

Appendix A Water Quality Data Summary

The following provides a summary of water quality data collected during previous maintenance dredging campaigns.

A.1 2011 Turbidity Data

A.1.1 Fixed Instruments

During the 2011 maintenance dredging campaign in late August 2011, fixed turbidity instruments were deployed on bed-mounted benthic frames at two sites (Sites 1 and 2) adjacent to seagrass meadows on both sides of the outer channel (refer to Figure A-1 for locations). The turbidity data from these two instruments is plotted in Figure A-2.



Figure A-1 Location of fixed water quality instruments (2011)

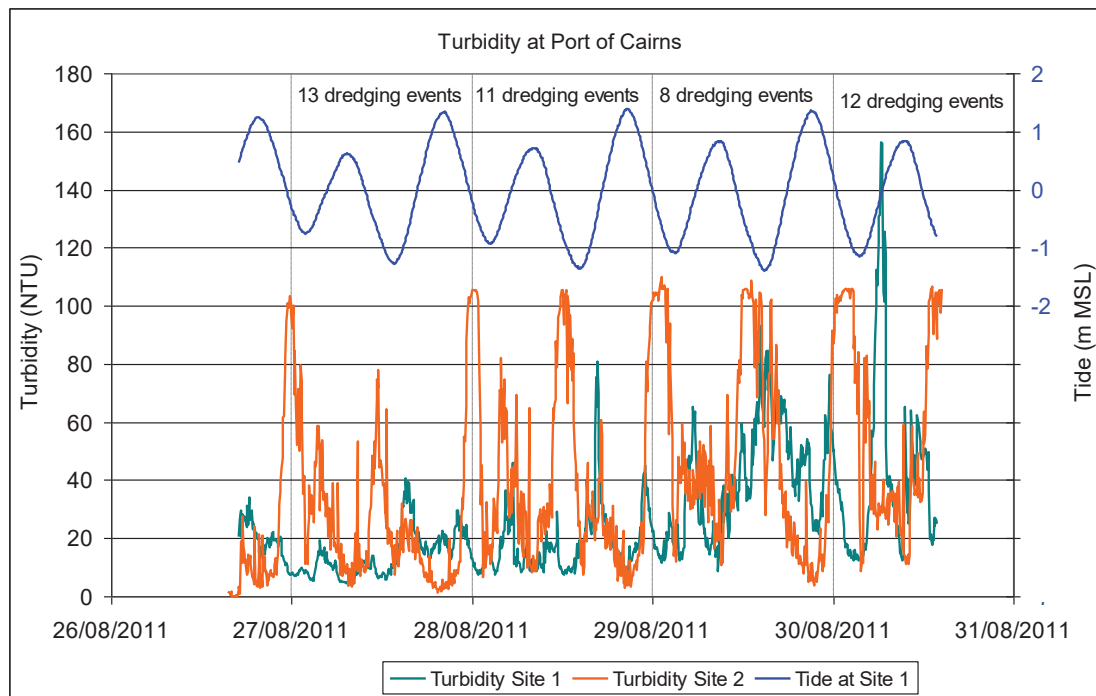


Figure A-2 Turbidity (NTU) at Sites 1 and 2

The turbidity measured at Site 1 (west of the outer channel) showed considerable variations over the maintenance dredging period, ranging from approximately 6.5 to 156 NTU. In the period 26 - 28 August, the turbidity was mainly less than 20 NTU, with a peak value of 80 NTU in the afternoon flooding tide of the 28 August 2011. The winds during this period were generally lighter than those subsequently on 29 and 30 August 2011. The turbidity at Site 1 over the latter 2 days of record was elevated, being generally less than 60 NTU, with a peak value of 156 NTU on the morning flood tide on the 30 August 2011.

Given that dredging operations were continuous over the measurement period, it is considered plausible that the peak in turbidity at Site 1 on 30 August 2011 (and the smaller peaks on other dates) were not associated with dredging. Other influences, such as wind driven waves resulting in the re-suspension of muddy bed sediments, are more likely to be the cause of the increased turbidity.

