

6. PROJECT DESCRIPTION: DREDGING

Development of the Port of Gladstone and adjacent Gladstone State Development Area requires improved shipping access within Port Curtis, particularly to facilitate access to proposed and approved LNG projects. Presently, Gladstone Ports Corporation is undertaking the deepening, widening and extension of existing shipping channels, swing basins and berth pockets through the Western Basin Dredging and Disposal (WBDD) Project, for which a separate environmental impact statement (EIS) and EIS Addendum has been prepared (GHD, 2009a; GHD, 2010).

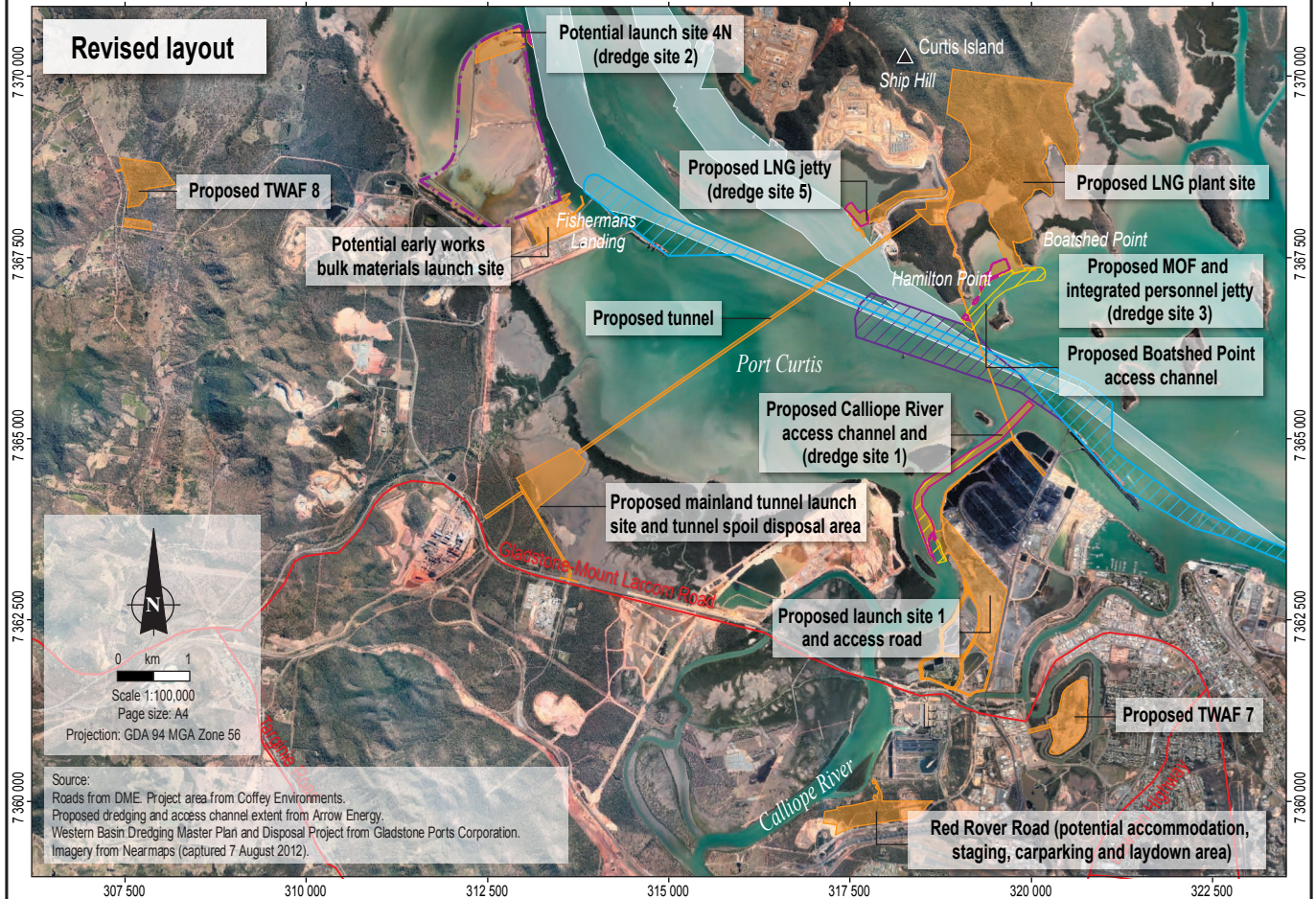
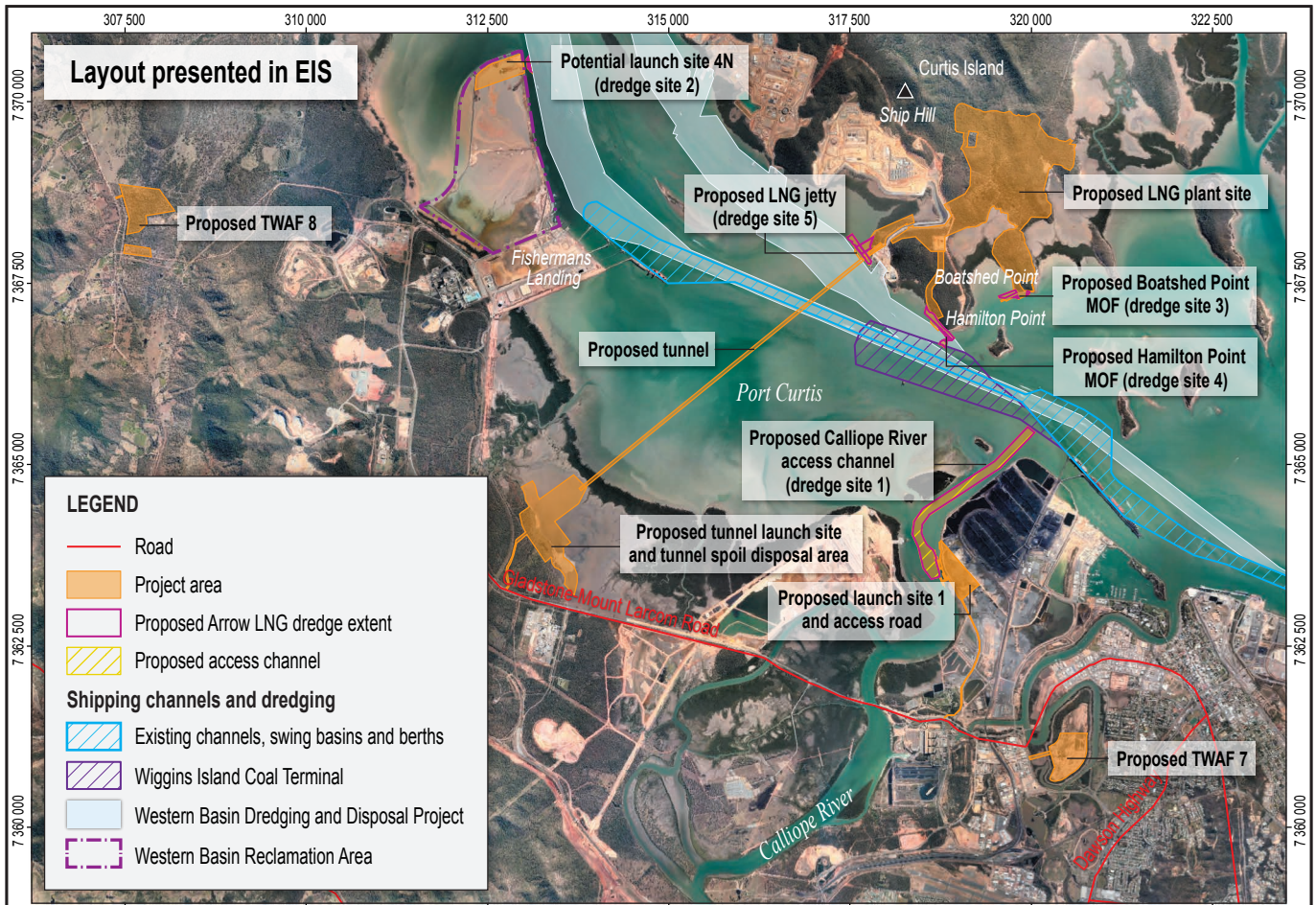
In addition to the dredging performed under the WBDD Project, construction and operation of the Arrow LNG Plant will require dredging to provide and maintain shipping access to marine infrastructure sites on Curtis Island and the mainland. The Arrow LNG Plant Environmental Impact Statement (EIS) described these requirements and identified likely disposal sites. As set out in the EIS, some of Arrow Energy's dredging and disposal requirements will, where possible, be integrated with dredging undertaken as part of the WBDD Project. Arrow Energy's preference is to dispose of spoil in approved, existing and proposed onshore and offshore disposal sites. Dredge spoil disposal options are under discussion with Gladstone Ports Corporation and relevant government agencies. All dredging required for the Arrow LNG Plant will be carried out in accordance with a dredge management plan approved by the relevant authorities.

