Doug's Opua Boat Yard AQ Assessment
Doug's Opua Boat Yard
09-Jul-2018
Doc No. R001a

Doug's Opua Boat Yard - Air Quality Assessment

Assessment of Air Emissions from Boat Yard Activities

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Client: Doug's Opua Boat Yard

ABN: N/A

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09-Jul-2018

Job No.: 60579740

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Quality Information

Document Doug's Opua Boat Yard - Air Quality Assessment

Ref 60579740

Date 09-Jul-2018

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Reviewed by Andrew Curtis (Technical Director)

Revision History

Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
A	5-July-2018	Draft	Andrew Curtis Technical Director	
	9-July-2018	Final		

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Abbreviations	Descriptions
AECOM	AECOM New Zealand Limited
AQNES	National Environmental Standards for Air Quality
AQG	Air Quality Guideline
AWS	Automatic Weather Station
CMA	Coastal Marine Area
CSIRO	Commonwealth Scientific and Industrial Research Organisation
GPG	Good Practice Guide
GPG Dust	Good Practice Guide for Assessing and Managing Dust
GPG ID	Good Practice Guide for Assessing Discharges to Air from Industry
GPG ADM	Good Practice Guide for Atmospheric Dispersion Modelling
3D	Three Dimensional
MfE	Ministry for the Environment
NASA	National Aeronautics and Space Administration
NES	National Environmental Standards
NRC	Northland Regional Council
NZAAQG	New Zealand Ambient Air Quality Guidelines
OEHHA REL	California Office of Environmental Health Hazard Assessment Reference Exposure Limits
RAQT	Regional Air Quality Targets
TSP	Total Suspended Particulate
TWA	Time Weighted Average
SRTM-3	Shuttle Radar Topography Mission
US EPA RfC	US Environmental Protection Agency's Inhalation Reference Concentrations
WES	Workplace Exposure Standards
WHO	World Health Organisation

1.0 Introduction

AECOM New Zealand Limited (AECOM) was engaged by Doug's Opua Boat Yard to assess the potential effects associated with air discharges from activities undertaken in the boat yard.

Doug's Opua Boat Yard is a fully commercial vessel maintenance facility for haul out, storage, brokerage, chartering, marine construction, repair, servicing, victualling and surveying of all classes of vessel up to 25 metric tons of displacement. The site has a range of resource consents issued by Far North District Council (FNDC) and Northland Regional Council (NRC) to allow for the above activities. This suite of consents include Air Discharge Permit CON20060791410 - 12 which authorises the discharge of contaminants to air in the coastal marine area from marine vessel construction, sale, repair, maintenance and associated activities. This resource consent expired on 30 March 2018. The applicant applied for replacement consents on 23 September 2017. The consent was publicly notified in December 2017 and a Council hearing was held on 17 and 18 May 2018.

The primary purpose of this assessment is to provide additional information to the Hearing Commissioners as set out in the memorandum to commissioners, dated 29 May 2018 (Memorandum of Counsel for the applicant seeking enlargement of the time by which supporting information is to be filed). Specifically, AECOM has assessed the effects of discharges to air from boatyard activities on the boatyard site and off-site locations.

The assessment has been undertaken in accordance with the following Ministry for the Environment (MfE) Good Practice Guides (GPG):

- Good Practice Guide for Assessing and Managing Dust[1] (GPG Dust);
- Good Practice Guide for Assessing Discharges to Air from Industry[2] (GPG ID); and,
- Good Practice Guide for Atmospheric Dispersion Modelling[3] (GPG ADM).

[1] Ministry for the Environment, Good Practice Guide for Assessing and Managing Dust, November 2016
[2] Ministry for the Environment, Good Practice Guide for Assessing Discharges to Air from Industry, 2008
[3] Ministry for the Environment, Good Practice Guide for Atmospheric Dispersion Modelling, 2004

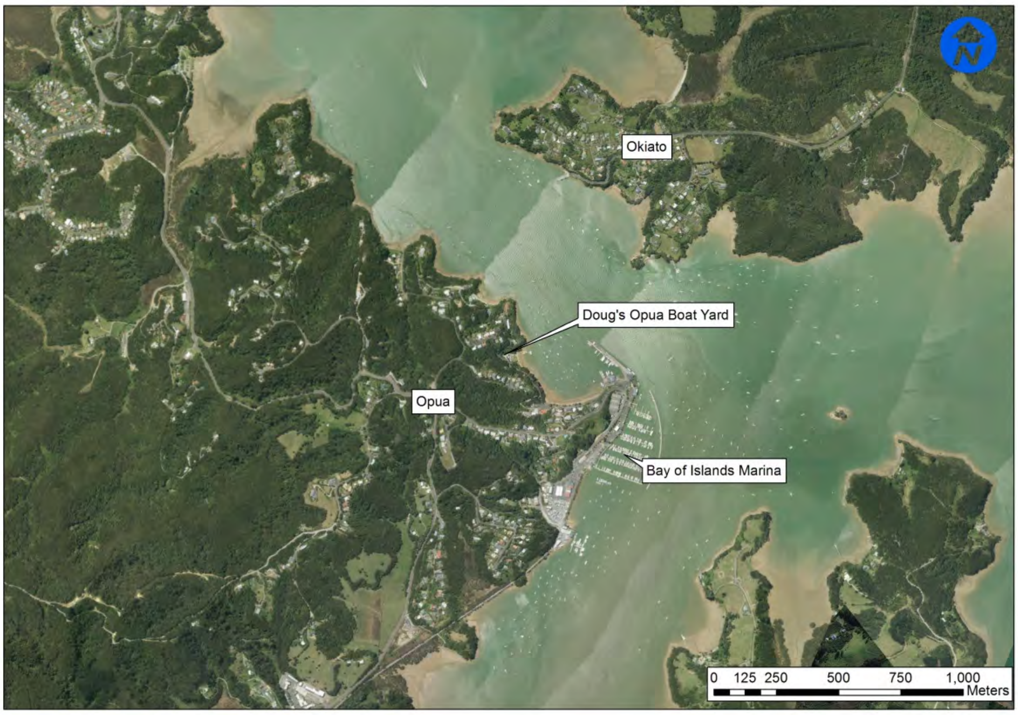
2.0 Location

Doug's Boat Yard is located off Richardson Street in Opua, Bay of Islands. The site is located within the Opua Town Basin at the southern-most end of the Veronica Channel and comprises approximately half of the small open bay and sandy beach directly west of the Opua Wharf and mooring area. The slipway extends to the east and is positioned at the northern side of the bay directly under a large bush covered bluff.

The landward site is completely surrounded by bush/rainforest and well below the level of the adjoining street. There are three residences that look onto the slipway and wharf in the Coastal Marine Area (CMA), but not the boat yard or the slipway located within the esplanade reserve.

The location of the site is shown in Figure 1.

Figure 1 Site Location



3.0 Air Discharge Sources

An AECOM staff member undertook a site visit on 12 June 2018 to identify activities that have the potential to generate air emissions. Based on this site visit and the findings of AECOM's assessments undertaken in 2000[4], AECOM considers there are four main activities that have the greatest potential to generate emissions. These include:

- Water blasting vessels;
- Sanding and grinding vessels;
- Antifouling vessels; and,
- Painting vessels.

Emissions from these sources are discussed in Sections 5 to 7 of this report.

[4] AECOM (formerly Woodward-Clyde), Boat Yard Emissions, 9 February and 28 September 2000.

4.0 Particulate Monitoring

To better understand the potential for particulate emissions from activities undertaken at the boat yard to cause effects, AECOM installed two E-BAM continuous particulate monitors, placed either side of the slipway during periods of on-site activity. Monitoring was undertaken for a period of eight days and during this time four vessels were hauled out, with a range of typical maintenance activities undertaken on these vessels including; water blasting, scraping, grinding, application of antifouling, both sprayed on and rolled on, and polishing of topsides. The applicant considers that this eight day period of activity represents approximately 10% of the total amount of works undertaken at the boat yard in any given year.

The location of the monitors is presented in Figure 2 and the monitors are shown in Figure 3. The monitors were moved up and down the slipway depending on the location of the vessel being worked on, so as to be directly alongside the work being undertaken, and on the site boundary (refer to resource consent map in Appendix A which shows the consented areas). Wind direction and wind speed measurements were also undertaken, in addition to particulate monitoring, to better understand conditions which could affect particulate emissions.

While the E-BAM is not a USEPA Federal Equivalent Method (FEM) instrument; it uses the same measurement technique (beta attenuation) as the FEM methods and is considered appropriate for screening monitoring such as this study[5]. The E-BAM continuously measures the intensity of beta particles passing through a filter tape, this allows particulate concentrations to be measured and reported over a variety of averaging periods.

The measured particulate concentrations have been compared with the suggested trigger levels for total suspended particulate (TSP) provided by the Ministry for the Environment in the GPG Dust. The suggested trigger levels are presented in Table 1.

For the purposes of this assessment AECOM has classified the receiving environment to be 'moderate' due to the close placement of the monitors (approximately 3 m) with respect to boat yard activities, typically particulate monitors are placed 50 to 100 m from particulate discharge sources. Given the close proximity of the particulate monitors, with respect to boat yard activities, the results of monitoring are considered to provide a worst-case assessment of air discharges from the site.

Generally residential areas are classified as high sensitivity, so the high sensitivity trigger values would be appropriate for the nearby residential receptor locations, however given that the particulate monitors were placed very close to the source of air discharges (namely the vessels being worked on) a less conservative trigger has been used. The concentration of particulate likely to be experienced at residential locations will be well less than the values measured by the particulate monitor as this material will have an opportunity to disperse and settle-out of the atmosphere.

The primary purpose of the 1-hour trigger value is to inform the operator that if this value is exceeded for large periods of time then there is the potential for the 24-hour average trigger to be exceeded. The 24-hour average trigger therefore provides a better indication of chronic nuisance effects, as it is the ongoing cumulative effect of particulate discharges which creates nuisance effects.

[5] Ministry for the Environment, Good Practice Guide for Assessing and Managing Dust, November 2016.

Table 1 Suggested Trigger Levels for Total Suspended Particulate (TSP)

Trigger	Sensitivity of the Receiving Environment		
	High	Moderate	Low
Short Term (1 hour)	200 µg/m³	250 µg/m³	n/a
Daily (24 hours)	60 µg/m³	80 µg/m³	100 µg/m³

Figure 2 Particulate Monitoring Locations

Figure 3 Particulate Monitors (M1 and M2)

Table 2 presents the monitoring results. As the monitoring was only undertaken during periods of activity, AECOM has inferred 24-hour average concentrations. To calculate the 24-hour average values AECOM has assumed a background concentration of 20 µg/m³. This value represents the concentrations at times when no activities were being undertaken. This value is considered conservative as the average concentration measured by Monitors 1 and 2 while activities were being undertaken was 12 µg/m³ and 18 µg/m³, respectively.