Plume Tracking

In addition to fixed instruments, an ADCP was used to track the dredging plume from the 2011 maintenance campaign, the following conclusions were made:

- The material placement operations at the DMPA on both ebb and flood tides resulted in plumes which were visible at the water surface beyond the boundary of the current DMPA. The plumes remained visible for up to approximately 2 hours after their formation and up to several hundred metres beyond the DMPA boundary. However, the bulk of the placed material was retained within the boundaries of the DMPA.

- Plume travel distance to the boundary of the current DMPA was approximately 1 km in each instance and was achieved by the selective placement of dredged material closest to the up-current side of the DMPA.
- Turbid plumes generated during maintenance dredging within the channel were contained mainly within the channel confines. This was due to the ebb and flood tide flows being almost parallel with the channel (northeast and southwest respectively) whilst the surrounding shallow bathymetry limited the opportunity for sediments disturbed by the dredge heads to move beyond the channel.

A.2 2013 Turbidity Data

During the 2013 maintenance dredging campaign in July/August 2013, fixed turbidity instruments were deployed on bed-mounted benthic frames at six sites in areas of known sensitive receptors as part of the CSDP EIS baseline monitoring program (refer to Figure 3-8 for locations). During this monitoring period, annual maintenance dredging was undertaken between 21/7/2013 and 17/8/2013.

The monitoring data from these six instruments was assessed to determine if any discernible impacts due to maintenance dredging could be observed in the data. The time series turbidity data, along with the maintenance dredging period, is presented in Figure A-3 to Figure A-5.

The turbidity data presented in Figure A-3 to Figure A-5 indicate spikes in turbidity occurred at each monitoring location during maintenance dredging and also after dredging. When considering the potential cause of these spikes (i.e. whether dredging related or not), the influence of weather has to be taken into account. The effects that wind speed and direction can have a significant impact on turbidity in the Cairns region, especially in areas exposed to these winds. To illustrate this a portion of the turbidity data from Palm Cove Beach (Site 1) has been plotted against wind speed and wind direction data in Figure A-6. This shows that during periods of stronger south-east winds, there was generally an associated spike in turbidity at Palm Cove Beach. In areas more sheltered from these winds, such as Trinity Inlet, turbidity is less susceptible to wind direction and more influenced by stronger currents during spring tides.

The plotted turbidity data in Figure A-3 to Figure A-5 indicate that all monitoring sites had a similar spike in turbidity which coincided with the commencement of maintenance dredging. However, during this period there were high winds and a spring tide. Once these high winds and spring tides abated, turbidity at all sites was greatly reduced, even while maintenance dredging continued. This indicates that turbidity measured at the six sensitive receptor locations is likely to have been driven primarily by weather events as opposed to any detectable effect of maintenance dredging plumes. Resuspension of dredge material is also unlikely to be contributing to these turbid spikes based on modelling outputs.

