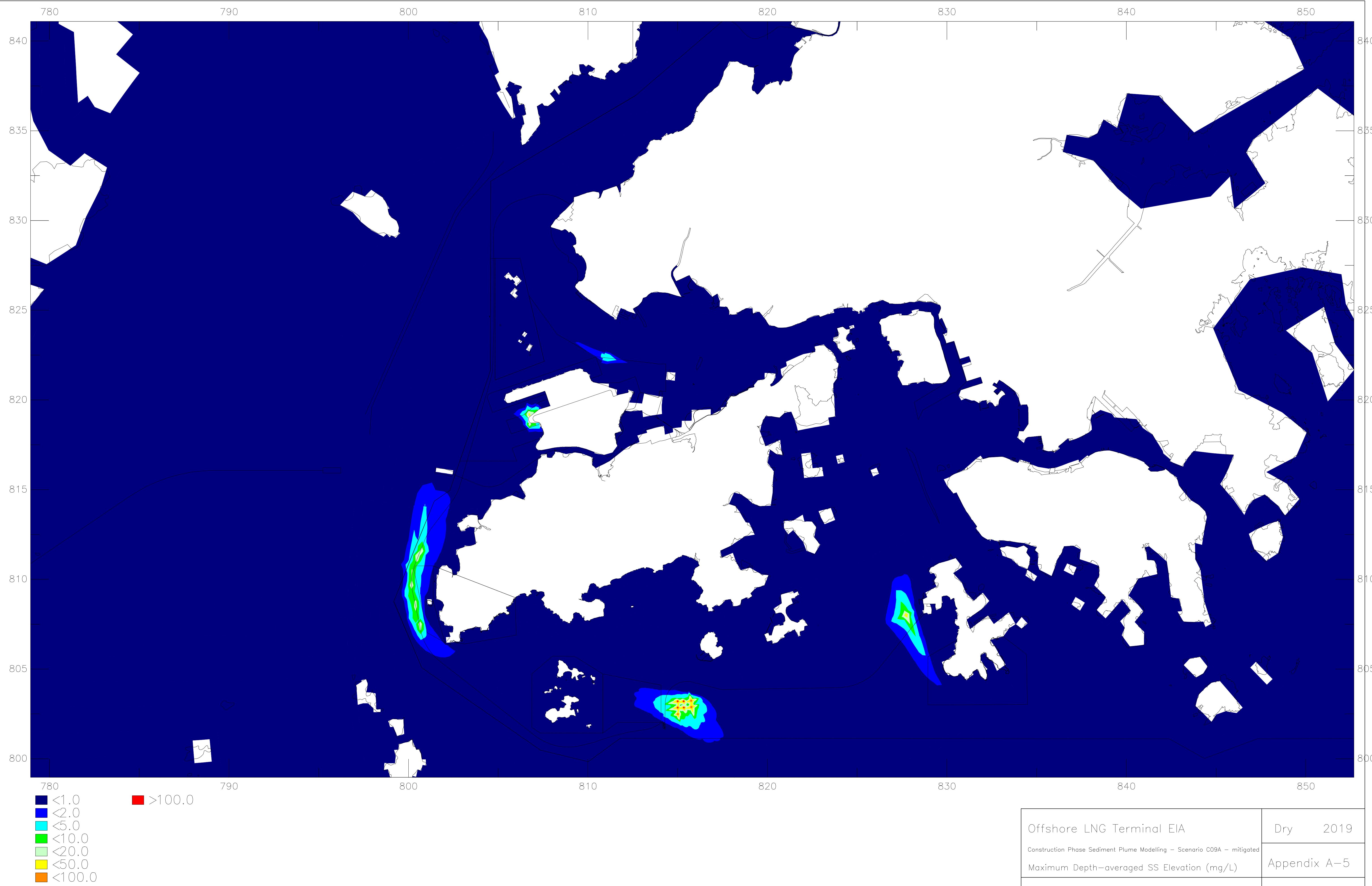
Offshore LNG Terminal EIA	Dry 2019
Construction Phase Sediment Plume Modelling – Scenario C05G – mitigated Maximum Depth–averaged SS Elevation (mg/L)	Appendix A–4
ERM	Appendix A.ssn



Offshore LNG Terminal EIA

Dry 2019

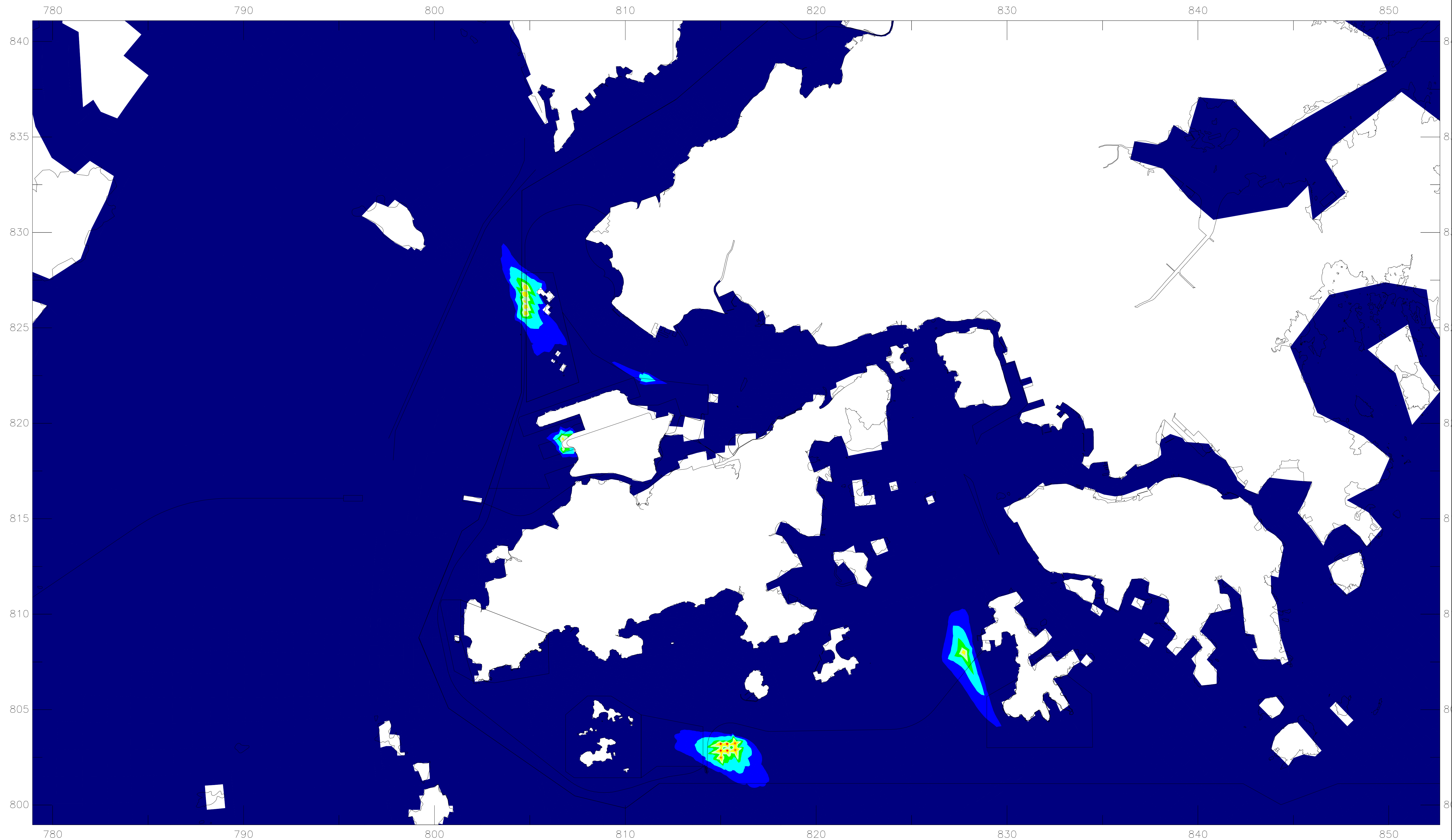
Construction Phase Sediment Plume Modelling – Scenario C09A – mitigated

Maximum Depth–averaged SS Elevation (mg/L)

Appendix A–5

ERM

Appendix A.ssn



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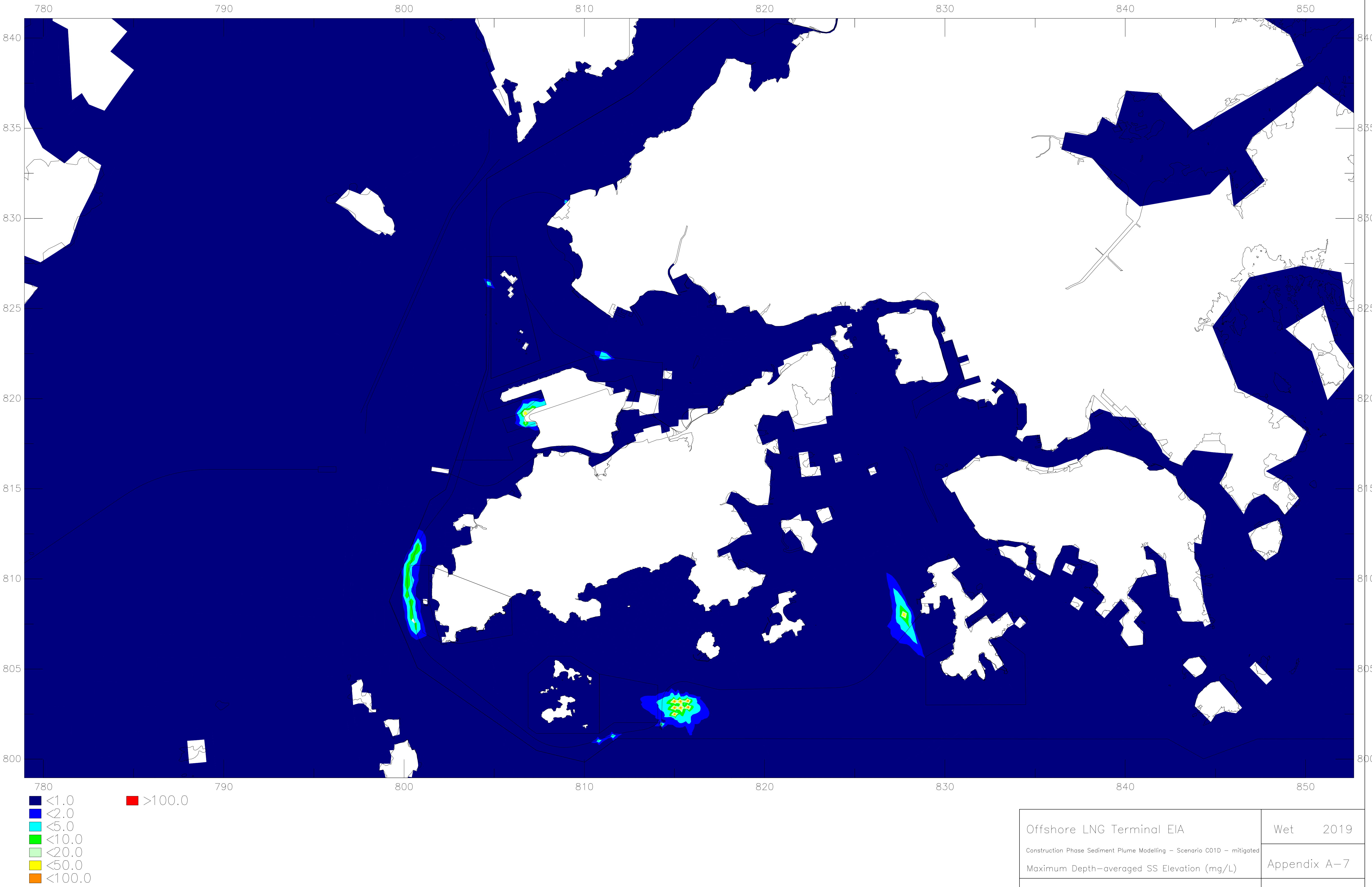
Offshore LNG Terminal EIA	Dry 2019
Construction Phase Sediment Plume Modelling – Scenario C08 – mitigated Maximum Depth–averaged SS Elevation (mg/L)	Appendix A–6
ERM	Appendix A.ssn



Offshore LNG Terminal EIA

Construction Phase Sediment Plume Modelling – Scenario C01D – mitigated

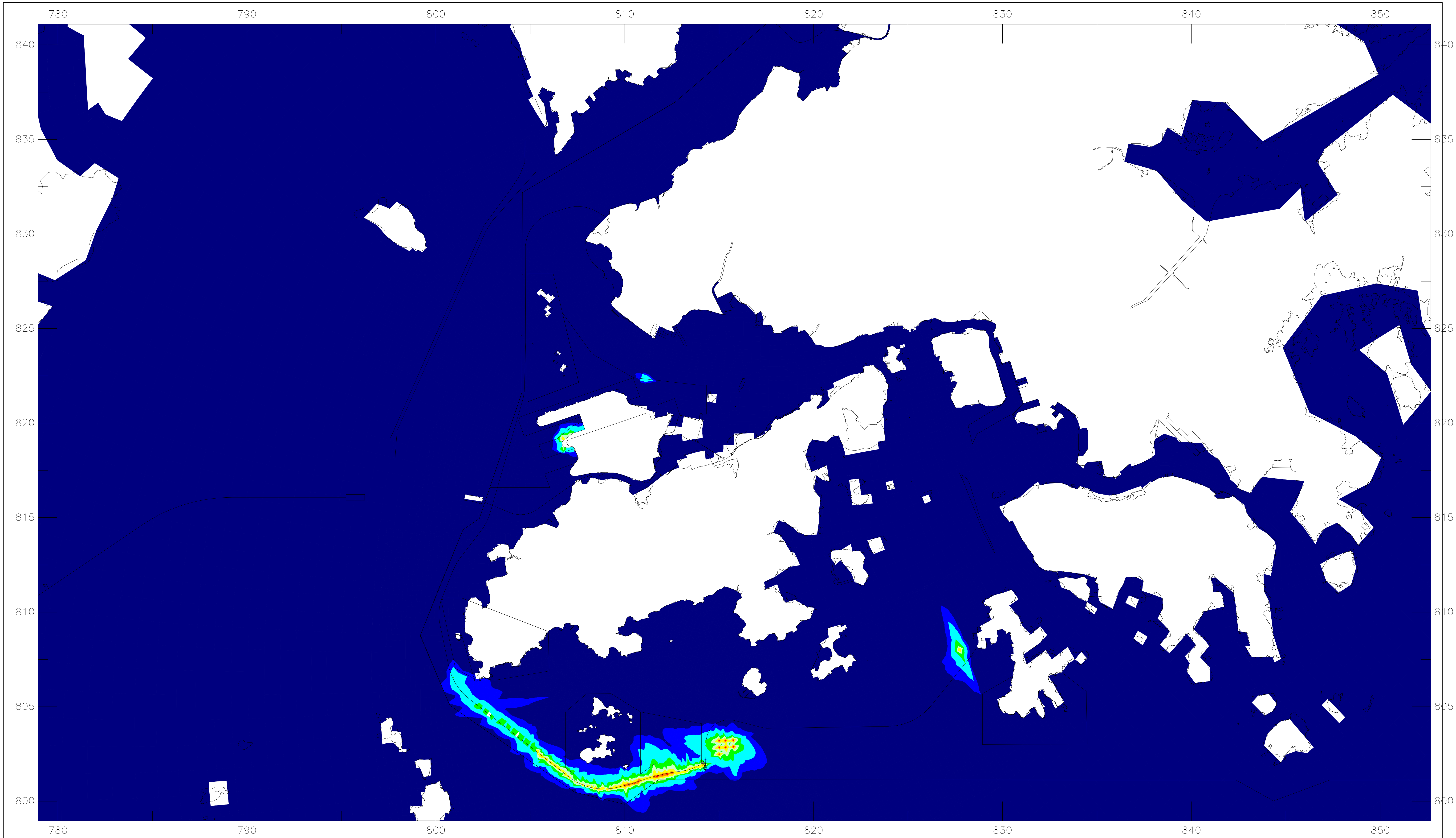
Maximum Depth-averaged SS Elevation (mg/L)

