Marsden Point Refinery: **A Resource Consent Application to Renew 20 Resource Consents from the Northland Regional Council**

Prepared for: **ChanceryGreen on behalf of The New Zealand Refining Company Limited, trading as 'Refining NZ'**

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Volume 1: Assessment of Environmental Effects Report

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GLOSSARY

Abbreviation or Phrase	Term
µg/m³	Micrograms per cubic metre
%	Percent
AAGL	Ambient Air Quality Guideline
AAQG	National Ambient Air Quality Guidelines 2002
ACM	Asbestos containing materials
AEE	Assessment of Environmental Effects
Anthropogenic	Caused or influenced by humans
ANZECC	Australian and New Zealand Environment and Conservation Council
ANZ	Australia and New Zealand
AOC	Accidentally Oil Contaminated System
BCF	Bioaccumulation Concentration Factor
BHCT	Bream Heads Conservation Trust
Bird	Avifauna
BOD	Biochemical oxygen demand
Boffa Miskell	Boffa Miskell Limited
Brown NZ	Brown NZ Limited
BTEX	Benzene/toluene/ethylbenzene/xylene
Cawthron	Cawthron Institute Limited
Celsius	°C
CCR	Continuous Catalyst Reforming
CD	Chart Datum
CEA	Cultural Effects Assessment
CMA	Coastal Marine Area
CO	Carbon Monoxide
COC	Continuously Oil Contaminated System
CPB	Cocoamido Propyl Betaine
CSP	Crude Shipping Project
D	Day limit
DGVs	Default Guideline Values
DIPA	Diisopropanolamine
Disposal Area 1.2	A 2.5 km^2 area of seabed situated on the southern end of the ebb tidal delta in water depth of between 7.0m and 15m Chart Datum.
Disposal Area 3.2	A 5.75 km^2 area of seabed situated in deep water that is around 45m below Chart Datum to the southeast of the channel.
DO	Dissolved oxygen
DoC	The Department of Conservation
EIANZ	Ecological Impact Assessment Guidelines for New Zealand
Environmental Medicine	Environmental Medicine Limited
EOCs	Emerging organic contaminants
ETS	Emissions Trading Scheme
FC	Faecal coliforms
GIS	Geographic Information System(s)
GLCs	Ground level concentrations
GME	Groundwater monitoring events
Greenaway & Associates	Greenaway & Associates Limited
Ha	Hectares
Harakeke	Prepared flax fibres
HNC	High Natural Character

IAQM	Institute of Air Quality Management
IMP	Iwi Management Plan
Intertidal area	Being the areas situated between the high and low tide marks
Jetties (Jetty 1, Jetty 2, Jetty 3).	The port facility associated with the Refinery has three jetties for berthing crude oil and 'product ships'. The three jetties are connected to the shoreline by one central arm that branches into two central jetties that are approximately 300m apart, known as Jetty 1 and Jetty 2. Both jetties consist of a concrete platform that is 25m in length and 5.6m above Mean Low Water Springs, which supports the hose gantry and other ancillary equipment. A third, smaller jetty (known as Jetty 3) was commissioned in 2009 and extends to the west from Jetty 2, which has a 5.8 m long concrete platform that supports a pipe manifold arrangement and other ancillary equipment
Kaimoana	Seafood, shellfish
Kaitiaki	Guardian, trustee, minder, caregiver, keeper, steward
kg/ha/yr	kilograms per hectare per year
Km	Kilometres
km^2	Square Kilometres
kW	Kilowatt
L	Litres
L/s	Litres per second
landfarms	Sludge fields that contain sludge generated at the Refinery
LNAPL	Light non-aqueous phase liquid
M	Metres
m^3	Cubic Metres
m^3/yr	Cubic metres per year
m/s	Metres per second
M1MA	Marine 1 (Protection) Management Area
M2MA	Marine 2 (Conservation) Management Area
M5MA	Marine 5 (Port Facilities) Management Area
MACA Act	Marine and Coastal Area (Takutai Moana) Act 2011
Mana moana	Authority over the sea and lakes
Manuhiri	Visitor or guest
Mauri	Life force, life principle, vital essence, special nature, a material symbol of a life principle, source of emotions – the essential quality and vitality of a being entity. Also used for a physical object, individual, ecosystem or social group in which this essence is located
MetOcean	MetOcean Services Limited
MfE	Ministry for the Environment
mg/L	Milligram per litre
MHWS	Mean High Water Springs
Mm	millimetres
mm/hr	millimetres per hour
MMDP	Mangakahio Māori Development Plan
MMH	Marsden Maritime Holdings
MOU	Memorandum of Understanding
MPLC	Marsden Point Liaison Committee
MRAC	Marine Reserve Advisory Committee
MW	Megawatt
Navaids	Navigational Aids
NDHB	Northland District Health Board
NESAQ	National Environmental Standard for Air Quality
NESHDW	National Environmental Standard for Sources of Human Drinking Water
Ngātiwai IHSEMP	Draft Ngātiwai Iwi Hapū Strategic and Environmental Management Plan
NH_4-N	Ammoniacal-nitrogen
NIEP	Ngātiwai Iwi Environmental Policy 2015

NIWA	National Institute of Water and Atmospheric Research
NO_2	Nitrogen Dioxide
NO_X	Nitrogen Oxides
Nohoanga	Seasonal occupation sites, places where food is gathered
Northport	Northport Limited
NPK	Nitrate – phosphorus – potassium
NPS	National Policy Statement
NPSFM	The National Policy Statement for Freshwater Management 2014 – Updated on the 7th of September 2017
NRC	Northland Regional Council
NTB	Ngātiwai Trust Board
NZCPS	New Zealand Coastal Policy Statement 2010
NZIER	New Zealand Institute of Economic Research
NZTA	New Zealand Transport Agency
oAQP	operative Regional Air Quality Plan for Northland – 22nd of November 2008
OEHHA	Office of Environmental Health Hazard Assessment
ONC	Outstanding Natural Character
ONL	Outstanding Natural Landscape
oRCP	operative Regional Coastal Plan for Northland – 2nd of February 2016
oRPS	operative Northland Regional Policy Statement – 14th of June 2018
oWDP	operative Whangārei District Plan
oWSP	operative Regional Water and Soil Plan for Northland – 15th of July 2014
PAHs	Polycyclic aromatic hydrocarbons
Patuharakeke	Patuharakeke Te Iwi Trust Board
PCBs	Polychlorinated biphenyls
PCE	Tetrachloroethene also known as perchloroethylene or perchloroethene
PCSA	Pakikaikutu Coastal Statutory Area
PFAS	Per- and polyfluoroalkyl substances
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonate
PFHxS	Perfluorohexanesulfonic acid
PHEMP	Patuharakeke Hapū Environmental Management Plan
pg/m	Picograms per cubic metre
pH	Potential for hydrogen
PM_{10}	Particulate Matter 10 micrometres or less in diameter
$PM_{2.5}$	Fine Particulate Matter 2.5 micrometres or less in diameter
pRP	Proposed Regional Plan for Northland (Decisions version June 2020)
PTB	Patuharakeke Te Iwi Trust Board
RAP	Refinery to Auckland Pipeline
RCAs	Resource Consent Applications
Refining NZ	New Zealand Refining Company Limited
Regional Council	Northland Regional Council
RNZ	New Zealand Refining Company Limited
rohe moana	Authority over the sea
RPS	The Northland Regional Policy Statement
RRRA	Ruakaka Residents and Ratepayers Association
RSKSE	Relative Risk Seasonal Kendall Slope Estimate- index of relative rate of change. A positive RSKSE value indicates an overall increasing trend, while a negative RSKSE value indicates an overall decreasing trend
Ryder	Ryder Consulting Limited
SGV	Soil guideline values- generic assessment criteria for assessing the risks to human health from chronic exposure to soil contaminated with phenol
Shoal	Waves becoming steeper
SO_2	Sulphur dioxide

SoE	State of the Environment
SNAs	Significant Natural Areas
Statutory Acknowledgements	A statutory acknowledgement is an acknowledgement by the Crown that recognises the mana of a tangata whenua group in relation to specified areas - particularly the cultural, spiritual, historical and traditional associations with an area. These acknowledgements relate to 'statutory areas ' which include areas of land, geographic features, lakes, rivers, wetlands and coastal marine areas, but are only given over Crown-owned land
Streamlined Environmental	Streamlined Environmental Limited
SWB	Stormwater Storage Basin
SWQG	Surface water quality guidelines
T&T	Tonkin and Taylor Limited
Taonga	Treasures, anything prized. Applied to anything considered to be of value including socially or culturally valued objects, resources, phenomenon, ideas and techniques
Te Mahi Hou project	Since the 1980s there has been a programme of upgrades and maintenance works across the Refinery and in 2012 an expansion of petrol-making facilities commenced
The Act	Resource Management Act 1991
The Applicant	New Zealand Refining Company Limited
The Company	New Zealand Refining Company Limited
The Expansion	in the mid-1980s, the Refinery underwent a major expansion
The 'FIDOL' factors'	The potential for offensive or objectionable odour effects can be objectively assessed by considering the FIDOL factors (frequency, intensity, duration, offensiveness/character and location) for locations where odour may be observed
The Harbour	Whangārei Harbour
The Landscape Assessment	Landscape Assessment prepared by Brown NZ Limited
The Plant	The Ruakaka Wastewater Treatment Plant
The Proposal	Resource consent is sought from the NRC for the continued existence (only in respect of those structures within the CMA), maintenance and operation (in terms of discharges) of the Refinery. Resource consents are also sought for some of the recurrent maintenance activities. Together these activities form what we refer to as 'the Proposal' through this AEE The key activities and structures that form part of the Proposal are: 1. The continued existence of three jetty structures (and several associated mooring dolphins and breasting's) located within the CMA; 2. A series of discharges to the air from the continued operation of the Refinery; 3. A series of discharges to land, in a manner where contaminants may enter groundwater; 4. A series of discharges to coastal waters, both directly from the Refinery and indirectly via groundwater entry into Bream Bay and the Whangārei Harbour; and 5. The abstraction of water from the groundwater reservoir that sits below the Refinery
The Refinery	The Marsden Point Refinery
The RMA	The Resource Management Act 1991
The Site	The area where the Refinery exists which is at Marsden Point, at the entrance to the Whangārei Harbour, approximately 16 km southeast of Whangārei City. The Refinery which is located within the CMA extends across a 119-ha site that is bounded to the west by Port Marsden Highway and Mair Road, to the north by Ralph Trimmer Drive and the Whangārei Harbour, and to the east and south by Bream Bay. The physical address of the Site is 12 Ralph Trimmer

	Drive, Marsden Point and the legal description is SECTION 10 BLK VIII RUAKAKA SD (Title identifier NA70A/371)
TOC	Total organic carbon
TPH	Total petroleum hydrocarbon
TSP	Total Suspended Particulate Matter
TSSs	Total suspended solids
VOCs	Volatile organic compounds
Wāhi Tapu	Sacred place, sacred site. A place subject to long-term ritual restrictions on access or use
WDC	Whangārei District Council
WHCA	Whangārei Heads Citizens Association
WHO	World Health Organisation
Wildlands	Wildlands Consultants Limited
WRMP	Whatitiri Resource Management Plan
WRMU	Whatitiri Resource Management Unit

1.0 INTRODUCTION

This Assessment of Effects report ('**AEE**') has been prepared to support a series of resource consent applications ('**RCAs**'). These RCAs are lodged by The New Zealand Refining Company Limited trading as Refining NZ (hereafter referred to as either '**RNZ**', '**Refining NZ**' or '**the Company**').

1.1 Report Contents

Section 1 introduces the Proposal, the Applicant and summarises the resource consents required and those aspects of the Refinery's operations that can be undertaken as a permitted activity. In addition, Section 1 also sets out the term sought for the resource consents, the proposed lapsing date of the same and discusses 'the permitted baseline'. A summary of the technical investigations that have been undertaken is also provided.

Section 2 sets out the existing environment, including the Site, its locality and context, and the existing activities undertaken on the Site.

Section 3 sets out the detail of the Proposal, including the measures proposed to avoid, remedy or mitigate adverse environmental effects, and the proposed monitoring programmes. The assessment of alternative options undertaken by Refining NZ is also discussed.

An assessment of the actual and potential environmental effects is provided in **Section 4**.

Section 5 discusses the consultation undertaken by Refining NZ and sets out the feedback that was provided, and any responses to that feedback, including listing the written approvals that have been obtained from potentially affected parties.

An assessment against the relevant planning instruments and sections of the Resource Management Act 1991 ('**the Act**' or '**the RMA**') is provided within **Section 6**.

Section 7 provides a conclusion for this AEE.

1.2 The Applicant & the Marsden Point Refinery

Refining NZ owns and operates New Zealand's only oil refinery (**'the Refinery'**) located at Marsden Point near Whangārei and the purpose-built 170-kilometre (**'km'**) 'Refinery to Auckland Pipeline' (known as the **'RAP'**). The RAP is the principal means of transporting bulk fuel from Marsden Point to Wiri in South Auckland with a throughput that is typically around 380,000 litres per hour (380,000 '**L/hr**').

The plant was commissioned in 1964 and operates 24 hours a day, seven days a week, 365 days a year processing a wide range of crude oil varieties to produce premium and regular petrol, diesel, jet fuel, fuel oil, roading bitumen and sulphur. In total, approximately 70 percent ('**%**') of the country's total fuel requirements are met by Refining NZ with the remainder imported as finished fuel products by its customers.

Refining NZ is a toll refiner, which means it processes crude oil for its customer and this crude oil is sourced by Refining NZ's customers from a number of different locations and suppliers and is delivered to the Refinery via ship. The Refinery has a crude oil capacity of 135,000 barrels per day, and is the leading supplier of refined petroleum products to the New Zealand market, producing for our nation, sulphur for farm fertilizer, carbon dioxide for the carbonated drinks industry; and around:

- 85% of jet fuel;
- 67% of diesel;
- 58% of all petrol;
- 75% - 85% of bitumen for roading; and
- 100% of fuel oil for ships.

The ultimate objective of refining is to convert crude oil into these various products cheaply and efficiently, while generating the minimum possible adverse impacts on the environment. While approximately 52% of all refined product leaves the Refinery via the RAP, a considerable portion (some 40%) is transported to other domestic centres by coastal tankers.

Refining NZ is an NZX top 50 listed company with around 5000 private and corporate investors. As well as being the Company's largest customers, ExxonMobil, Z Energy and BP are significant shareholders in Refining NZ. Other shareholders include a mix of both corporate and private investors. Refining NZ is also a significant contributor to both the local and national economies, employing around 390 staff, with an extended team of approximately 265 local contractors (significantly more during plant shutdowns).

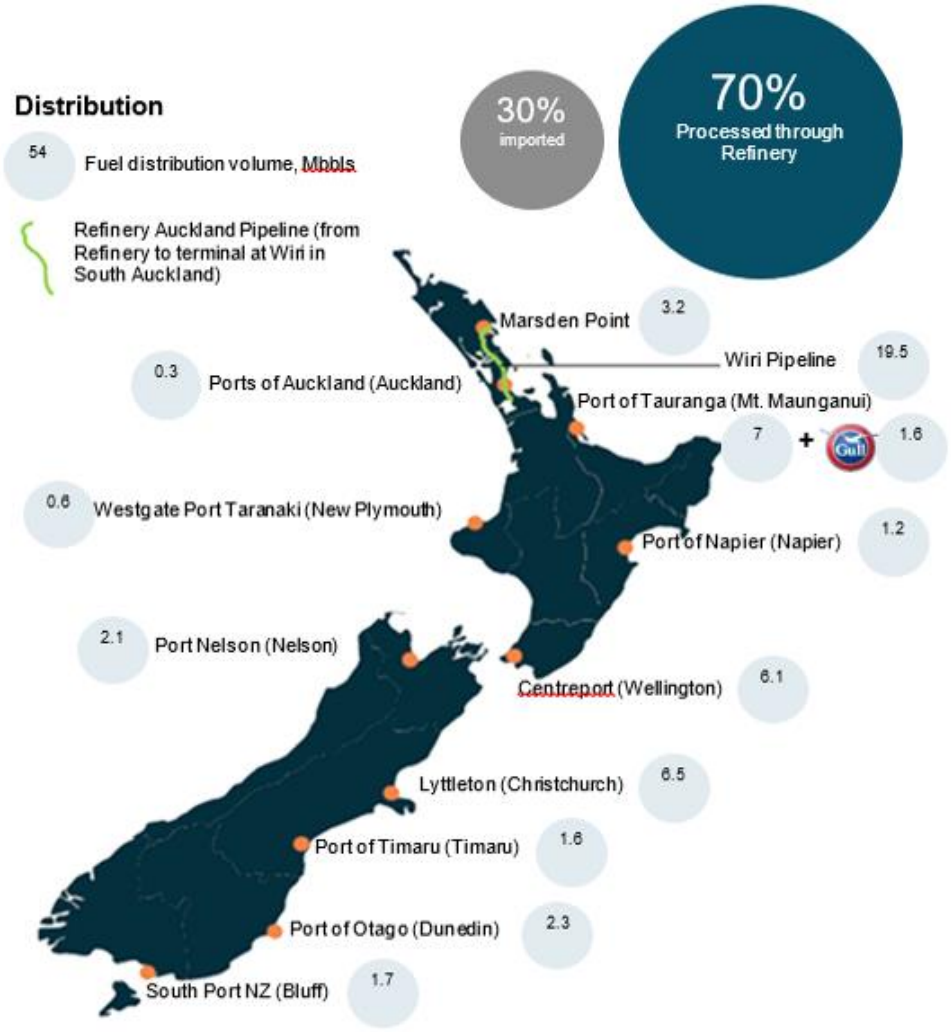


Figure 1.2.1: *National Distribution of Refined Fuels from Refining NZ*

Refining NZ's assets currently exceed $1 billion with three-quarters of that value in refinery plant and equipment, which would face substantial value drop if it were not able to operate as a refinery. The national economy and the Auckland/Northland/Waikato regions are all heavily dependent on the continuous operation of the Refinery and the RAP as they are responsible for approximately 97% of the Auckland region's road transport and aviation fuel needs. It is notable, for instance, that the Auckland International Airport is totally dependent on the Refinery and the RAP for supply of its aviation fuels. As we saw in September 2017 when the RAP was taken out of commission for 10 days, any significant outage to the RAP or the Refinery has the potential to result in severe restrictions on fuel supplies to the airport and the Auckland region. Mr Peter Clough of the New Zealand Institute of Economic Research (**'NZIER'**) has prepared an economic assessment for the Proposal, a full copy of his assessment is attached within **Annexure 3** to this AEE[1]. Mr Clough considers the significance of the Refinery for the Northland economy could be even stronger under the post-Covid recovery period as other businesses shed jobs or face closure[2].

1.3 The Site

Refining NZ's operations take place within the coastal environment. The wider Whangārei Harbour (or the '**Harbour**') and Bream Bay area have important ecological, cultural, and recreational values (among other values). In terms of the surrounding environment, Marsden Bay and One Tree Point enclose the shoreline to the west of the Refinery. To the east, runs the extensive shoreline of Bream Bay. Opposite the Site are a number of bays, including, from the entrance of the channel, Urquharts Bay, Mckenzie Bay, Taurikura Bay, McGregors Bay (which contains High Island), Little Munro Bay, Reotahi Bay (which contains Motukaroro Island), McLeod Bay, the Nook and Parua Bay. These bays are to the north of the Refinery. A number of small settlements are located within each of these bays, with views extending towards the Refinery, or towards Home Point and the channel entrance. Some of the defining bays, points, banks, headlands and other key geographic features in relation to the Site are reflected in **Figure 1.3.1** below.

[1] Clough, P. NZIER, *The Value of Consent Renewal- Economic Assessment of Reconsenting Discharges and Structures at the Marsden Point Refinery*. Dated July 2020

[2] Clough, P. NZIER, *The Value of Consent Renewal- Economic Assessment of Reconsenting Discharges and Structures at the Marsden Point Refinery*. Dated July 2020, page 23

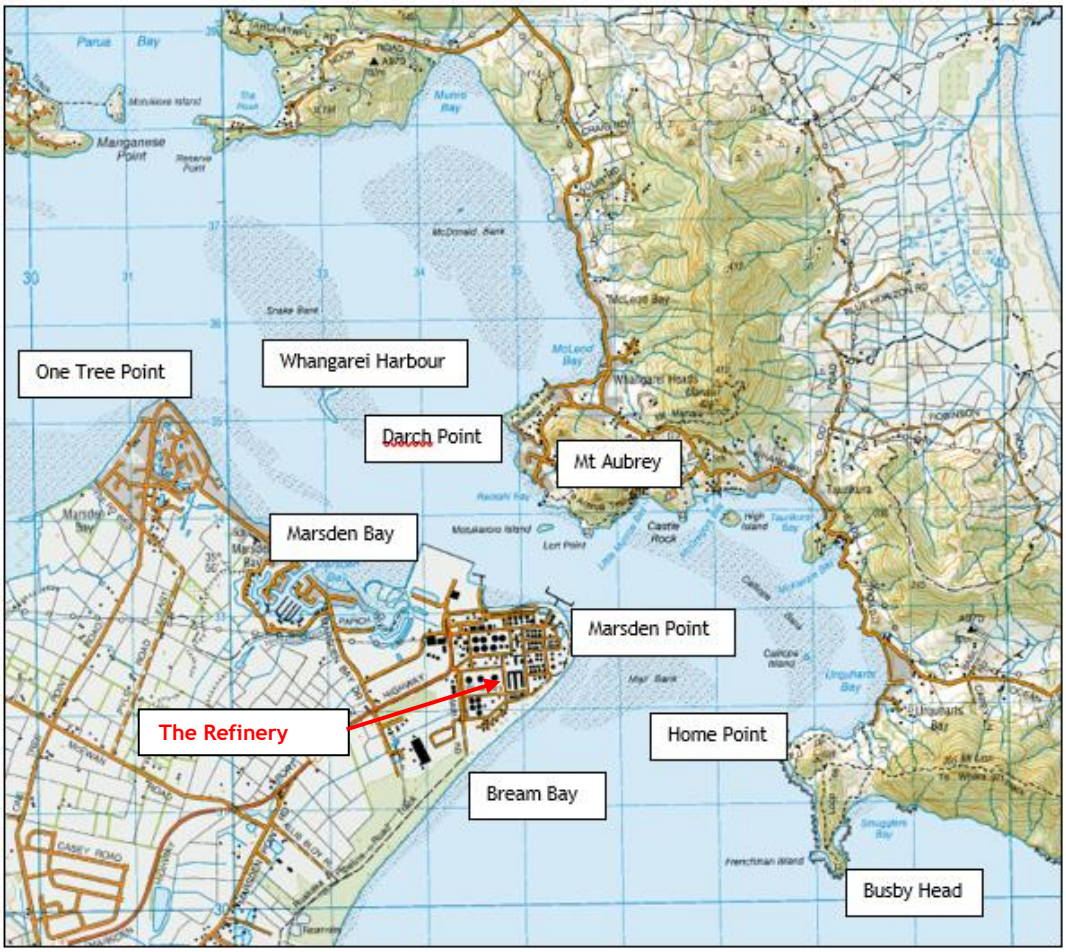


Figure 1.3.1: *The Site and its Surrounding Geographic Environment*[3]

The catchment more directly associated with the Refinery is framed by the adjoining deep-water port and, across the Harbour, by Darch Point – at the western edge of Reotahi below Mount ('**Mt**') Aubrey. Home Point and Busby Head define the outer limits of the main body of the Harbour, whereas its mouth, extending into Bream Bay, is more loosely framed by Bream Head and the dune system / sedimentary plain around Ruakaka.

The Refinery, which we now refer to as '**the Site**' is located at Marsden Point, at the entrance to the Whangārei Harbour, approximately 16 km southeast of Whangārei City. The Refinery extends across a 119 hectare ('**ha**') Site that is bounded to the west by Port Marsden Highway and Mair Road, to the north by Ralph Trimmer Drive and the Whangārei Harbour, and to the east and south by Bream Bay. The physical address of the Site is 12 Ralph Trimmer Drive, Marsden Point and the legal description is SECTION 10 BLK VIII RUAKAKA SD (Title identifier NA70A/371).

The Refinery's location was chosen due to the natural deep-water port at Marsden Point, low risk of earthquakes, flat topography of the Site and proximity to large residential populations in the North Island. The land at Marsden Point is dominated by industrial and manufacturing land uses, including Northport and the Carter Holt LVL (laminated wood products) facility. The wider surrounding area is predominantly rural. The rural areas around the Refinery are primarily zoned for industrial use.

[3] Adapted from NZ Topo Map. https://www.topomap.co.nz/

Figure 1.3.2: ***The*** *Site and Jetty based at Marsden Point at the entrance to Whangārei Harbour - Whangārei Terenga Parāoa*

The flat Site that is only a few metres above mean high tide sea level is densely developed with operational refining facilities covering the majority of the Site's surface. These facilities can be considered in relation to a number of key refinery processing components:

- The 'Process North' primarily consists of the Hydroskimming and Utility processes with the various Process Units that perform these functions broken up into five Blocks (A, B, Utilities, D and E).
- The 'Process South' is primarily responsible for the Residue upgrading processes. The various process units that perform these functions are located in Block C, which is further split into two areas.
- The 'Offplot Operational Unit' consists of the waste gas (H_2S) treatment plants (Block B2), storage tanks (Tank Farm), oil movement and wastewater treatment infrastructure.

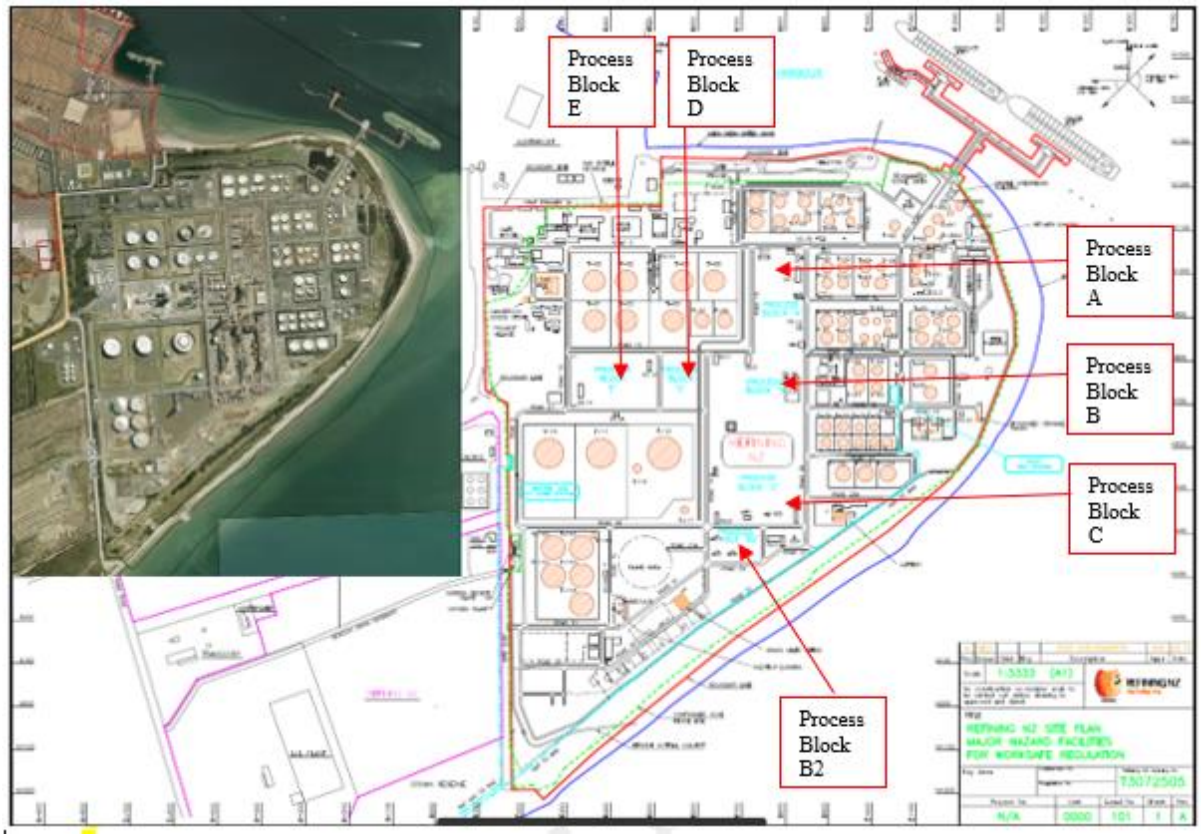


Figure 1.3.3: *Schematic / Layout of the Site*

The thermal energy that is required for the various processes within the Refinery (heating crude and various products) is currently provided by a series of furnaces that are predominantly fired on gas, but also include fuel oil and asphalt depending on market conditions. These furnaces are grouped by process block and discharge via a stack that relates to each block.

1.3.1 Site History

Prior to development, the Site was used for farming. Refining NZ purchased the Site in the early 1960s and commenced refinery operations in February 1964 and in the mid-1980s, the Refinery underwent a major expansion (**'the Expansion'**). The Expansion converted the plant to a 'hydrocracker' refinery with associated feedstock plant, utility and environmental facilities.

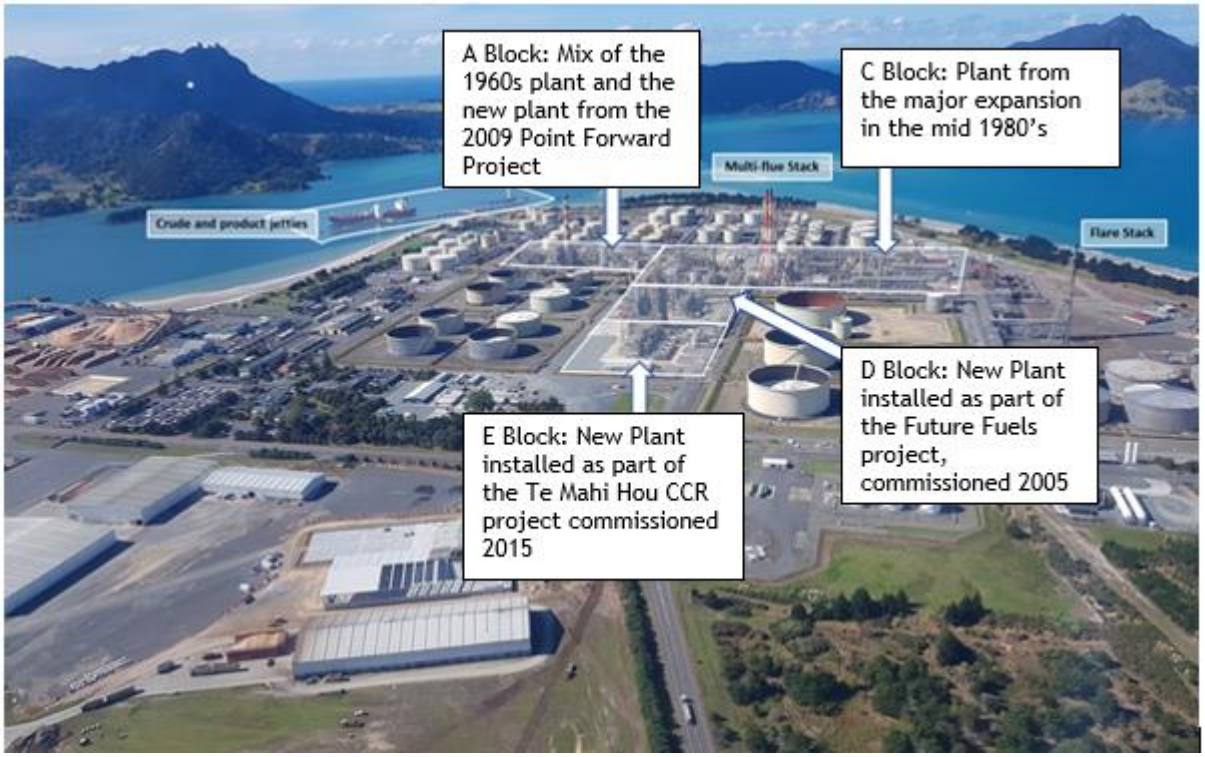


Figure 1.3.1.1: *The Refinery and its Development*

The 170 km RAP was commissioned prior to the Refinery's Expansion and a historical land drain (known as the Bercich Drain, which ran across the centre of the Site from west to east) was diverted to the south to allow for site development and the redundant section of the drainage channel was filled with sand and brown rock and compacted.