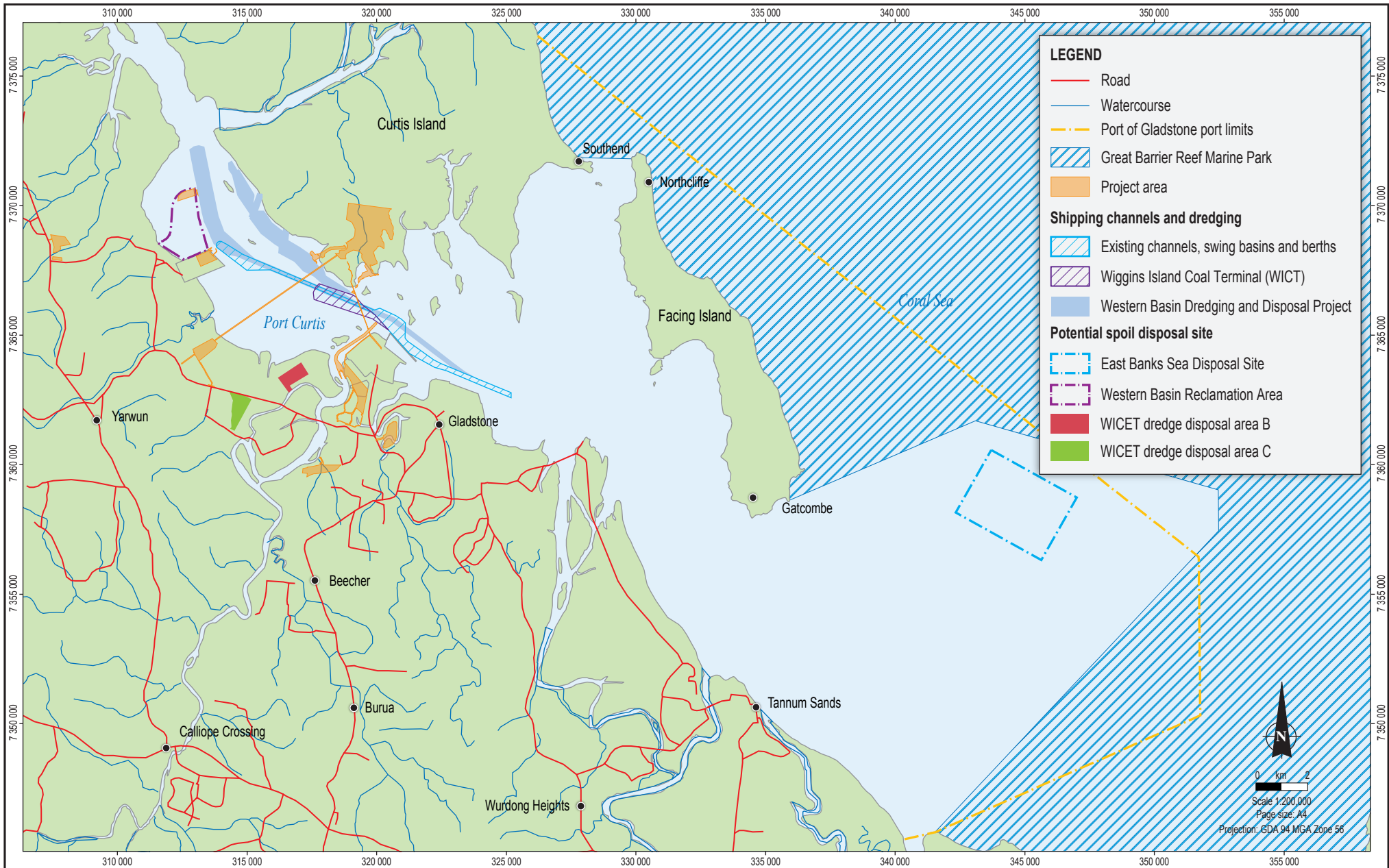
The following sections provide an update to the capital and maintenance dredging requirements for the project, dredging methods and disposal locations, and management of dredge spoil. The dredge depths detailed in the following sections are the minimum dredge depths required to obtain the required under keel clearance. Overdredging of up to 1 m beyond the nominated dredge depth may be required to achieve the minimum depth. The overall volumes identified in this chapter are considered to be the upper requirement for dredging and every effort will be made to reduce these volumes.

