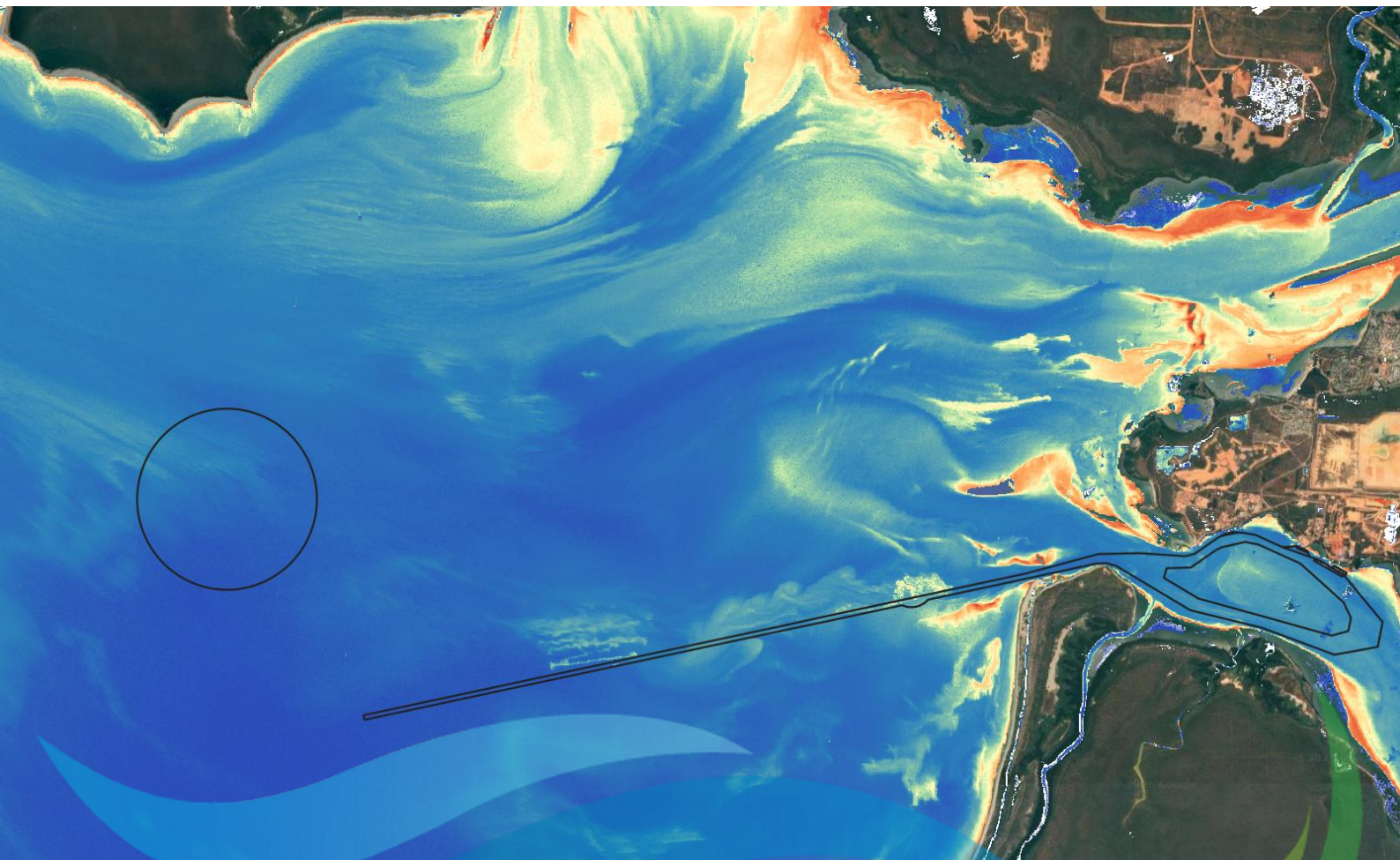


Port of Weipa, 2026 Maintenance Dredging

Summary of Turbidity Monitoring

Report No. P099_R04v2



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North Queensland Bulk Ports Corporation Ltd

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Author(s)	Andy Symonds		12/10/2026
Reviewer	Anna Symonds		12/10/2026

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Executive Summary

North Queensland Bulk Ports Corporation (NQBP) commissioned Port and Coastal Solutions Pty Ltd (PCS) to undertake work to support the 2026 maintenance dredging program at the Port of Weipa (the Port). This included the following:

- 1) to analyse the turbidity and metocean conditions over the duration of the dredge program, including 7 days pre- and post-dredging;
- 2) to assess the relative contribution of the maintenance dredging and placement activities on the natural turbidity at the measurement sites;
- 3) to better understand the spatial extent of any plumes resulting from the maintenance dredging and placement activities based on satellite-derived total suspended matter (TSM) data; and
- 4) provide a technical report which presents and interprets both the in-situ benthic turbidity data and satellite-derived TSM data collected over the entire pre-, during and post-dredging periods.

The 2026 maintenance dredging program was undertaken by the TSHD Brisbane and involved the relocation of 1,147,000 m³ of sediment from the dredged areas of the Port to the Albatross Bay DMPA. The data showed that during the dredging program the turbidity around the Port of Weipa was generally driven by the natural conditions (predominantly the astronomical tide, although a number of small wave events also resulted in elevated turbidity), with higher turbidity occurring during spring tides with a larger tidal range. The key findings from the turbidity data analysis are detailed below:

- the exceedance analysis of the in-situ measured benthic turbidity data showed that the duration exceedances were below the 90th percentile duration exceedance at all sites and below the average duration exceedance at two of the three sites during the dredging period. The results therefore show that the turbidity over the period was within the natural variability for the region with no significant increase due to the maintenance dredging. This finding also correlates with the satellite imagery which showed that only occasional plumes from the maintenance dredging or bed levelling resulted in elevated TSM close to the monitoring sites (indicating the potential at some point during that day for elevated TSM at the sites), with the Imagery showing the TSM in these areas was predominantly controlled by natural processes;
- all of the plumes resulting from maintenance dredging (including those from both dredging and placement) were found to remain relatively close to where they were created. Plumes generated in the South Channel were shown to have the potential to migrate to the north and south of the channel and in an offshore direction. Overall, the results showed that little net residual transport occurs in the region, this was also noted during the 2019 to 2025 maintenance dredging programs and as part of the Port of Weipa Sustainable Sediment Management assessment (PCS, 2019, 2020, 2021, 2022, 2023, 2024b, 2025). Based on this, it can be assumed that the majority of the sediment suspended by the maintenance dredging and bed levelling is subsequently redeposited close to where it was either dredged/disturbed or placed;
- the dredging and placement activities associated with the Port of Weipa 2026 maintenance dredging program were found to result in visible plumes. Plumes were observed close to the TSHD Brisbane during dredging, close to the Pacific Titan during bed levelling, adjacent to the South Channel and within and adjacent to the Albatross Bay DMPA. The size and concentration of the plumes was variable depending on the dredging and placement activities;
 - the largest plume, which was due to repeat maintenance dredging loads in the South Channel, was a residual plume which was up to 6 km in length and 2 km in width and was present adjacent to the South Channel (both to the north and south) and had a concentration of 4 to 8 mg/l. Satellite imagery also indicated that localised plumes of

- up to 20 mg/l were regularly present in the lee of the TSHD Brisbane and Pacific Titan during dredging/bed levelling. These local plumes were predominantly observed in the South Channel, as this was where the majority of the maintenance dredging and bed levelling was undertaken, but were also occasionally observed in the Inner Harbour; and
- plumes in the DMPA from the placement of dredged sediment were typically less than 500 m in length and only persisted for short durations (typically less than 3 hours). The observed plumes were consistent with placement by the TSHD Brisbane during previous annual maintenance dredging programs.
 - the Port of Weipa 2026 maintenance dredging program did not influence the regional turbidity in the area. The dredging only influenced the local turbidity close to where dredging and bed levelling was undertaken in the Port and where placement occurred at the Albatross Bay DMPA. Natural variations in turbidity driven by the tide and wave conditions over the monitoring period were larger than the variations in turbidity due to the maintenance dredging. The satellite imagery showed that the turbidity in the area of the seagrass meadows in the Inner Harbour was controlled by natural processes over the 2026 maintenance dredging program, with no visible plumes from dredging or bed levelling activities observed in the seagrass meadows; and
 - the post-dredging satellite imagery showed that just over 1 day after dredging ended there were no plumes from the dredging or placement activities visible. This correlates with findings from previous dredge programs (2020, 2022, 2023, 2024 and 2025) where satellite imagery showed that the turbidity had returned to natural conditions within days of the dredging activity finishing (PCS, 2020, 2022, 2023, 2024b and 2025).

1. Introduction

North Queensland Bulk Ports Corporation (NQBP) commissioned Port and Coastal Solutions Pty Ltd (PCS) to undertake work to support the 2026 maintenance dredging program at the Port of Weipa (the Port). This includes the following:

- source satellite imagery for the Port of Weipa region and process the imagery to output satellite-derived turbidity to show the spatial distribution of turbidity over the duration of the dredging program in addition to 7 days pre- and post-dredging;
- obtain metocean data for the Weipa region over the whole pre-, during and post-dredging period to help interpret the satellite-derived turbidity data;
- provide a pre-dredging technical note prior to the dredging commencing which presents the satellite-derived turbidity data and metocean conditions and provides an overview of the natural turbidity and the relative influence of different drivers during the pre-dredging period;
- provide a during dredging technical note after 10 to 14 days of the maintenance dredging which presents results from the satellite-derived turbidity monitoring over this initial dredging period and discusses the potential impacts of the dredging on the turbidity in the region; and
- provide a post-dredging technical report following completion of the maintenance dredging and the post-dredging monitoring period. This note will present both the satellite derived turbidity and in-situ turbidity data for the pre-, during and post-dredge periods and discuss the metocean conditions, the associated natural variability in turbidity and potential impacts of the maintenance dredging to turbidity in the region.

Following completion of the 2026 maintenance dredging program and the 7 day post-dredging period, this technical report presents and discusses the metocean and turbidity data collected.

1.1. Project Overview

The Port of Weipa is located in the Gulf of Carpentaria, on the north-west coast of the Cape York Peninsula in Northern Queensland (Figure 1). The Port is within Albatross Bay, a large embayment, with the wharves and berths located in the Embley River (Figure 1 and Figure 2).

In the 2025/26 financial year, the Port of Weipa handled just over 15 million tonnes of commodities, including bauxite (>95%), fuel, cattle and general cargo. Rio Tinto Alcan (RTA) currently operates most of the port facilities for the export of bauxite (aluminium ore) from the nearby RTA mine.

The layout of the Port of Weipa is shown in Figure 1. The Port consists of:

- a main shipping channel in Albatross Bay called the South Channel; and
- an Inner Harbour, which is within the Embley River and consists of four shipping berths (Lorim Point East and West, Humbug Wharf and Evans Landing) and the Approach and Departure Channels (Figure 2).

The Port has approximately 622 hectares of channels, swing basins and berths where depths are maintained by maintenance dredging. NQBP currently has a 10-year Sea Dumping Permit for the Port of Weipa, which allows for an average of just over 1,000,000 m³ of sediment to be removed by maintenance dredging per annum up to January 2031. This dredge volume includes a contingency for events such as cyclones and so is not realised on an annual basis.

Since 2002 maintenance dredging at the Port of Weipa has been undertaken annually by the Trailing Suction Hopper Dredger (TSHD) Brisbane, with volumes ranging from approximately 300,000 m³ to 2,400,000 m³. The sediment, which has historically been removed by maintenance dredging, has been relocated to the offshore Dredge Material Placement Area (DMPA) located in Albatross Bay (Figure 1). Following the 2020 maintenance dredging program the DMPA was moved to the west, by the distance of its radius (1.1 nautical miles), to provide additional capacity for the future. The moved DMPA has been used as the placement site for the annual maintenance dredging programs since 2021.

Based on detailed bathymetric analysis by PCS (2018) it was found that the annual sedimentation at the Port was highly variable depending on the wave conditions which occurred during the wet season, with the occurrence of Tropical Cyclones (TCs) in the region being a key driver for larger waves and increased sedimentation. The analysis also found that the majority of the sedimentation occurred in the South Channel, with limited sedimentation occurring in the Inner Harbour region (see Figure 3 for locations).

Wave conditions in the Gulf of Carpentaria during the 2025/26 wet season were energetic, with multiple wave events where the H_s exceeded 2 m. Based on the wave conditions since the 2025 maintenance dredging program the sedimentation was estimated by PCS (2026a) to be in the order of 1,000,000 m³ in the South Channel (excluding the channel batters) and in the order of 100,000 m³ in the Inner Harbour.

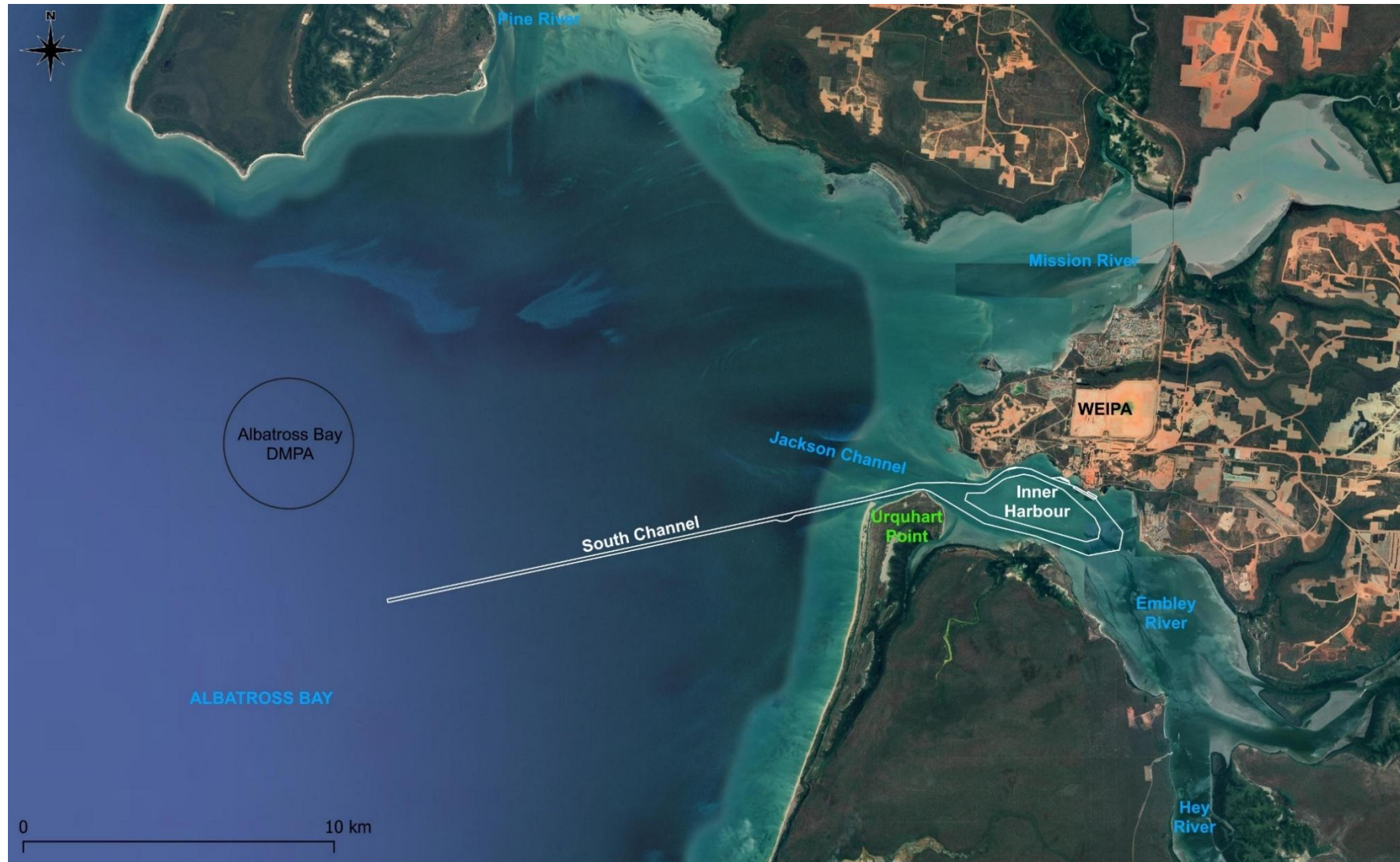


Figure 1. Layout of the Port of Weipa.



Figure 2. Close up of the Port of Weipa Inner Harbour area.

1.2. Report Structure

The report herein is set out as follows:

- a summary of the dredge program is provided in [Section 2](#);
- details of the turbidity monitoring undertaken are provided in [Section 3](#);
- analysis of the in-situ turbidity and satellite-derived data is presented in [Section 4](#); and
- a summary of the findings is detailed in [Section 5](#).

Unless stated otherwise, levels are reported to Chart Datum (CD). Zero metres CD is equal to the Lowest Astronomical Tide (LAT) at the Port of Weipa. Volumes presented throughout are in-situ cubic metres and time is presented in 24 hour format relative to Australian Eastern Standard Time (AEST).

2. Dredge Program

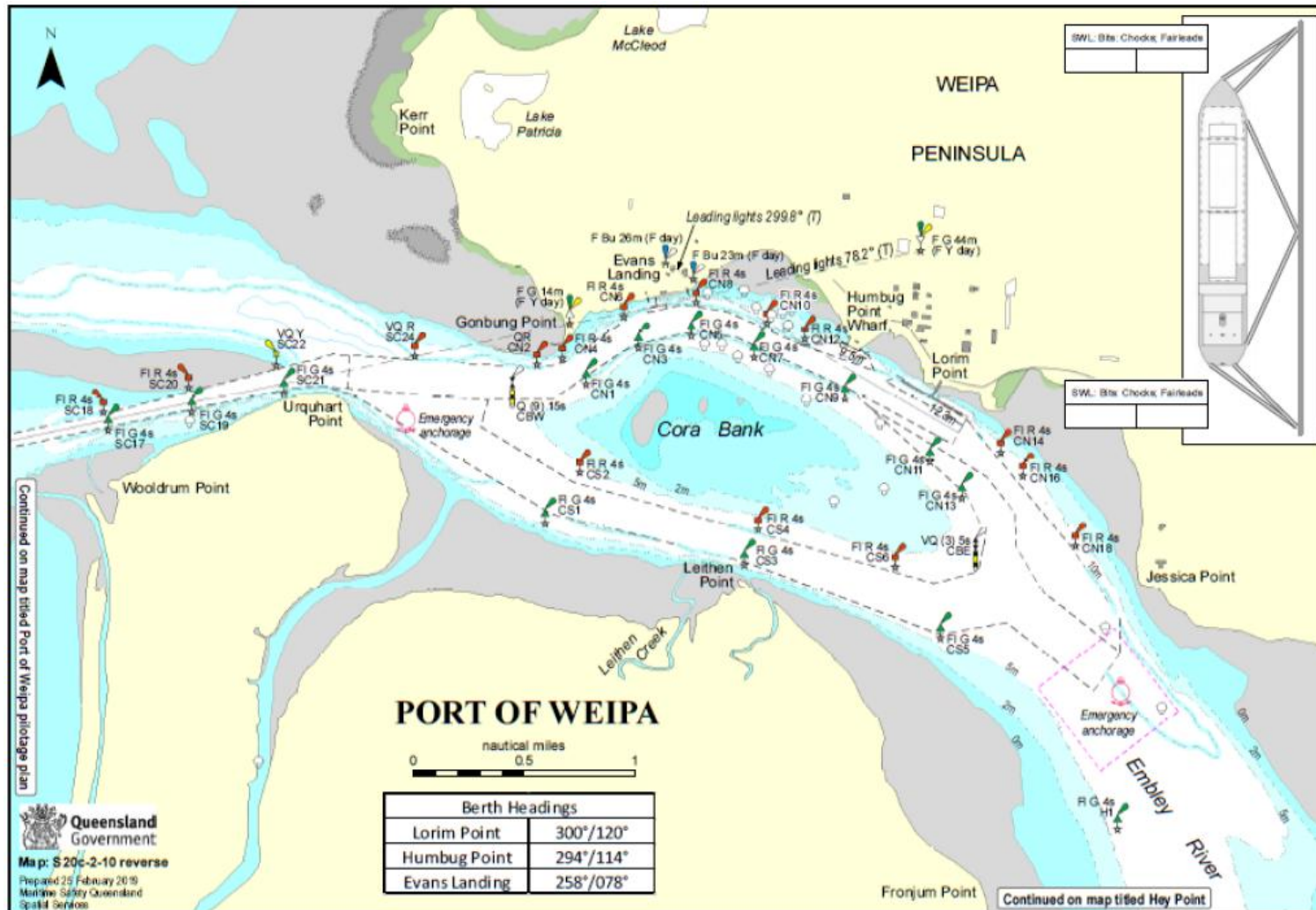
The Port of Weipa 2026 maintenance dredging program commenced at 09:41 AEST on the 11th June 2026 and was completed at 04:00 AEST on the 13th August 2026. Over the 63 day period a total of 574 dredge hopper loads were relocated to the Albatross Bay DMPA, with an average of just over nine loads per day. Based on analysis of the pre- and post-dredge bathymetric surveys by PCS (2026b) the total in-situ volume of sediment removed from the dredge areas of the Port of Weipa during the program was approximately 1,147,000 m³.

The majority of the maintenance dredging was focussed in the South Channel, although some maintenance dredging along with bed levelling was undertaken in the Inner Harbour (bed levelling was also undertaken in the South Channel). It is important to note that the maintenance dredging requirement within the South Channel was not uniform, with approximately 67% of the dredge loads removed from between SC6 and SC14 (Figure 3) which represents approximately 40% of the total length of the South Channel (7.2 km of the total 17.5 km length of the channel). Although only 6% of the dredge loads (34 in total) were from the Inner Harbour, bed levelling was also undertaken in the Inner Harbour. The bed levelling targeted sedimentation in the southeastern corner of the Approach Channel, along sections of the Departure Channel adjacent to Cora Bank and within the berth pockets and their approaches (Figure 4).

The dredged sediment was placed at the Albatross Bay DMPA, with the location of the placements within the DMPA being rotated between the five separate regions of the DMPA to ensure an even distribution over the DMPA.



Figure 3. Location of the Port of Weipa ambient monitoring sites (WQ1, WQ2 and WQ4), DES waverider buoy (WRB) and South Channel (beacons SC2 – SC24).



Source: MSQ (2019)

Figure 4. Location of the Port of Weipa and beacons within the Inner Harbour.

2.1. Metocean Conditions

To provide an understanding of the metocean conditions over the pre-, during and post-dredging periods, the following data have been sourced:

- **Water Level:** the predicted water level for the Port of Weipa (provided by the Bureau of Meteorology (BoM));
- **Wind and Rain:** measured wind and rainfall at the BoM Weipa Aero weather station (ID 027045); and
- **Waves:** measured wave conditions at the Albatross Bay waverider buoy (WRB) (Figure 3) (provided by the Department of the Environment, Tourism, Science and Innovation (DETSI)).

The metocean conditions over the entire monitoring period are shown in Figure 5, with shading indicating the maintenance dredging period. The figure shows the following:

- throughout the majority of the period the metocean conditions were fairly consistent and representative of calm dry season conditions;
- the winds were consistently from the east through to south over the period. The wind speed was more variable, with peak speeds during the day varying between 8 and 21 knots while the overnight speeds were consistently lower with overnight speeds consistently dropping to less than 8 knots;
- rainfall was very low throughout the period. Rainfall only occurred on three of the days over the entire period and the highest daily rainfall was less than 2 mm; and
- the wave direction varied between waves from the east to southeast (offshore at Weipa) and southwest (onshore at Weipa). Wave directions from the southeast correlated with periods of smaller H_s (typically less than 0.5 m), while larger wave events with an H_s of more than 0.5 m typically correlated with waves from the southwest. The largest wave event ($H_s = 0.9$ m) occurred over the 7 day pre-dredge period, while three wave events with an H_s of more than 0.5 m occurred during the dredging. The wave direction during all of these wave events were from the southwest meaning they were a result of longer period swell waves.

Overall, the monitoring period is considered to be relatively calm in terms of wave conditions, although resuspension of fine-grained sediment in Albatross Bay is likely to have occurred during wave events from a southwesterly direction with an H_s of 0.5 m and above. These wave events occurred over the pre-dredge period and during the dredging.

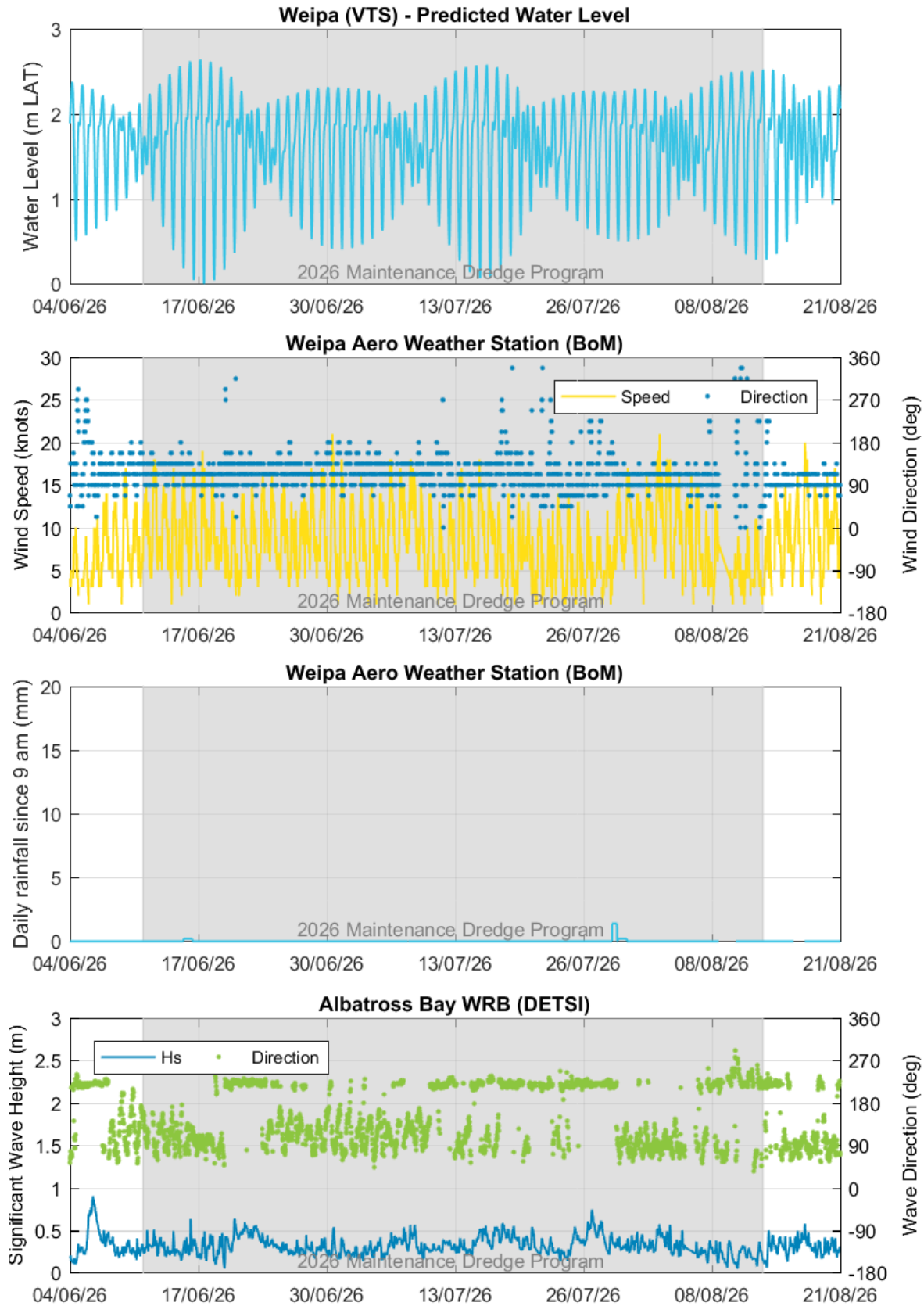


Figure 5. Metocean conditions at Weipa over the monitoring period, with water level (upper), winds (upper middle), rainfall (lower middle) and waves (lower).

3. Turbidity Monitoring

As part of the ongoing ambient water quality monitoring which NQBP have setup, benthic turbidity data have been collected by James Cook University (JCU) since January 2018 at monitoring sites around the Port of Weipa. The instruments measure near bed turbidity in Nephelometric Turbidity Unit equivalent (NTUe)¹. There were originally two sites in Albatross Bay (WQ2 and WQ5), but one of these sites (WQ5) was decommissioned in July 2018 and there are currently two sites (WQ1 and WQ4) in the Inner Harbour (Figure 3). The water depth at the three monitoring sites is approximately 4.5 m (ranging from 4.4 m at WQ1 to 4.8 m at WQ4).

The instruments were serviced prior to the 2026 maintenance dredging program commencing and after completion of the maintenance dredging and the 7 day post-dredging period. Measured data up to the 9th September 2026 were provided by JCU for analysis as part of this assessment.

The data return for the measured turbidity data over the 2026 maintenance dredging monitoring period, which includes 7 days pre- and post-dredging and 63 days of dredging (77 days in total), was >99% at WQ1 and WQ2 and 81% at WQ4. The lower data return at WQ4 was due to the measurements having a lot of spikes which were removed from the dataset as they failed the JCU quality control (QC) either due to the rate of change being too large or due to them being identified as spikes by the JCU QC process.

In addition to the benthic turbidity data collected by JCU, a real-time surface (1 m below the water surface) turbidity sensor was also deployed at WQ2 by Swash from the 29th July to 18th August 2026 (Swash, 2026). This instrument was deployed when it was confirmed that the dredging would aim to relocate more than 1 million m³ of sediment. The instrument was aimed at providing real-time turbidity data to allow any potential impacts of the dredging to be monitored in case any mitigation measures were required (in accordance with the Marine Environmental Monitoring Plan).

3.1. Previous Analysis

Benthic turbidity data from the ongoing ambient monitoring were analysed by PCS (2020, 2021b, 2024a) to understand the natural variability in turbidity at the three monitoring sites. The analysis undertaken as part of the Environmental Thresholds component of the Port of Weipa Sustainable Sediment Management (SSM) Project recommended that the 90th percentile turbidity should be adopted as a turbidity intensity threshold as it approximately correlates with published benthic Photosynthetically Active Radiation (PAR) thresholds for the species of seagrass which are present in the Weipa region.

Monitoring during the 2023 maintenance dredging program at the Port of Weipa showed that the benthic turbidity at both WQ1 and WQ4 (the Inner Harbour sites) were naturally high which resulted in the duration exceedance at both sites being significantly higher than at WQ2 during the 2023 dredging program (PCS, 2023). Based on this, the turbidity intensity thresholds at the three monitoring sites were updated prior to the 2024 maintenance dredging program to ensure that the thresholds were based on measured turbidity data which can be considered to represent the existing natural turbidity at the sites. It was noted that the measured turbidity at WQ1 and WQ4 had increased since December 2021 and so the updated thresholds at these sites were based on measured data from December 2021 to October 2023, while at WQ2 the turbidity was not found to have increased and so at this site the analysis was based on data from January 2018 to October 2023. Updated trigger limits were defined by PCS (2024a) using the same approach as the previous trigger limits and

¹ The international turbidity standard ISO7027 defines turbidity readings in NTU for 90 degree backscatter, while the JCU instrumentation uses 180 degree backscatter. In recognition of this fact, the units are reported as NTU equivalent (NTUe).

separate values were defined for wet and dry seasons. The updated dry season 90th percentile benthic and surface turbidity intensity thresholds at the three ambient water quality monitoring sites are shown in Table 1.

Table 1. Dry season benthic and surface turbidity thresholds derived by PCS (2024a).

Location	90 th Percentile Benthic Turbidity Threshold (NTUe)	90 th Percentile Surface Turbidity Threshold (NTUe)
WQ1	25	14
WQ2	19	10
WQ4	95	34

4. Data Analysis

This section presents in-situ turbidity data and satellite-derived turbidity data to provide an understanding of the variability in turbidity in the Weipa region and to determine the potential impact of the maintenance dredging activity on water quality in the region.

4.1. In-situ Turbidity Analysis

The measured benthic turbidity data at the three monitoring sites, along with the predicted water level for the Port of Weipa (sourced from BoM), the measured wave conditions in Albatross Bay (from the DETSI WRB in Albatross Bay) and measured wind conditions at the Weipa Aero weather station (sourced from BoM) are shown in Figure 6, while individual plots of the turbidity at each monitoring site along with the benthic turbidity threshold are shown in Figure 7. The figures show that there is a tidal signal present in the turbidity data at all three sites, with a clearer signal at WQ1 and WQ2, resulting in higher turbidity during spring tides and lower turbidity during neap tides.