Since the 1980s there has been a programme of upgrades and maintenance works across the facility and in 2012 an expansion of petrol-making facilities commenced (which is referred to as the '**Te Mahi Hou project**'). This comprised the integration of two compounds (T7 and T9), the demolition of another two compounds (T10 and T12) and the construction of Block E containing the continuous catalyst regeneration (CCR) unit. In 2016 a buried revetment wall and foredune was constructed to the southeast of the butane spheres to protect a section of the coastline from erosion and a sulphur solidification plant has recently been constructed to the south of the Site in the vicinity of the flare stack.

Historical waste management at the Site has included an application of sludge to land. In this respect, at the commencement of Refinery's operation, small volumes of sludge were generated from tanks, interceptors and canals/drains. Sludge generated at the Refinery was buried onsite or transferred to sludge fields (also known as '**landfarms**'), these fields were previously located in numerous other locations across the Refinery. During the enabling works for the expansion, some material that had been buried, weathered, or put in pits during the 1960s and 1970s was excavated and placed on adjacent land owned by Refining NZ. After the expansion, the sources of sludge increased but then a sludge handling unit which could treat much of the sludge produced, offset the overall strain on the landfarms. Ultimately, the former landfarms were excavated and taken offsite or used to strengthen the sand dunes on the southeast coast surrounding the Refinery. The Refinery does not use landfarms and has no intention of recommencing this activity.

1.4 The Proposal

Section 3.0 of this AEE describes the Proposal. In summary, however, resource consent is sought from the Northland Regional Council (the '**NRC**' or the '**Regional Council**') for the continued existence (only in respect of those structures within the Coastal Marine Area ('**CMA**')), maintenance and operation (in terms of discharges) of the Refinery. Resource

consents are also sought for some of the recurrent maintenance activities. Together these activities form what we refer to as 'the Proposal' through this AEE.

The key activities and structures that form part of the Proposal are:

1. The continued existence of three jetty structures (and several associated mooring dolphins and breasting's) located within the CMA;
2. A series of discharges to the air from the continued operation of the Refinery;
3. A series of discharges to land, in a manner where contaminants may enter groundwater;
4. A series of discharges to coastal waters, both directly from the Refinery and indirectly via groundwater entry into Bream Bay and the Whangārei Harbour; and
5. The abstraction of water from the groundwater reservoir that sits below the Refinery.

As we have noted, all of the foregoing aspects of the Proposal are set out in Section 3.0 of this AEE. A number of the technical assessments, which are attached as **Annexure 3** to this AEE, also particularise aspects of the Proposal.

1.5 Resource Consents Required

We discuss, in Section 6.0 of this AEE, the statutory planning framework that the Proposal has been assessed against. Having, however, considered the Proposal against the applicable statutory planning instruments, we are of the opinion that the following resource consents are required. We note that a more detailed summary of the reasons for why the various resource consents are required is set out in the tables that form **Annexures 8 to 14** to this AEE.

We record, for completeness, that neither the operative National Environmental Standard for Sources of Human Drinking Water – 2007 (**'the NESHDW'**) nor the operative National Environmental Standard for Air Quality (**'the NESAQ'**) require further resource consent applications to be made, nor do they present a bar to the resource consents sought by Refining NZ being granted. Refining NZ already holds the resource consents (or will seek them separately) that arise from the operative National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health 2011, and thus we have not assessed the Proposal against that planning instrument.

We also note that the proposed Northland Regional Plan (**'the pRP'**) is well advanced, with decisions having been issued, appeals lodged and a number of amendments agreed by way of consent orders that have been sealed by the Court. As a consequence, there are a number of rules within the pRP that are beyond challenge, and thus need to be treated as if they are operative. Where the rules are operative, the corresponding provisions in the existing regional plans are superseded and no longer have legal effect. As, however, not all of the pRP's provisions are beyond challenge, we now list all of the resource consents that are, in our opinion, required when regard is had to both the operative plans and the proposed regional plan.

1.5.1 Regional Air Quality Plan for Northland ('oAQP')

1. As the proposed dry abrasive blasting does not fall within the ambit of rules 9.1.5, 9.2.2, 9.4.3 or 9.4.4 of the oAQP, Rule 9.3.1 does not apply. This means that Rule 9.3.2 applies to the proposed dry abrasive blasting and causes it to become a discretionary activity;
2. A variety of fuels are used to generate heat and produce electricity. All of the heat capacities exceed the thresholds imposed by Rule 9.1.1(1.) to (3.). As a consequence, the Proposal does not fall within the permitted activity thresholds that this rule sets. This causes it to become a discretionary activity in accordance with Rule 9.3.2 of the oAQP;

3. The discharges from firefighting training fall within the ambit of Rule 9.1.10 and Appendix 5 of the oAQP[4] While Refining NZ is of the opinion that the discharge of the smoke from these training exercises is neither offensive nor objectionable, it has received complaints in relation to these discharges in the past. As a consequence, it has adopted a conservative interpretation and assumed that the proposed discharges cannot achieve standard (a.) of Rule 9.1.10. This causes the proposed discharge to become a discretionary activity in accordance with Rule 9.3.2; and
4. The discharge of contaminants to air from effluent[5] storage, treatment and disposal systems cannot achieve the discharge volume set out in Rule 9.1.6(a.). This causes this aspect of the Proposal to become a discretionary activity in accordance with Rule 9.3.2. Similarly, all other fugitive discharges (other than those associated with emissions from vehicles and dust producing activities) also fall within the ambit of Rule 9.3.2 and require a resource consent for a discretionary activity.

Four of the activities that form part of the Proposal are permitted as of right by the oAQP. We now list those components that are permitted activities:

1. Refining NZ proposes to conduct wet abrasive blasting as part of its ongoing repair and maintenance programme at the Refinery. As the proposed wet abrasive blasting can be conducted in a manner that achieves Rule 9.1.5 of the oAQP, it is a permitted activity;
2. The use of herbicides (which falls within the oAQP's definition of 'agrichemical') within the Refinery to control weeds is a permitted activity in accordance with Rule 9.1.9;
3. The discharge of vapour and steam from the Refinery that is not otherwise captured by Rule 9.1.1 to 9.1.9 is a permitted activity in accordance with Rule 9.1.10; and
4. The activities that produce dust within the Refinery can achieve the permitted activity standard that applies. As a consequence, this aspect of the fugitive discharges is a permitted activity.

1.5.2 Regional Water and Soil Plan for Northland ('oWSP')

1. The discharge of wastewater onto land in a manner where it could enter into surface water / groundwater as it is conveyed, stored and treated within the Site (prior to its discharge to the Harbour), and discharges from the areas of the historic 'land farming activities', the fire training areas and discharges from the three main hydrocarbon storage areas cannot achieve all of the permitted activity standards imposed by of Rule 20.1.2 of the oWSP. As a consequence, the discharge of these contaminants to land is a discretionary activity in accordance with Rule 20.3.1;
2. The discharge of the blasting materials used by the Refinery in its wet and dry abrasive blasting activities to land in a manner where they get into the groundwater and / or surface water is a discretionary activity in accordance with Rule 20.3 of the oWSP; and
3. The proposed groundwater abstraction exceeds the 10 cubic metres ('**m^3**') per ('**/**') day limit ('**d**') that is set by Rule 25.1.1 of the oWSP. As a consequence, the proposed abstraction is a discretionary activity in accordance with Rule 25.3.1; and
4. The proposed damming and diversion of wastewater in the Accidentally Oil Contaminated System (or the '**AOC**'), Continuously Oil Contaminated System (or the '**COC**') and Stormwater Storage Basin (or the '**SWB**') is a discretionary activity in accordance with Rule 24.3.3.

Four of the activities that form part of the Proposal are permitted as of right by the oWSP. We now list those components that are permitted activities:

1. The herbicides employed within the Refinery are applied in accordance with Rule 18.1.2. As a consequence, this discharge can occur as a permitted activity;
2. Refining NZ occasionally applies herbicide over surface water as part of its maintenance functions. While unintended, Refining NZ assumes that some of this

[4] We note the existence of Rule 9.4.1 which makes the open burning of, amongst other things, waste hazardous substances (which includes) hydrocarbons a prohibited activity. While the firefighting training falls within the oAQP's definition of the term 'open burning', the materials being burnt are not 'waste'. As a consequence, Rule 9.4.1 does not apply to this aspect of the Proposal

[5] As we have noted in our discussion of the oRCP, the wastewater streams at the Refinery fall within the ambit of what is deemed to be 'effluent'

herbicide enters water, and thus falls within the ambit of Rule 18.1.3. As the application of the herbicide achieves relevant standards set by Rule 18.1.3, this discharge is a permitted activity;

3. The diversion of stormwater into the AOC and then its discharge to ground (in very small quantities) while it is being conveyed and / or stored prior to its discharge into the Harbour is a permitted activity in accordance with Rule 21.1.1; and
4. The proposed damming and diversion of rainwater at various locations within the AOC, COC and in the SWB accords with the standards set out within Rule 24.1.1 of the oWSP, and thus, is a permitted activity.

1.5.3 Regional Coastal Plan for Northland ('oRCP')

1. The occupation of space by, and the use of the jetties is a controlled activity in accordance with Rule 31.7.4(d.) of the oRCP;
2. The use of existing buildings on the jetties is a controlled activity in accordance with Rule 31.7.4(b.);
3. The spillway from the SWB is not listed in schedule 2 of the oRCP, and thus it falls within the ambit of Rule 31.7.4(d.). A controlled activity classification therefore applies to both its occupation of coastal space and use;
4. The discharge of treated industrial wastewater which, in our opinion, is for the purposes of this rule, 'treated effluent'[6] is deemed to be a discretionary activity within the M5MA in accordance with Rule 31.7.6(f.) of the oRCP; and
5. Aside from discharges to air from small fuel burning equipment and the emission of dust from the loading and unloading of vessels, fugitive emissions are not specifically regulated within the M5MA. As a consequence, those emissions fall within the ambit of Rule 31.7.6(u.) and thus, are a discretionary activity where they are discharged into this zone.

As with the preceding planning instruments, a number of the activities that form part of the Proposal are permitted as of right by the oRCP. We now list those components that are permitted activities:

1. The occupation of space for buildings on the jetties is a permitted activity in accordance with Rule 31.7.4(a.) of the oRCP;
2. The recurrent maintenance and repair of the jetties and the portion of the spillway that extends below Mean High Water Springs ('**MHWS**') is a permitted activity in accordance with Rule 31.7.4(l.);
3. The occupation of space associated with vessels berthing at the jetties is a permitted activity in accordance with Rule 31.7.9(a.);
4. The discharge of seawater that is associated with, and taken for firefighting purposes, is a permitted activity in accordance with Rule 31.7.6(a.);
5. Rule 31.7.6(s.) allows the discharge of contaminants into the air from fuel burning equipment with a capacity less than 40 kilowatt ('**kW**'), that uses LPG, diesel oil or petrol and that generates electricity as a permitted activity. The discharges to air from the diesel / petrol generators that are used on the jetties and the dolphins during maintenance and repairs fall within the ambit of these rules, and thus are permitted as of right;
6. The discharge of dust that is associated with the loading and unloading of the vessels at the jetties is a permitted activity within the M5MA in accordance with Rule 31.7.6(l.)(iii.); and
7. The taking of water for firefighting purposes from an area within the CMA is a permitted activity in accordance with Rule 31.7.7(a.).

1.5.4 Proposed Regional Plan for Northland (Decisions Version 2020) ('pRP')

1. A resource consent to use the jetties, the mooring breastings and dolphins and the spillway from the SWB (where it extends below MHWS) is required. This resource consent is for an innominate activity in accordance with section 87B of the Act;

[6] We can find no definition of "treated effluent" in the oRCP. The Collins Dictionary (Tenth edition 2009) defines, at page 529, effluent to be *"1 liquid discharged as waste from an industrial plant or sewage works ..."*

2. The dry abrasive blasting that is part of the Proposal falls within the ambit of Rule C.7.2.9. As a consequence, a controlled activity classification applies to this discharge;
3. When the Refinery is using oil (but not waste oil), natural gas or LPG the resulting discharge of contaminants to air falls within the ambit of Rule C.7.1.8 and is thus deemed to be a restricted discretionary activity;
4. The discharges to air from firefighting training are a discretionary activity in accordance with Rule C.7.1.9 of the pRP;
5. Aside from the operation of various small generators within the Refinery, fugitive emissions are not specifically regulated within the pRP. As a consequence, those emissions fall within the ambit of Rule C.7.1.9 and thus are a discretionary activity;
6. The discharge of treated industrial wastewater to the CMA (and any associated discharge of odour to air) is deemed to be a controlled activity in accordance with Rule C.6.6.4 of the pRP;
7. The diversion and discharge of stormwater to the CMA is a discretionary activity in accordance with Rule is C.6.4.4;
8. Some of the stormwater and wastewater (not from the underground pipe network) from the Site is discharged to the ground (via a passive discharge pathway). While Refining NZ abstracts (via pumps) the groundwater and treats it, some (very small) quantities of contaminated groundwater are thought to be discharged from under the Refinery to the CMA. This discharge also falls within the ambit of Rule C.6.6.4, and this is a controlled activity;
9. The discharge of wastewater from the underground pipe network to ground is a discretionary activity in accordance with Rule C.6.2.1.
10. The passive discharge of contaminants that are already within the ground to groundwater from the Refinery is a controlled activity in accordance with Rule C.6.6.4;
11. The discharge of stormwater from the AOC to the ground, and thus into the groundwater is a discretionary activity in accordance with Rule C.6.4.4; and
12. The groundwater abstraction exceeds the 10 m^3/d that is a permitted activity pursuant to Rule C.5.1.1 and the 50 m^3/d that is a controlled activity pursuant to Rule C.5.1.9. Equally, the proposed take does not exceed the allocation limit set in Appendix H.4 (Policy H.4.4) and therefore, does not become a non-complying activity in accordance with Rule C.5.1.14. As the proposed abstraction was authorised when the pRP was notified, the take does not fit within the ambit of Rule C.5.1.11. As a consequence, the proposed abstraction is a discretionary activity in accordance with Rule C.5.1.12.

A number of the activities that form part of the Proposal are also permitted as of right by the pRP. We now list those components that are permitted activities:

1. The occupation of common coastal and marine space by jetties, the breastings and dolphins and the spillway from the SWB is a permitted activity in accordance with Rule C.1.1.1(13.) of the pRP;
2. The structures and buildings attached to the jetties are a permitted activity within the MPPZ in accordance with Rule C.1.1.1(14.);
3. The recurrent maintenance and repair of the jetties, the breastings and the dolphins and the spillway from the SWB (and the incidental disturbance of the foreshore and seabed) is a permitted activity in accordance with Rule C.1.1.7;
4. The vessels berthing at the jetties and at the Dolphins is a permitted activity in accordance with Rule C.1.2.1;
5. The discharge of contaminants to air from the wet abrasive blasting that is conducted by Refining NZ accords with Rule C.7.2.1. As a consequence, these discharges are a permitted activity;
6. The discharge of vapour and steam to air from the Refinery does not cause any of the outcomes / effects listed in the standard that applies to Rule C.7.2.5 and thus, is a permitted activity;
7. The operation of the small generators throughout the Refinery complies with Rule C.7.1.6 or C.7.2.5(7). As a consequence, these discharges are a permitted activity;
8. The discharge of seawater associated with and taken for firefighting purposes is a permitted activity in accordance with Rule C.6.9.6;
9. The diversion of stormwater into the AOC is a permitted activity in accordance with Rule C.3.1.1.

10. The proposed damming and diversion of rainwater at various locations within the AOC and in the SWB accords with the standards set out within Rule C.3.1.1, and thus, is a permitted activity;
11. The maintenance and repair of the basins (including any associated diversions, damming and discharges to land or water) are a permitted activity in accordance with Rule C.3.1.4;
12. The herbicides employed within the Refinery Site are to be applied in accordance with the standards set out in Rule C.6.5.1. As a consequence, this discharge (to both land and to air) can occur as a permitted activity; and
13. The taking and use of coastal water for firefighting purposes is a permitted activity in accordance with Rule C.5.1.2.

1.5.5 Bundling

Having applied the bundling principle (as convention dictates is appropriate in this instance) we conclude that the RCAs lodged by Refining NZ are to be assessed as a **discretionary activity**, pursuant to both the operative and proposed plans, given that it is the most restrictive of the activity classifications that applies across all of the statutory planning instruments.

1.6 Assessment Framework

When considering an application for a resource consent, a consent authority must have regard to the matters set out in section 104 of the Act, being:

1. Any actual and potential effects on the environment of allowing the activity. Of note is that an applicant can propose measures to generate positive effects in order to offset or compensate for adverse effects on the environment; and
2. Any relevant provisions of:
    a. A national environmental standard;
    b. Other regulations;
    c. A national policy statement;
    d. A New Zealand coastal policy statement;
    e. A regional policy statement or proposed regional policy statement;
    f. A plan or proposed plan; and
3. Any other matter the consent authority considers relevant and reasonably necessary to determine the application.

Pursuant to sections 104(2A) and 124, a consent authority is also required here to consider the value of investment of the existing consent holder. In accordance with clause 3(b) of Schedule 4 to the Act we provide at section 6.2, an assessment of the value of that investment.

When forming an opinion for the purposes of paragraph (1.) (that is, the magnitude of any actual and potential environmental effects that the Proposal may generate), a consent authority may disregard an adverse effect of the activity on the environment if a national environmental standard or the plan permits an activity with that effect. We return to this matter in section 2.1 of this AEE, where we discuss the application of the permitted baseline. We note, at the outset, that while the permitted baseline can be applied at the discretion of the consent authority, it is good practice to do so where a non-fanciful and relevant baseline exists.

The matters highlighted by sections 105 and 107 of the Act are also directly applicable to the proposed discharges to air and water. We traverse the considerations they raise in section 6.2 of this AEE.

1.7 Summary of Investigations Undertaken

Refining NZ has carefully considered how the continued existence and operation of the Refinery could impact on the environment. It has retained a number of respected experts to assist it in this regard. **Table 1.7.1**, which follows, sets out the experts that have been retained to advise Refining NZ on the advancement of the Proposal.

Number	Investigation	Organisation	Lead Author
1.	Air Quality	Tonkin & Taylor Limited	Richard Chilton
2.	Hydraulic Modelling of the Coastal Waters[7]	MetOcean Services Limited	Dr Brett Beamsley
3.	Coastal Water Quality	Streamlined Environmental Limited	Dr Mike Stewart
4.	Hydrogeological Conceptual Site Model	Tonkin & Taylor Limited	Sarah Schiess & Chris Simpson
5.	Groundwater Quality & Land Contamination	Tonkin & Taylor Limited	Sarah Schiess

[7] This investigation has been appended to that of Dr Mike Stewart, who addresses Coastal Water Quality

Number	Investigation	Organisation	Lead Author
6.	Marine Ecology (excluding avifauna & marine mammals)	Boffa Miskell Limited & REC Science	Dr Sharon De Luca & Dr Phillip Ross
7.	Avifauna Ecology	Bioresearches Limited	Graham Don
8.	Marine Mammals	Cawthron Institute Limited	Dr Deanna Clement
9.	Terrestrial Ecology (excluding avifauna)	Wildlands Limited	Dr Tim Martin & Ms Jessica Reaburn
10.	Human Health	Environmental Medicine Limited	Dr Francesca Kelly
11.	Cultural Effects Assessment	Patuharakeke Te Iwi Trust Board	Juliane Chetham
12.	Natural Character, Landscape & Visual Amenity	Brown NZ Limited	Stephen Brown
13.	Economics	NZIER Limited	Peter Clough
14.	Assessment of Alternatives	Refining NZ	Jane Thomson

Table 1.7.1: *Investigations Undertaken & Lead Author*

1.8 Resource Consent Lapse Period

Sections 125(1)(a) and 125(1A) of the Act states that, in the context of the applications that are being made by Refining NZ, if there is no lapse date specified on a resource consent, the consent shall lapse 5 years after the commencement of the consent, unless it is given effect to, or an application is made to extend the lapse date.

The structures for which the consent is sought are already in place, and the discharges are for ongoing operations, so will be given effect to almost immediately in most cases. Therefore, no extended terms are necessary or sought.

The Applicant therefore seeks that a five year lapse period be applied to all of the resource consents it is seeking for the Proposal.

1.9 Term of Resource Consent

Section 123 of the Act establishes a maximum term of 35 years for all resource consents that are sought for the Proposal.

Refining NZ contends that this consent term would accord with the sustainable management purpose of the Act. We note that there are several cases when the Environment Court (and some superior courts) has confirmed that long consent terms are acceptable for large infrastructural projects. In this instance, we note that a very significant level of investment has been made by the consent holder, the likely actual and potential adverse effects are known, very good information exists about the existing environment and on-going monitoring is proposed to certify that the predicted effects (and their magnitude) are realised.

We also understand (Martin, D, pers. com.) that a 35 year term will provide Refining NZ with an acceptable level of investment security, which is, in our opinion and experience, a relevant consideration.

These combined factors lead us to the opinion that the proposed 35 year terms are reasonable and accord with Part 2 of the Act.

2.0 THE EXISTING ENVIRONMENT

When considering Refining NZ's resource consent application for the Proposal, one of the central matters is the nature and magnitude of the effects of the activity on the environment. Defining what constitutes the 'existing environment' has been the subject of a number of different cases before New Zealand's courts. ChanceryGreen (counsel to Refining NZ) advise, however, that the caselaw traversing the correct application of the existing environment principle in the context of regional reconsenting proposals is divided. In that regard, ChanceryGreen advises that while the issue as to what constitutes the existing environment is not yet 'settled', it records that there is recent High Court authority[8] which suggests that the correct application of the existing environment in 're-consenting' proposals is to disregard the activities and structures authorised by the resource consents which are the subject of the application.

The approach suggested by the High Court requires assumptions to be made in order to characterise this version of the 'existing environment' – particularly with regard existing structures. In that regard, ChanceryGreen has suggested the following approach be applied to the consideration of the effects of the Proposal. Refining NZ has accepted this advice and it has been applied by those technical experts that are assisting the Company.

a. The assessment of the effects of the proposed of takes and discharges (to air and land / water) has been undertaken as if the currently authorised takes / discharges have been discontinued and the Proposal is an application for a new activity (that is, and in simplistic terms, the Refinery is 'turned off' today, and the effects assessment relates to 'turning back on' the Refinery tomorrow. This is not to say that the environment has been considered as if the takes / discharges under the existing consents never occurred – the existing environment (for example the receiving airshed or waterbody with respect to discharges) includes any legacy effects of past authorised discharges; and
b. An assessment of the jetty and dolphins against an environment in which the structures do not exist. In other words, the existing environment is the present environment with the structures removed. This means the relevant effects assessment is of placing the structures back in their existing location (excluding the construction effects).

To inform this, our description of the existing environment, several technical assessments have been prepared and are summarised in this section of the AEE.

Further, engagement has occurred with the NRC over the resource consents that exist, in close proximity to the Refinery, but which have yet to be exercised. This reflects accepted resource management and planning practice that the effects of the Proposal need to be assessed as if the consented, but as yet unimplemented activities exist and are operating. While some contend that regard only needs to be paid to those unimplemented activities that are 'likely' to be advanced, this filter is difficult, if not impossible, to apply. In that regard, the advancement of a resource consent is a matter that is determined by the circumstances of the consent holder. Given this, for the purpose of this AEE, we have adopted the conservative position that all unimplemented consents are 'likely' to be advanced.

Lastly, the Act enables the effects of permitted activities to be discounted in the evaluation of a new proposal. Given this, we have set out the environment that exists, overlaid with what we consider to be non-fanciful permitted activities.

The following sub-sections describe the existing environment.

2.1 Refining NZ's Existing Resource Consents

The continued existence, maintenance and operation of Refining NZ's existing operations is governed by a suite of existing resource consents that have been granted by both the WDC and the NRC.

[8] Ngati Rangi Trust v Manawatu-Whanganui Regional Council [2016] NZHC 2948

Refining NZ's existing resource consents authorise activities such as coastal discharges, air discharges, water discharges, coastal air discharges, water permits, water takes, groundwater takes, land use, land discharges, and structures, and are summarised in a table in **Annexure 4**.

2.2 The Permitted Baseline

In accordance with sections 95D and 104(2) of the Act, a Consent Authority may disregard an adverse effect that is permitted by a Plan and a National Environmental Standard. We have considered whether the Proposal, or discrete parts thereof can be assessed against a credible (non-fanciful) permitted baseline. As is apparent from the tables that are attached as **Annexures 8-14** to this AEE, there are few activities that fall within the ambit of the permitted activities that apply. Indeed, the complex array of rules and standards that apply to the Proposal make it challenging to establish a permitted baseline that the Proposal can be assessed against.

Given the foregoing, we have not applied the permitted baseline to the assessment of environmental effects that is set out in Section 4.0 of this AEE. Neither have, we understand, any of the independent experts. In our opinion, that represents a slightly conservative starting position, but one that also reflects the integrated nature of the Proposal and the assessments that have been completed by Refining NZ.

2.3 The Environmental Baseline

When considering Refining NZ's resource consent application, one of the central matters that must be assessed is the nature and magnitude of the actual and potential effects of the Proposal on the environment.

The environmental effects of the Proposal have been assessed against the environment, as it actually exists now. Refining NZ has commissioned a number of reports that, amongst other things, describe the environmental values that are present within and adjacent to the Site, or which otherwise have relevance to the Proposal (such as the regional economy). As we have already noted, full copies of those reports are attached as **Annexure 3** to this AEE.

It is, in our experience, generally accepted that when assessing the actual and potential effects of a Proposal, the existing environment needs to be 'overlaid' with both activities permitted in the relevant plan and any consented, but as yet unimplemented activities. With respect to the latter, while some contend that regard only needs to be paid to those unimplemented activities that are 'likely' to be advanced, this filter is difficult, if not impossible, to apply. In that regard, the advancement of a resource consent is a matter that is determined by the circumstances of the consent holder. Given this, for the purpose of this AEE, in the absence of information to the contrary, we have adopted the position that all unimplemented consents are 'likely' to be advanced.

We have engaged with staff of the NRC[9] who advised us that there are no unimplemented consents within the Site or in its general vicinity. We are aware, however, of three unimplemented resource consents in the vicinity of Refining NZ's Site.

Firstly, while it has been partially exercised, Northport's resource consent (numbered CON20030505523) has not been fully implemented, insofar as the full extent of the possible reclamation is yet to be built. The consent enables the consent holder to reclaim 5.20 ha of seabed by deposition of dredged materials. To date only 2.40 ha has been reclaimed, leaving a total of 2.80 ha fronted by a 270 metre ('**m**') long berth yet to be reclaimed.

We are also aware that Whangārei District Council ('**WDC**') hold a suite of resource consents from NRC for the Ruakaka Wastewater Treatment Plant ('**the Plant**') ocean outfall (being resource consents numbered AUT.021532.01.01 through to AUT.02153.09.01). The Ruakaka Wastewater Treatment Plant's upgrade, and the associated ocean outfall pipe, is to be

[9] Stuart Savill, Consents Manager at Northland Regional Council, email correspondence. Dated 4th of July 2019 to the 5th of September 2019.

constructed in stages, and according to Council's growth projections, the ocean outfall pipe is not envisaged until around 2026. The pipe is consented to run from the Plant to a point three km offshore in Bream Bay. Further, the Plant is consented to discharge at an average dry-weather rate of 185 litres per second ('**L/s**'), up to a maximum wet weather discharge rate of 740 L/s.

The third extant consent granted by the NRC is Refining NZ's own Crude Shipping Project ('**CSP**'). This suite of resource consents enables the dredging of 3,620,200 m^3 of material from the approaches to Whangārei Harbour and the berth pocket next to Marsden Point Jetty, the maintenance dredging of between 56,000 and 122,000 m^3 of material per year in this area, the disposal of this material to two locations in Bream Bay, and changes to the navigation aids within the Whangārei Channel.

We also engaged with staff of WDC[10] who advised us of four subdivision consents and two land use consents that they had granted in the past 10 years in the vicinity of the Refinery but had no evidence if they had been given effect to.

Consent number *SD1600128* permits the consent holder to subdivide the existing 5929 square metre ('**m^2**') Living 1 Environment site at 10 Princes Road, Ruakaka, into three allotments.

Consent number *SD1600101* permits the consent holder to subdivide an existing 1088 m^2 Living 1 Environment site at 137 Marsden Point Road, Ruakaka, into two allotments.

Consent *SD1600099*, permits the consent holder to subdivide a site at Harambee Road / Te Whata Way, Taiharuru held in two titles into 3 allotments.

Consent *SD1700244* permits the consent holder at 395 Ody Road, Taurikura, to reconfigure the boundaries between two existing titles to create a proposed Lot 3, and to undertake a two-lot subdivision of the balance of the land to create a new Environmental Benefit allotment (Lot 1), and a balance Lot containing a conservation covenant area (Lot 2).

Consent *LU1800084* permits the construction of a residential dwelling and shed on a site which will require the removal of 1244 m^2 of indigenous vegetation and 441 m^3 of earthworks at 39 Rarangi Heights, Kauri Mountain.

Consent number *LU1400073* enables the consent holder to remove five 'heritage trees' within the Esplanade Reserve at Port Marsden Drive Highway, Marsden Point.