ERM

Wet 2019

Appendix A-7

Appendix A.ssn



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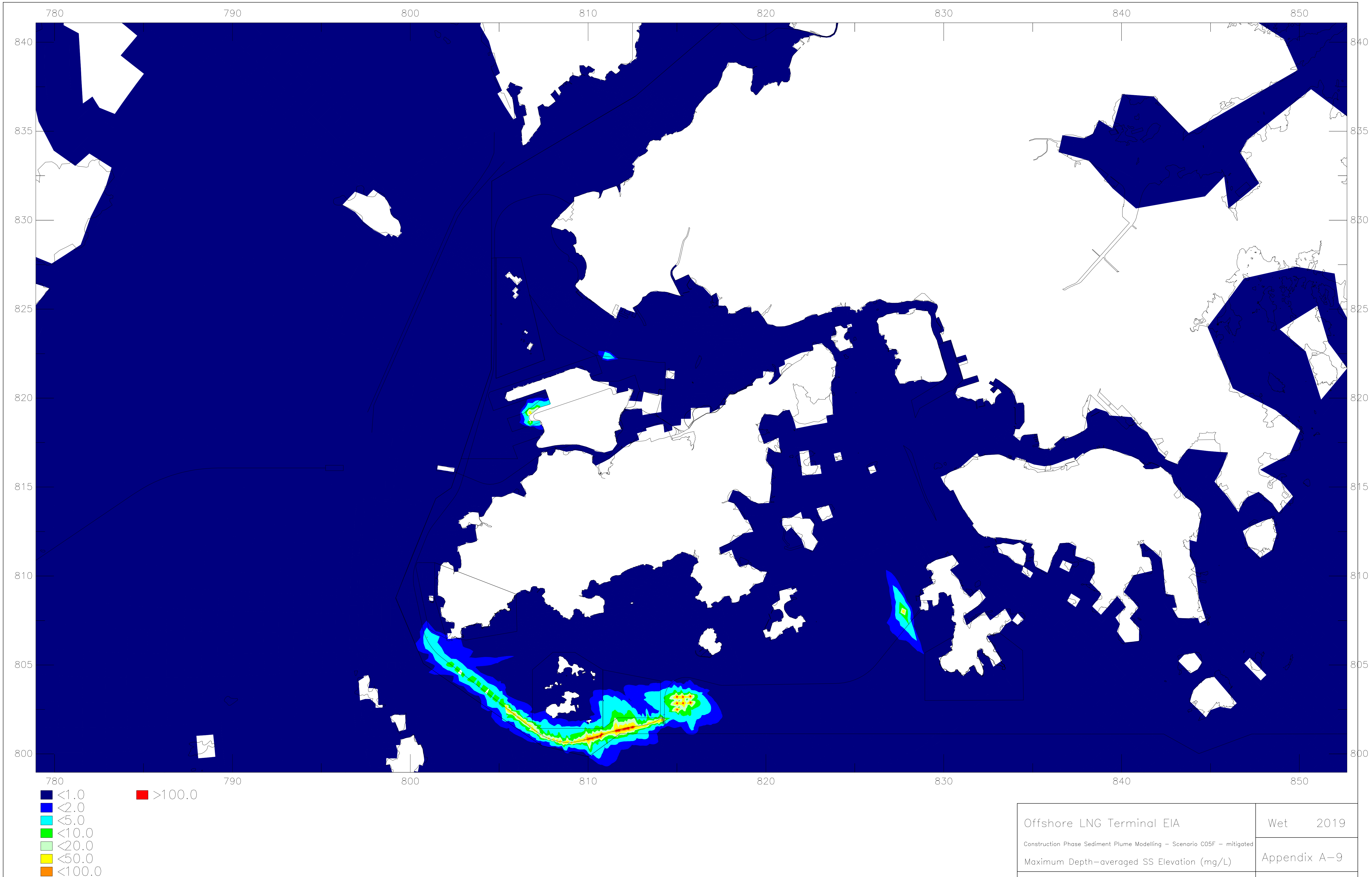
Offshore LNG Terminal EIA	Wet 2019
Construction Phase Sediment Plume Modelling – Scenario C05E – mitigated Maximum Depth–averaged SS Elevation (mg/L)	Appendix A–8
ERM	Appendix A.ssn



Offshore LNG Terminal EIA

Construction Phase Sediment Plume Modelling – Scenario C05F – mitigated

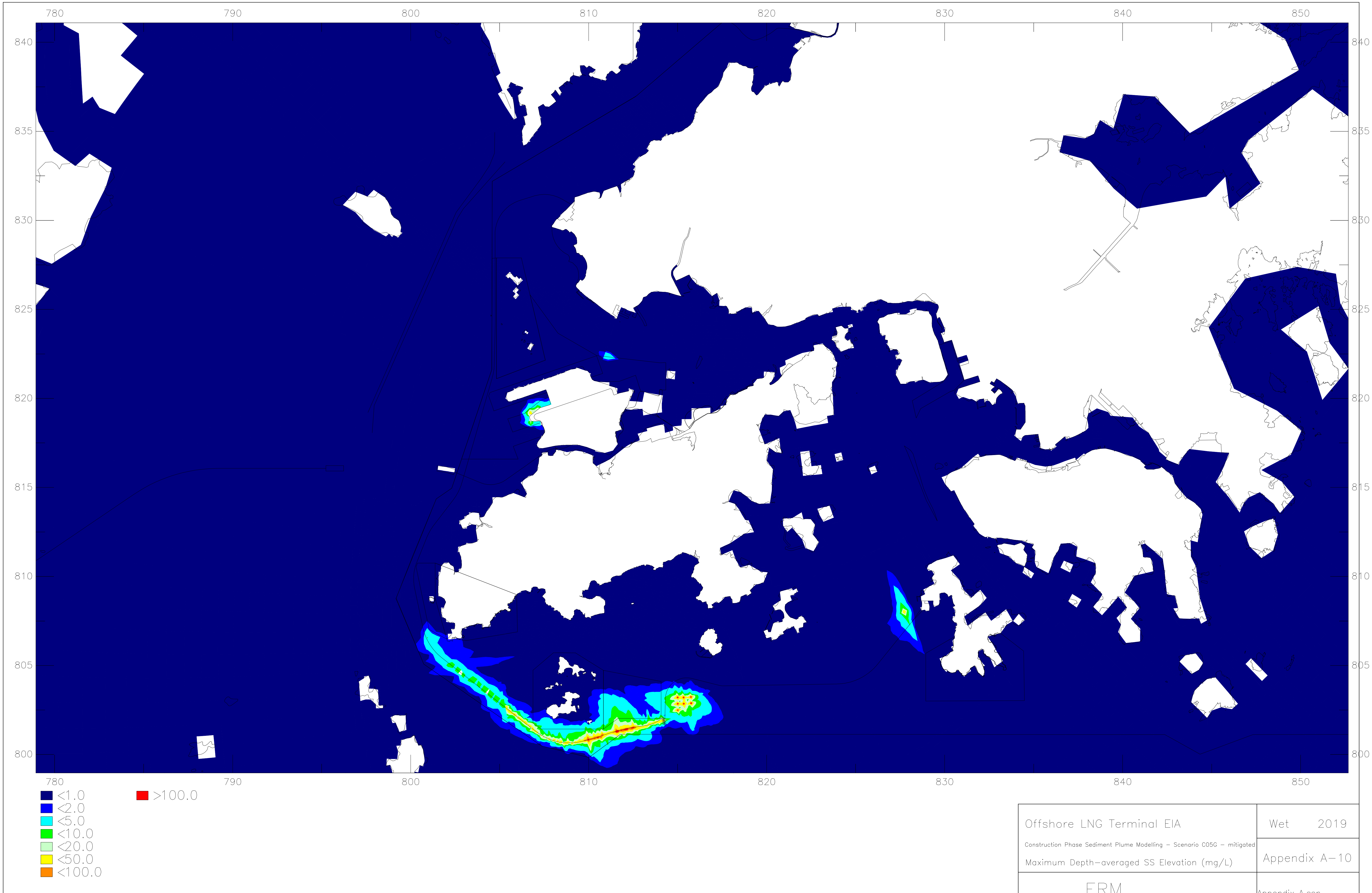
Maximum Depth-averaged SS Elevation (mg/L)

ERM

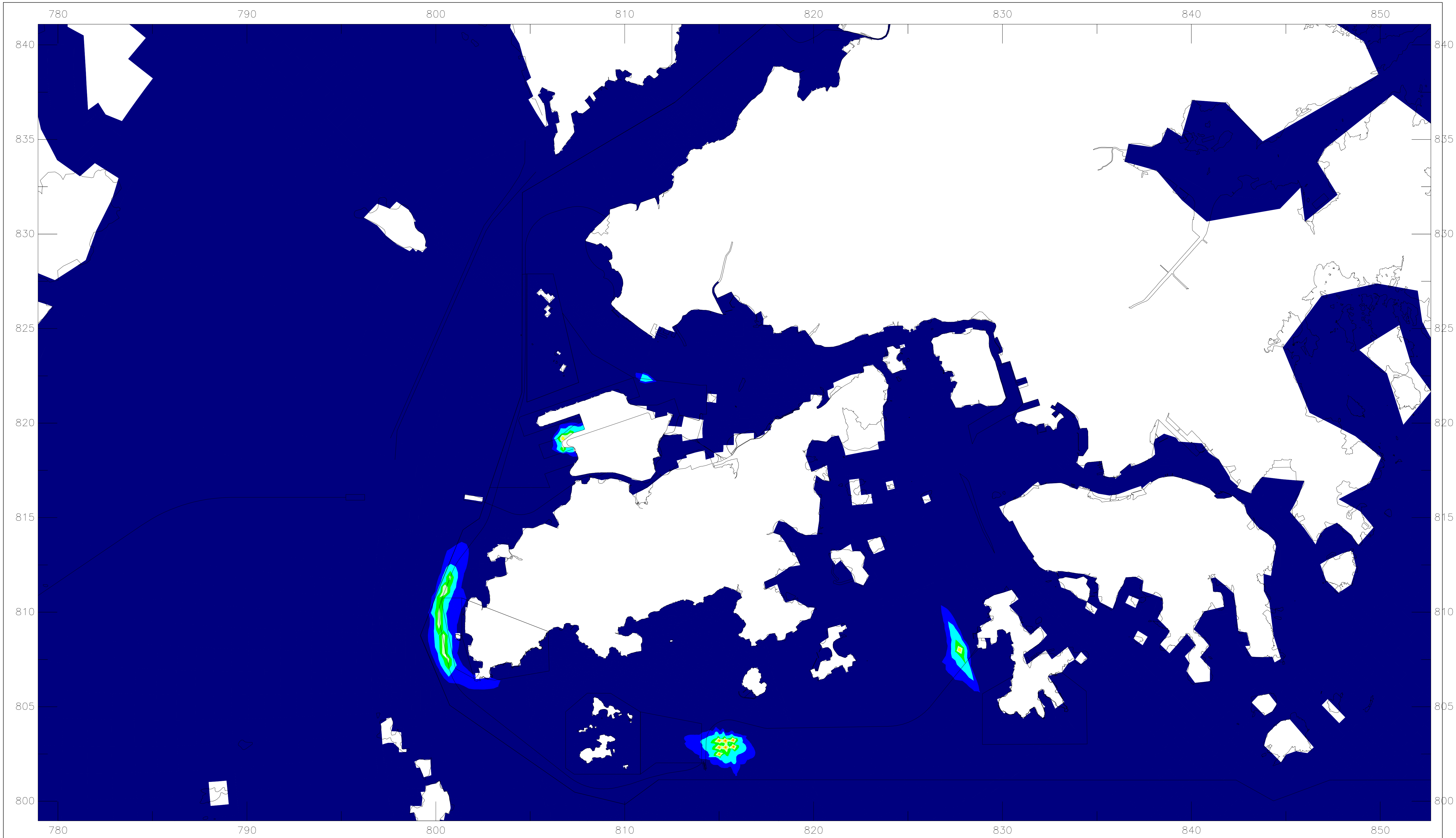
Wet 2019

Appendix A-9

Appendix A.ssn



Offshore LNG Terminal EIA	Wet 2019
Construction Phase Sediment Plume Modelling – Scenario C05G – mitigated Maximum Depth-averaged SS Elevation (mg/L)	Appendix A-10
ERM	Appendix A.ssn