6.1 Capital Dredging and Disposal

The refinement of project design during the front end engineering design (FEED) study saw the removal of Hamilton Point South MOF site as a project option. This process reduced the number of the potential dredge sites for the project from the five described in the EIS to four. This included dredging required to operate launch site 1 (dredge site 1) or launch site 4N (dredge site 2), the Boatshed Point materials offloading facility (MOF) and associated access channel (dredge site 3), and the LNG jetty (dredge site 5) (Figure 6.1). FEED identified the need for additional dredging at the LNG jetty and Boatshed Point MOF sites.

The revised estimated dredging volumes based on in situ material, dredge depth and dredger type are set out in Table 6.1. The table identifies any changes to dredge volumes from that described in the EIS and also summarises the likely disposal locations (Figure 6.2) for dredged material from the four main sites. The EIS (Chapter 8, Section 8.3) provides details of the different dredge methods proposed. Dredging for construction of the Arrow LNG Plant is expected to commence in late 2014 and will be governed by a dredge management plan that will detail measures at each site to limit the impacts of dredging, including increases in turbidity and impacts on marine fauna.





Source:
 Place names, roads and watercourses from DME, Great Barrier Reef Marine Park from GBRMPA.
 Project area and potential soil disposal sites from Coffey Environments.
 Western Basin Dredging Master Plan from Gladstone Ports Corporation.
 Port of Gladstone port limits and East Banks Sea Disposal Site digitised by Coffey from GPC figure (accuracy may be compromised).



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Arrow Energy

Arrow LNG Plant



Potential spoil disposal sites

Figure No:

6.2

Table 6.1 Summary of Dredging Requirements for Arrow LNG Plant

Component	EIS Volume of In-Situ Material	SREIS Volume of In-Situ Material	Depth	Likely Dredging Method	Likely Spoil Disposal Location
LNG jetty	120,000 m ³	131,000 m ³	-5.5 m LAT	Backhoe or cutter suction	Western Basin Reclamation Area or East Banks Sea Disposal Site
Boatshed Point MOF	50,000 m ³	148,000 m ³	-2.5 m to -3.5 m LAT	Backhoe or cutter suction	East Banks Sea Disposal Site
Boatshed Point access channel and swing basin	N/A (option not presented)	165,000 m ³	-8.0 m LAT	Backhoe or cutter suction	East Banks Sea Disposal Site
Hamilton Point South MOF (option)	50,000 m ³	N/A (option discontinued)	-8.0 m LAT	N/A (option discontinued)	N/A (option discontinued)
Launch site 1 channel and jetties	900,000 m ³	900,000 m ³	-5.0 m LAT	Cutter suction	Wiggins Island Coal Export Terminal Area B and C (or alternatively the Western Basin Reclamation Area / East Banks Sea Disposal Site)
Launch site 4N channel and jetties (option)	2,500 m ³	2,500 m ³	-5.0 m LAT	Backhoe	Western Basin Reclamation Area / East Banks Sea Disposal Site
Maximum total dredge volume [^]	1,007,000 m ³	1,344,400 m ³	–	–	–