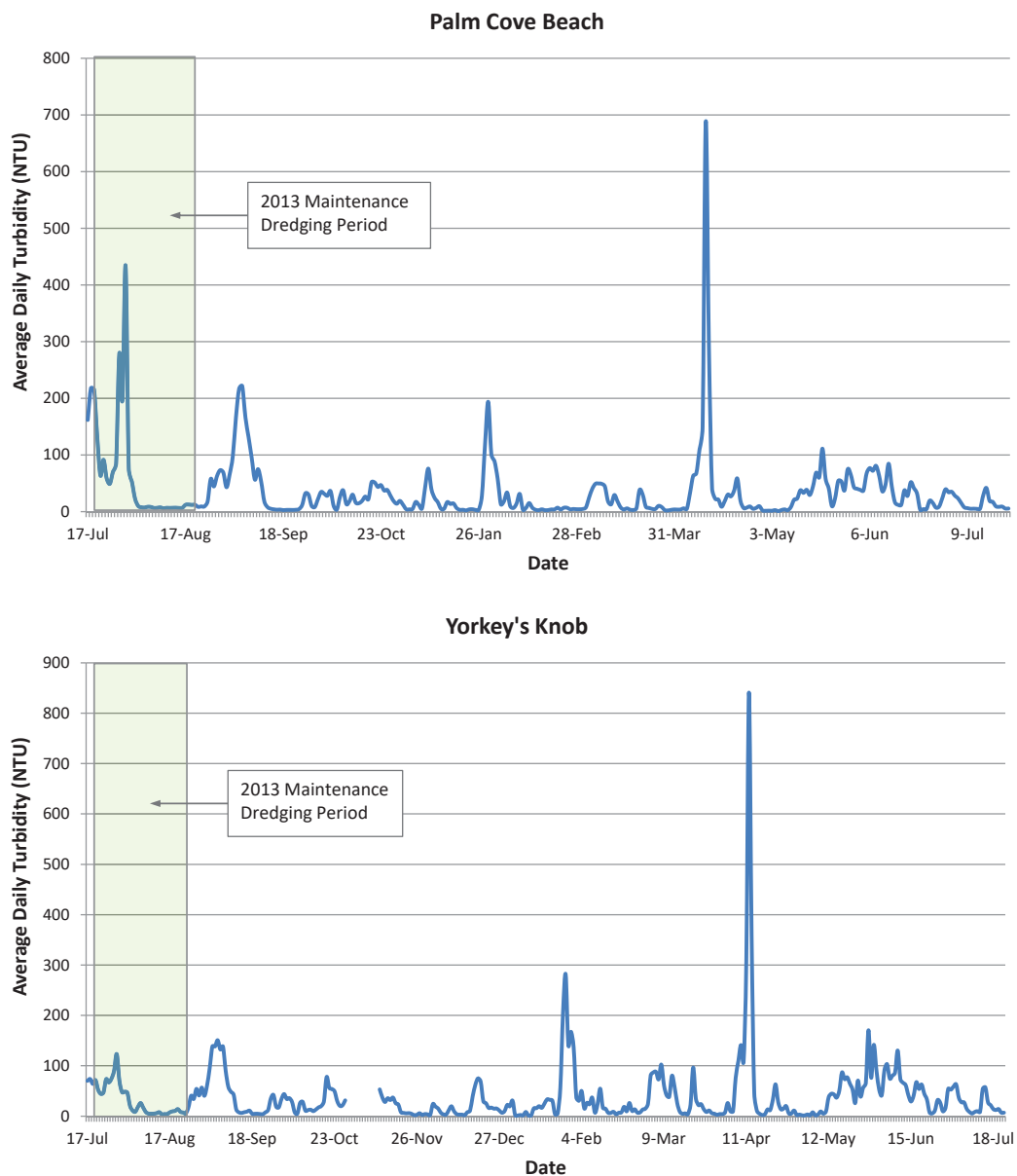


Figure A-3 Turbidity Data and Maintenance Dredging Period at Palm Cove Beach (top) and Yorkeys Knob (bottom)