Refining NZ's CSP involves (in summary) the deepening and realignment of the Whangārei Harbour entrance and its approaches, via dredging, in order to increase the size of the shipments of crude oil that can be brought to the Refinery. The resource consents for the CSP were granted on the 17th of July 2018 and confirmed by the Environment Court following an appeal on the 14th of December 2018. **Table 2.3.1**, which follows, summarises the resource consents that enable the CSP.

Consent No.	Purpose of the Resource Consent
AUT.037197.01.01	Capital dredging of 3,620,200 m^3 of material from the Whangārei Harbour entrance and approaches between the Refinery jetty, at or about location coordinates 1735387E 6033137N, and a point within Bream Bay, at or about location co-ordinates 1735683E 6027182N;
AUT.037197.02.01	Discharge decant water from a dredge hopper or barge into coastal waters as a result of capital dredging operations;
AUT.037197.03.01	Deposition of capital dredging spoil at two defined marine disposal sites within Bream Bay, at or about approximate location coordinates 1736739E 6027636N and 1743686E 6024450N;

[10] Rebecca Rowsell, Legal Advisor at Whangārei District Council, email correspondence. Dated 4th of July 2019 to the 12th of September 2019

Consent No.	Purpose of the Resource Consent
AUT.037197.04.01	Discharge of sediment and water associated with capital dredging spoil disposal at two defined marine disposal sites within Bream Bay, at or about approximate location co-ordinates 1736739E 6027636N and 1743686E 6024450N;
AUT.037197.05.01	Removal of sand, shell and other capital dredging material from the coastal marine area for land-based disposal;
AUT.037197.06.01	Erection, placement, alteration, and maintenance and repair of navigation aids;
AUT.037197.07.01	Maintenance dredging of between 56,000 and 122,000 m^3 of material per year from the Whangārei Harbour entrance and approaches between the Refinery jetty, at or about location coordinates 1735387E 6033137N, and a point within Bream Bay, at or about location co-ordinates 1735683E 6027182N;
AUT.037197.08.01	Discharge decant water from a dredge hopper or barge into coastal waters as a result of maintenance dredging operations;
AUT.037197.09.01	Deposition of maintenance dredging spoil at two defined marine disposal sites within Bream Bay, at or about approximate location coordinates 1736739E 6027636N and 1743686E 6024450N;
AUT.037197.10.01	Discharge of sediment and water associated with maintenance dredging spoil disposal at two defined marine disposal sites within Bream Bay, at or about approximate location co-ordinates 1736739E 6027636N and 1743686E 6024450N;
AUT.037197.11.01	Removal of sand, shell and other maintenance dredging material from the coastal marine area for land-based disposal;
AUT.037197.12.01	Discharge water and contaminants (comprising predominantly seabed materials and construction materials) into water when installing the new aids to navigation, and relocating the existing aids to navigation; and
AUT.037197.13.01	Take coastal water when undertaking dredging.

Table 2.3.1: *Resource Consents that enable the CSP*

The CSP can be divided into the following four main themes:

a. Capital dredging of selected sites within the entrance channel and adjacent to the Refinery jetty, an area referred to as 'the jetty berth pocket' (AUT.037197.01.01, AUT.037197.02.01, AUT.037197.05.01, AUT.037197.13.01);
b. Periodic maintenance dredging of the channel and berth pocket to maintain water depth (AUT.037197.07.01, AUT.037197.08.01, AUT.037197.11.01);
c. The disposal of capital and maintenance dredging spoil at two locations, referred to as Disposal Area 1.2 and Disposal Area 3.2, both within Bream Bay (AUT.037197.03.01, AUT.037197.04.01, AUT.037197.09.01, AUT.037197.10.01); and
d. The relocation of some existing navigational aids ('**navaids**') and installation of new navaids to facilitate safe passage of vessels (AUT.037197.06.01, AUT.037197.12.01).

The duration for all components is for 35 years, except for the navaids which have a consent term of 25 years. Of note is that none of these resource consents lapse until their expiry.

We have assumed that each of the unexercised resource consents are likely to be implemented, and thus that they form part of the existing environment. The technical assessments have been prepared on this basis.

Further, and as we discuss in section 2.2 of this AEE, while it is possible to apply a permitted baseline to aspects of the Proposal, we see little benefit, and no real resource management reason for doing so. As a consequence, we have adopted the slightly conservative approach of not applying the permitted baseline in this instance.

We now, drawing on the technical reports that have been produced, summarise the existing environment, as it applies to the Site and its surrounds:

A. Terrestrial Ecology;
B. Air Quality;
C. Marine Water Quality;
D. Marine Ecology;
E. Avifauna (Coastal Birds);
F. Marine Mammals;
G. Landscape, Visual and Natural Character;
H. Archaeological and Historic Heritage;
I. Cultural Values;
J. Recreation and Tourism Values;
K. Economic Considerations; and
L. Groundwater and Land Contamination.

We now discuss each of these aspects of the existing environment in turn.

2.3.1 Terrestrial Ecology

Dr Tim Martin and Ms Jessica Reaburn of Wildlands Consultants Limited ('**Wildlands**') have prepared an Assessment of Terrestrial Ecological Effects[11] for the Proposal, a full copy of which is attached within **Annexure 3** to this AEE. Their focus has been on the impacts that the discharges to air could have on this ecology. Their report provides relevant information relating to the receiving environment of the air discharge, including the ecological context of the Site. We now summarise those aspects of the report that describe the existing environment. Should more detail be required, please refer to **Annexure 3**.

2.3.1.1 Vegetation & Habitat Types - Manaia Ecological District

Dr Martin and Ms Reaburn report that modelling data was utilised to determine the geographical extent of the terrestrial receiving environment. They state that based on the extent of air discharges of Sulphur dioxide ('**SO_2**') at an annual mean of 0.5 micrograms per cubic metre ('**µg/m³**') or greater, the existing environment assessed includes approximately two-thirds of the Manaia Ecological District (southwards from Munro Bay and the northern end of Ocean Beach).

Dr Martin and Ms Reaburn note that their study recorded 155 ecological units in the Manaia Ecological District that could be impacted by the Proposal. We now discuss those ecological units that are within the area that could be impacted by the Proposal.

Forests

Dr Martin and Ms Reaburn advise that the coastal forest is the most abundant indigenous habitat type in the Manaia Ecological District, with four relatively large tracts of forest remaining: Manaia Ridge Scenic Reserve and surrounds (594 ha), Taurikura Ridge Bush (212 ha), Bream Head Scenic Reserve and surrounds (687 ha) within the receiving environment, and Kauri Mountain Conservation Area and surrounds beyond the northern limit of the receiving environment (493 ha). Most of the forest that occurs in Manaia Ecological District can be classed as coastal forest (a type of Broadleaved Forest), because of its close proximity to the sea.

Shrublands

Dr Martin and Ms Reaburn state that mānuka and kānuka shrublands comprise the second largest indigenous vegetation type (after coastal forest) in the Manaia Ecological District. They go on to describe these shrublands as providing important linkages between other habitats and a buffering for large tracts of indigenous forest. Shrublands often contain high biodiversity values and provide an important habitat for threatened and uncommon fauna and flora.

[11] Martin, T. and Reaburn, J. Wildlands Limited, *Assessment of Ecological Effects for Air Discharges from the Marsden Point Oil Refinery*. Dated June 2020

Wetlands

Two areas of saltmarsh occur in the Manaia Ecological District, and according to Dr Martin and Ms Reaburn both are beyond the northern limit of the receiving environment. They state that Saltmarsh dominated by sea rush occurs near the creek at the northern end of Ocean Beach Recreation Reserve and surrounds and both are beyond the northern limit of the receiving environment and mangroves that occur in Kiteone Road Saltmarsh southeast of Parua Bay.

Some freshwater wetlands do, however, exist. In this regard, Dr Martin and Ms Reaburn report that fertile wetlands (or swamps) are fed by nutrient-rich ground and surface water, as well as rainwater. They also note that their water levels vary seasonally, and they are often flooded by water loaded with silt and nutrients when river or lake levels are high. Dr Martin and Ms Reaburn specifically note that in the Manaia Ecological District, raupō reedland and associations of *Machaerina* species, harakeke, and *Bolboschoenus fluviatilis* are the most common ecological units within the fertile wetlands. A representative example of harakeke flaxland in swamp is present in Whangārei Heads Road Wetland within the receiving environment. This habitat type is particularly rare in Northland.

Gumland

Dr Martin and Ms Reaburn set out that gumland is a very uncommon wetland type in Manaia Ecological District; there is only one known site in the Ecological District. They state that gumlands are typically dominated by mānuka occurring on strongly leached, podzolised, infertile soils where drainage is impeded. They go on to report that pure mānuka stands on gumland are found at one site in the Manaia Ecological District, being McDonald Coastal Shrubland, and that this site straddles the northern limit of the receiving environment.

Rocklands

Dr Martin and Ms Reaburn state that rockland occurs mainly on the exposed coastal margins of Bream Head Scenic Reserve and surrounds, islands and rock stacks, and, beyond the northern limit of the receiving environment, at Kauri Mountain Conservation Area and surrounds. They further state that exposed rocky outcrops and rock stacks are present within the receiving environment at Manaia Ridge Scenic Reserve and surrounds, Mount Aubrey Coastal Forest and Shrubland, and Bream Head Scenic Reserve and surrounds. They also indicate that rockland vegetation is dominated by salt-resistant herbs such as native iceplant, glasswort, makaokao, rem uremu, NZ celery, NZ spinach, Mercury Bay weed, shore groundsel, and *Pse udognaphalium luteoalbum*.

Dunelands

Dr Martin and Ms Reaburn report that Dunelands in Manaia Ecological District are restricted to Smugglers Bay in Bream Head Scenic Reserve and surrounds and Ocean Beach Recreation Reserve and surrounds, the latter of which is approximately 6.5 km in length and comprises most of the eastern boundary of the ecological district. They further state that the dunelands are relatively small and narrow but support a distinctive plant and animal community and provide habitat for many threatened species. They also noted that the dunes are typically in a state of flux as they are shaped and reshaped by erosion and deposition of sand brought about by wind and, at times, water movement.

2.3.1.2 Vegetation & Habitat Types - Waipu Ecological District

As in the case of the Manaia Ecological District the modelling data was utilised to determine the geographical extent of the terrestrial receiving environment. Dr Martin and Ms Reaburn state that based on the extent of air discharges of SO_2 at an annual mean of 0.5 ug/m^3, or greater, the existing environment assessed includes the northeastern parts of the Waipu Ecological District (from the Takahiwai Hills east to Marsden Point, and south to Ruakaka).

Dr Martin and Ms Reaburn report that there are 249 ecological units in Waipu Ecological District. We now briefly summarise the habitats and values that are present within the receiving environment.

Wetlands

Freshwater wetlands were documented at 24 sites within the Waipu Ecological District covering a total of 116 ha according to Dr Martin and Ms Reaburn. They state that prior to agricultural clearance, riverine and palustrine wetlands are likely to have been relatively extensive on the *c*.7,000 ha of alluvial plains and *c*.2,000 ha of coastal duneland in this District. They go on to note that Raupō reedland is the most common wetland vegetation type and tends to be associated with valley floor alluvium (especially gullies in farmland), but also occurs around the margins of a dune lake margin and in a small dune slack. The presence of raupō is an indicator of moderate to high nutrient status.

Within the coastal zone there are only five 'natural origin' wetlands according to Dr Martin and Ms Reaburn, each with a quite different character. They report that three of these occur within the receiving environment. They further state that McEwan Road and Sime Road Wetlands, within the receiving environment, are the two smallest; being tiny dune slack wetlands barely over half a hectare. The former has an island of mānuka shrubland at its centre surrounded by Azolla filiculoides-burr reed herbfield and Eleocharis sphacelata reedland; while latter is dominated by Eleocharis sphacelata reedland and Machaerina articulata reedland. They state that the third natural wetland within the receiving environment is the only dune lake in the whole Eastern Northland Ecological Region. They further state that Ruakaka Racecourse Dune Lake is mostly open water but has raupō and lake clubrush reedlands around the margins, all of which are infested with alligator weed. They then go to note that these sites form an important wetland bird habitat network for species such as Australasian bittern.

Estuarine Vegetation & Habitats

Dr Martin and Ms Reaburn report that estuarine vegetation occurs at five sites in Waipu Ecological District, as follows: two large river mouth estuaries on Bream Bay (Waipu River Estuary and Sandspit and Ruakaka River Estuary); two small stream mouth estuaries on the southern margin of Whangārei Harbour (Blacksmith's Creek Estuary and Takahiwai Stream Estuary)[12], and another small site on the Harbour margin (Takahiwai Saltmarsh and Shrubland). Apart from the Waipu River Estuary and Sandspit, these sites are within the receiving environment of the air discharge. They state that the two vegetation types common to the four largest estuaries are mangrove shrubland and different combinations of oioi and sea rush and mangrove forest only occurs in upper reaches of the larger two estuaries of Waipu and Ruakaka, and even then, these are tiny stands compared with those present in other Northland estuaries. They go on to state that another widespread vegetation type is glasswort herbfield, which often occurs on upper tidal sandy substrates or shell banks, or on the edges of sandy estuarine channels.

Duneland Vegetation & Habitats

Dr Martin and Ms Reaburn note that the Waipu Ecological District has extensive Holocene and Pleistocene dunelands covering the wide sweep of Bream Bay from One Tree Point and Marsden Point in the north to Waipu Cove in the south and extending inland for several kilometres. They record that wild duneland vegetation has been reduced to a strip that runs parallel to the beach and the majority of Waipu Ecological District dunelands are now dominated by exotic plant cover, although a moderate diversity of indigenous species and vegetation types remains.

Dr Martin and Ms Reaburn report that some planting of indigenous species has occurred in recent times along Waipu Ecological District coast, probably with a view to restoring dune vegetation. They also indicate species recorded in plantings include pīngao, spinifex, hinarepe, and *Carex testacea*.

[12] Note that only these small parts of Whangārei Harbour are within the Waipu Ecological District

Alluvial Landform Vegetation

Dr Martin and Ms Reaburn state that the area of indigenous vegetation on alluvial flats and gullies remaining in Waipu Ecological District is approximately 360 ha, occurring within 28 different sites. They also state that Alluvial flats are the most productive land and would have been the first to be cleared and maintained as farmland.

Hill Vegetation

Dr Martin and Ms Reaburn state that most terrain in the Waipu Ecological District is hilly, and hill country is where most indigenous vegetation remains or has been allowed to regenerate since logging and burn-offs in the 1800s and 1900s. They record that the series of east-west trending moderately dissected ranges still supporting large forest remnants, begins with Takahiwai Forest in the north and continues southwards through to Ruakaka Forest.

Coastal Hill Vegetation

Dr Martin and Ms Reaburn advise that indigenous hill vegetation within the coastal zone occurs at Takahiwai Forest (northern side) and Pakauhokio Knoll Forest next to Whangārei Harbour in the north, and on low consolidated sand ridges next to Ruakaka River Estuary. They report that Takahiwai Forest has one of the largest areas of coastal kānuka forest, with kauri-kānuka forest dominant on many of the ridges.

2.3.1.3 Flora

Dr Martin and Ms Reaburn record that a total of 628 vascular plant species (420 indigenous and 208 adventive) have been recorded in the Manaia Ecological District. Of these, 42 are classified as Threatened or At Risk, and nine qualify as significant under Schedule 17C of the Whangārei District Plan (**'oWDP'**) and they also state that the Manaia Ecological District has 72 regionally significant plant species.

Dr Martin and Ms Reaburn further record that a total of 611 vascular plant species (378 indigenous and 223 adventive) have been recorded in the Waipu Ecological District. Of these, 29 are classified as Threatened or At Risk, and 26 plant species qualify as regionally significant.

2.3.1.4 Avifauna

According to Dr Martin and Ms Reaburn, records exist for 68 bird species (indigenous, 22 introduced) in Manaia Ecological District, with records for an additional four bird species at two locations being; Ocean Beach and Peach Cove Track. They state that the North Island robin (*Petroica longipes*) and pōpokatea/whitehead (*Mohoua albicilla*) were released at Bream Head by the Bream Head Conservation Trust in April 2016 and May 2017 and then record that of these species, seven are classified as Threatened, 22 as At Risk, with two as non-resident Native-Migrant. They further state that six species are regionally significant in Whangārei District, and 17 qualify as significant under Schedule 17B of the oWDP.

Dr Martin and Ms Reaburn record that there are three key features of Manaia Ecological District that make it important for terrestrial birds, including many threatened species:

- Close proximity of the Hen and Chicken Islands and the Poor Knights Islands;
- Coastal breeding and feeding sites for wetland birds; and
- Large, significant areas of semi-contiguous forest.

According to Dr Martin and Ms Reaburn the trapping of pest animals and translocation of North Island brown kiwi (*Apteryx mantelli*) by the Bream Head Conservation Trust and Whangārei Heads Landcare Forum has seen the kiwi numbers increase significantly within the last 10 years. They note further that the North Island brown kiwi is identified as having Outstanding Ecological Value under the oWDP.

Further, Dr Martin and Ms Reaburn state that Lux *et al*. (2007) provide records for 104 bird species (81 indigenous and 23 introduced) in the Waipu Ecological District, with records for an additional 18 bird species from 10 locations (Marsden Bay Boat Ramp, Marsden Bay foreshore, Marsden Point-Papich Road, Ormiston Road Ruakaka, Ruakaka Wildlife Refuge, Ruakaka-Mountfield Dam, Ruakaka-Wilson Dam, Waipu Cove, Waipu Wildlife Refuge, Waipu-

Uretiti dune lakes). They note that of these species, 10 are classified as Threatened, 26 as At Risk, and 21 as Non-resident Native (either Coloniser, Migrant or Vagrant). In addition, they state that nine species are regionally significant in Whangārei District, and 28 qualify as significant under Schedule 17B of the oWDP.

2.3.1.5 Freshwater Fauna

Twelve indigenous freshwater fish species have been recorded in Waipu Ecological District and four in Manaia Ecological District, with five of these species classified as Threatened or At Risk according to Dr Martin and Ms Reaburn. They further advise that the banded kōkopu (*Galaxias fasciculatus*) is classified as regionally significant in Whangārei District, while both banded kōkopu and shortjaw kōkopu qualify as significant under Schedule 17B of the oWDP.

Further, Dr Martin and Ms Reaburn state that three freshwater invertebrate species have been recorded in each ecological district, with one classified as At Risk.

2.3.1.6 Herpetofauna

In terms of herpetofauna, Dr Martin and Ms Reaburn state that one indigenous frog species and 11 indigenous lizard species have been recorded in Manaia and Waipu Ecological Districts. They indicate that the Hochstetter's frog population is situated to the southwest of the Refinery, beyond the extent of the receiving environment for the air discharge.

In addition, Dr Martin and Ms Reaburn state that eight lizard species are classified as Threatened or At Risk. They note that the forest gecko (*Mokopirirakau granulatus*) is a regionally significant species in Whangārei and further advise that Macgregor's skink (*Oligosoma macgregori*) qualify as significant under Schedule 17B of the oWDP.

2.3.1.7 Bats

There is an unconfirmed record of long-tailed bat (Chalinolobus tuberculatus; classified as Threatened-Nationally in O'Donnell et al. 2018) from Peach Cove in the early 1990s at Bream Head Scenic Reserve and surrounds according to Dr Martin and Ms Reaburn. They further state that bats have also been sighted by a resident at Ocean Beach on two occasions in 2008. Both locations are within the Manaia Ecological District. They go on to report that a single survey (which was undertaken in November 2013) did not find any bats in the Manaia Ecological District.

Dr Martin and Ms Reaburn highlight that there are no surveys recorded in the Department of Conservation ('**DoC**') Bat Distribution database for Waipu Ecological District. However, they advise that there are unconfirmed reports of bats from the south eastern Brynderwyn Hills. They go on to state that the closest records of long-tailed bats in the Department of Conservation Bat Distribution database are in Whangārei Ecological District, which is immediately adjacent to both the Waipu and Manaia Ecological Districts (although there is the Harbour between Whangārei Ecological District and Manaia Ecological District).

2.3.1.8 Terrestrial Invertebrates

A range of terrestrial invertebrate species are known from Manaia Ecological District, according to Dr Martin and Ms Reaburn with several classified as Threatened or At Risk. They further state that most land snails are found in forest remnants, but one taxon is restricted to duneland and prostrate shrubland at Smugglers Bay. They report that there are few records of invertebrates within Waipu Ecological District.

2.3.1.9 Acid Sulphate Soils

Dr Martin and Ms Reaburn advise that acid sulphate soils have been identified by the WDC and are naturally occurring and formed around 5,000 to 10,000 years ago when the sea level was higher than it is today. They state that salts in seawater mixed with the land and these remained when the sea receded. Over time, the salts (most commonly sulphates) were broken down by bacteria into sulphides. When the land is disturbed, the sulphides can react with oxygen, resulting in sulphuric acid, which can leach into groundwater, which can have several implications on the surrounding environment.

In addition, Dr Martin and Ms Reaburn state that acid sulphate soils, and their location, may be of relevance to the Proposal as they could have a greater sensitivity to acidification than soils that are more neutral or alkaline (**Figures 2.3.1.9.1** and **2.3.1.9.2**). They state further that there are several areas of acid sulphate soils in the receiving environment including low-lying lands near Marsden Point and on the eastern side of Whangārei Heads, as well as small pockets encompassing the residential areas of Whangārei Heads and Mcleod Bay.

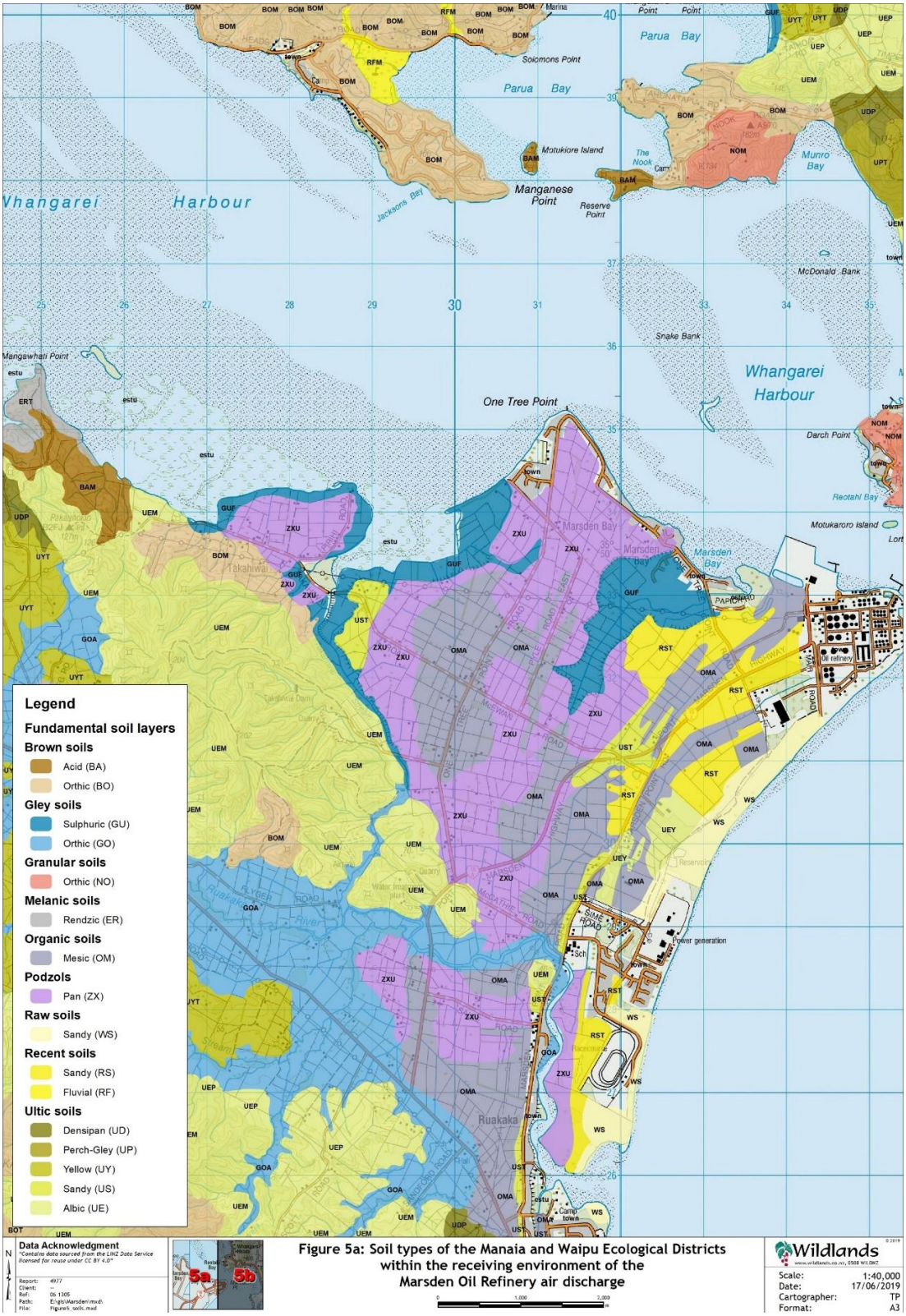


Figure 2.3.1.9.1: *Soil Types of the Manaia and Waipu Ecological Districts (South)*

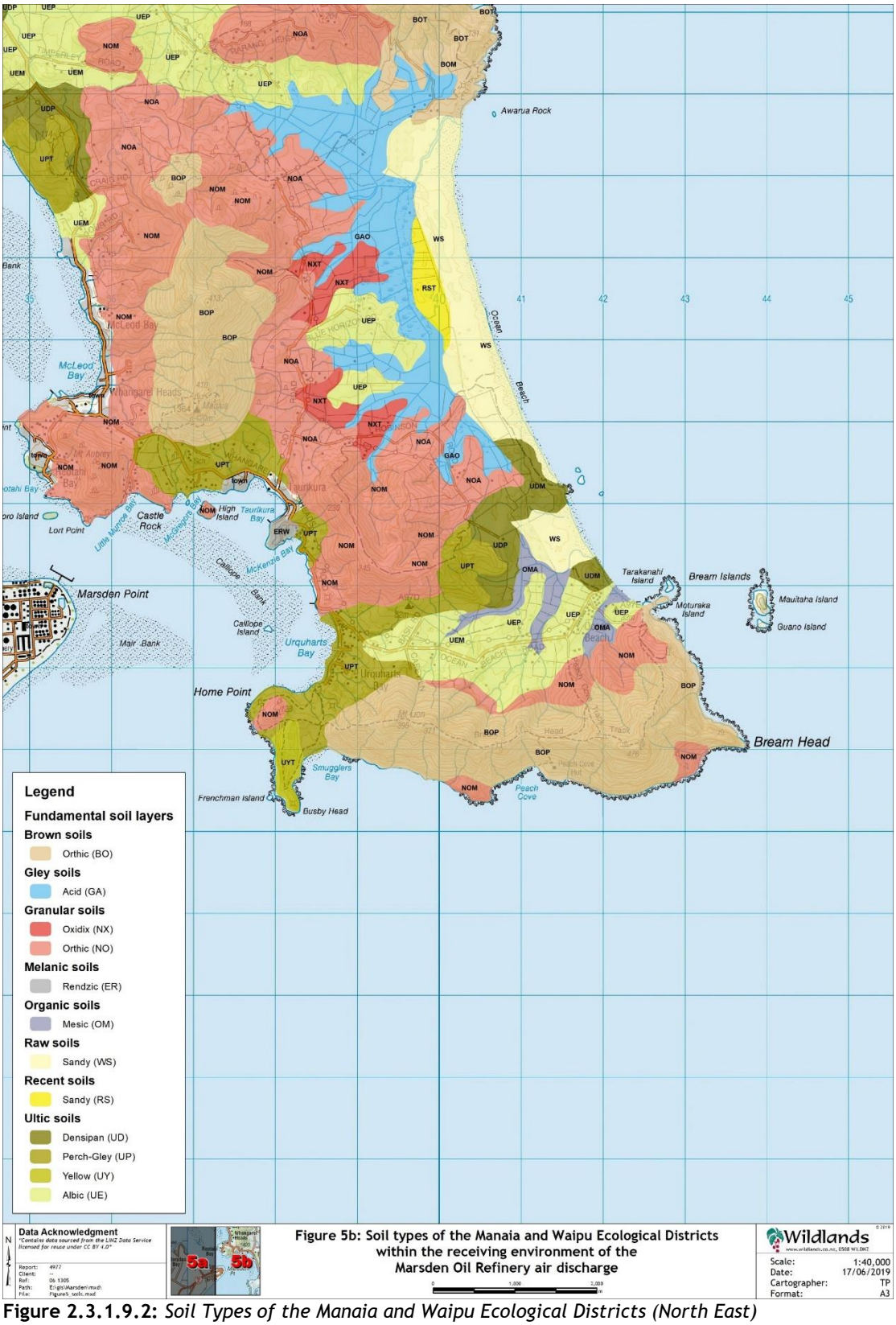


Figure 2.3.1.9.2: *Soil Types of the Manaia and Waipu Ecological Districts (North East)*

2.3.1.10 Effects of Human Settlement on the Receiving Environment

Dr Martin and Ms Reaburn advise that to the southwest of the discharge point, on the coastal flats of the Waipu Ecological District, vegetation clearance and conversion to agricultural and industrial land uses has resulted in almost the complete loss of indigenous vegetation and habitats within approximately six km of the discharge point. They identify this pattern of

highly modified coastal plains, with indigenous habitats largely restricted to a narrow band of coastal dunes, several tidal inlets, and small freshwater wetlands in dune slacks. They report that larger tracts of indigenous vegetation occur on coastal hill country, the nearest area being the Takahiwai Hills, six km to the west of the Refinery.

Dr Martin and Ms Reaburn advise that in contrast to the northeast of the discharge point, the receiving environment, within the Manaia Ecological District, encompasses areas of steep hill country, and as a consequence of this, retains a high degree of indigenous vegetation cover. They further state that most of the steeper land is indigenous forest and scrub, with remnant areas of coastal forest also occurring along the shoreline of Whangārei Harbour. The western side of the main ridges, that run approximately northwest to south east, gentler slopes and small coastal flats are characterised by small settlements, and small areas of pasture grazed by sheep or beef cattle. They record that to the east of this main ridge, larger tracts of pasture on the coastal flats behind Ocean Beach include both dairy farms and dry stock farms.

Dr Martin and Ms Reaburn set out that all-natural areas within the receiving environment are adversely affected, to varying degrees, by pest plants and pest animals and some are also subject to the effects of grazing. They state further that where livestock have access to natural areas (such as the foothills of Mount Manaia and the Takahiwai Hills), browsing and trampling by livestock is likely to be the primary cause of biodiversity decline.

Similarly, they advise that where natural areas are close to urban areas that provide a source of pest plants, these areas, without the implementation of a pest control programme, may see a gradual progression towards being dominated by pest plant species. They note that this pattern is readily observable in small areas of coastal vegetation within or close to the coastal settlements from Parua Bay to Urquharts Bay and state that some areas within the receiving environment are actively managed for conservation purposes. They state that these areas are the least modified areas within the terrestrial receiving environment and are important refuges for Threatened and At-Risk indigenous plants and fauna, and threatened ecosystem types.