N/A – Not applicable

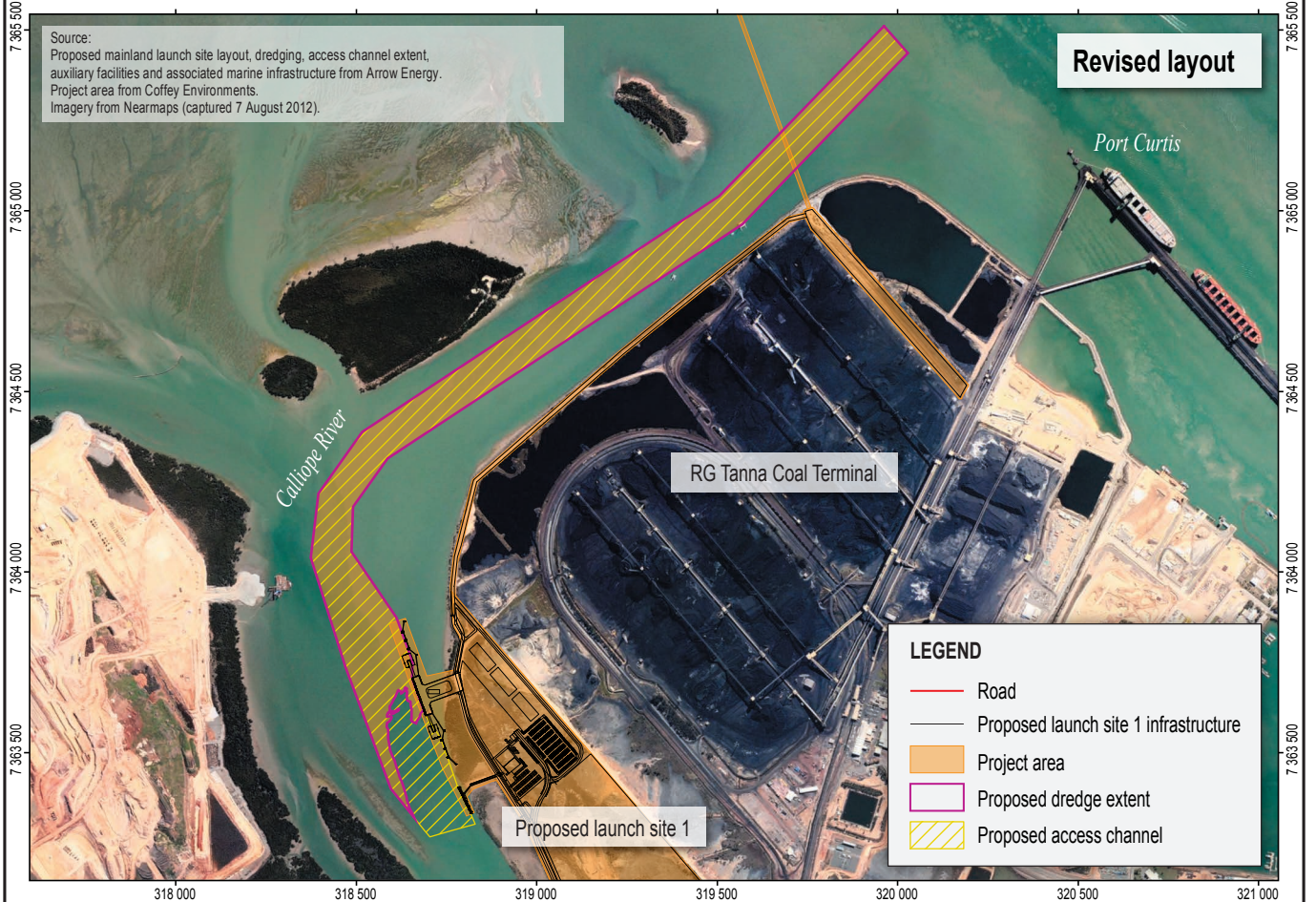
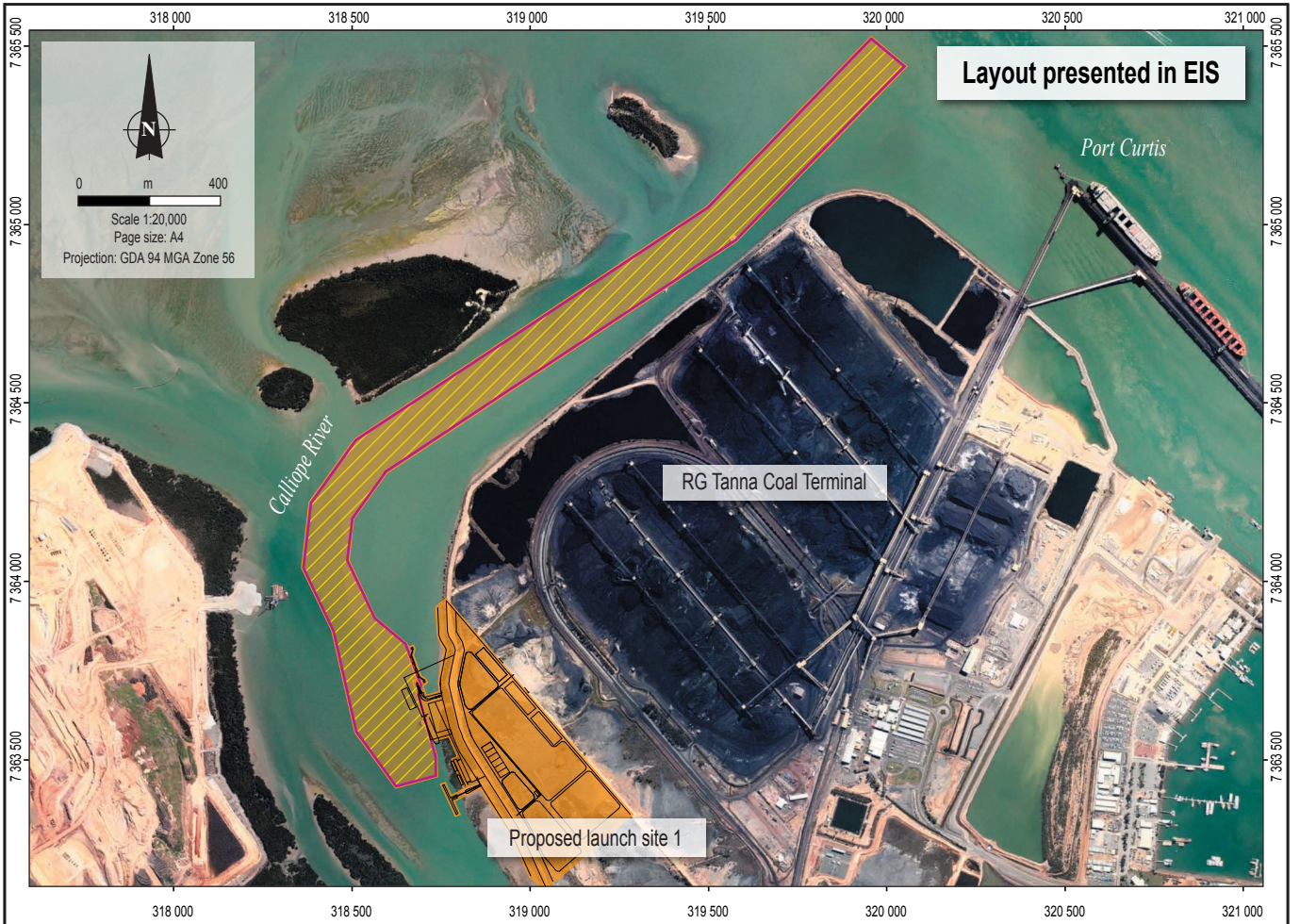
* Typically backhoe dredged material will be disposed offshore and cutter suction dredge material will be disposed to the Western Basin Reclamation Area or the Wiggins Island Coal Export Terminal disposal areas.