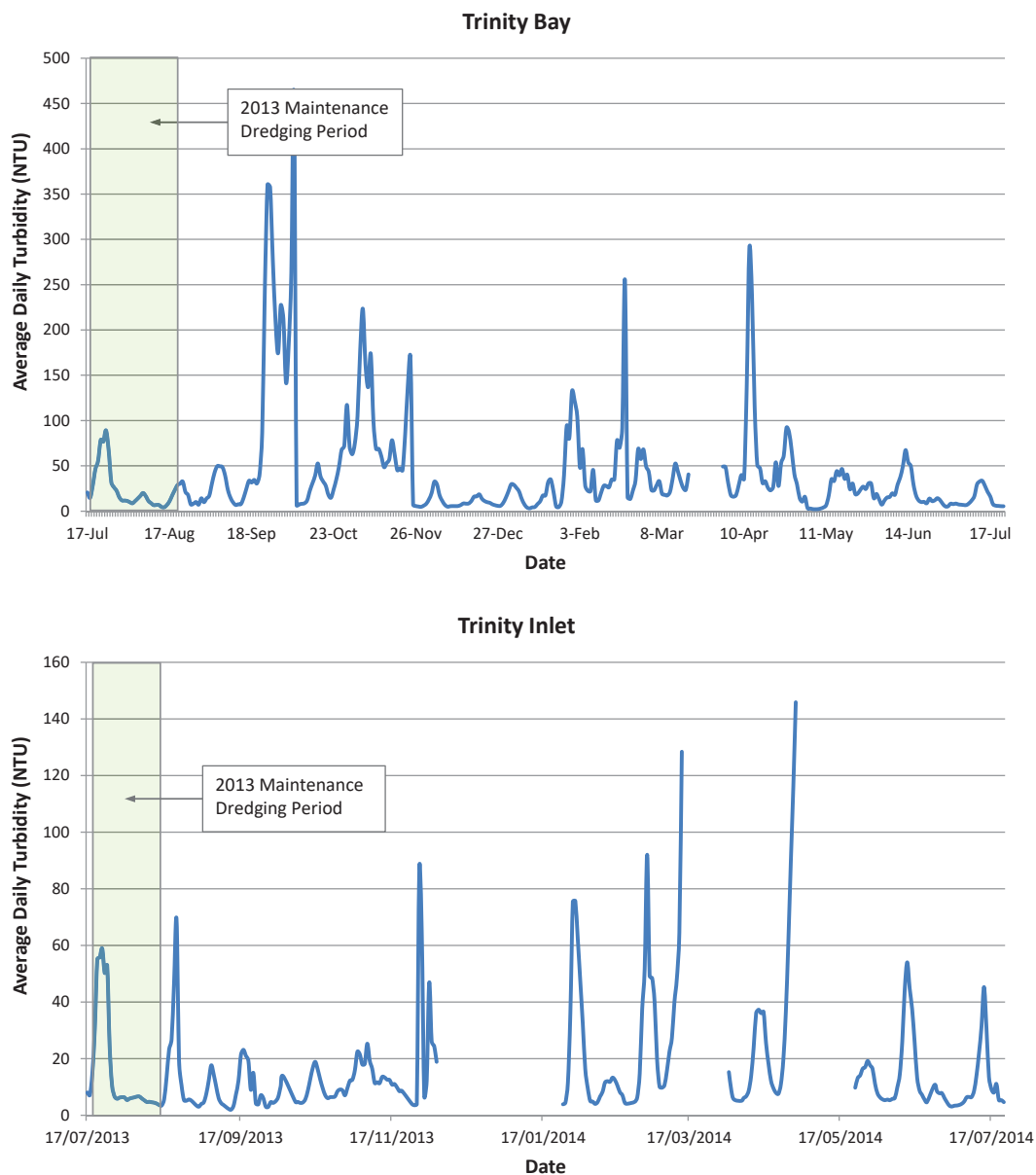


Figure A-4 Turbidity Data and Maintenance Dredging Period at Trinity Bay (top) and Trinity Inlet (bottom)