2.5.1.11 Summary of Ecological (Terrestrial) Significance

As we have already foreshadowed, Wildlands have highlighted the existence of a number of ecologically significant habitats and species of flora and fauna within the receiving environment. Dr Martin and Ms Reaburn state that the term 'significant' has other meanings in relation to the statutory context of an application, although the assessment criteria for assigning relative value and significance are generally similar. Dr Martin and Ms Reaburn advise that due to the extensive nature of the receiving environment, the extent of the discharge encompasses a wide range of ecological values and that all of the sites assessed in this report are considered significant at a regional scale. In summary, they also state that the study area has nine plant species, 28 bird species, two fish species, one frog species, and one lizard species that are significant.

2.3.2 Air Quality

Mr Richard Chilton of Tonkin and Taylor (**'T&T'**) has prepared an Assessment of Air Quality (**'AQA'**)[13] for the Proposal, a full copy which is attached within **Annexure 3** to this AEE. In his report Mr Chilton has provided details of the receiving environment in relation to air quality, surrounding the Refinery. We now summarise his key findings.

2.3.2.1 Receiving Environment

Mr Chilton advises that the receiving environment surrounding the Refinery has several nearby residential communities that are considered to have a 'high sensitivity' to air quality impacts. These communities are as follows: Marsden Cove (910 m west-northwest); One Tree Point (2.7 km northwest) and Bream Bay (3.8 km south-southwest). He also reports that the receiving environment includes various communities on the opposite of the Whangārei Harbour, namely: Whangārei Heads (2 km north-northeast); Reotahi Bay (1.25 km north);

[13] Chilton, R. Tonkin & Taylor Limited, *Air Quality Assessment*. Dated June 2020

Little Munro Bay (1.3 km north-northwest); McKenzie Bay (2.9 km east-northeast); and Urquharts Bay (3.3 km east).

Mr Chilton records that Whangārei City is located at the head of the Whangārei Harbour approximately 15 km northwest of the Refinery and that Ruakaka Township is located approximately 6.3 km south of the Site. He states further that the land immediately surrounding the Site is industrial in nature and reports that that this land includes the Carter Holt Harvey plant immediately west of the Site and land to the immediate northwest of the Site is occupied by Northport. He also advises that the industrial and port land uses have a low sensitivity to air quality.

In addition, Mr Chilton notes that WDC has identified 'Marsden Point – Ruakaka' as an identified growth area in the district and that growth in this area has led to the development of the 'Marsden Primary Centre', which *"… is intended as a new southern primary suburban centre which will complement Whangārei City itself"*. He advises that the closest distance between the Marsden Primary Centre and the Refinery is approximately 3.5 km to the west-southwest. He goes on to state that although this area is still being developed, it is considered that it will have a high sensitivity to air quality impacts.

Mr Chilton advises that within these zones there are a number of ecologically sensitive locations. He reports that further details of these locations are provided in the ecological assessment prepared by Wildlands. He then states that there are other sensitive locations and activities, such as schools, places of worship and marae surrounding the Site, as follows:

- Takahiwai Marae (6 km west of Site);
- One Tree Point School (2.4 km northwest of the Site);
- Whangārei Heads School (2.3 km northeast of the Site);
- Bream Bay College (4 km south-southwest of the Site);
- Marsden Playcentre (4 km west of the Site);
- Bream Bay Kindergarten (4 km south-southwest of the Site);
- Life Point Baptist Church (3.8 km northwest of the Site);
- Holy Family Centre (4 km south-southwest of the Site);
- St Pauls Anglican Church (4 km south-southwest of the Site); and
- McLeod Bay Community Church (2.6 km north of the Site).

2.3.2.2 Meteorology & Topography

Mr Chilton reports that Refining NZ measures wind speed and direction at its monitoring station located near the Jetty. He advises that wind roses graphically summarise wind speed and direction data, over a period of time, and that the 'petals' of the wind rose show the direction that winds come from and the frequency of winds from that direction (shown by their length). He states further that the different colour bands within each petal indicate the frequency distribution of wind speeds for each direction.

A wind rose developed for all hours shows the prevailing winds are southwest through to northwest, with winds from the northeast also occurring frequently and that the strongest winds occur from the northeast, Mr Chilton advises. He goes on to indicate that another three wind roses developed, illustrate that during the early morning prior to sunrise, winds are predominantly from the northeast and generally light. Further, Mr Chilton states that wind speeds are typically much higher during daytime hours and winds in the evening reduce when winds are from the southwest to west compared with daytime hours. He states that for all times of the day, the winds from the northeast are generally strong; and winds from the southeast are relatively infrequent.

According to Mr Chilton, the topography of Marsden Point and the Whangārei Heads significantly affect local wind patterns. He reports that the topography surrounding the Site is characterised by the Whangārei Harbour and surrounding terrain, and that Marsden Point where the Site is located, is relatively flat and low-lying, with the Takahiwai Hills (200 m above sea level) rising approximately 5.5 km to the west of the Site. He states that this flat land exposes the Site to winds from the southwest. He also notes that to the east of the Site,

on the opposite side of the Harbour, are the Whangārei Heads where the land rises significantly and that this elevated terrain, particularly Mount Mania, significantly acts on wind flow. It channels elevated winds from the northeast, and the direction of highest strength winds aligns with the area of low-lying land behind Taurikura Bay and south of Mount Manaia.

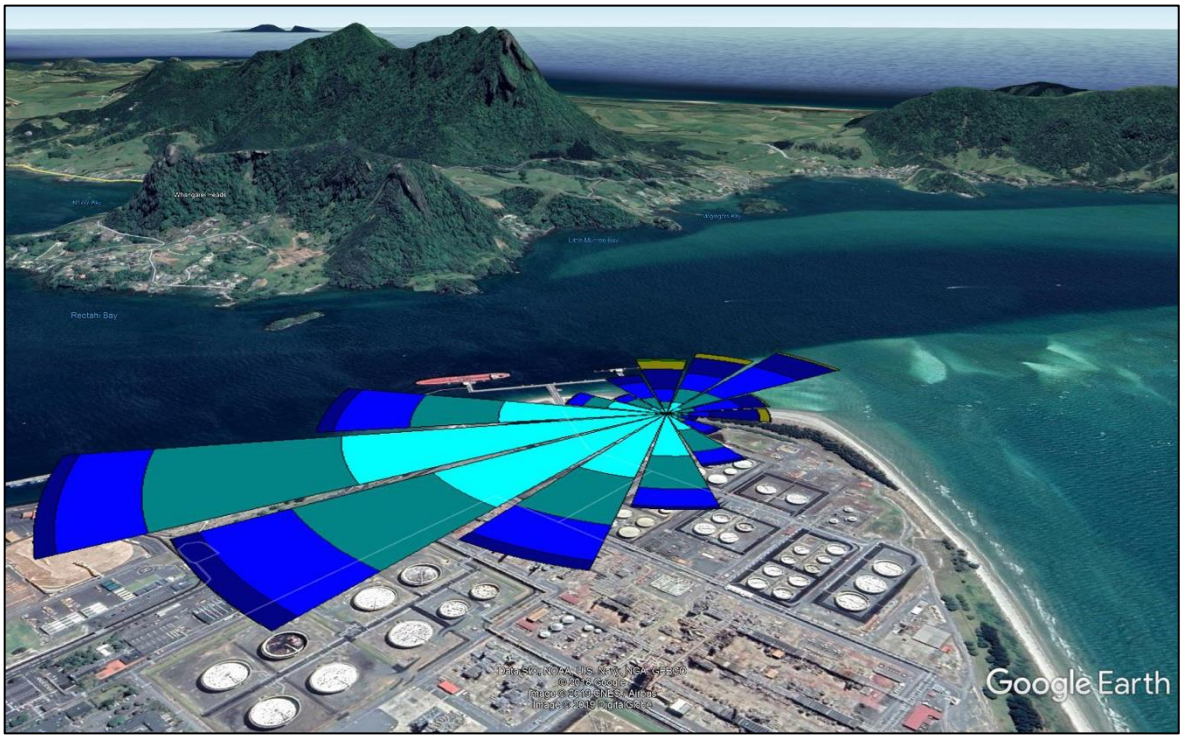


Figure 2.3.2.2.1: *Three-dimensional view of terrain looking east-northeast from the site. Mount Mania is the tall mountain rising on the left side of the image. Overlaid on the image is the wind rose for 2011 and 2012*

2.3.2.3 Background Air Quality

We now discuss the various contaminants that are present in the air within and surrounding the Refinery.

Sulphur Dioxide (SO_2)

Mr Chilton records that ambient monitoring of SO_2 is carried out at the three monitoring sites run by Refining NZ on the opposite side of the Harbour from the Refinery. In this regard, the monitoring is undertaken at Urquharts Bay, Whangārei Heads, and Little Munro Bay. He states that from the results of monitoring contaminants for the previous five years (2013 – 2018), the following is evident:

- Peak one-hour concentrations are typically below 150 µg/m^3 and therefore well below the NESAQ of 570 µg/m^3; and
- Peak 24-hour concentrations are typically below 30 µg/m^3, although Little Munroe Bay recorded levels up to 52 µg/m^3. These values are well below the Ambient Air Quality Guideline (**'AAGL'**) of 120 µg/m^3.

Mr Chilton advises that when the above results for SO_2 are evaluated against the relevant assessment criteria, within the framework set out by the Institute of Air Quality Management (**'IAQM'**) 2009, consideration is given to the fact that the Refinery is the dominant source of SO_2 in the airshed and that it is expected to be a significant contributor to measured SO_2 levels. He also reports that other sources that contribute to SO_2 concentrations are emissions associated with shipping, which typically burn heavy fuel oil that has a significant sulphur content. He states that it is difficult however to separate the contribution of the Refinery from other sources within the monitoring data in a robust and meaningful manner.

Particulate Matter (PM_{10})

Mr Chilton advises that the 2015 State of the Environment ('**SoE**') report prepared by the NRC summarises a limited study of particulate matter 10 micrometres or less in diameter ('**PM_{10}**') monitoring carried out at Ruakaka (Peter Snell Road) just south of the Refinery and indicates generally low levels within 30 µg/m^3 (24-hour average). He states that airshed modelling of PM_{10} emissions in the wider Marsden Point area was undertaken for the NRC and that the study focused on domestic home heating emissions while also considering motor vehicle emissions and emissions from industry, including the Refinery.

Mr Chilton reports that the peak concentrations of PM_{10} within the Marsden Point Airshed will generally be low, but elevated concentrations may occur on occasions because of the Whangārei urban plume and smaller contributions from Marsden Point industries. He also states that predictions of up to 40 µg/m^3 were modelled for a location between the Refinery and Ruakaka over a largely rural area. This result appears to be broadly consistent with the findings of the NRC SoE Report. He advises further that predicted annual average concentrations are very low, with the most impacted location being immediately to the west of the Site boundary reaching 0.3 µg/m^3. He also reports that on the opposite side of the Harbour, concentrations reach approximately 0.2 µg/m^3 over Mount Manaia. In addition, Mr Chilton concludes that the above results for PM_{10} are also evaluated against the relevant assessment criteria with the framework set out by the IAQM (2009).

Very Small Particulate Matter ($PM_{2.5}$) Carbon Monoxide (CO), Nitrogen Dioxide (NO_2) & Other Contaminants

*Fine Particulate Matter 2.5 micrometres or less in diameter ('**$PM_{2.5}$**')*

There has been no monitoring of background $PM_{2.5}$ concentrations in the vicinity of the Site, which, according to Mr Chilton is to be expected since there are very few $PM_{2.5}$ monitoring sites outside of large urban centres in New Zealand. In the absence of such data he reports that the approach used by Auckland Council has been adopted which describes multiplying the 24-hour and annual average PM_{10} concentration by 0.37 (for rural locations) to derive corresponding $PM_{2.5}$ values. Mr Chilton explains that this data, which is intended for use with air quality assessments, provides the best available indication of likely background $PM_{2.5}$ concentrations in the vicinity of the Site. He goes on to state that predicted annual average $PM_{2.5}$ concentrations are very low, with the most impacted location being immediately to the west of the Site boundary reaching 0.3 µg/m^3. Allowing for an annual average background concentration of 5.6 µg/m^3, he advises that cumulative concentrations will not approach the World Health Organisation ('**WHO**') guideline of 10 µg/m^3. Mr Chilton states further that the results for $PM_{2.5}$ are evaluated against the relevant assessment criteria, with the framework set out by the IAQM (2009).

*Nitrogen Dioxide ('**NO_2**')*

Mr Chilton reports that there is no ambient monitoring of NO_2 that takes place in the vicinity of the Site. Further, Mr Chilton indicates that in the absence of such data, background air quality concentration estimates are produced by the New Zealand Transport Agency ('**NZTA**'). He advises that NZTA produces an interactive air quality map[14] for determining background concentrations of NO_2. According to Mr Chilton this data, which is intended for use with air quality assessments, provides the best available indication of likely background NO_2 concentrations in the vicinity of the Site. He indicates that model predictions of the annual average NO_2 concentrations are very low (maximum off site concentration of 3 µg/m^3 and 1ug/m^3 at the most impacted sensitive location). In addition, Mr Chilton states that with a background concentration of 4 µg/m^3, it is clear, that the cumulative concentrations will not approach the WHO guideline of 40 µg/m^3.

*Carbon Monoxide ('**CO**')*

Mr Chilton advises that there is no ambient monitoring of CO that takes place in the vicinity of the Site and that ambient concentrations of CO seldom approach relevant standards and

[14] https://www.nzta.govt.nz/roads-and-rail/highways-information-portal/technical-disciplines/air-quality-climate/planning-and-assessment/background-air-quality/

guidelines in New Zealand. Consequently, it is not widely monitored outside of large metropolitan areas. He states further that where it is monitored, it is typically in order to characterise the impacts of significant road transport routes in urban environments. He then states that in the absence of such data, values have been taken from the 'default values' listed by the Auckland Council for areas outside the urban extent of Auckland City, which according Mr Chilton, provides the best indication of background CO concentrations, typically found in NZ rural areas. He claims that there has been no monitoring of background $PM_{2.5}$ concentrations and CO in the vicinity of the Site and that in the absence of such data, the approach described by Auckland Council has been used. He also advises that there is no ambient monitoring of NO_2 that takes place in the vicinity of the Site and that in the absence of such data, background air quality concentration estimates produced by NZTA have been used. Mr Chilton goes further to advise that the remainder of contaminants are expected to be present at trace levels in the receiving environment, given that there are no other significant sources of those contaminants in the receiving environment. He also concludes with respect to ambient concentrations of CO, that when the results for CO are evaluated against the relevant assessment criteria with the framework set out by the IAQM (2009), the potential adverse effects can be considered as negligible for the most impacted sensitive location.

Other Contaminants

Mr Chilton states that the remainder of contaminants are expected to be present at trace levels in the receiving environment, given that there are no other significant sources of those contaminants in the receiving environment. In relation to dioxins and furans, Mr Chilton indicates that the resulting annual average predicted ground level concentrations are compared against the Office of Environmental Health Hazard Assessment (**'OEHHA'**) guideline of 40 picograms per m^3 (pg/m^3 - equivalent to $4x10^{-5}$ $\mu g/m^3$). He states that these model predictions, which are considered to be very conservative due to the emission assumptions, indicate very low concentrations relative to the guideline. He then concludes that the potential adverse effects from dioxin and furan air discharges are negligible. In terms of metals he indicates that all but nickel is at very low levels relative to the corresponding assessment criteria. He concludes further that when the results for the various metals, excluding that for nickel, are evaluated against the relevant assessment criteria with the framework set out by the IAQM (2009).

Background Sulphur & Nitrogen Deposition Rates

Mr Chilton advises that he is not aware of representative background monitoring data relating to sulphur and nitrogen deposition rates and states that it is not routinely collected as part of air quality assessments. He therefore advises, that in the absence of such data, an estimation of annual average deposition rates has been made based on the annual average ambient concentration of SO_2 and NO_2.

Mr Chilton indicates that background sulphur and nitrogen deposition rates have been calculated from estimated background SO_2 and NO_2 concentrations using UK guidance[15] and conservative dry deposition velocity values for forest conditions of 0.024 m/s for SO_2 and 0.003 m/s for NO_2. He states that this is an appropriate approach in the absence of data. Mr Chilton also notes that nitrogen and sulphur deposition have been modelled to inform the terrestrial ecological assessment and that both wet and dry deposition were modelled, and the combined total deposition rates determined. He concludes that in this case, unlike nitrogen deposition, there is no direct criteria that the cumulative sulphur deposition rates are compared against, and that he therefore does not consider them to have any adverse air quality effects which require further characterisation and/or assessment.

2.3.2.4 Emissions from Ships at Berth

Mr Chilton states that crude oil is received via ships at its jetty, with some product also being shipped from the Site via its jetty. He outlines that the largest ships, and therefore emissions, are associated with the receipt of crude oil. He states further that these ships

[15] Habitats Directive 2014. Technical Guidance on Detailed Modelling Approach for an Appropriate Assessment for Emissions to Air – AQTAG06

when berthed, use on-board auxiliary engines, fired with heavy fuel oil to run pumps that are used to transfer the crude from the ship to the sites' storage tanks. In addition, he states that the heavy fuel oil contains a relatively high proportion of sulphur and that it is therefore a source of SO_2 emissions, which according to Mr Chilton, can have cumulative effects, from the Site.

Mr Chilton advises that in order to assess the cumulative effects of ship discharges, dispersion modelling has been carried out to examine the potential impact of emissions from a berthed crude tanker when operating off its auxiliary engine. He states that the following conservative assumptions have been made for this assessment:

- The largest ship (Suezmax class tanker) is berthed at the jetty;
- The ship is berthed continuously for the entire period (In practice, a crude tanker will be present about once every week for less than two days in duration);
- Downwash effects are modelled, assuming the structure of the ship is 275 m in length, 50 m in width and 15 m in height; and
- A typical auxiliary engine for a Suezmax class tanker is approximately 4 megawatts ('**MW**') and operating at 75% output.

Based on these assumptions the specific discharge parameters and emission rates were determined for the modelling assessment.

2.3.3 Marine Water Quality

Dr Mike Stewart of Streamlined Environmental Limited prepared a water quality assessment for Refining NZ to inform the resource consent renewal applications.[16] The report provides commentary on the historic compliance of the Refinery in the context of water quality at the Marsden Point Refinery. We now summarise those aspects of the report that describe the existing environment.

2.3.3.1 Surface and groundwater infrastructure

Surface water

Dr Stewart outlines that there are two types of drainage systems employed by Refining NZ, being the COC and the AOC.

Dr Stewart states that the COC intercepts process water, stormwater and tank drainage water that is likely to be contaminated from processing and treatment activities at the Site. He notes further that the oil that is collected in the interceptors is directed back to the slops[17] processing unit for recycling and that the separated water is pumped to the water treatment unit (the biotreater[18]unit) for further treatment. He also points out that when rainfall intensity exceeds 6 mm/h the treated water from the interceptors is discharged into the AOC.

The AOC is effectively the stormwater system for the Site according to Dr Stewart, and it generally has lower concentrations of contaminants from the Refinery. He records that the reticulated stormwater network drains to the open channel within the Site that flows to the stormwater retention ponds and eventually discharges to the SWB. He also indicates that stormwater from the SWB is pumped through a pipe along the No. 2 (western) Oil Jetty to an outfall and the stormwater discharge is then tested for a range of water quality parameters in accordance with the consent conditions.

Groundwater

Dr Stewart reports that a hydraulic containment system has operated at the Site since 1983. Its purpose is to manage hydrocarbon contamination of groundwater. He notes that the

[16] Stewart, M. Streamlined Environmental Limited, *A Water Quality Assessment at Marsden Point Oil Refinery to Inform Resource Consent Renewal Applications*. Dated July 2020

[17] crude oil which is emulsified with water and solids rendering it a waste stream that cannot be sold down the pipeline

[18] Biotreatment or otherwise biodegradation by natural populations of microorganisms is one of the primary mechanisms by which petroleum and other hydrocarbon pollutants can be eliminated from the environment

current extraction system comprises recovery wells and operates continuously and that recovered product is pumped to the COC and slops system for separation and treatment.

2.3.3.2 Defining the Mixing Zone

Dr Stewart has considered the comments of Dr Rob Bell of the National Institute of Water and Atmospheric Research (**'NIWA'**) contained within the Cultural Effects Assessment (**'CEA'**)[19] prepared by the Patuharakeke Te Iwi Trust Board (**'PTB'**). Dr Stewart notes that Dr Bell questioned the appropriateness of the size of the mixing zone during pre-application feedback on the consultation draft reports[20]. In response to this query Dr Stewart notes that several applicable planning documents contain provisions that are relevant to the concept of reasonable mixing and mixing zones. Dr Stewart has referenced the New Zealand Coastal Policy Statement (**'NZCPS'**) for the definition of mixing zones and the pRP for how these zones are determined. Dr Stewart notes that both the NZCPS and pRP state that mixing zones used shall be of the smallest size necessary to achieve the required water quality in the receiving environment. Dr Stewart states that the mixing zone for the Proposal reflects the extant consents of which Refining NZ seeks to renew and is identified in the planning maps for both the oRCP and the pRP. Dr Stewart highlights that his assessment of effects relates to coastal water quality outside the mixing zone, the method he uses calculates concentrations of stormwater basin contaminants at specific sites (including the four corners of the current mixing zone) after dilution in the receiving environment. Dr Stewart states that in his opinion the mixing zone proposed/used (being the status quo / maintaining the mixing zone at the current size) is appropriate.

Dr Stewart states this is because;

- the mixing zone proposed/used is the smallest area necessary to achieve the required water quality in the receiving environment;
- within the proposed mixing zone, effects on the life-supporting capacity of water will be minimised and are appropriate (being minor at worst). In particular, the mixing zone contaminant concentrations and levels of dissolved oxygen will not cause acute toxicity effects on aquatic ecosystems; and,
- after reasonable mixing, significant adverse effects on ecosystems and habitats will be avoided; and overall water quality will be maintained.

2.3.3.2 Refining NZ SWB Discharge Water & Sediment Quality

SWB Sample Collection and Analysis Methodology

Dr Stewart notes that in relation to the SWB, samples are collected by staff from Refining NZ from a continuously pressurised line fed by a small pump which is located next to the larger discharge pumps. Dr Stewart indicates that the water in the line is representative of what is being discharged to the Harbour, which he notes is a minimum of 5,000m^3 per day. Dr Stewart indicates that the volume of SWB discharge is incorporated into the hydrodynamic modelling undertaken by MetOcean Solutions (2020). Dr Stewart states that the prop sample consists of sub-samples based on volume discharged and is therefore representative of the discharge over the day. Dr Stewart explains that the prop sample is collected at 8:00am each morning, is subsequently placed in a container that is kept under refrigeration before being taken to an on-site Ecological Impact Assessment Guidelines for New Zealand (**'EIANZ'**) accredited independent laboratory so there are no transportation issues.

Discharge Water Quality Status (2014 to 2019)

Dr Stewart reports that NRC monitor the SWB as part of their receiving environment monitoring and that from 2014-2019, total phenols, total polycyclic aromatic hydrocarbons (**'PAHs'**)[21] and benzene/toluene/ethylbenzene/xylene (**'BTEX'**)[22] were below detection limits in all samples and that for the same period sulphides were below the detection limit.

[19] PTB, *Cultural Effects Assessment Report: Refining NZ Reconsenting.* Dated July 2020

[20] Feedback was provided in a memorandum prepared by Dr Bell, dated the 23rd of March 2020

[21] air pollutants of particular concern because of the recognised mutagenic and carcinogenic properties of a number of the individual compounds (termed congeners)

[22] classified as priority pollutants regulated by many environmental organizations around the world. These monocyclic aromatics are highly water soluble and volatile compared to their aliphatic counterparts

He states that the potential for hydrogen (‘**pH**’)[23] was within the consent limit range and maximum biochemical oxygen demand (‘**BOD_5**’)[24] was well below the consent limit. He further states that total suspended solids (‘**TSSs**’)[25] ranged from 2.0 to 23.0 mg/L, with a median of 12.5 mg/L. From 2014 to 2019, ammoniacal-nitrogen (‘**NH_4-N**’)[26] concentrations ranged from 0.02 to 15.0 mg/L, with a median of 0.41 mg/L. Dr Stewart reports that it should be noted that metal and metalloid concentrations[27] have been measured since 2015.

Discharge Sediment Quality Status

Dr Stewart reports that Refining NZ SWB sediment quality was assessed from three sampling events: 2012, 2014 and 2016 and that analysis was performed by comparison of sediment concentrations for metals/metalloids, total petroleum hydrocarbon (‘**TPH**’)[28] and Total PAH with sediment quality guidelines. Organic data was corrected to 1% total organic carbon (‘**TOC**’) and only a few individual PAH congeners were found to be below detection limits in the SWB sediments. He advises further that for the purposes of calculating total PAH, these were set to the detection limit and that there are no soil guideline values (‘**SGV**’)[29] for phenols so potential effects could not be assessed. He also notes that all phenol concentrations were below detection limits and reports that results of the analysis show that sediment concentrations have been relatively stable between 2012 and 2016, with the possible exception of total PAH. He further states that the contaminants of most potential concern are mercury, zinc, copper and TPH, which were materially higher than SGV.

Dr Stewart concludes that although the SWB sediment contaminant concentrations appear high in comparison with SQG, it is important to note that SQG are designed for receiving environment sites and sediment is not being discharged directly. He notes further that to assess any potential effects from sediment contaminants discharged to the receiving environment, SWB sediment concentrations data was inputted into a 3D-hydrodynamic model to estimate the potential receiving environment sediment concentrations.

Whole Effluent Toxicity Testing

Dr Stewart advises that the Refining NZ SWB water has been assessed for marine species toxicity under ‘normal’ operating conditions, in September 2017 by NIWA and May (and August) 2019 by Cawthron Institute[30]. He states that NIWA ran the toxicity screen against three test species in 2017: blue mussel bivalve embryo development; wedge shell bivalve survival and morbidity (reburial); and marine alga. He notes that they reported ‘no toxicity dilution’ of the storm-water samples; a dilution at which the sample would be expected to exhibit no toxicity to the organisms tested after a chronic exposure. He records that the most sensitive organism was the marine alga; blue mussels were least sensitive and wedge shell bivalve had a ‘no toxicity dilution’.

Dr Stewart advises further that Cawthron ran the toxicity screen against four test species in both the 2019 tests: blue mussel bivalve embryo development; pipi survival/reburial; amphipod mortality; and marine alga growth, and the ‘no toxicity dilution’ was consistent amongst all the species.

Dr Stewart states further, that between the three sampling events there were two species in common, marine alga and blue mussel. By comparison of data for these two species, the September 2019 Refining NZ SWB discharge appears to be more toxic than the May 2019 and September 2017 sampling He states that the NZ September 2019 SWB discharge required a

[23] a measure of acidity or alkalinity of water-soluble substances
[24] measures the quantity of biodegradable organic matter contained in water
[25] the dry-weight of suspended particles, that are not dissolved, in a sample of water that can be trapped by a filter
[26] often called ‘ammonium’, covers 2 forms of nitrogen; ammonia (NH3) and ammonium (NH4). NH_4-N can be transformed to other forms of nitrogen and is a very important plant fertiliser
[27] common groundwater contaminants that present a risk to users of groundwater if concentrations exceed acceptable risk-based concentrations
[28] a term used for any mixture of hydrocarbons that are found in crude oil
[29] generic assessment criteria for assessing the risks to human health from chronic exposure to soil contaminated with phenol
[30] New Zealand's largest independent science organisation specialising in aquaculture, biosecurity, marine and freshwater, and lab testing

'no toxicity dilution' of around 11.3-fold for green alga, and greater than 256-fold for blue mussel. Dr Stewart advises that the September 2019 SWB sampling was associated with a storm event, while the previous sampling events were associated with more standard plant operating conditions. He states further that dilutions required to reduce the toxicity of the SWB discharge water to a no-toxicity threshold is based on a 256-fold dilution, i.e. a worst-case scenario of a plant upset and most sensitive marine species.

2.3.3.3 Refining NZ SWB Discharge Water Quality Trends

Dr Stewart reports that a temporal trend analysis of selected parameters routinely measured from the Refining NZ SWB was undertaken to provide a longer-term view of all potential contaminants discharged, which according to Dr Stewart will assist in informing the setting of future consent limits. Dr Stewart notes that trends for all the discharge data were estimated using a Mann-Kendall trend test as the majority of the SWB data did not exhibit obvious seasonal bias, however a Seasonal Kendall test was used where there was apparent seasonal bias. He reports further that between 2014 and 2019, pH has been increasing significantly and meaningfully annually, the second half of 2018 showed relatively high pH (although still within consent limits) and that the increase has been relatively consistent over the last five years. He states that NH_4-N has been decreasing significantly and meaningfully between 2014-2019 and that a considerable contributor to these large decreases are relatively high NH_4-N concentrations in 2014 and early 2015.

Dr Stewart notes that of the data used in this assessment, a high number of censored data was present for BOD_5 (33% censored data), cadmium (71% censored data), mercury (64% censored data), lead (50% censored data), and chromium (50% censored data). Dr Stewart explains that censored data, (that is; data below detection limits), is treated by the software used for his assessment by setting all data below the detection limit to the detection limit. Dr Stewart records that this can influence the significance of trends where there are large numbers of censored data. Dr Stewart notes that for BOD_5 cadmium, mercury and lead, this corresponded to non-significant or zero trends. Dr Stewart advises that chromium[31] has increased significantly between 2014 and 2019[32]. Dr Stewart advises that there were non-significant increases between 2014 and 2019 for TSS, faecal coliforms and copper. He further advises that there were non-significant decreases between 2014 and 2019 for arsenic, mercury and zinc. Further, Dr Stewart notes that no temporal trends were observed for BOD_5, cadmium, nickel and lead, and that sediment quality temporal trend data was not significant.

2.3.3.4 Northport Stormwater Discharge Quality

Dr Stewart states that Northport Limited discharge stormwater from Marsden Maritime Holdings (**'MMH'**) and the Port after storage and settlement pond system, in accordance with Resource Consent CON20090505532 and that the combined stormwater is discharged into Whangārei Harbour near the Refining NZ stormwater discharge. Thus, the contaminants discharged from Northport, contribute to the current receiving environment. He notes further that TSS concentration is higher in the Northport discharge compared with Refining NZ. He also states that the minimum, median and mean pH in Northport is than Refining NZ by 1pH respectively. Dr Stewart also indicates that copper and lead concentrations are similar between Northport and Refining NZ. Dr Stewart states that zinc concentrations are higher at Refining NZ (median 0.0420 mg/L) than Northport (median 0.0178 mg/L) by a factor of around 2. He further notes that total PAHs were below the detection limits in both discharges.