[^] Note that the maximum volume for the EIS does not include the Hamilton Point South MOF or launch site 4N as these are project options. Similarly, the volumes for the SREIS do not include launch site 4N as this is an alternative to launch site 1.

6.1.1 Mainland Launch Site

Launch Site 1 is Arrow Energy’s preferred mainland launch site. Dredging at this site will be required for the construction and operation of Launch Site 1 located north of Gladstone city near the mouth of the Calliope River, adjacent to the existing RG Tanna coal export terminal. The dredge site will extend from the intertidal area abutting Launch Site 1, past Mud Island to the main shipping channel, providing adequate under-keel clearance for vessel docking and navigation. The access channel will be approximately 3 km long by 100 m wide and dredged to -5 m LAT.

The maximum dredge volume estimated at this site is approximately 900,000 m³. This dredge volume has not changed from that described in the EIS, although the dredging footprint now extends further into the Calliope River, to the fore of the launch site facilities (Figure 6.3). The change to the dredging configuration from that presented in the EIS has arisen through an improved understanding of the bathymetry of the riverbed.



A cutter suction dredger is most likely to be used at this site. Excavated material would be pumped either via submerged temporary delivery lines with booster stations or via a temporary overland delivery pipeline to the Wiggins Island Coal Export Terminal dredge placement facility (areas B and C). Alternatively, this material could be transported and disposed to the Western Basin Reclamation Area or to the East Banks Sea Disposal Site. Dredging at launch site 1 is estimated to take around five to nine months of effective dredging depending on the ultimate volume.

Launch site 4N at the Western Basin Reclamation Area remains as a project option. Dredging requirements at this site have not changed since the EIS was finalised.

6.1.2 Boatshed Point MOF and Integrated Personnel Jetty

Dredging will be required for the construction and operation of the MOF and integrated personnel jetty at the southern tip of Boatshed Point. Through work undertaken for the FEED study, Arrow Energy now proposes to transport larger modules to the LNG plant site during construction. This has led to the redesign of the MOF to incorporate a larger main wharf to accommodate the delivery ships required to transport the larger modules. The redesign of the MOF conflicted with the siting of the personnel jetty terminal. As a consequence, the personnel jetty terminal was moved to the north as there was insufficient room along the open water quay line. These changes have increased the dredging requirements at Boatshed Point.