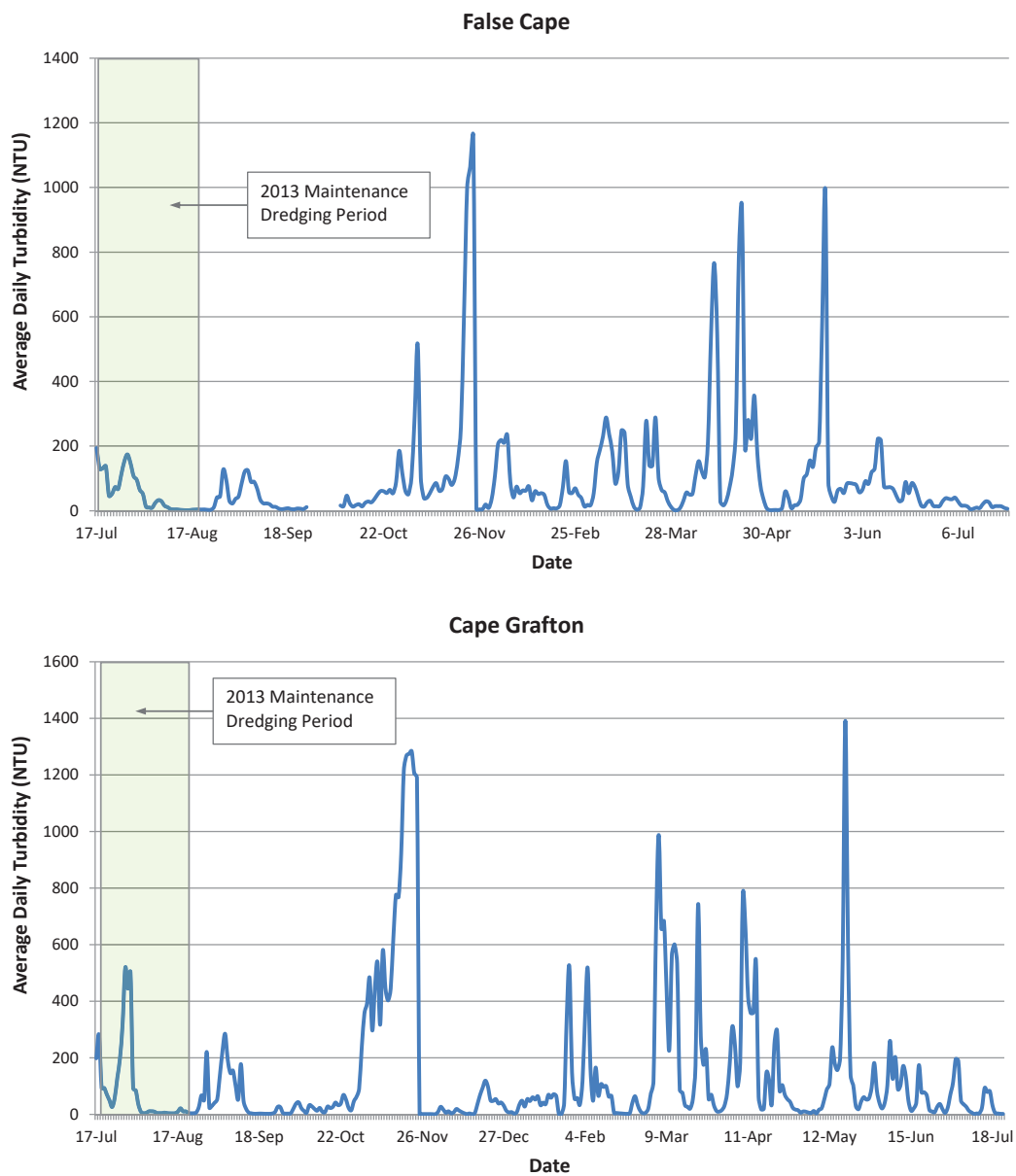
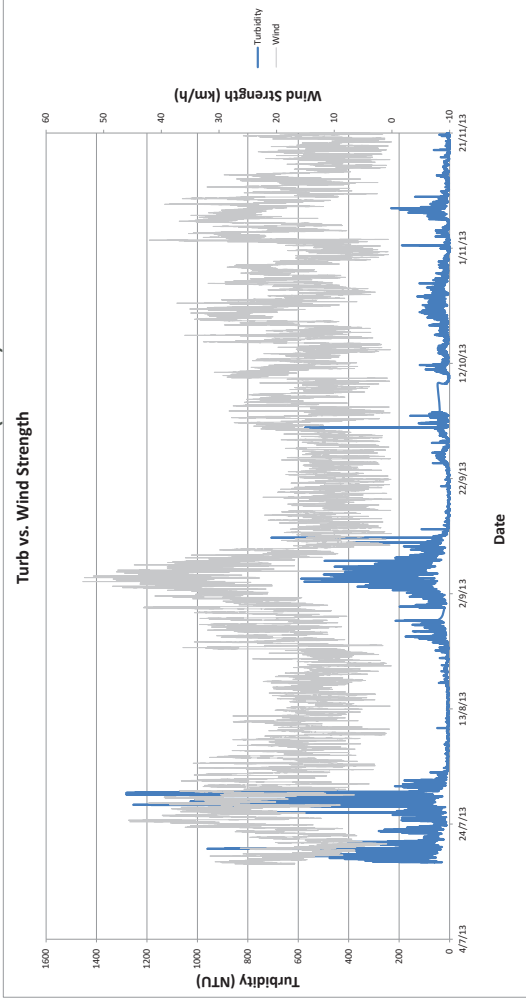
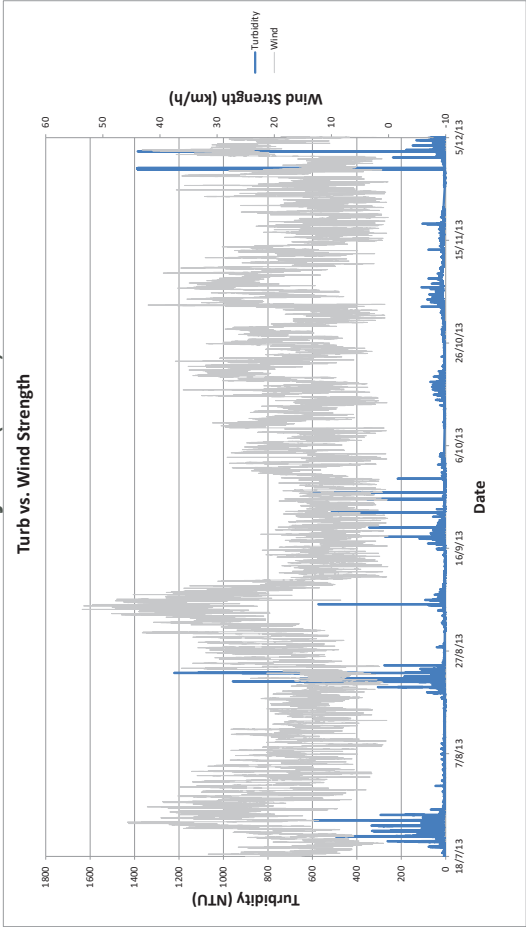