2.3.3.5 Receiving Environment Water & Sediment Quality

Quarterly NRC receiving environment water quality monitoring data from May 2014 to February 2019 was provided by Refining NZ. Dr Stewart notes that parameters consistently measured[33] at water quality sites are summarised as: Physical – DO, pH, temperature, salinity,

[31] a metal found in natural deposits as ores containing other elements. Hexavalent chromium (or chromium-6) is a highly toxic form of the naturally occurring metal chromium and is a well-known human carcinogen when inhaled

[32] Dr Stewart notes that Chromium has 50% censored data (below detection limit). When censored data are replaced with a value 0.5x the detection limit, the annual increase is 0.0004 mg/L (+23% annually) ($p = 0.01$)

[33] Some parameters have been measured sporadically. These have not been assessed due to lack of consistent data

or; Toxicants[34] – phenols, metals/metalloids, NH_4-N, BOD_5, Faecal coliforms (**'FC'**), sulphide, TPH, and TSS. Dr Stewart states that these parameters were assessed against the applicable surface water quality guideline (**'SWQG'**). The assessment outcomes are summarised briefly below:

Physical Parameters

Dr Stewart states that the surface water of Whangārei Harbour sites monitored by the NRC has been consistently well oxygenated in the period assessed (2014-2019). For NRC Whangārei Harbour sites monitored between 2014 and 2019, he indicates that pH was well within the required range of 7 to 8.5 and that there was no more than 0.1 pH unit difference between inner Harbour sites, mixing zone sites and outer Harbour sites. He also advises that the SWQGs defined by the proposed Northland Regional Plan (**'pRP'**) are for a maximum temperature change of three degrees Celsius (**'°C'**) at the edge of the mixing zone and notes that across the NRC water quality sites monitored, there is very little difference in temperature (generally less than 1 °C). In terms of physical parameters Dr Stewart concludes that temperature variation of the Whangārei Harbour surface water is not significantly influenced by the Refining NZ stormwater discharge.

Toxicants

Dr Stewart notes that between 2014 and 2018, all the NRC water quality sites had median annual NH_4-N concentrations below the SWQG with one exception that marginally exceeded the SWQG in 2014. Dr Stewart records that sites on the edge of the mixing zone had low NH_4-N concentrations compared with NRC monitoring sites in the inner Harbour and the outer Harbour. Dr Stewart advises that arsenic (a metalloid) was the only metal/metalloid consistently above detection limits, however, concentrations were never greater than 11% of the oRCP SWQG. He indicates that there was no apparent inter-site or inter-annual variation in arsenic concentrations at these sites. Further, he reports that the Refining NZ SWB maximum arsenic concentration between 2015 and 2019 was 0.0041 mg/L, which is virtually identical to the receiving environment arsenic concentrations.

He also states that the detection limits in the analytical methods for chromium, copper and mercury were not sufficient to accurately assess the potential temporal or spatial ecological effects of these toxicants. Dr Stewart reports that maximum copper, mercury and zinc SWB concentrations exceeded the ANZ marine default guideline values (**'DGVs'**). Median concentrations also exceeded the same trigger values. According to Dr Stewart, this suggests potential for point source discharges of these metals to have an adverse effect on the receiving environment, however, there is no evidence that this is occurring. Dr Stewart goes further to report that zinc in the discharge was especially high, however it was below detection limits at all receiving environment sites. Copper in the discharge was up to 3.5 times the ANZ marine DGV, but only detected in two of the receiving environment sites, neither of which is a mixing zone site.

Dr Stewart states that 14 individual phenol congeners were measured at all the sites and that all the results were below detection limits. Annual maximum TPH concentrations at the NRC receiving environment sites for the period of 2014 to 2018 were generally very low and below detection limits (0.3 mg/L). The main exception was 2016, when maximum TPH concentration ranged between 0.4 and 1.7 mg/L. Over this time there were no apparent differences between mixing zone sites and sites in the inner Harbour and the outer Harbour, suggesting that Refining NZ SWB is not causing any elevation of TPH concentrations in the marine receiving environment. Dr Stewart records that the value of 1.7 mg/L at Outer Harbour site was an annual maximum value, whereas at the other sites the annual maximum ranged from <0.3 to 0.6 mg/L, to no more than two times the detection limit of 0.3 mg/L. Dr Stewart considers that the small and consistent increase in TPH in the receiving environment sites over 2016 was an anomaly as years 2014, 2015, 2017 and 2018 have TPH concentrations mostly below detection limits. Dr Stewart further notes that there are no applicable marine water quality guidelines for TPH.

[34] a toxic substance introduced into the environment

Dr Stewart records that sulphide was measured at all sites over the whole period (May 2014 to February 2019) with all results below detection limit. Further, Dr Stewart advises that generally, average annual TSS concentrations at the NRC receiving environment sites are around 20 mg/L, ranging from 4 to 35 mg/L, which suggests suspended solid concentrations at these sites are not excessively high.

2.3.3.6 Receiving Environment Water Quality Trends

Dr Stewart states that temporal trends for selected parameters at NRC water quality sites were assessed with time trends, and advises that NH4-N, dissolved oxygen (**'DO'**)[35], pH and temperature were assessed as there was consistent data available. He reports that data was predominantly above detection limits and states that all temporal trends were not significant (p 0.36 to 1.00). He also indicates that temperature was assessed using a Seasonal Trend test, as there was a clear seasonal bias in the data. He then goes on to report that Inner Harbour site trends were not significant (p 0.12 to 0.19) but that the mixing zone and outer Harbour sites were either significant (p 0.04) or borderline significant (p 0.05 – 0.06), with all sites showing an increase in temperature between 2014 and 2019.

2.3.3.7 Receiving Environment Sediment Quality Sites

Dr Stewart records that seven NRC sediment quality sites in the Whangārei Harbour have been monitored reasonably consistently and that all seven sites were assessed for current status sediment quality (2012, 2014 and 2016).

2.3.3.8 Receiving Environment Sediment Quality Status

Dr Stewart states that the same suite of PAHs, phenols, TPH and metals/metalloids as measured at the water quality sites and the Refining NZ SWB were measured in receiving environment sediments. He reports that additional TOC and grainsize (sediment texture, or particle size) analyses were undertaken at the sediment sites. Dr Stewart also notes that a one-off sediment quality analysis of eight soft-sediment sites around the mixing zone was conducted by Refining NZ in May 2019. Between 2012 and 2016, Dr Stewart notes that the sediment texture at some NRC sediment sites was highly variable. Dr Stewart records that the NRC sampling protocol states that a single surficial sediment sample is to be collected at each site and samples are to be analysed for grain size by either Watercare or the University of Waikato. Therefore, the high variability may be in part due to the lack of replicate samples and a single laboratory used for analysis. Dr Stewart states that this indicates that Inner Harbour sites have been predominantly sandy over this time, with very low coarse gravel and mud (<10%). Dr Stewart further notes that mixing zone sites were also predominantly sandy over this time period with a consistently low mud content, but variable coarse sand and gravel. Dr Stewart states that the outer Harbour sites encompass different settings and sediment types.

Toxicants

Dr Stewart advises that between 2012 and 2016, metal/metalloid sediment concentrations have been relatively consistent and show no clear spatial or temporal patterns. He reports that the data appears to show that mercury is the most problematic in the stormwater settlement basin, with up to 30% of the SGV observed. He however notes, that virtually all sediment mercury concentrations in the receiving environment were below the detection limit and that this is a function of the methodology used to assess these data, where all values below the detection limit are set to the detection limit. He also advises that, in practice, this is the most conservative approach and that it is possible that mercury concentrations are well below this detection limit. He states further that only arsenic, chromium and lead were consistently above detection limits and that Zinc was above detection limits for around 50% of samples. Dr Stewart records, in relation to toxicants, that the detection limits for cadmium, copper, and mercury are sufficient to assess sediment quality but not sufficient to assess spatial or temporal trends. He also states that total PAH sediment concentrations were always below detection limits. Dr Stewart goes on to state

[35] a measure of how much oxygen is dissolved in the water - the amount of oxygen available to living aquatic organisms

that TPH in the receiving environment sediment does not appear to correlate with Refining NZ SWB sediment TPH concentrations.

2.3.3.9 Receiving Environment Sediment Quality Trends

Dr Stewart advises that temporal trends for arsenic, chromium, lead and zinc sediment concentrations at the NRC sediment quality sites (2002 to 2016) were assessed with Time Trends. He notes that results show that all sediment metal concentrations have been reducing from 2002 to 2016. He goes on to state that virtually all decreases have been meaningful (i.e. the Relative Risk Seasonal Kendall Slope Estimate (**'RSKSE'**) is greater than 1% per year[36]) and indicates that for the Inner Harbour site, arsenic, chromium and lead reductions are also significant ($p < 0.05$).

2.3.3.10 Process Chemicals

Dr Stewart advises that in his assessment it was necessary to separate 'traditional' contaminants (such as petroleum hydrocarbons, metals, ammoniacal-nitrogen) from 'non-traditional' contaminants. Dr Stewart states that 'non-traditional' contaminants are contained within the formulation of process chemicals used by Refining NZ in the refinery process:

- flocculants;
- oxygen scavenger;
- emulsion breaker;
- biocide;
- pH modifier/alkalinity builder;
- boiler water treatment;
- acid gas removal;
- biodispersant; and
- removal of benzene, hydrogen sulphide and pyrophoric iron.

Dr Stewart notes that traditional contaminants are measured by virtually all analytical laboratories using standard and often validated method. He notes further that traditional contaminants are normally measured (in both water and sediment) routinely in the SWB and at the receiving environment sites. Dr Stewart advises that due to lack of analytical capabilities, the majority of process chemicals have not been measured in the SWB or in the receiving environment. He goes on to state that there is the potential for process chemicals to enter the SWB and thus for them to be discharged to the marine receiving environment. Dr Stewart therefore explains that he has employed a risk assessment approach to assess the potential ecological effects of process chemicals in the receiving environment. Dr Stewart states that most of the process chemical formulations assessed are used on a daily basis, however special scenarios depicting a site shutdown, unintended chemical spills and fire training foams were included.

2.3.4 Groundwater & Land Contamination

Ms Sarah Schiess and Mr Chris Simpson of T&T have prepared a Hydrogeological Conceptual Site Model[37] for Refining NZ, a full copy which is attached within **Annexure 3** to this AEE. In this report Ms Schiess and Mr Simpson have provided details of the receiving environment in relation to groundwater and land contamination, surrounding the Site. We now summarise the advice that Ms Schiess and Mr Simpson set out below:

2.3.4.1 Previous Waste Handling

Ms Schiess and Mr Simpson outline that historical waste management at the Site has resulted in application of sludge to land. She records that at the commencement of operations small volumes of sludge were generated from tanks, interceptors and canals/drains. Further, they state that the early sludge was buried onsite or transferred to sludge fields (also known as

[36] Index of relative rate of change. A positive RSKSE value indicates an overall increasing trend, while a negative RSKSE value indicates an overall decreasing trend

[37] Schiess, S. and Simpson, C. Tonkin & Taylor Limited, *Hydrogeological Conceptual Site Model for the Marsden Point Refinery*. Dated July 2020

'landfarms') where bioremediation practices were undertaken. They indicate that prior to the expansion, leaded sludge was weathered on concrete slabs at various locations around the Site and states that during the enabling works for the expansion, some material that had been buried, weathered, or put in pits during the 1960s and 1970s was excavated and removed from the Site.

Ms Schiess and Mr Simpson state that after the expansion, the sources of sludge increased, however, a sludge handling unit which could treat much of the sludge produced, reduced the overall load on the landfarms. They state further that landfarms/sludge fields were previously located in a number of other locations across the Refinery and that landfarming ceased at the Refinery around 1996.

2.3.4.2 Soil Contamination

Ms Schiess and Mr Simpson set out that Refining NZ has developed a plan of the known areas of subsurface contamination within the Refinery and because of the nature of Site activities there is potential for other areas of the Refinery to contain contamination. They advise that there are a range of known possible contaminants that are all derived as part of the refining process within several areas within the Refinery. We now summarise their advice.

Metals

Ms Schiess and Mr Simpson state that metal contamination at the Refinery is generally derived from:

- Impurities released from the crude oil during its refining process, including arsenic, vanadium, iron, nickel and mercury;
- Garnet used in abrasive blasting contains metals from its source as well as contaminants from the blasting process;
- Spent catalyst contaminated by impurities in the crude oil including vanadium, cobalt and nickel;
- Sludge removed from leaded gasoline tanks contained high levels of lead; of organometallic[38] forms of lead, such as tetraethyl lead;
- Spent carbon storage; and
- Waste/slops storage and processing.

Ms Schiess and Mr Simpson advise that the areas where metal contamination has been identified generally relate to known areas of landfarms or waste disposal. According to Ms Schiess and Mr Simpson, it is in these areas that it is likely to be present in near surface soil around waste by-product storage areas. They also note that in these areas, deeper contamination may also occur as a result of leaching and vertical migration of more soluble metals through the soil profile.

Petroleum Hydrocarbons

Ms Schiess and Mr Simpson state that petroleum hydrocarbon residues are known to be present in soil and groundwater, in areas of crude/product storage, refining processes and storage and processing of wastes. They report that the presence of light non-aqueous phase liquid (**'LNAPL'**)[39] on the groundwater table is well documented, and that soil contamination by LNAPL will occur within the smear zone[40] above and below the groundwater table. They further report that shallower areas of hydrocarbon contamination may be present in locations were spills or leaks have occurred, depending on the depth of release.

[38] Organometallic lead can break down to elemental lead, which is less toxic, as part of the landfarming/bioremediation process- Tetraethyl lead is known to break down relatively quickly, with literature values for half-life in soil ranging from 7 hours to 47 days. Leaded gasoline production ceased at the Refinery in the mid-1990s

[39] A light non-aqueous phase liquid with a lower density than water, that is a groundwater contaminant not soluble in water

[40] A 'smear zone' is the soils between the top and bottom of the groundwater table that becomes saturated by the groundwater part of the year due to water table fluctuations. The smear zone is the area where LNAPL has been smeared vertically across the aquifer material (in this case, soil) when groundwater levels have fluctuated

Volatile Organic Compounds

Ms Schiess and Mr Simpson report that volatile compounds such as light fraction petroleum hydrocarbons, benzene, toluene, ethylbenzene, xylene and naphthalene are known to occur where petroleum hydrocarbons are recorded and that volatile organic compounds (**'VOCs'**)[41] may occur in soil, groundwater, and as a gas phase within unsaturated soil.

Polycyclic Aromatic Hydrocarbons

Ms Schiess and Mr Simpson state that PAHs are present in the heavier end petroleum hydrocarbon fractions and as a by-product of the refining process. They advise that available information for the Refinery indicates an area of PAH contamination exists, associated with storage of spent carbon. In addition, they state that it is also possible that other Refinery process and waste processing areas may contain PAH contamination in soil and that more volatile PAH compounds such as naphthalene may occur associated with VOC contamination.

Chlorinated Solvents

Ms Schiess and Mr Simpson note that tetrachloroethene (or **'PCE'**, which is also known as perchloroethylene or perchloroethene) is stored and used in the Refinery's Continuous Catalytic Reforming (**'CCR'**)[42] unit located in Block E and stored in a purpose-built vessel within a bunded area. During catalyst regeneration PCE is injected into the reactor from the vessel via an injection pump that is also located within the bunded area. They report that PCE is converted to hydrochloric acid, water and carbon dioxide within the regenerator, with the hydrochloric acid sorbing[43] onto the catalyst. They go on to note that spent chloride removed from the catalyst is sorbed onto absorbent material comprised of zinc oxide, aluminium oxide and sodium carbonate components.

Ms Schiess and Mr Simpson state further, that the PCE vessel at the CCR unit or old platformer unit was topped up once every 18 months using eight to 10 drums of PCE and that Refining NZ advised that there are no recorded incidents in relation to spills of PCE. They point out that the management practices adhered to suggest that soil or groundwater contamination associated with use of PCE is unlikely to have occurred. They go on to record that the investigation of chlorinated solvents in soil or groundwater near the CCR unit or old platformer unit has not been undertaken for this assessment and indicates that these areas are within the area of hydraulic containment and are, therefore, not expected to impact the surrounding environment.

Asbestos Containing Materials

Ms Schiess and Mr Simpson state that Refining NZ holds a register of asbestos containing materials (**'ACM'**) within the Refinery and that although a large component of the ACM that has been historically present within the Refinery buildings and structures has been removed, some fibre cement cladding and insulation lagging remains. They advise that there is potential for asbestos contamination of soil to have resulted around areas of former or current asbestos product use, or where buildings containing asbestos have been demolished and there is demolition fill remaining in ground. Ms Schiess and Mr Simpson also indicate that current asbestos product-use at the Site is limited and comprises some gaskets which are disposed of into dedicated bins when required.

Ms Schiess and Mr Simpson advise that the risk from asbestos relates to inhalation of airborne fibres and that due to the fact that asbestos does not have significant mobility in ground and does not impact groundwater. The presence of asbestos has not been considered further in this assessment. Ms Schiess and Mr Simpson also state that potential migration of asbestos in stormwater or surface water (originating from discharges to air) have not been considered in this assessment.

[41] Organic chemicals that have a high vapor pressure at ordinary room temperature
[42] CCR is a chemical process that converts petroleum refinery naphthas distilled from low-octane oil into high-octane liquid products called reformates, which are premium blending stocks for high-octane gasoline
[43] Sorption is a physical and chemical process by which one substance becomes attached to another

PFAS

Ms Schiess and Mr Simpson state that Per and polyfluoroalkyl substances (**'PFAS'**) are a group of synthetic compounds that have been produced commercially since the 1950s – the most widely studied being perfluorooctane sulfonate **('PFOS'**), perfluorooctanoic acid (**'PFOA'**) and perfluorohexanesulfonic acid (**'PFHxS'**). They note that as PFAS are very persistent in the environment. In this regard, they can be found in air, water and soil and are known to bioaccumulate in some living organisms. They state that given the mobility of the compounds there is potential for PFAS contamination to spread widely from the area of intentional or accidental release into soil or stormwater at the fire training area and former fire training area, as well as into the stormwater system. They then report that the results of Refining NZ's investigation indicated that concentrations of PFOA and PFOS in surface soil and sediment were below the assessment criteria relevant at the time of the investigation.

Transformer Oils

Ms Schiess and Mr Simpson record that polychlorinated biphenyls (**'PCBs'**) are a group of man-made chemicals that were widely used in industry from 1930 to the late 1970s, including in transformer oils. They state that PCBs are environmentally persistent and have been demonstrated to cause a variety of adverse health effects. They report that PCBs are banned from importation, manufacture and use in New Zealand (with exemptions for small-scale research and laboratory use) and that while Refining NZ has had numerous substations over its operational history, that no fires involving these facilities are known to have occurred. Further, they indicate that it is also understood that there are currently 19 substations in use at the Site.

According to Ms Schiess and Mr Simpson Refining NZ has advised that:

- Transformers are in sealed bunded areas;
- Most of the transformers are from the expansion and are understood to have used PCB-free oil from commissioning;
- Oil from the pre-expansion transformers was replaced as required and is now PCB-free;
- When oil replacement is required, this is undertaken by an approved contractor; and
- Approximately 600 litres of oil per year is used.

Ms Schiess and Mr Simpson advise that based on information provided by Refining NZ, the likelihood of PCB contamination emanating from a pre-Expansion transformer is relatively low. They then state that PCBs, when lost to the environment, preferentially absorb to soil and are less likely to leach or migrate to groundwater than other chemicals.

Nutrients

Ms Schiess and Mr Simpson report that nitrate – phosphorus – potassium (**'NPK'**) fertiliser was historically applied to sludge in the landfarms and the presence of nitrogen in the crude products can result in the generation of process waters with elevated ammoniacal nitrogen concentrations. They advise that leaks from process water infrastructure may also potentially be a source of nitrogen.

2.3.4.3 Groundwater Contamination

Ms Schiess and Mr Simpson advise that Refining NZ has monitored groundwater quality at the Site since the early 1980s, with an increasing density of monitoring wells. They state that there are currently 140 monitoring wells on the Site that are periodically gauged for depth to water and depth to LNAPL and that 29 perimeter wells are routinely monitored primarily for hydrocarbon contamination.

Ms Schiess and Mr Simpson state that hydrocarbon contamination in the form of LNAPL was found to be present as a result of several leaks and spills over the operation of the Refinery. They report, however, that distribution of LNAPL is now contained within the groundwater under the Site.

Ms Schiess and Mr Simpson also advise that in addition to the existing data from Refining NZ and GHD/GWS 2014, T&T conducted three groundwater monitoring events (**'GMEs'**) in 2019:

a. June 2019: PFAS monitoring at the fire training ground;
b. September 2019: monitoring of 28 perimeter wells and PF54 based on data gaps identified during preparation of the initial draft hydrogeological conceptual model report. Ms Schiess and Mr Simpson state further that the findings from these GMEs are incorporated into the assessment that relates to the same; and
c. In November 2019, Refining NZ undertook groundwater sampling from nine temporary wells along the Bream Bay foreshore to provide additional data for metals and nitrogen species closer to the receiving environment.

2.3.4.4 Dissolved Phase[44]

Ms Schiess and Mr Simpson advise that the groundwater analytical results from December 2013 (GHD/GWS assessment) to December 2019 for the VOC, PAH and phenol suites, were below the laboratory limits of reporting. That said, we now provide a concise summary of their advice on all these potential contaminants.

Petroleum Hydrocarbons

Ms Schiess and Mr Simpson report that the concentrations of dissolved phase hydrocarbons in groundwater were found to be relatively low, which they advise suggests a limited partitioning between the product sources and groundwater. They state that TPH concentrations in wells outside of hydraulic containment area were below the limits of reporting in the most recent monitoring undertaken in 2018 and 2019, which we understand means, for all intents and purposes, that the TPH contamination has been successfully contained.

Volatile Organic Compounds

Ms Schiess and Mr Simpson state that elevated concentrations of BTEX were also recorded in groundwater samples analysed for the GHD/GWS 2014 assessment. They report that benzene[45] concentrations were below the assessment criteria relevant for ecosystems except for samples from two wells in an area also impacted by residual LNAPL and within hydraulic containment. They further note that BTEX concentrations in wells outside of hydraulic containment were all below the limit of reporting in the most recent monitoring undertaken in 2018 and 2019.

PAHs

Ms Schiess and Mr Simpson state that no PAHs were detected above the laboratory limits of reporting. In this regard, they state that while PAH were detected in samples, the concentrations found did not exceed the relevant criteria.

Phenols

Ms Schiess and Mr Simpson report that halogenated and non-halogenated phenols were analysed in the three samples collected from Refining NZ's 2016 PFAS investigation of the fire training area. They state that no phenols were detected above the laboratory limits of reporting. Ms Schiess and Mr Simpson further indicate that as part of the September 2019 GME, perimeter wells were sampled and tested for phenols and states that Phenols were not detected in any of the samples.

Chlorinated Solvents

With respect to chlorinated solvents[46] (which form part of the VOCs suite), Ms Schiess and Mr Simpson state that no chlorinated solvents were detected above the laboratory limits of reporting in a 2016 investigation. They state that groundwater in the vicinity of the areas where PCE has been used in Block A and Block E have not been tested for chlorinated solvents. Ms Schiess and Mr Simpson record, however, that these areas are within the area of hydraulic containment and monitoring of the perimeter wells for chlorinated solvents is not considered necessary.

[44] Dissolved Phase Contaminants can be described as the part of (VOCs-hydrocarbon) contamination which has dissolved/partitioned into a body of water (In this case – groundwater and typically petroleum-based compounds)
[45] a clear, colorless, highly flammable and volatile, liquid aromatic hydrocarbon with a gasoline-like odour
[46] chemical compounds containing chlorine that have been widely used in various industries

Metals

As part of Refining NZ's monitoring programme, groundwater samples from the perimeter wells were analysed for a suite of seven metals (namely arsenic, cadmium, chromium, copper, lead, nickel and zinc). Of those contaminants, total heavy metals and total arsenic, copper, lead and zinc concentrations exceeded the Australian and New Zealand Environment and Conservation Council ('**ANZECC**') 2000 default guideline values at the 80% level of protection.

Ms Schiess and Mr Simpson record the following observations after they compared the dissolved metals and the total metals data:

- Dissolved nickel and lead concentrations were lower than historic total concentrations and were below the criteria.
- Dissolved arsenic and zinc concentrations were generally similar to historic total concentrations, and criteria exceedances were still observed. It is important to note that for arsenic the adopted ANZECC criterion is a low reliability value (i.e. not a default guideline value).
- Dissolved cadmium and chromium (total) concentrations were generally similar to historic total concentrations; and dissolved and total concentrations for both metals do not exceed the ANZECC 80% values.
- Dissolved copper concentrations were generally lower than the historic total values, however, two concentrations still exceeded the ANZECC 80% guideline.
- Dissolved iron concentrations were generally lower than the September 2019 total iron concentrations, and the number of exceedances of the ANZECC 80% guideline value was halved.
- Dissolved zinc concentrations were generally similar to historic total concentrations.

According to Ms Schiess and Mr Simpson, the majority of the metals exceedances are likely to be the result of local variations in the mineral composition of the aquifer material (put another way, the exceedances are likely to be naturally occurring) and those that are not naturally occurring, appear to be limited in extent. They state that the dissolved iron concentration is a by-product of natural attenuation of petroleum hydrocarbons. Ms Schiess and Mr Simpson then indicate that given the localised nature of the exceedances, it is considered unlikely that the metals concentrations in groundwater will affect the marine environment.

Ms Schiess and Mr Simpson set out that dissolved metal concentrations in groundwater samples collected from temporary wells on the foreshore in November 2019 were below the adopted criteria with the exception of arsenic and zinc. They go on to record that manganese and iron were not analysed in November 2019 on the basis the previous foreshore sampling in 2013 had shown all iron and manganese concentrations to be below the adopted criteria. They state that in the 2019 foreshore sampling, arsenic concentrations exceeded the ANZECC low reliability value and drinking water standard was also exceeded in two locations. They further note that a sample of seawater was collected downgradient of each groundwater sampling location, and arsenic was not detected above the limit of reporting. In comparison, they advise that arsenic concentrations at upgradient perimeter wells in this area were below the criteria in September 2019, indicating the foreshore exceedances are not related to the Site. Ms Schiess and Mr Simpson also note that zinc concentrations exceeded the ANZECC 80% guideline value at locations on the southern stretch of the beach and zinc concentrations at perimeter wells upgradient of this area were all below the criteria in the September 2019 sampling, indicating that the foreshore exceedances are not related to the Site.

Nutrients

Ms Schiess and Mr Simpson state that nitrate (as nitrogen) and nitrite (as nitrogen) were analysed for in groundwater samples as part of the assessment of natural attenuation for GHD/GWS 2014. They contend that the presence of nitrogen is as a consequence of the leakage from the stormwater detention ponds and the former landfarm that existed to the south and east of the butane spheres. They also advise that nitrate in groundwater can also

be sourced from leaking septic tanks or sewage infrastructure and from fertiliser application in farming

PFAS

Ms Schiess and Mr Simpson states that there were a number of instances where PFAS was detected in groundwater in 2016 and 2019. They advise that concentrations of PFCAs (which include PFOA)[47] tended to be the highest. As other PFAS have been found to be present which can cause interference, Ms Schiess and Mr Simpson indicate that it may be difficult to achieve the limits of reporting for groundwater samples below the 99% marine guideline value (which is applicable to surface water). They state however, that PFOS and PFOA concentrations in groundwater do not exceed the 95% or 80% marine guideline value.

2.3.5 Marine Ecology

The *'Assessment of Effects on Marine Ecological Values'* that was completed by Drs Sharon De Luca and Phillip Ross[48] of Boffa Miskell Limited (2020)[49] provides details of the existing marine environment and values within, and adjacent to the Site[50]. We now summarise their findings in relation to the following sub-sections:

a. Identified Significant Marine Ecological Areas;
b. Benthic Habitats;
c. Subtidal Soft Sediment;
d. Intertidal Soft Sediments;
e. Intertidal Rocky Shore;
f. Subtidal Rocky Shore;
g. Shellfish Contaminant Body Burden;
h. Fish; and
i. Summary of Marine Ecological Values.

2.3.5.1 Identified Significant Marine Ecological Areas

Dr De Luca and Dr Ross record that the oRCP identifies marine sites of special scientific or conservation value adjacent to the Project Area namely: Motukaroro Island Whangārei Marine Reserve, Outer Harbour sandbanks and an area around and incorporating Busby Head. They advise that Motukaroro Island marine reserve has a high diversity of species, including subtropical species and states that Calliope Bank is identified as providing intertidal habitat for internationally significant habitats and for migratory and endemic avifauna. Further, they report that the outer Harbour sandbanks (Snake, Mair, Calliope, McDonald) are identified as intertidal areas that provide an internationally significant habitat for international migratory and New Zealand endemic wading and wetland birds, including threatened species. Dr De Luca and Dr Ross also record that Mair Bank is also identified based on its historic values relating to shellfish abundance (pipi) and states that Busby Head is identified on the basis of incorporating a rocky shore that is an internationally significant habitat for New Zealand endemic wading and coastal birds, including threatened species. They further note that Busby Head is identified for the rocky shore that provides habitat for a range of threatened and at-risk wading and coastal birds.

Dr De Luca and Dr Ross advise that the pRP identifies a large proportion of Whangārei Harbour as a Significant Ecological Area (**'SEA'**) (refer to **Figure 2.3.5.**1**,** which follows). They do not agree with the notation of Marsden Bank as being part of the SEA stating that the main channels and upper Harbour areas are excluded from the SEA layer. However, they indicate that Mair and Marsden Banks are an identified SEA[51] in the pRP, based on the historic (now largely absent) pipi population. They advise that the pRP has separate layers for Significant

[47] Perfluorinated carboxylic acids (PFCAs), including perfluorooctanoic acid (PFOA), are persistent organic pollutants that pose human health risks

[48] Dr Phillip Ross of REC Science has co-authored the *Assessment of Effects on Marine Ecological Values- Reconsenting of discharges and structures in the CMA* with Dr Sharon De Luca of Boffa Miskell, the report remains attributable to Boffa Miskell

[49] De Luca, Dr S, and Ross, Dr P., Boffa Miskell, *Assessment of Effects on Marine Ecological Values- Reconsenting of discharges and structures in the CMA*. Dated July 2020

[50] Dr Coffey, *Crude Shipping Project, Proposal to Deepen and Partially Realign the Approaches to Marsden Point, Assessment of Marine Ecological Effects, Excluding Seabirds and marine Mammals*. Dated 10 August 2017

[51] It should be noted that the inclusion of Mair and Marsden Banks within the SEA are currently subject to appeal

Bird Areas and Significant Marine Mammal and Seabird Areas and highlights that the oRPS also identifies Marsden and Mair Bank as having high natural character.