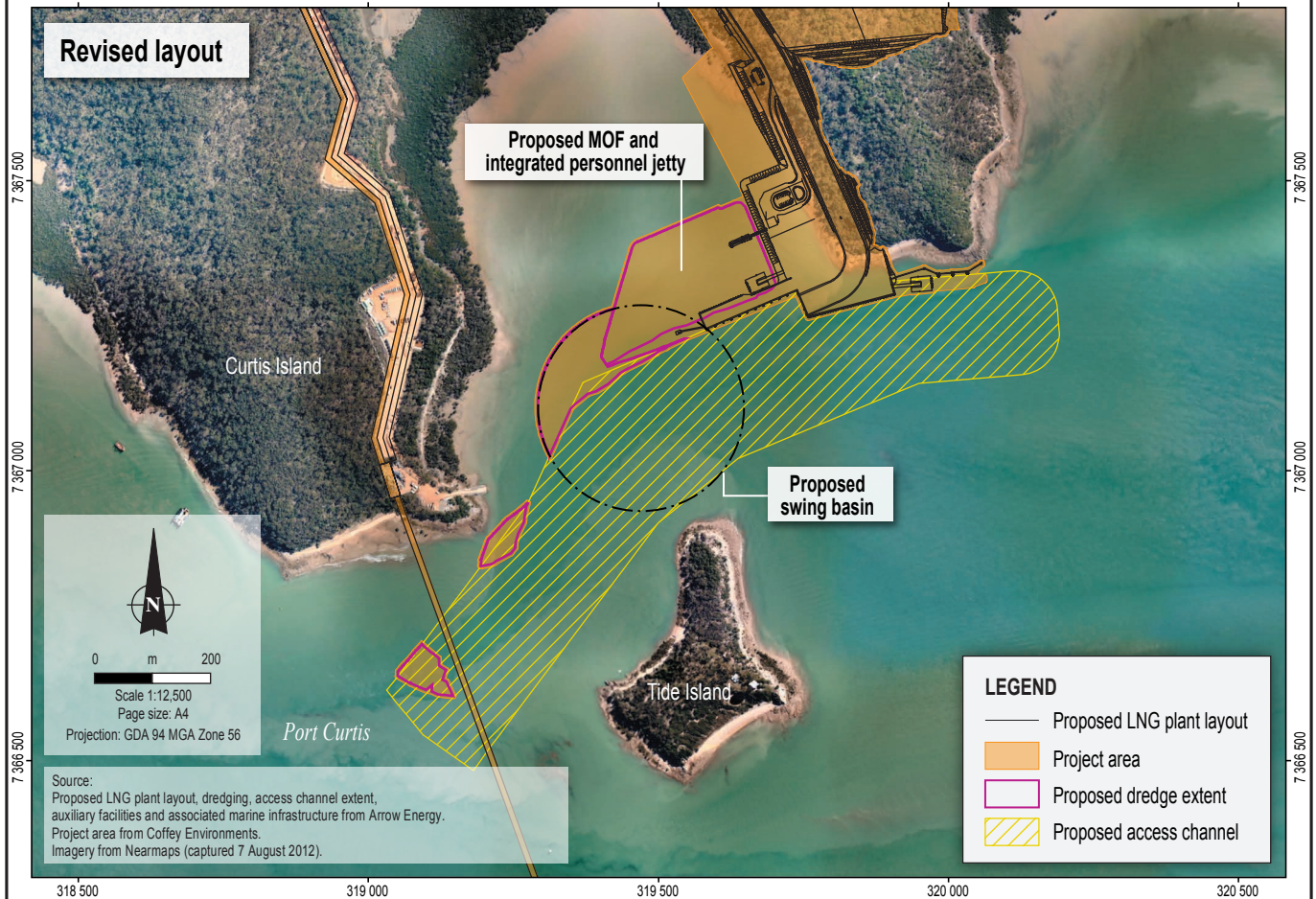
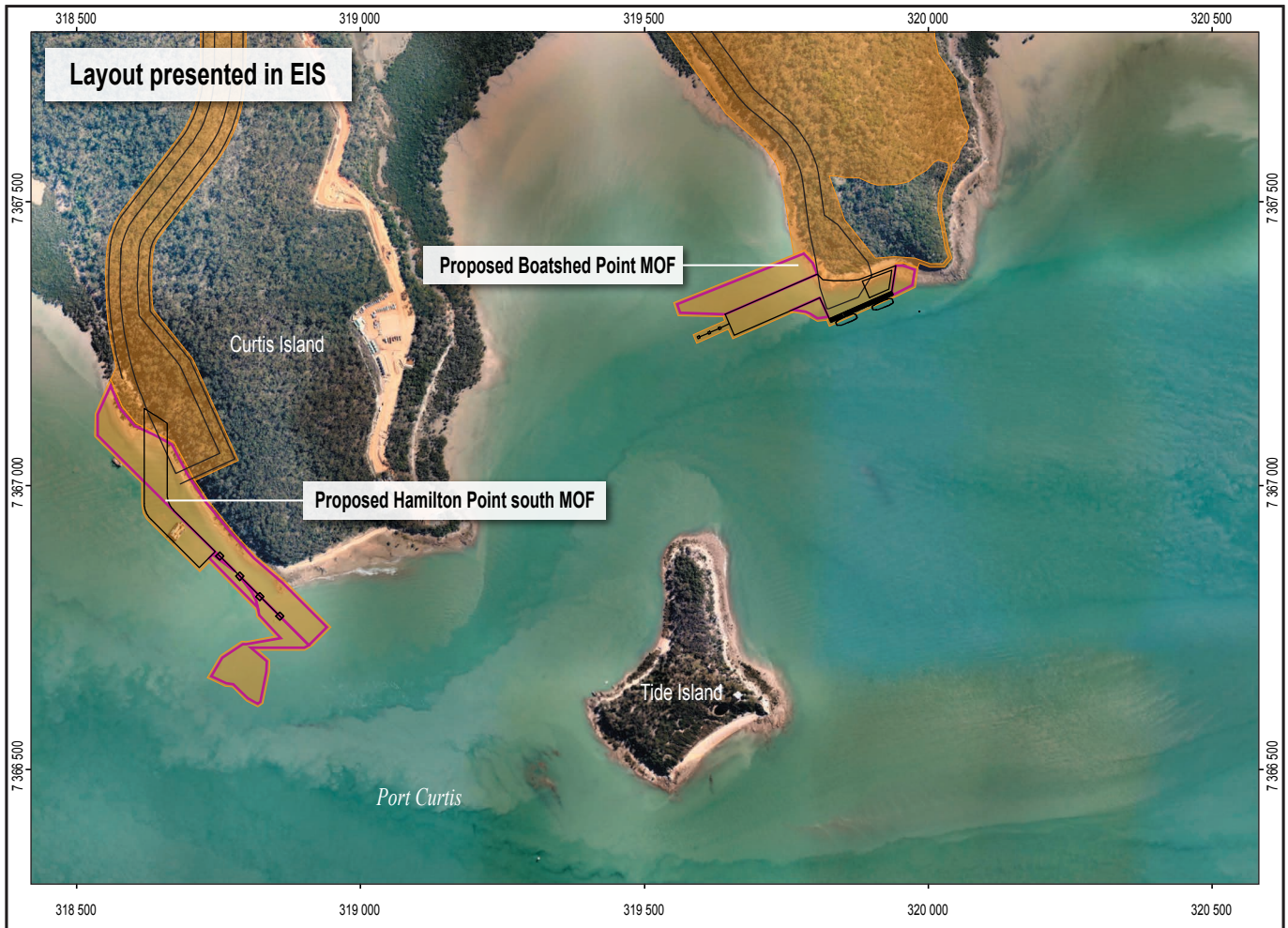
The dredge area around these facilities will provide adequate depth for vessel access, docking and navigation. The exposed berth on the south side of the MOF will be dredged to a depth of -8 m LAT to accommodate roll-on, roll-off and lift-on, lift-off vessels using the MOF. On the northern side, the area will be dredged to -3.5 m LAT for the RoPax and passenger ferry berths, and -2.5 m LAT for catamarans or passenger ferries using the personnel jetty berth.

The anticipated maximum dredge volume at the MOF is 148,000 m³ (Figure 6.4). A backhoe dredger is most likely to undertake this dredging. Excavated material will be loaded onto barges and transported to the East Banks Sea Disposal Site. Dredging at Boatshed Point is estimated to take approximately one month of effective dredging.

6.1.3 Boatshed Point Access Channel and Swing Basin

A deeper access channel is now required to the Boatshed Point MOF and a swing basin to accommodate the larger ships. Dredging will be required for access to the MOF from the main Passage Island Channel and for a swing basin adjacent to the MOF (Figure 6.4). This dredging was not included in the EIS. The area will be dredged to a depth of -8 m LAT to accommodate roll-on, roll-off and lift-on, lift-off vessels.

The anticipated maximum dredge volume for the access channel and swing basin is 165,000 m³, which is additional to the total dredge volumes described in the EIS. A backhoe dredger is most likely to undertake this dredging, although a cutter suction dredger could also be employed. With backhoe dredging, the excavated material would be loaded onto barges and likely be transported to the East Banks Sea Disposal Site. Dredging is estimated to take approximately 1 month of effective dredging.