Figure A-5 Turbidity Data and Maintenance Dredging Period at False Cape (top) and Cape Grafton (bottom)

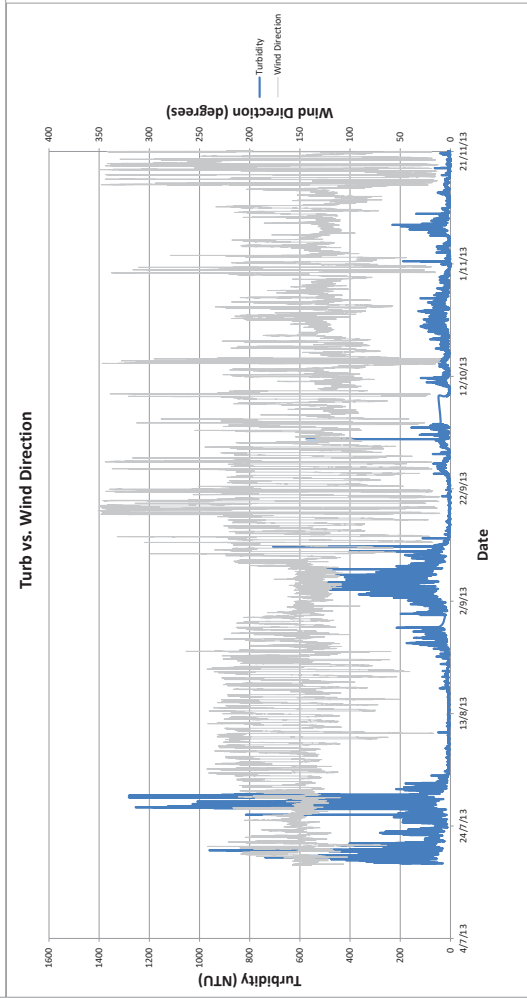
Palm Cove Beach (Site 1)