Offshore LNG Terminal EIA

Construction Phase Sediment Plume Modelling – Scenario C09A – mitigated

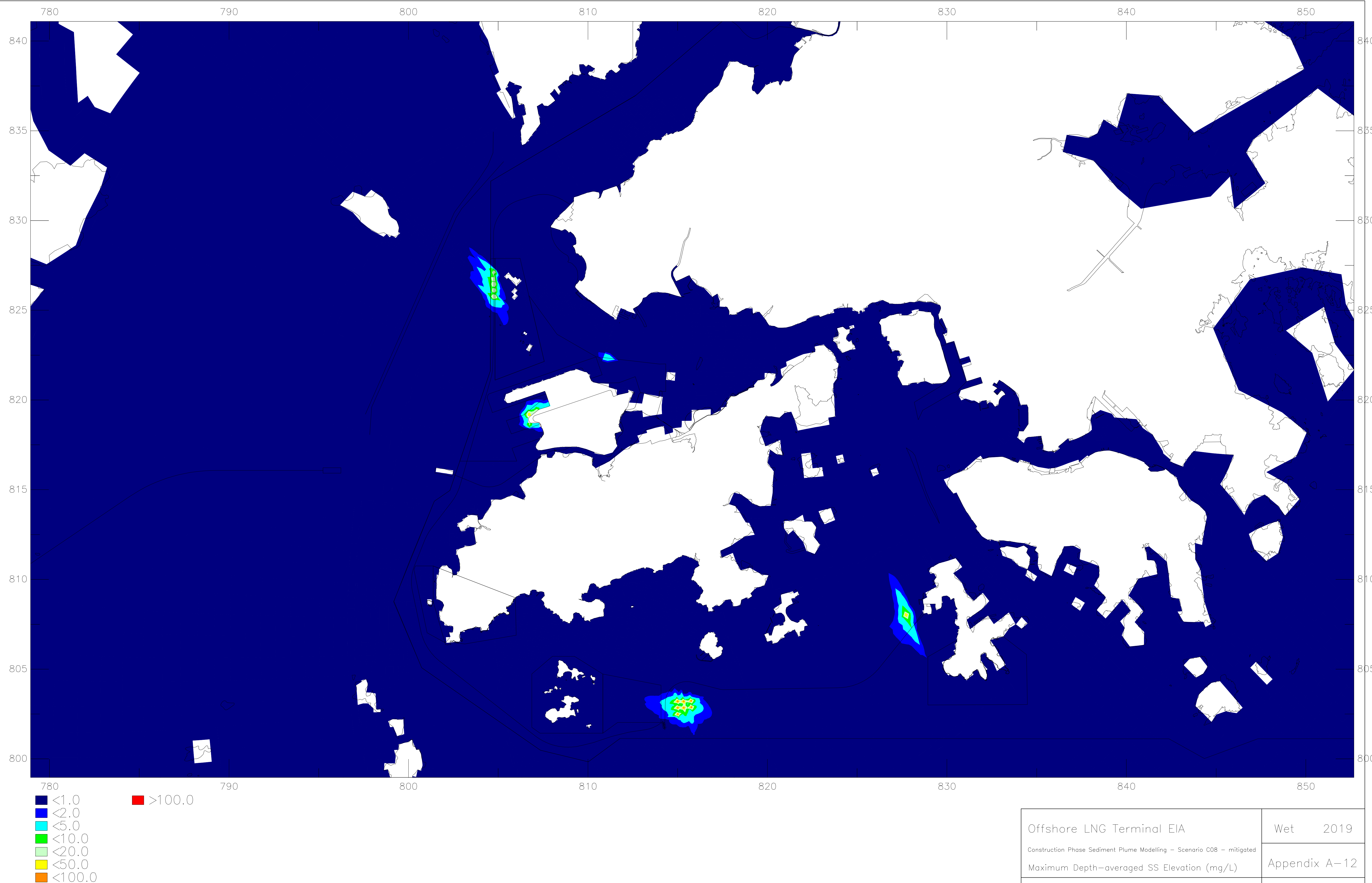
Maximum Depth-averaged SS Elevation (mg/L)

ERM

Wet 2019

Appendix A-11

Appendix A.ssn



Offshore LNG Terminal EIA

Construction Phase Sediment Plume Modelling – Scenario C08 – mitigated

Maximum Depth–averaged SS Elevation (mg/L)

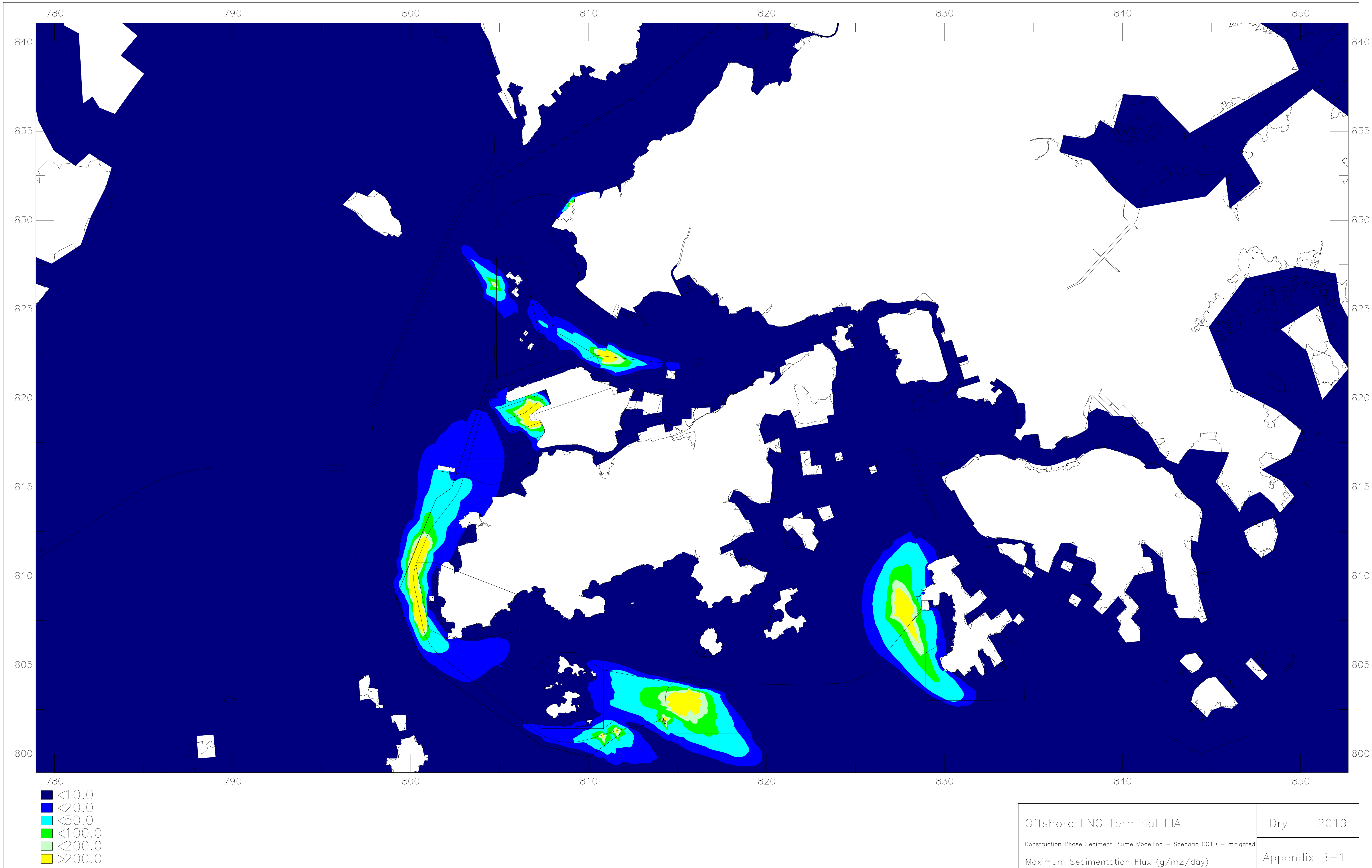
Wet 2019

Appendix A–12

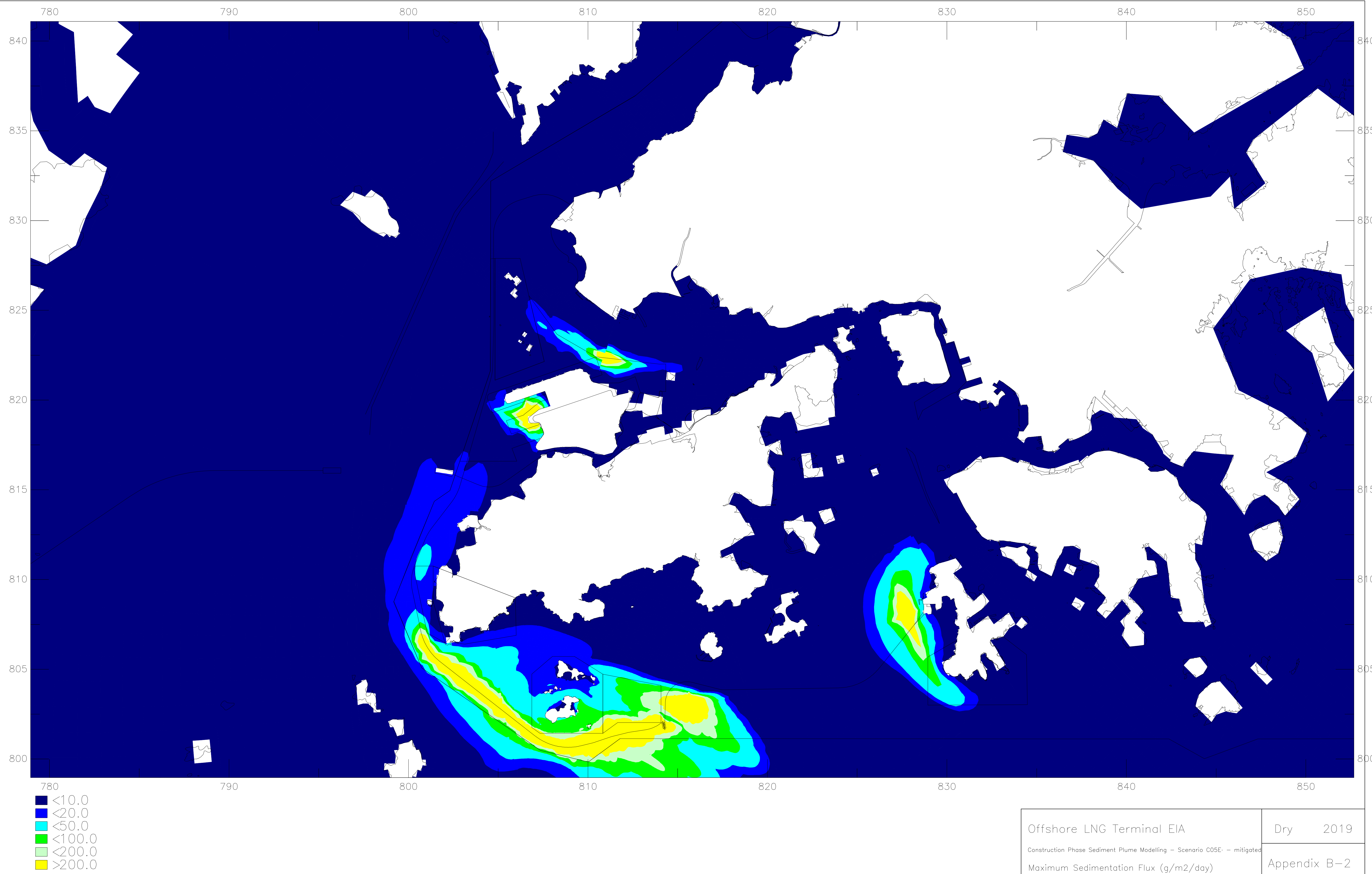
ERM

Appendix A.ssn

Appendix B Contour Plots for Sediment Plume Modelling – Sedimentation Flux



Offshore LNG Terminal EIA	Dry 2019
Construction Phase Sediment Plume Modelling – Scenario C01D – mitigated Maximum Sedimentation Flux (g/m2/day)	Appendix B-1
ERM	Appendix B.ssn



Offshore LNG Terminal EIA

Construction Phase Sediment Plume Modelling – Scenario C05E· – mitigated

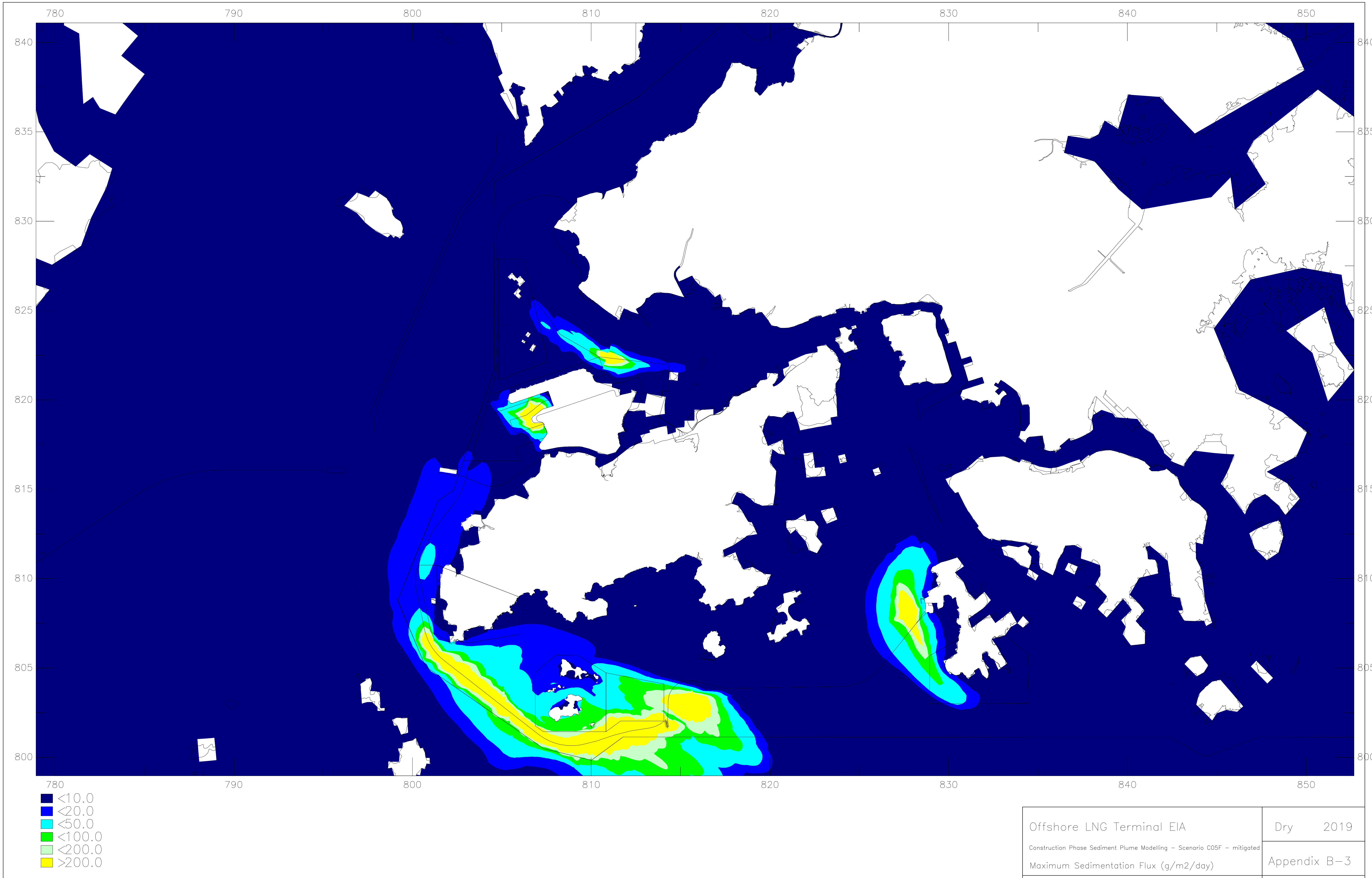
Maximum Sedimentation Flux (g/m2/day)