6.1.4 LNG Jetty

Dredging (in addition to that being carried out under WBDD project) is likely to be required to construct the LNG jetty located in North China Bay, off the northwest corner of Hamilton Point. Capital dredging of the berth pocket and swing basin is addressed in the WBDD Project EIS (GHD, 2009a) and is not discussed in the Arrow LNG Plant EIS or this supplementary report.

The FEED study has refined the LNG jetty construction plan. The dredging proposed by Arrow Energy at the LNG jetty site is required to provide access and manoeuvrability for floating construction equipment (floating cranes and jack-up barges). The refinement of the construction method for the LNG jetty has meant an increase of 11,000 m³ in the estimated dredging volume of in-situ material to 131,000 m³ (Figure 6.5).

The area that would be dredged extends east of the berth pocket (dredged as part of the WBDD Project) and north and south of the LNG jetty to the shoreline of Hamilton Point. The majority of the proposed dredging occurs north of the LNG jetty. The area would be dredged to a depth of -5.5 m LAT.

The dredging required for construction is likely to be carried out using either a cutter suction, or back hoe dredger. The preferred option is for the dredging to be carried out using a cutter suction dredger with the dredge spoil pumped to the Western Basin Reclamation Area. Alternatively, material could be excavated by a backhoe dredger and loaded onto barges and transported to the Eastern Banks Sea Disposal Site. Dredging of the LNG jetty area is estimated to take approximately one month of effective dredging.

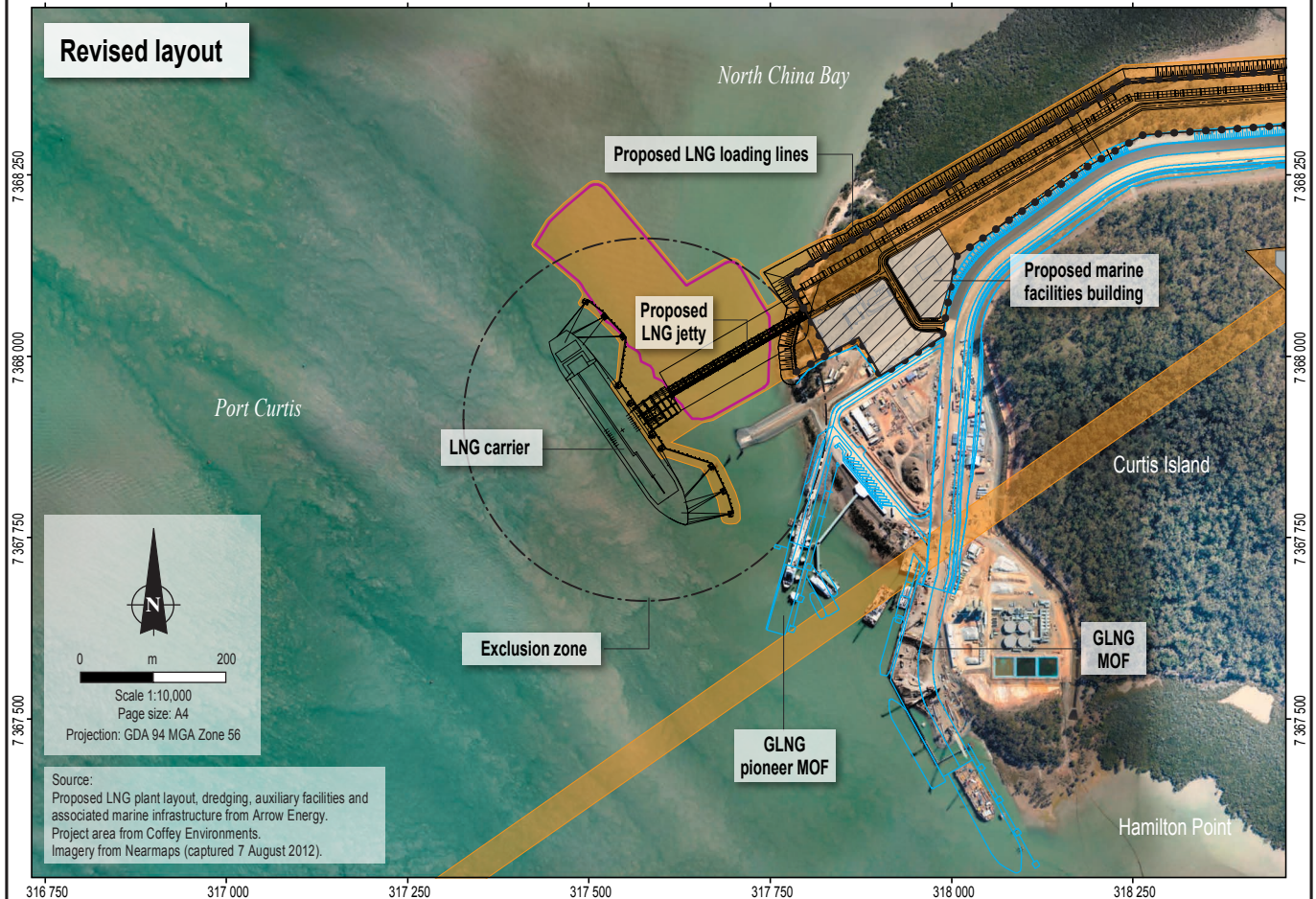
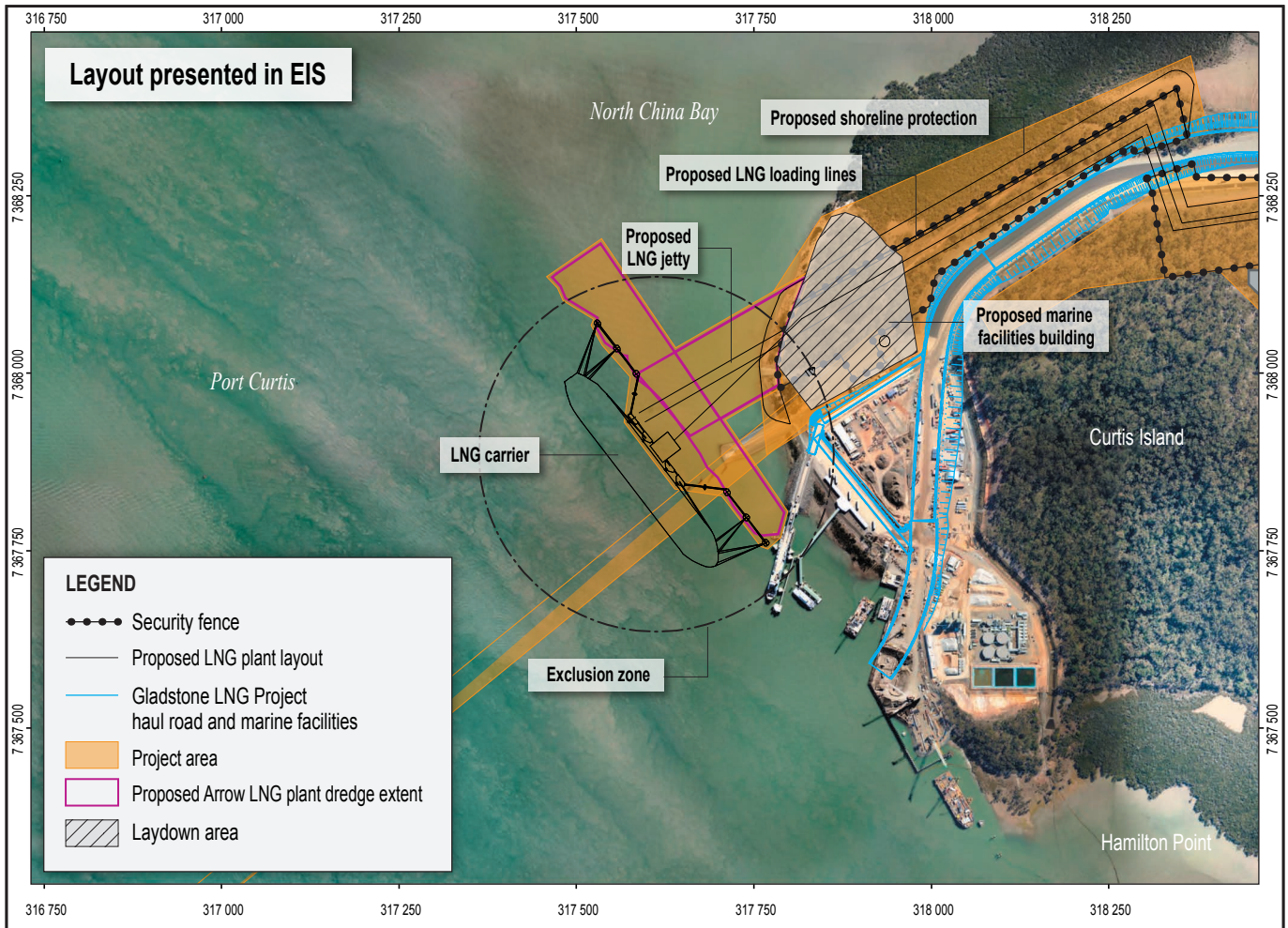
6.2 Maintenance Dredging