Trinity Inlet (Site 4)



Turb vs. Wind Direction



Turb vs. Tide

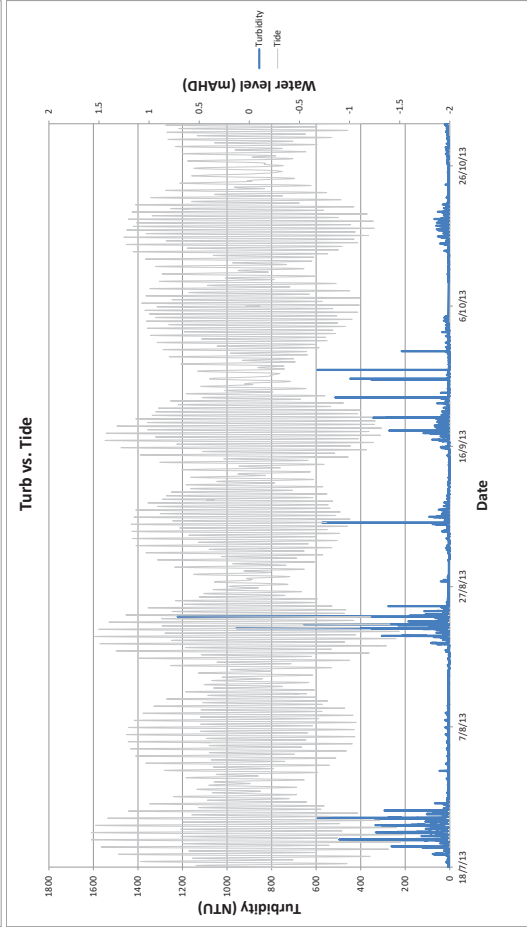


Figure A-6 Turbidity Data Correlated with Wind and Tidal Data (Sites 1 and 4)



A.3 2019 Turbidity Data

The 2019 maintenance dredging campaign was held immediately prior to the capital dredging campaign, between 4 May and 22 May 2019.

Fixed water quality instruments were deployed on monitoring buoys (measuring near-surface water quality) on 9-14 May in preparation for the commencement of capital dredging, with monitoring sites at Double Island, Yorkeys Knob, Trinity Bay, False Cape and Cape Grafton (refer to Figure 3-8). A further monitoring site at Trinity Inlet was deployed after maintenance dredging was complete and is therefore not shown on the figures below.

Raw turbidity data collected at each site is shown in Figure A-7, with 6-day and 15-day rolling median turbidity also shown in Figure A-7. Raw turbidity remained below 50 NTU at most sites, with the exception of Trinity Bay (located adjacent to the shipping channel). Turbidity at the Trinity Bay site peaked up to 120 NTU, however these peaks coincided with the outgoing ebb tide during the spring tidal cycle between 14 May and 19 May. During the incoming flood spring tide (and also during the neap tidal cycle), turbidity at the Trinity Bay site decreased to around 20 NTU.

Figure A-7 shows that the 6-day rolling median values remained below 25 NTU, with the highest values at Cape Grafton (located on the up-current side of maintenance dredging) and the lowest values at Yorkeys Knob and Double Island (located on the down-current side of maintenance dredging). A similar pattern is indicated in the 15-day rolling median values, with all sites below 20 NTU.