Figures 10 to 17 in Appendix A present the particulate concentrations measured over the monitoring period.

The results of particulate monitoring are discussed further in the following sections of the report.

Table 2 Total Suspended Particulate (TSP) Monitoring Results

Day	Activities undertaken	Wind Direction	Average Wind Speed (m/s)	Wind Gust (m/s)	Maximum 1-hour Average TSP Concentration (µg/m³)			Inferred Average TSP 24-hour Concentration (µg/m³)		
					MfE Trigger Level	Monitor 1	Monitor 2	MfE Trigger Level	Monitor 1	Monitor 2
1 (12 June 2018)	Scraping and Grinding	N	0.5	3.1	**250**	43	123	**80**	18	22
2 (13 June 2018)	Spray Painting Antifouling	NW	0.3	4.3		No Result[6]	51		No Result	18
3 (14 June 2018)	Water blasting	NE moving thought to W	0.2	2.4		9	8		16	15
4 (15 June 2018)	Sanding and hand painting antifouling	ENE	0.4	1.9		6	13		17	16
5 (16 June 2018)	Water blasting, antifouling and topside repairs	ENE	1.7	4.5		7	5		16	16
6 (17 June 2018)	Sanding and Polishing topsides	NE	0.2	0.9		11	9		17	16
7 (18 June 2018)	Water blasting and cleaning	ENE	1.1	3.6		1	12		18	18
8 (19 June 2018)	Scraping and Grinding	ENE	0.2	2.1		392	313		32	38

[6] Instrument was not operating.

5.0 Water blasting vessels

Water blasting is undertaken as part of the first step in preparation for painting. The vessel is first hauled out of the water using a cradle which carries the vessel up the slipway on a track. The cradle is pulled up the slipway using an electric motor/worm drive assembly. This activity is usually undertaken at the location shown in Figure 4.

Figure 4 Water Blasting Location

This activity has the potential to generate particulate discharges as material, such as sediments, barnacles and other sea crustaceans are removed from the underside of the vessel. These particles have the potential to cause nuisance effects, due to the deposition of this material on surfaces. The particles will either be discharged directly to air or will be encapsulated within large water droplets. Figure 5 shows a picture of a vessel being water blasted and prepared for antifouling.

This activity generally occurs two to three times per week and typically takes up to an hour to complete. This operation will generate a visible water vapour plume with any particulate disturbed from the vessel likely to fall immediately to the ground or be contained within large water droplets which would also fall to the ground very near to the vessel. AECOM consider that it represents good practice not undertake this activity during conditions where the wind is greater than 5 m/s (10 knots) when the wind is not blowing up the slipway, i.e. when the wind is from the north, west or south.

Figure 5 Picture of a vessel being Water Blasted

As mentioned in Section 4, AECOM undertook particulate monitoring over a period of eight days to assess emissions and determine the potential for nuisance effects to occur. Water blasting was undertaken on days 1, 3, 5 and 7 and during these occasions the maximum 1-hour average and 24-hour average concentrations were 12 µg/m³ and 18 µg/m³, respectively. These concentrations are well below the 1-hour average and 24-hour average trigger values of 200 µg/m³ and 80 µg/m³ respectively. While the period of monitoring provided calm to low wind speed conditions, given the close proximity of the particulate monitors with respect to activities, AECOM considers that the measured concentrations represent the worst-case conditions that could be experienced off-site, and that it could reasonably be expected that work will only be undertaken in winds less than 5 m/s or 10 knots.

Based results of monitoring AECOM considers that there is no potential for nuisance from this activity.

In addition to particulates and water droplets containing particulate, the water blaster generates a very fine water mist that has the potential to travel beyond the site boundary. AECOM considers that providing that the water used by the water blaster has low levels of impurities including suspended solids, there is limited potential for this to cause health or nuisance effects. AECOM understands that the water used for water blasting is from a local spring, which would be unlikely to contain significant levels of impurities. To further satisfy any potential concerns, AECOM recommends that the water source is tested to confirm the quality of the water. If the water is high in impurities a water filter could be fitted to eliminate these compounds.

6.0 Sanding and grinding vessels

Sanding and grinding is another step in the paining preparation process. After the vessels are hauled out of the water and water blasted, residual material is removed from the hull using scrapers, grinders and sanders. The activity can generate particulate that under normal circumstances will fall in the immediate vicinity of the boat cradle and is collected below in a bunded impermeable area – refer to Figure 6 which shows a picture of the keel being prepared for painting. During periods of high wind speed the potential for off-site particulate increases.

As mentioned in Section 4, AECOM undertook particulate monitoring over a period of eight days to assess emissions. A range of scraping, sanding and grinding activities were undertaken on days 1, 4, 6 and 8 and during these occasions the maximum 1-hour average and 24-hour average concentrations were 392 µg/m³ and 38 µg/m³, respectively. While the 1-hour trigger was exceeded on day 8, at other times the particulate concentration was well below the trigger value. The trigger was only exceeded for the period of 1 hour and given that this activity does not occur for long periods of time the 24-hour average is unlikely to ever be exceeded.

As previously mentioned the 24-hour average trigger provides a better indication of chronic nuisance effects, as it is the ongoing cumulative effect of particulate discharges which creates nuisance effects, therefore concentrations slightly above the trigger value from time to time are unlikely to result in dust nuisance effects.

As previously mentioned, while the period of monitoring provided calm to low wind speed conditions, given the close proximity of the particulate monitors with respect to activities, AECOM considers that the measured concentrations represent worse-case conditions that could be experienced off-site. Especially considering that this work should only be undertaken when winds are less than 5 m/s or 10 knots.

Given the relative infrequency of this activity, estimated to occur for 1 to 2 hours a day on up to 40 days of the year, AECOM considers that this activity has limited potential to cause nuisance at off-site locations and no potential for nuisance at the nearest residential locations.

Figure 6 Picture of a vessel being prepared for painting

7.0 Atmospheric Dispersion Modelling of Antifouling and Paint Emissions

To assess the potential effects associated with antifouling and paint emissions, AECOM has undertaken an atmospheric dispersion modelling assessment using the model CALPUFF (Version 7). CALPUFF has been used extensively in New Zealand and Australia and is a recommended model in the GPG AMD particularly for sites surrounded by complex terrain and where sea-breeze conditions are likely to occur. CALPUFF is a US EPA approved atmospheric dispersion model and is a recommended model in GPG AMD.

CALPUFF is a non-steady state Lagrangian Gaussian puff model containing modules for complex terrain effects, overwater transport, coastal interaction effects, building downwash, wet and dry removal, and simple chemical transformation. In other words, the model can simulate the effects of time- and space-varying meteorological conditions on contaminant transport, transformation and removal.

The model was set up in accordance with the guidance contained in GPG AMD.

7.1 Assessment Criteria

7.1.1 Sources of Air Quality Assessment Criteria

The Ministry for the Environment's *GPG ID* recommends an order of priority when reviewing air quality assessment criteria. This order of priority is as follows:

- Ministry for the Environment, Resource Management (National Environmental Standards for Air Quality) Regulations, 2004 (NES)[7];
- Ministry for the Environment, Ambient Air Quality Guidelines (2002 update) (NZAAQG)[8];
- Regional Air Quality Targets (RAQT); and,
- World Health Organisation air quality guideline (WHO AQG) Global Update 2005[9].

When there is no available New Zealand or WHO standards or guidelines, the GPG recommends that the ambient air quality criteria from other jurisdictions are to be used. These are as follow, in order of priority:

- California Office of Environmental Health Hazard Assessment Reference Exposure Limits (OEHHA REL)[10];
- US Environmental Protection Agency's Inhalation Reference Concentrations for Inhalation (US EPA RfC)[11];
- Texas Commission on Environmental Quality Effects Screening Level (TCEQ ESL)[12]
- New Zealand Worksafe -Workplace Exposure Standards (WES) Time Weighted Average (TWA) divided by 50 for low and moderately toxic hazardous air contaminants or divided by 100 for highly toxic bio-accumulative or carcinogenic hazardous air contaminants.

[7] Ministry for the Environment, Resource Management (National Environmental Standards for Air Quality), Regulations 2004
[8] Ministry for the Environment, Ambient Air Quality Guidelines (2002 update)
[9] Air quality Guidelines for Europe Second Edition, 2000
[10] California Office of Environmental Hazard Assessment http://www.oehha.ca.gov/air/allrels.html
[11] US EPA http://www.epa.gov
[12] Texas Commission on Environmental Quality Effects https://www.tceq.texas.gov/toxicology/esl/list_main.html

7.1.2 Summary of Assessment Criteria

Based on the guidance contained in the MfE GPG ID, AECOM has selected appropriate health-effect based guidelines and these values are presented in Table 3.

Given that antifouling and painting typically only occurs for a maximum of 2 hours in any given day, predicted concentrations were compared with 1-hour average assessment criteria.