The turbidity data at WQ4 is consistently higher than at the other two sites throughout the monitoring period. Over the monitoring period the higher peaks in turbidity at WQ4 range from around 80 to 370 NTUe, while at WQ1 (the other site in the Inner Harbour) all peaks remain below 80 NTUe. As previously discussed in Section 3.1, higher turbidity at WQ4 was observed during previous maintenance dredging programs and as a result the turbidity intensity thresholds were updated. This update to the thresholds should ensure that despite the measured turbidity at WQ4 being higher than at the other two sites, the exceedance duration will not be higher than at the other sites unless the dredging has resulting in increased turbidity in the area.

At WQ2 the measured turbidity data over the monitoring period remained below 75 NTUe, with peaks of less than 20 NTUe during neap tides and the higher peaks of 20 to 75 NTUe during spring tides. The peak in turbidity of 75 NTUe coincided with large spring tides and a wave event when the peak H_s was around 0.5 m and the wave direction was from the southwest.

A comparison between the measured benthic (JCU) and surface (Swash) turbidity data over the period of concurrent data is shown in Figure 8. The plot shows very similar temporal patterns in turbidity at the two depths and that during periods of lower turbidity (e.g. less than 5 NTU) the turbidity near the bed and near the surface are very similar. However, during periods of elevated turbidity the peaks close to the bed are much higher (2 to 5 times) than the peaks near the surface. The data therefore show that despite the similarity between the data, it is not possible to adopt a simple linear scaling to convert measured surface turbidity to measured benthic turbidity or vice versa.

Based on the benthic turbidity data at all monitoring sites it appears that the turbidity during dredging was predominantly controlled by the metocean conditions. To further assess any potential increase in turbidity at the sites due to maintenance dredging, the duration of time the updated benthic turbidity intensity thresholds (shown in Table 1) were exceeded is assessed in the following section.

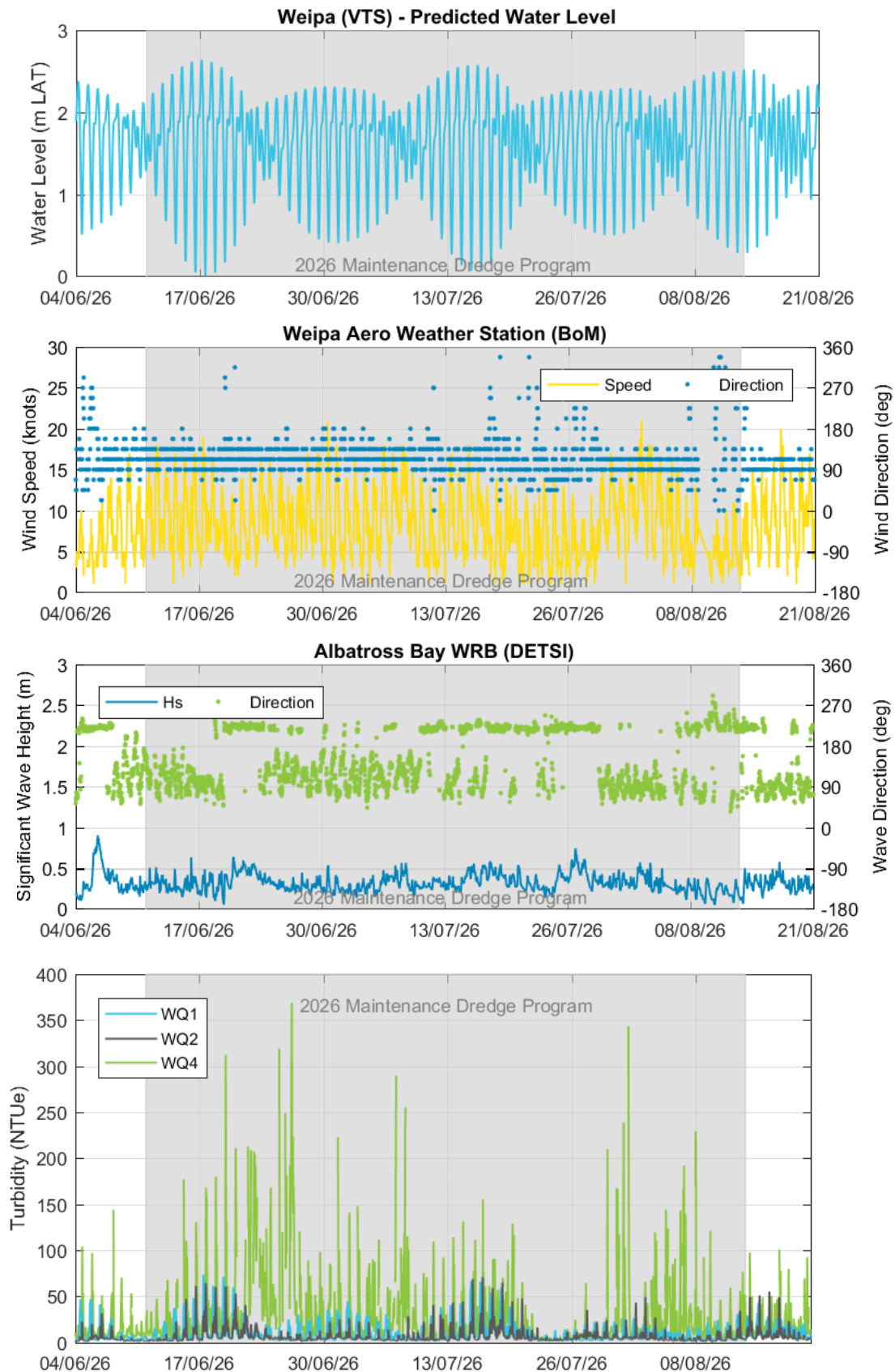
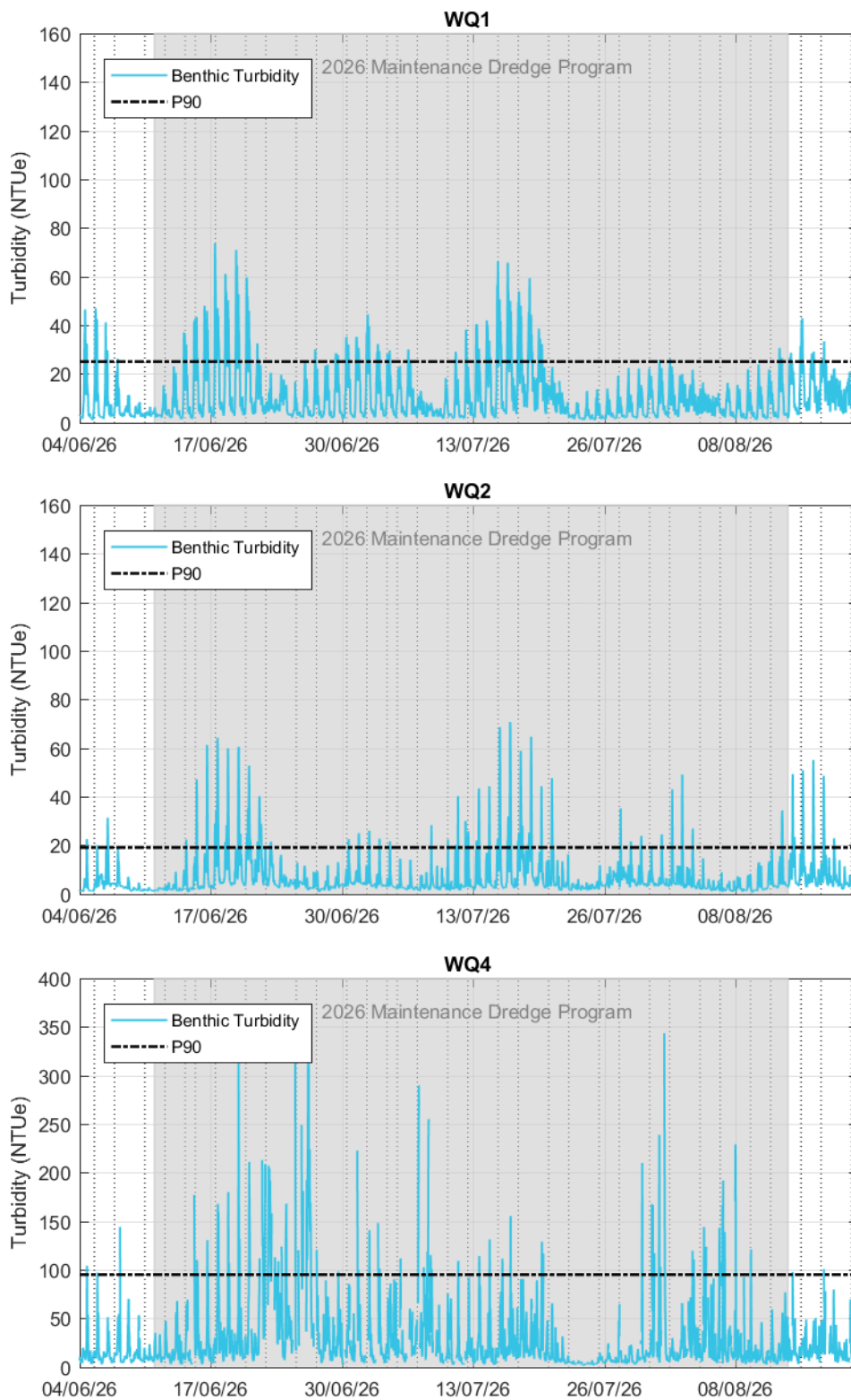


Figure 6. Metocean and turbidity conditions at Weipa over the monitoring period, with water level (upper), waves (upper middle), winds (lower middle) and turbidity at the three monitoring sites (lower).



Note: Vertical dotted lines indicate periods when Sentinel-2 satellite images were obtained and analysed.

Figure 7. Measured turbidity data and percentile thresholds at the three Weipa monitoring sites over the monitoring period, with WQ1 (upper), WQ2 (middle) and WQ4 (lower).

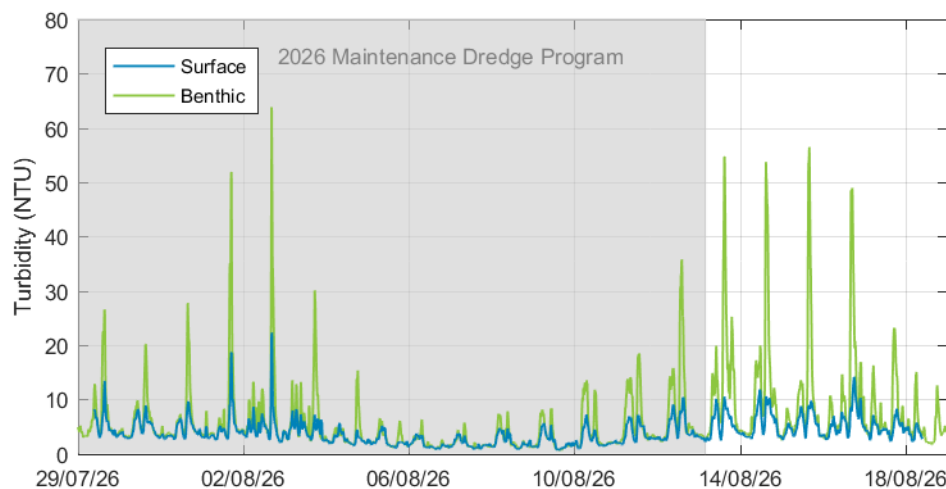


Figure 8. Measured benthic (JCU) and surface (Swash) turbidity data over the period of concurrent data at WQ2.

4.1.1. Exceedance

The duration of time that the 90th percentile benthic turbidity intensity thresholds were exceeded at the three monitoring sites was calculated over 7 days pre-dredging, the during dredging period and 7 days post-dredging as part of the 2026 maintenance dredging program (Table 2). The timeseries plots presented in Figure 6 show that the metocean conditions were relatively consistent and calm throughout the majority of the period, with some small, wave events occurring in the pre-dredge period and during the dredging. Overall, the post-dredge period can be considered to represent the calmest conditions, while more energetic short-duration wave conditions occurred during the pre-dredging and during dredging periods.

The exceedance durations show lower exceedances during the 7 day pre-dredge period compared with the subsequent dredging and post-dredging periods (except at WQ4 which shows the lowest exceedances during the post-dredging period).

The suggested duration triggers for the 90th percentile turbidity intensity threshold for both 20 and 40 day dredge periods are presented in PCS (2024a). These duration triggers were suggested as possible adaptive management thresholds which could be adopted sequentially to minimise the risk of any impacts to sensitive receptors. The dry season duration triggers have been scaled to represent the duration of the dredge period (63 days) and the duration of the dredge period including the 7 days pre- and post-dredging (77 days) (Table 3). The table does not include the maximum duration trigger as the exceedance durations remained well below the 90th percentile duration triggers at all of the sites.

The exceedance durations at the three sites ranged from 73 to 158 hours over the 63 day dredge period and between 74 and 183 hours over the total 77 day monitoring period which also included the 7 days pre- and post-dredging. Based on the duration of the 63 day dredge period the average exceedance duration is 151 hours, while the average exceedance duration over the total 77 day monitoring period is 185 hours. Therefore, the results show that at WQ1 the exceedance duration was just above the average exceedance duration threshold (but well below the 90th percentile exceedance threshold) over the dredge period and just below it over the entire monitoring period, while at the other two sites the exceedance durations remained below the average exceedance duration thresholds over both periods. The results therefore show that during the dredge period the turbidity was within the natural variability, with the exceedance durations remaining close to or below the average duration triggers. Based on this, no adaptive management would have been implemented should real-time monitoring have been undertaken at these sites over the entire monitoring period.

The duration of time the surface turbidity threshold was exceeded at WQ2 over the 21 day monitoring period was reported by Swash (2026) to be 10.5 hours. Over this same period the time that the benthic turbidity threshold was exceeded at WQ2 has been calculated to be 24 hours. This difference is a result of the surface turbidity data having much lower peaks in turbidity compared to the benthic turbidity data. To get a comparable exceedance duration for the surface turbidity relative to the benthic turbidity, the surface intensity threshold would need to be reduced from 9.9 NTU to 8.5 NTU.

Table 2. Duration of exceedance of the benthic turbidity intensity thresholds over each period of the Port of Weipa 2025 maintenance dredging program.

Location	7 days Pre-Dredge (hrs)	Dredge Period, 63 days (hrs)	7 days Post-Dredge (hrs)	Total Duration, 77 days (hrs)
WQ1	11	158	14	183
WQ2	3	104	14	121
WQ4	1	73	0	74

Table 3. Scaled duration triggers for the different periods of the Port of Weipa 2026 maintenance dredging program.

Location	Dredge Period: 63 days (hrs)		Dredge Period inc. pre and post: 77 days (hrs)	
	Av. (hrs)	90 th (hrs)	Av. (hrs)	90 th (hrs)
WQ1	151	339	185	414
WQ2	151	326	185	398
WQ4	151	268	185	327

4.2. Satellite-Derived Data

Satellite-derived turbidity data are a valuable resource which can provide a reliable spatial overview of the variability in turbidity over a large area (Fearn et al., 2017). Analysis of repeat images can be used to assist in understanding how spatial variations in turbidity change over time.

To better understand the spatial extent of both the natural turbidity in the Weipa region and any plumes resulting from the maintenance dredging activity (including from the placement of dredged sediment at the Albatross Bay DMPA), satellite imagery was used. High-resolution imagery from the Sentinel-2 (10 m) sensor and low-resolution imagery (300 m) from the Sentinel-3 sensor were sourced over the 2026 maintenance dredge monitoring period.

In the Weipa region the repeat satellite coverage is high for the Sentinel-3 sensor (images captured 11 out of every 14 days) and relatively high for the Sentinel-2 sensor (images captured every 2 to 3 days). The reason the temporal coverage is relatively high for the Sentinel-2 sensor is because the area is partially covered by two separate satellite tracks, which means the entire region is not covered for each image (the Inner Harbour is only captured in every second image). The satellite data are restricted by cloud cover, and so imagery can only be used when there is little to no cloud cover in the areas of interest.

The available imagery was post-processed to calculate the satellite-derived turbidity based on the approach of Brockmann et al. (2016). This approach provides an estimate of total suspended matter (TSM) and has been validated in various studies (Kyrliuk and Kratzer, 2019). An assessment of the accuracy of the satellite derived TSM against the in-situ near bed turbidity data was undertaken during the 2021 maintenance dredging program to allow a local calibration of the imagery. The results showed that the satellite derived TSM was able to provide a good representation of the benthic in-situ measured SSC data at the WQ1 and WQ2 monitoring sites (Figure 9).

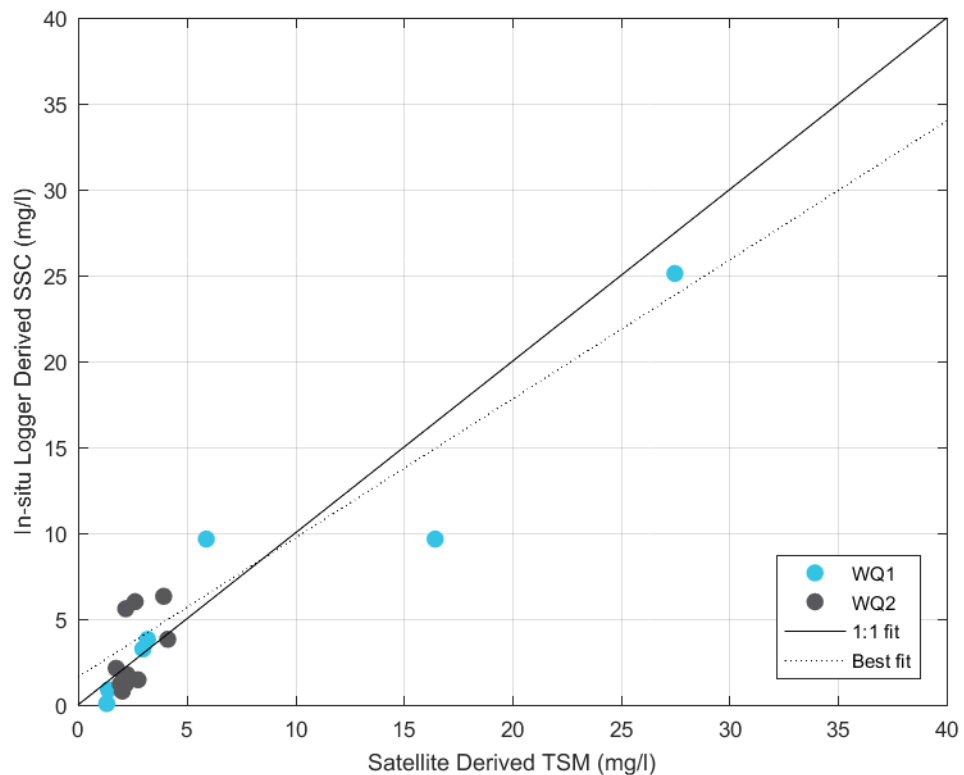


Figure 9. Correlation between satellite derived TSM from Sentinel-2 and in-situ logger derived SSC during the 2021 maintenance dredge monitoring period.

To ensure continuity between the satellite-derived TSM from different sensors a comparison between the TSM images derived from the Sentinel-2 and Sentinel-3 sensors was undertaken during the pre-dredge period (Figure 10). Both images have similar spatial patterns in TSM and magnitudes which gives confidence that both approaches were able to provide comparable TSM values during the dredge program.

Throughout the dredge period PCS provided NQBP with daily updates including spatial maps of TSM from the available satellite imagery from both satellite sensors to provide as much near real-time information about the natural turbidity and any plumes due to the maintenance dredging as possible. From the daily updates provided during the dredging it was noted that the plumes from the maintenance dredging were relatively small and localised and as such they could be difficult to definitively identify from the lower resolution Sentinel-3 imagery. Based on that, the two technical notes provided during dredging focussed on satellite imagery from the Sentinel-2 sensor (PCS, 2026c & 2026d). This post-dredging report also focusses on imagery from just the Sentinel-2 sensor.

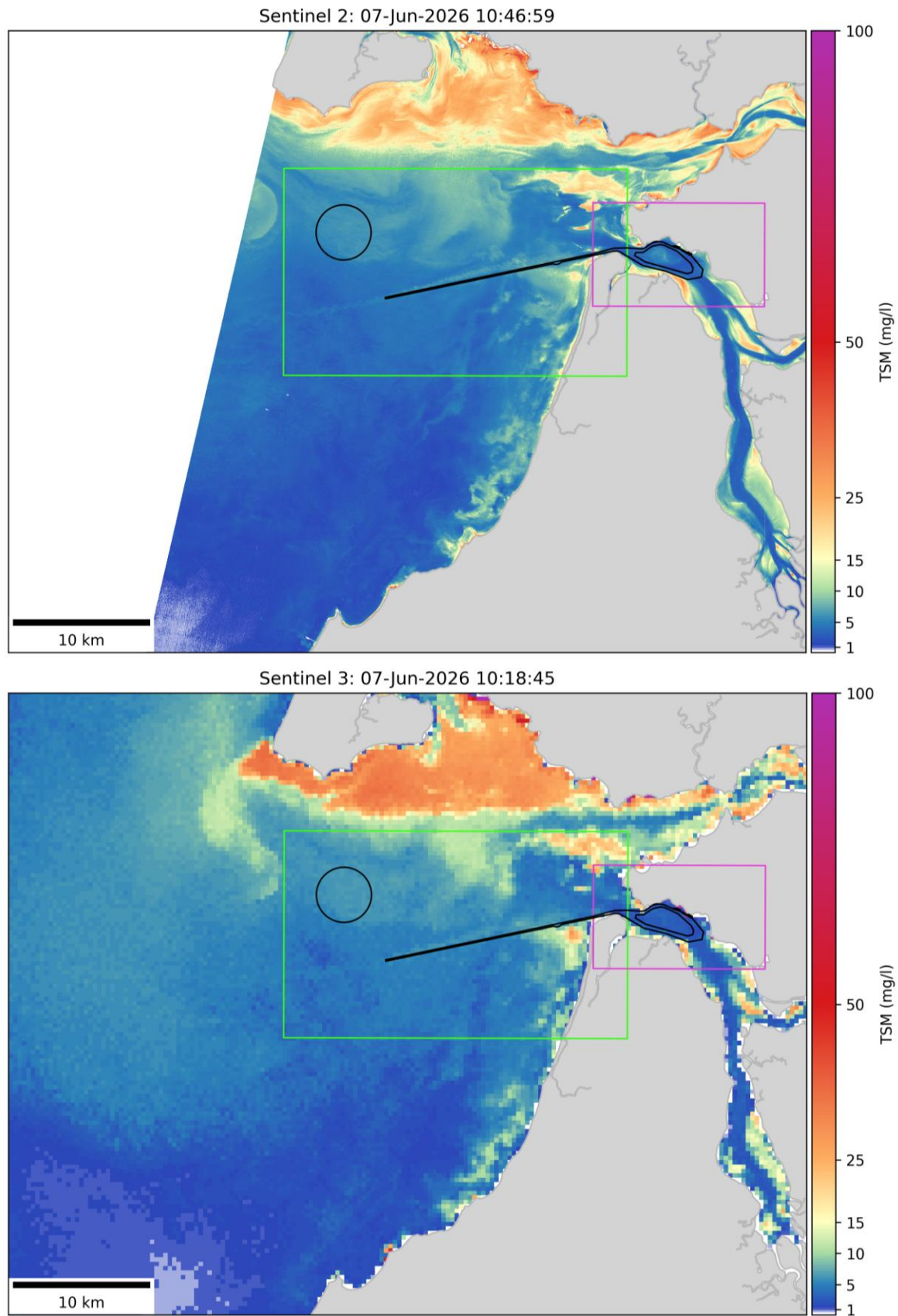


Figure 10. Comparison between satellite-derived TSM from the Sentinel-2 (top) and Sentinel-3 (bottom) sensors for images captured approximately 30 minutes apart.

Over the 77 days over the pre-, during and post-dredging monitoring period when satellite imagery were sourced for the Port of Weipa 2026 maintenance dredging program, a total of 35 high resolution and 69 low resolution satellite images were captured by the Sentinel-2 and Sentinel-3 sensors respectively. Based on this, high resolution satellite imagery was captured for 45% of the days and low resolution satellite imagery was captured for 90% of the days, with either a high or low resolution satellite image available for 92% of the days. However, due to high cloud cover only 89% of the images were usable (4 high resolution and 8 low resolution images were not usable due to high cloud cover).

For reference, the times of the usable high-resolution Sentinel-2 imagery over the pre-, during and post-dredge monitoring periods are provided in Table 4. A selection of images are presented in this report to show the range of natural conditions and plumes observed over the period. The images which are presented in this report are highlighted in bold text in the table.

Table 4. Times and notes for the usable high-resolution Sentinel-2 satellite images over the pre-, during and post-dredge monitoring periods.

Date and Time	Notes
Pre-Dredge	
05/06/2026 10:57	Image excludes Inner Harbour.
07/06/2026 10:47	-
During Dredging	
12/06/2026 10:47	Patches of cloud cover, mainly over Inner Harbour. At this time the TSHD Brisbane was sailing to the DMPA having finished dredging SC21 to Urquart Pt at 09:38. The most recent placement at the DMPA was at 05:56.
14/06/2026 10:47	At this time the TSHD Brisbane was dredging SC10 to SC12. The most recent placement at the DMPA was at 09:42.
17/06/2026 10:47	At this time the TSHD Brisbane was just finishing dredging SC17 to SC21. The most recent placement at the DMPA was at 08:14.
20/06/2026 10:57	Image excludes Inner Harbour. At this time the TSHD Brisbane was sailing to the DMPA having finished dredging SC8 to SC10 at 10:35. The most recent placement at the DMPA was at 07:28.
22/06/2026 10:47	Patches of cloud cover, mainly over Inner Harbour. At this time the TSHD Brisbane was sailing to the DMPA having finished dredging SC6 to SC8 at 10:34. The most recent placement at the DMPA was at 09:34.
27/06/2026 10:47	Patches of cloud cover over Inner Harbour and landward end of South Channel. At this time the TSHD Brisbane was sailing to the DMPA having finished dredging SC6 to SC8 at 10:16. The most recent placement at the DMPA was at 09:05.
02/07/2026 10:47	Cloud cover over Inner Harbour and landward end of South Channel. The TSHD Brisbane was not operating at this time due to a delay. The most recent dredging was at SC10 to SC12 at 03:35 and the most recent placement at the DMPA was at 04:39.
04/07/2026 10:47	Cloud cover over Inner Harbour, landward end of South Channel and DMPA. At this time the TSHD Brisbane was sailing back from the DMPA having just placed a load at 10:41. The most recent dredging had been at SC4 to SC6 which was completed at 09:58.
05/07/2026 10:57	Image excludes Inner Harbour. At this time the TSHD Brisbane was sailing to the DMPA having finished dredging SC8 to SC10 at 10:28. The most recent placement at the DMPA was at 09:10.
07/07/2026 10:47	Cloud cover over Inner Harbour and landward end of South Channel. At this time the TSHD Brisbane was dredging SC10 to SC12. The most recent placement at the DMPA was at 09:59.

Date and Time	Notes
10/07/2026 10:57	Image excludes Inner Harbour. At this time the TSHD Brisbane was sailing to the DMPA having finished dredging SC12 to SC14 at 10:26. The most recent placement at the DMPA was at 08:58.
12/07/2026 10:47	At this time the TSHD Brisbane was sailing to the DMPA having finished dredging SC14 to SC16 at 10:29. The most recent placement at the DMPA was at 08:49.
15/07/2026 10:57	Smoke plume through offshore half of South Channel. Image excludes Inner Harbour. At this time the TSHD Brisbane was sailing to the DMPA having finished dredging SC6 to SC8 at 10:44. The most recent placement at the DMPA was at 09:35.
17/07/2026 10:57	At this time the TSHD Brisbane was sailing to the DMPA having finished dredging SC10 to SC12 at 10:07. The most recent placement at the DMPA was at 08:49.
20/07/2026 10:57	Image excludes Inner Harbour. At this time the TSHD Brisbane was sailing back from the DMPA having just placed a load at 10:32. The most recent dredging had been at East Cora Bank which was completed at 08:27.
22/07/2026 10:47	At this time the TSHD Brisbane was sailing to the DMPA having finished dredging SC12 to SC14 at 10:44. The most recent placement at the DMPA was at 09:19.
25/07/2026 10:57	Image excludes Inner Harbour. At this time the TSHD Brisbane was sailing to the DMPA having finished dredging SC10 to SC12 at 09:57. The most recent placement at the DMPA was at 08:32.
27/07/2026 10:47	At this time the TSHD Brisbane was sailing to the DMPA having finished dredging CS3 to CS5 at 09:43. The most recent placement at the DMPA was at 07:30.
30/07/2026 10:57	Image excludes Inner Harbour. The TSHD Brisbane was not operating at this time due to a delay. The most recent dredging was at SC8 to SC10 at 03:33 and the most recent placement at the DMPA was at 04:56.
01/08/2026 10:47	At this time the TSHD Brisbane was dredging CN3 to CN5. The most recent placement at the DMPA was at 06:42.
04/08/2026 10:57	Image excludes Inner Harbour. At this time the TSHD Brisbane was dredging at Amrun Port. The most recent dredging at Weipa was at SC10 to SC12 at 04:54 and the most recent placement at the DMPA was at 05:44.
06/08/2026 10:47	At this time the TSHD Brisbane was dredging CS3 to CS5. The most recent placement at the DMPA was at 08:44.
09/08/2026 10:57	Patches of cloud cover near the DMPA. Image excludes Inner Harbour. At this time the TSHD Brisbane was sailing back from the DMPA having just placed a load at 10:24. The most recent dredging had been at SC12 to SC14 which was completed at 09:25.
11/08/2026 10:47	At this time the TSHD Brisbane was sailing back from the DMPA having just placed a load at 10:20. The most recent dredging had been at SC14 to SC16 which was completed at 09:22.
Post-Dredge	
14/08/2026 10:57	Image excludes Inner Harbour.
16/08/2026 10:47	-
19/08/2026 10:57	Image excludes Inner Harbour.

4.2.1. Turbidity Analysis

To provide an understanding of natural turbidity levels within the study area and to identify the extent of potential increases in turbidity due to the 2026 maintenance dredging program, the turbidity analysis was undertaken at two different spatial scales, namely:

- regional and local (Albatross Bay and Port of Weipa); and
- dredge/bed levelling vessel (in close proximity to the TSHD Brisbane or Pacific Titan).

4.2.1.1. Regional and Local Scales

To provide an understanding of how the turbidity varied over the 2026 Maintenance Dredging Program, plots of the satellite-derived TSM in Albatross Bay, the South Channel/Albatross Bay DMPA and the Inner Harbour area are shown for selected satellite images over the pre-, during and post-dredging periods in Figure 11 to Figure 41. The plots show the following:

- the TSM in the Albatross Bay region has varied spatially and temporally over the period. The natural TSM was typically between 5 and 25 mg/l (4 to 18 NTU) around the South Channel, 5 to 15 mg/l (4 to 11 NTU) around the DMPA, while higher TSM of 25 to 50 mg/l (approximately 18 to 35 NTU) occurred in the shallow areas adjacent to the northern shoreline of Albatross Bay and in the estuaries. The natural TSM shown by the satellite imagery was highest on the 17th June, the 17th July and the 14th August. The reasons for the higher TSM in these images was due to them being captured close to low water on spring tides which is immediately after the high current speeds on the ebbing tide which results in increased resuspension in the estuaries and Albatross Bay;
- extensive natural plumes with a TSM of up to 25 mg/l (approximately 18 NTU) were present within Albatross Bay over the majority of the period. These extended up to 10's of kilometres and at times were present close to the South Channel and the DMPA. These plumes were present during the pre- and post-dredge periods and so these large-scale plumes are known to have been due to natural processes;
- a number of the images have captured visible plumes due to maintenance dredging and bed levelling activities in the Inner Harbour. These activities were shown to result in localised plumes of up to 20 mg/l (approximately 14 NTU) occurring close to where the vessels were operating. The plumes were shown to predominantly remain within the dredge footprint and with none of the plumes extending into any areas of seagrass beds. The natural TSM in the deeper dredged areas of the Inner Harbour typically remained below 10 mg/l (approximately 7 NTU) except during the periods when spring tides resulted in elevated TSM in Albatross Bay when the TSM in the channel was up to 25 mg/l (approximately 18 NTU);
- the images indicate that the TSM in the area of the seagrass meadows in the Inner Harbour has been controlled by natural processes with the natural TSM typically being between 10 and 50 mg/l (approximately 7 to 35 NTU) and consistently being higher than the adjacent channel. No persistent plumes that would be expected to impact seagrass beyond what they are normally exposed to were observed as a result of the maintenance dredging program; and
- plots of the satellite-derived TSM over the post-dredging period are shown in Figure 40 to Figure 42. The image captured one day after the dredging finished shows that the localised plumes which were present around the South Channel and DMPA were no longer visible, with an elevated TSM of 5 to 15 mg/l (4 to 11 NTU) present throughout the majority of Albatross Bay due to the large spring tides. This indicates that any plumes from the maintenance dredging activity dispersed prior to the image being captured (approximately 31 hours after the dredging finished). The image captured three days after the dredging finished shows that the TSM in Albatross Bay and the Inner Harbour has remained elevated, with a TSM of 5 to 10 mg/l (approximately 4 to 7 NTU) around the DMPA and outer half of the South Channel and between 10 and 15 mg/l (approximately 7 to 11 NTU) along the inner half of the South Channel and a TSM of 10

to 25 mg/l (approximately 7 to 18 NTU) the Inner Harbour. This provides further evidence as to how the natural processes influence the TSM in the region and how the natural processes can result in elevated TSM over large areas.