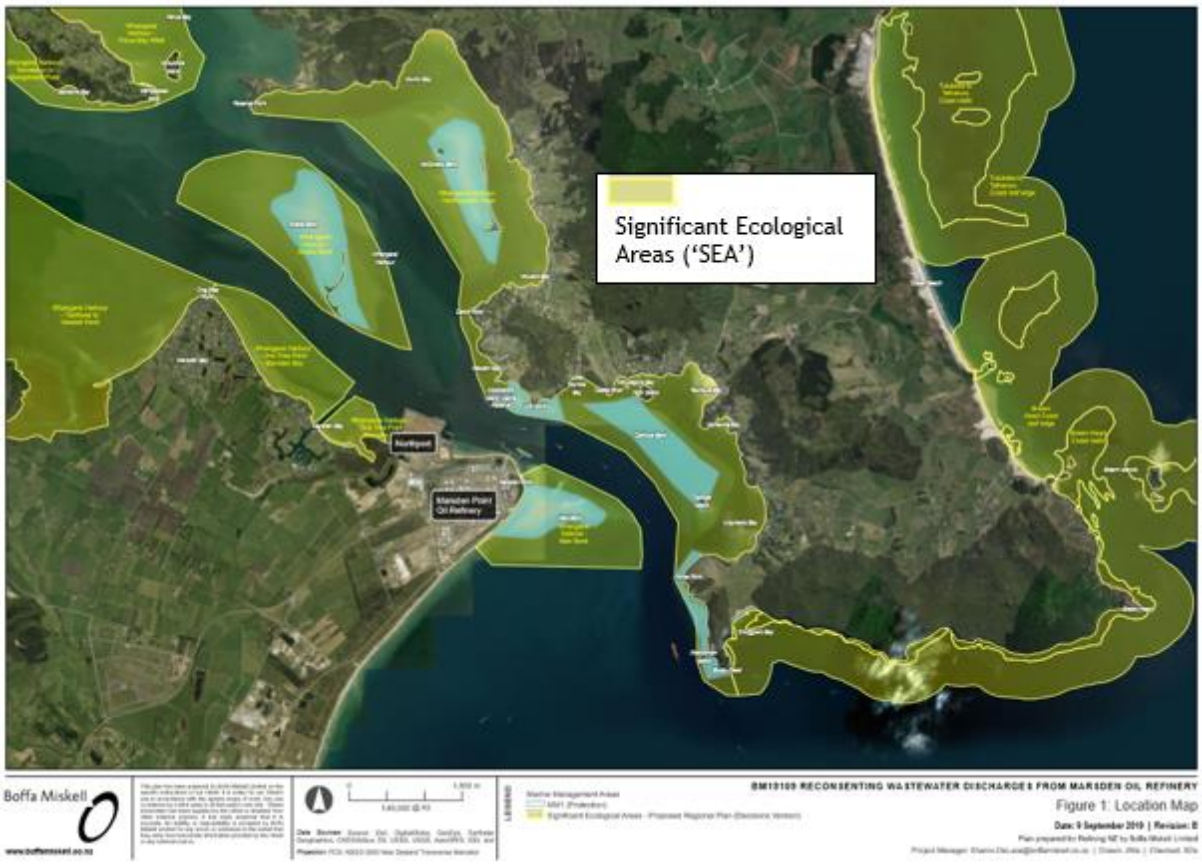


Figure 2.3.5.1: *Map showing a large portion of Whangārei Harbour as a Significant Ecological Area*

2.3.5.2 Benthic Habitats

Dr De Luca and Dr Ross report that subtidal and intertidal benthic habitats within Whangārei Harbour and Bream Bay are generally dominated by soft sediment (predominantly sand grain sizes), whilst rocky shore habitats occur between Bream Head and Home Point, between Darch Point and Home Point, and at Motukaroro Islands and High Island. They state further that shell banks are present at the mouth of the Harbour, including Marsden, Mair, Calliope, Snake Bank and MacDonald Bank.

2.3.5.3 Subtidal Soft Sediment

Dr De Luca and Dr Ross note that the subtidal benthic soft sediment habitat beneath and adjacent to Refining NZ's jetty comprises low relief, coarse sandy sediment which supports a diverse invertebrate epifauna and infauna community. They report that of the subtidal sediment surveyed by NRC in 2012, as part of NRC's estuary monitoring programme, Snake Bank is the closest site to the Refining NZ jetty. They also indicate that the benthic invertebrate assemblage at Snake Bank was dominated by the polychaetes Euchone sp., and Boccarcia syrtis, crustaceans Tanaidacea sp., ostracods and amphipods.

Dr De Luca and Dr Ross state that an extensive survey of subtidal benthic soft sediment ecology was carried in 2016 in order to inform the assessment of effects for Refining NZ's capital dredging proposal. They go on to state that at 26 sites within Whangārei Harbour (inner Harbour) and Bream Bay (outer Harbour), five replicate core samples were collected and analysed for benthic invertebrate community composition and abundance. Further, they report that Inner Harbour sites are supported by a higher diversity and abundance of benthic invertebrates than outer Harbour sites. They state that at inner Harbour sites, the total number of individual organisms recorded ranged from 102 and 1,498 per sample core, whereas species richness (the number of species recorded at a site) ranged from 10 to 91.

They also advise that dominant taxa groups included polychaete worms, amphipods, gastropods, bivalves, nematodes, oligochaete worms, polyplacophora, cnidaria, echinoderms, and cephalocordata and that the less abundant taxonomic groups included nemertea, copepods, isopods, decapods, ostracods, cumacea, platyhelminthes, bryozoan, hemichordata, chaetognatha, ascidians, and rhodophyta.

Dr De Luca and Dr Ross report that at outer Harbour sites, the total number of individuals ranged from 31 to 154, and species richness ranged from 13 to 36. They state that dominant taxonomic groups were similar to those in the inner Harbour and that subtidal sandflats in the wider Bream Bay area are inhabited by a range of benthic invertebrates including the olive snail, sea snail, morning star shell, bivalves, echinoderms, cushion star, crustaceans and polychaete worms.

2.3.5.4 Intertidal Soft Sediments

Dr De Luca and Dr Ross report that NRC's estuary monitoring programme revealed intertidal sites closest to Marsden Point (Marsden Bay 2-3)[52] were dominated by the polychaete worms, bivalves (cockle, nutshell, wedge shell and pipi), anemone, and shrimp. They state further that the Shannon Weiner diversity index indicated moderate to high diversity.

Dr De Luca and Dr Ross record that the benthic invertebrate community composition on open sandy beaches in Bream Bay are characterised by the sea-slater, common sandhopper, Sphaeromidae and Eurydicidae isopods, paddle crab, ghost shrimp, mantis shrimp and tuatua. They also advise that between the Refining NZ jetty and Northport, there are areas of finer grained sediment that support cockles and mud whelk and reports that pipi historically dominated Mair and Marsden bank, but over the past decade pipi populations have collapsed. She states that cockles, green-lipped mussel and Ruditapes are also present on the banks.

Dr De Luca and Dr Ross report that a 2014 pipi survey indicated low abundances and patchy distribution of pipi in the intertidal area, and the disappearance of the large subtidal pipi bed. They state that in 2014, pipi biomass was recorded at approximately 1% of the biomass present in 2005 and that size-frequency data indicated that much of the 2005 pipi biomass was made up of a single cohort which may have reached by the end of the natural lifespan between 2010 and 2014. They then advise that recruitment of pipi into the adult population has failed since 2010. Dr De Luca and Dr Ross state that in the 2016/2017 survey, pipi were only recorded along a small narrow band on the southern intertidal flank of Mair Bank and report that Pipi were generally found in low density and considered an insufficient abundance for cultural or recreational harvesting. They state that a recent survey conducted this year indicated that pipi remain absent from the vast majority of Mair/Marsden bank, leading to the conclusion that pipi populations have collapsed over the past decade. Dr De Luca and Dr Ross further state that the intertidal and subtidal soft sediment assemblages contain species that are known to be sensitive to contaminants and silt and clay (suspended and deposited) as well as species considered tolerant.

Dr De Luca and Dr Ross note that two surveys of pipi histology were carried out at various sites within the Whangārei Harbour and Bream Bay in 2019 and 2020[53]. Dr De Luca and Dr Ross note that no significant pathogens were detected in pipi from Mair Bank, Marsden Bank and One Tree Point in the 2019 survey. Further, Dr De Luca and Dr Ross state that in the 2020 survey, the researcher concluded that it was unlikely that protozoa, parasites, bacteria, nutrients, heavy metals and general water quality were having adverse effects on shellfish health. Dr De Luca and Dr Ross consider that of all five sites surveyed, mucus and haemocyte responses, plus the presence of symbiotic bacteria (Endoziocomonas) were present, although these were more prevalent at One Tree Point, and Mair and Marsden Bank (the estuarine sites), compared to the open water sites along Bream Bay. Dr De Luca and Dr Ross note that both the 2019 and 2020 survey were unable to identify any single cause of these effects,

[52] Marsden 2 and 3 formed part of a grouping of sites with similar assemblages referred to as Group C. Group C also included McLeod Bay 2, Takahiwai 2, Tamaerau, Waikaraka and Onerahai. Marsden Bay 1 had an assemblage that was not similar to other sites

[53] Howell, J., 2019. Report on shellfish health. Prepared for Patuharakeke. LM38430 W19_07304
Howell, J., 2020. Report on shellfish health. Prepared for Patuharakeke. LM38430 W20 648

although a post-spawning immunity response was put forward as a possible cause. In addition, Dr De Luca and Dr Ross record that in the 2020 survey pipi at all sites were noted to have small bodies within their shells, which also could be a natural post-spawning response.

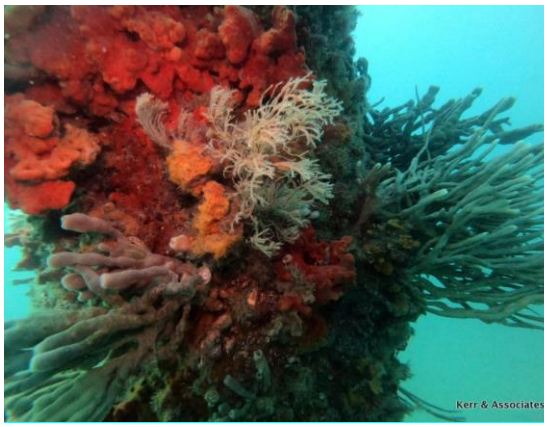
2.3.5.5 Intertidal Rocky Shore

Dr De Luca and Dr Ross state that hard shore assemblages are similar to those recorded within the Hauraki Gulf and indicates that intertidal habitats are dominated by barnacles, Pacific oysters, tubeworms, Coralline algae and Neptune's necklace. They also report that common sessile and mobile organisms include chitons, gastropods, and crabs.

2.3.5.6 Subtidal Rocky Shore

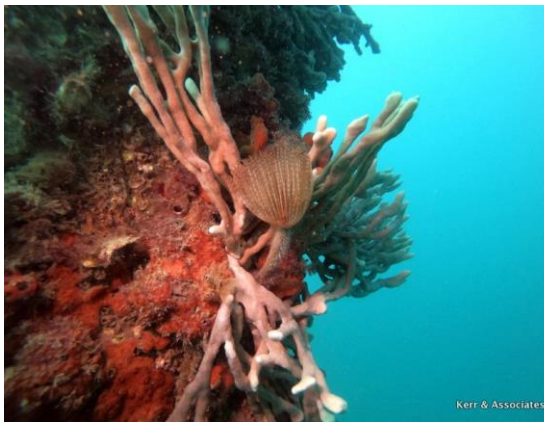
Dr De Luca and Dr Ross report that the shallow subtidal zone is dominated by brown algae, which give way to Ecklonia radiata in deeper water. They state further, that in 2016, subtidal rocky shore communities were surveyed at Darch Point, Motukaroro Island, Castle Rock, Home Point, and Bream Head. They advise that the subtidal assemblages were diverse, with dominant taxa including coralline paint, filamentous and foliose algae, a variety of sponges, cnidaria, gastropods, bivalves, cup corals, tubeworms, anemones, hydroids, polychaete worms, and bryozoans. They also state that diverse sponge garden habitats are present within the Motukaroro Island marine reserve.

Dr De Luca and Dr Ross state that a survey of subtidal encrusting communities of the Refinery wharf was undertaken in December 2018 and repeated in February 2019. They report that communities on three piles at Jetty 1 were assessed using quadrat photo images to a depth of 12m. They state that five replicate photo quadrats were analysed for community composition and percentage cover and observed that encrusting communities had 100% cover and were found to be healthy. They report that a variety of upright and encrusting sponges, hydroids, tubeworms, and bivalves (oysters) dominated the assemblages, with ascidians, algae and bryozoans less common. Dr De Luca and Dr Ross state that the photographs below (Photographs 1 to 4) were opportunistically collected in May 2019, whilst the dive team were carrying out the subtidal benthic soft sediment survey below the Refining NZ jetty and states that the photographs support the findings of the survey before and after the dredging programme that occurred in January 2019 (being that there is diverse assemblage of encrusting communities on the jetty piles).

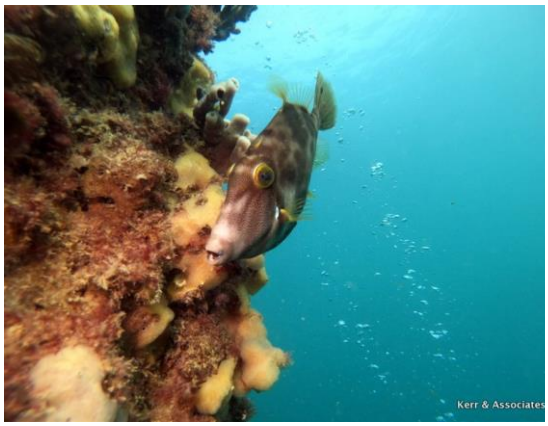


Photograph 2.3.5.6.1: *Diverse encrusting assemblages on the Refining NZ jetty piles*

Photograph 2.3.5.6.2: *Diverse encrusting assemblages on the Refining NZ jetty piles*



Photograph 2.3.5.6.4: *Diverse encrusting assemblages (including invasive species Mediterranean fanworm - subsequently removed) on the Refining NZ jetty piles*



Photograph 2.3.5.6.4: *Leatherjacket (Meuschenia scaber) alongside the encrusting assemblages on the Refining NZ jetty piles*

Dr De Luca and Dr Ross report that subtidal encrusting communities at Motukaroro Island, located to the north-east of the Refinery wharf, were also surveyed in 2019. They indicate that species diversity was higher at Motukaroro Island than on the jetty piles. They state that both reef sites and jetty piles were dominated by diverse mixes of encrusting and upright sponges. Further, they advise that sponge and ascidians (being filter feeders) are commonly used as indicators of stress in marine environments as they are sensitive to perturbations.

Dr De Luca and Dr Ross state that data from two studies can be combined to tell us about how rocky subtidal community at the Refining NZ jetty compares to elsewhere within Whangārei Harbour and Bream Bay. They report that in 2016, Kerr surveyed Darch Point, Motukaroro Island, Castle Rock, Home Point, and Bream Head, whereas in 2019 Kerr surveyed Motukaroro Island and the Refining NZ jetty. They then advise that similar taxonomic groups are present across all sites and dominant species were upright and encrusting sponges, hydroids, tubeworms, and bivalves (oysters and goes on to state that ascidians, algae and bryozoans were less common.

Dr De Luca and Dr Ross report that the same types of species were present across Refining NZ and reference sites. They states both soft sediment and hard shore habitats at and adjacent to the Refining NZ jetty and at sites distant to the jetty comprise a mix of species that are sensitive to environmental perturbations (e.g. elevated contaminants, suspended and deposited sediment, changes to sediment grain size etc.) and some taxa which are considered tolerant.

2.3.5.7 Shellfish Contaminant Body Burden

Dr De Luca and Dr Ross note that shellfish (pipi and cockles) have been periodically collected and analysed for contaminant body burden by NRC at established survey sites since 2003, with some caged mussels deployed at the Refining NZ mixing zone boundary and western dolphin in 2005/2006. They state that shellfish body burden surveys ceased in 2012, due to a lack of available shellfish and issues with interference with caged sentinel shellfish. They also advise that data from NRC established survey sites indicate low levels of contaminants in shellfish at all four sites surveyed and data from caged sentinel mussels also indicate low concentrations of contaminants. Dr De Luca and Dr Ross record that Refining NZ collected pipi from Mair Bank on the 14th of June 2018 and had the flesh analysed for body burden of fire-fighting foam contaminants. The result of this analysis was that no fire-fighting contaminants were detected in the pipi flesh.

2.3.5.8 Fish

Dr De Luca and Dr Ross state that a high diversity of fish has been detected within the Proposal Area and in adjacent areas. The most commonly detected species adjacent to the Proposal Area include snapper, spotty, sweep, parore, jack mackerel, and goatfish, and triplefin species are also abundant.

2.3.5.9 Summary of Marine Ecological Values

Dr De Luca and Dr Ross report that the marine ecological values within the receiving environment adjacent to the Jetty comprise a diverse and abundant assemblage of invertebrates, low sediment contaminant concentrations, sandy grain sizes, high water quality and relatively limited habitat modification. Dr De Luca and Dr Ross also state that the body burden of contaminants in oysters from the Refining NZ jetty were for the most part lower than concentrations at reference sites and four contaminants were higher at Refining NZ jetty compared to reference sites. They conclude that the marine ecological value characteristics range from medium to very high, with high characteristics being the most numerous and overall, it is therefore considered, that the marine ecological values at and adjacent to the Refining NZ jetty are high.

2.3.6 Avifauna (Coastal Birds)

Mr Graham Don of Bioresearches has prepared a Coastal Bird Assessment[54], a full copy of which is attached within **Annexure 3** to this AEE. We now summarise those aspects of the report that describe the existing environment.

According to Mr Don the wider Whangārei Harbour area and adjoining Bream Bay have a number of notable coastal bird features including:

- Wading bird roosts and feeding habitats from the eastern side of Northport to Marsden Bay, One Tree Point and Snake Bank;
- Variable oystercatcher feeding habitat at Mair Bank;
- A number of shag nesting colonies (Motukaroro Island and Home Point);
- A small population of little penguin, recorded in 2016, that use the area inside Home Point for apparent breeding (but not feeding);
- A diverse population of pelagic birds using the open water habitat of Bream Bay;
- A breeding colony of grey-faced petrels within the Bream Bay Reserve; and
- Nesting by a number of coastal bird species within the Refinery's predator-controlled grounds.

Mr Don states that the habitats adjacent to the Refinery are diverse. In this respect, he states that the habitats include relatively sheltered, sandy intertidal areas, sheltered and exposed rocky shorelines, open ocean beach, the open pelagic habitat of Bream Bay and islands both within the Harbour and in Bream Bay. In addition, he highlights the large cliff edge pohutukawas used for nesting and also the high ridgeline of Bream Head that provides nesting habitat for petrels. He indicates that throughout the wider outer Harbour and Bream Bay area a total of four nationally threatened and 18 nationally at risk coastal and pelagic species are present. He also notes that there are approximately 34 avifauna species within the area from One Tree Point east to Busby Head and within Bream Bay.

Mr Don advises that the record of birds using the Refinery structures indicates limited and intermittent use of the Mooring Dolphins. In this regard, he states that the Mooring Dolphins are mainly used by black-backed gull, little shag, red-billed gull, pied shag and white-fronted tern. In contrast, he emphasises that the use of the Refinery Jetty, predominantly on the western side, is significant and consistent, especially by white-fronted tern. Other species using the Jetty include red-billed gull, black-backed gull and little shag. Overall, Mr Don notes that the Refinery structures are positive features that are particularly attractive to white-fronted tern.

Mr Don states that the values of the coastal avifauna in the vicinity of the Refinery and within its grounds are high, which in turn indicates high quality habitats. He goes on to state that the Refinery Jetty and the Refinery grounds provide roosting and nesting habitat respectively for nationally at-risk species. He concludes that the quality of the most notable feeding habitat close to the Refinery, being Mair Bank, has remained high. His conclusion is based on

[54] Don, G. Bioresearches Limited, *Coastal Bird Assessment*. Dated June 2020

the presence of variable oystercatcher (a key indicator species), despite the reported decline of the Bank's pipi population in the last ten years.

Mr Don has addressed the comments contained within the CEA[55] on the observed presence of dead red-billed gulls at the SWB at the Site which he notes is adjacent to a significant breeding colony of the gulls. Mr Don states that there is no indication that the mortality of red-billed gulls is a widespread issue. Mr Don also reports that during the comprehensive coastal bird surveys along the coastal strip adjacent to the colony undertaken as part of his assessment no dead gulls were observed. Mr Don notes that colony within the Site contains some 3500 to 4500 (adults plus juveniles) individuals during the nesting season and therefore some mortality can be expected on a regular basis for a variety of reasons. Mr Don notes that the reported mortality of red-billed gulls at the SWB by PTB does not alter his conclusions

2.3.7 Marine Mammals

Dr Deanna Clement of the Cawthron Institute has prepared an Assessment of the Effects on Marine Mammals[56] for the Proposal, a full copy of which is attached within **Annexure 3** to this AEE. We now summarise those aspects of the report that describe the existing environment.

2.3.7.1 General Approach

Dr Clement states that the 'normal' home range for marine mammals can vary between hundreds to thousands of kilometres. By way of example, she records that while southern right whales may be considered only seasonal migrants to Bream Bay waters, this stretch of water may represent an important corridor that mother whales use to safely reach Northland nursery grounds during their winter migration. She advises that as a result, the importance of Bream Bay and Whangārei waters needs to be considered in the context of species' regional and New Zealand-wide distributions.

Dr Clement reports that to date no marine mammal studies have focused on Whangārei Harbour and/ or the Bream Bay region and that in the absence of any long-term and spatially explicit baseline research on marine mammals in the greater Whangārei area, species information and sighting data were collated from ongoing research throughout the central-eastern coastal region. She further advises that opportunistic sightings reported to Department of Conservation (including the public, tourism vessels, seismic surveys, etc.) and stranding's (previously collated through Te Papa National Museum and now DoC) were reviewed. This information was combined and used to determine what is currently known about any relevant species' occurrence, behaviour, and distribution within the area of interest and to evaluate those species most likely to be affected by the Proposal.

2.3.7.2 General Site Description

Dr Clement reports that Whangārei Heads is also known as 'Whangārei Terenga Parāoa', which means 'Whangārei, the gathering place of whales' and that the significance of whale migrations past this region is supported by the number of whaling stations found to the north near Whangamumu and along the entire eastern coastline of the North Island, during the late 1800s and early 1900s. She states that out of the more than 50 species of cetaceans (whales, dolphins and porpoises) and pinnipeds (seal and sea lions) known to live or migrate through New Zealand waters, at least 27 cetacean and two pinniped species have been sighted or stranded along the north-eastern coastline of the North Island. **Figure 2.3.7.2.1**, which follows, highlights where the various marine mammal species have been recorded from the north-eastern coastal regions between the Bay of Islands to the north and the entrance to the Hauraki Gulf and Great Barrier Island to the south.

Dr Clement states further that it is important to note that a large majority of sightings are collected opportunistically rather than systematically and that sightings were recorded

[55] PTB, *Cultural Effects Assessment Report: Refining NZ Reconsenting*. Dated July 2020
[56] Clement, D. Cawthron Institute Limited, *Marsden Point Refinery Re-consenting: Marine Mammal Assessment of Effect*s. Dated June 2020

around the Bay of Islands and Hauraki Gulf regions, which is most likely a reflection of the marine tour companies operating within these vicinities that offer marine mammal tours and swims. She emphasises that for this assessment, less importance is placed on the location of sightings and a greater emphasis is placed on the presence and timing of an identified species in the lower Northland region. She reports that most sightings were recorded around the Bay of Islands and Hauraki Gulf regions.

2.3.7.3 Species of Interest

Dr Clement reports that several of the species are known to be year-round or seasonal residents of the coastal regions surrounding Whangārei Harbour and Bream Bay areas. She states that the more common species occurring along the Whangārei coastline, and therefore most likely to be affected by the proposed project, include bottlenose dolphins, common dolphins, orca, and Bryde's whale. In her assessment, Dr Clement also considers several other species, due to various life history dynamics and / or because they are of special concern to local iwi, Tangata Whenua o Whangārei Terenga Parāoa. She then advises that additional species of concern include those that may be less frequent visitors but are more vulnerable to anthropogenic (human-made) impacts due to their current conservation status (for example, the southern right whales are 'at risk–recovering') or species-specific sensitivities (for example, the mass stranding tendencies of pilot whales).

Dr Clement advises, when considering potential implications of coastal developments on local marine mammal populations, the importance of Whangārei waters needs to be placed in the context of the species' regional and New Zealand-wide distribution. She states that based on the available species data, and in reference to Section 6(c) of the Act, Policy 11 of the NZCPS, Policy 4.4.1 of the oRPS and Method 9.2.5.2 of the oRCP, and the relevant maps from the pRP, there is no evidence indicating that any of these species have home ranges restricted solely to Whangārei Harbour and nearby Bream Bay waters. She goes on to state that while several whale species have their regular migration routes through this region, the Harbour is not considered as an ecologically important migration corridor as most animals generally pass by the area further offshore. She, therefore, advises that the Proposal area is not ecologically significant in terms of feeding, resting or breeding habitats for any marine mammal species.

Notwithstanding the foregoing, Dr Clement reports that these waters also periodically support threatened species, such as Bryde's whales, bottlenose dolphins, orca and southern right whales and that these species are relevant in regard to Policy 11(a) of the NZCPS, which refers to avoiding adverse effects on nationally and / or internationally recognised threatened species.

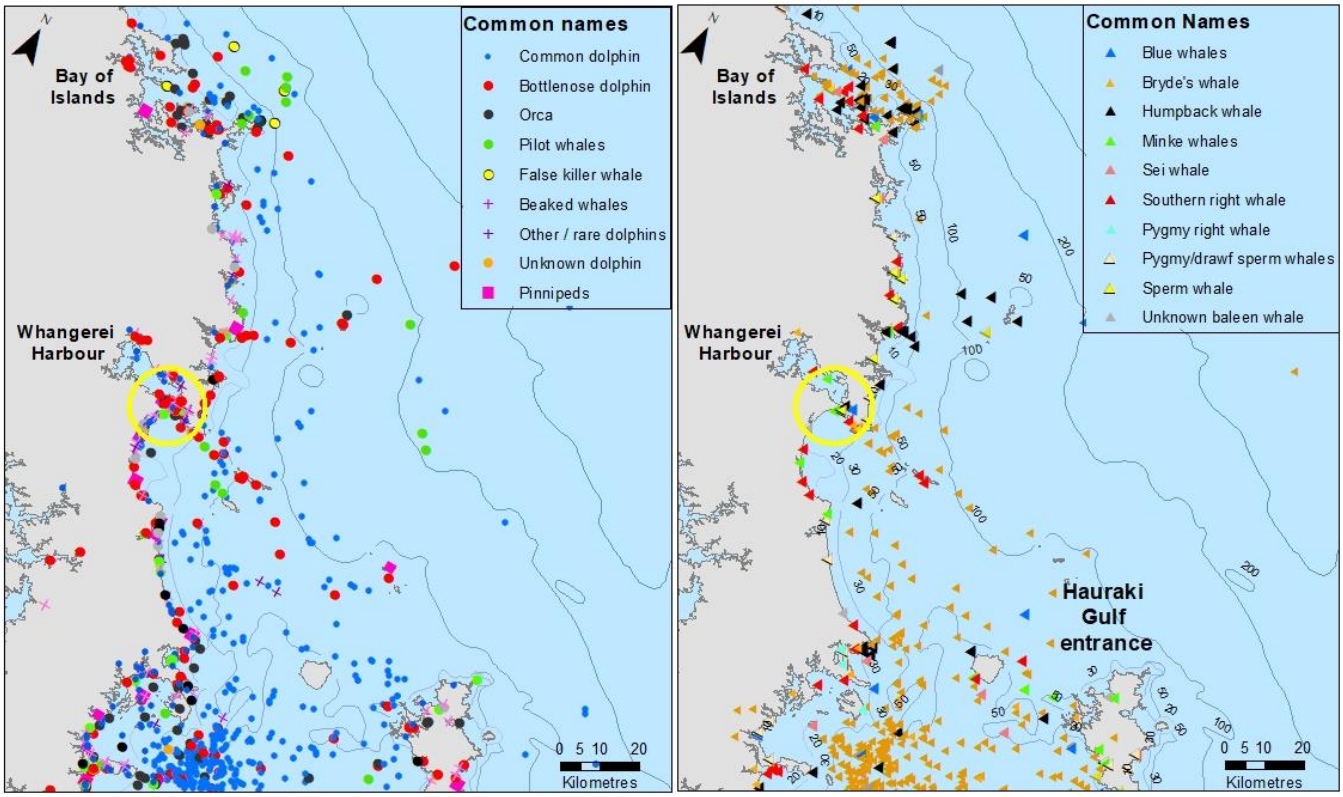


Figure 2.3.7.3.1: *The distribution of Department of Conservation (DoC) reported sightings (1978-2018) and strandings (1869-2018) between Bay of Islands and the northern entrance of the Hauraki Gulf. Toothed whales and dolphins plus pinniped (seals) are shown in the left image and migrating whale species in the right image. The yellow circles indicate the extent area in which modelled dilution scenarios for the proposal discharge sites are being considered*

2.3.8 Landscape, Visual & Natural Character

Mr Brown of Brown New Zealand Limited has prepared a landscape assessment[57] that addresses the reconsenting of both activities and structures that are currently associated with the Refinery.

Mr Brown evaluates these activities and structures in terms of their visual, landscape, amenity and natural character effects, in the context of the existing environment at Marsden Point and the wider catchment of Whangārei Harbour. A copy of his report is also attached within **Annexure 3** of this AEE. We now summarise his findings in relation to the following sub-sections:

a. Landscape Context;
b. Identified Values;
c. Natural Character; and
d. Amenity.

2.3.8.1 Landscape Context

Mr Brown describes the landscape context as follows: *"The outer reaches of Whangārei Harbour and Marsden Point are framed by the expansive coastal plain around Ruakaka to the south, and the volcanic peaks of Home Point, Mt Lion, Bream Head, then Taurikura, Mt Manaia and Mt Aubrey, to the north. At the junction of these contrasting landforms, the Marsden Point Oil Refinery also sits at the end of a distal spit that marks the very entrance to Whangārei Harbour and a succession of bays – from Little Munroe to Urquharts – that*

[57] Brown, S. Brown NZ Ltd, *Marsden Point Refinery Re-Consenting Project – Landscape Assessment*. Dated June 2020

directly frame the northern side of its mouth. West of the oil refinery, Marsden Bay and One Tree Point enclose the shoreline west of Blacksmiths Creek, while a series of headlands and indented bays / coves – including McLeod Bay and Munroe Bay, together with Reserve Point and Manganese Point – line the harbour's northern coastline."