Table 3 Summary of Relevant Air Quality Criteria

Pollutant	CAS Number	Threshold Concentration (µg/m³)	Assessment Criteria
1,2,4-trimethyl benzene	95-63-6	4,400	TCEQ ESL
1,3,5-trimethylbenzene	108-67-8	4,400	TCEQ ESL
2,4,6-tris[(dimethylamino)methyl]phenol	90-72-2	420	TCEQ ESL
2,4-pentanedione	123-54-6	830	TCEQ ESL
aspartic acid, N,N'-(methylenedicyclohexanediyl)bis-,ester	136210-32-7	350	TCEQ ESL
bis(1,2,2,6,6-pentamethyl-4-piperidyl)sebacate	41556-26-7	100	TCEQ ESL
C18 fatty acid dimers/ polyethylenepolyamine polyamides	68410-23-1	1,000	TCEQ ESL
diethyl fumarate	623-91-6	400	TCEQ ESL
ethyl acetate	141-78-6	3,100	TCEQ ESL
ethyl Benzene	100-41-4	2,000	OEHHA REL
ethyl-3-ethoxypropionate	763-69-9	270	TCEQ ESL
ethylbenzene	100-41-4	2,000	OEHHA REL
hexamethylene diisocyanate	822-06-0	0.7	TCEQ ESL
hexamethylene diisocyanate polymer	28182-81-2	8.7	TCEQ ESL
kerosene	8008-20-6	1,000	TCEQ ESL
methyl 1,2,2,6,6-pentamethyl-4-piperidyl sebacate	82919-37-7	100	TCEQ ESL
methyl ethyl ketone	78-93-3	18,000	TCEQ ESL
methyl isobutyl ketone	108-10-1	820	TCEQ ESL
naphtha petroleum, heavy, hydrodesulfurised	64742-95-6	4,400	TCEQ ESL
naphtha petroleum, light aromatic solvent	64742-95-6	4,400	TCEQ ESL
naphtha, petroleum, hydrodesulfurised heavy	64742-82-1	3,500	TCEQ ESL
n-butanol	71-36-3	610	TCEQ ESL
n-butyl acetate	123-86-4	11,000	TCEQ ESL
polyethylene glycol	25322-68-3	1,000	TCEQ ESL
propylene glycol monomethyl ether acetate, alpha-isomer	108-65-6	2,700	TCEQ ESL
propylene glycol monomethyl ether acetate, beta-isomer	70657-70-4	280	TCEQ ESL
solvent naphtha (petroleum), light aromatic	64742-95-6	4,400	TCEQ ESL

Pollutant	CAS Number	Threshold Concentration (µg/m³)	Assessment Criteria
Tinuvin 1130	104810-47-1	120	TCEQ ESL
Tinuvin 213	104810-48-2	120	TCEQ ESL
toluene	108-88-3	37,000	OEHHA REL
xylene	1330-20-7	22,000	OEHHA REL

7.2 Identification of Sensitive Receptors

A desktop study was undertaken to identify discrete receptors deemed sensitive to changes in air quality as a result of discharges to air from the site. In the context of the assessment contained in this report, the term 'sensitive receptors' is defined as a location where people or surroundings may be particularly sensitive to the effects of air pollution. This type of receptor includes:

- residential properties;
- hospitals;
- schools;
- libraries; and,
- public outdoor locations (e.g. parks, reserves, beaches, sports fields).

For this project four residential locations and the reserve to the south have been identified near to the site, where it could reasonably be expected that people could be exposed to paint emissions for the duration of the assessment criteria averaging period which is typically 1 hour. These locations are shown in Figure 7.

Figure 7 Nearest Residential Receptor Locations

7.3 Model Parameters

The modelled parameters used in this assessment are presented in Table 4. The emission source has been characterised as a small stack 4 m in diameter, 1 m high and with a discharge velocity of 0.5 m/s (the minimum velocity allowed by the model), this is considered to approximate the dispersion of antifouling/paint over a relatively small area.

Table 4 Emission Data

Parameter	Units	Value
Source Coordinates (UTM) (x)	(m)	237,817
Source Coordinates (UTM) (y)	(m)	6,088,604
Base Elevation	(m)	27.52
Stack Diameter	(m)	4.0
Source Height	(m)	1.0
Discharge Velocity	(m/s)	0.5

7.4 Meteorological Modelling

The atmospheric dispersion model used in this assessment requires local meteorological data as an input to predict ground level concentrations of pain solvents. While some of the parameters required, such as wind speed, temperature and relative humidity can be obtained from local automatic weather stations (AWS), the model requires other meteorological parameters such as mixing height, vertical wind profile and temperature profile. These parameters are not typically measured by AWS and therefore for this project we undertook meteorological modelling using ‘The Air Pollution Model’ (TAPM) to predict the required meteorological parameters for the project domain. This data was then subsequently refined using CALMET, CALPUFF’s, meteorological pre-processing module, which takes into consideration the influence of the local terrain and land use.

7.4.1 TAPM

TAPM is a prognostic model which is used to predict three-dimensional meteorological data, with no local data inputs required. TAPM Version 4 was developed in Australia by the Commonwealth Scientific and Industrial Research Organisation (CSIRO).

The TAPM modelling domain was centred at Universal Transverse Mercator (UTM) 237,836 m E, 6,088,570 m N, (zone 60, south).

A three dimensional prognostic meteorological file was extracted from TAPM for the year 2017 and was used to generate the CALMET meteorological data input file.

7.4.2 CALMET

The CALMET modelling domain was centred at (UTM) 237,000 m E, 6,088,570 m N, (zone 60, south). A 33 km by 3 km Cartesian grid was used at a resolution of 150 m.

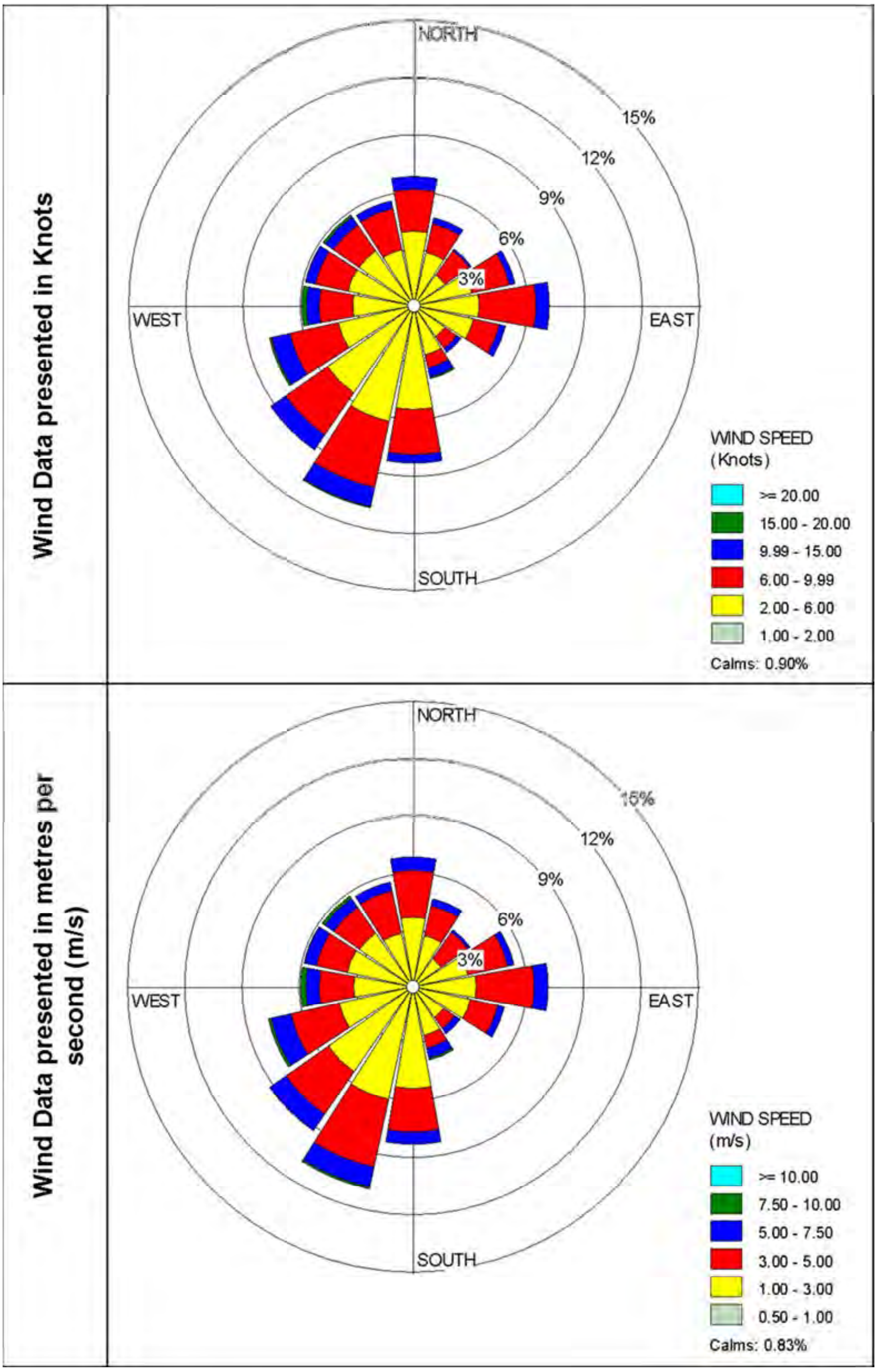
Geophysical (terrain and land use) data were input into the CALMET model at a resolution of 150m.

The surface elevation (terrain) data were taken from Lakes Environmental Software’s website (www.webGIS.com), which was based on the Shuttle Radar Topography Mission (SRTM-3) digital elevation model data (Version 2) originally produced by the National Aeronautics and Space Administration (NASA). The land use data was extracted from the Global Land Cover Characterization database

Wind speed and wind direction data from the Russell Automatic Weather Station (AWS) was input into the model. Figure 8 presents a windrose of the CALMET data extracted from the model at the location of the project site - the wind data is provided in both wind speed units of m/s and knots.

AECOM has reviewed the CALMET model outputs and considers that the meteorological data developed is appropriate for an assessment of this type, however due to the very sheltered nature of the location on-site winds are likely to be lower in strength than modelled with a higher frequency of winds from the east. Notwithstanding, there are enough low wind speed conditions in the meteorological dataset to provide a good indication of worst-case dispersive conditions.

Figure 8 CALMET Generated Wind Roses centred on the Project Site (2017)



7.5 Background Air Quality

AECOM has assumed that background solvent concentrations are zero given that there are no significant nearby sources of these compounds.

7.6 Model Assumptions

It has been assumed that antifouling and painting will occur between the hours of 8 am and 5 pm. The model has been configured to assess emissions between these hours for all the days in the 2017 CALMET dataset.

The 99.9%ile 1-hour average concentrations have been compared with the 1-hour average assessment criteria.

7.7 Antifouling Emissions

Antifouling paint is generally brushed onto vessels, however from time to time it is sprayed on. The amount used varies with the size of the vessel however it is generally applied up to a rate of 6.125 litres per hour, this includes the thinner which is mixed at up to 20% depending on how the antifouling is applied i.e. 5 L of antifouling to 1.125 L of thinner. The number of vessels painted with antifouling is approximately 40 to 50 per year. The boat yard currently uses either Altex or Awlcraft antifouling paint. These are copper and zinc (20-50% of the total paint component) in a solvent base.

The estimate of emissions has been based on the following conservative assumptions:

- That all of the volatile organics (VOC) will evaporate off from the product. This is a worst-case scenario as some of the compounds will bind with the copper/zinc solids.
- The maximum concentration of the VOCs listed in the Material Safety Datasheets (MSDS) has been used to estimate solvent concentrations.

Based on these assumptions the emissions presented in Table 5 have been used in this assessment. The effects from these emissions are assessed in Section 8.