Dry 2019

Appendix B–2

ERM

Appendix B.ssn



Offshore LNG Terminal EIA

Construction Phase Sediment Plume Modelling – Scenario C05F – mitigated

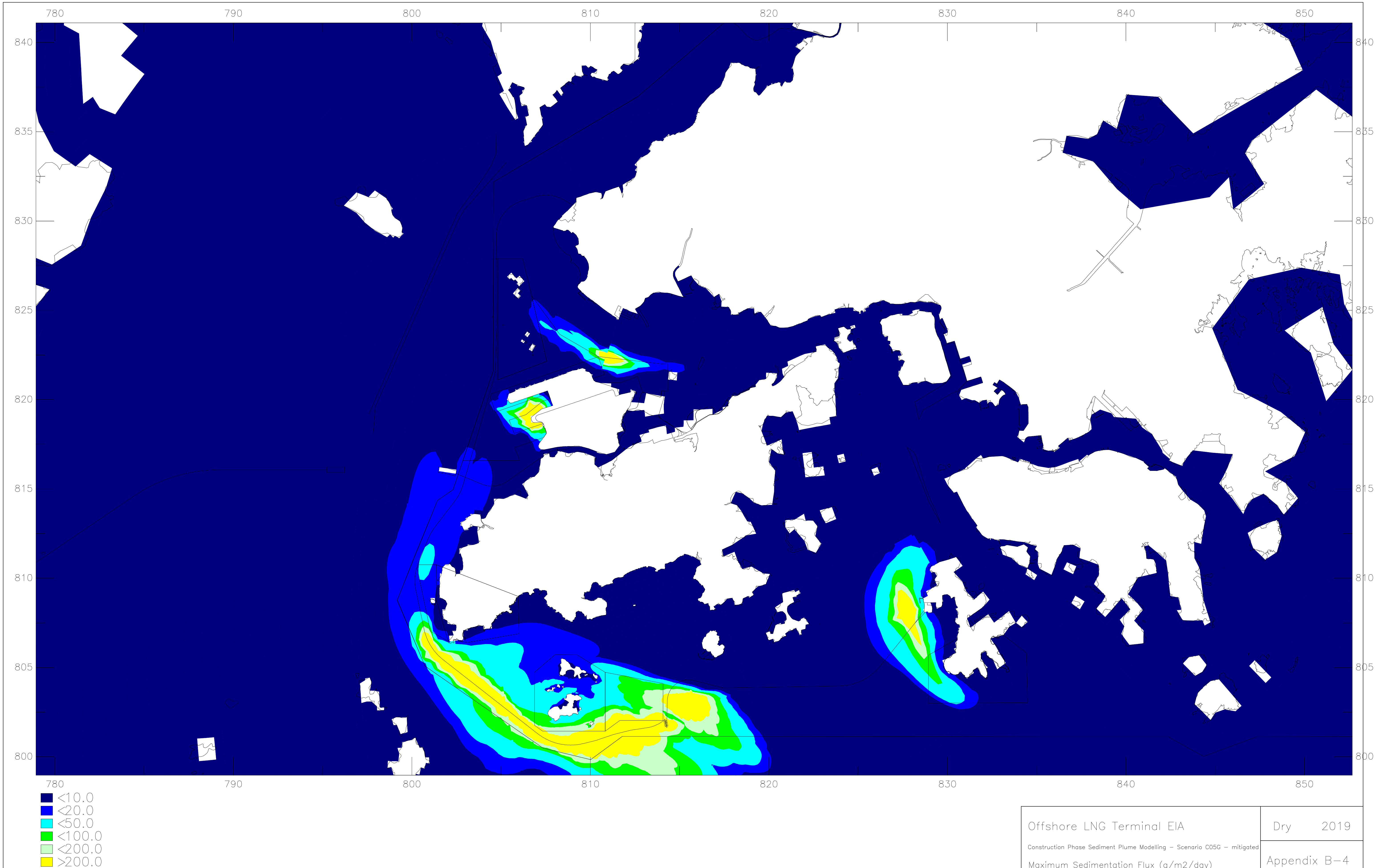
Maximum Sedimentation Flux (g/m2/day)

Dry 2019

Appendix B–3

ERM

Appendix B.ssn



Offshore LNG Terminal EIA

Construction Phase Sediment Plume Modelling – Scenario C05G – mitigated

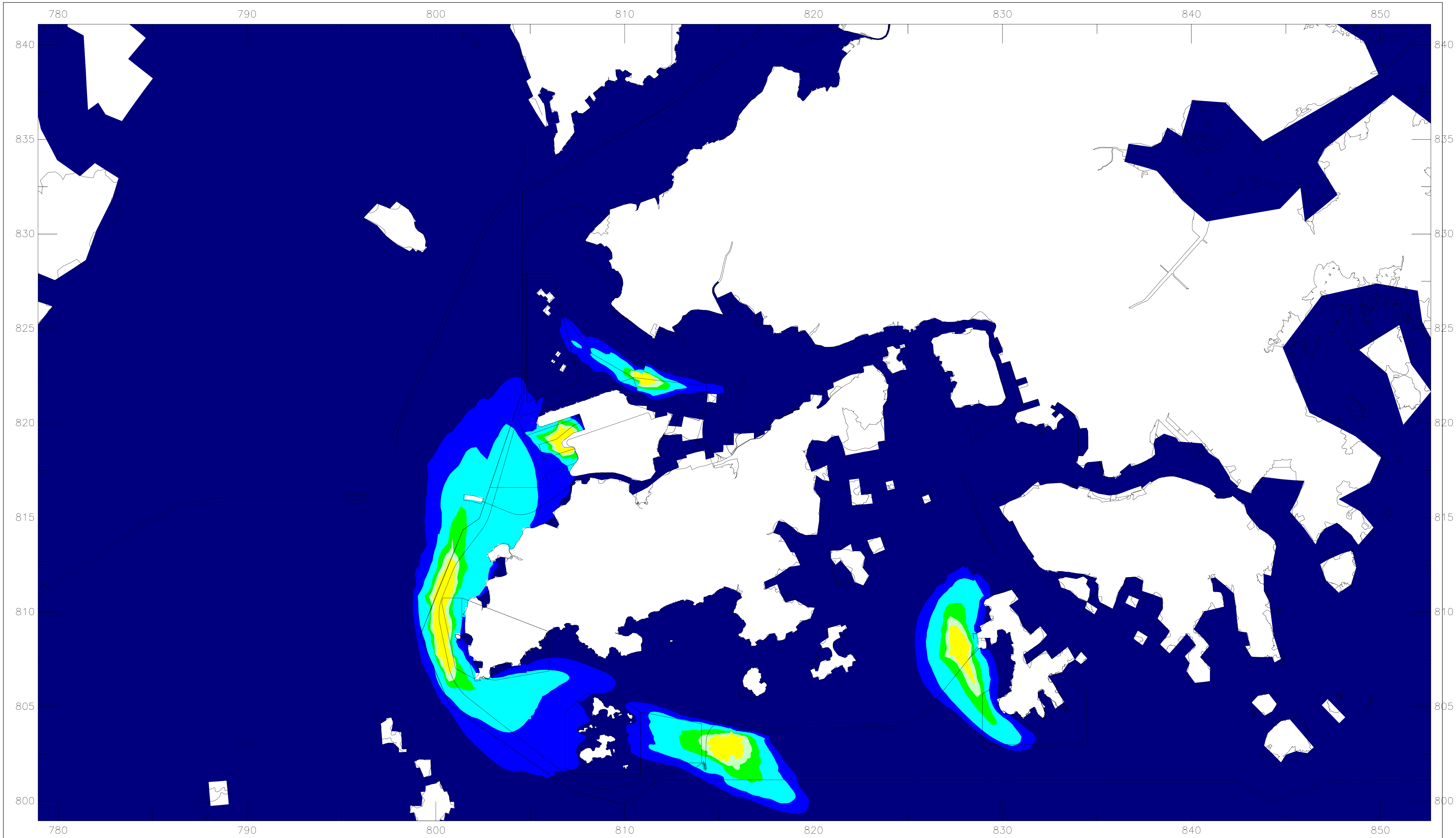
Maximum Sedimentation Flux (g/m2/day)

Dry 2019

Appendix B-4

ERM

Appendix B.ssn



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Offshore LNG Terminal EIA

Construction Phase Sediment Plume Modelling – Scenario C09A – mitigated

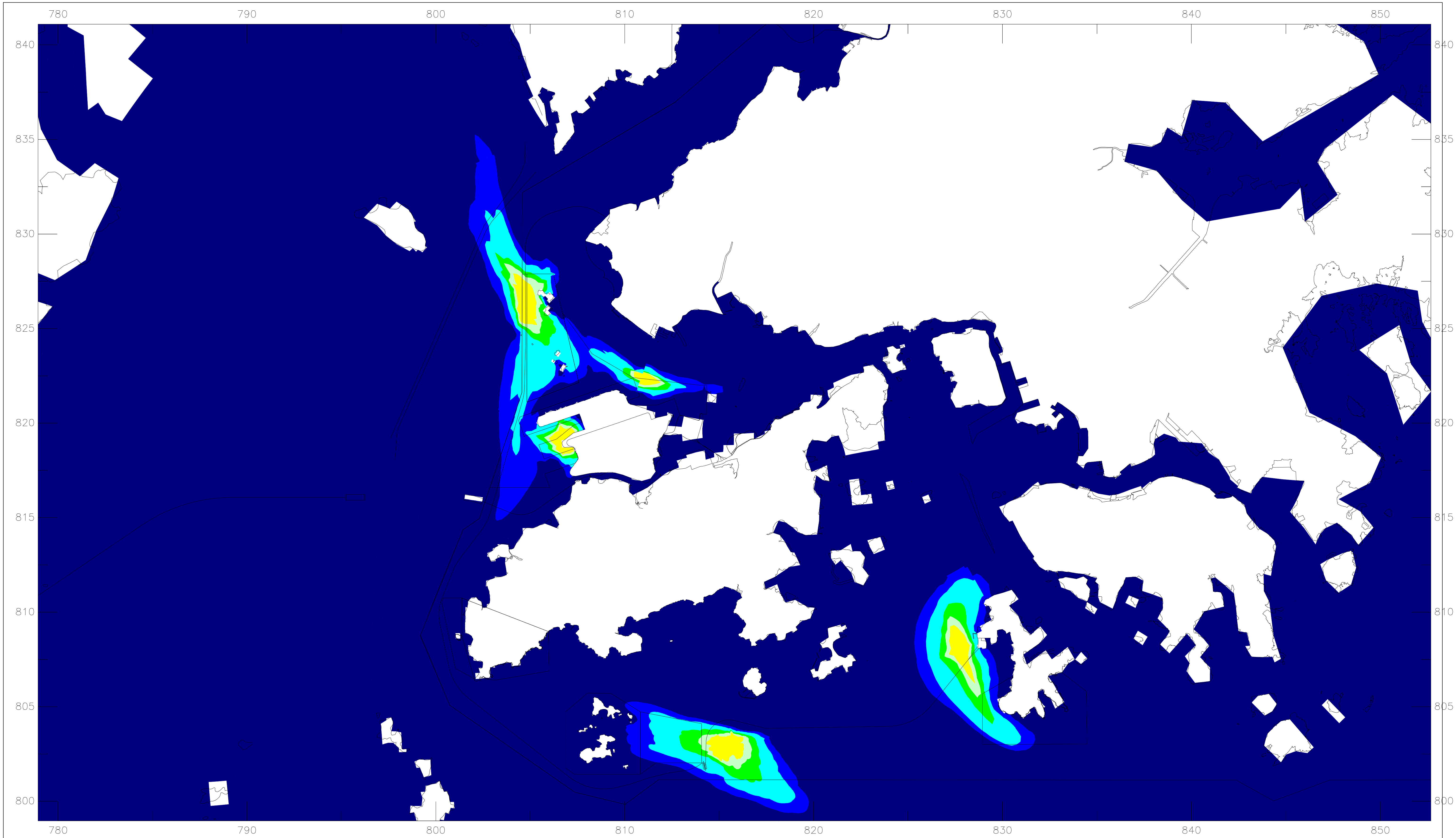
Maximum Sedimentation Flux (g/m2/day)

Dry 2019

Appendix B-5

ERM

Appendix B.ssn



Offshore LNG Terminal EIA

Construction Phase Sediment Plume Modelling – Scenario C08 – mitigated

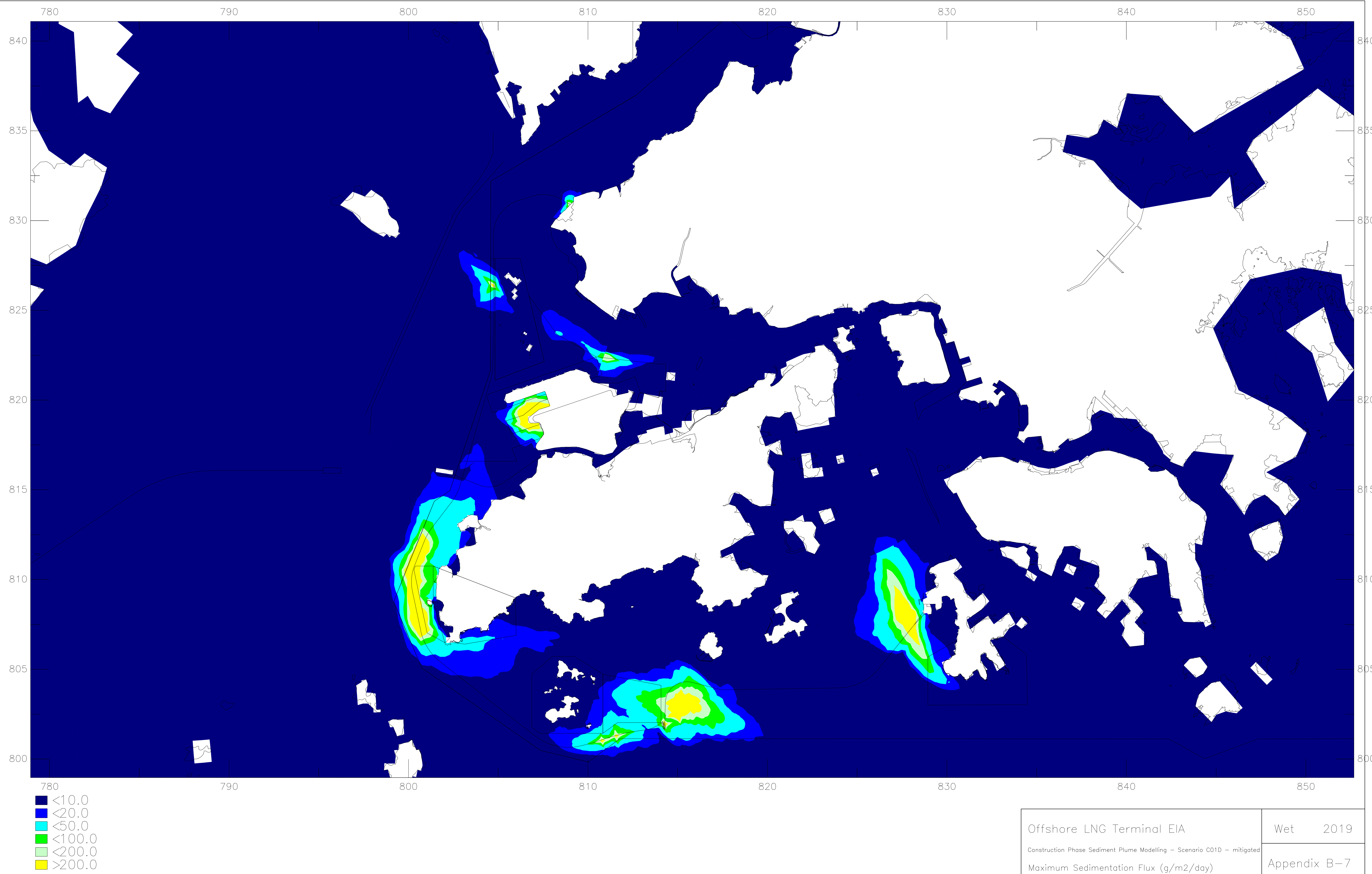
Maximum Sedimentation Flux (g/m2/day)