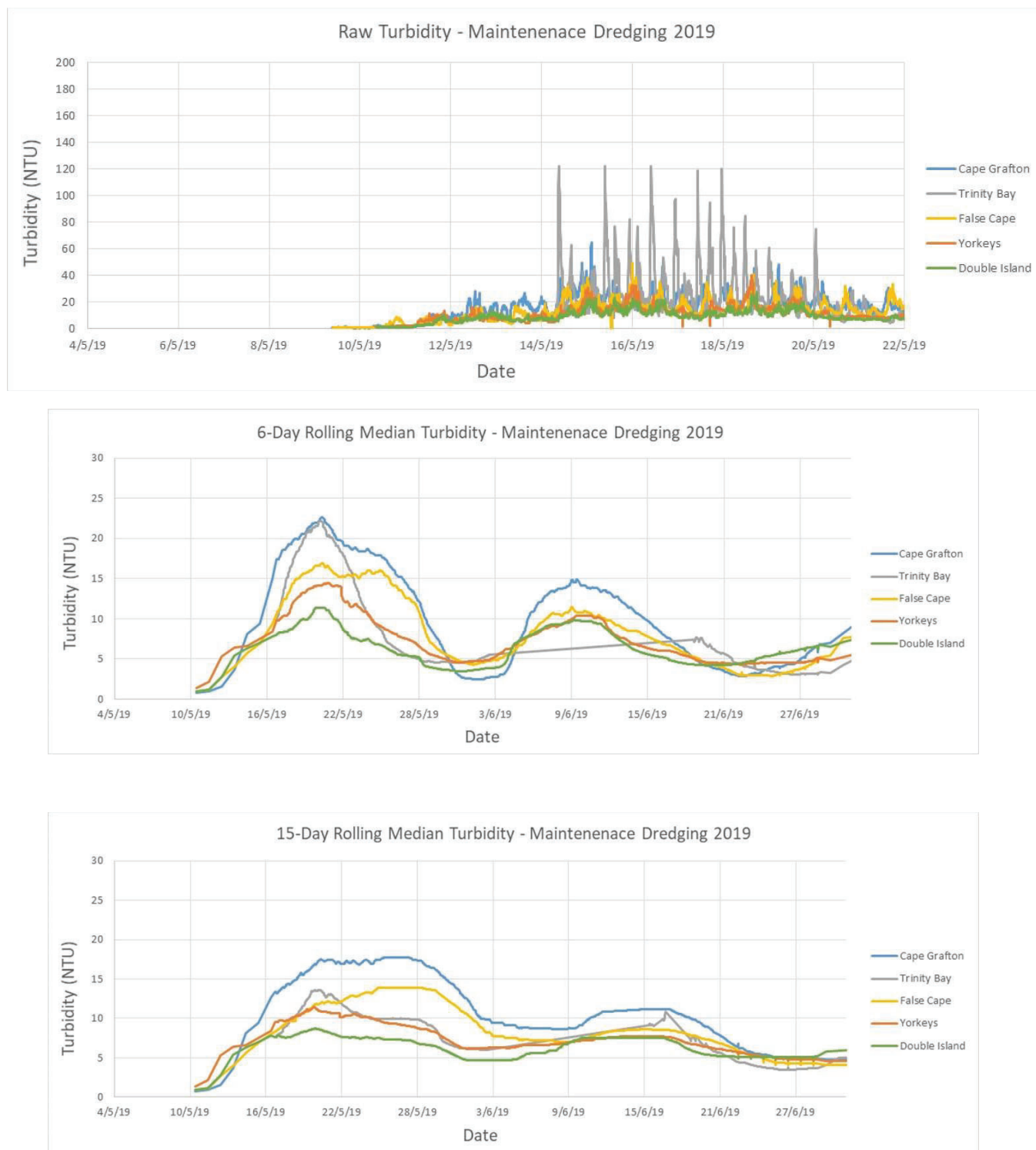


Figure A-7 Turbidity Data – Maintenance Dredging 2019