Table 5 Antifouling Emissions

Manufacturer	Use	Compound	% of Total VOC	VOCs (g/L)	Maximum Paint Usage (L/hour)	Emission Rate (g/s)
Altex Coastal Copper Antifouling	Antifouling	n-butanol	20	251.5	4	0.056
Altex Coastal Copper Antifouling	Antifouling	xylene	20	251.5	4	0.056
Altex No.5 Antifouling	Antifouling	xylene	20	251.5	5	0.070
Altex No.5 Antifouling	Antifouling	n-butanol	20	251.5	5	0.070
Awlcraft Antifouling Blue	Antifouling	solvent naphtha (petroleum), light aromatic	25	348.0	5	0.121
Awlcraft Antifouling Blue	Antifouling	1,2,4-trimethylbenzene	10	348.0	5	0.048
Awlcraft Antifouling Blue	Antifouling	xylene	10	348.0	5	0.048
Awlcraft Antifouling Blue	Antifouling	1,3,5-trimethylbenzene	2.5	348.0	5	0.012
Awlcraft Antifouling Blue	Antifouling	ethyl Benzene	2.5	348.0	5	0.012
Altex Thinning Solvent #10	Thinner	xylene	80	869.4	1.125	0.217
Awlcraft International Thinner no. 3	Thinner	xylene	100	251.5	1.125	0.079
Awlcraft International Thinner no. 3	Thinner	ethyl Benzene	25	251.5	1.125	0.020

7.8 Painting Emissions

In addition to the application of antifouling, vessels are also painted with primers, undercoat and linear polyurethane and enamel top coat paints, typically manufactured by Altex. This occurs on average 4 times per year and approximately 6 to 7.5 Litres of paint is used per vessel. This equates to a maximum of 30 L of paint per year. The majority of these products are two pot mixtures containing a resin and a base, typically mixed at a ratio of 1:4.

The estimate of emissions has been based on the following conservative assumptions:

- That all of the solvent will evaporate off from the product. This is conservative as some of the compounds will bind with the solids in the paint. The only exception to this is for paints with an isocyanate component where, given the very low vapour pressure of isocyanate compounds the amount evaporated has been assumed to be negligible. Emissions of isocyanate compounds have instead been based on the proportion of overspray that is typically expected, which is 2%.
- The maximum concentration of the solvents listed (with the exception of isocyanates) in the MSDS has been used to estimate solvent concentrations.
- Some compounds identified in the MSDS have not been included in this assessment if they are expected to be bound to the painted surfaces or if they have very low vapour pressures i.e. they evaporate at a very slow rate that the above assumption that all of the VOC from the paint is discharged is overly conservative.

Based on these assumptions the emissions presented in Appendix B have been used in this assessment. The effects from these emissions are assessed in Section 8.

8.0 Atmospheric Dispersion Modelling Results – Antifouling and Paint Emissions

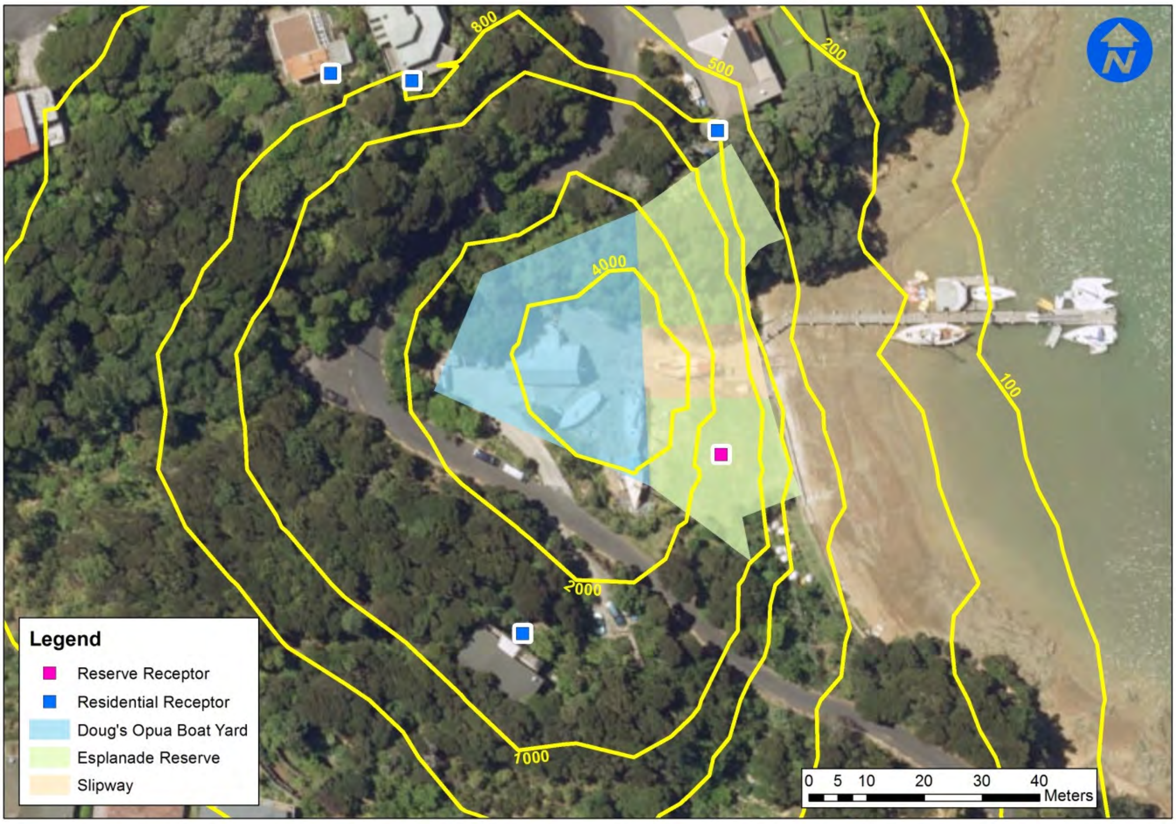
The predicted ground level ambient solvent concentrations are presented in Table 6. The predicted 99.9%ile concentrations of xylene, the solvent with the highest discharge rate, are presented as an isopleth plot in Figure 9.

Table 6 Predicted VOC Concentrations

Pollutant	Threshold Concentration (µg/m³)	99.9 % ile 1-hour Average Predicted Concentration (µg/m³)	
		Nearest Residence	Within the Reserve
1,2,4-trimethyl benzene	4,400	300	280
1,3,5-trimethylbenzene	4,400	75	70
2,4,6-tris[(dimethylamino)methyl]phenol	420	53	50
2,4-pentanedione	830	99	93
aspartic acid, N,N'-(methylenedicyclohexanediyl)bis-,ester	350	37	35
bis(1,2,2,6,6-pentamethyl-4-piperidyl)sebacate	100	3	3
C18 fatty acid dimers/ polyethylenepolyamine polyamides	1,000	52	49
diethyl fumarate	400	1	1
ethyl acetate	3,100	99	93
ethyl Benzene	2,000	122	114
ethyl-3-ethoxypropionate	270	99	93
ethylbenzene	2,000	106	99
hexamethylene diisocyanate	0.7	0.04	0.03
hexamethylene diisocyanate polymer	8.7	*8.7	*8.7
kerosene	1,000	101	94
methyl 1,2,2,6,6-pentamethyl-4-piperidyl sebacate	100	1	1
methyl ethyl ketone	18,000	405	378
methyl isobutyl ketone	820	166	155
naphtha petroleum, heavy, hydrodesulfurised	4,400	89	83
naphtha petroleum, light aromatic solvent	4,400	71	66
naphtha, petroleum, hydrodesulfurised heavy	3,500	202	188
n-butanol	610	434	405
n-butyl acetate	11,000	187	175
polyethylene glycol	1,000	1	1
propylene glycol monomethyl ether acetate, alpha-isome	2,700	535	500
propylene glycol monomethyl ether acetate, beta-isomer	280	0.3	0.3
solvent naphtha (petroleum), light aromatic	4,400	750	700
Tinuvin 1130	120	2	2
Tinuvin 213	120	4	4
toluene	37,000	81	76
xylene	22,000	1,350	1,260

*Guideline has the potential to be exceeded during certain wind conditions.

Figure 9 Predicted 99.9%ile 1-hour average xylene concentrations (µg/m³)



8.1 Summary of Atmospheric Dispersion Modelling Results

AECOM has assessed the potential effects from paint emissions and has found that the off-site concentrations, for the majority of the VOCs associated with the paints commonly used at the boat yard, are below the relevant health-effects based air quality assessment criteria. The only exception being that the guideline for hexamethylene isocyanate has the potential to be exceeded at off-site locations.

Hexamethylene isocyanate is primarily associated with the resin component for two types of paint; Altex Elite Pro-Spray Polyurethane and Altex Polyurethane Undercoat. The applicant has advised that these paint products are seldom used; typically up to three times a year for a period of two hours on a given day. To minimise any potential for off-site effects associated with the use of these products, AECOM considers that any resource consent should limit the use of these products during periods of time when the wind is blowing from the northern quadrant i.e. northwest through to northeast. Based on AECOM understanding of the local meteorology, winds from the north quadrant are relatively uncommon. This is due to a combination of the regional prevailing wind flows and the unique topography surrounding the site. It is therefore considered that this recommended resource consent condition would not significantly limit the ability of the applicant to undertake painting activities.

Providing that painting using hexamethylene isocyanate products is not undertaken during periods when the wind is blowing from the northern quadrant (northwest through to northeast), AECOM considers that there is limited potential for health-effects from boat yard activities to occur at the nearby residential receptor locations or the reserve to the south.

9.0 Conclusions

AECOM has assessed the potential effects associated with air discharges from activities at Doug's Opua Boat Yard. This included assessing the potential for dust nuisance from water blasting, sanding and grinding activities and VOC emissions from the application of antifouling and paints.

AECOM assessment concluded, based on an eight day particulate monitoring study, that there is unlikely to be any nuisance effects from water blasting, sanding or grinding activities.

To assess the potential effects from VOC emissions associated with the application of antifouling and paint, AECOM undertook an atmospheric dispersion modelling assessment using the model CALPUFF. As part of this assessment AECOM developed meteorology for the local environment that was incorporated into the computer model. The modelling assessment conservatively assumed that all of the VOC associated with the antifouling and paint are discharge to atmosphere and that painting occurred between 8 am and 5 pm for all the hours of the modelled year (2017) i.e. 3,285 hours in the year, this compares with the typical boat yard throughput which is in the order of 80 to a 100 hours of paint application per year.

The results of atmospheric dispersion modelling determined that VOC concentrations at nearby residences and at the reserve to the south, locations where it can be reasonable expected that people would be for significant periods of time, were typically below accepted international air quality assessment criteria designed to protect human health. Concentrations of hexamethylene isocyanate have the potential to exceed health-effect assessment criteria when the wind is blowing from the northern quadrant, therefore it is recommended that the use of paints containing this compound are limited during these periods of time.