Dry 2019

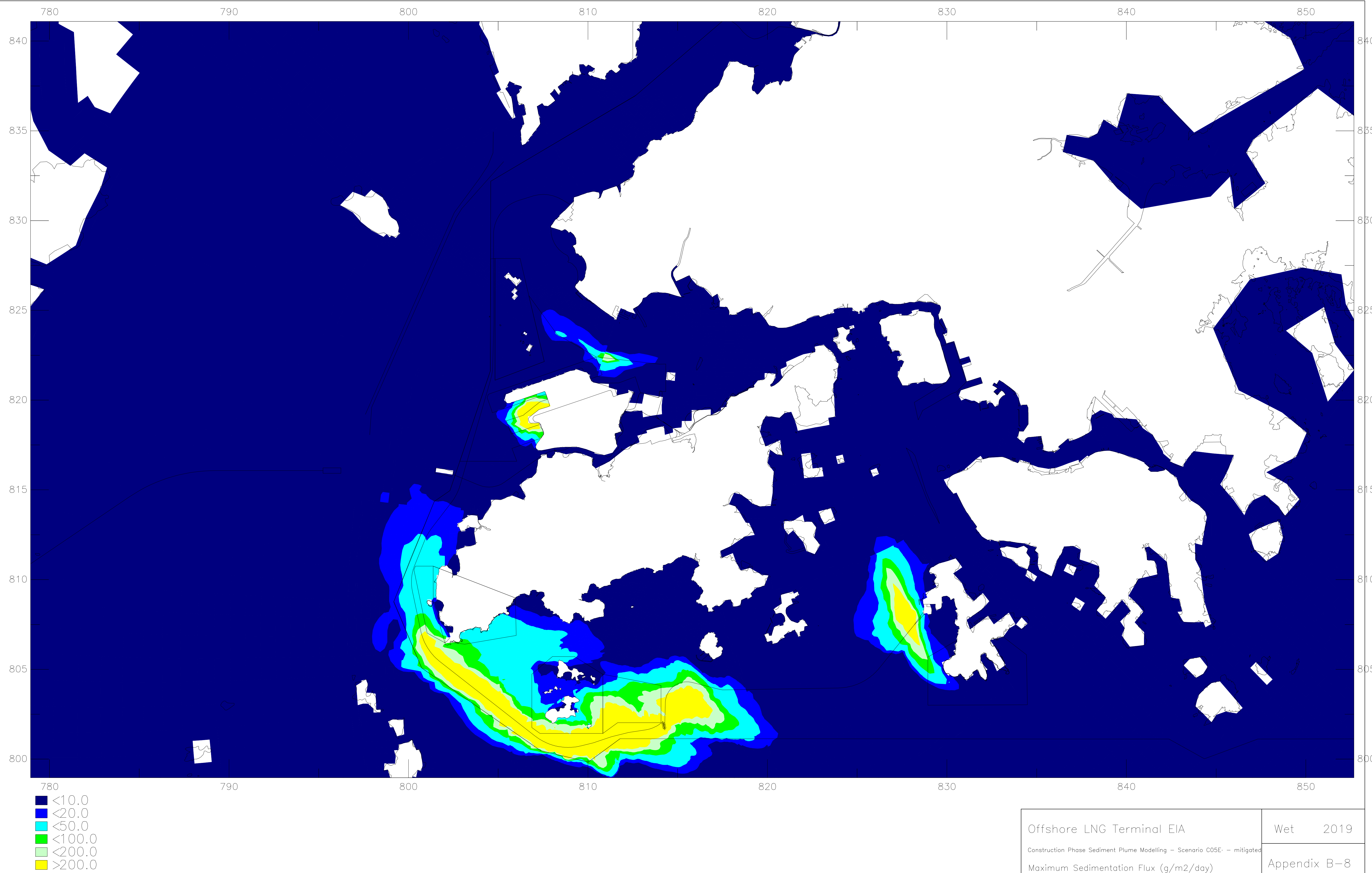
Appendix B-6

ERM

Appendix B.ssn



Offshore LNG Terminal EIA	Wet 2019
Construction Phase Sediment Plume Modelling – Scenario C01D – mitigated Maximum Sedimentation Flux (g/m2/day)	Appendix B-7
ERM	Appendix B.ssn



Offshore LNG Terminal EIA

Construction Phase Sediment Plume Modelling – Scenario C05E- – mitigated

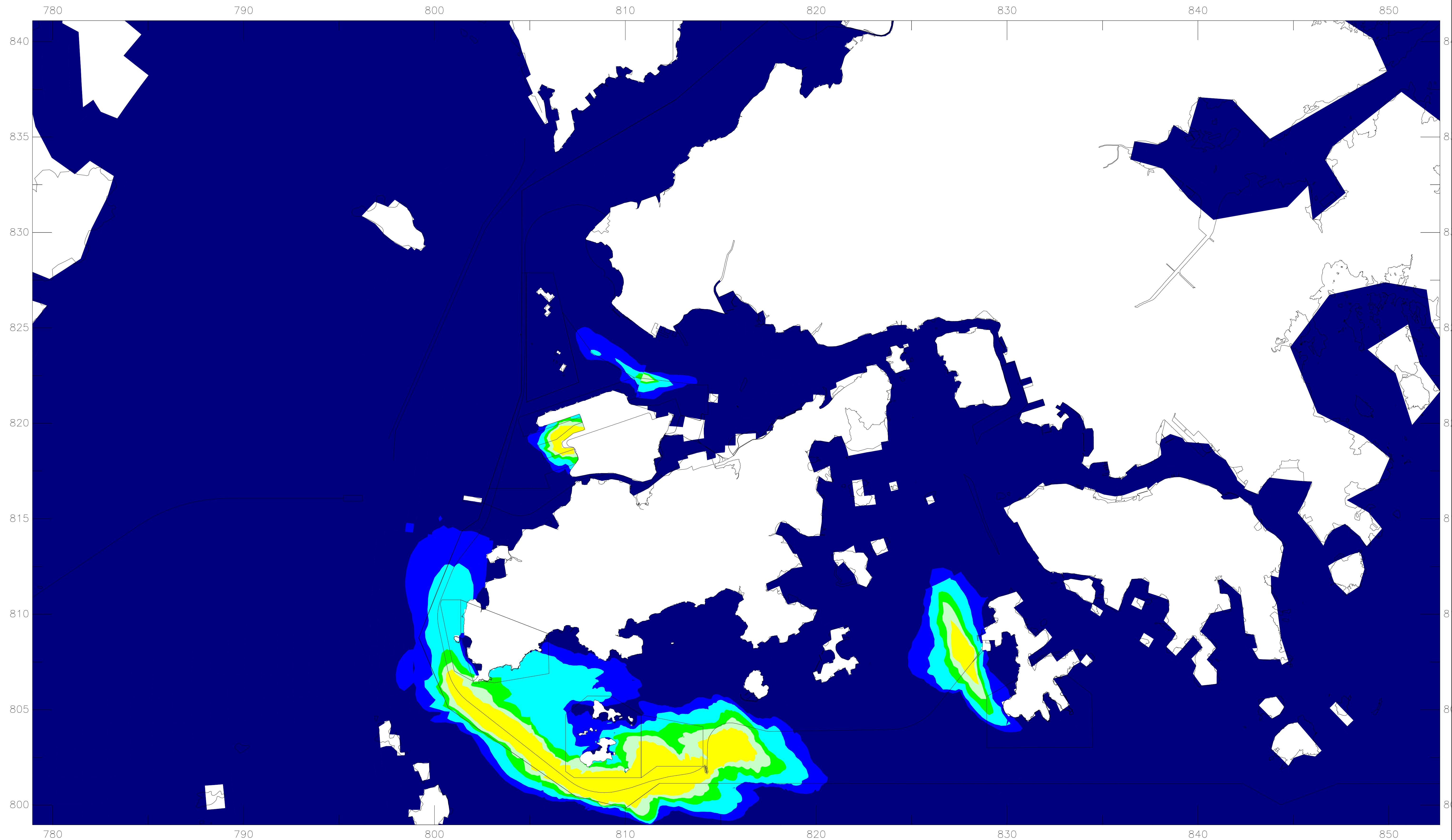
Maximum Sedimentation Flux (g/m2/day)

ERM

Wet 2019

Appendix B–8

Appendix B.ssn



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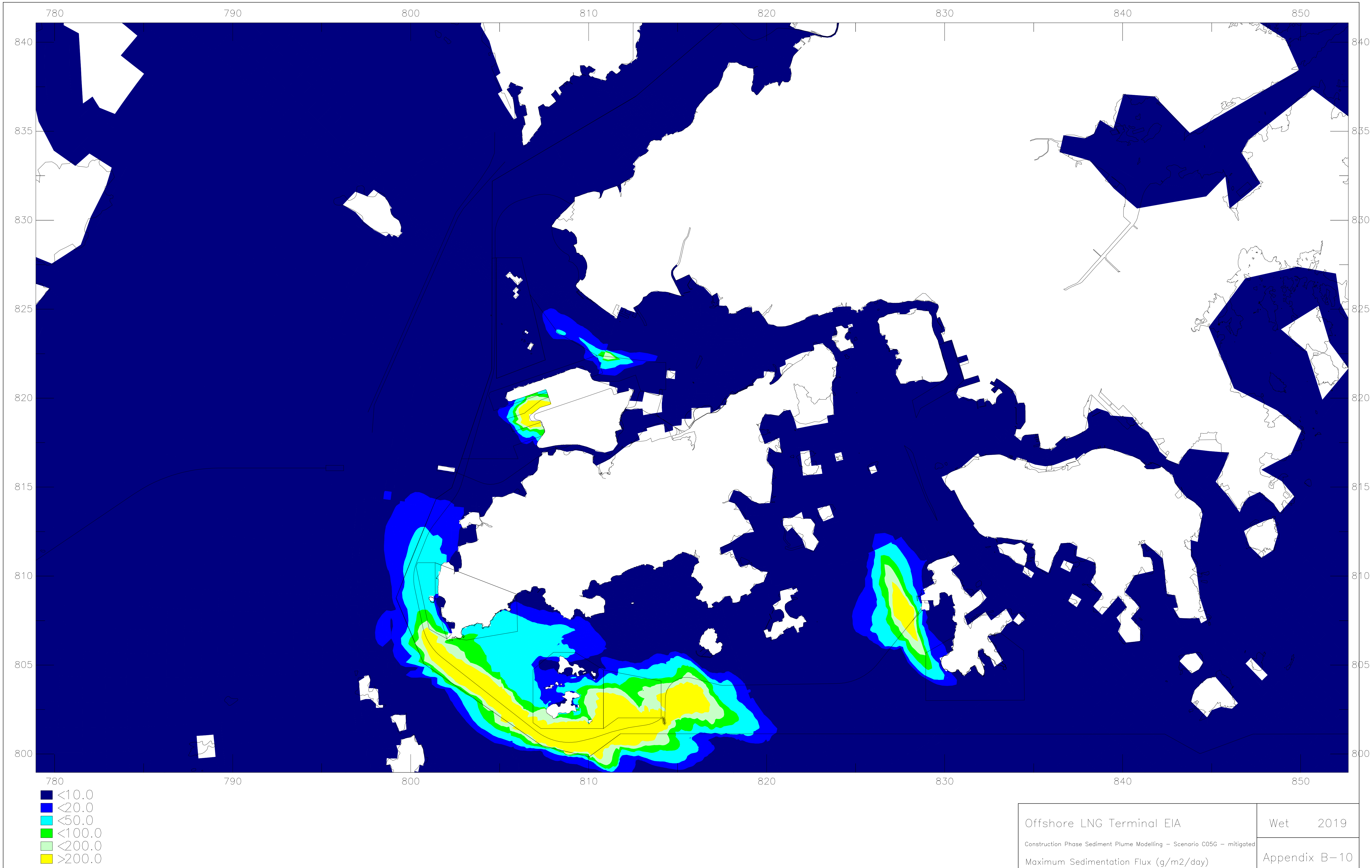
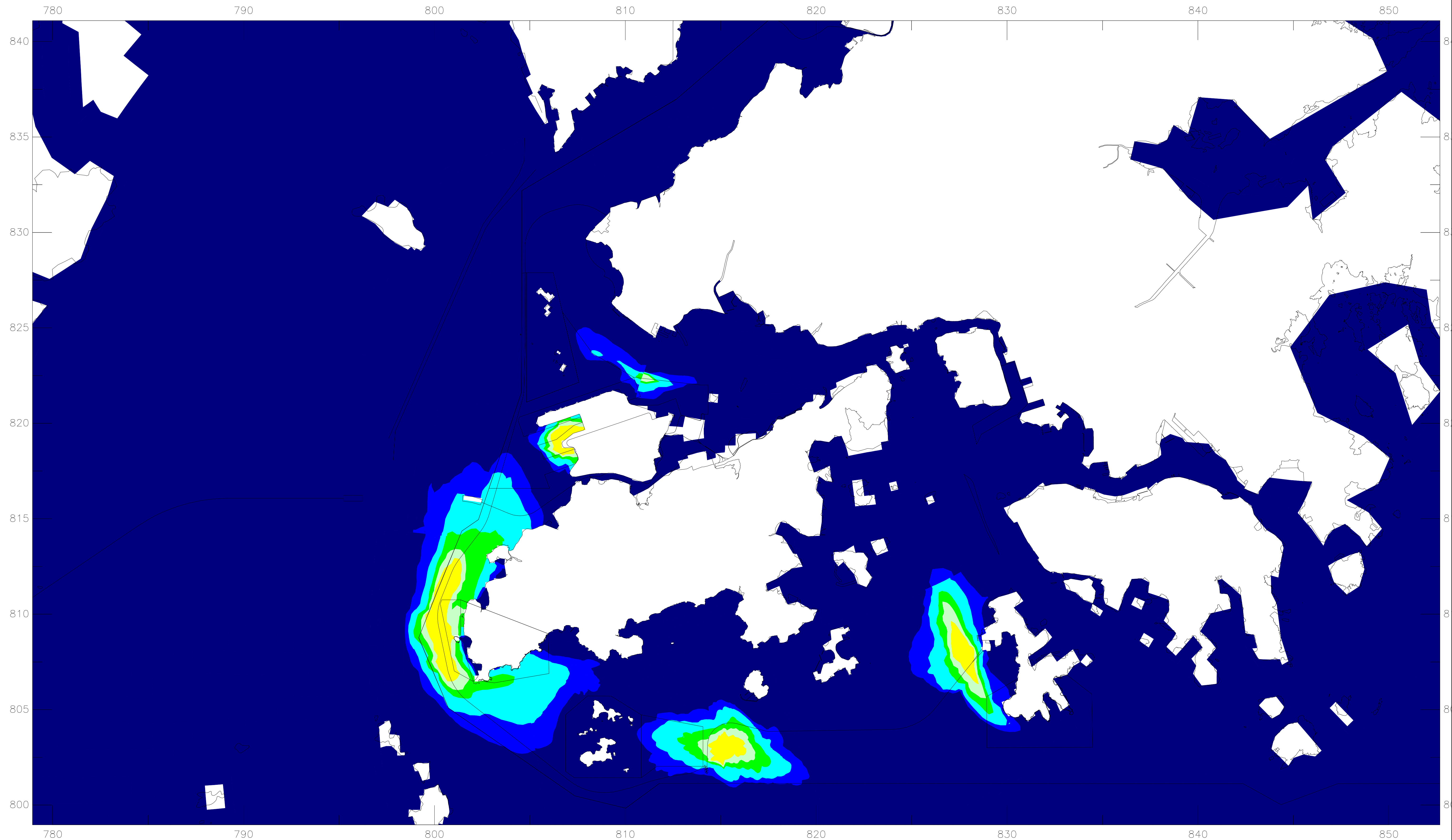
Offshore LNG Terminal EIA	Wet 2019
Construction Phase Sediment Plume Modelling – Scenario C05F – mitigated Maximum Sedimentation Flux (g/m2/day)	Appendix B-9
ERM	Appendix B.ssn