The imagery has also shown plumes with a TSM of up to 20 mg/l (approximately 14 NTU) and spatial extents of up to kilometres around the South Channel, DMPA and Inner Harbour occurred through the dredge period as a result of the dredging and bed levelling activity. The plumes from the maintenance dredging and bed levelling are further assessed in Section 4.2.1.2.

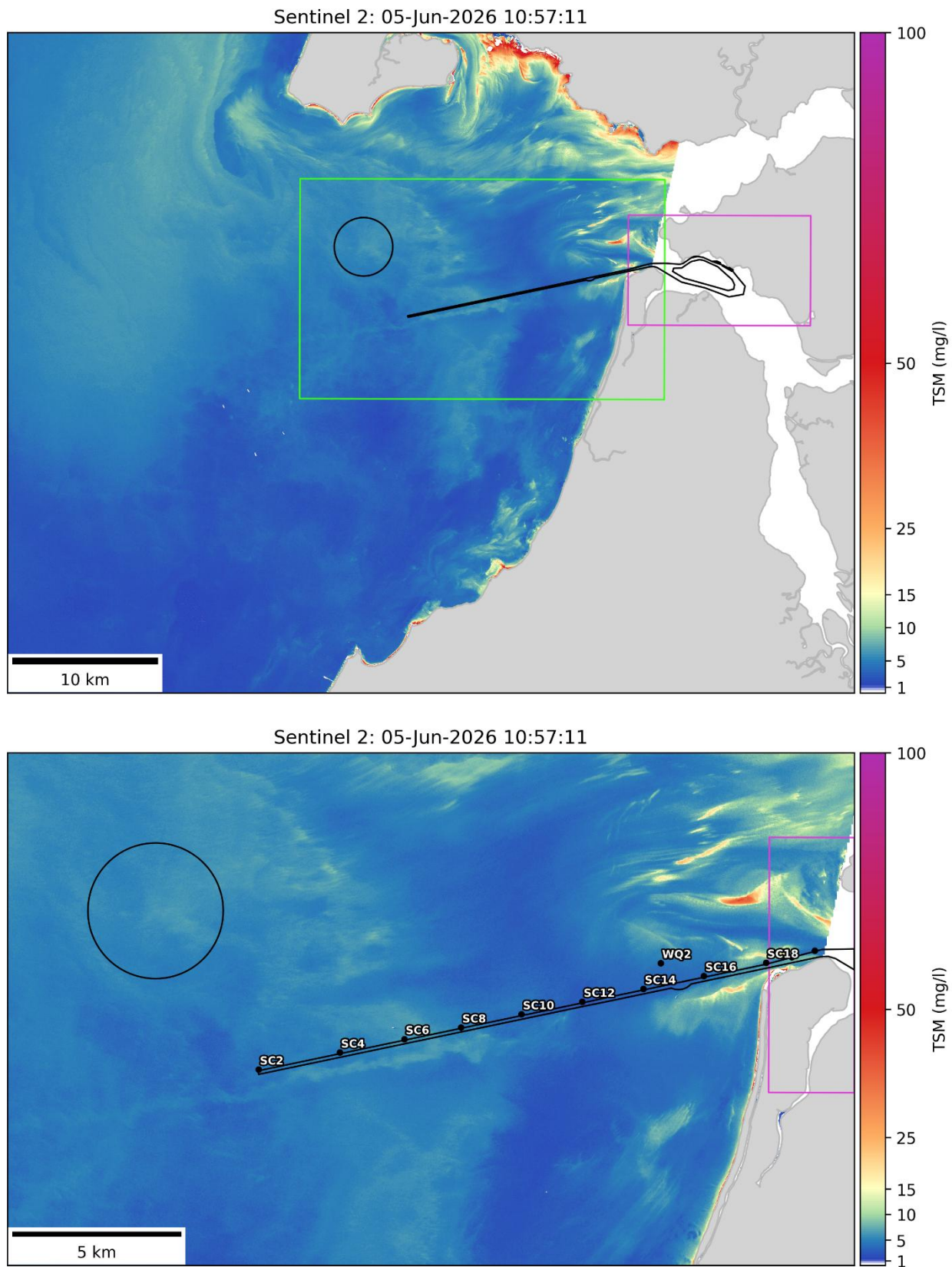


Figure 11. Regional scale (top) and local scale (bottom) plots of satellite-derived TSM from the Sentinel-2 sensor on 05/06/2026 (pre-dredging).

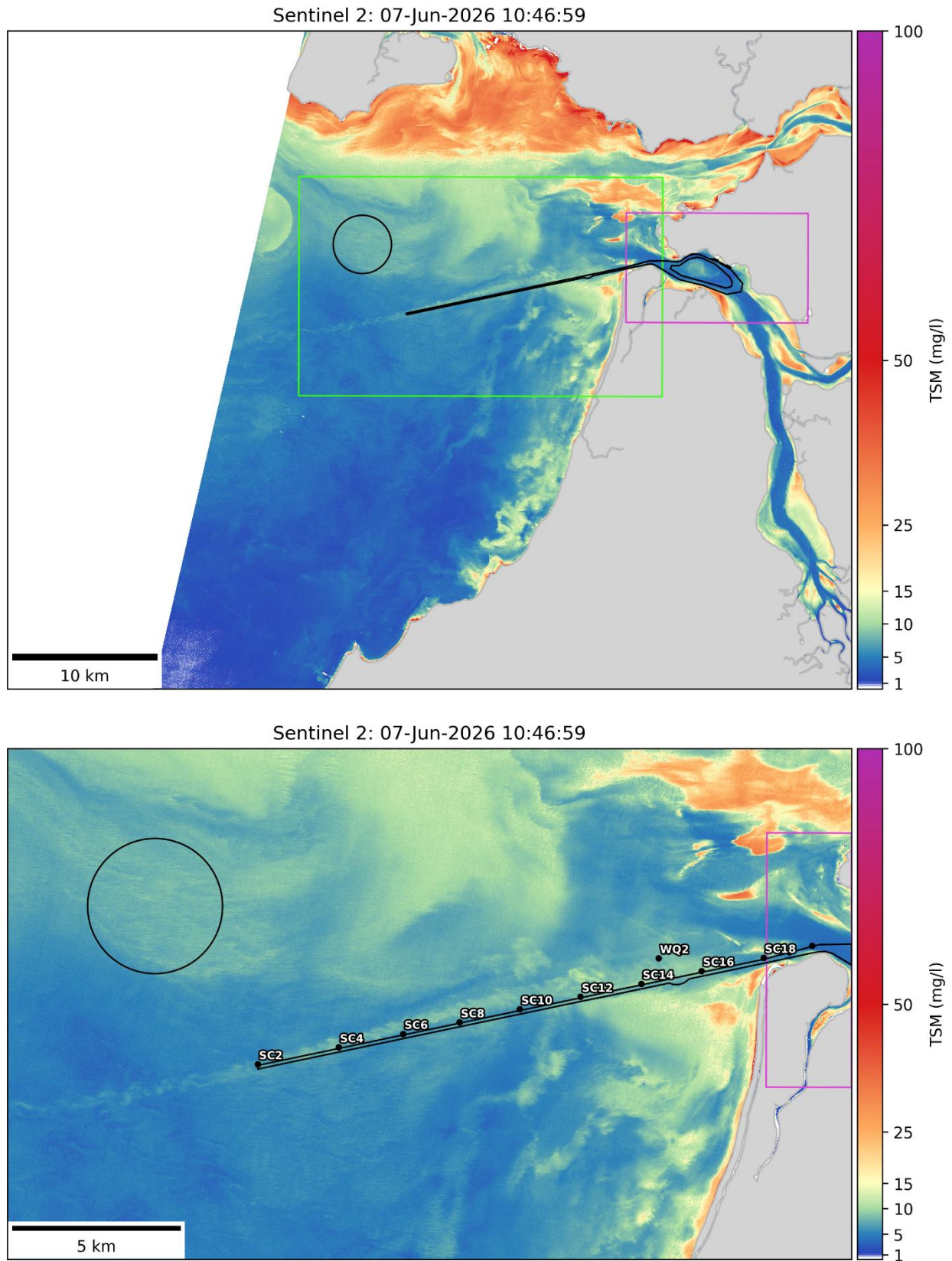


Figure 12. Regional scale (top) and local scale (bottom) plots of satellite-derived TSM from the Sentinel-2 sensor on 07/06/2026 (pre-dredging).

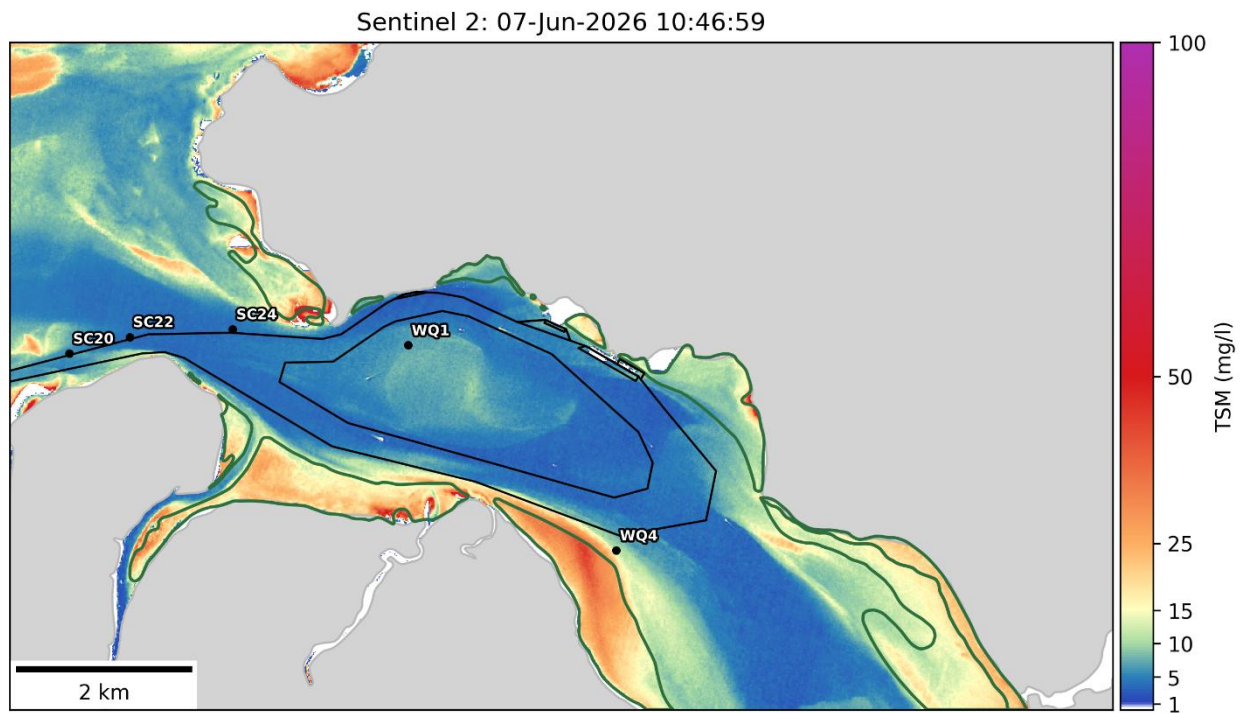


Figure 13. Inner Harbour plot of satellite-derived TSM from the Sentinel-2 sensor on 07/06/2026 (pre-dredging).
Note: the green outlined regions show area of seagrass.

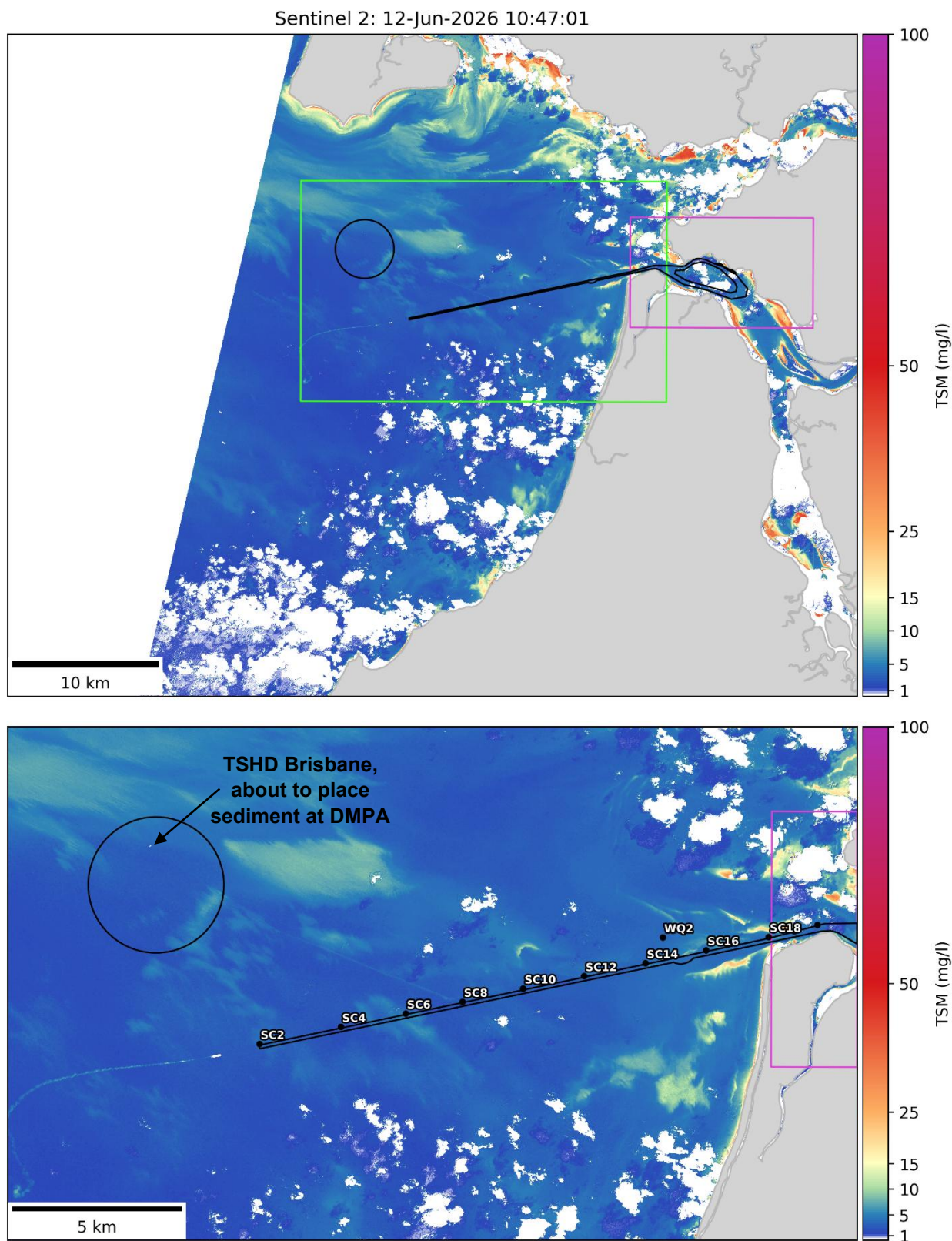


Figure 14. Regional scale (top) and local scale (bottom) satellite-derived TSM from the Sentinel-2 sensor on 12/06/2026 (during dredging). Note: the white areas represent cloud cover and the adjacent low TSM values are due to the cloud shadow.

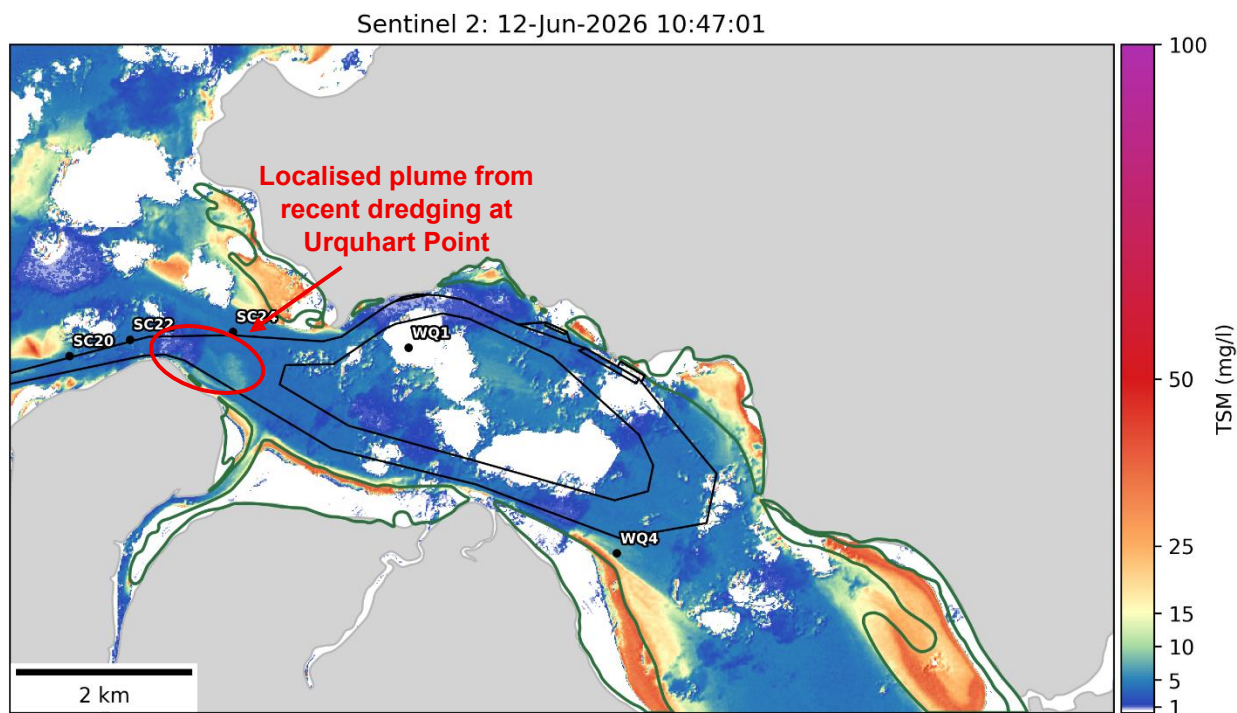


Figure 15. Satellite-derived TSM of the Inner Harbour from the Sentinel-2 sensor on 12/06/2026 (during dredging).
Note: the green outlined regions show area of seagrass and the white areas represent cloud cover and the adjacent low TSM values are due to the cloud shadow.

Sentinel 2: 14-Jun-2026 10:47:21

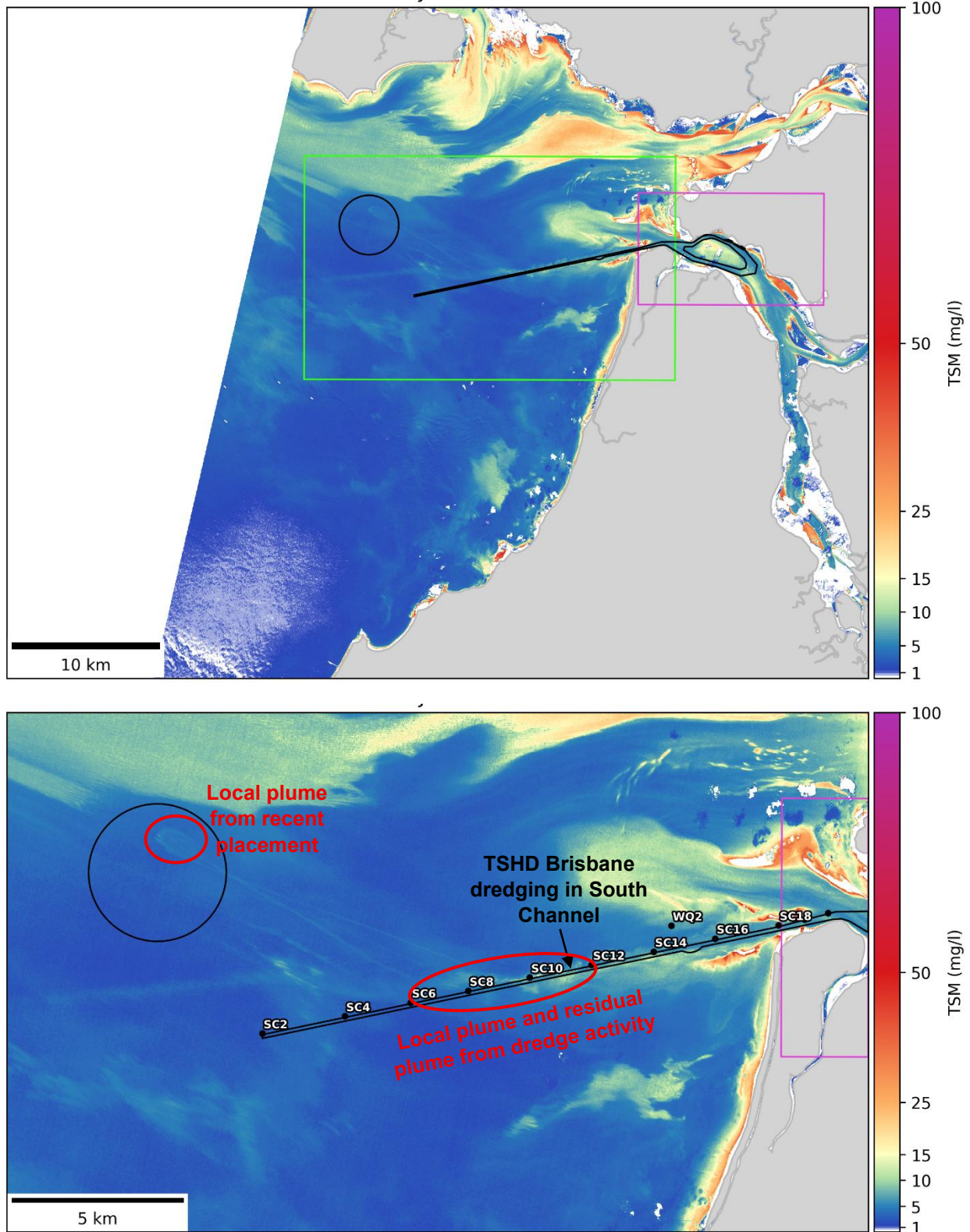


Figure 16. Regional scale (top) and local scale (bottom) satellite-derived TSM from the Sentinel-2 sensor on 14/06/2026 (during dredging). Note: the white areas represent cloud cover and the adjacent low TSM values are due to the cloud shadow.

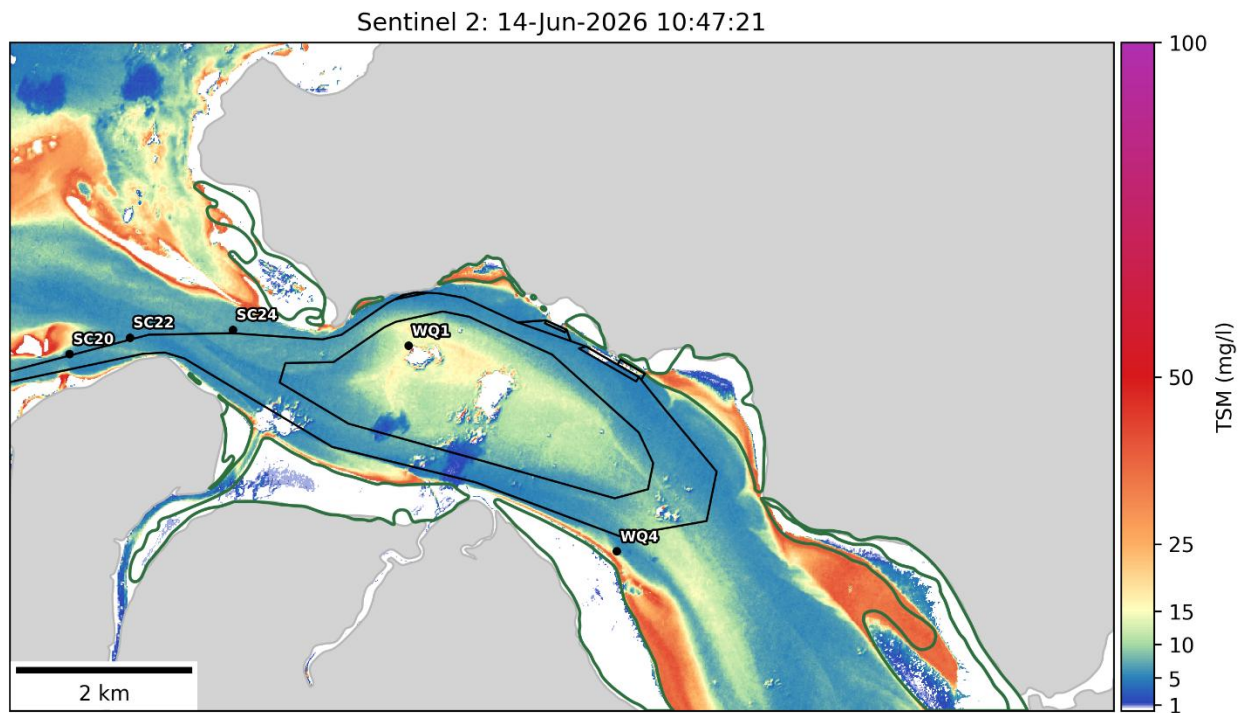


Figure 17. Satellite-derived TSM of the Inner Harbour from the Sentinel-2 sensor on 14/06/2026 (during dredging).
Note: the green outlined regions show area of seagrass and the white areas represent cloud cover and the adjacent low TSM values are due to the cloud shadow.

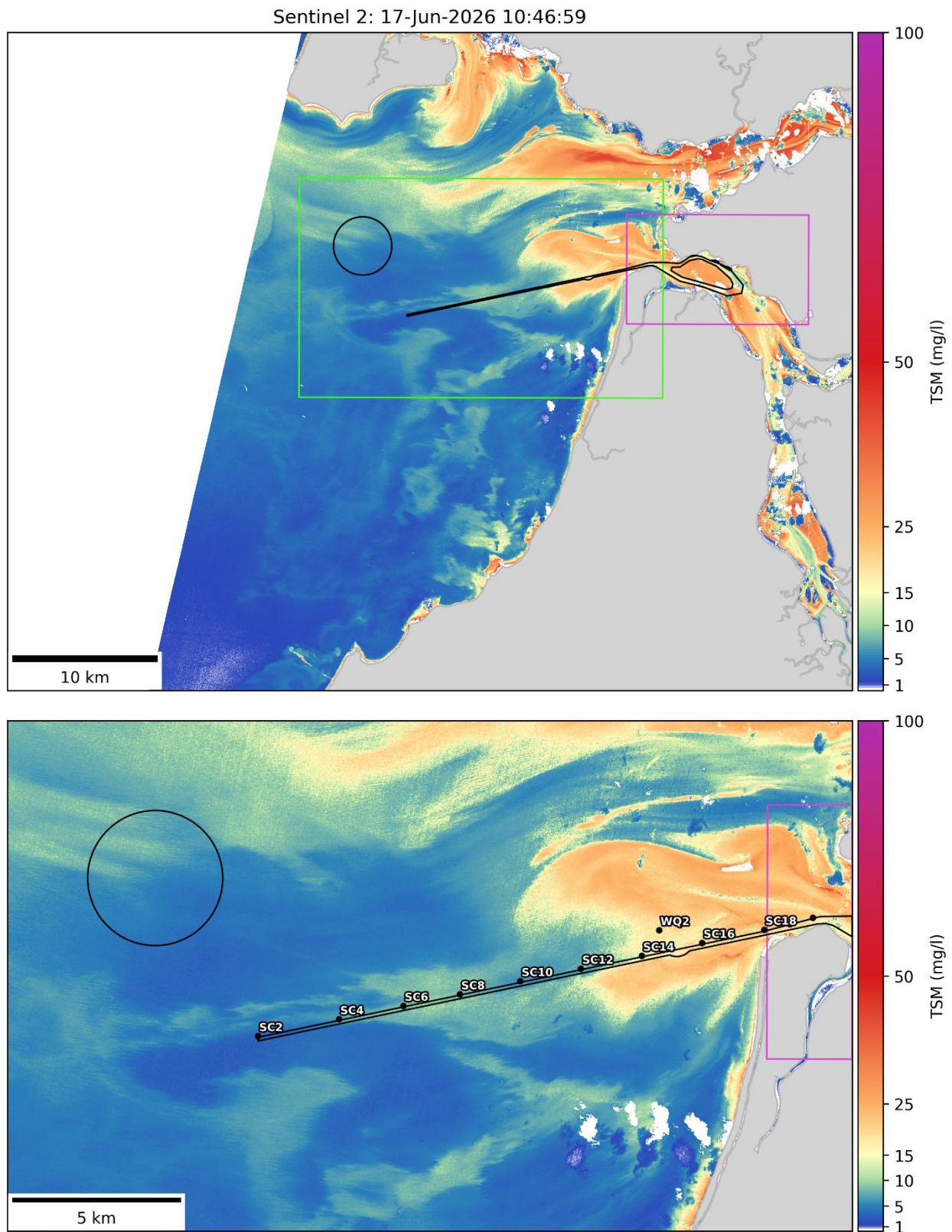


Figure 18. Regional scale (top) and local scale (bottom) satellite-derived TSM from the Sentinel-2 sensor on 17/06/2026 (during dredging). Note: : the white areas represent cloud cover and the adjacent low TSM values are due to the cloud shadow.

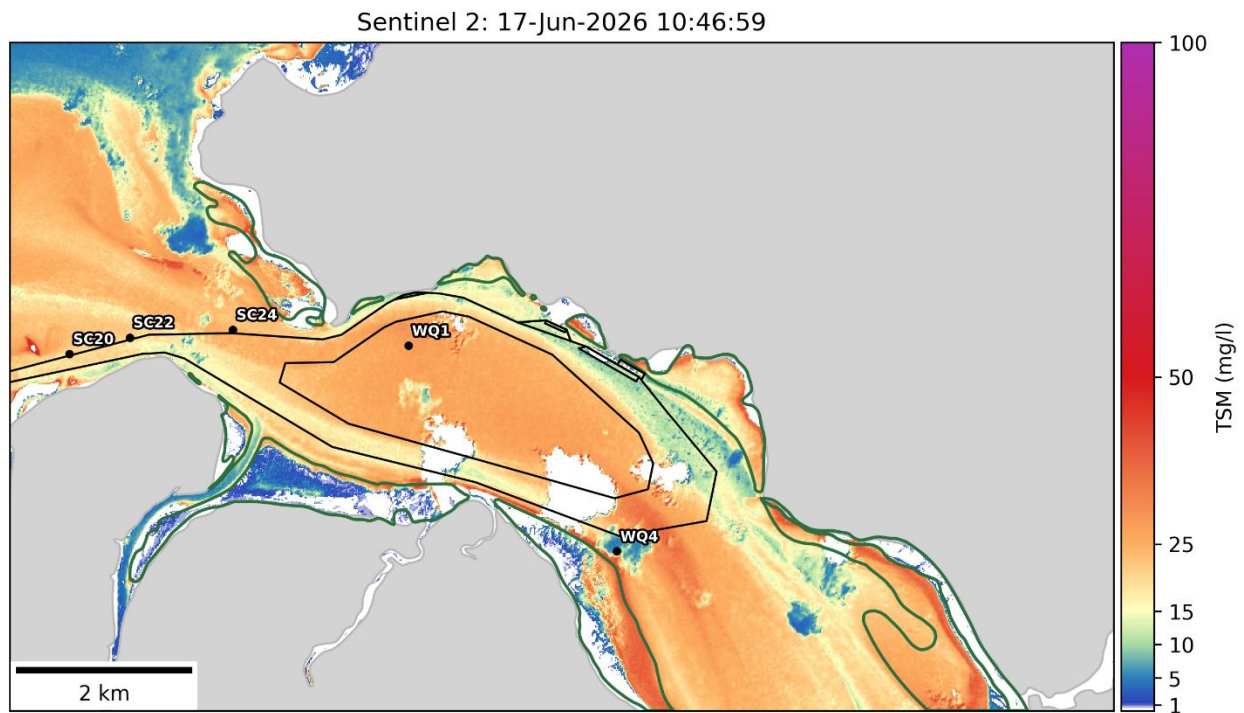


Figure 19. Satellite-derived TSM of the Inner Harbour from the Sentinel-2 sensor on 17/06/2026 (during dredging).
Note: the green outlined regions show area of seagrass and the white areas represent cloud cover and the adjacent low TSM values are due to the cloud shadow.