Mr Brown goes on to describe the catchment more directly associated with the Site as being effectively framed by the adjoining deep-water port and, across the Harbour, by Darch Point, at the western edge of Reotahi below Mount Aubrey. He then states that Home Point and Busby Head define the outer limits of the main body of the Harbour, whereas its mouth, extending into Bream Bay, is more loosely framed by Bream Head and the dune/ sedimentary plain around Ruakaka.

According to Mr Brown the Ruakaka coastline is fronted by a shallow, relatively low lying, dune corridor, behind which various industrial premises, the Ruakaka Sewerage Plant, the local racecourse and pockets of residential development that all face out across Bream Bay. He states further that the Refinery at the Harbour's edge is defined by its storage tanks, pipe work, buildings and other infrastructure. Mr Brown describes the Jetty and two unloading gantries as projecting out into the enclosed Harbour and that tankers are often located at these wharves and their 'dolphins'. He also reports that immediately west of the Refinery, Northport's deep-water berths are constantly in motion, with logs being loaded onto freighters, while trucks re-supply the large timber and timber chip stockpiles behind the main wharves. He then records that this industrial node outlined above, which includes storage sheds, additional storage tanks and a light industrial premises flanking Marsden Point Road, is separated from Blacksmiths Creek by a planted bund.

Mr Brown indicates further that immediately west of the creek is residential development that is mostly traditional bungalows facing the open waters of the Harbour, while more modern, beach houses are found around the enclosed waterways of the Marsden Bay development expanding the Harbour frontage. He states that although views from this quarter include the margins of the deep water port and vessels berthed at both the port and the Refinery, the main outlook from Marsden Bay and One Tree Point is directly across the Harbour, towards Mount Aubrey, Taurikura and the matrix of forested hills filling the northern horizon.

Photograph 2.3.8.1.1: *Looking from One Tree Point towards Mt Aubrey, Taurikura, Mt Lion & the Refinery*

Mr Brown goes on to describe the volcanic peaks (which we previously mention) and native forest as being broken into the series of headlands and bays. He states further that these bays are defined and framed by both ridges and headland promontories namely:

- Pockets of rural-residential development amid a 'farm park' at the western end of Parua Bay and across Reserve Point;
- More traditional bach settlements at Reotahi, Little Munroe Bay, McGregors Bay, Taurikura bay, McKenzie Bay and Urquharts Bay; and
- A small marina next to Solomon's Point.

Mr Brown records further that bush and pockets of residual pasture extend down from the mountain peaks to both enclose, and separate, isolated residential areas. He then advises that Mount Lion and Home Point decisively mark the outer limits of the Harbour, while a broad area of bush extending from Home Point to Busby Head, then from the northern side

of Smugglers Bay to Bream Head, helps to further reinforce the more natural qualities of the area.

Mr Brown states that most of the settlements between Reotahi and Urquharts Bay lie within the visual catchment of the Site and the adjoining Northport facilities and as a result, the Site acts as the visual focus of most views to, and across, the Harbour entrance. However, Mr Brown advises that this is not always the case: as descending towards McGregors Bay and Taurikura Bay on Whangārei Heads Road, the volcanic relief of the surrounding hills, and the associated waters of the northern Harbour reaches, is a defining feature of many views. He goes on to advise that the unique profile and visual presence of Mount Lion and Home Point, joint sentinels at the Harbour mouth, are a key facet of the Whangārei Heads landscape and that they share the role of being a signature feature within the outer heads landscape, one that is largely divorced from Marsden Point.

Mr Brown reports that in addition to affording a key landmark within this coastline, Mount Lion and Home Point help to instil the wider Harbour setting with a level of naturalness and aesthetic appeal that contrasts with the situation evident directly across the Harbour. According to Brown this appeal is central to the attraction that the 'Heads' provide for locals and visitors, which is also why so many small settlements line the northern side of the Harbour.

Mr Brown goes on to advise that beyond the sheltered waters and terrestrial limits of the outer Harbour, the steep faced peaks and slopes of Busby Head, Mount Lion and Bream Head provide a more the natural setting for the outer edge of the Harbour and its mouth. He describes bush as dominating the DoC reserve facing out into Bream Bay, contrasting with the pasture that extends from Smugglers Bay up and over a low saddle to meet the western end of Urquharts Bay. He then states that the waters off Smugglers Bay and Bream Head mark the junction with Bream Bay and it's even more open, physically exposed, sea area, with just the distant Hen and Chicken Islands (Taranga island and the Marotere Islands), on the far side of the Parry Channel, providing protection and containment from the Pacific Ocean's swells. Mr Brown reports that as a result of this, the waters facing the northern edge of Bream Bay are frequently turbulent. Mr Brown concludes that although lying close to the coastal settlements just described, it has a much more remote quality, and unlike the other parts of the Marsden Point's landscape setting, there is little sense of contact with the Refinery or other areas of more obvious human activity, apart from the ships lined up offshore, waiting to berth.

2.3.8.2 Identified Values

Mr Brown advises that the oWDP identifies Outstanding Natural Landscapes (**'ONLs'**) within Bream Bay and around Whangārei Heads on Map 16 of the Operative District Plan. He states that in addition to this, the oRPS identifies both ONLs at the regional scale and areas of High Natural Character (**'HNC'**) and Outstanding Natural Character (**'ONC'**). He states further that of most relevance to the Proposal, the RPS's more recent maps (which we have repeated as **Figure 2.3.8.2.1**, which follows), identify:

- An area of ONC covering the seaward slopes and bluffs of Mt Aubrey, next to Reotahi;
- Another area of ONC addressing the coastline from Smugglers Bay to Bream Head;
- Areas of high Natural Character within the Harbour covering the Snake, McDonald and Calliope Banks down the northern side of the Harbour next to Munroe, McLeod and Taurikura Bays, and another HNC addressing part of Mair Bank on the southern side of the Harbour entry channel;
- An area of HNC flanking Home Point and the series of coastal ridges and promontories around Busby Head;
- An ONL (regional policy statement) running along Bream Bay's beachfront and dune corridor, south of the oil terminal boundary; and
- ONLs (district plan and regional policy statement) covering the broad sweep of hills and coastal ridges that frame Whangārei Heads and Home Point, including Taurikura, Mt Lion, Manaia, Busby Head, and the coastal ridges above Smugglers Bay extending out to Bream Head.

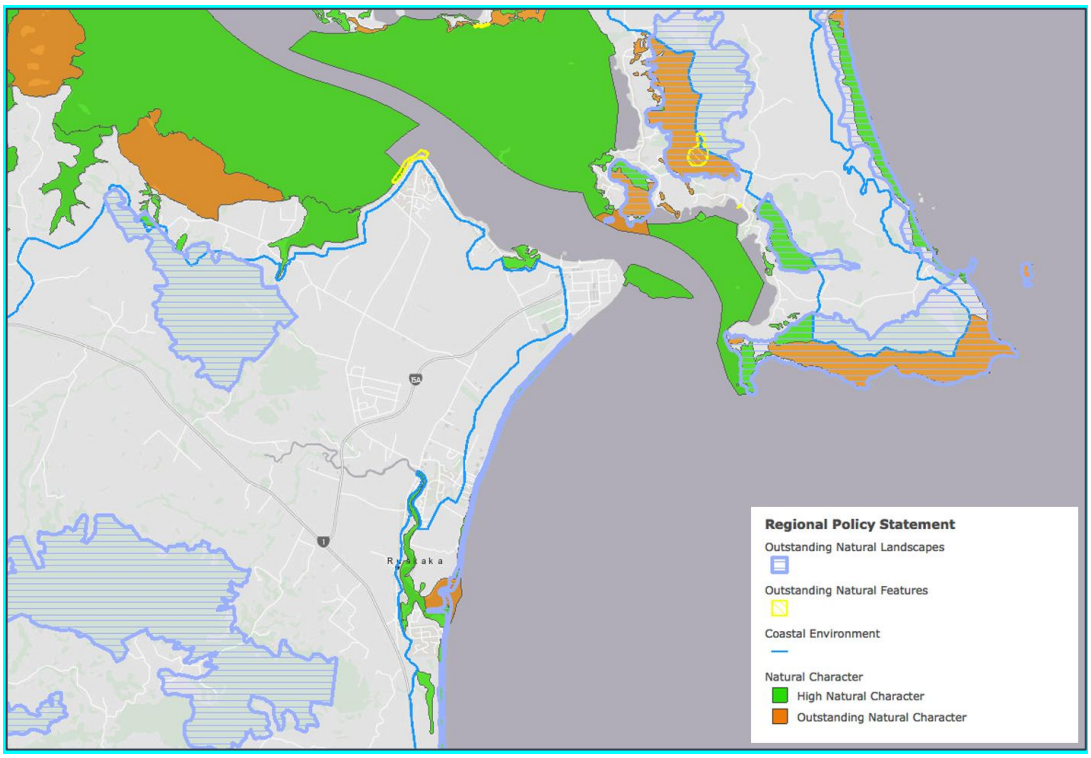


Figure 2.3.8.2.1: *Operative Northland Regional Policy Statement map showing areas of Outstanding Natural Character (orange), High Natural Character (green) & Outstanding Natural Landscapes (horizontal green stripes framed by a mauve border)*

Mr Brown states that to the west, most of Mount Aubrey and part of its apron of CMA either side of Lort Point is also identified as an ONC area, while Mounts Manaia, Aubrey and Taurikura, facing Whangārei Harbour and Marsden Point, are each subject to an ONL overlay. He goes on to advise that this complex situation and the high number of areas subject to landscape and natural character overlays, highlights the dichotomy evident within and around the outer Harbour. He states that while its outer waters are physically enclosed and overlooked by a sequence of forested, and spectacular volcanic landforms, the margins of the Harbour also engage with settlements, slopes that were once mostly in pasture and still remain so in part, and the southern Harbour margins that contain an increasing number of houses, industrial development and port related activities.

Mr Brown advises that even though the crescent of Bream Bay, further south again, retains natural character and an area of high public appeal down its coastal edge, it is soon succeeded by the housing development around Ruakaka, industrial premises lining Marsden Point Rd, the remains of the old Marsden B thermal power station and the local sewerage works. He concludes that this creates a highly complex, contextual setting for Refining NZ.

2.3.8.3 Natural Character

Mr Brown states that the oRPS has evaluated areas of High[58] and Outstanding Natural Character around Marsden Point. He indicates that the worksheet descriptions of those areas close to the proposed navigation channel, however, are largely devoid of detail apart from rather generic descriptions of the different Natural Character areas identified within the Coastal Environment and a summary of the referenced ecosystems applicable to each area.

Mr Brown reports that the rudimentary descriptions set out within the oRPS provide very little appreciation of the environmental conditions associated with the multiple areas identified as having ONC and HNC values around the entrance to Whangārei Harbour and down Bream Bay. He goes on to state that as a result, the oRPS's landscape assessment and

[58] The focus for the Northland Regional Council is to identify and map those areas with High and Outstanding Natural Character, in order to give effect to Policy 13 of the NZCPS

its descriptions of individual ONLs offer more insight into the nature of the environmental setting for the 'proposed' air emissions, stormwater discharges and jetty than the Natural Character worksheets.

2.3.8.4 Amenity

Mr Brown advises that the concept of 'amenity' focuses more directly on a certain cohesion of expression and unity of elements that give rise to a locality or landscape being considered 'pleasant', 'aesthetically cohesive' and having cultural or recreational appeal.

Mr Brown states that consequently, just as Whangārei Head's volcanic terrain, bush and Harbour waters comprise the landscape's basic 'building blocks', local amenity values reside in a wide range of experiences that contribute to the aesthetic value, identity and sense of place associated with the local area – including the:

- Myriad views to, and from, the Harbour and its varied coastal margins;
- Recreational resources provided by local beaches and beachfronts;
- Spectacle and resource offered by the DoC reserve covering the northern side of the Harbour mouth from Home Point to Bream Head, with its trails, beaches, bush and scenic promontories; and
- Waters of the Harbour and Bream Bay, catering to fishermen, 'boaties' and visitors alike.

Mr Brown advises that the outlook to Whangārei Harbour and Bream Bay clearly underpins much of the locality's residential appeal, and the interaction between land and sea is a key part of the northern coastline's identity and sense of place. He reports that local residents on both sides of the Harbour are exposed daily to the dynamic relationship between the sea area, with both views of the volcanic peaks, and the dune plain around Ruakaka running southwards towards the Brynderwyns.

Mr Brown emphasises that these experiences don't exist in a vacuum, divorced from human activities and structures that surround most of the vantage points. He states further that just as the sharp faced hills, native forest and Harbour waters are key components of the outer Harbour's coastal landscape, it also contains a multiplicity of long established cultural / man-made elements, from the many local settlements already described, to the Site, neighbouring deep water port, and development around Marsden Cove, One Tree Point and Ruakaka. He advises further that these are also 'part and parcel' of the present-day Marsden Point/ Whangārei Heads experience.

2.3.9 Human Health

Dr Francesca Kelly of Environmental Medicine Limited has prepared a health effects assessment[59] a full copy of which is attached within **Annexure 3** to this AEE. We now summarise those aspects of the report that describe the existing environment.

In her assessment, Dr Kelly considers that there are likely to be people with a variety of health characteristics living in the assessment area including those with health problems such as diabetes and cardiovascular disease and also those who are pregnant. She assumes further that the exposed[60] population includes long-term residents, and that some people will have had a lifetime of exposure to seafoods sourced locally from the coast. She advises that the Whangārei District Health Board have not published detailed localised information about the health characteristics of the population. Further to this, Dr Kelly acknowledges how PTB in the CEA[61] have expressed their difficulty in obtaining localised health data. Dr Kelly notes that information regarding the resident population of Whangārei District/Northland/New Zealand has been used to inform her assessment, as the characteristics of those affected by the Proposal are likely to be similar.

2.3.9.1 Cultural characteristics

[59] Kelly, F. Environmental Medicine Limited, *Health Effects Assessment prepared for Refining NZ*. Dated July 2020
[60] Population exposed to potential health risk
[61] PTB, *Cultural Effects Assessment Report: Refining NZ Reconsenting*. Dated July 2020

In terms of cultural characteristics, Dr Kelly states that the Patuharakeke traditional rohe has been documented as an area that includes the Site of the Proposal and other areas south of the Whangārei Harbour, affected by the Proposal. Dr Kelly notes that the relationship of Patuharakeke with the Proposal area is set out in the CEA[62]. Dr Kelly records that other tangata whenua, in particular Ngātiwai and Te Parawhau, also have a significant relationship with the area affected by the Proposal which is set out in the CEA[63].

Dr Kelly states that Marsden and Mair Banks have been identified as areas of significance to tangata whenua[64] for shellfish gathering and consumption. However, she states that currently the gathering of any species of shellfish in these locations is affected by the issuance of a temporary closure notice, pursuant to the Fisheries Act 1996[65].

Dr Kelly has considered that the CEA. She notes that Mair and Marsden Banks have been used by tangata whenua until relatively recently as a source for shellfish harvest. She further records that the CEA states that tangata whenua intake of shellfish from the Harbour mirrors the upper limits of dietary consumption that is related to elevated levels of contaminants. Dr Kelly notes that the CEA records that there is a reliance of Māori coastal communities on kaimoana as a staple of their diet and PTB express that their aspiration is to return to a state where shellfish will provide a traditional staple contribution to their diet.

2.3.9.2 Sensitive receptors

In terms of sensitive receptors within the existing environment, Dr Kelly outlines that a number of community facilities have been identified within the Air Quality Assessment[66] for the Proposal, including:

- Takahiwai Marae (6 km west of the Site);
- One Tree Point School (2.4 km northwest of the Site);
- Whangārei Heads School (2.3 km northeast of the Site);
- Bream Bay College (4 km south-southwest of the Site);
- Marsden Playcentre (4 km west of the Site); and
- Bream Bay Kindergarten (4 km south-southwest of the Site).

2.3.9.3 Identification of the Hazards

Dr Kelly advises that the Identification of hazards examines whether a contaminant has the potential to cause harm to human health. The hazards addressed in this assessment relate to discharges to the air; groundwater and soil and the ocean. The hazards are described as follows:

Discharges to Air

Dr Kelly describes the Refinery as having eight tall stacks that discharge combustion products associated with the burning of natural gas, refinery generated gas, fuel oil and asphalt. She records that the mix of fuel sources is described by Mr Chilton in his Air Quality Assessment[67]. She notes further that amounts and proportions of various combustion products are partly determined by the mix of fuels in use, and this is controlled among the conditions of consent to discharge to air. Dr Kelly states that flaring and its associated effects have also been taken in to consideration.

Dr Kelly states that hazards among the stack discharges, identified by Mr Chilton, include:

- Sulphur oxides – sulphur dioxide, sulphur trioxide and sulphate;
- Fine particulate matter less than ten microns and less than 2.5 microns in diameter;
- Oxides of nitrogen;
- Carbon monoxide;

[62] PTB, *Cultural Effects Assessment Report: Refining NZ Reconsenting*. Dated July 2020
[63] PTB, *Cultural Effects Assessment Report: Refining NZ Reconsenting*. Dated July 2020
[64] Proposed Northland Regional Plan
[65] http://www.legislation.govt.nz/regulation/public/2018/0097/latest/whole.html
[66] Chilton, R. Tonkin & Taylor Limited, *Air Quality Assessment*. Dated June 2020
[67] Chilton, R. Tonkin & Taylor Limited, *Air Quality Assessment*. Dated June 2020

- Various metals – including nickel and vanadium[68]; and
- Trace dioxins and furans.

Dr Kelly notes that other potential sources of inhaled hazards are the use of abrasive materials for maintenance activities (e.g. sand blasting) and possible fugitive emissions from sources at the Site. She lists the following existing hazards that have been identified:

- BTEX – benzene, toluene, ethylbenzene and xylene fumes
- Silica (respirable quartz) in abrasive materials

Discharges to Groundwater and Soil

Dr Kelly notes that Ms Schiess and Mr Simpson, in their hydrogeological conceptual site model[69] identify contaminants in the soil and groundwater with potential to impact the soil, groundwater and coastal water systems. Dr Kelly notes that Ms Schiess and Mr Simpson describe the wastewater processing systems and stormwater containment systems at the Site, including groundwater discharging to the coast.

Hazards to public health among the soil contaminants and discharges to groundwater include:

- Metals – arsenic, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, vanadium, zinc[70];
- Petroleum hydrocarbons;
- Volatile organic compounds;
- Polycyclic aromatic hydrocarbons (PAHs);
- Phenols;
- Per- and poly-fluoroalkyl substances (PFAS); and
- The PFAS originate from firefighting foams used at the site.

Discharges to Ocean

Dr Kelly outlines that the Marine Ecological Assessment[71] prepared by Boffa Miskell undertakes an assessment of effects from the discharges from the SWB, including discharge of treated stormwater, wastewater, and groundwater and discharge of uncontaminated seawater. She states that their report notes the design of the SWB to absorb fluctuations in flows from the site and to accommodate heavy rainfall events. She indicates that environmental sampling has included shellfish flesh, benthic invertebrates, sediments, Harbour waters and SWB waters and goes on to note that the contaminants assessed among the coastal discharges include:

- Heavy metals and aluminium;
- BTEX – benzene, toluene, ethylbenzene and xylene;
- Total petroleum hydrocarbons (TPH);
- Polycyclic aromatic hydrocarbons (PAHs);
- Phenols;
- Per- and poly-fluoroalkyl substances (PFAS);
- Sulphide;
- Tributyl tins (TBT and derivatives); and
- Faecal coliforms.

[68] Chilton, R. Tonkin & Taylor Limited, *Air Quality Assessment*. Dated June 2020, page 20 - Table 3.8 summarises: aluminum, calcium, iron, sodium, nickel, silicon and vanadium testing results for asphalt and fuel oil. Other metals were below detection

[69] Schiess, S. and Simpson, C. Tonkin & Taylor Limited, Hydrogeological Conceptual Site Model for the Marsden Point Refinery. Dated July 2020

[70] Schiess, S. and Simpson, C. Tonkin & Taylor Limited, *Hydrogeological Conceptual Site Model for the Marsden Point Refinery*. Dated July 2020, page 44
Table 5.1 metal concentrations in water from perimeter wells;
Table 5.2 dissolved metals in groundwater samples Sept 2019;
Table 5.3 dissolved metals in groundwater within Bream Bay foreshore Nov 2019

[71] De Luca, S., and Ross, Dr P., Boffa Miskell, *Assessment of Effects on Marine Ecological Values- Reconsenting of discharges and structures in the CMA*. Dated July 2020

2.3.10 Archaeological Historical Heritage

In 2017 Ryder Consulting prepared an Assessment of Environment Effects (**'the CSP-AEE'**) for the CSP[72]. The Archaeological Historic Heritage chapter of the CSP-AEE is founded on the *Marsden Refinery, Whangārei harbour Dredging: Archaeological Assessment* (2017) prepared by Dr Rod Clough of Clough and Associates Limited[73]. Dr Clough set out those archaeological resources and sites that are known to exist within and in close proximity to the Site. A full copy of his report is attached within **Annexure 3** of this AEE. We now summarise the advice it conveys in relation to the existing environment.

Dr Clough advises that extensive archaeological excavations have been carried out around Whangārei Harbour since the 1960's. He also records that those investigations have revealed a number of archaeological sites related to Māori occupation that are situated in a relatively close proximity to the Site. This includes middens, hangi stones, fishing equipment, Pa sites with pits and terraces and gum-digging activities throughout the area, including at One Tree Point and Whangārei Heads. We understand his advice to be that the archaeologists that investigated the Site have concluded that this collection of sites points to a summer occupation of the One Tree Point area for large scale processing of shellfish, from 1500 AD onwards. Notably, Dr Clough records that there are no known archaeological sites at Marsden Point itself, although he advises that it is likely that the occupation in this area would likely have been similar to the surrounding sites. In this regard, we understand his advice to be that the earthworks associated with the development of the Site are likely to have destroyed most of the archaeological sites that may have been present. We also understand him to advise that some intact evidence could be discovered in the future given the prograding (which means extending outward) shoreline and possible burial of some sites.

Relevantly, Dr Clough concludes that there are no known archaeological sites directly affected by activity. The current distribution of archaeological sites in the New Zealand Archaeological Association database is shown in **Figure 2.3.10.1**, which follows:

[72] Kemble, G. Ryder Consulting Limited, *Refining NZ Crude Shipping Project Proposed Deepening and Realigning of the Whangārei Harbour Entrance and Approaches AEE*. Dated August 2017

[73] Clough, Dr R., Clough and Associates Limited, *Archaeological Historic Heritage chapter of the CSP-AEE*, addresses the archaeological and historic heritage values that exist in close proximity to the Site and is based on a technical report prepared for the CSP-AEE. Dated July 2017

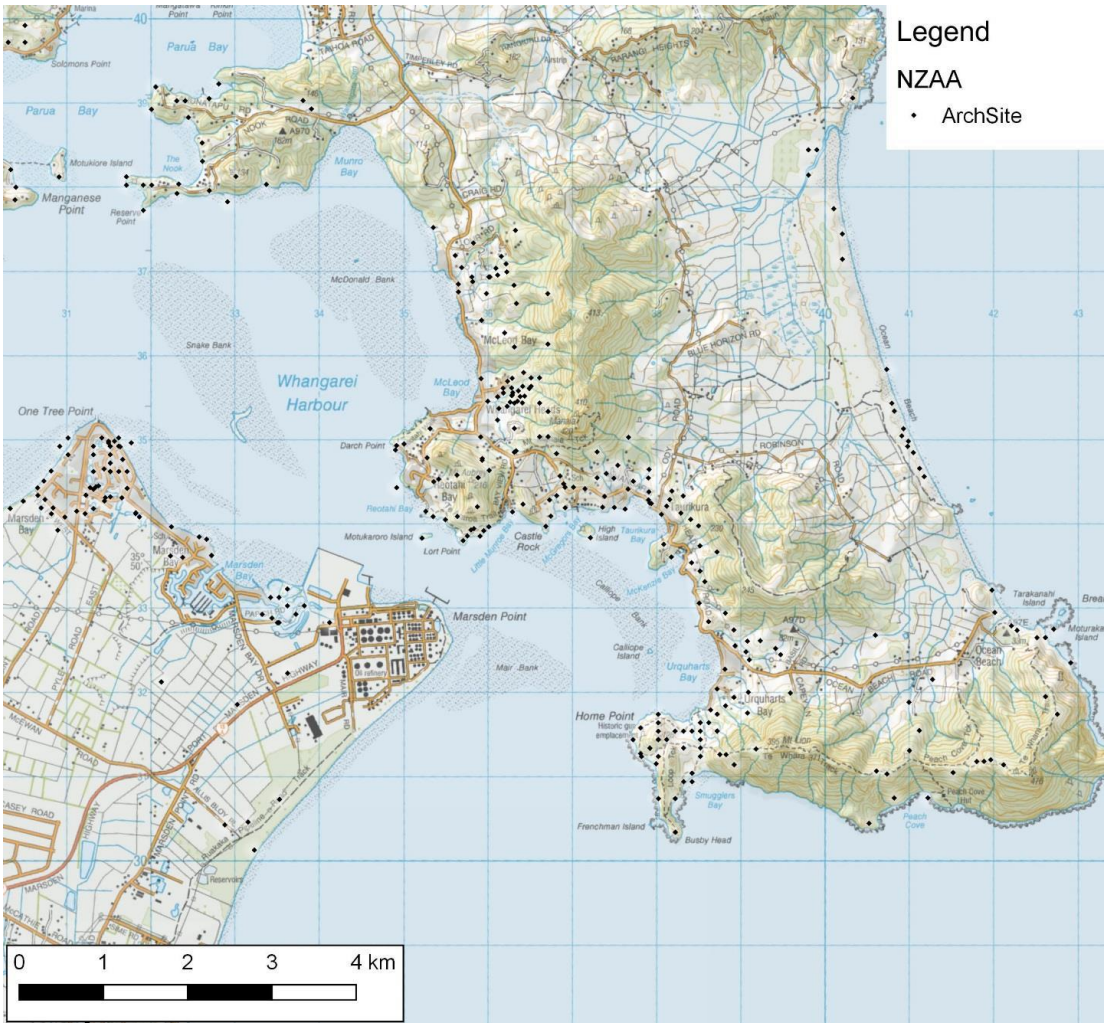


Figure 2.3.10.1: *Distribution of Archaeological Sites*

Dr Clough records that the archaeological sites are generally clustered along the coastlines around One Tree Point, Marsden Bay, and McLeod Bay to Smugglers Bay.

2.3.10.1 Archaeological Significance of the Site & Its Surroundings

Dr Clough advises that the archaeological value of sites relates mainly to their information potential, that is, the extent to which they provide evidence relating to local, regional and national history through the use of archaeological investigation techniques, and the research questions to which the Site could contribute. He states that the surviving extent, complexity and condition of archaeological sites are the main factors in their ability to provide information through archaeological investigation and notes further that sites such as pa, are more complex and have higher information potential than most small midden. He also states that archaeological values include the context of the area, and concepts such as the heritage landscape values. Overall, Dr Clough advises that the broader area is relatively significant, from an archaeological perspective.

2.3.11 Cultural Values

The Cultural Effects Assessment or CEA[74] has been prepared by Patuharakeke Te Iwi Trust Board or PTB. The CEA identifies tangata whenua values within and surrounding area of the Site. We note, that Patuharakeke asserts mana whenua status over Poupouwhenua (Marsden Point), although, as discussed below, a number of iwi and hapū of Whangārei Terenga Parāoa have an interest in the Proposal Site and the wider area of Whangārei Harbour (Whangārei

[74] PTB, *Cultural Effects Assessment Report: Refining NZ Reconsenting*. Dated July 2020

Heads, Ruakaka and Bream Bay area)[75]. We now summarise our understanding of the key findings from the CEA below. We have reviewed the Statutory Acknowledgements and applicable iwi management plans identified by the NRC that apply to, or are within the broader Whangārei Harbour / Bream Bay area.

2.3.11.1 Interested Hapū & Iwi

The CEA notes that there is a strong connection amongst the hapū and iwi of Whangārei Terenga Parāoa[76]. In addition to Patuharakeke, the CEA records that there are other hapū and iwi with mana whenua, those that hold ahi kaa (title to the land through occupation by a group), those that are hau kainga (local people of a marae) or kaitiaki, as well as those with seasonal rights, access/travel rights, and those from ancient tribes that have been subsumed by modern tribes. There are also manuhiri (visitors) who settled in the area and those that are customary fishers, or hold/have held title to the adjacent lands.

The hapū and iwi that have been identified as having an interest in and around the Site include:

a. Patuharakeke;
b. Te Parawhau;
c. Te Parawhau / Toetoe;
d. Ngati Kahu o Torongare me Te Parawhau;
e. Te Waiariki;
f. Ngati Korora;
g. Ngati Tu;
h. Te Uriroroi;
i. Te Kumutu;
j. Ngātiwai;
k. Ngapuhi;
l. Ngati Whatua;
m. Ngai Tahuhu
n. Ngati Manaia; and
o. Manuhiri (e.g. non mana whenua Māori families at Marsden Village).

2.3.11.2 Significance of Parāoa/Tohora (Whales) and Kuaka (Bar Tailed Godwit)

The CEA records that there are number of traditions relating to the meaning of the Harbour's name that are shared and valued by all hapū and iwi of the Harbour[76]. In reviewing the CEA, we understand that named the Harbour Whangārei-terenga-parāoa (the gathering place of whales) because whales gathered there to feed during summer.[77] The CEA notes that whales are considered a kaitiaki and taonga species that are of great significance to Māori. Kuaka (Bar Tailed Godwit) are also considered to be a kaitiaki[78] and feature prominently in Ngai Tahuhu mythology and tradition as guides for the path of the ancestral migration to Aotearoa from Hawaiki (the ancient homeland). The CEA records that Patuharakeke consider the presence of whales and Kuaka within Whangārei Terenga Parāoa as an indicator of ecological health, and therefore an indicator of the success of their practice of kaitiakitanga. Further, we note that the CEA informs how the presence of whales and Kuaka is representative of the cultural health and wellbeing of the environment and tangata whenua.

2.3.11.3 Historical Uses of Poupouwhenua

The CEA identifies that the traditional uses of Poupouwhenua both whenua and moana by Patuharakeke and other local Māori informs the historical significance of the area. We note that the CEA records that historically Poupouwhenua was an extremely important tauranga waka (canoe landing site) often occupied by various waka taua (war parties) stopping there to prepare and strategise for battles further south. The CEA considers that Poupouwhenua as a tauranga waka, was a key site within Whangārei-terenga-parāoa as it linked iwi and hapū

[75] Whangārei Terenga Parāo is te reo Māori for Whangārei Harbour
[76] PTB, *Cultural Effects Assessment Report: Refining NZ Reconsenting*. Dated July 2020
[77] According to Ngātiwai
[78] Te reo Māori for 'environmental guardian' as defined by Dick, J., et al., (2012) 'Listening to the kaitiaki: consequences of the loss of abundance and biodiversity of coastal ecosystems in Aotearoa New Zealand', MAI Journal, 1(2), pp.117-130

together during times of tribal war.