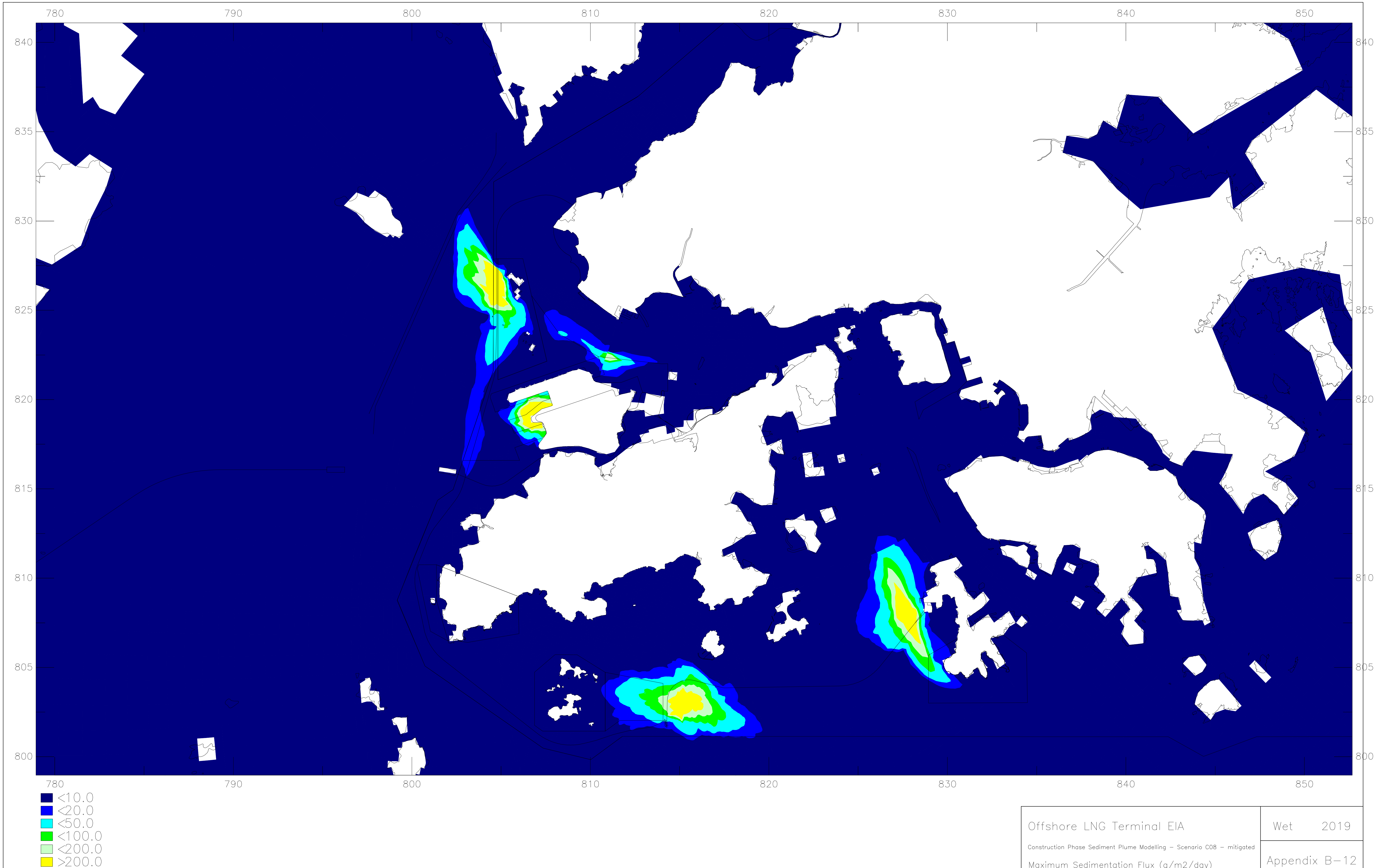


Offshore LNG Terminal EIA	Wet 2019
Construction Phase Sediment Plume Modelling – Scenario C05G – mitigated Maximum Sedimentation Flux (g/m2/day)	Appendix B-10
ERM	Appendix B.ssn



- <10.0
- <20.0
- <50.0
- <100.0
- <200.0
- >200.0

Offshore LNG Terminal EIA	Wet 2019
Construction Phase Sediment Plume Modelling – Scenario C09A – mitigated Maximum Sedimentation Flux (g/m2/day)	Appendix B-11
ERM	Appendix B.ssn



Offshore LNG Terminal EIA

Construction Phase Sediment Plume Modelling – Scenario C08 – mitigated

Maximum Sedimentation Flux (g/m2/day)

Wet 2019

Appendix B–12

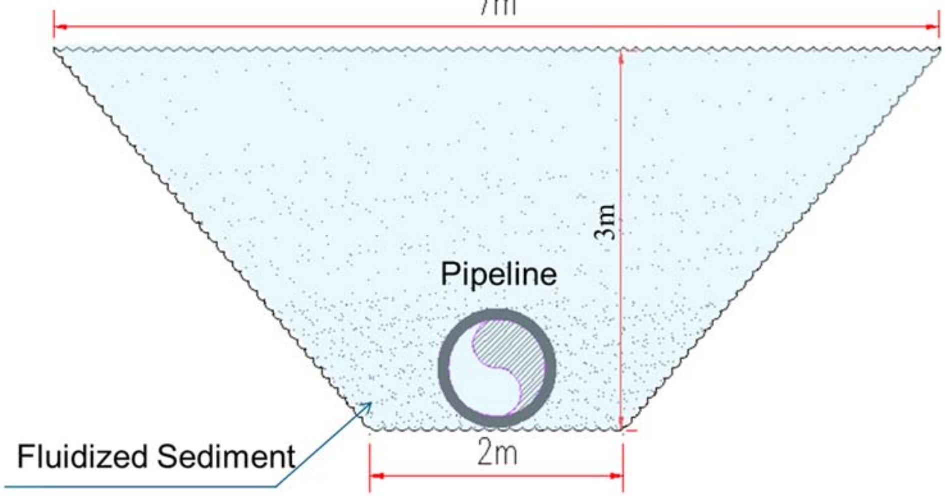
ERM

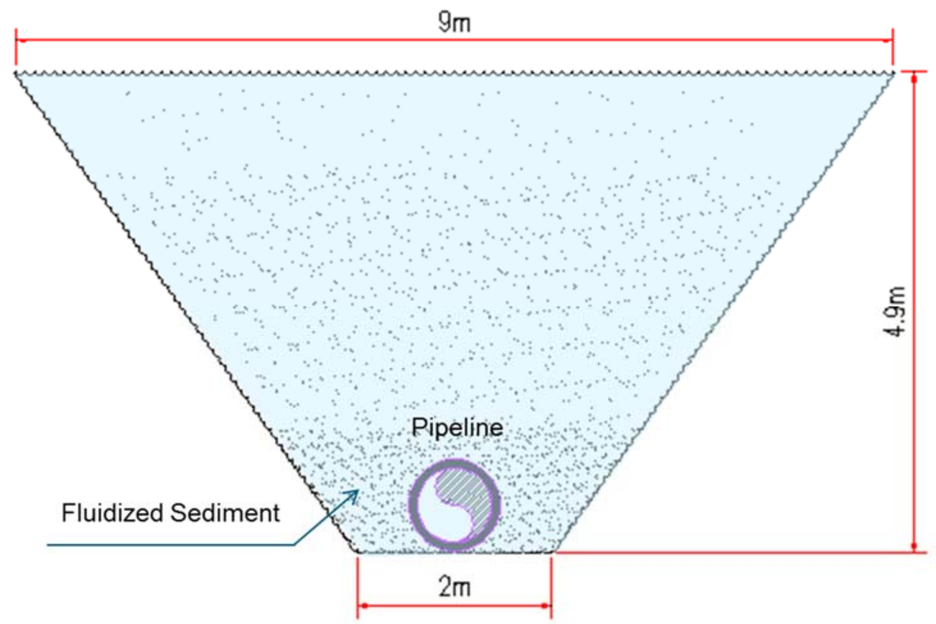
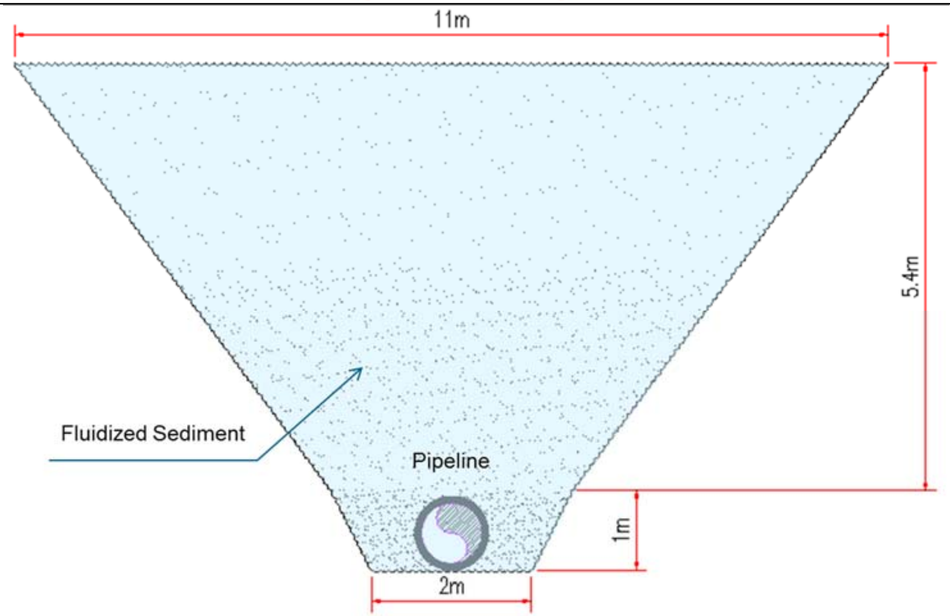
Appendix B.ssn

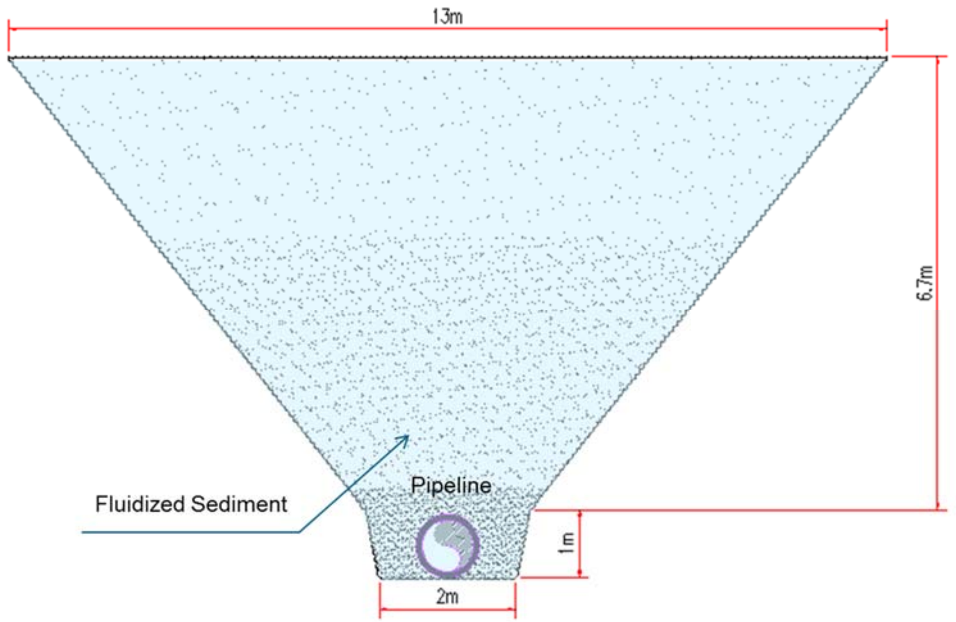
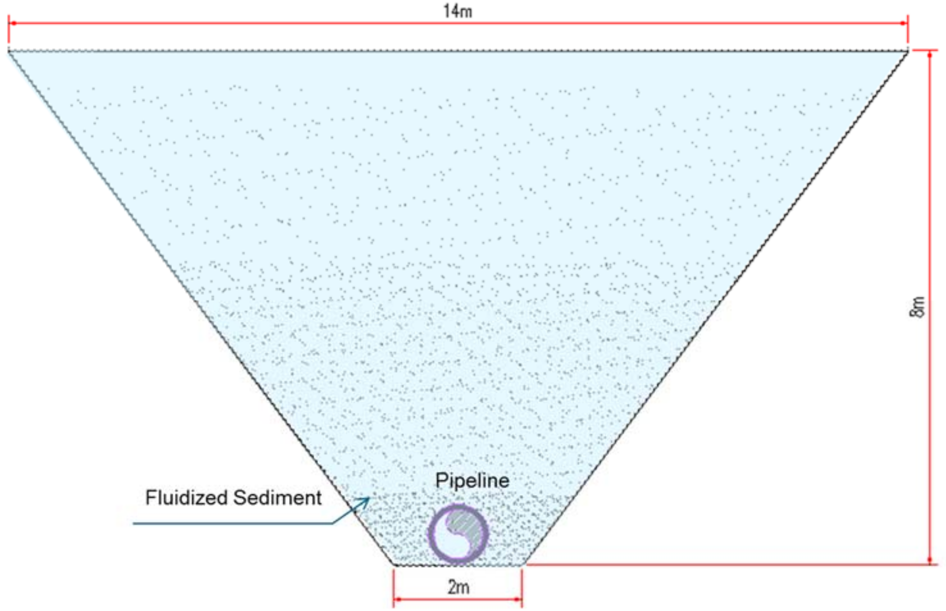
Appendix C Proposed Indicative Trench Design at Subsea Cable Sterile Corridors