Sentinel 2: 22-Jun-2026 10:47:01

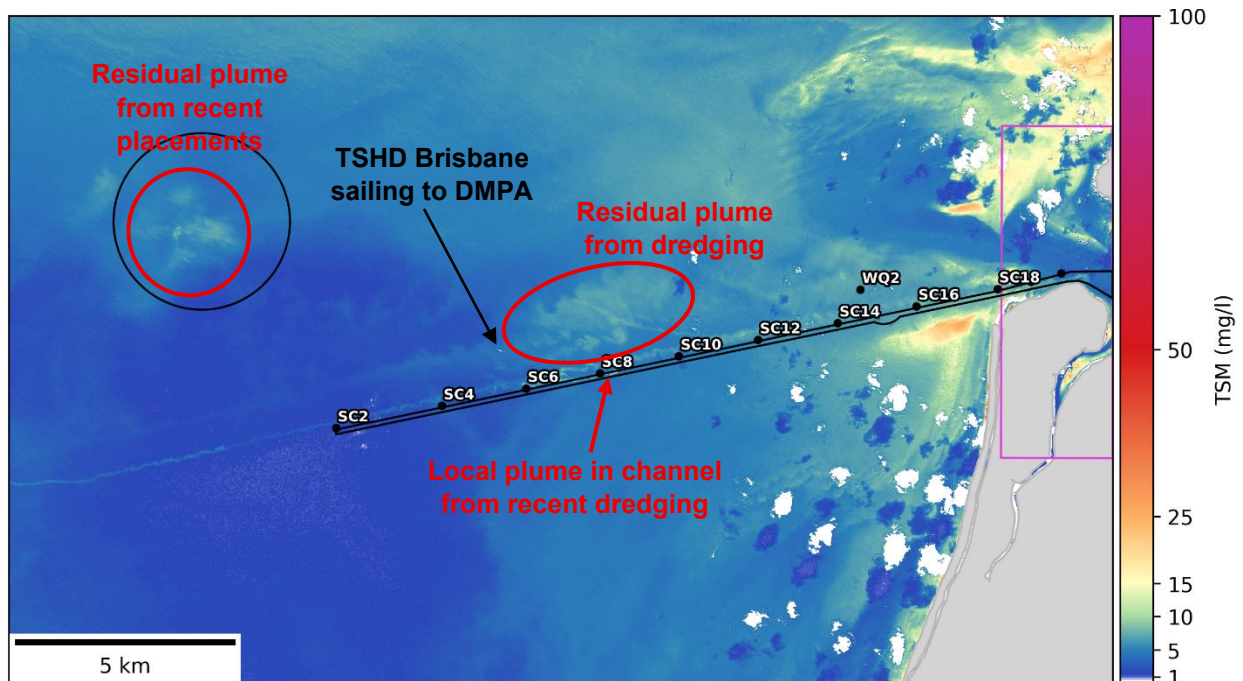
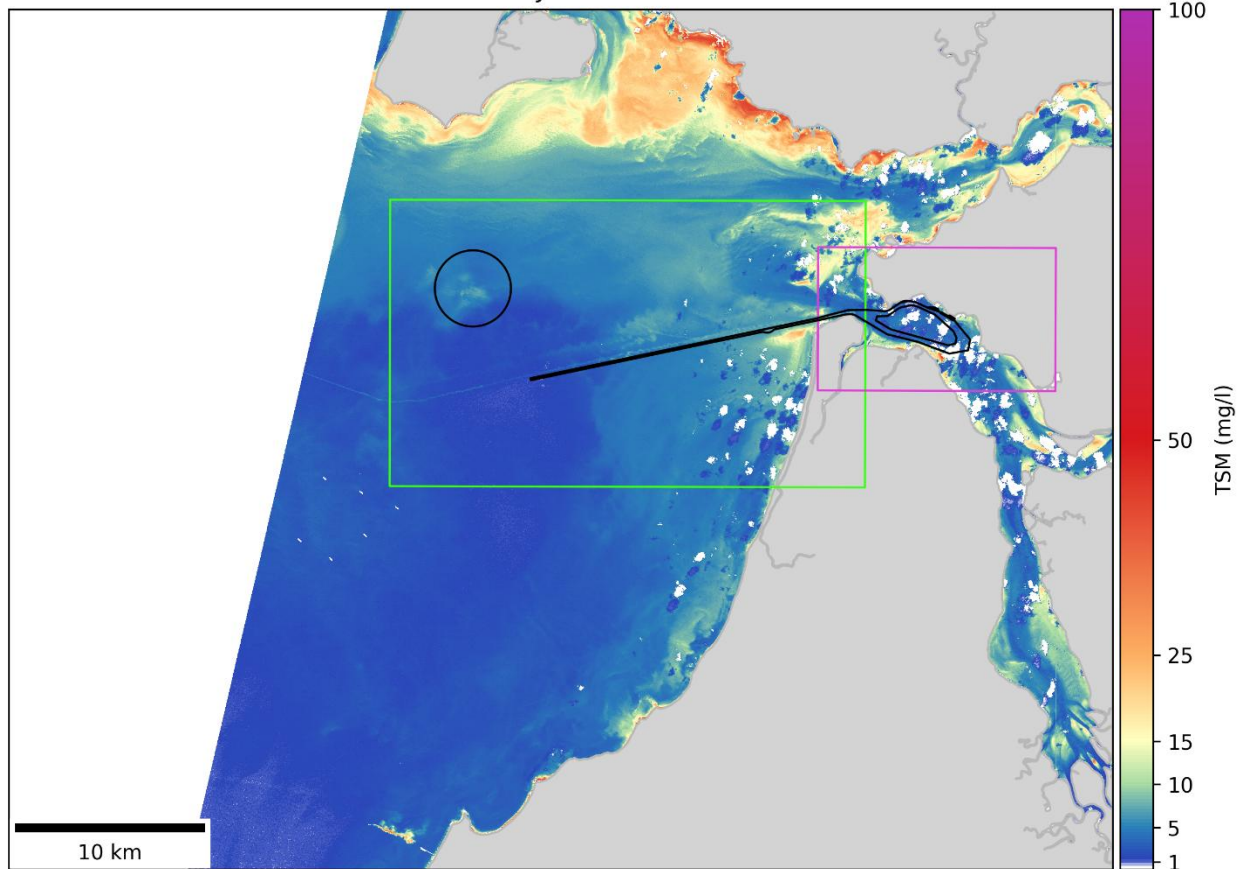


Figure 20. Regional scale (top) and local scale (bottom) satellite-derived TSM from the Sentinel-2 sensor on 22/06/2026 (during dredging). Note: the white areas represent cloud cover and the adjacent low TSM values are due to the cloud shadow.

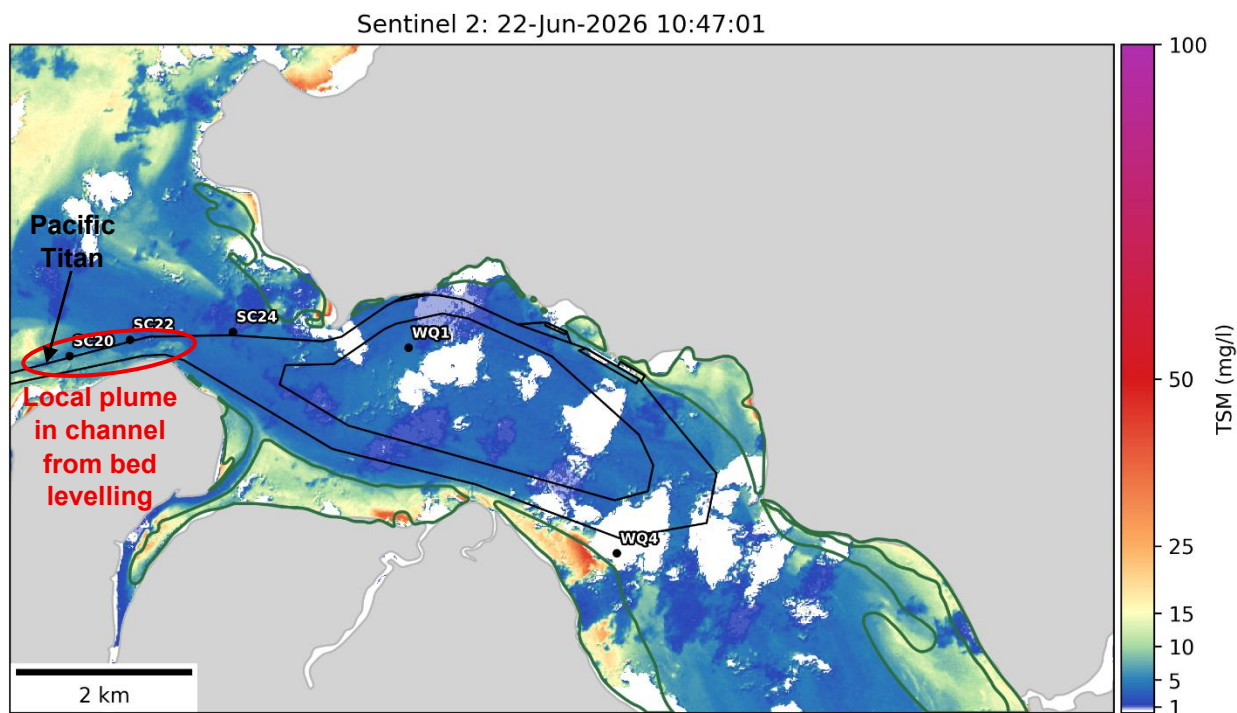


Figure 21. Satellite-derived TSM of the Inner Harbour from the Sentinel-2 sensor on 22/06/2026 (during dredging).
Note: the green outlined regions show area of seagrass and the white areas represent cloud cover and the adjacent low TSM values are due to the cloud shadow.

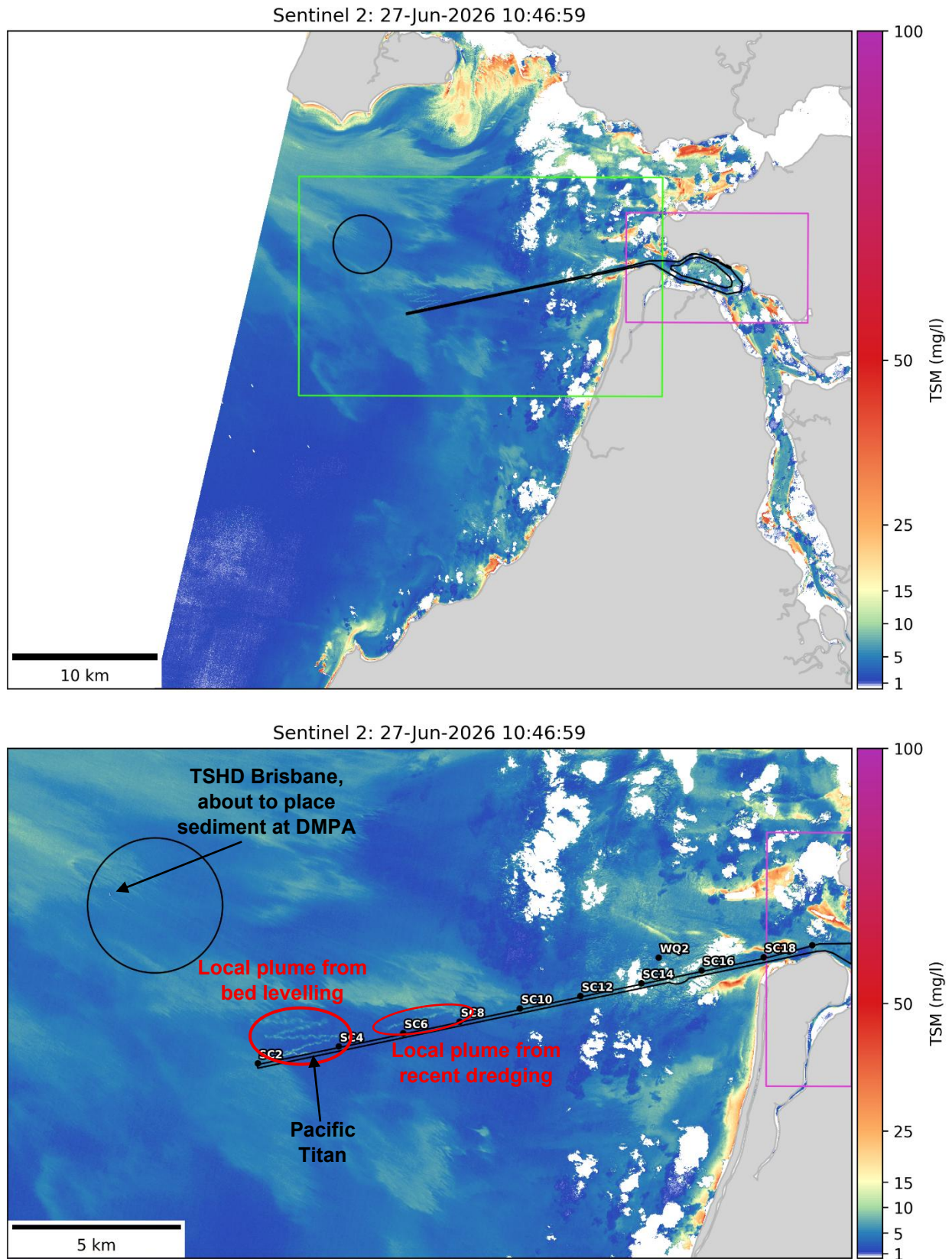


Figure 22. Regional scale (top) and local scale (bottom) satellite-derived TSM from the Sentinel-2 sensor on 27/06/2026 (during dredging). Note: the white areas represent cloud cover and the adjacent low TSM values are due to the cloud shadow.

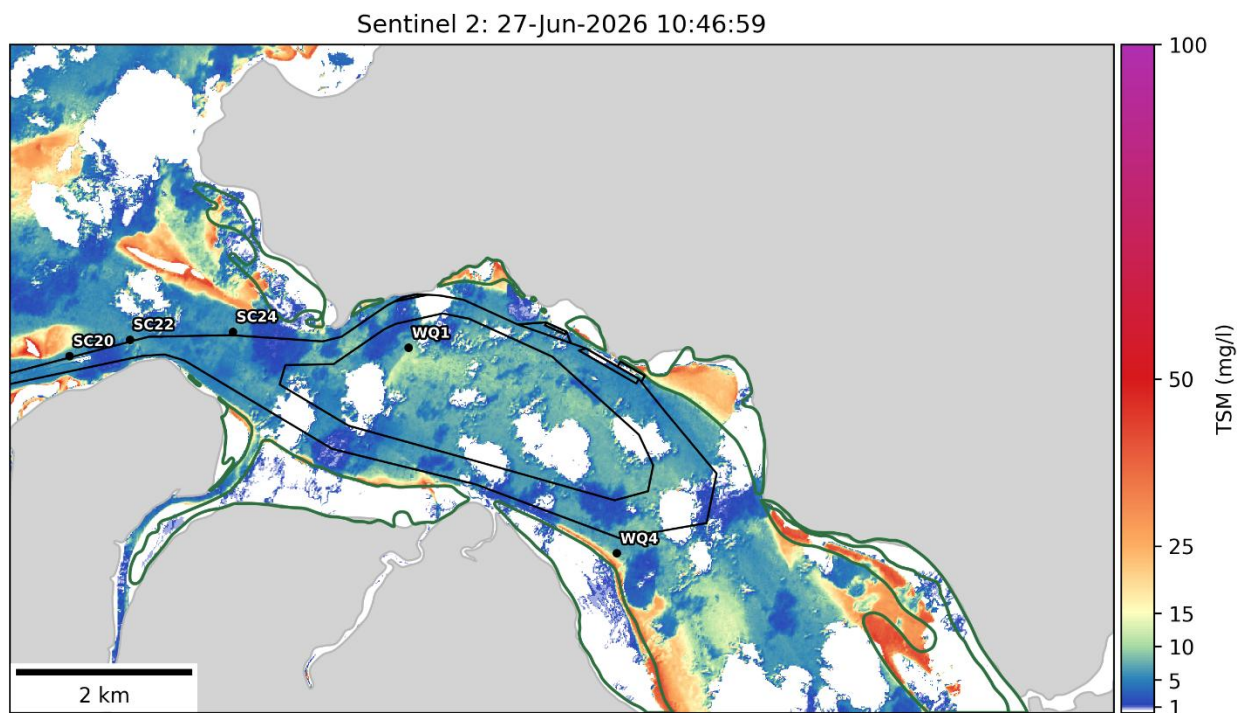


Figure 23. Satellite-derived TSM of the Inner Harbour from the Sentinel-2 sensor on 27/06/2026 (during dredging).
Note: the green outlined regions show area of seagrass and the white areas represent cloud cover and the adjacent low TSM values are due to the cloud shadow.

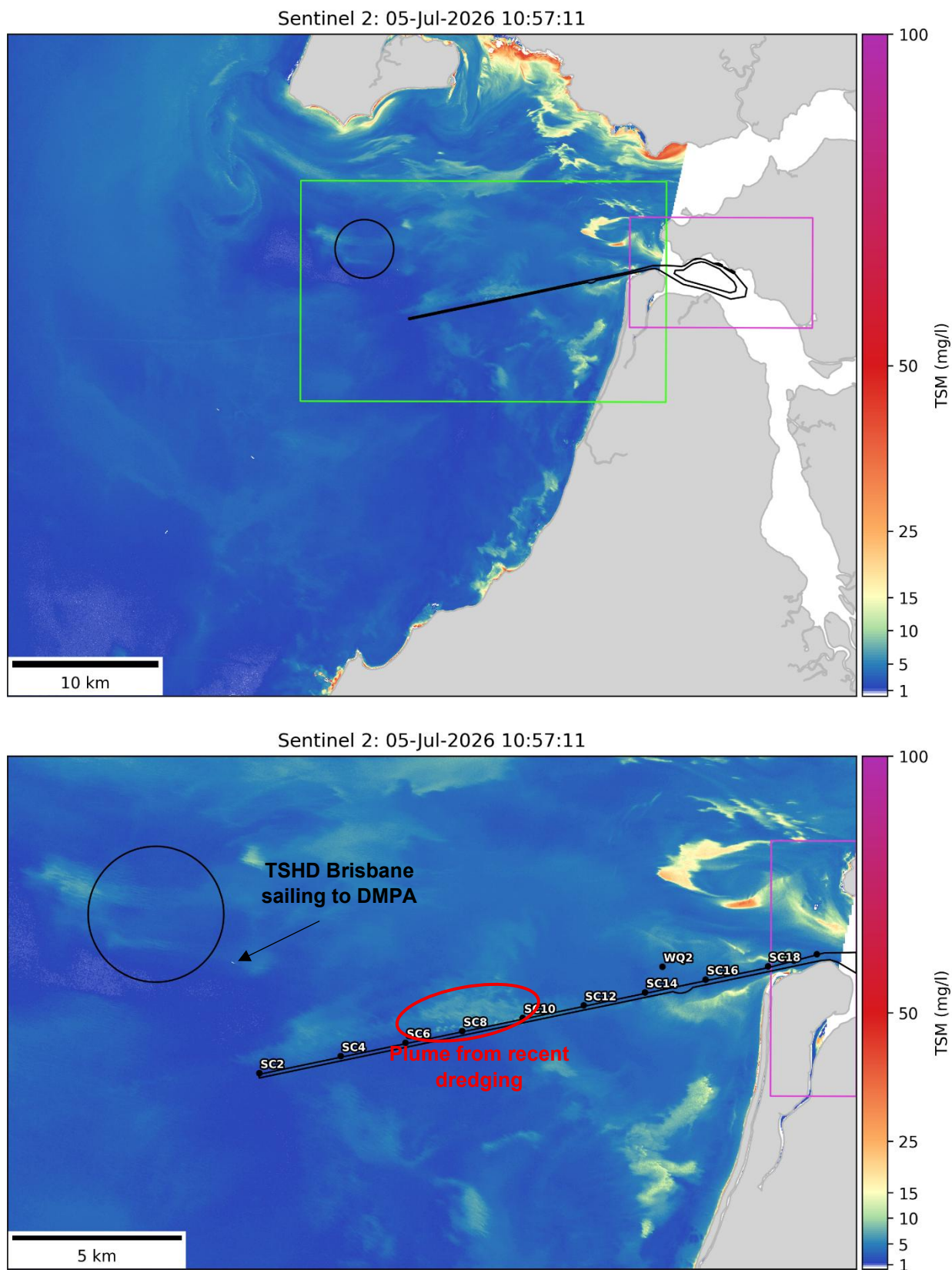


Figure 24. Regional scale (top) and local scale (bottom) satellite-derived TSM from the Sentinel-2 sensor on 05/07/2026 (during dredging).

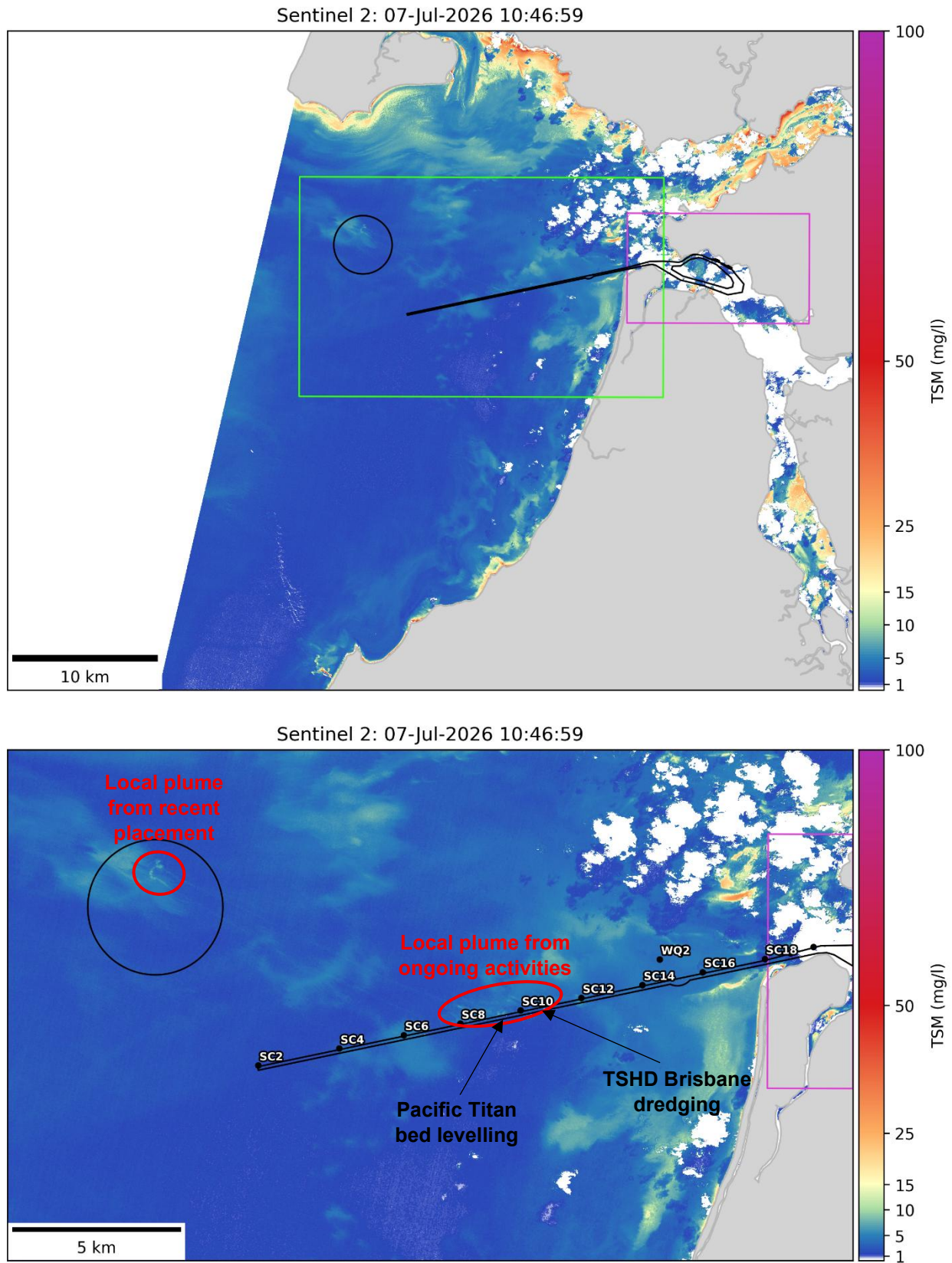


Figure 25. Regional scale (top) and local scale (bottom) satellite-derived TSM from the Sentinel-2 sensor on 07/07/2026 (during dredging). Note: the white areas represent cloud cover and the adjacent low TSM values are due to the cloud shadow.

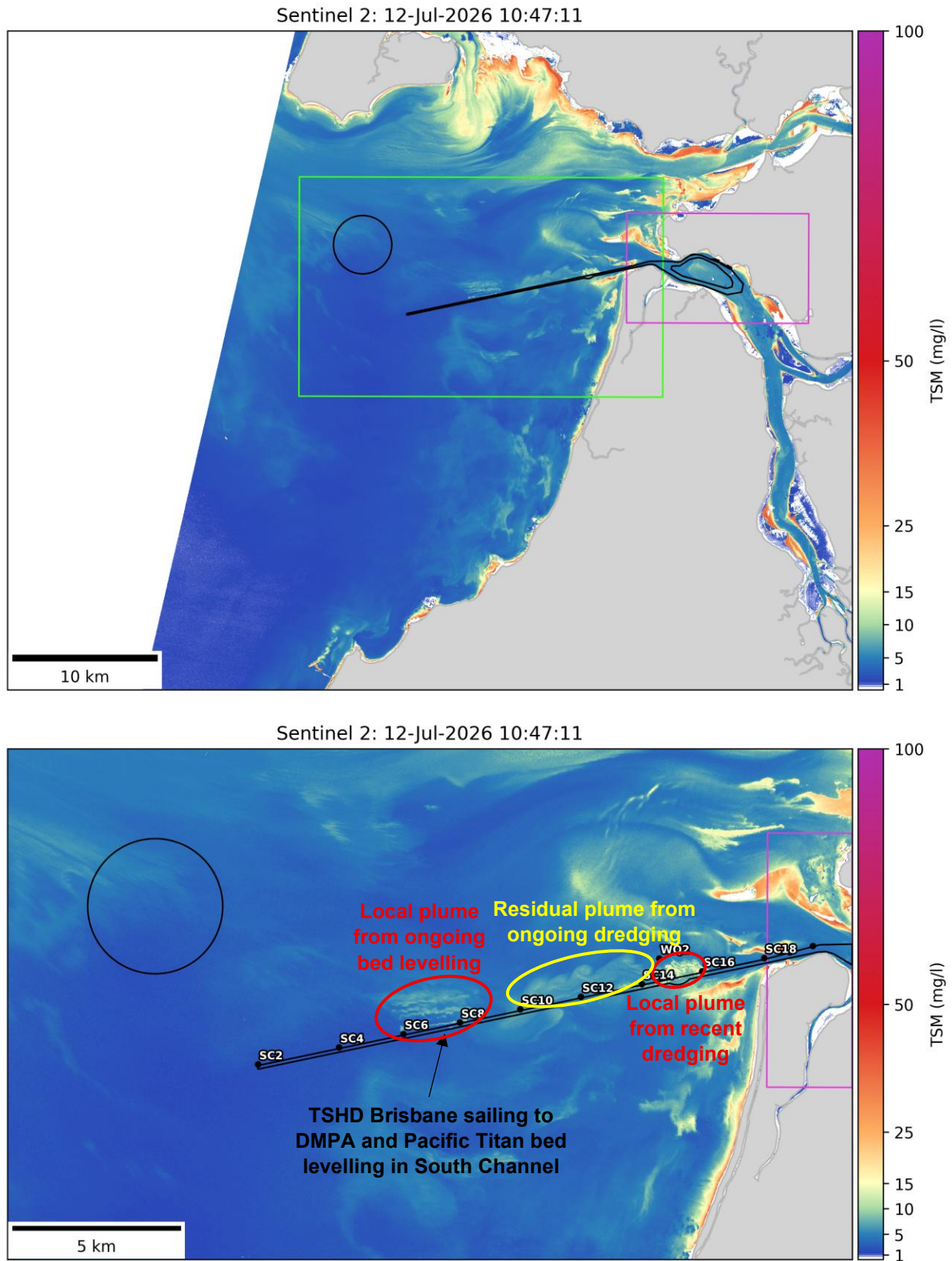


Figure 26. Regional scale (top) and local scale (bottom) satellite-derived TSM from the Sentinel-2 sensor on 12/07/2026 (during dredging).

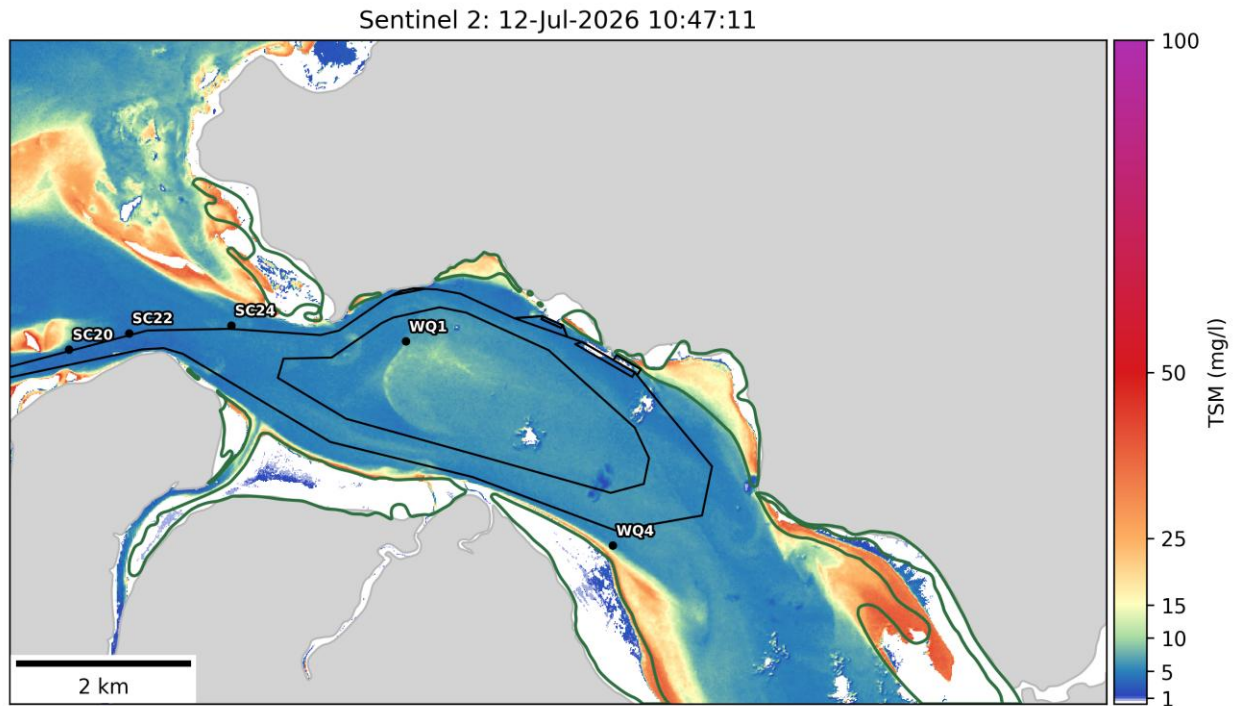
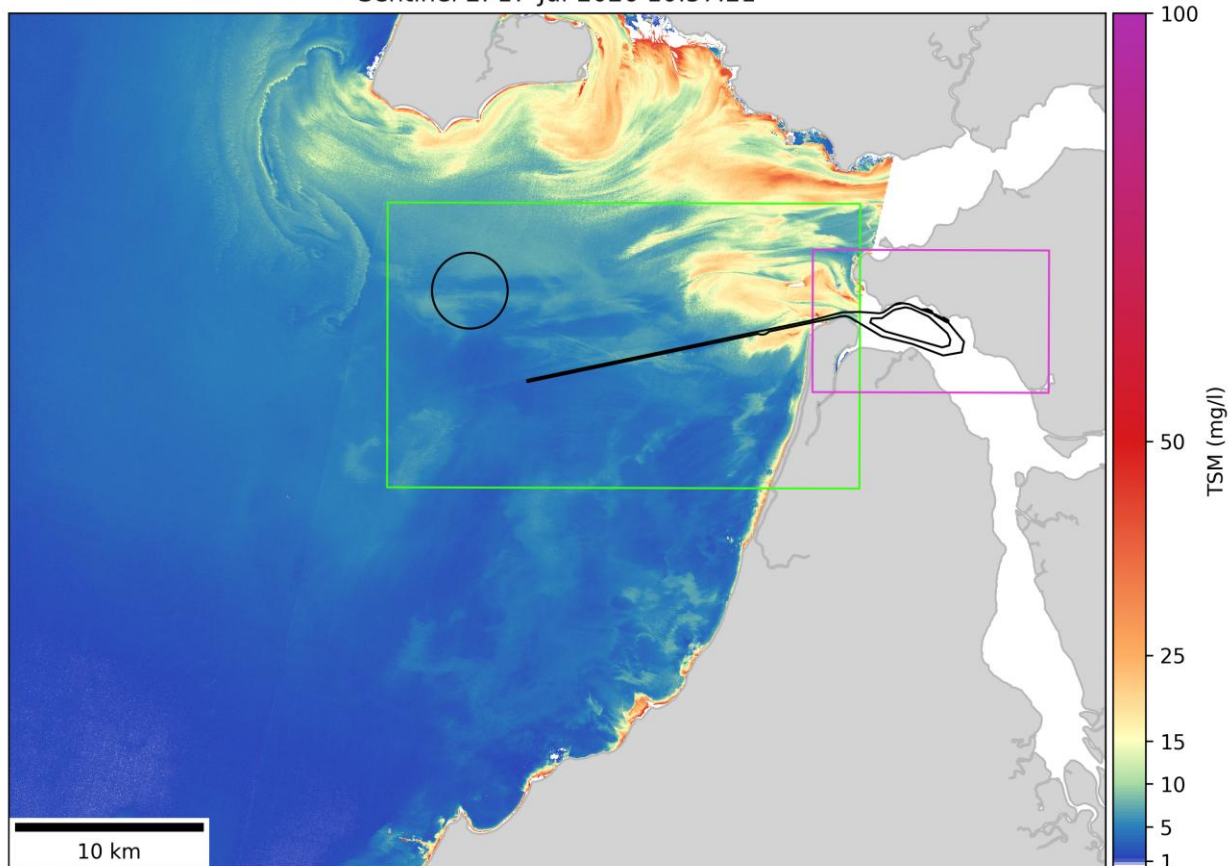


Figure 27. Satellite-derived TSM of the Inner Harbour from the Sentinel-2 sensor on 12/07/2026 (during dredging).
Note: the green outlined regions show area of seagrass and the white areas represent cloud cover and the adjacent low TSM values are due to the cloud shadow.