Maintenance dredging will be required to maintain navigable water depths at the above facilities. The largest volumes are expected to be dredged from around the Boatshed Point swing basin and berth areas. Indicative modelling carried out since the EIS was finalised suggests that the maximum rate of siltation is up to 0.14 m/month in the manoeuvring basin and up to 0.2 m/month near the roll-on, roll-off berth. In the Calliope River, modelling shows that fine sediment is likely to accumulate largely outside the area of dredging and the maximum siltation rate in a navigation area is up to 0.06 m/month.

These modeling results are indicative only, and will be reviewed following the detailed design phase of the project.

6.3 Disposal of Dredge Spoil

Arrow Energy has investigated a range of options for disposal of dredge spoil and the EIS discussed options including: the Western Basin Reclamation Area, the East Banks Sea Disposal Site, a new offshore disposal site approved by the Commonwealth Government, or a new onshore reclamation area. The Western Basin Reclamation Area was Arrow Energy's preferred site for disposal.



Preferred disposal sites (see Figure 6.2) now include:

- East Banks Sea Disposal Site adjacent to the entrance to Port Curtis, as approved by the Commonwealth Government.
- Western Basin Reclamation Area, as approved by the Commonwealth Government.
- Wiggins Island Coal Export Terminal disposal areas, as approved by the Commonwealth Government.

A sediment sampling program is being undertaken as part of a broader geotechnical program for the project. The aim of the sediment sampling program was to inform sediment characterisation studies carried out for the supplementary report to the EIS. Samples have been tested for particle size, metals, organics and potential acid sulfate soils organics. Detailed information on the results of this analysis is provided in Chapter 12, Sediment Characterisation.

The geotechnical program is being undertaken to meet the requirements of the National Assessment Guidelines for Dredging 2009 (NAGD, 2009) and will be completed before applying for a dredging permit.

Some of the samples from Boatshed Point, the area adjacent to the LNG jetty and the Calliope River dredging sites were found to contain a portion of potential acid sulfate soil (PASS) material. PASS material is generally contiguous in the strata and either extends the full depth of proposed dredging or commences below seabed level and extends to the proposed dredging depth. The distribution of PASS material is more varied in the Calliope River, appearing at shallow depths in some boreholes and deeper depths in other bores. An acid sulfate soil (ASS) management plan will be developed in conjunction with the dredge management plan to provide clear procedures for managing and disposing of the expected volumes of ASS/PASS material at each site. All spoil disposal activities, to both onshore and offshore disposal sites will be undertaken in accordance with the plan.