Option 1 (Pure Jetting)

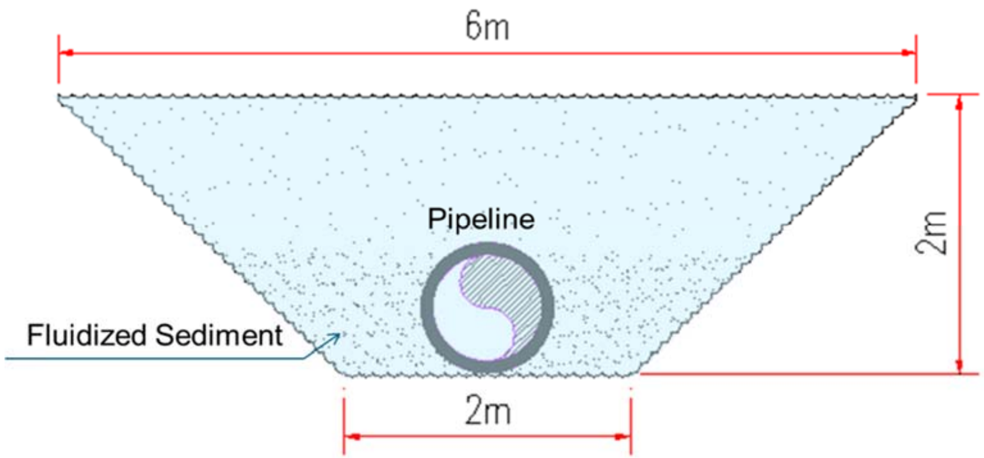
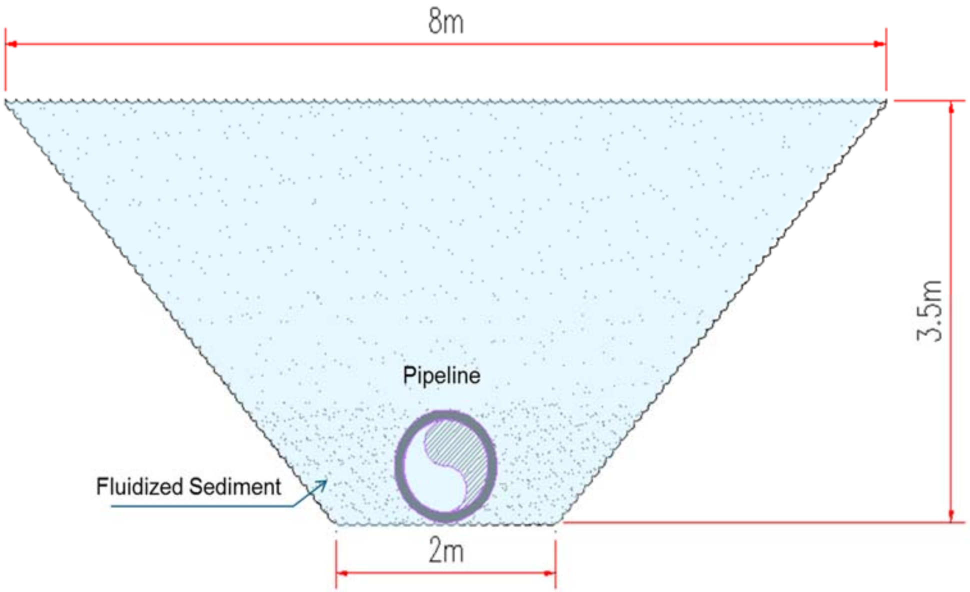
Option 1a: achieving the proposed pipeline burial depth with five jetting passes

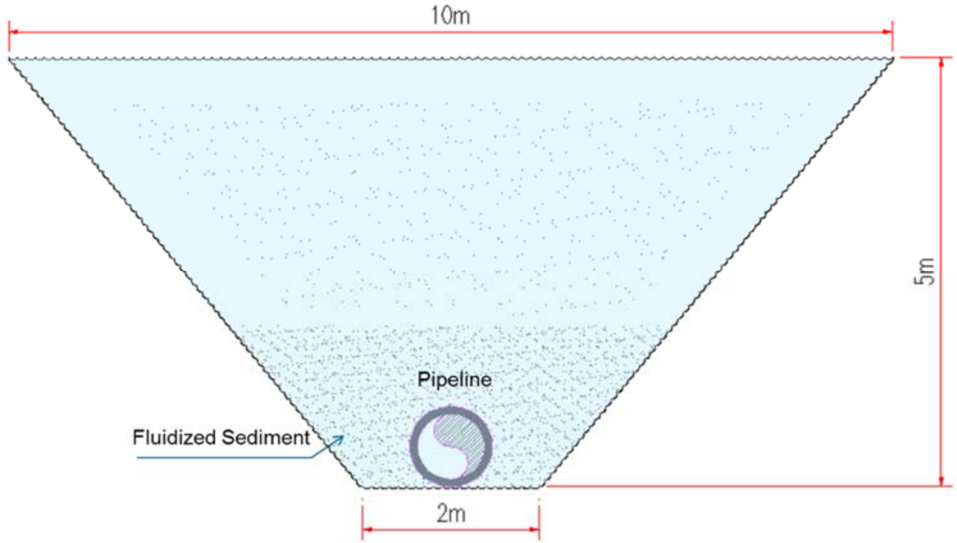
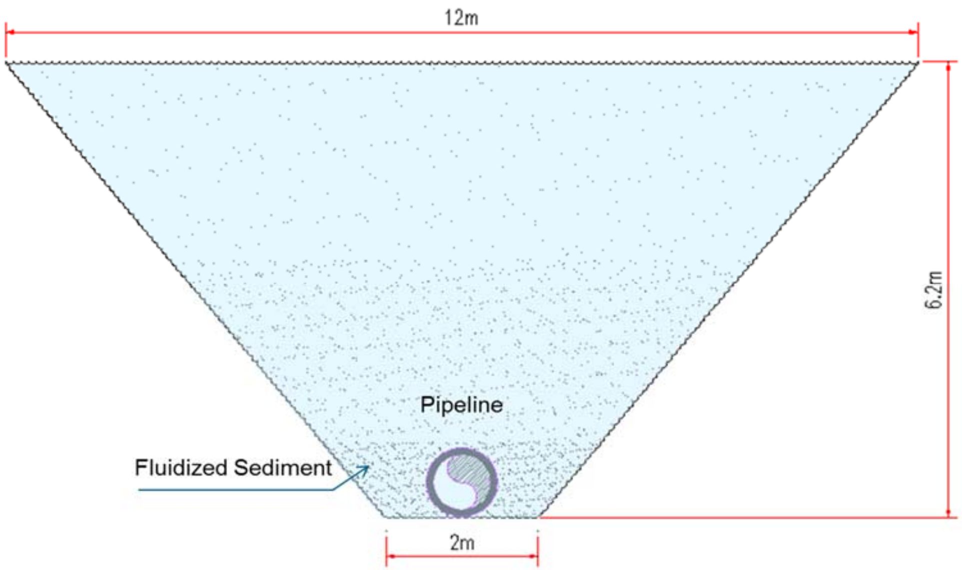
Passage number	Proposed Trench Configuration (not to scale)	Cross Section of Jetting Trench (m^2)
1		13.5

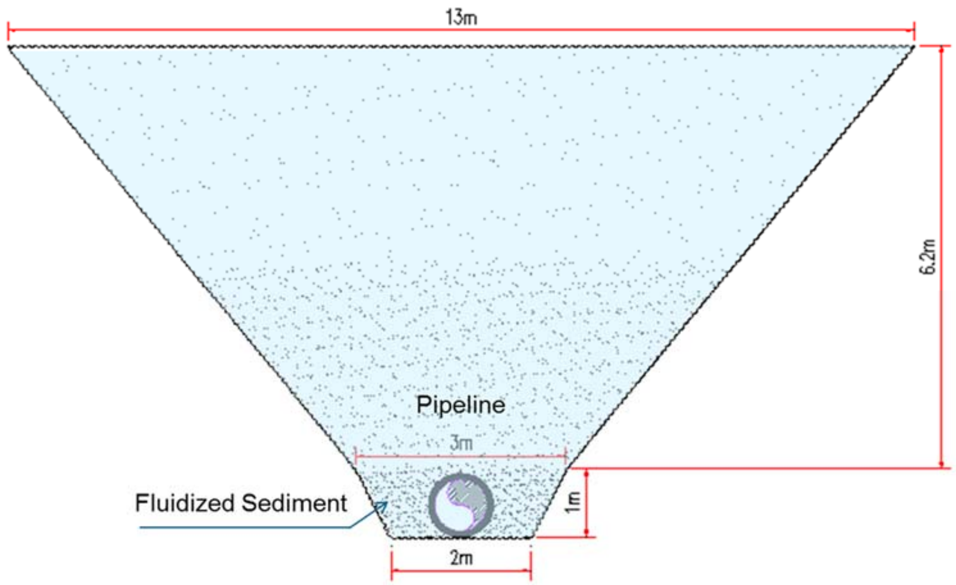
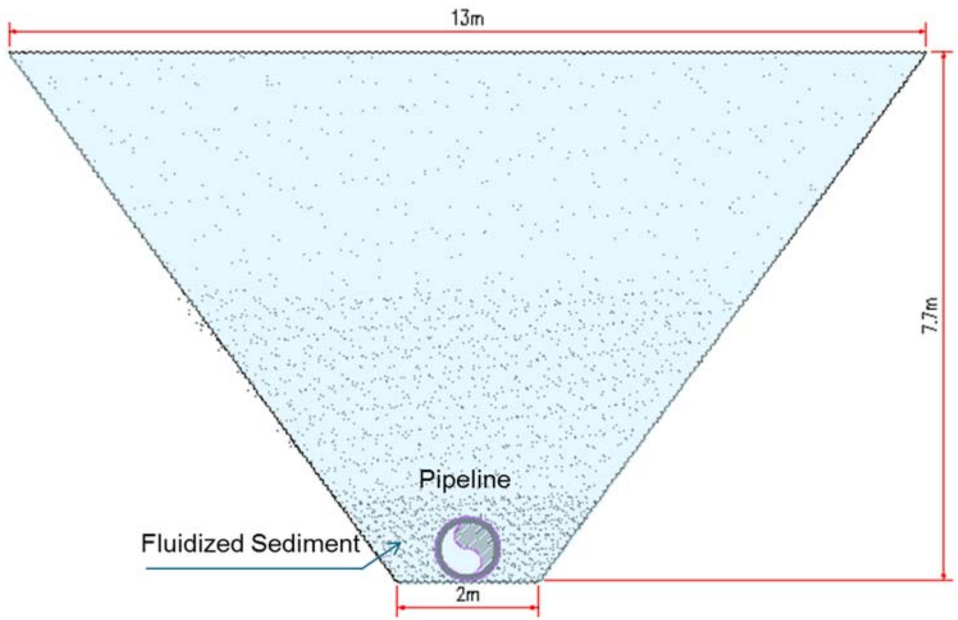
Passage number	Proposed Trench Configuration (not to scale)	Cross Section of Jetting Trench (m^2)
2		27.0
3		40.3

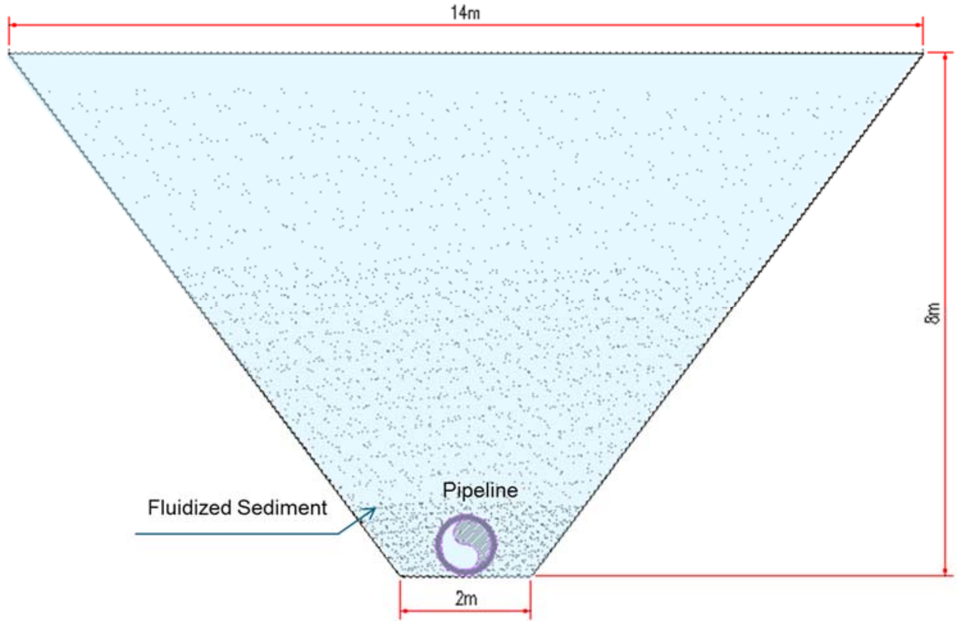
Passage number	Proposed Trench Configuration (not to scale)	Cross Section of Jetting Trench (m²)
4		52.3
5		64.0

Option 1b: achieving the proposed pipeline burial depth with seven jetting passes