Overall, AECOM considers that there is limited potential for VOC from the application of antifouling and painting to cause human health effects, particularly given the limited duration that this activity takes place.

10.0 Review of Proposed Resource Consent Conditions

AECOM has reviewed the resource consent conditions relating to air discharges recommended in the Northland Regional Council officer's report.

These are set out as follows and AECOM's comments are provided below each condition in bold text:

AUT.039650.13.01, AUT.039650.14.01 – Discharge Contaminants to Air in the Coastal

Marine Area and Discharge Contaminants to Air from Land

67 *The discharges to air authorised by these consents apply only to the Occupation Area and the Boat Yard Discharge area identified on the attached Northland Regional Council Plan Numbers 4801/2 and 4801/4* – See appendix C – Total Marine Discharge Boundary Plan 0155-0504-0007.

AECOM considers this condition to be appropriate.

68 *The preparation or smoothing of vessel hulls or superstructure including removal or smoothing of antifouling using electric sanders without an attached dust collection shall not be undertaken within the consent area.*

AECOM considers this condition to be appropriate.

69 *Electric sanding and spray coating operations shall be conducted with regard to wind direction and wind strength to prevent or minimise any adverse effects on the environment.*

Based on AECOM assessment it is considered that electric sanding, grinding and spray coating operations should only be undertaken over impermeable surfaces and when the wind speed is between 0.5 m/s and 5 m/s (as a 60 second average). An anemometer has recently been installed at the site which can be used by staff to identify whether the wind speed and direction is within the appropriate range to allow activities to be undertaken.

AECOM proposes the following alternative condition:

"Sanding and grinding operations shall only be conducted when the wind speed is between 0.5 m/s and 5 m/s (as a 60 second average)."

70 *The application of antifouling paint using spray application equipment shall not occur when the wind speed is below 0.5 m/s (as a 60 second average) or the wind direction (as a 60 second average) is blowing from between 45 degrees through to 170 degrees.*

AECOM considers that the application of antifouling and paint should only be undertaken when the wind speed is greater than 0.5 m/s and when the apparent winds on the slipway are from the northeast to south i.e. the wind is blowing up the slipway through and angle of 45 to 170 degrees. This opinion is based on the results of atmospheric dispersion modelling which indicates that winds from the northern quadrant (northwest through to the northeast) give rise to the highest off-site concentrations of paint solvents at the reserve location to the south (Refer to Appendix 3 Resource Consent Map, Section 3)

AECOM proposes the following alternative condition:

"The application of antifouling and paint should only be undertaken when the wind speed is greater than 0.5 m/s and when the apparent winds on the slipway are from the northeast to south i.e. the wind is blowing up the slipway through an angle of 45 to 170 degrees."

71 *All spray application of antifouling paint shall comply with Environmental Protection Agency rules including setting up of a controlled work area around the vessel concerned.*

AECOM considers this condition to be appropriate.

72 *Screens shall be erected around blasting areas during high pressure water blasting to mitigate effects of spray drift.*

AECOM's assessment has demonstrated that there is limited potential for dust nuisance from the water blasting of vessels and therefore for the purpose of controlling particulate emissions the screens are considered unnecessary. AECOM considers that providing the

water source is free of significant impurities, there is limited potential for effects from this activity.

In terms of controlling spray drift, the screens are unlikely to significantly improve fine spray from drifting off-site and are generally considered to be impractical, especially given the limited occurrence of this activity per year, which is typically no more than 50 hours.

AECOM proposes the following alternative condition:

"The water used for water blasting activities shall be tested on an annual basis and, provided it conforms to the New Zealand drinking water standards, screening of the water blasting areas shall not be necessary"

73 *All equipment used to avoid or mitigate any adverse effects on the environment from emissions to air shall be maintained in good working order.*

AECOM considers this condition to be appropriate.

74 *The Consent Holder's operations shall not give rise to any dust, overspray, or odour at or beyond the site boundary, which in the opinion of a Monitoring Officer of the council is offensive or objectionable.*

AECOM agrees with this condition, providing that the production of fine spray-droplets from water blasting activities are not considered by NRC to be offensive or objectionable. AECOM's air quality assessment has demonstrated that emissions from water blasting activities are unlikely to cause dust nuisance, providing that the water source is free of containments.

AECOM proposes the following advice note should be attached to the condition.

"Advice Note: Water vapour associated with water blasting activities at or beyond the site boundary is not considered to be offensive or objectionable."

75 *Dry abrasive blasting operations shall only be carried out when the object's size, shape or weight prevents it being practicably transported and blasted in an abrasive blasting booth for which appropriate resource consents are held.*

AECOM understands that dry abrasive blasting is no longer undertaken at the boat yard.

76 *All dry abrasive blasting shall be undertaken in a fully enclosed working area that is, where practicable, sealed and ventilated through an air cleaning system. Discharges from the air cleaning system shall be minimised as far as is practicable.*

AECOM understands that dry abrasive blasting is no longer undertaken at the boat yard.

77 *All abrasive used for abrasive blasting shall contain less than 2% by dry weight free silica.*

AECOM understands that dry abrasive blasting is no longer undertaken at the boat yard.

78 *The Consent Holder shall, on a daily basis, keep records of all occasions when abrasive blasting and spray coating activities are undertaken. These records shall be made available to the council's assigned monitoring officer on written request and shall include the:*

(a) Type and quantity of abrasive used;.

(b) Item(s) being blasted, and/or spray coated;

(c) Method of abrasive blasting used;

(d) Location at which abrasive blasting and/or spray coating occurred;

(e) Hours of operation each day;

(f) Number of blasting and/or spray coating units being used; and

[sic] 79 Types and volumes of coating materials being applied.

This condition is considered appropriate for painting activities, however as blasting is no longer undertaken on site the references to blasting should be removed.

AECOM proposes the following alternative condition:

"The Consent Holder shall, on a daily basis, keep records of all occasions when spray coating activities are undertaken. These records shall be made available to the council's assigned monitoring officer on written request and shall include the:

~~(a) Type and quantity of abrasive used;.~~

(a) Item(s) being ~~blasted, and/or~~ spray coated;

~~(c) Method of abrasive blasting used;~~

(b) Location at which ~~abrasive blasting and/or~~ spray coating occurred;

(c) Hours of operation each day; and,

~~(f) Number of blasting and/or spray coating units being used; and~~

(d)Types and volumes of coating materials being applied."

11.0 Limitations

AECOM New Zealand (AECOM) has prepared this Assessment of Effects report on discharges to air in accordance with the usual care and thoroughness of the consulting profession for Doug's Opua Boat Yard for use in a statutory process from the Auckland Council under the Resource Management Act 1991 for activities undertaken at 1 Richardson Street, Opua, Bay of Islands.

Except as specifically stated in this section, AECOM does not authorise the use of this Report by any third party except as provided for by the Resource Management Act 1991.

Nor does AECOM accept any liability for any loss, damage, cost or expenses suffered by any third party using this report for any purpose other than that stated above.

It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this Report.

It is prepared in accordance with the scope of work and for the purpose outlined in the contract dated June 2018.

Where this Report indicates that information has been provided to AECOM by third parties, AECOM has made no independent verification of this information except as expressly stated in this Report. AECOM assumes no liability for any inaccuracies in or omissions to that information.

This Report was prepared during June 2018 and is based on the conditions encountered and information reviewed at the time of preparation. AECOM disclaims responsibility for any changes that may have occurred after this time.

Appendix A

Particulate Monitoring Results

Figure 10 Particulate Monitoring Day 1 (12 June 2018) – Water blasting Scraping and Grinding

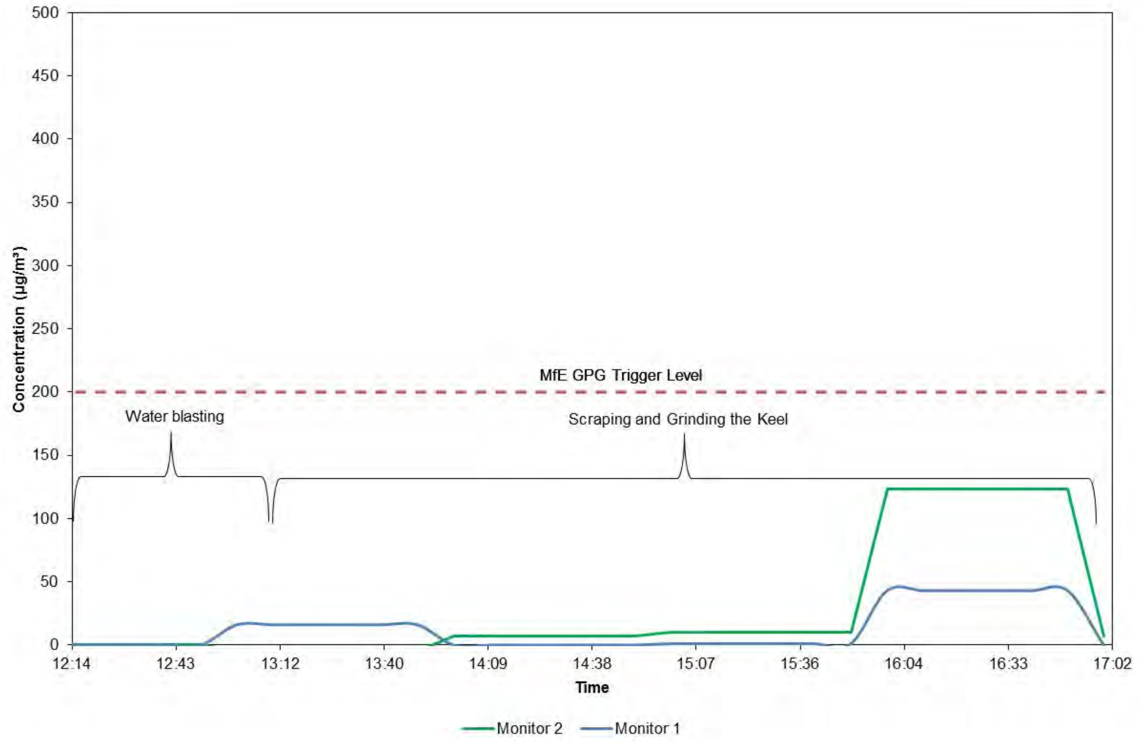


Figure 11 Particulate Monitoring Day 2 (13 June 2018) – Spray Painting Antifouling