Sentinel 2: 17-Jul-2026 10:57:21



Sentinel 2: 17-Jul-2026 10:57:21

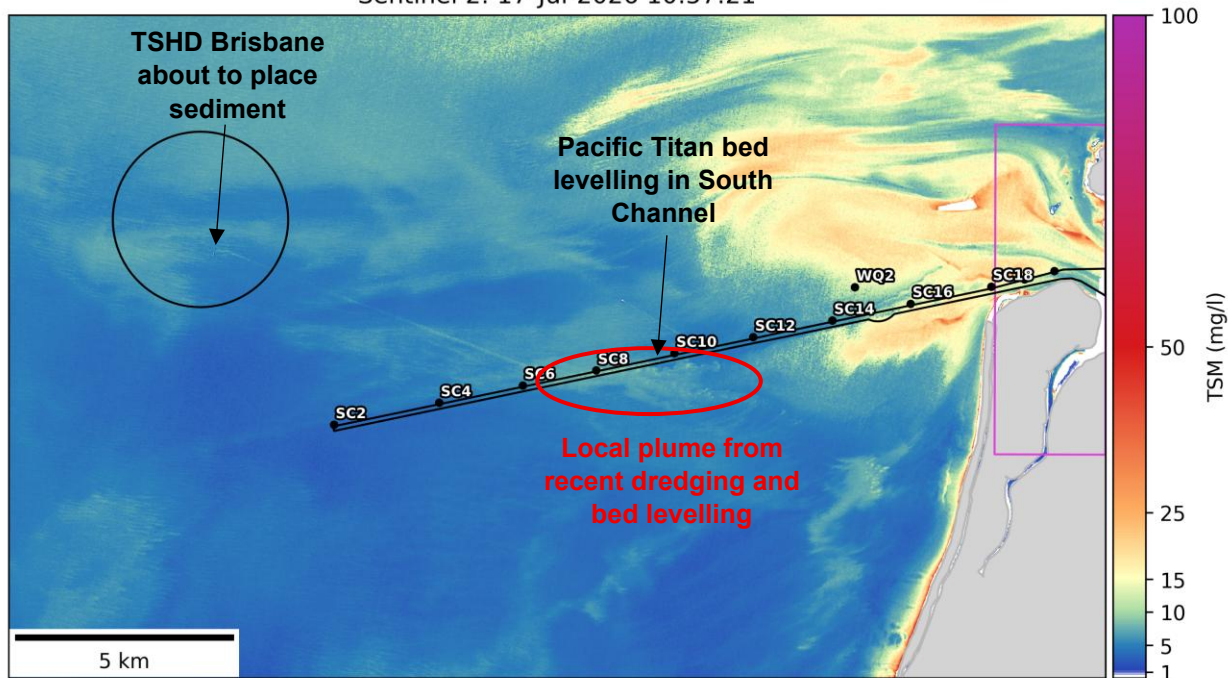


Figure 28. Regional scale (top) and local scale (bottom) satellite-derived TSM from the Sentinel-2 sensor on 17/07/2026 (during dredging).

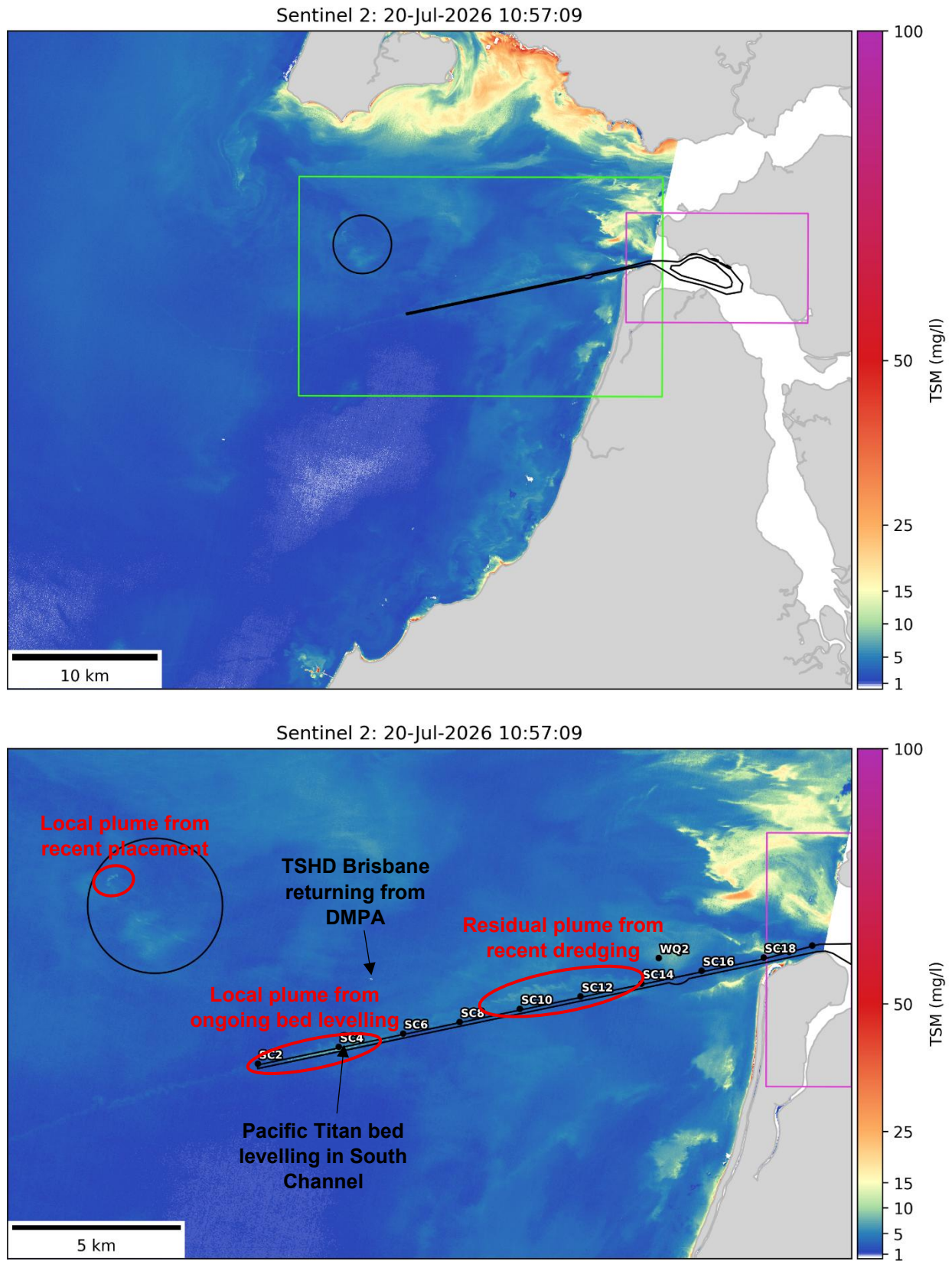


Figure 29. Regional scale (top) and local scale (bottom) satellite-derived TSM from the Sentinel-2 sensor on 20/07/2026 (during dredging).

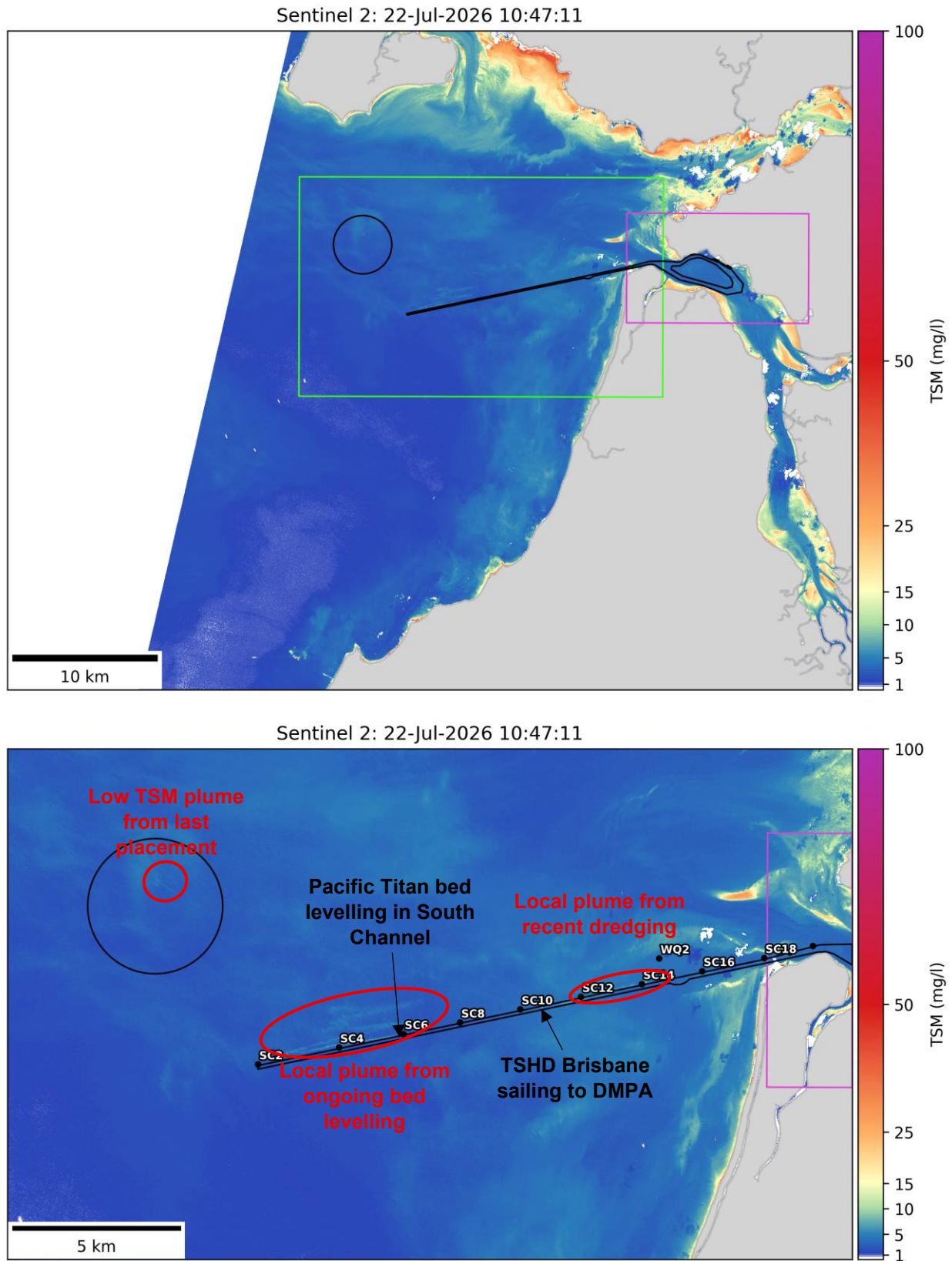


Figure 30. Regional scale (top) and local scale (bottom) satellite-derived TSM from the Sentinel-2 sensor on 22/07/2026 (during dredging).

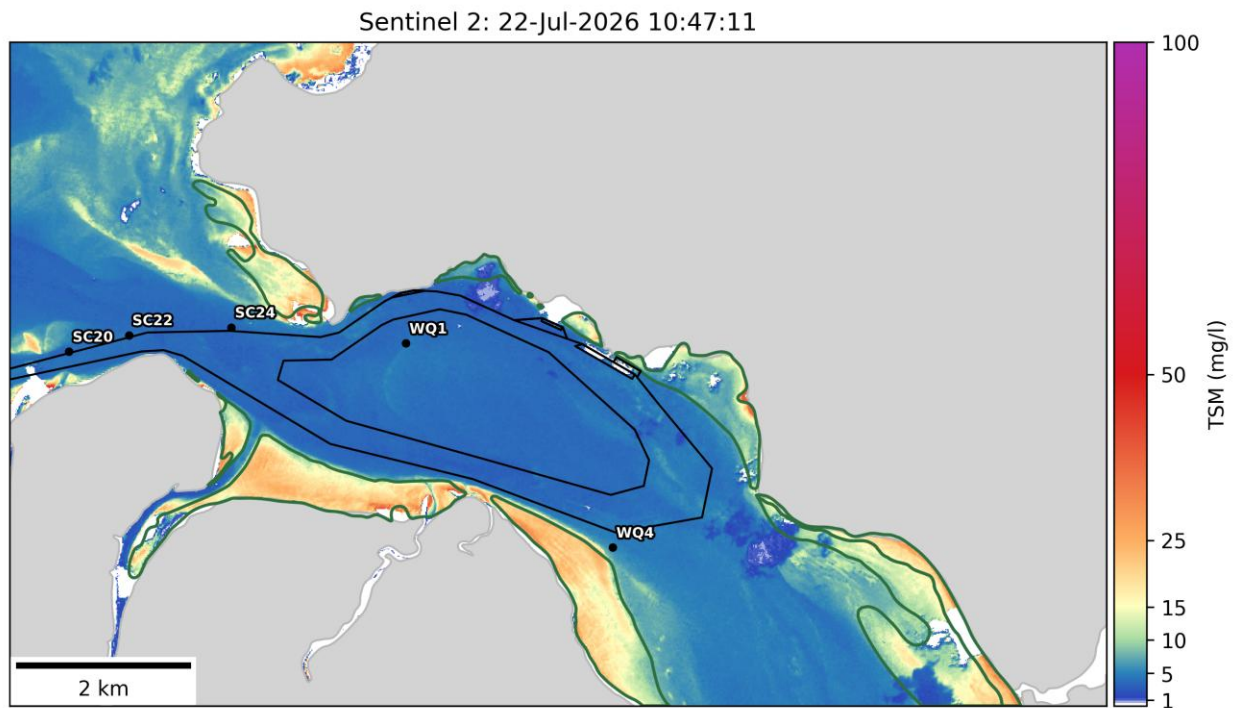


Figure 31. Satellite-derived TSM of the Inner Harbour from the Sentinel-2 sensor on 22/07/2026 (during dredging).
Note: the green outlined regions show area of seagrass.

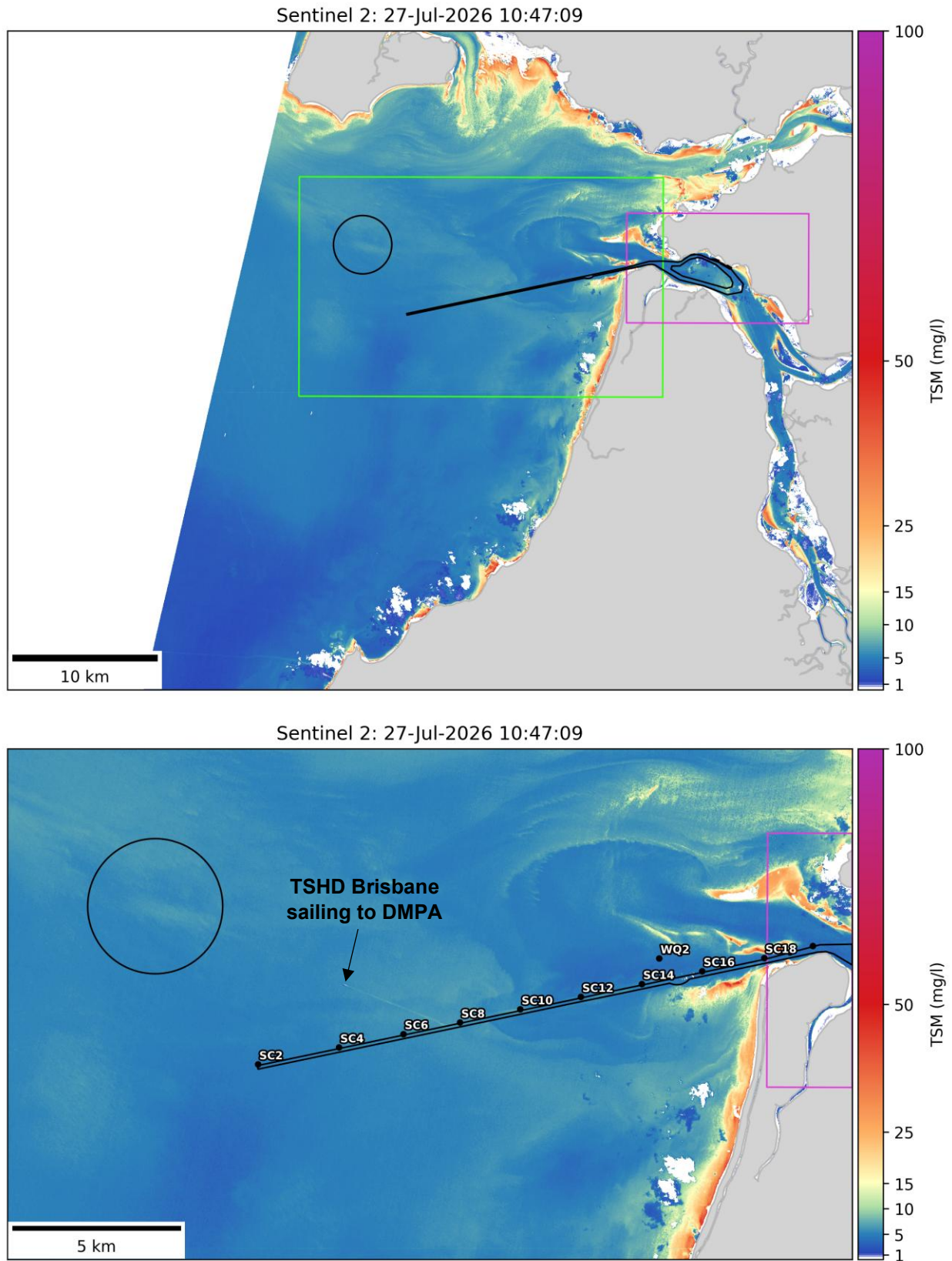


Figure 32. Regional scale (top) and local scale (bottom) satellite-derived TSM from the Sentinel-2 sensor on 27/07/2026 (during dredging). Note: the white areas represent cloud cover and the adjacent low TSM values are due to the cloud shadow.

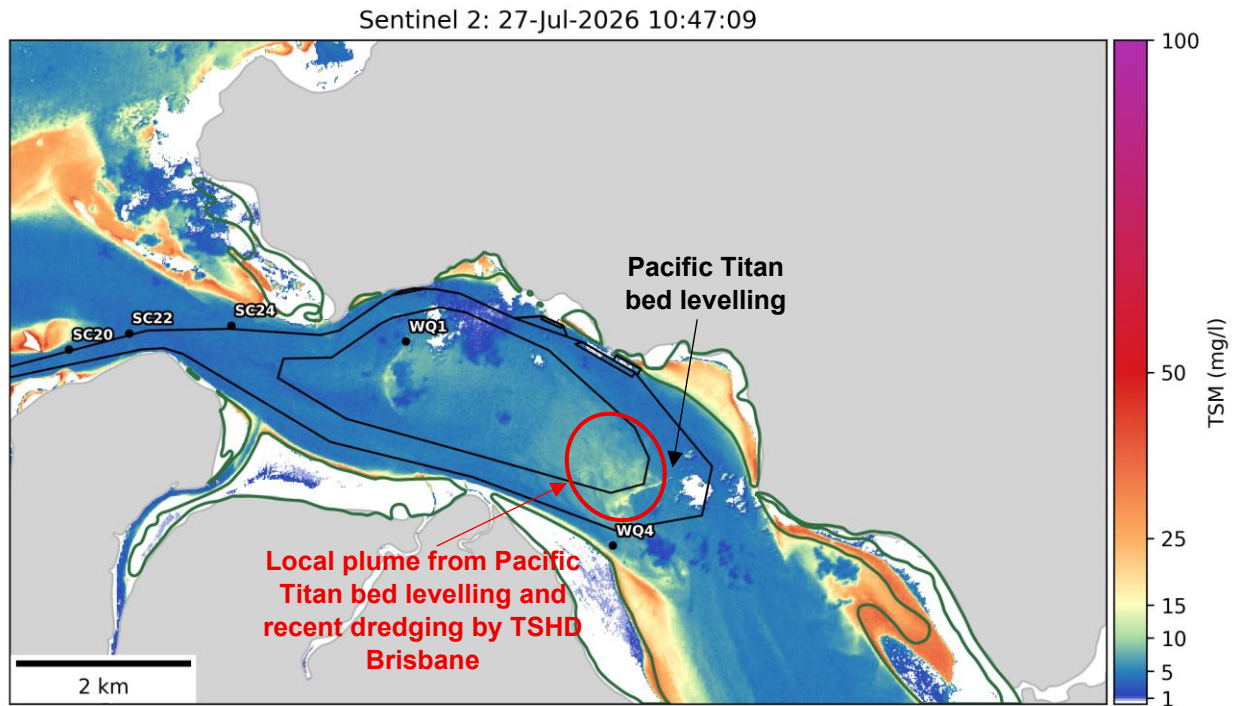


Figure 33. Satellite-derived TSM of the Inner Harbour from the Sentinel-2 sensor on 27/07/2026 (during dredging).
Note: the green outlined regions show area of seagrass and the white areas represent cloud cover and the adjacent low TSM values are due to the cloud shadow.

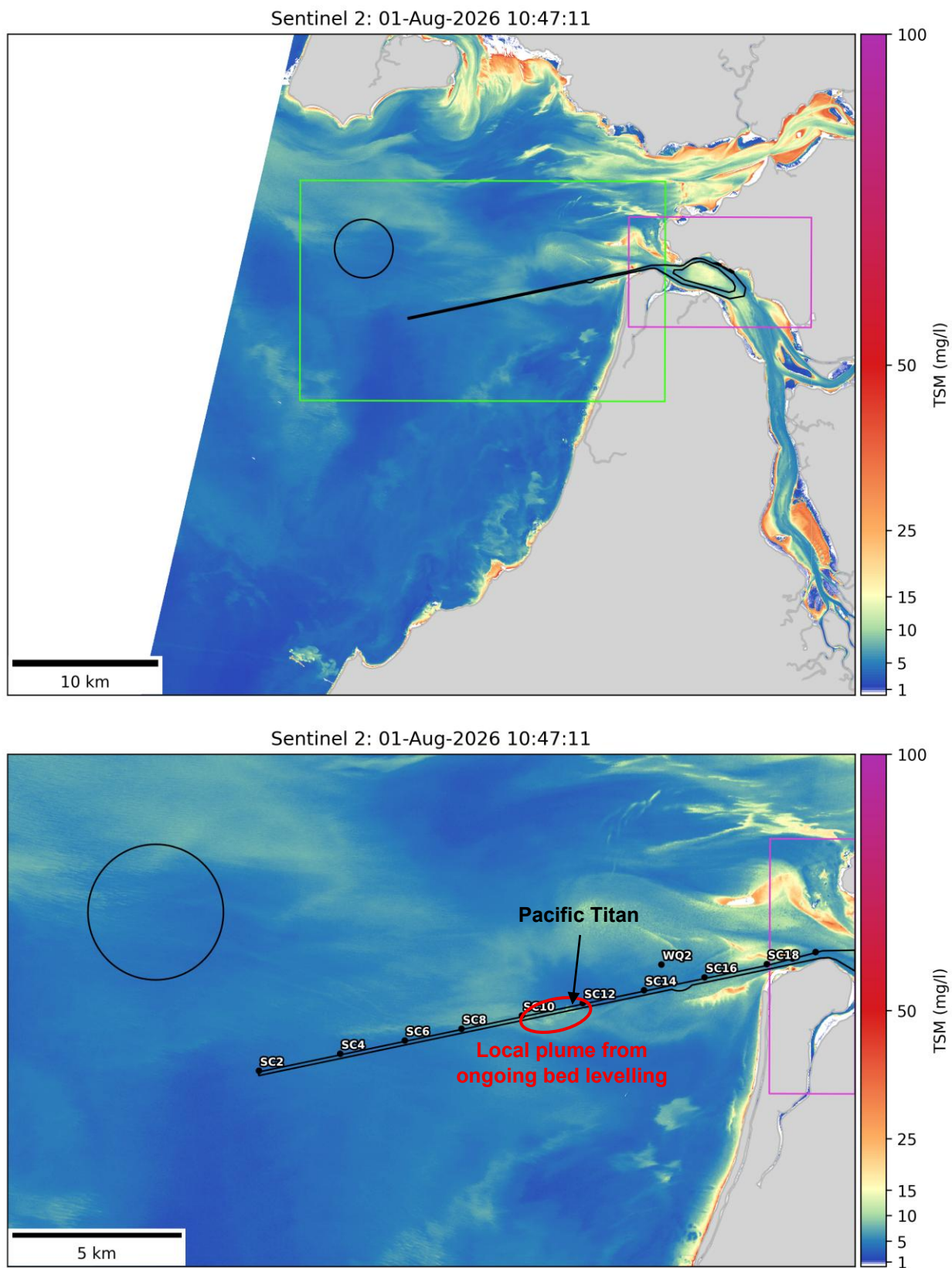


Figure 34. Regional scale (top) and local scale (bottom) satellite-derived TSM from the Sentinel-2 sensor on 01/08/2026 (during dredging).

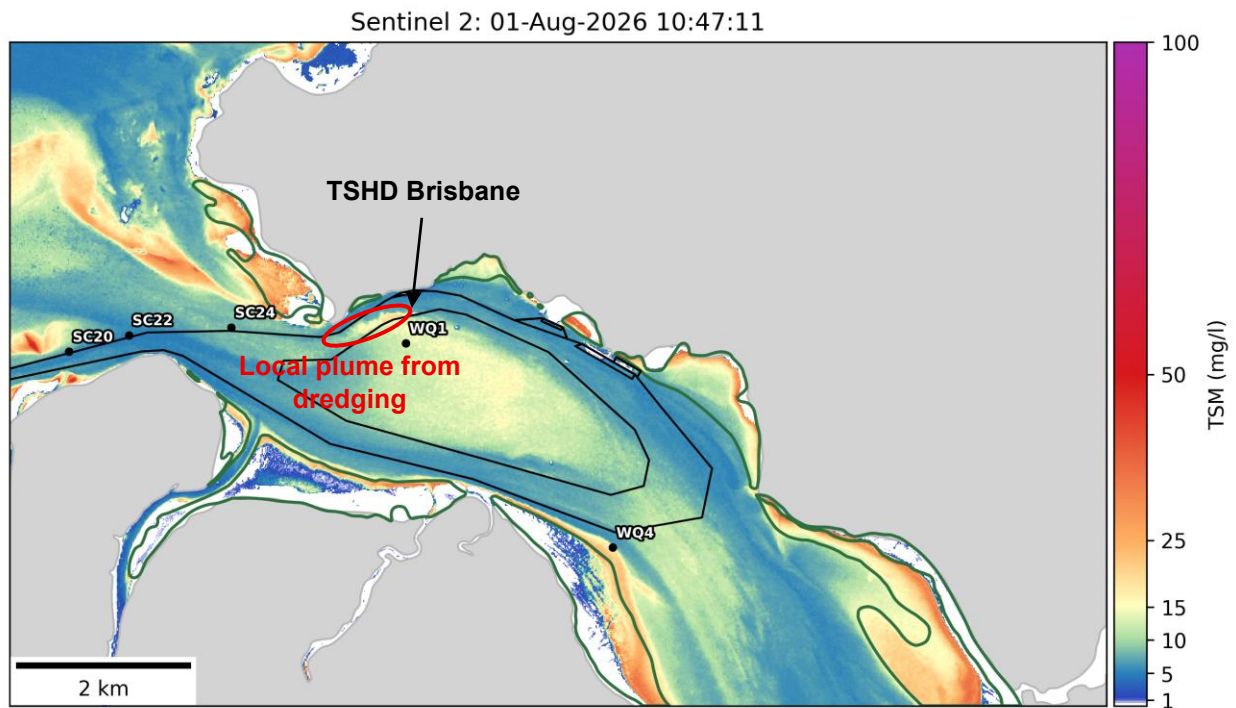


Figure 35. Satellite-derived TSM of the Inner Harbour from the Sentinel-2 sensor on 01/08/2026 (during dredging).