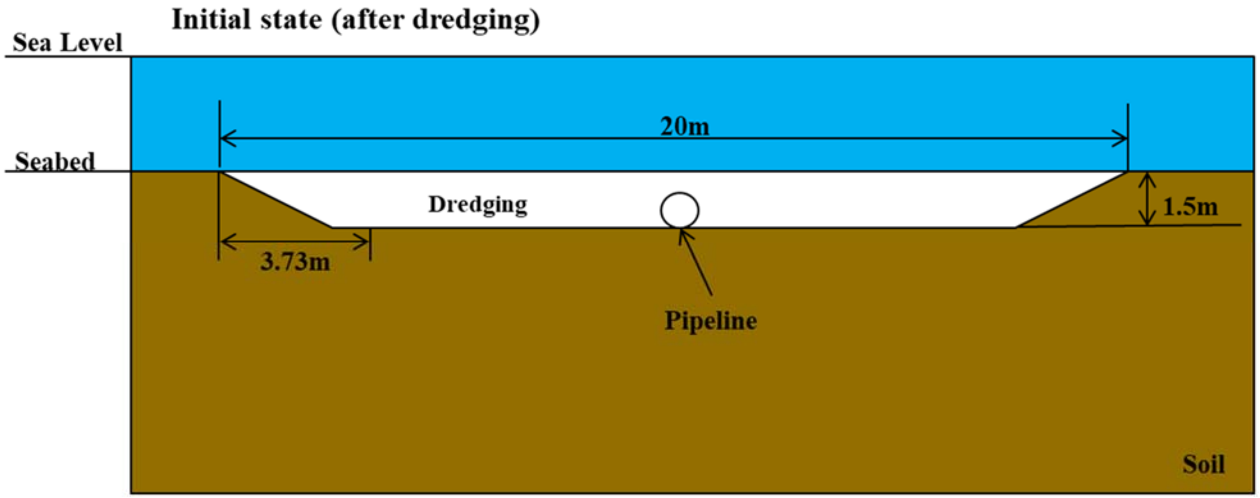
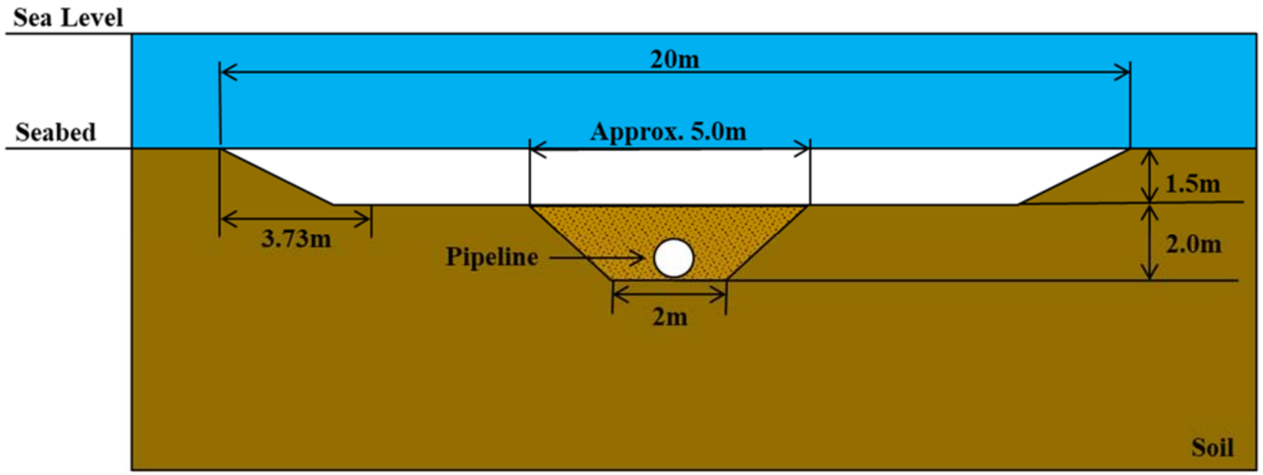
Passage number	Proposed Trench Configuration (not to scale)	Cross Section of Jetting Trench (m²)
1		8.0
2		17.5

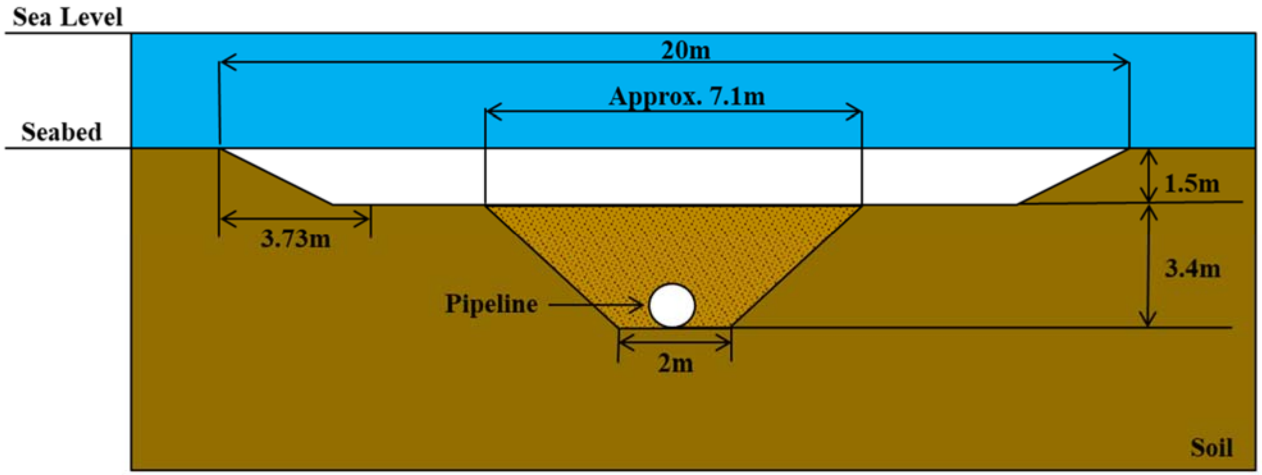
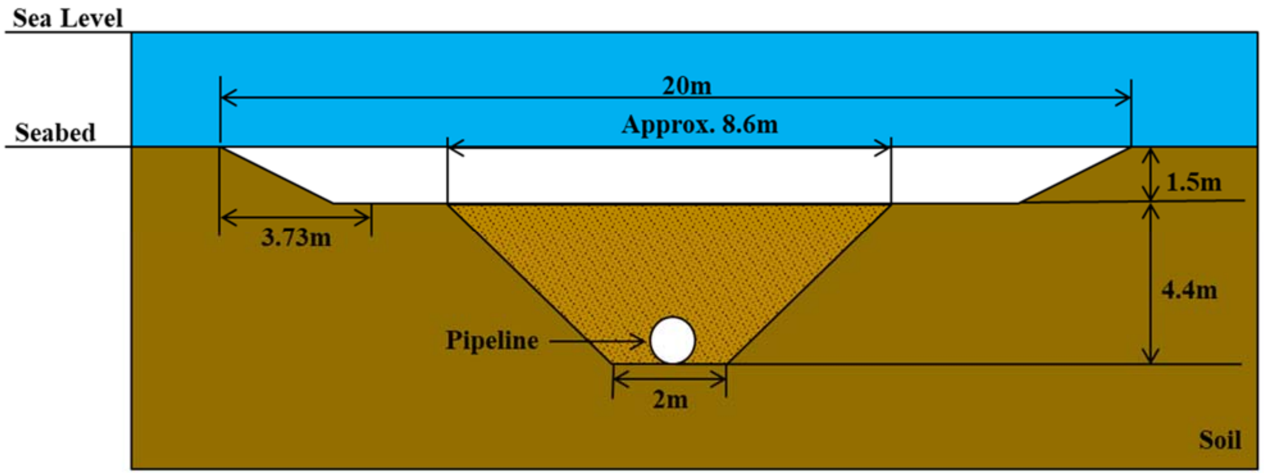
Passage number	Proposed Trench Configuration (not to scale)	Cross Section of Jetting Trench (m^2)
3		30.0
4		43.4

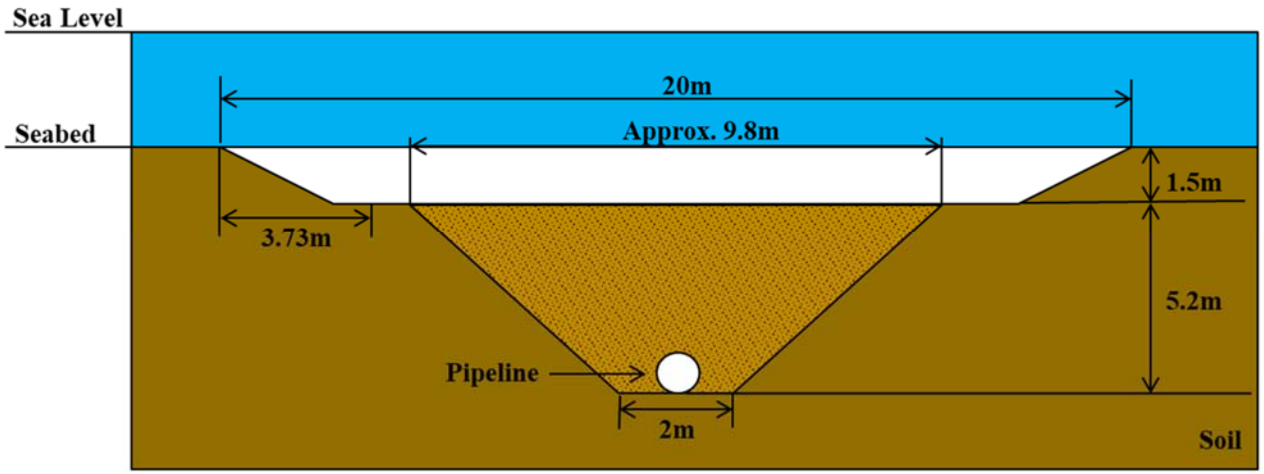
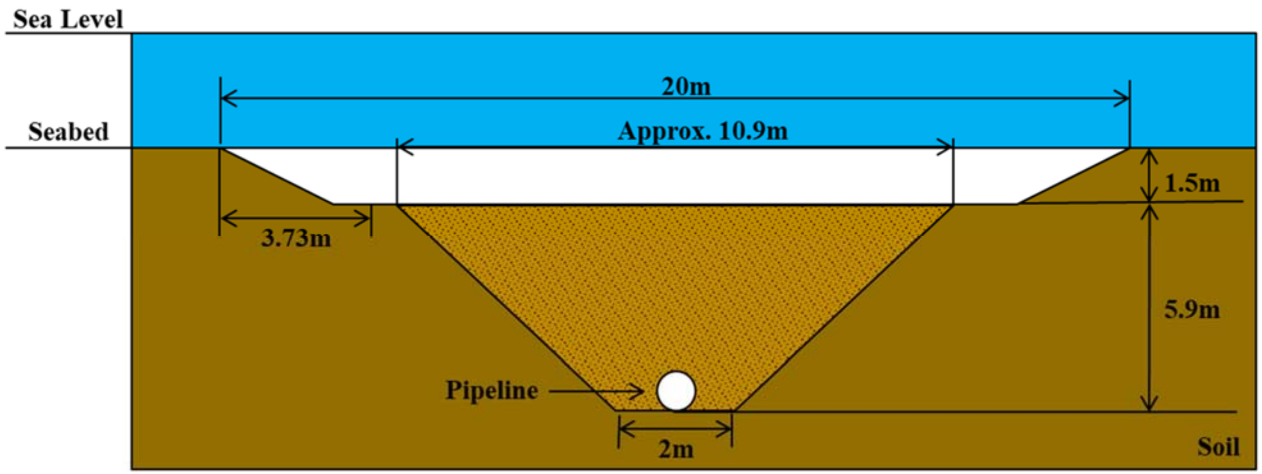
Passage number	Proposed Trench Configuration (not to scale)	Cross Section of Jetting Trench (m²)
5		52.1
6		57.8

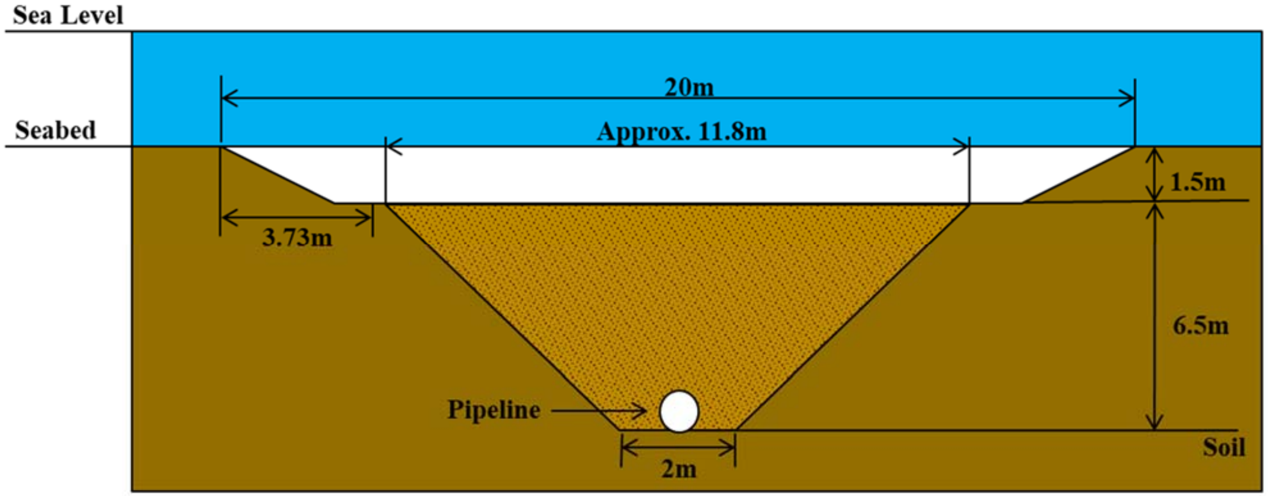
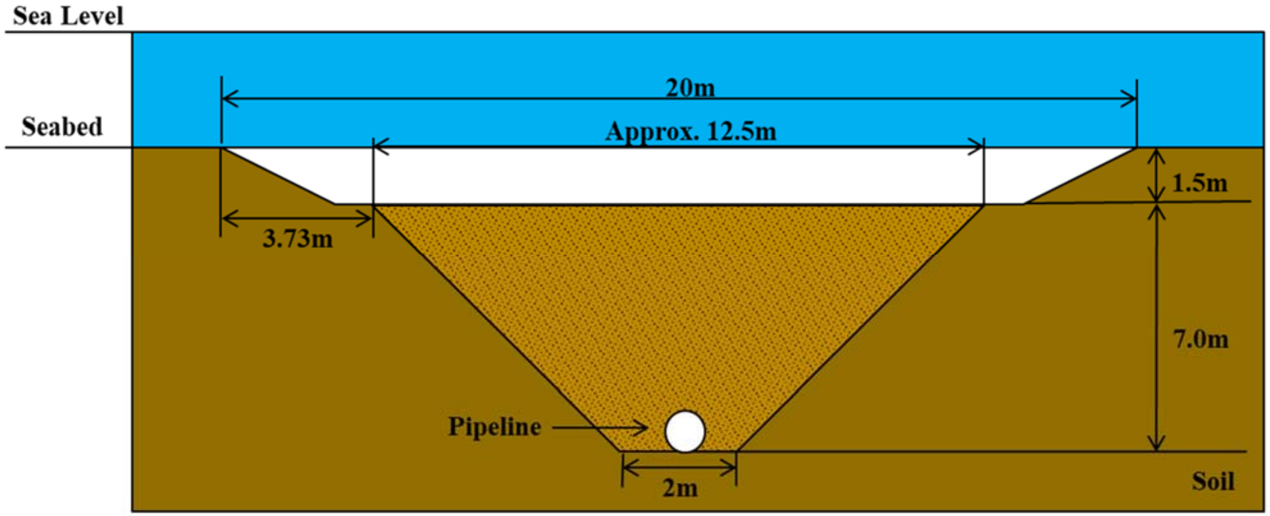
Passage number	Proposed Trench Configuration (not to scale)	Cross Section of Jetting Trench (m²)
7		64.0

Option 2 (Dredging top 1.5m then Jetting) - achieving the proposed pipeline burial depth with seven jetting passes

Passage number	Proposed Trench Configuration (not to scale)	Cross Section of Jetting Trench (m²)
Dredging		n/a
1		7.0

Passage number	Proposed Trench Configuration (not to scale)	Cross Section of Jetting Trench (m²)
2		15.5
3		23.3

Passage number	Proposed Trench Configuration (not to scale)	Cross Section of Jetting Trench (m²)
4		30.7
5		38.1

Passage number	Proposed Trench Configuration (not to scale)	Cross Section of Jetting Trench (m²)
6		44.9
7		50.8