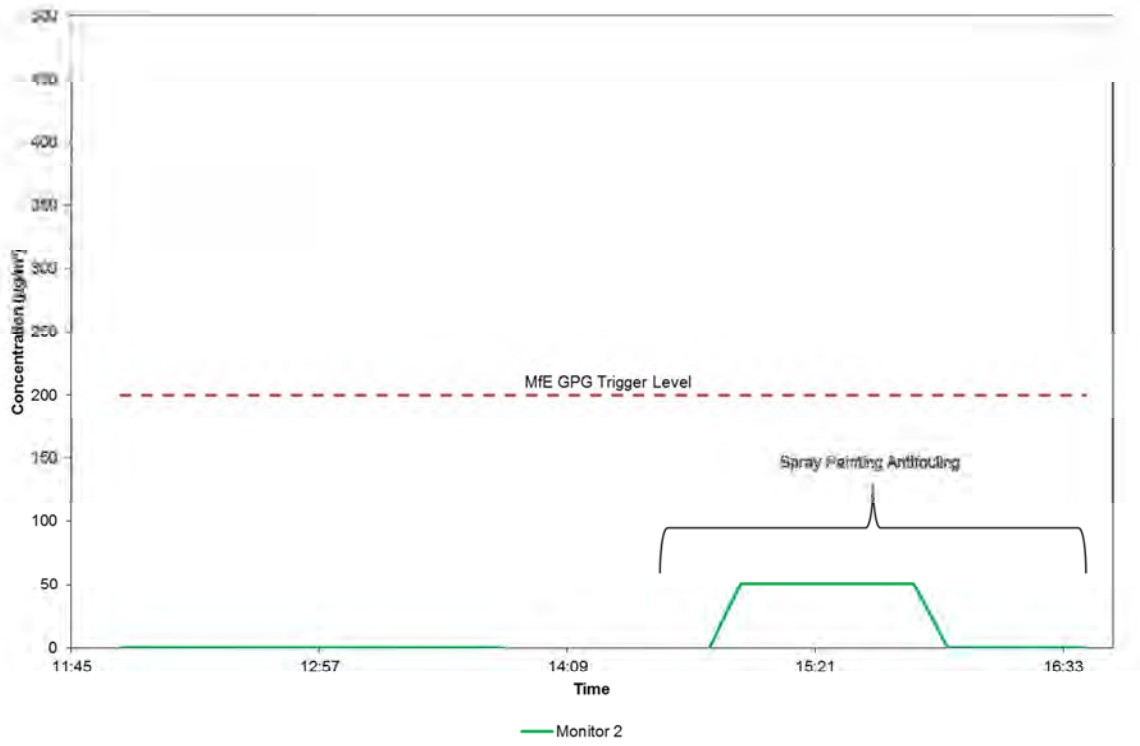


Figure 12 Particulate Monitoring Day 3 (14 June 2018) – Water blasting

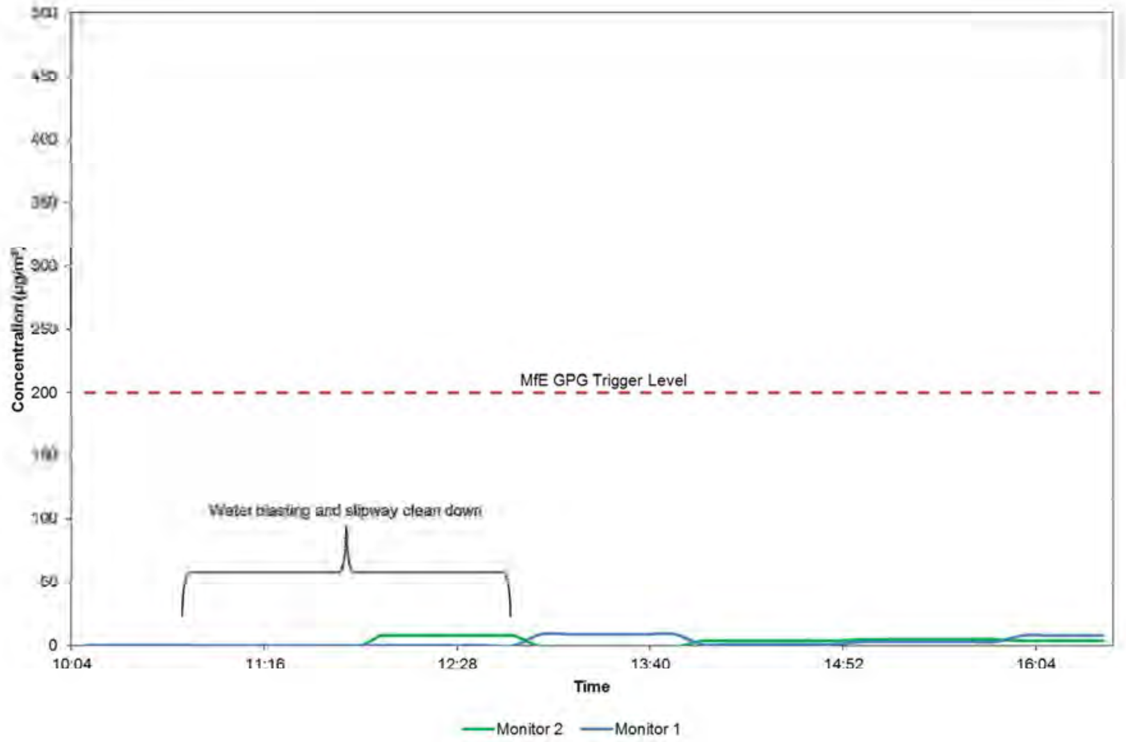


Figure 13 Particulate Monitoring Day 4 (15 June 2018) – Sanding and hand painting antifouling

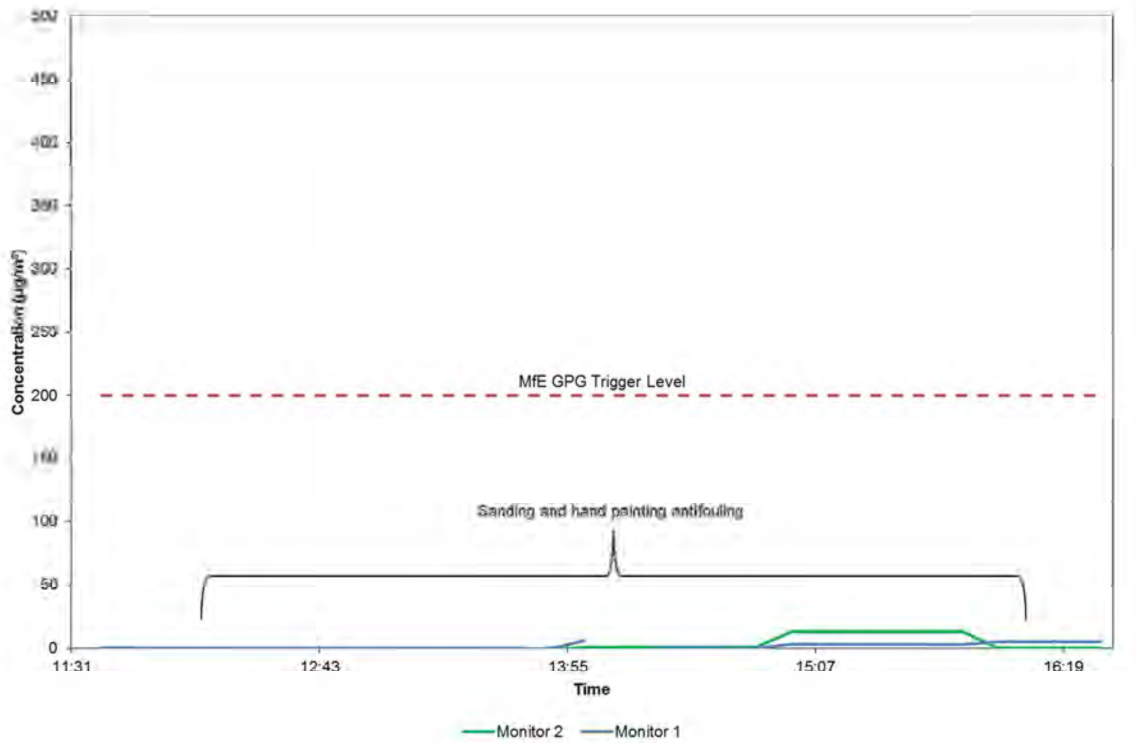


Figure 14 Particulate Monitoring Day 5 (16 June 2018) – Water blasting, antifouling and topside repairs

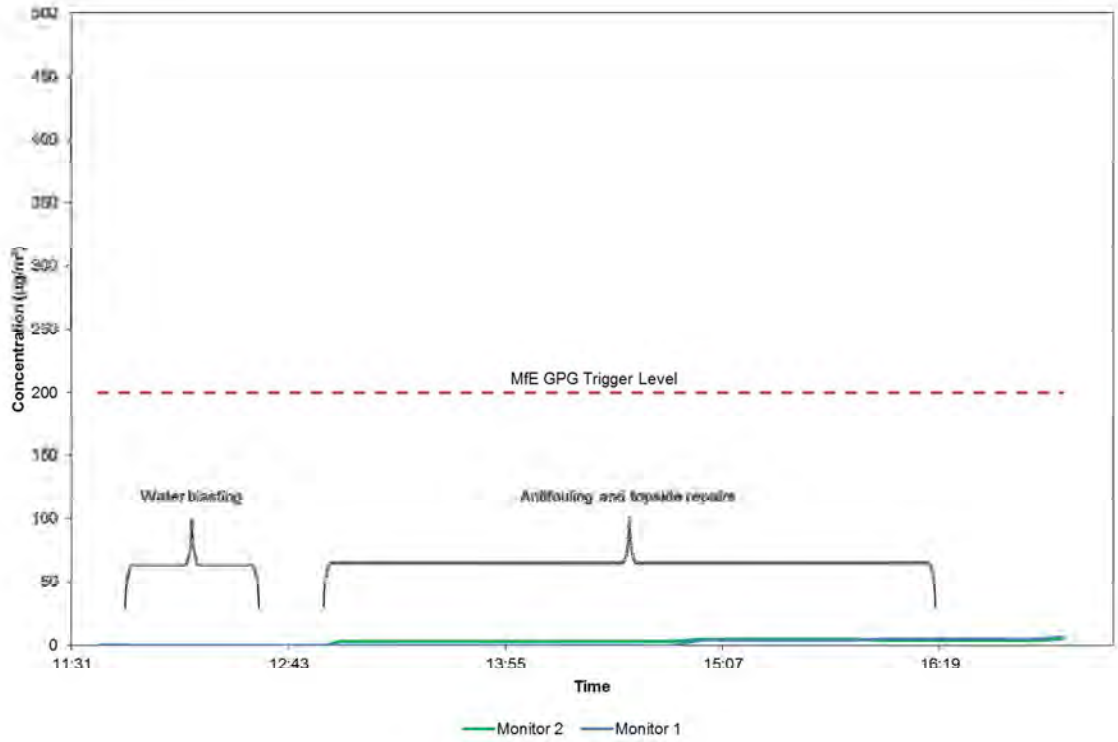


Figure 15 Particulate Monitoring Day 6 (17 June 2018) – Sanding and Polishing topsides