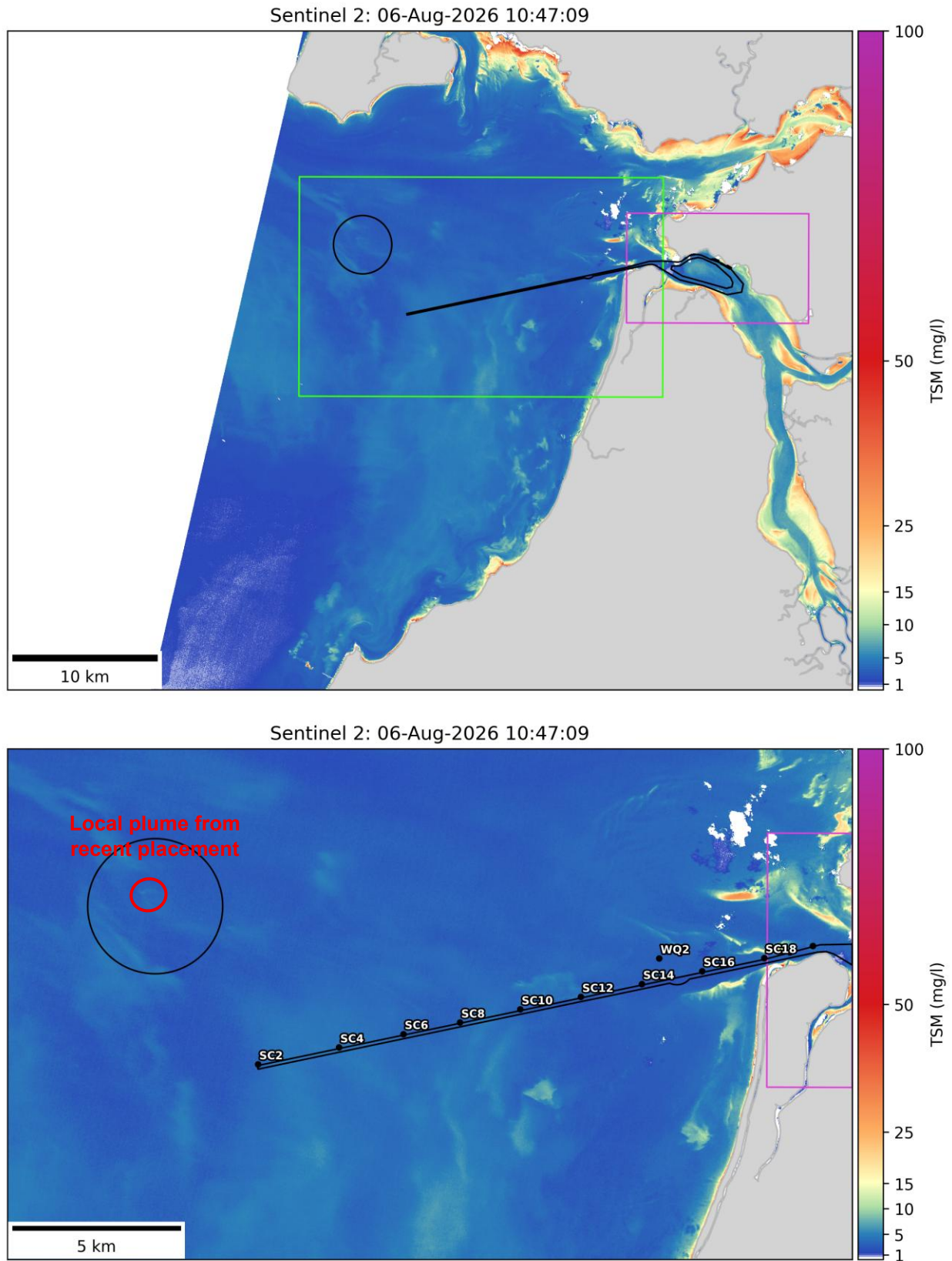


Figure 36. Regional scale (top) and local scale (bottom) satellite-derived TSM from the Sentinel-2 sensor on 06/08/2026 (during dredging). Note: the white areas represent cloud cover and the adjacent low TSM values are due to the cloud shadow.

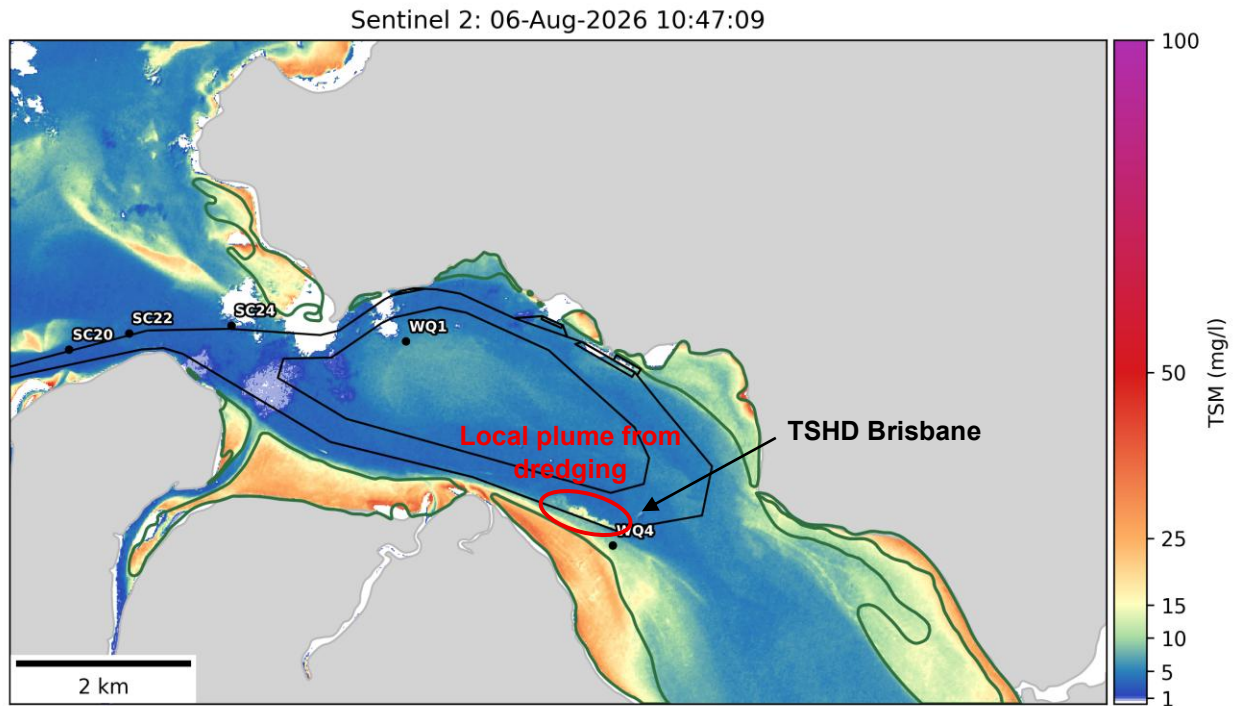


Figure 37. Satellite-derived TSM of the Inner Harbour from the Sentinel-2 sensor on 06/08/2026 (during dredging).
Note: the green outlined regions show area of seagrass and the white areas represent cloud cover and the adjacent low TSM values are due to the cloud shadow.

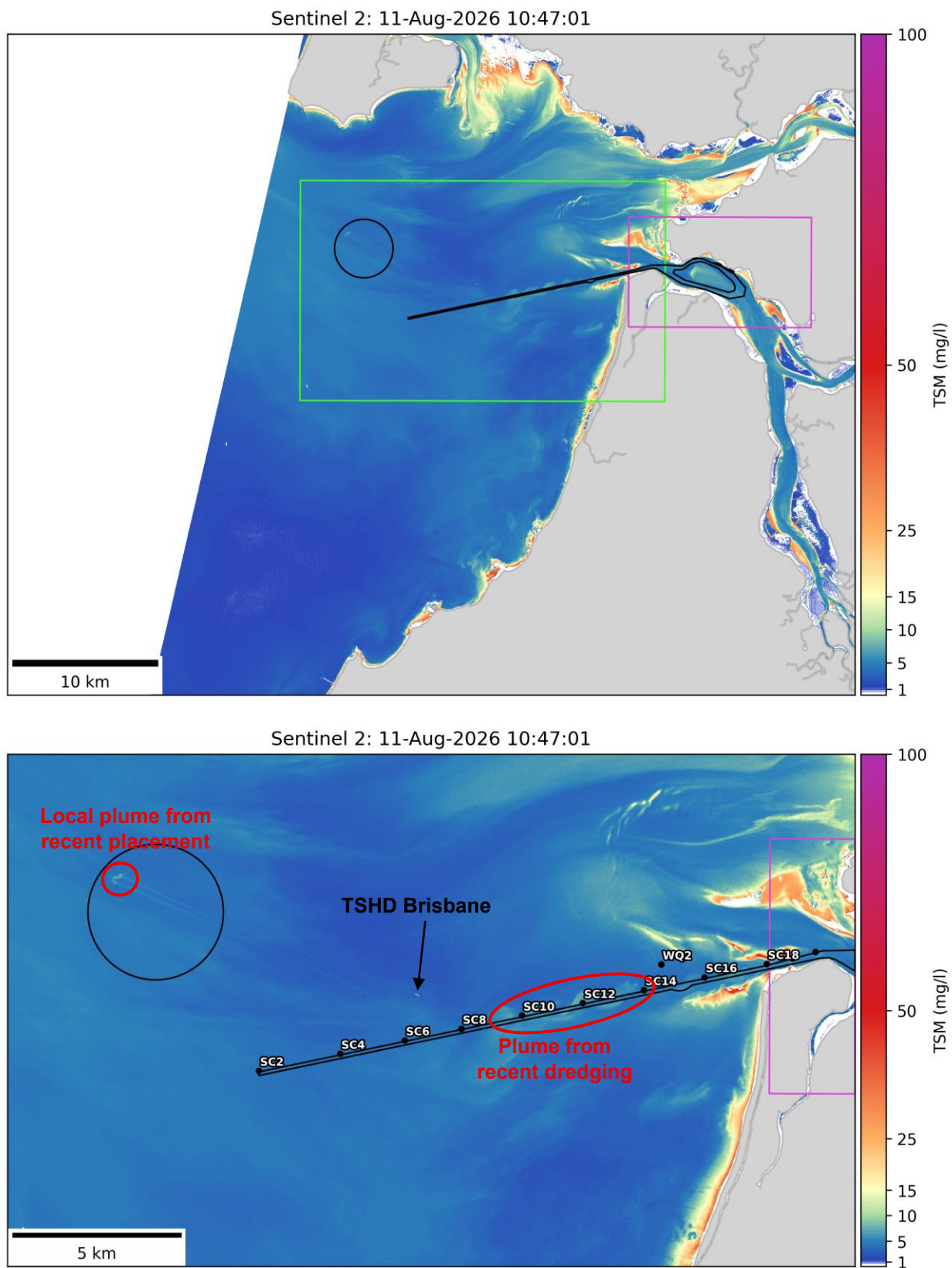


Figure 38. Regional scale (top) and local scale (bottom) satellite-derived TSM from the Sentinel-2 sensor on 11/08/2026 (during dredging).

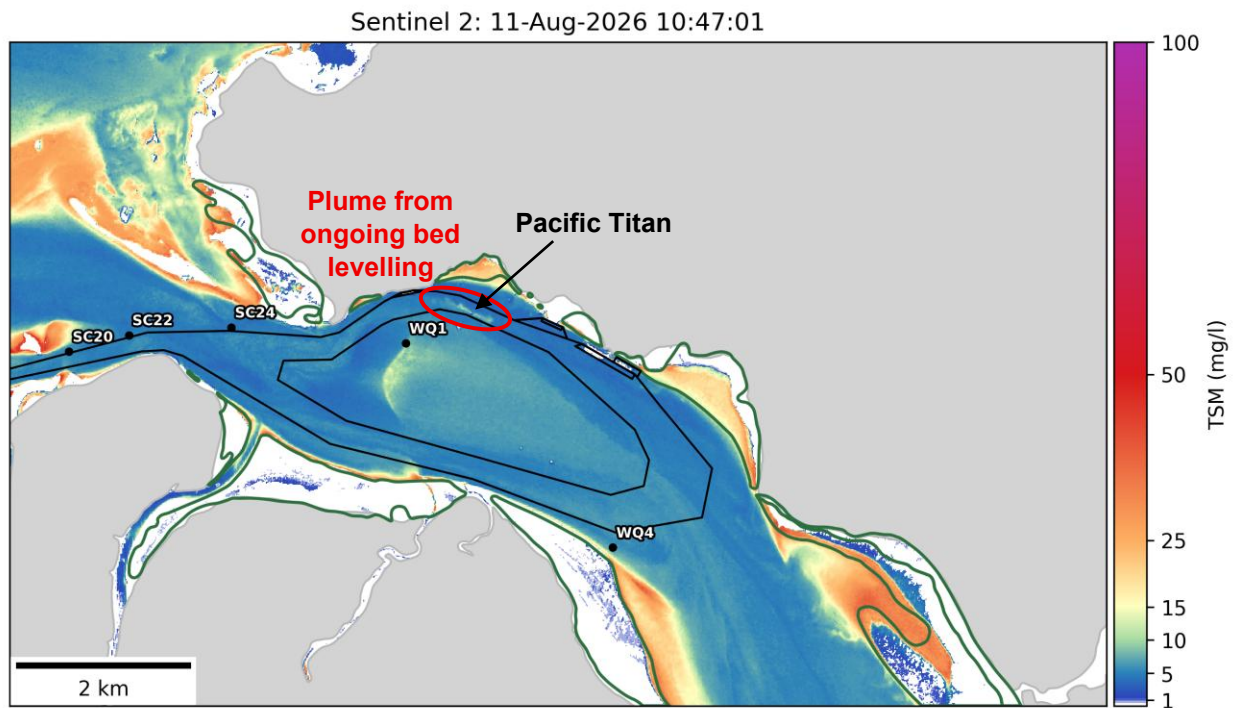


Figure 39. Satellite-derived TSM of the Inner Harbour from the Sentinel-2 sensor on 11/08/2026 (during dredging).
Note: the green outlined regions show area of seagrass.

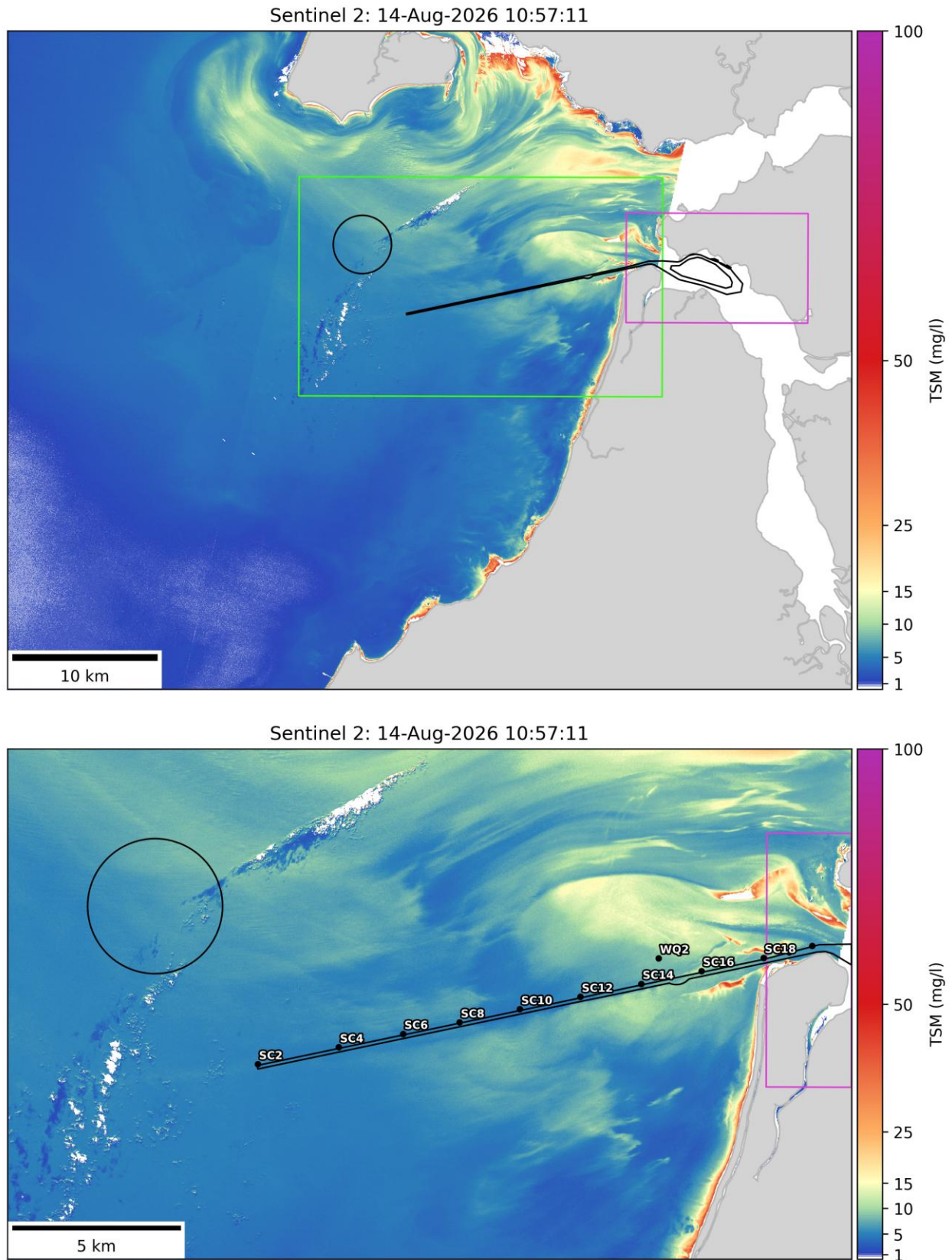


Figure 40. Regional scale (top) and local scale (bottom) satellite-derived TSM from the Sentinel-2 sensor on 14/08/2026 (post-dredging). Note: the white areas represent cloud cover and the adjacent low TSM values are due to the cloud shadow.

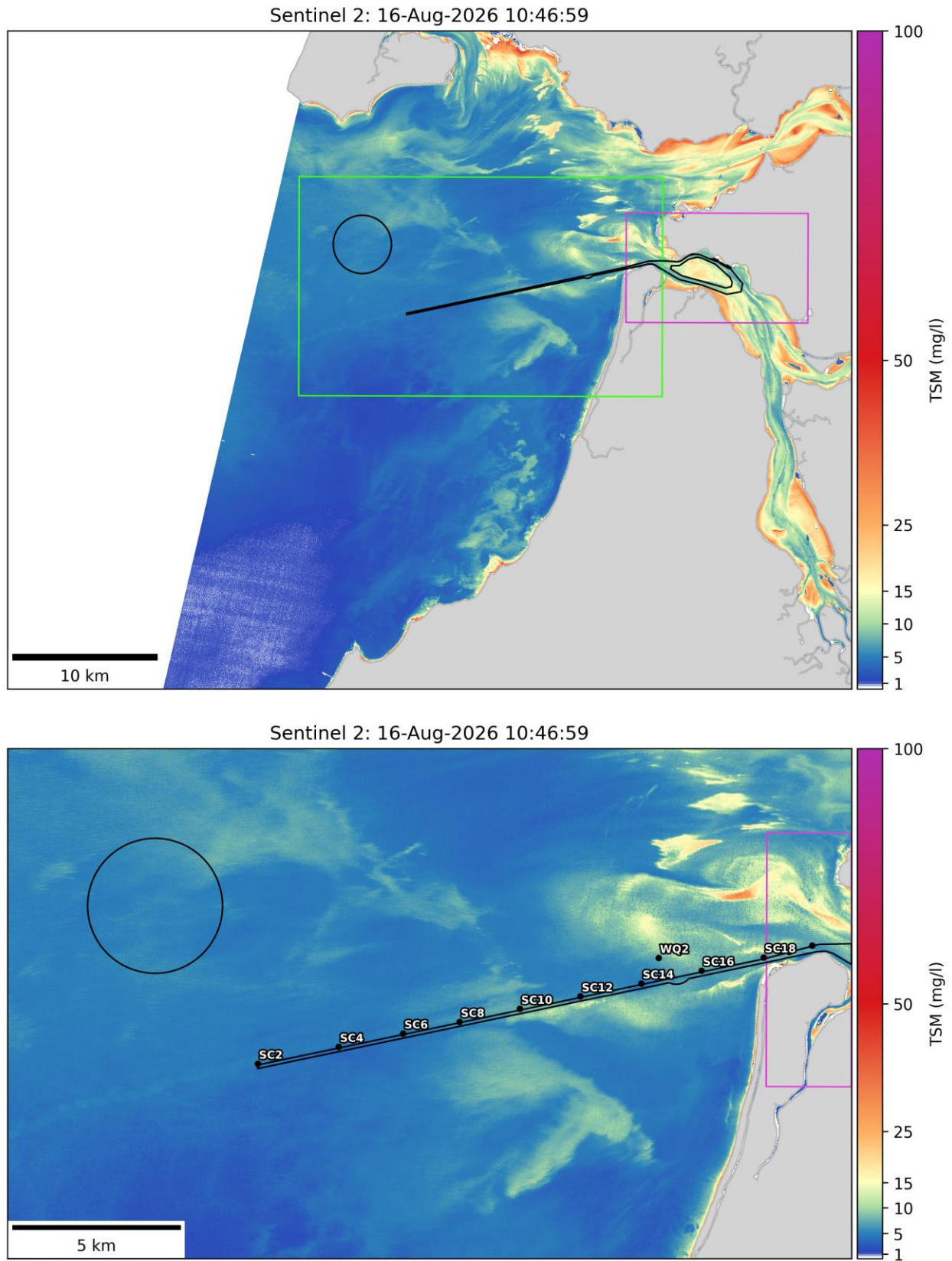


Figure 41. Regional scale (top) and local scale (bottom) satellite-derived TSM from the Sentinel-2 sensor on 16/08/2026 (post-dredging).

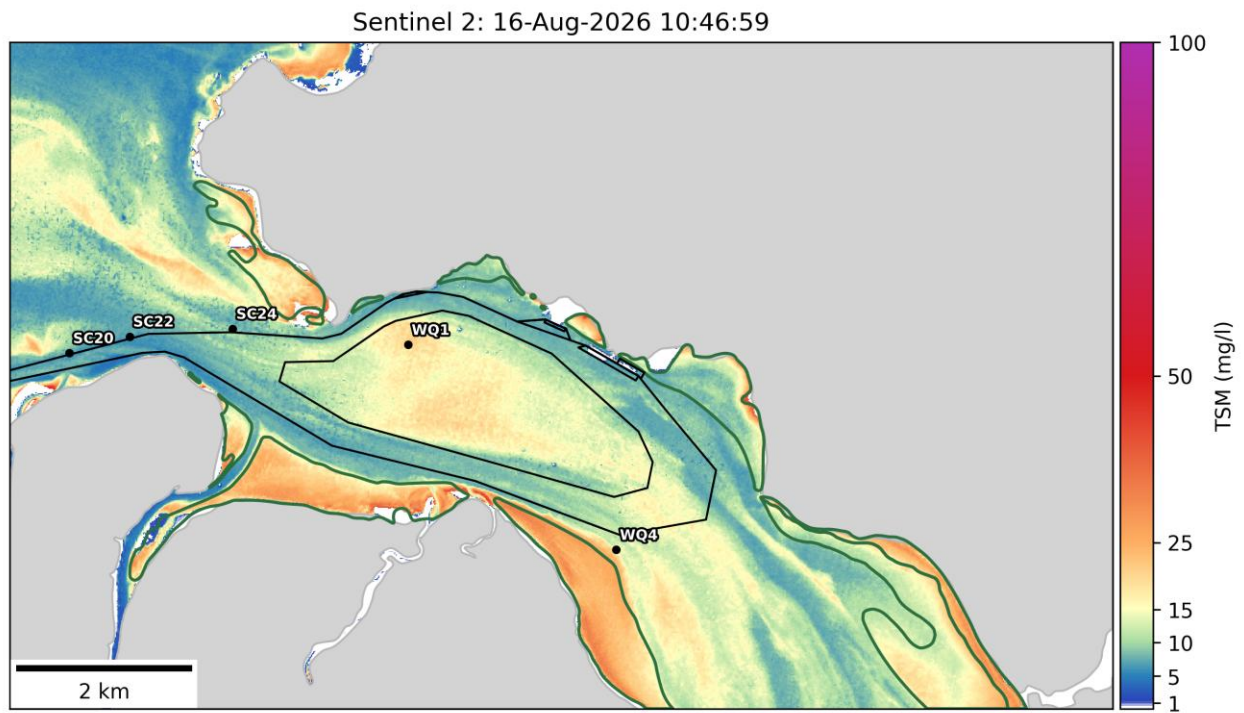


Figure 42. Satellite-derived TSM of the Inner Harbour from the Sentinel-2 sensor on 16/08/2026 (post-dredging).
Note: the green outlined regions show area of seagrass.

4.2.1.2. Dredge Plume Scale

To further analyse the satellite-derived TSM for increases due to the maintenance dredging and bed levelling activities, zoomed in plots of the dredging/bed levelling plumes shown by Sentinel-2 imagery during periods with visible plumes are shown in Figure 43 to Figure 57. The plumes have been found to remain close to where the dredging/bed levelling or placement activity occurred. Further details on the observed plumes are provided below:

- localised plumes were observed in the South Channel in the lee of the TSHD Brisbane due to ongoing dredging activity. The satellite images of these plumes were typically captured either soon after the dredging ceased or towards the end of the dredge cycle and showed plumes of up to 20 mg/l (approximately 15 NTU) which extended 3 km in length and 200 m in width and were either within or close to the South Channel;
- localised plumes were also observed within and adjacent to the South Channel in the lee of the Pacific Titan due to ongoing bed levelling activity. The satellite imagery showed plumes of up to 10 mg/l (approximately 7 NTU) which extended up to 4 km in length and 80 m in width;
- low concentration residual plumes of 5 to 10 mg/l (approximately 4 to 7 NTU) were observed within and adjacent to the South Channel following repeat dredge activity or ongoing bed levelling in this area. Natural advection and dispersion of the plumes resulted in them being transported beyond the boundaries of the South Channel, with the plumes typically being transported to the north of the South Channel. The residual plumes due to ongoing dredging/bed levelling in an area of the South Channel were observed to extend up to 6 km in length and 2 km in width, although they were typically less than 5 km in length and 1.5 km in width;
- localised plumes of up to 10 mg/l were observed extending between SC20 and SC24 (up to 1.4 km in length) due to dredging and bed levelling adjacent to Urquhart Point and Jackson Bank. The plumes were predominantly constrained within the channel; and
- small, localised plumes of up to 20 mg/l (approximately 14 NTU) which extended up to 1 km in length and 150 m in width were observed in the Inner Harbour in the lee of the TSHD Brisbane due to ongoing dredging activity. In addition, localised plumes of up to 15 mg/l (approximately 11 NTU) which extended 850 m in length and 50 m in width were also observed in the Inner Harbour due to bed levelling by the Pacific Titan. Both the plumes from dredging and bed levelling in the Inner Harbour were predominantly within the dredge footprint and did not extend into any recorded seagrass beds.

The plots show how the maintenance dredging activity can result in a localised plume in the area where the dredging was undertaken with a concentration of up to 20 mg/l during dredging. Plots of residual plumes from the maintenance dredging show how more than an hour after the dredging activity finished the plume concentration has reduced to less than 10 mg/l but with the plume extent increasing. The imagery also showed how the residual plumes from multiple dredge loads can combine to create a plume of up to 6 km in length, but with the majority of this larger plume being a low TSM (< 5 mg/l).

The satellite imagery has shown how the plumes resulting from the bed levelling undertaken by the Pacific Titan are smaller and of a lower TSM compared to the plumes from the TSHD Brisbane. Similar to the plumes from the TSHD Brisbane, the plumes from the bed levelling reduce in TSM over time and can result in low concentration residual plumes when ongoing bed levelling is focussed in one area.

To better understand the increases in TSM at the Albatross Bay DMPA, plots of the plume shown by Sentinel-2 imagery after the TSHD Brisbane had placed sediment are shown in Figure 58 to Figure 63. How the plumes behave with time after placement is summarised below:

- **30 minutes after placement** (Figure 62 and Figure 63): soon after placement plumes of up to 10 mg/l with lengths of 400 m and widths of 150 m are clearly visible in the DMPA. The plume is typically a half arc in shape as the dredger turns during placement to ensure the sediment is placed where intended and the hopper is completely emptied. In one of the images there is no residual plume present from the previous placement (which was 3 hours prior), while in the other image when the placement occurred 5 hours prior there is a small residual plume of up to 5 mg/l. This variability indicates that the duration that residual plumes remain is related to the metocean conditions (large spring tides coincided with the plume which was still visible after 5 hours);
- **1 hour to 1 hour 15 minutes after placement** (Figure 58 and Figure 59): approximately 1 hour after placement plumes of up to 8 mg/l with lengths of up to 500 m and widths of approximately 300 m remain visible in the DMPA. There are no obvious residual plumes present in the DMPA from previous loads (there is a large natural plume with a TSM of around 5 mg/l on the 22nd June 2026), with the previous placements having been more than 3 hours prior to the images being captured; and
- **2 hours after placement** (Figure 61): approximately 2 hours after placement there can still be a low concentration circular plume with a 300 m diameter of up to 5 mg/l (natural background TSM in DMPA was 3-4 mg/l) present in the DMPA.

The imagery therefore has shown that the plumes resulting from the placement of dredged sediment within the DMPA typically quickly settle out following placement, while the extent of the plume has the potential to increase due to the advection and dispersion of the plume. Typically, the plumes from placements more than 3 hours before the satellite image was captured were no longer clearly distinguishable from the natural background TSM in the region. However, plumes were found to still be visible up to 5 hours after placement during large spring tides, with the increased tidal current speeds potentially limiting the settling of the suspended sediment.

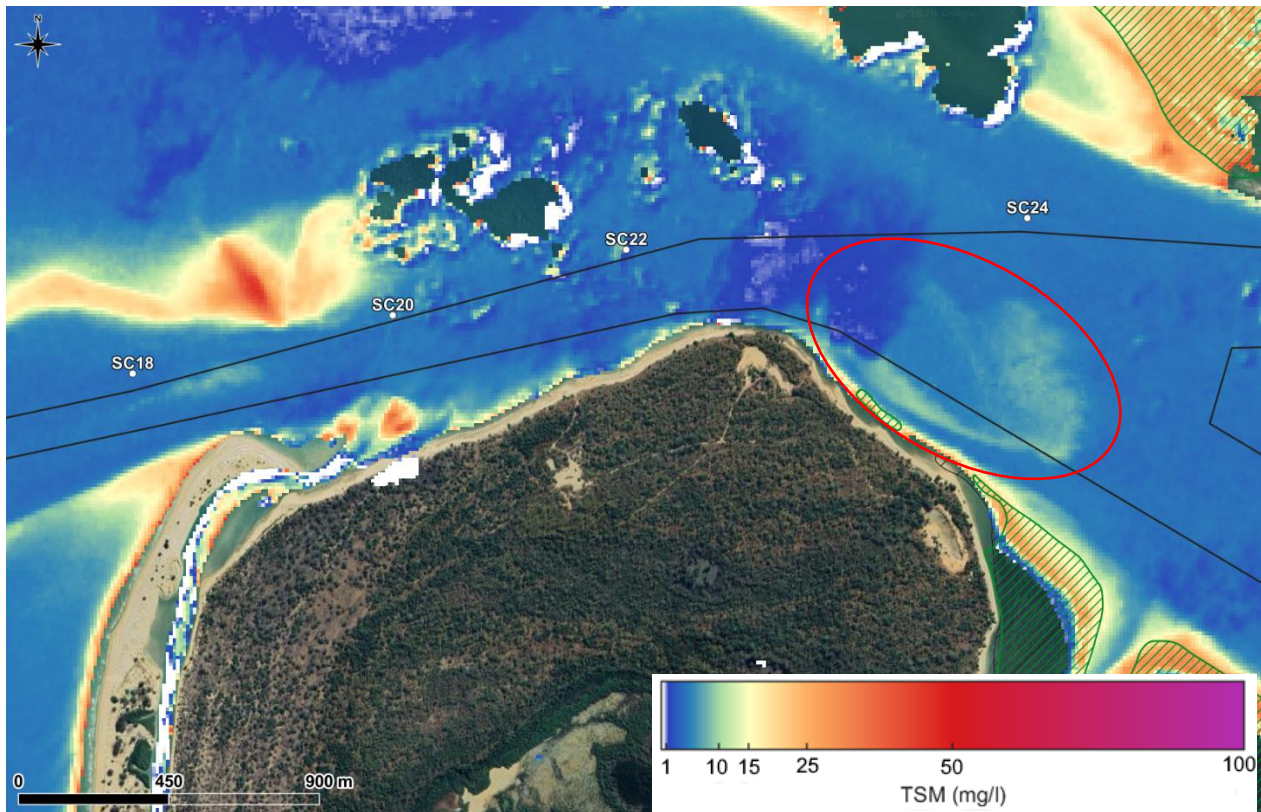


Figure 43. Satellite-derived TSM around Urquhart Point and Jackson Bank on 12/06/2026. The red ellipse shows a plume from recent dredging by the TSHD Brisbane.