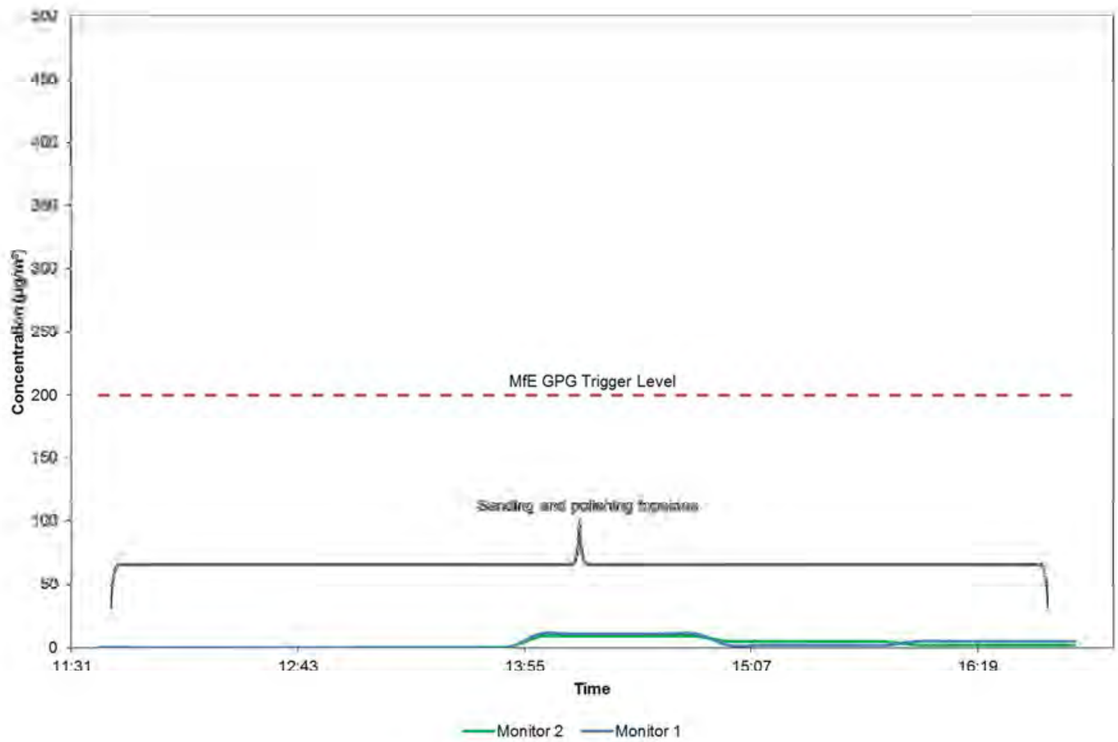


Figure 16 Particulate Monitoring Day 7 (18 June 2018) – Water blasting and cleaning

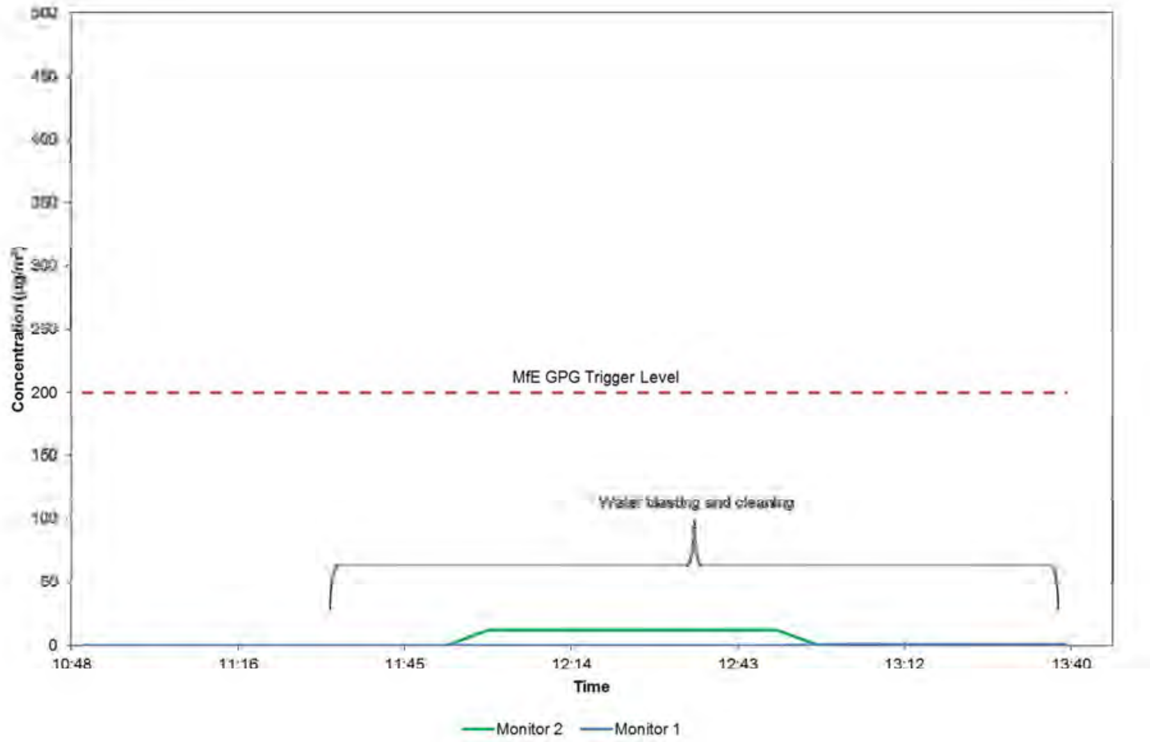
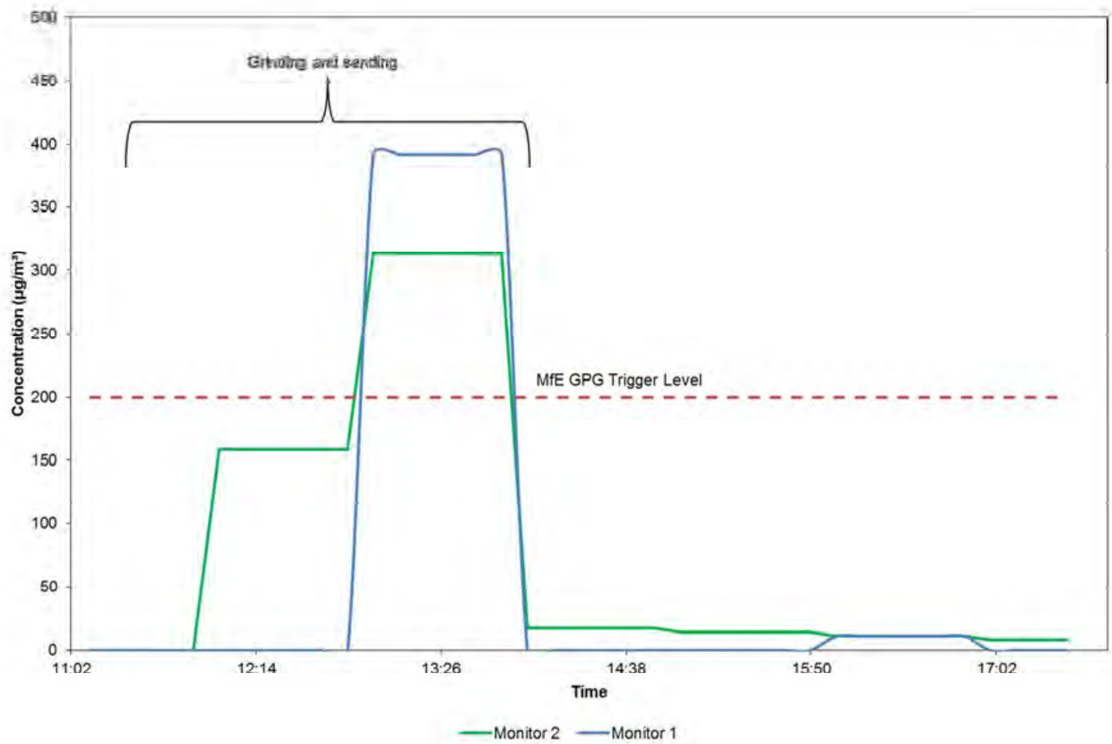


Figure 17 Particulate Monitoring Day 8 (19 June 2018) – Scraping and Grinding



Appendix B

Paint Emissions

Manufacturer	Use	Compound	% Weight	VOC Paint Density (g/L)	Maximum Paint Usage (L/hour)	Emission Rate (g/s)
Altex Epoxy Barrier Undercoat Part A	Undercoat	bisphenol A/ bisphenol A diglycidyl ether polym	20	250.07	2	0.028
Altex Epoxy Barrier Undercoat Part A	Undercoat	n-butanol	20	250.07	2	0.028
Altex Epoxy Barrier Undercoat Part A	Undercoat	xylene	20	250.07	2	0.028
Altex Epoxy Barrier Undercoat Part A	Undercoat	ethylbenzene	10	250.07	2	0.014
Altex Epoxy Barrier Undercoat Part B	Undercoat	xylene	70	616.9	0.5	0.060
Altex Epoxy Barrier Undercoat Part B	Undercoat	ethylbenzene	20	616.9	0.5	0.017
Altex Epoxy Barrier Undercoat Part B	Undercoat	2,4,6-tris[(dimethylamino)methyl]phenol	10	616.9	0.5	0.009
Altex Epoxy Barrier Undercoat Part B	Undercoat	n-butanol	10	616.9	0.5	0.009
Altex Polyurethane Undercoat Part A	Undercoat	2,4-pentanedione	10	287.49	2	0.016
Altex Polyurethane Undercoat Part A	Undercoat	ethyl acetate	10	287.49	2	0.016
Altex Polyurethane Undercoat Part A	Undercoat	ethyl-3-ethoxypropionate	10	287.49	2	0.016
Altex Polyurethane Undercoat Part A	Undercoat	methyl isobutyl ketone	10	287.49	2	0.016
Altex Polyurethane Undercoat Part A	Undercoat	n-butyl acetate	10	287.49	2	0.016
Altex Polyurethane Undercoat Part A	Undercoat	propylene glycol monomethyl ether acetate, alpha-isome	10	287.49	2	0.016
Altex Polyurethane Undercoat Part A	Undercoat	xylene	10	287.49	2	0.016
Altex Polyurethane Undercoat Part B	Undercoat	propylene glycol monomethyl ether acetate, alpha-isome	60	1034.62	0.5	0.086
Altex Polyurethane Undercoat Part B	Undercoat	naphtha petroleum, heavy, hydrodesulfurised	10	1034.62	0.5	0.014
Altex Polyurethane Undercoat Part B	Undercoat	n-butyl acetate	10	1034.62	0.5	0.014
Altex Polyurethane Undercoat Part B	Undercoat	hexamethylene diisocyanate polymer	50	1034.62	0.5	0.001*Based on 2% overspray
Altex Polyurethane Undercoat Part B	Undercoat	hexamethylene diisocyanate	0.2	1034.62	0.5	0.0001*Based on 2% overspray
Altex Surfacer Undercoat	Undercoat	kerosene	10	205.35	2	0.011