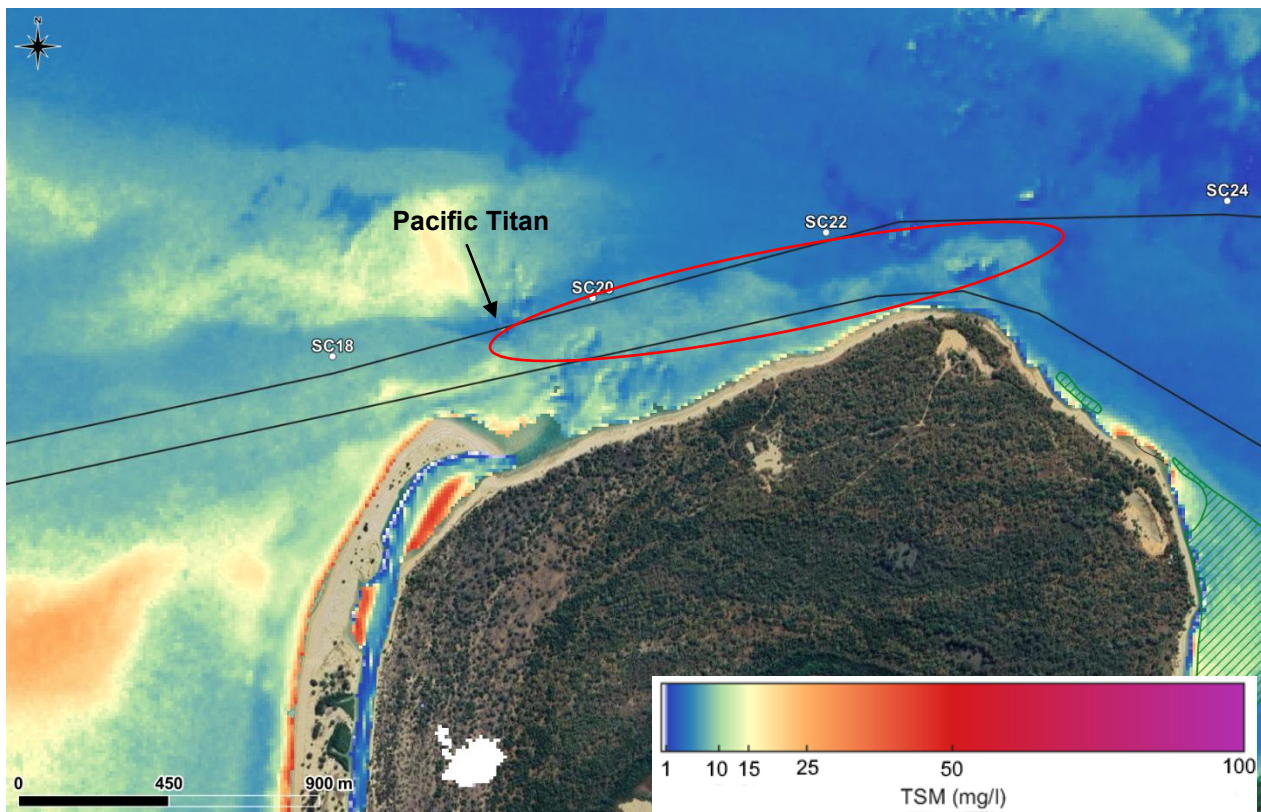


Figure 44. Satellite-derived TSM around Urquhart Point and Jackson Bank on 22/06/2026. The red ellipse shows the plume from the bed levelling.

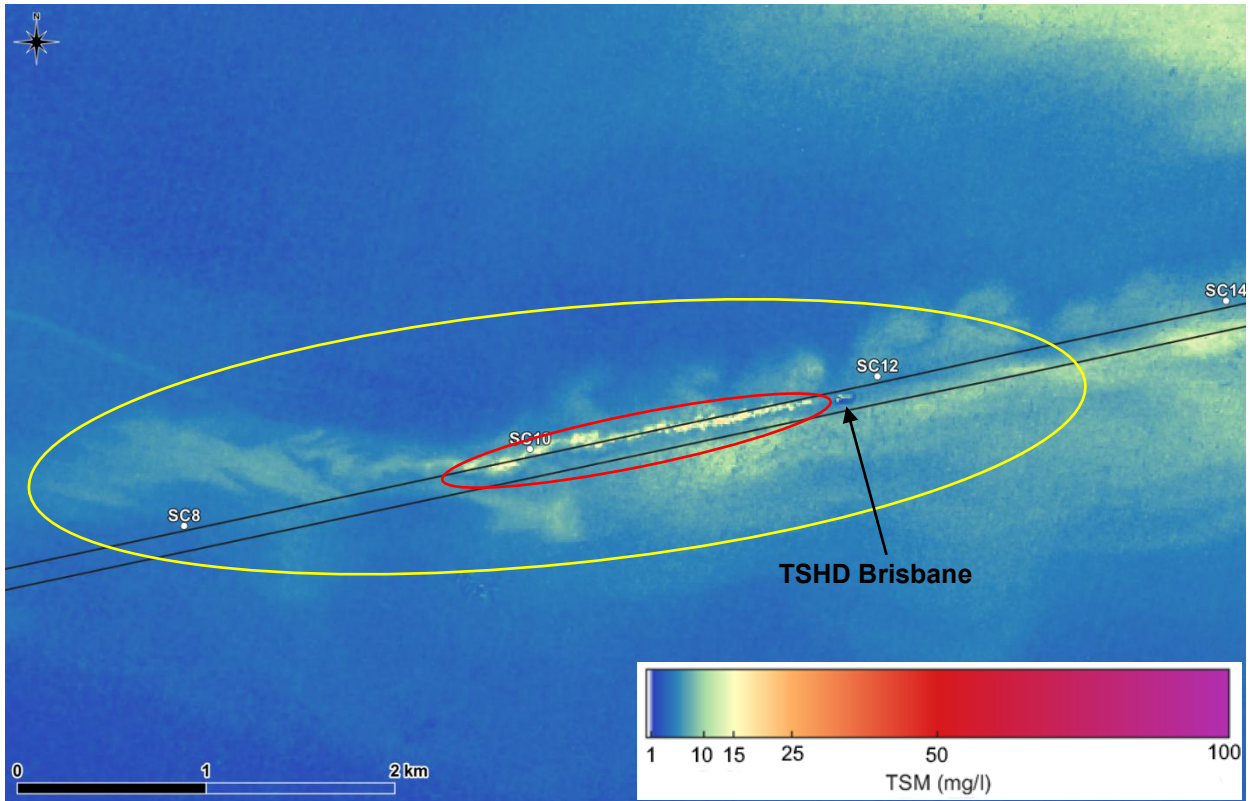


Figure 45. Satellite-derived TSM of South Channel on 14/06/2026. The red ellipse shows a local plume from maintenance dredging and the yellow ellipse a residual plume from previous dredging.

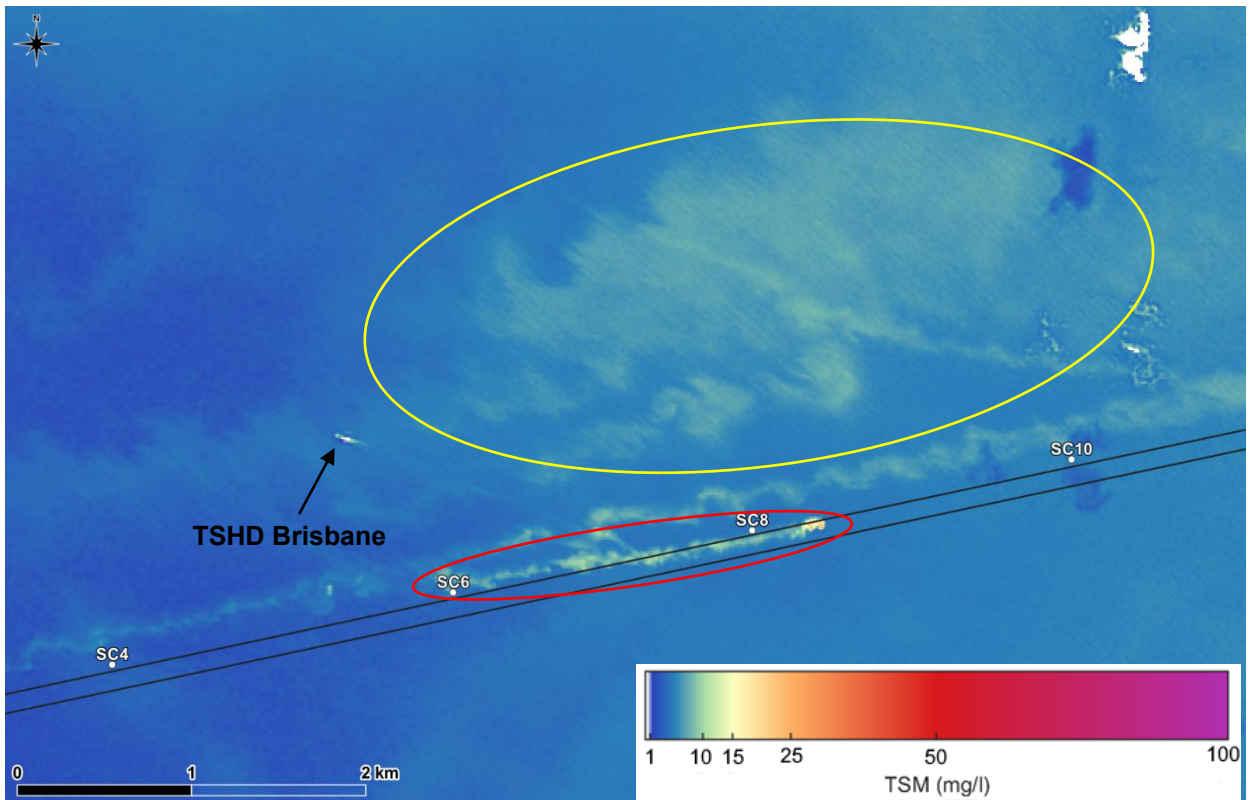


Figure 46. Satellite-derived TSM of South Channel on 22/06/2026. The red ellipse shows a local plume from recent maintenance dredging and the yellow ellipse a residual plume from previous dredging.

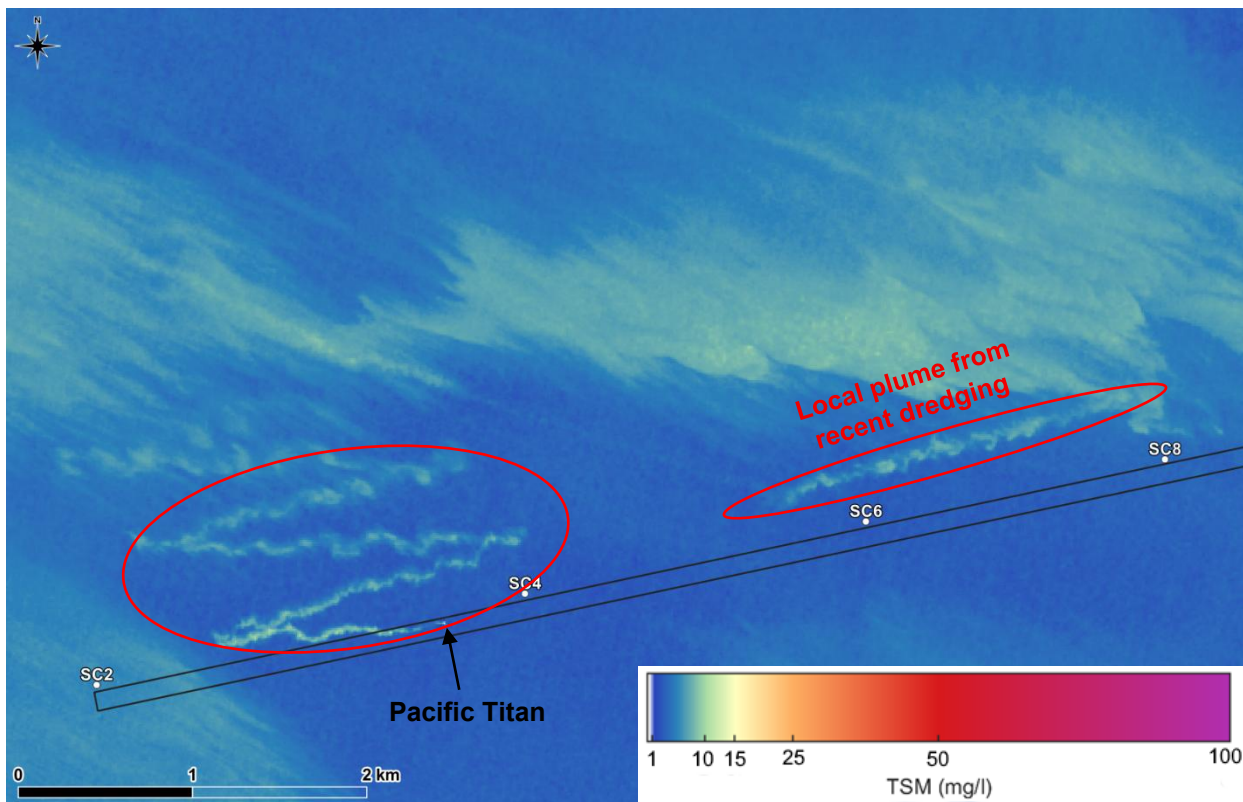


Figure 47. Satellite-derived TSM of South Channel on 27/06/2026. The red ellipses show local plumes from ongoing bed levelling and recent maintenance dredging.

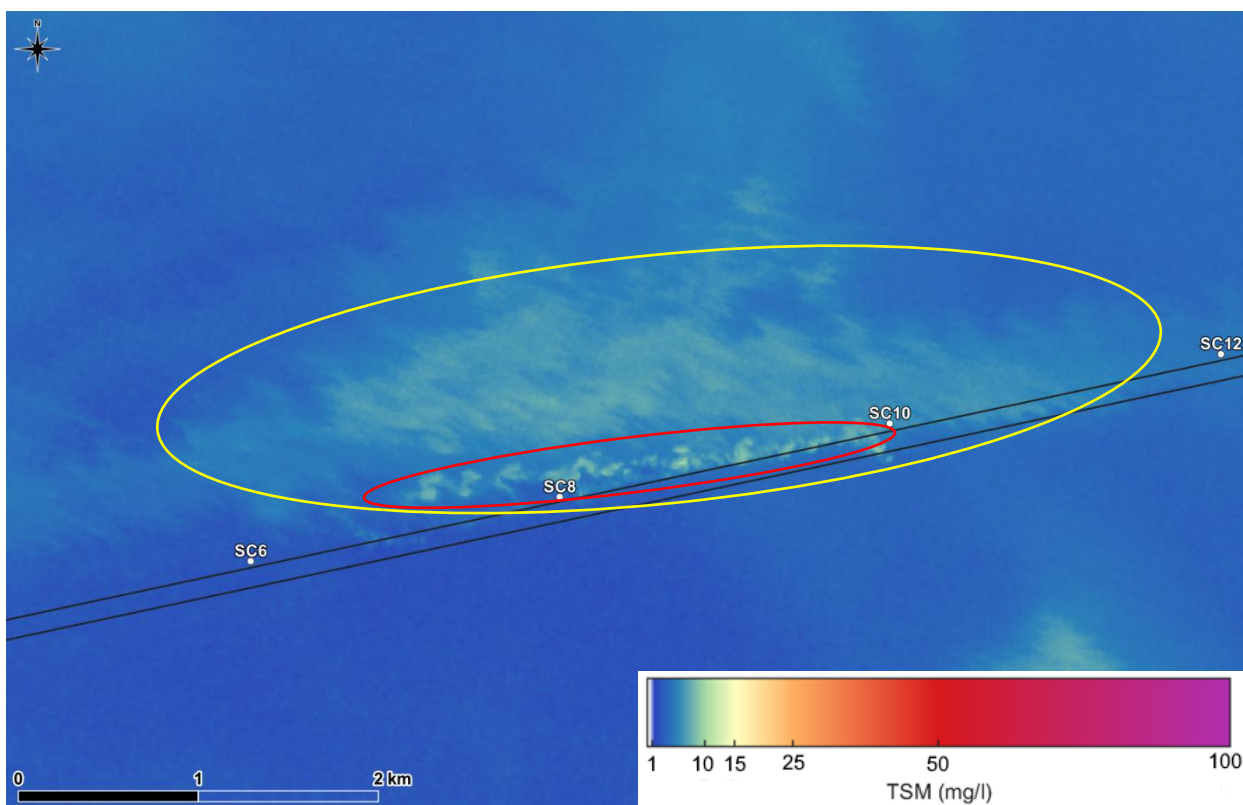


Figure 48. Satellite-derived TSM of South Channel on 05/07/2026. The red ellipse shows a local plume from recent maintenance dredging and the yellow ellipse a residual plume from previous dredging.

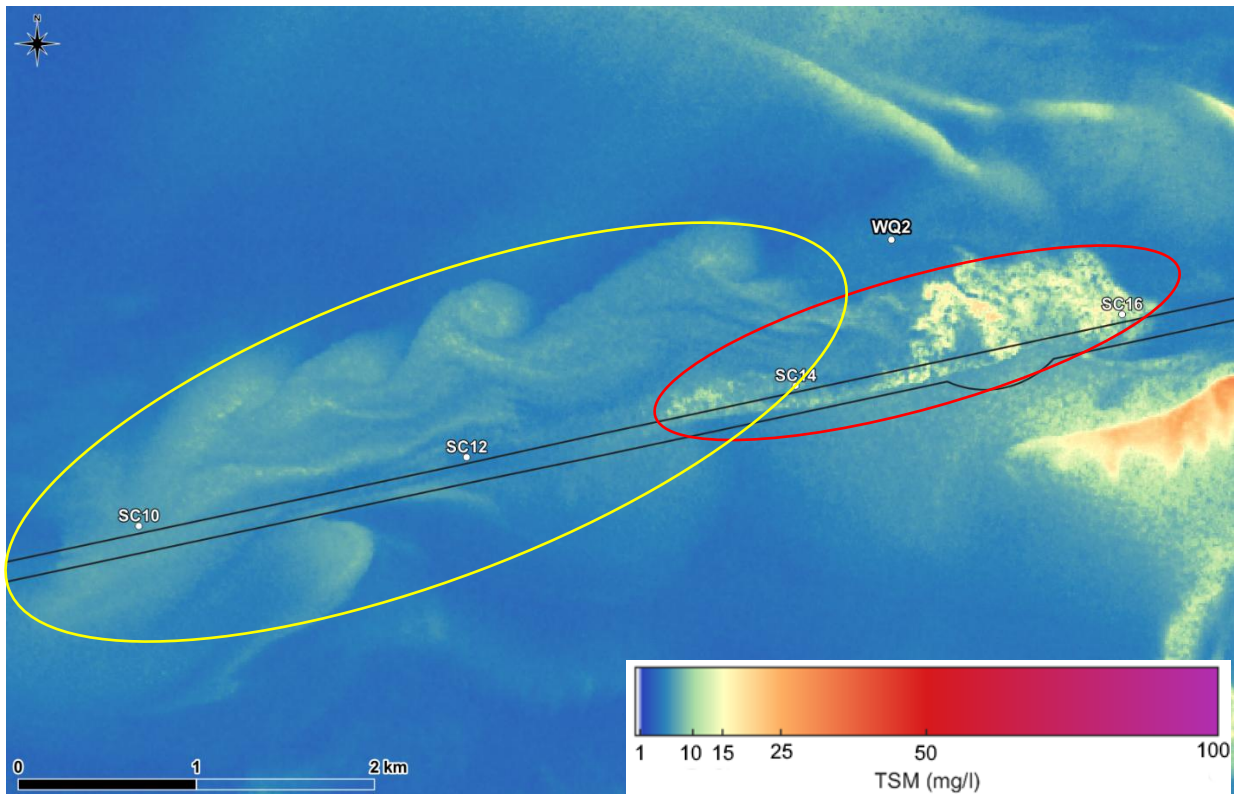


Figure 49. Satellite-derived TSM of South Channel on 12/07/2026. The red ellipse shows a local plume from recent maintenance dredging (15 mins before image was captured) and the yellow ellipse a residual plume from previous dredging (3 hours earlier).

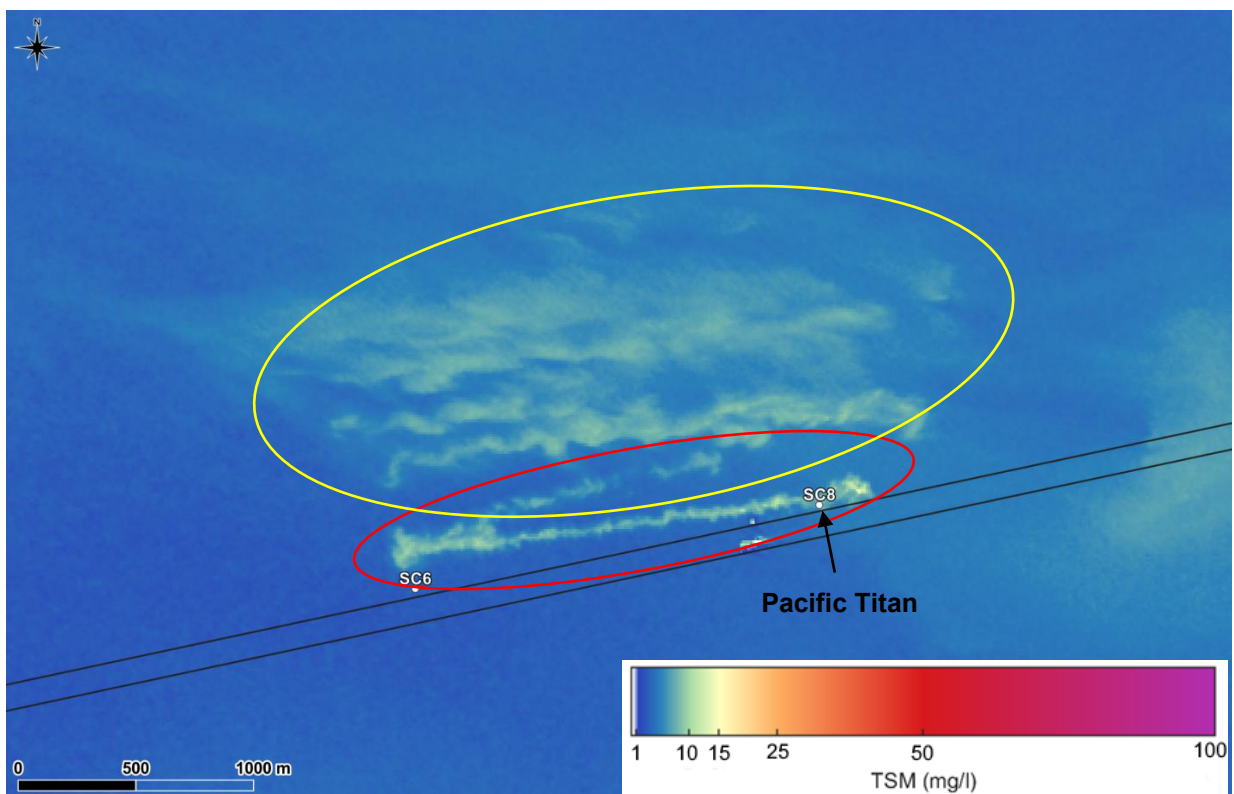


Figure 50. Satellite-derived TSM of South Channel on 12/07/2026. The red ellipse shows a local plume from recent bed levelling and the yellow ellipse a residual plume from ongoing bed levelling.

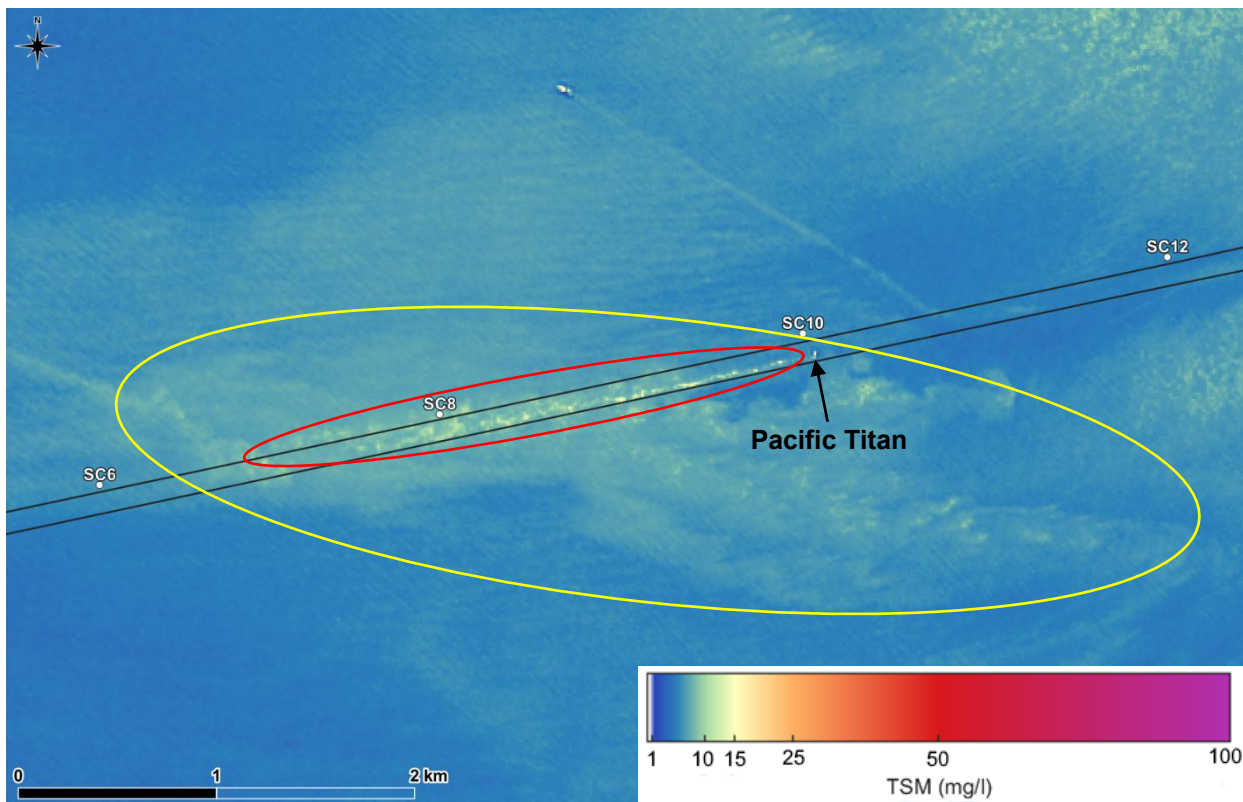


Figure 51. Satellite-derived TSM of South Channel on 17/07/2026. The red ellipse shows a local plume from recent bed levelling and the yellow ellipse a residual plume from bed levelling and dredging.

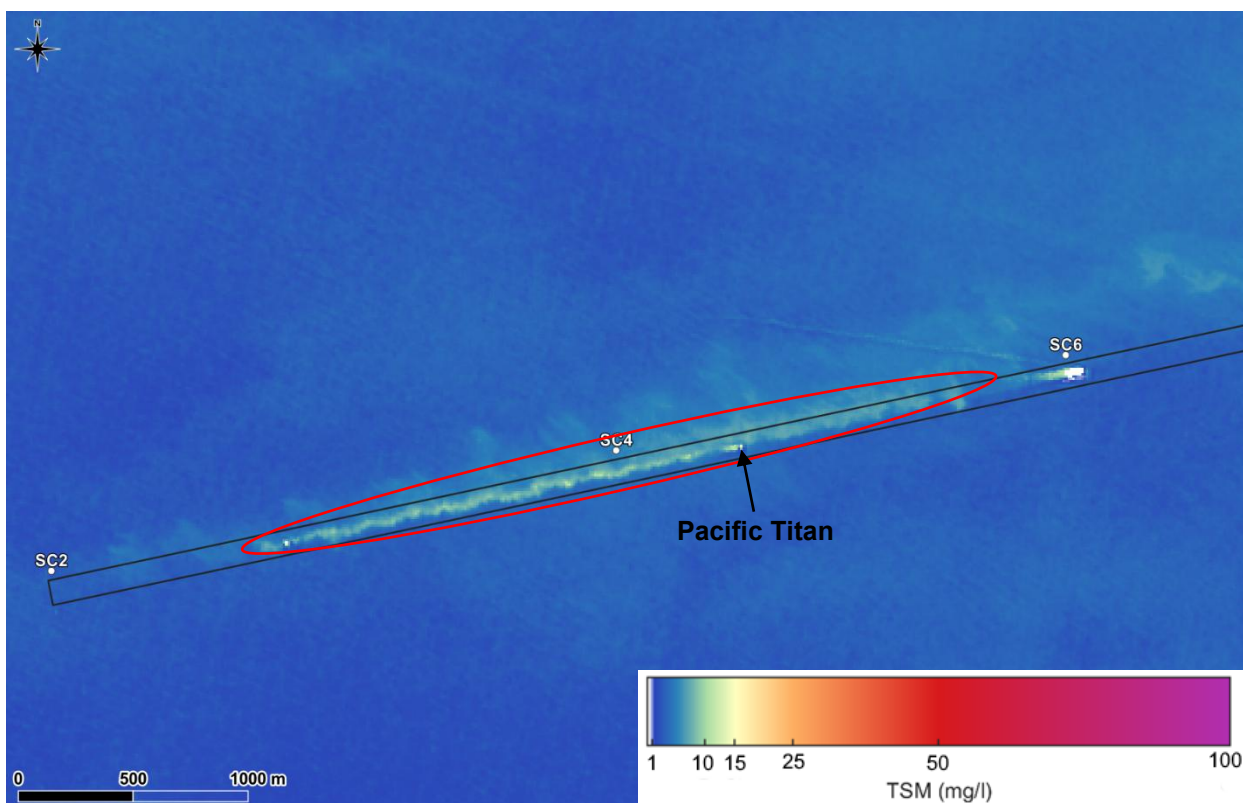


Figure 52. Satellite-derived TSM of South Channel on 20/07/2026. The red ellipse shows a local plume from recent bed levelling.

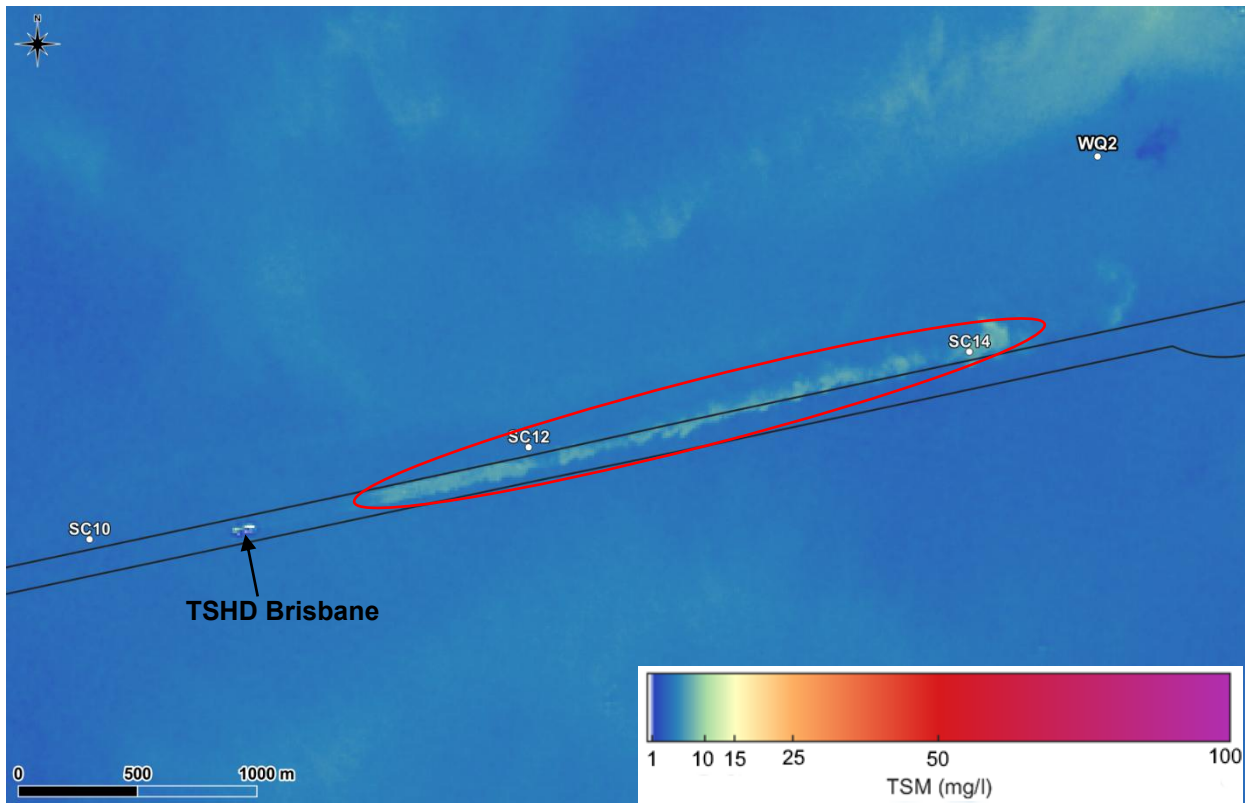


Figure 53. Satellite-derived TSM of South Channel on 22/07/2026. The red ellipse shows a local plume from recent dredging.

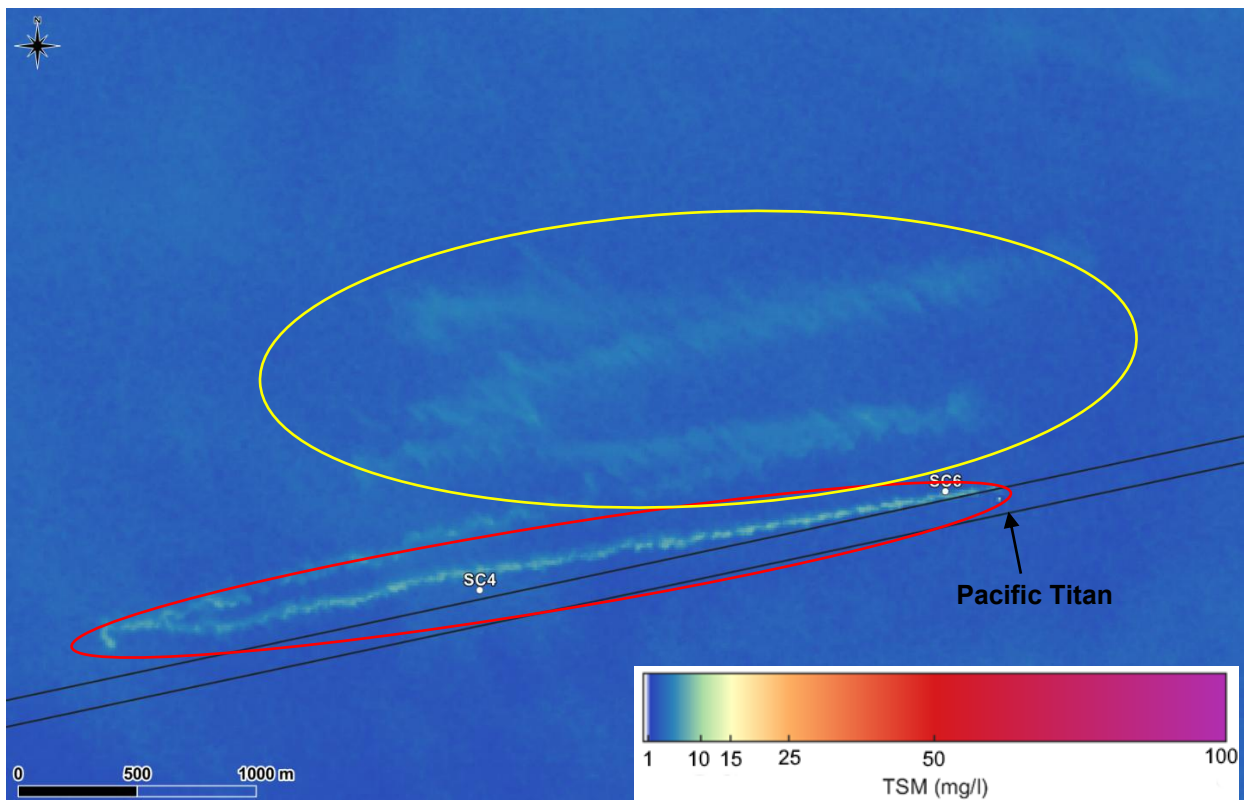


Figure 54. Satellite-derived TSM of South Channel on 22/07/2026. The red ellipse shows a local plume from recent bed levelling and the yellow ellipse a residual plume from bed levelling.

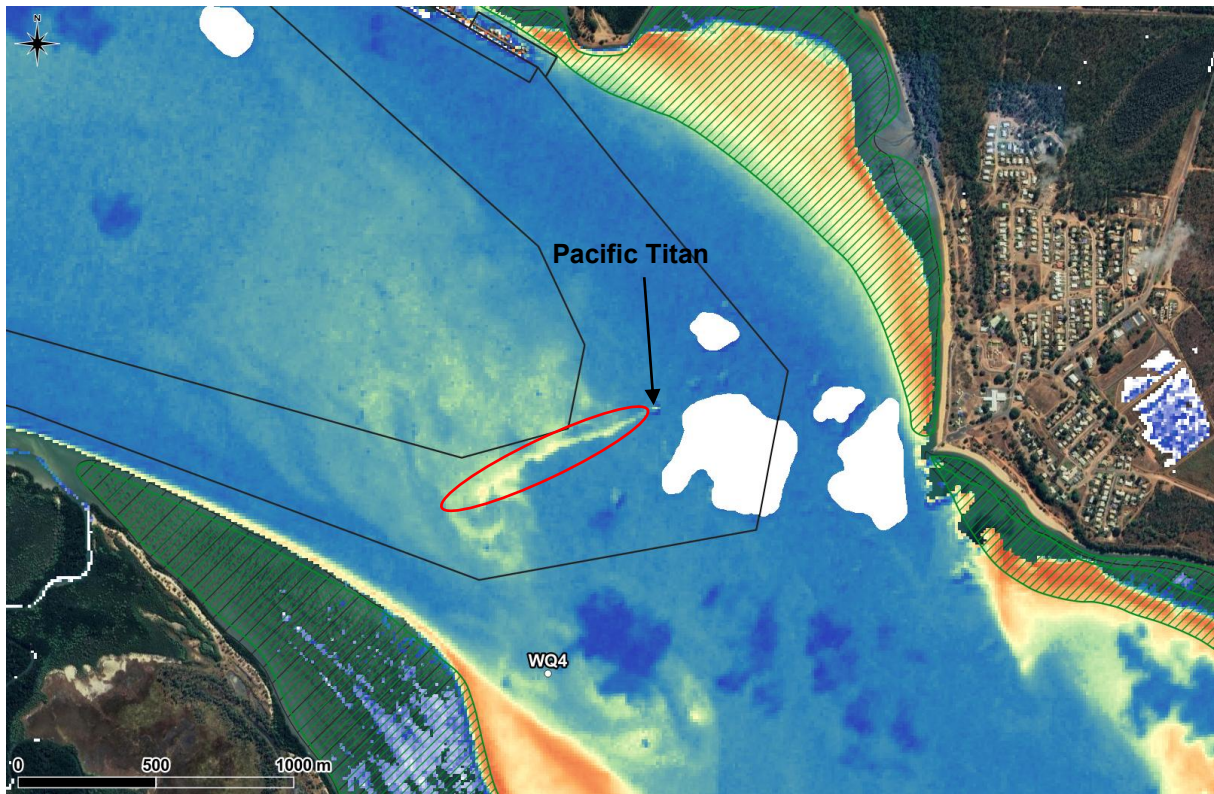


Figure 55. Satellite-derived TSM of Inner Harbour on 27/07/2026. The red ellipse shows a local plume from recent bed levelling.

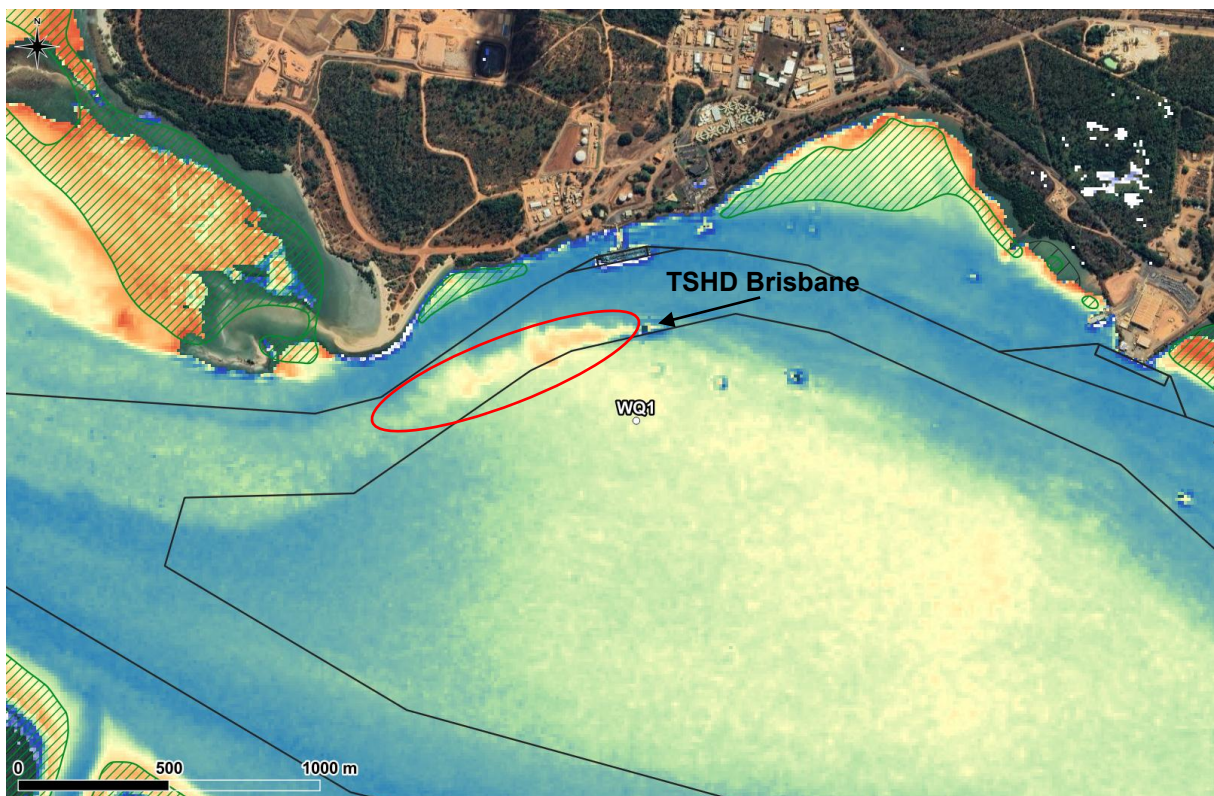


Figure 56. Satellite-derived TSM of Inner Harbour on 01/08/2026. The red ellipse shows a local plume from recent dredging.

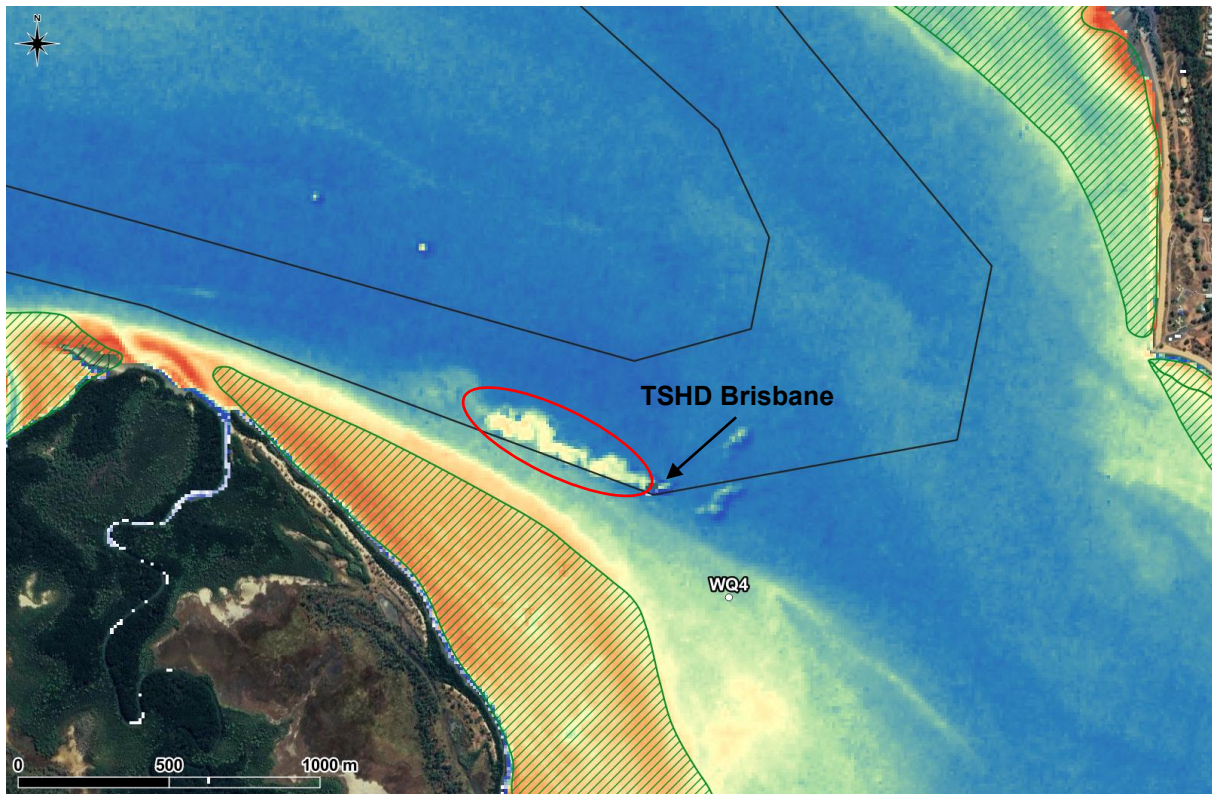


Figure 57. Satellite-derived TSM of Inner Harbour on 06/08/2026. The red ellipse shows a local plume from recent dredging.

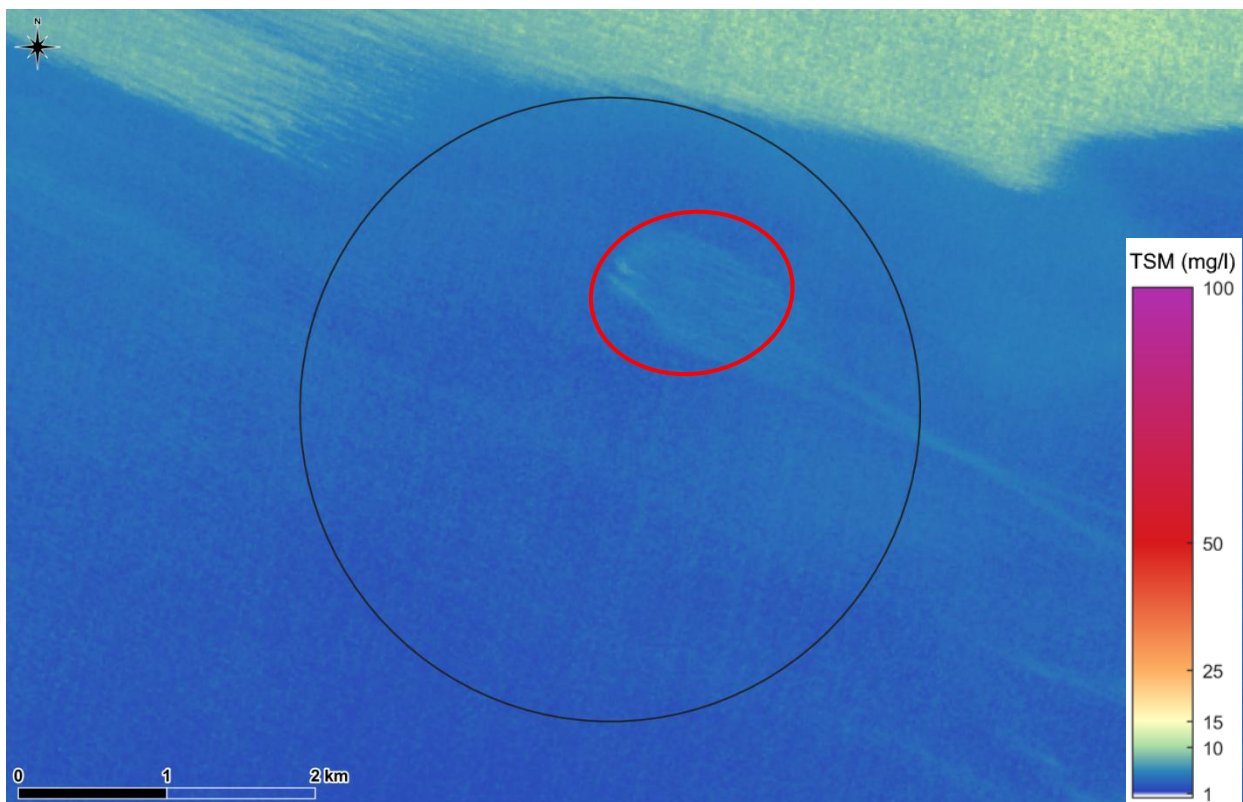


Figure 58. Satellite-derived TSM of DMPA on 14/06/2026. The red ellipse shows a local plume from a recent placement (1 hour prior) by the TSHD Brisbane.

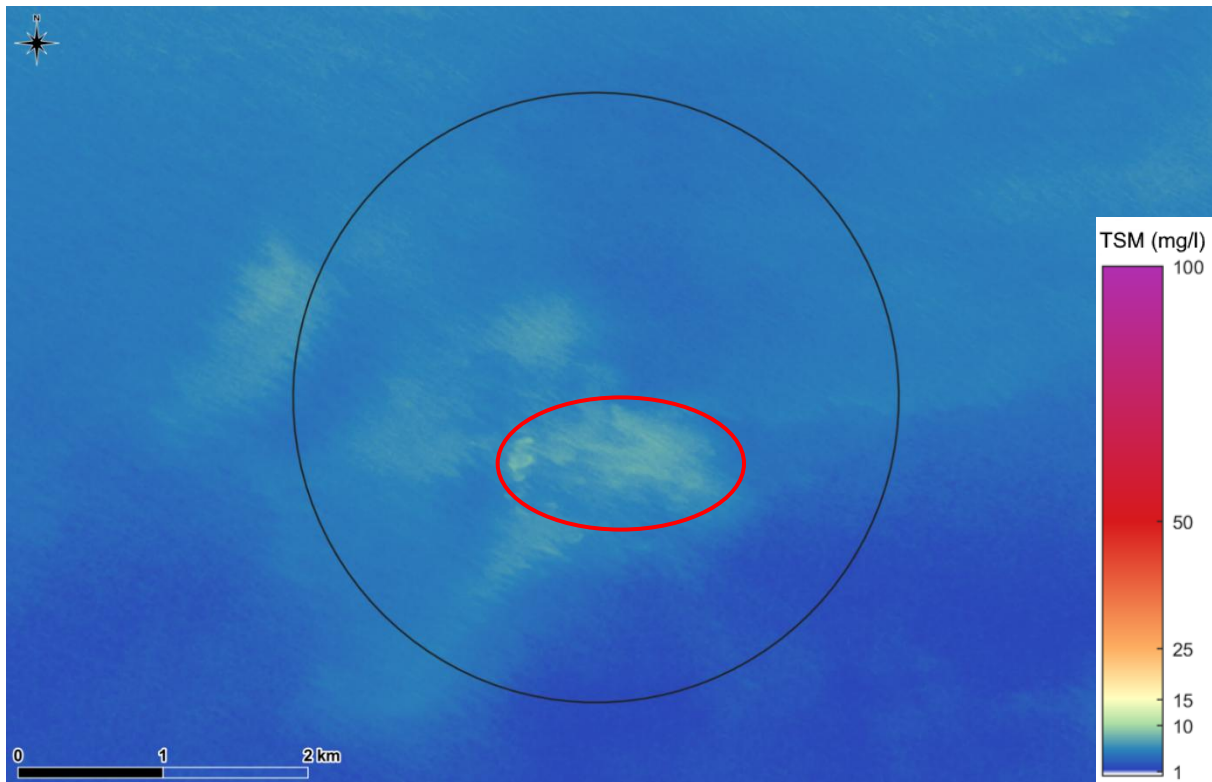


Figure 59. Satellite-derived TSM of DMPA on 22/06/2026. The red ellipse shows a local plume from a recent placement (1.25 hours prior) by the TSHD Brisbane.

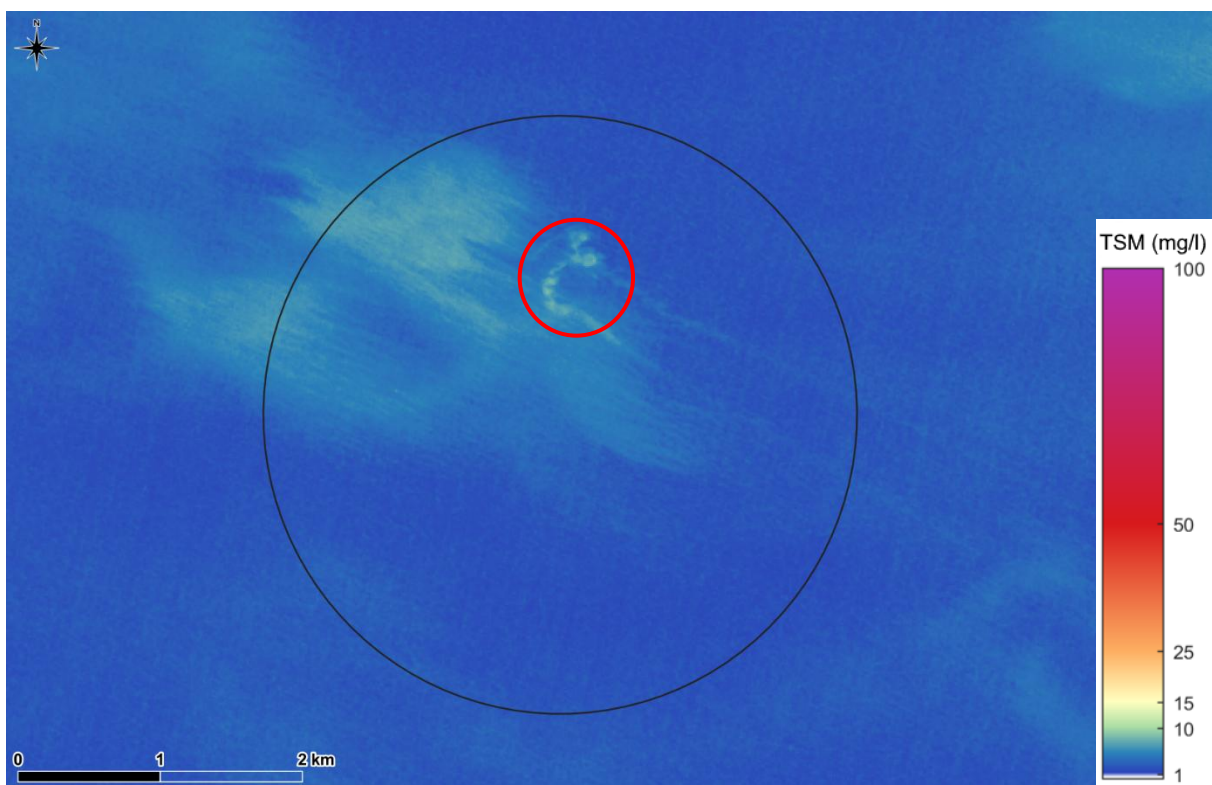


Figure 60. Satellite-derived TSM of DMPA on 07/07/2026. The red ellipse shows a local plume from a recent placement (0.75 hours prior) by the TSHD Brisbane.

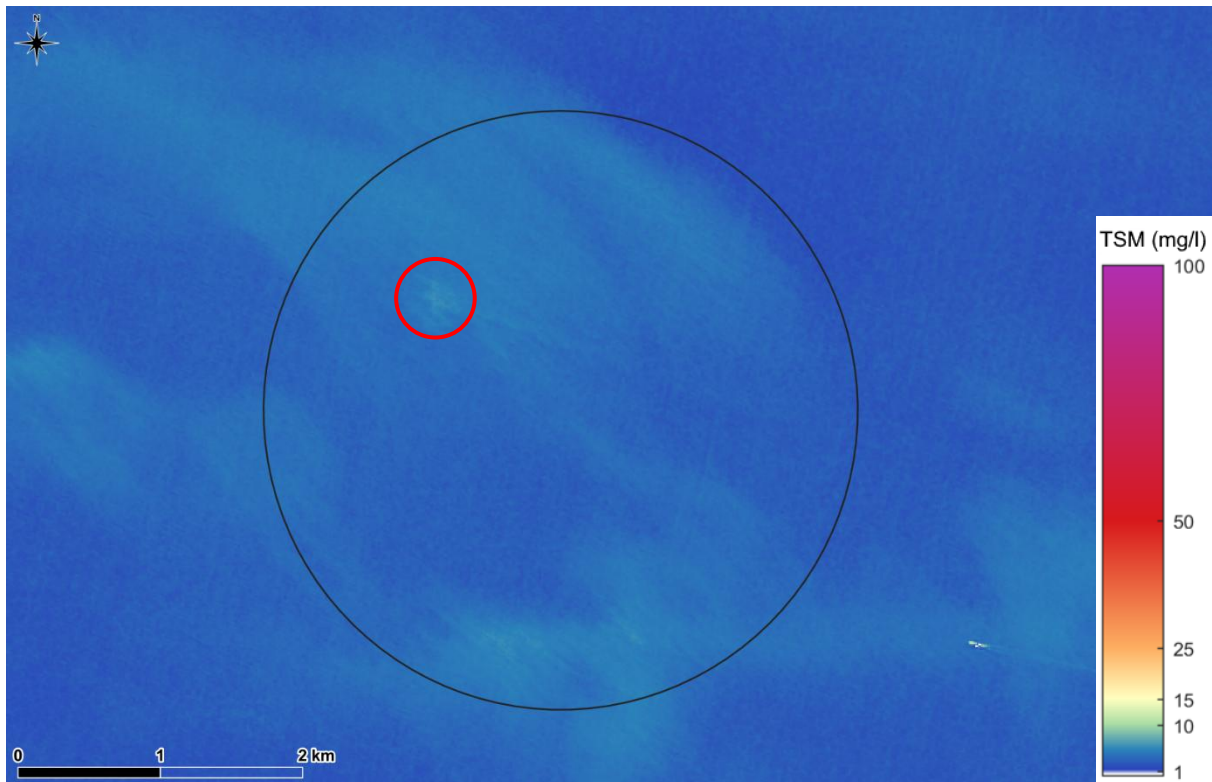


Figure 61. Satellite-derived TSM of DMPA on 10/07/2026. The red ellipse shows a local plume from a recent placement (2 hours prior) by the TSHD Brisbane.

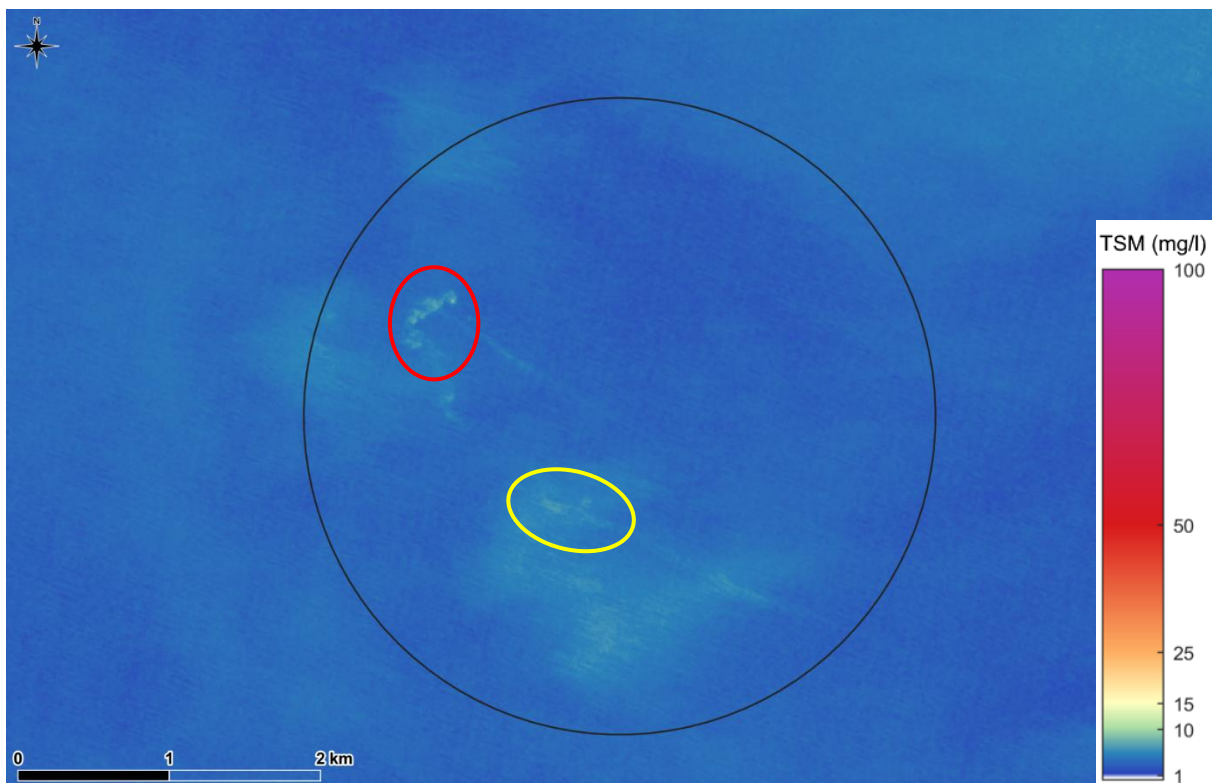


Figure 62. Satellite-derived TSM of DMPA on 20/07/2026. The red ellipse shows a local plume from a recent placement (0.5 hours prior) and the yellow ellipse shows a residual plume from a previous placement by the TSHD Brisbane (5 hours prior).



Figure 63. Satellite-derived TSM of DMPA on 11/08/2026. The red ellipse shows a local plume from a recent placement (0.5 hours prior) by the TSHD Brisbane.

5. Summary

This report has analysed and interpreted turbidity data collected pre-, during and post the Port of Weipa 2026 maintenance dredging program. The 2026 maintenance dredging program was undertaken by the TSHD Brisbane and involved the relocation of 1,147,000 m³ of sediment from the dredged areas of the Port to the Albatross Bay DMPA over a 63 day period. The data showed that during the dredging program the turbidity around the Port of Weipa was generally driven by the natural conditions (predominantly the astronomical tide, although a number of small wave events also resulted in elevated turbidity), with higher turbidity occurring during spring tides due to the larger tidal range. The key findings from the turbidity data analysis are detailed below:

- the exceedance analysis of the in-situ measured benthic turbidity data showed that the duration exceedances were below the 90th percentile duration exceedance at all sites and below the average duration exceedance at two of the three sites during the dredging period. The results therefore show that the turbidity over the period was within the natural variability for the region with no significant increase due to the maintenance dredging. This finding also correlates with the satellite imagery which showed that only occasional plumes from the maintenance dredging or bed levelling resulted in elevated TSM close to the monitoring sites (indicating the potential at some point during that day for elevated TSM at the sites), with the Imagery showing the TSM in these areas was predominantly controlled by natural processes;
- all of the plumes resulting from maintenance dredging (including those from both dredging and placement) were found to remain relatively close to where they were created. Plumes generated in the South Channel were shown to have the potential to migrate to the north and south of the channel and in an offshore direction. Overall, the results showed that little net residual transport occurs in the region, this was also noted during the 2019 to 2025 maintenance dredging programs and as part of the Port of Weipa Sustainable Sediment Management assessment (PCS, 2019, 2020, 2021, 2022, 2023, 2024b, 2025). Based on this, it can be assumed that the majority of the sediment suspended by the maintenance dredging and bed levelling is subsequently redeposited close to where it was either dredged/disturbed or placed;
- the dredging and placement activities associated with the Port of Weipa 2026 maintenance dredging program were found to result in visible plumes. Plumes were observed close to the TSHD Brisbane during dredging, close to the Pacific Titan during bed levelling, adjacent to the South Channel and within and adjacent to the Albatross Bay DMPA. The size and concentration of the plumes was variable depending on the dredging and placement activities;
 - the largest plume, which was due to repeat maintenance dredging loads in the South Channel, was a residual plume which was up to 6 km in length and 2 km in width and was present adjacent to the South Channel (both to the north and south) and had a concentration of 4 to 8 mg/l. Satellite imagery also indicated that localised plumes of up to 20 mg/l were regularly present in the lee of the TSHD Brisbane and Pacific Titan during dredging/bed levelling. These local plumes were predominantly observed in the South Channel, as this was where the majority of the maintenance dredging and bed levelling was undertaken, but were also occasionally observed in the Inner Harbour; and
 - plumes in the DMPA from the placement of dredged sediment were typically less than 500 m in length and only persisted for short durations (typically less than 3 hours). The observed plumes were consistent with placement by the TSHD Brisbane during previous annual maintenance dredging programs.
- the Port of Weipa 2026 maintenance dredging program did not influence the regional turbidity in the area. The dredging only influenced the local turbidity close to where dredging and bed levelling was undertaken in the Port and where placement occurred at the Albatross Bay DMPA. Natural variations in turbidity driven by the tide and wave

conditions over the monitoring period were larger than the variations in turbidity due to the maintenance dredging. The satellite imagery showed that the turbidity in the area of the seagrass meadows in the Inner Harbour was controlled by natural processes over the 2026 maintenance dredging program, with no visible plumes from dredging or bed levelling activities observed in the seagrass meadows; and

- the post-dredging satellite imagery showed that just over 1 day after dredging ended there were no plumes from the dredging or placement activities visible. This correlates with findings from previous dredge programs (2020, 2022, 2023, 2024 and 2025) where satellite imagery showed that the turbidity had returned to natural conditions within days of the dredging activity finishing (PCS, 2020, 2022, 2023, 2024b and 2025).

6. References

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