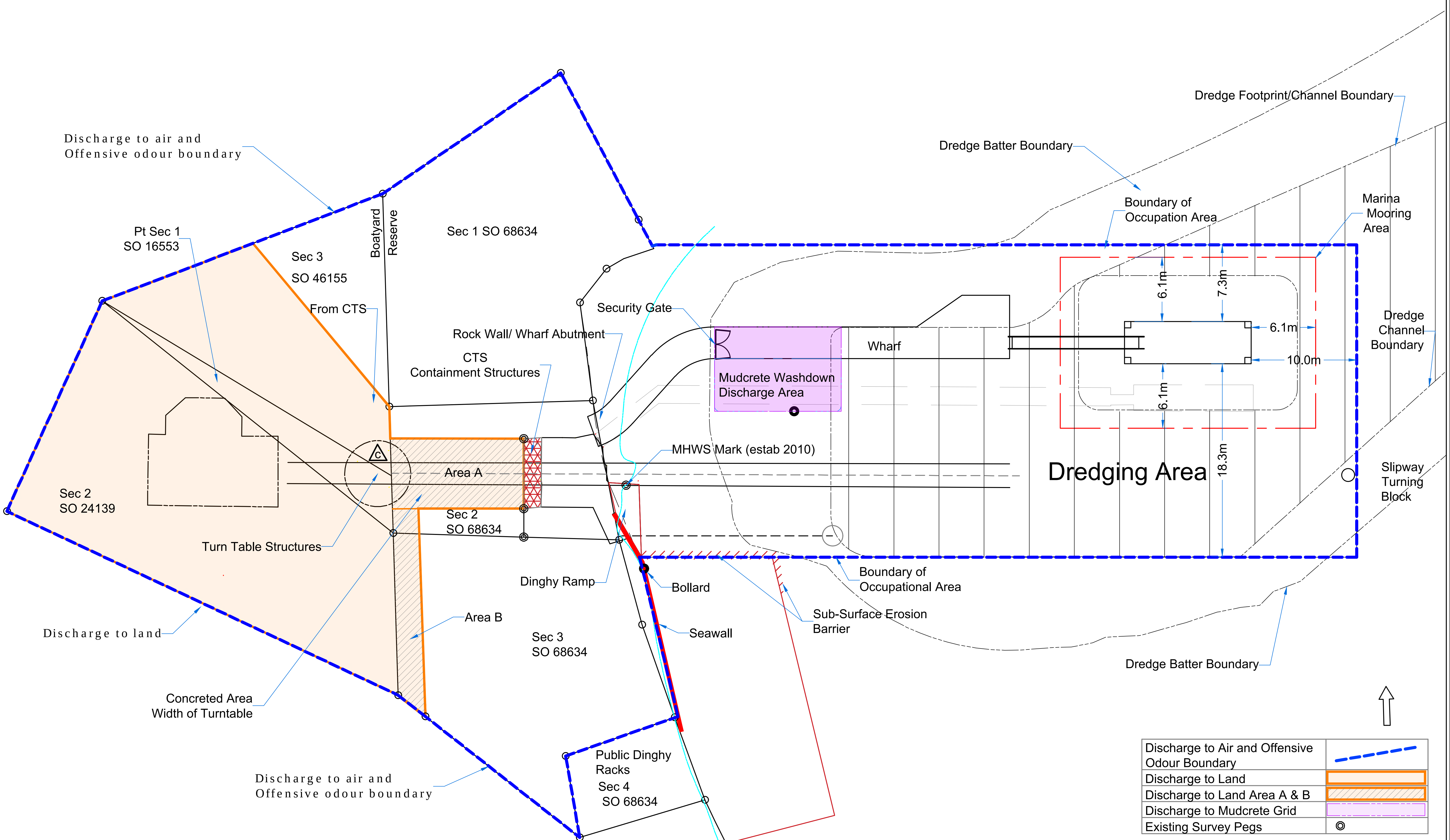
Manufacturer	Use	Compound	% Weight	VOC Paint Density (g/L)	Maximum Paint Usage (L/hour)	Emission Rate (g/s)
Altex Surfacer Undercoat	Undercoat	naphtha petroleum, light aromatic solvent	10	205.35	2	0.011
Altex Surfacer Undercoat	Undercoat	naphtha, petroleum, hydrodesulfurised heavy	10	205.35	2	0.011
Altex Surfacer Undercoat	Undercoat	xylene	10	205.35	2	0.011
Altex Epoxy Primer Part A	Primer	bisphenol A/ bisphenol A diglycidyl ether polymer	30	240	2	0.040
Altex Epoxy Primer Part A	Primer	methyl isobutyl ketone	20	240	2	0.027
Altex Epoxy Primer Part A	Primer	zinc phosphate	20	240	2	0.027
Altex Epoxy Primer Part A	Primer	n-butanol	10	240	2	0.013
Altex Epoxy Primer Part A	Primer	xylene	10	240	2	0.013
Altex Epoxy Primer Part A	Primer	ethylbenzene	5	240	2	0.007
Altex Epoxy Primer Part A	Primer	propylene glycol monomethyl ether acetate, alpha-isome	1	240	2	0.001
Altex Epoxy Primer Part B	Primer	xylene	30	302.28	0.5	0.013
Altex Epoxy Primer Part B	Primer	n-butanol	10	302.28	0.5	0.004
Altex Epoxy Primer Part B	Primer	C18 fatty acid dimers/ polyethylenepolyamine polyamides	20	302.28	0	0.000
Altex Multi Purpose Primer	Primer	1,2,4-trimethyl benzene	20	262.22	2	0.029
Altex Multi Purpose Primer	Primer	solvent naphtha (petroleum), light aromatic	10	262.22	2	0.015
Altex Multi Purpose Primer	Primer	xylene	10	262.22	2	0.015
Altex Multi Purpose Primer	Primer	ethylbenzene	5	262.22	2	0.007
Altex Multi Purpose Primer	Primer	naphtha petroleum, heavy, hydrodesulfurised	1	262.22	2	0.001
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	titanium dioxide	29.12	291.36	2	0.047
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	n-butyl acetate	18.65	291.36	2	0.030
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	propylene glycol monomethyl	7.67	291.36	2	0.012

Manufacturer	Use	Compound	% Weight	VOC Paint Density (g/L)	Maximum Paint Usage (L/hour)	Emission Rate (g/s)
		ether acetate, alpha-isomer				
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	silica amorphous	4	291.36	2	0.006
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	aspartic acid, N,N'-(methylenedicyclohexanediyl)bis-,ester	3.72	291.36	2	0.006
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	xylene	3.52	291.36	2	0.006
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	aluminium hydroxide	3.28	291.36	2	0.005
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	2,4-pentanedione	1.4	291.36	2	0.002
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	ethylbenzene	0.88	291.36	2	0.001
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	Tinuvin 213	0.42	291.36	2	0.001
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	bis(1,2,2,6,6-pentamethyl-4-piperidyl)sebacate	0.28	291.36	2	0.000
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	quaternium 18-hectorite	0.2	291.36	2	0.000
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	Tinuvin 1130	0.18	291.36	2	0.000
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	methyl 1,2,2,6,6-pentamethyl-4-piperidyl sebacate	0.12	291.36	2	0.000
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	polyethylene glycol	0.09	291.36	2	0.000
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	diethyl fumarate	0.08	291.36	2	0.000
Altex Elite Pro~Spray Polyurethane Part A	Polyurethane	propylene glycol monomethyl ether acetate, beta-isomer	0.03	291.36	2	0.000
Altex Elite Pro~Spray Polyurethane Part B	Polyurethane	hexamethylene diisocyanate polymer	40	939.37	0.5	0.001*Based on 2% overspray
Altex Elite Pro~Spray Polyurethane Part B	Polyurethane	methyl ethyl ketone	50	939.37	0.5	0.065
Altex Elite Pro~Spray Polyurethane Part B	Polyurethane	hexamethylene diisocyanate	0.1	939.37	0.5	0.0001 *Based on 2% overspray
Altex Elite Pro~Spray Polyurethane Part B	Polyurethane	propylene glycol monomethyl ether acetate, alpha-isomer	20	939.37	0.5	0.026
Altex Elite Pro~Spray Polyurethane Part B	Polyurethane	ethyl acetate	10	939.37	0.5	0.013
Altex Elite Pro~Spray Polyurethane Part B	Polyurethane	toluene	10	939.37	0.5	0.013

Manufacturer	Use	Compound	% Weight	VOC Paint Density (g/L)	Maximum Paint Usage (L/hour)	Emission Rate (g/s)
Altex Regatta Gloss Enamel	Enamel	naphtha, petroleum, hydrodesulfurised heavy	20	292.73	2	0.033
Altex Regatta Gloss Enamel	Enamel	kerosene	10	292.73	2	0.016
Altex Regatta Gloss Enamel	Enamel	xylene	10	292.73	2	0.016

Appendix C

Site Discharge Boundary Plan



Legend	
Discharge to Air and Offensive Odour Boundary	
Discharge to Land	
Discharge to Land Area A & B	
Discharge to Mudcrete Grid	
Existing Survey Pegs	

Rev	Date	Description	Checked	Approved
2	04/05/2018	ADDED SHEETS 6 & 7	CC	AJ
3	09/05/2018	UPDATE DREDGING & MOORING MANAGEMENT PLAN	CC	AJ
4	18/05/2018	UPDATED DREDGING & BACKGROUND IMAGE	CC	AJ
5	13/07/2018	VARIOUS MINOR CHANGES	CC	AJ

Drawing No:	0155-0504-0005	Scale:	1:250
		Client:	Doug's Opua Boatyard
Date:	13/07/2018	Drawn by:	Craig Cave

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APP-039650-01-01

Structural Site Boundary Details