Poupouwhenua is also considered a 'kapata kai' which is a bountiful and rich food basket. The CEA identifies the area of the Proposal as significant for seasonal migration of descendants of Patuharakeke from in and around the Harbour and related inland hapū to harvest kaimoana. The foreshore and dunes between the Marsden Point Wharf and Refinery Jetty were used as nohoanga (camping sites for harvesting kai) regularly by Patuharakeke and other relations from the Whangārei area. The CEA considers that Whangārei-terenga-parāoa was host to many other important mahinga mātaitai[79] at Marsden Bay, McDonald Bank, Mair Bank, Marsden Bank, Calliope Bank and Urquharts Bay, along the coastline from Reotahi to Taurikura as well as Smugglers Bay, Peach Cove and Bream Bay. We note that the CEA records that a number of species were harvested at those locations, including snapper, tarakihi, gurnard, trevally, kahawai, kingfish, pipi, kokota, tio, koura, kina, paua, tuatua, kutai, and tauranga ika. The CEA also sets out how shark fishing took place at the entrance to the Harbour and records that mullet and flounder were generally sought further up the Harbour. These mahinga mātaitai have been identified in the pRP as Sites and Areas of Significance to Tangata Whenua (Mangawhati, Takahiwai, Te Poupouwhenua and Ruakaka).

We understand the CEA to indicate that Whangārei-terenga-parāoa was a rich tapestry of areas that local hapū and iwi would use for harvesting taonga, other than kaimoana. The sandbanks and beaches surrounding the Proposal Site area were important seasonal bird harvesting sites for species such as Parera (Ducks), Manu Oi (Shearwaters/Mutton Birds) and Kuaka (Bar Tailed Godwit). Many areas of Whangārei-terenga-parāoa were repositories of plants with useful fibres (pīngao, muka and harakeke) used by hapū and iwi for weaving and rongoā (medicine).

2.3.11.4 Cultural Landscapes and Seascapes

The CEA reflects that the landscape and seascape of the Site is of cultural significance to Patuharakeke as well as other hapū and iwi. We understand that this is reflected in the names of places, landmarks and waterbodies at and around the Site which inform historical connections and whakapapa. The CEA records that many areas and features of the landscape and seascape are the subject of historical korero, pūrākau, whakatauki, and waiata, as well as important identifiers of local hapū and iwi in pepeha. In addition, the CEA sets out that features of the landscape included in korero and pūrākau are a physical and spiritual link for Patuharakeke to the very beginnings of their ancient occupation of their rohe.

The CEA identifies several important markers in the area that form the cultural landscape and seascape, including;

- Maunga - Manaia, Matariki (Mt Lion), Te Whara (Bream Head), the Takahiwai and Pukekauri, Kukunui and Piroa (Brynderwyn) ranges;
- Islands - Taranga and Marotiri (Hen and Chickens) and Motukaroro;
- Reefs and rocks - Motu Karoro, Taurikura Motu Tapu (Calliope Island) and Motu Panamaia; and
- Tahuna (sand banks)- Poupouwhenua/Mair, Marsden Bank, Patarangahi/Snake Bank, Calliope Bank, McDonald Bank and Tahuna Patupo regarded as a historical Kuaka gathering spot.

The CEA notes other important sites in the vicinity of the Proposal. These include;

- Ngaungara (High Island in McGregors Bay) – traditional korero states that Ngati Manu fishers were stranded on Ngaungara on the rising tide after Ngāti Kahu o Torongare took their waka and they were rescued by Patuharakeke people;
- Otarakaihae (Mt Aubrey), – there is an assumption that the name Otarakaihae which is said to mean 'jealousy' is likely to be associated with the korero around Manaia and his wife's lover Paeko; and
- Horomanga – this is the large pa of the Ngai Tahuhu paramount chief- Hikurangi – which sits above Urquharts wharf).

[79] Mahinga mātaitai is a customary seafood gathering site/shellfish bed

The markers that define the cultural landscape and seascape all have beliefs associated with them that are integral to the histories and identity of local hapū and iwi. The CEA records that these sites are of high cultural significance to not only Patuharakeke, but to Ngātiwai, Ngati Kahu o Torongare, Te Waiariki, Parawhau and others, for their strong associations with the tupuna Manaia and important linkages through whakapapa and land ownership to the ancestor Torongare and the 19th century chiefs - Pohe and Tirarau.

2.3.11.5 Wāhi Tapu

The CEA sets out that there are a number of sites that are wāhi tapu within Whangārei-terenga-parāoa and that Poupouwhenua is a significant ancestral site of great importance to Patuharakeke. The CEA confirms that the Proposal "*will not impact on any individual archaeological sites or wāhi tapu.*"[80] The CEA also states that kaumātua of Patuharakeke advise that there are a number of unrecorded wāhi tapu sites such as Waiana koiwi (underwater burial caves and ledges) of which the locations cannot be disclosed due to their cultural sensitivity. In general, the CEA records that sites and areas that are wāhi tapu in the Harbour support not only the physical sustenance of local hapū and iwi, but also their spiritual and cultural practices. In addition to areas used to harvest resources such as kai and plants, the CEA expresses how certain areas within rivers and creeks were reserved for baptisms, swimming lessons and funeral preparations, as well as bathing and healing rituals. Patuharakeke as kaitiaki are responsible for the protection of all wāhi tapu within their rohe.

2.3.11.6 Contemporary Relationships of Patuharakeke and Poupouwhenua

The CEA expresses that the connection to the whenua and moana of Poupouwhenua by Patuharakeke is determined not only through story-telling, whakapapa, wananga, waiata, whaikorero and hui, but also by the continued interactions between tangata whenua and the physical environment of Poupouwhenua. Further, the CEA states that the relationships of Patuharakeke with the Proposal Site and surrounding area is strongly maintained through the presence of the marae at Takahiwai, ahi-kā-roa by the descendants of the ancestors of the rohe and the continuation of traditional practices such as gathering and harvesting kai and using the moana for its recreational values.

The CEA articulates how the capacity of Patuharakeke to practice kaitiakitanga has been challenged by the colonisation of Aotearoa that led to the loss of Patuharakeke's ancestral lands and the dominance of Western governance over resource management that had little regard for Te Ao Māori. Further, the CEA records that Patuharakeke is committed to practicing kaitiakitanga in collaboration with iwi, hapū, relevant agencies, scientific bodies, developers and the wider community of Whangārei-terenga-parāoa to restore the health of their rohe moana.

2.3.11.7 Statutory Acknowledgements

The oRPS companion document[81] details the statutory acknowledgements in Northland. We record for completeness, that the Regional Council's Tikanga Māori Advisor has also confirmed that there are no relevant Statutory Acknowledgements associated with the Proposal Site[82]. Of all the statutory acknowledgements in Northland, there is one statutory area to note for its proximity to the Site. This statutory area is the Pakikaikutu Coastal Statutory Area ('**PCSA**') as recognised within section 29 of Ngāti Pūkenga Claims Settlement Act 2017[83]. The PCSA runs along the Tamaterau coast to Pārua Bay, approximately 6.3km North West of the Site, across the Harbour as shown in **Figure 2.3.11.7.1**.

There is a particular cultural, spiritual, historical and traditional association with this area for Ngāti Pūkenga, however the area is a significant distance (approximately 6.3km) from the Site, and as such is not considered likely to be impacted by the operations of the Refinery.

[80] PTB, *Cultural Effects Assessment Report: Refining NZ Reconsenting.* Dated July 2020, page 28
[81] NRC, Te Ture Whakamana ngā Iwi o Taitokerau: Statutory Acknowledgements in Northland. Dated 2018
[82] Arama Morunga, Kaiārahi Tikanga Māori: Māori Cultural Advisor at Northland Regional Council, email correspondence. Dated 25 October 2019
[83] Ngāti Pūkenga Claims Settlement Act 2017, www.legislation.govt.nz/act/public/2017/0039/latest/DLM6745613.html

It is on this basis that the AEE does not take in to consideration the PCSA within the assessment of effects.

Figure 2.3.11.7.1: *Approximate Location of the Pakikaikutu Coastal Statutory Area (PCSA) adapted from Whangārei District Council (2020) SAK.2 Statutory Acknowledgement for Ngāti Pūkenga*[84].

Further assessment using NRC's Treaty Settlement Statutory Acknowledgment Areas online GIS map shown by **Figure 2.3.11.7.2**, confirms the next closest statutory acknowledgement areas to the Site are Ngati Manuhiri's Coastal Statutory Acknowledgment Area approximately 23 km south and Te Uri o Hau's Statutory Acknowledgment Area for the Mangawhai Harbour, which is located at an even greater distance from the Site.

[84] Whangārei District Council, SAK.2 Statutory Acknowledgement for Ngāti Pūkenga, 2020, www.wdc.govt.nz/PlansPoliciesandBylaws/Plans/DistrictPlan/Documents/Decision/Part-1/Decision-Version-District-Plan-Part-1-Statutory-Acknowledgements.pdf

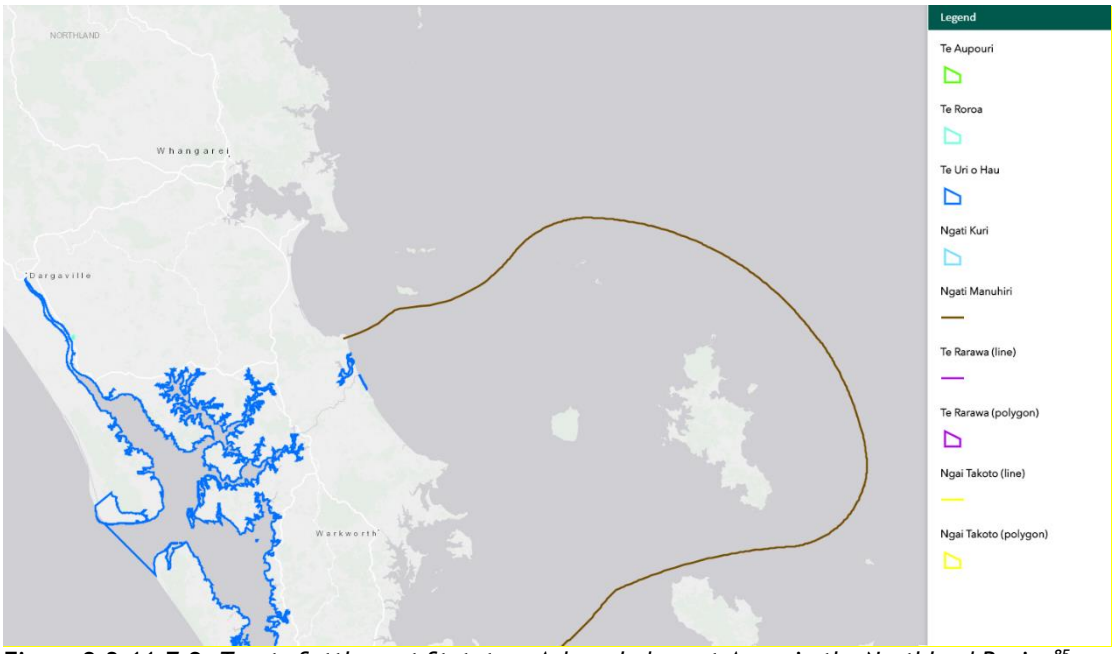


Figure 2.3.11.7.2: *Treaty Settlement Statutory Acknowledgment Areas in the Northland Region*[85]

2.3.11.8 Applicable Iwi Management Plans

The NRC's website lists those iwi and hapū who have developed environmental management plans that are recognised by an iwi authority.[86] We have reviewed the two key environmental management plans of relevance to the Site and surrounding area, and two further environmental management plans of Iwi/Hapū that are located on the outer boundaries of Whangārei.

a. Ngātiwai Trust Board, Ngātiwai Iwi Environmental Policy Document 2015;
b. Patuharakeke Te Iwi Trust Board, Hapū Environmental Management Plan 2014;
c. Whatitiri Resource Management Plan 2016; and
d. Mangakahia Māori Development Plan 1995.

For completeness, NRC's Tikanga Māori Advisor confirmed that there are no further Iwi/Hapū Management Plans of relevance to the Site.[87] We now summarise the key values and issues that are of relevance to the Proposal.

2.3.11.9 Ngātiwai Iwi Environmental Policy Document 2015[88]

Ngātiwai Iwi Environmental Policy Document (2007) was updated by the Ngātiwai Iwi Environmental Policy Document (2015). We note however that the draft Ngātiwai Iwi Hapū Strategic and Environmental Management Plan **('Ngātiwai IHSEMP')** was developed in 2019.

Those core values and main issues expressed within Ngātiwai Iwi Environmental Policy 2015 (**'the NIEP'**) are conveyed under nine broad headings which we list and then, concisely summarise:

a. Air Quality;
b. Minerals;
c. Water Issues;
d. Indigenous Flora and Fauna;
e. Engagement;
f. Wāhi Tapu;
g. Rāhui;

[85] Northland Regional Policy Statement maps viewer, Treaty Settlement Statutory Acknowledgement Areas
[86] Northland Regional Council, Nga Whakamahere o Te Taiao – Iwi / Hapū Management Plans
[87] Arama Morunga, Kaiārahi Tikanga Māori: Māori Cultural Advisor at Northland Regional Council, email correspondence. Dated 25 October 2019
[88] Ngātiwai Iwi Hapū Strategic & Environmental Management Plan (2019) has just been developed however as it is a draft document it has not been specifically addressed

h. Taniwhā; and
i. Landscapes[89].

Air Quality
The Ngātiwai Trust Board (**'the NTB'**) states that the mauri (life force) of air within the rohe of Ngātiwai (which includes the Whangārei Harbour and the surrounding area) is being destroyed. NTB makes specific reference to the negative impacts on the wellbeing of tangata whenua caused by emissions of contaminants from vehicles, industrial processes and procedures, and flue stack emissions from the Site. NTB seek increased involvement in the sustainable management of their ancestral taonga.

Minerals
NTB considers that the use of minerals or geothermal resources is led by economic factors and does not assess the environmental, cultural or social impacts of activities related to the use of these resources. NTB considers that the mauri of mineral and geothermal resources contained within the rohe of Ngātiwai is being destroyed or lost with potentially detrimental environmental, cultural and social effects. NTB also consider that activities related to mineral and geothermal resources within their rohe should not negatively affect areas of significance identified by Ngātiwai and as kaitiaki, should afford Ngātiwai greater involvement in the assessment and decision making of the use of these resources and associated activities.

Water Issues
NTB states that the mauri of water, soil, and their associated ecosystems is also being destroyed within their rohe. NTB considers that Ngātiwai have a special relationship with water, as Ngātiwai means people of the water (wai). Ngātiwai history, strength and mana stems from water which is a sacred resource and a taonga. NTB records that prior to European contact, the Harbour boasted numerous annual visits of marine mammals, but go on to advise that the Harbour's water quality has decreased as a result of anthropogenic activities. NTB further records that damage to the mauri of water has increasingly compromised the ability of Ngātiwai to put kaimoana on the table for visitors and family at tangi, hui and other events on the marae, as well as their ability to feed their whanau and hapū on a regular and sustained basis. NTB strongly advocates for the holistic consideration of ecosystems of which water is an essential component, but stress that water should not be considered in isolation of soil, air and all other living things as everything is interconnected. In addition, NTB considers that water is a sacred resource to Ngātiwai to be given the highest level of protection.

Indigenous Flora and Fauna
NTB states that high percentages of species in Te Tai Tokerau (Far North, Whangārei and Kaipara regions) are endemic which Ngātiwai consider to be both whanau (family) and taonga (treasures). The NTB asserts there has been a decline in the abundance of biodiversity within their rohe, which has diminished the ecosystem services provided by indigenous flora and fauna as a result of the negative impacts of farming, subdivision, forestry practices and other development. NTB also record that indigenous flora (and associated fauna) fulfils a role in recreation and tourism as well as providing customary, historic, landscape and visual amenity values. The NTB considers that Te Tai Tokerau had the highest number of threatened indigenous plant and animal species in Aotearoa (as of NRC's 2002 State of the Environment Report). Given this, an objective of the NTB is the maintenance and restoration of natural species, habitats and ecosystems, with particular regard for endemic and endangered indigenous species and habitat. We note that NTB has not provided the names of specific species or specific areas of indigenous fauna that they wish to be protected.

Engagement
NTB state that there is a lack of direct and effective Ngātiwai involvement, as the kaitiaki of their rohe, in the sustainable management of their ancestral taonga, mineral and geothermal resources. NTB seek increased involvement for Tangata Whenua in the management and

[89] Ngātiwai Trust Board, pages 1 to 77, *Ngātiwai Iwi Environmental Policy Document*. Dated 2015

monitoring of environmental resources.

Wāhi Tapu
NTB define wāhi tapu as a place that is sacred, significant or important; and seek that wāhi tapu and the role of Ngātiwai are correctly understood and managed by all. NTB state that some wāhi tapu are places other than where a human burial has occurred, including both tangible and intangible values and dimensions. We note that no wāhi tapu sites were identified by NTB in the Iwi Environmental Policy Document.

Rāhui
NTB define rāhui as both a traditional and contemporary form of managing a resource. As defined by NTB, rāhui is the temporary prohibition of use of any natural resource for rejuvenation purposes, or the temporary prohibition of access to a place for health and safety purposes. This system recognises the need to balance human requirements with the survival of a species or resource. NTB ask that the use of rāhui is recognised, respected and practiced, however, they do not specifically identify any current rāhui in place.

Taniwhā
NTB considers that there are misperceptions by the general public around taniwhā, and as a consequence, that there is mismanagement of places over which taniwhā reside. NTB record that taniwhā play a major role in the enforcement of the management of resources and places over which they reside and that areas can be designated as wāhi tapu due to the local existence of taniwhā. An objective of the NTB is that taniwhā are accorded their due respect and Ngātiwai are involved in the decision making of developments that may affect taniwhā.

Landscapes
NTB is concerned with the destruction of areas or sites of customary value which contribute to or are part of the Ngātiwai cultural landscape. NTB also advise that there are large numbers of pā around the coast of Ngātiwai Territory which are surrounded by a high occurrence of other features, such as tracks, disposal sites, and wāhi tapu, including burial sites. We note that NTB does not stipulate any additional specific areas or sites of customary value.

2.3.11.10 Patuharakeke Hapū Environmental Management Plan 2014
The key values and main issues highlighted within the Patuharakeke Hapū Environmental Management Plan (‘**the PHEMP**’) and which are relevant to the Proposal are[90]:

a. Ranginui (Discharges to Air);
b. Papatuanuku (Land issues);
c. Wai Māori (Freshwater issues);
d. Tane Mahuta (Flora and Fauna);
e. Wāhi Tapu;
f. Coastal Water Quality;
g. Foreshore and Seabed;
h. Oil Spill Risk; and
i. Industrial Activities at Poupouwhenua.

We now summarise our understanding of these values and issues.

Ranginui (Discharges to Air)
PTB refer to their unique and sensitive location in close proximity to the heavy industry cluster at Marsden Point, which they consider discharges a significant amount of emissions to the air and has the potential to adversely affect the local ecology, amenity values, and the health of the people living and working in the area. PTB acknowledges that a positive step in reducing air pollution has been the introduction of the oAQP. Further, the PTB state that it has a good working relationship with Refining NZ that strives to take a best practice approach and ensures air quality performance stays within consented levels. PTB notes, however, that the current industrial zoning and the expected future growth means that it is

[90] PTB, pages 1 to 89, *Patuharakeke Hapū Environmental Management Plan*. Dated 2014

important for the hapū to remain vigilant and provide input into any future policy development and air discharge permits granted. PTB consider that as kaitiaki of their rohe, protecting the mauri of air is a responsibility that they must undertake with greater involvement of Patuharakeke in the decision making, monitoring and research of air quality.

Papatuanuku (Land Issues)

Land issues are considered in the PHEMP under the heading of 'Papatuanuku'. Issues of concern to the hapū include the alienation of ancestral land, changing ownership of the land (often to overseas owners), and changing land uses and the resulting increased pressure on land and water resources. Further, the PHEMP identifies the importance of appropriately managing soil and mineral resources to ensure there are no adverse effects on the environment (such as erosion and sedimentation of waterways), and that resources are retained for future generations. PTB believes that future development on land within their rohe should not be at the expense of Patuharakeke's relationship with that land, culture and heritage or at the expense of the environment. In addition, PTB expresses that their support will follow proposals that promote sustainable land uses on Māori land where they are economically viable.

Wai Māori (Freshwater issues)

For Patuharakeke, freshwater is a most precious taonga and the quality and quantity of the resource is a key area of concern and responsibility for Patuharakeke as kaitiaki. The PHEMP asserts that the mauri of wai is in serious decline and needs to be enhanced and protected. It also 'contests' the perception of water as a public utility and infinite resource, rather it is a taonga that is to be protected. Patuharakeke also seeks greater justice in the sustainable and fair allocation of water within their rohe. Patuharakeke actively seeks greater involvement in decision making, policy development, and monitoring, in order to fulfil their duty as kaitiaki to preserve the mauri of wai for future generations.

Tane Mahuta (Flora and Fauna)

The PHEMP highlights how extensive forests and the indigenous fauna had once thrived within its rohe prior to colonisation. Many of the native species (flora and fauna) that are known to have existed within Patuharakeke's rohe are now threatened, endangered or extinct. PTB considers that pests and invasive species, as well as anthropogenic activities, have had devastating effects on indigenous biodiversity and the health of ecosystems within their rohe. The services provided by these ecosystems are particularly important to Patuharakeke as it provides for their physical, social, economic and cultural wellbeing. The PHEMP considers how Patuharakeke have been working collaboratively with DoC, WDC, NRC and schools, together with conservation and community groups, to protect and enhance the mauri of indigenous ecosystems. Patuharakeke seeks the restoration of traditional ecosystems and indigenous species within their rohe, free from pests and invasive species, so that that will enable Patuharakeke to provide for their physical, social, economic and cultural wellbeing.

Wāhi Tapu

Patuharakeke record that wāhi tapu and sites of significance are a most precious taonga. Wāhi tapu and sites of significance have placed Patuharakeke within their rohe over a long period of time. The PHEMP considers how colonisation resulted in large scale physical destruction of wāhi tapu and other sites of significance. PTB records that consideration of wāhi tapu and sites of significance within the planning regime have been afforded a very narrow focus, usually largely on archaeological sites which do not reflect the views and knowledge of tangata whenua. PTB considers that there is still a long way to go before wāhi tapu and cultural landscapes are afforded their appropriate status and until that time, the narrow focus taken by most agencies precludes many sites of significance from protection. The PHEMP identifies sites considered to be wāhi tapu to Patuharakeke, as shown in **Figure 2.3.11.10.1.** It also highlights the existence of a number of significant cultural values in and in close proximity to the Site. This reinforces our understanding that large areas of Whangārei Harbour and Bream Bay are culturally significant.

Figure 2.3.11.10.1: *Patuharakeke Sites of Significance Overlay*[91]

Coastal Water Quality

The PHEMP states that Patuharakeke are concerned about the water quality of the coastal water, as it impacts on the kaimoana (seafood) and mahinga kai (food-gathering place) in both the Harbour and Bream Bay. More specifically, the PEMHP advises that cumulative impacts of discharges from industries such as Northport and the Refinery have not been adequately quantified. The PHEMP also states that Patuharakeke seek to be included in decision making over the management of coastal waters, and cite the Whangārei Harbour Catchment Group as a positive step forward to managing coastal water quality. We note that PTB consider that the mauri and cultural health of the Harbour, Bream Bay and other estuaries must be protected and enhanced in ways that will enable Patuharakeke to provide for their physical, social, economic and cultural wellbeing.

Foreshore and Seabed

The PHEMP states Patuharakeke assert authority over the foreshore and seabed in the south of Harbour and through Bream Bay. In that regard, the PHEMP also states that Patuharakeke has an inalienable right that has been ignored by successive local governments and record that their loss of control over these sites has allowed some of their most significant kaimoana beds, bird roosting sites, Tauranga waka, wāhi tapu, and nohoanga sites (camping site for

[91] PTB, page 64, section 8.2, "*Patuharakeke Hapū Environmental Management Plan*", Dated 2014, page 64

food-gathering) to be lost forever to industrialisation and reclamations. Patuharakeke list a number of specific Port and reclamation activities that need to be addressed.

Oil Spill Risk

Patuharakeke use the oil spill from the *MV Rena* incident in the Bay of Plenty as an example to express their concern over a potential oil spill from the Refinery. They state that the location of the Site, Northport and busy shipping routes within their rohe moana[92] and coastal waters places the marine environment at risk of oil spill. They also record that a significant oil spill would have devastating consequences for the kaimoana, taonga species, amenity and recreational values and the cultural health of their rohe moana.

Industrial Activities at Poupouwhenua

PTB note that the natural attributes of the Harbour, particularly Poupouwhenua, were sought by commercial entities in the 1960s for industrial activities. PTB consider that the effects of industrial activities were little known at that time, other than the employment opportunities that would be available. PTB consider that industrial activities in the Harbour have had adverse impacts on the mauri and cultural health of their rohe, and have transformed their cultural landscapes and seascapes. Notwithstanding this, Patuharakeke advise that they have developed a robust working relationship with Refining NZ, to work on improving the cultural and environmental health of the area.

2.3.11.11 Whatitiri Resource Management Plan 2016

The Whatitiri Resource Management Unit ('**the WRMU'**) developed the Whatitiri Resource Management Plan ('**the WRMP'**) in 2016. The WRMU rohe is demarcated by a number of sites of significance to Whatitiri, specifically, centered around Whatitiri Maunga, Waipao or "Poroti Springs" and catchment, the marae at Maungarongo and Waimarie, and surrounding Wairua, Mangere and Mangakahia River Catchments. The WRMU records that there are wider or 'secondary' rohe boundaries that define the area where Whatitiri also have interests. These extend north to Purua Falls and south to Te Ripo on the Wairua River, and further down the Northern Wairoa River, to the Waiotama River. The key values and main issues highlighted within the WRMP that are relevant to the Proposal are:

a. Water (Wai Māori);
b. Land Soils and Minerals;
c. Indigenous Biodiversity; and
d. Heritage, Landscapes and Wāhi Tapu.

Water (Wai Māori)

The WRMP states that the mauri of water is being destroyed within their rohe. The WRMP states that fresh water is a most precious taonga for Whatitiri and the quality and quantity of this resource is the foremost driver of the work of the WRMU. The WRMU notes how Whatitiri have worked fervently to improve water quality in their rohe and sets out that their strong commitment to their land and water stems from their duty as kaitiaki to preserve the resource for generations to come. An objective of the WRMU is to protect and enhance the mauri of water, in ways that will enable Whatitiri to provide for their physical, social, economic and cultural wellbeing.

Land, Soils & Minerals

The WRMP considers that as tangata whenua, the relationship of Whatitiri to their land is central to their being, with all land within their rohe considered as ancestral land. The WRMU records that since colonisation, all but a fraction of Whatitiri land has been alienated, and that now it is mostly held by the Crown (mainly conservation estate) or councils (e.g. recreation and road reserves) or is privately owned (general title). The WRMP records that ongoing and future developments are straining land, soil and water resources, and continue to threaten pa, kainga and wāhi tapu when modern lifestyle choices come into conflict with heritage values. In addition, the WRMU records that there should be no further alienation of Māori land and that long-term sustainable uses of Māori land need to be adopted where it is economically viable to do so. Further, the WRMU sets out that the development of land

[92]Authority over the sea. Definition sourced from Moorfield, J, C, Te Aka Online Māori Dictionary. Dated 2003-2017

resources in the rohe of Whatitiri should not be at the expense of their relationship with that land, culture and heritage, or at the expense of the environment.

Indigenous Biodiversity

The WRMP considers that there has been a decline in the abundance of biodiversity within the rohe of Whatitiri, which has diminished the ecosystem services provided by indigenous biodiversity. Historically, taraire and puriri, together with karaka, rewarewa, kohekohe and fivefinger covered the mountain Whatitiri, and much of rohe of Whatitiri. The WRMU goes on to note that there are now remnants of native bush as a result of poor management and the negative impact of anthropogenic activities. An objective of the WRMU is the maintenance and restoration of natural species, habitats and ecosystems, with particular regard for endemic and endangered indigenous species and habitat. In addition, the WRMU identifies tuna as a specific species of particular significance to Whatitiri, and details their ambition to protect, enhance and sustainably manage tuna habitats and ecosystems.

Heritage, Landscapes and Wāhi Tapu

The WRMP records that there are sites, places, resources, traditions, knowledge, and landscapes of great importance to Whatitiri. These sites include wāhi tapu, wāhi taonga, mahinga kai and other sites of significance, and the traditional and contemporary landscapes within which they occur. The WRMU notes that there are several fortified pa and village sites from pre- and post-European times, located on and around the rohe of Whatitiri. The WRMU also sets out that there are a number of noted burial grounds and marked graves that is evidence that the rohe of Whatitiri has been occupied for a very long time. In addition, the WRMP has an objective that seeks to curtail ongoing damage and destruction to areas or sites of customary value, which contribute to, or are a part of, the Whatitiri cultural landscape.

2.3.11.12 Mangakahia Māori Development Plan 1995

The Mangakahio Māori Development Plan[93] (**'the MMDP'**) covers the rohe of the Mangakahia hapū, which is situated to the west of the Wairua River. The key issues included in the MMDP that are of relevance to the Proposal are summarised as follows:

Wāhi Tapu

The MMDP lists Wahi Tapu sites and highlights the importance of the associated land and water of these sites. The taonga associated with the Hapū must be protected and preserved for future generations.

Land and Water

The key issue for Mangakahia is the loss of ngahere (bush) and the detrimental effects on the environment that this causes (such as erosion, loss of ability to sustain life, a decline in water quality in waterways). The Mangakahia Hapū encourages the reintroduction and retainment of wetlands and enhanced water quality. Mangakahia state they are to be acknowledged and recognised as kaitiaki so as to be enabled to actively practise kaitiakitanga in regard to all resources within their rohe.

2.3.11.13 Summary of Iwi Management Plans

There are two iwi management planning instruments that are of direct relevance to the Proposal[94], and two further documents, that, due to their rohe being located a significant distance from Marsden Point, we regard as being of less relevance to the Proposal. Having read the instruments, we are of the opinion that they highlight a number of issues of significance. In particular, the following values are universally highlighted as being of importance:

a. Kaitiakitanga – all of the iwi management plans consider that tangata whenua must be acknowledged and recognised as kaitiaki, enabling them to practise kaitiakitanga in regard to the natural resources and taonga within their rohe.

[93] Mangakahia Māori Komiti, pages 1 to 12, *Mangakahia Māori Development Plan*. Dated 1995

[94] NTB, Ngātiwai Iwi Environmental Policy Document 2015
PTB Hapū Environmental Management Plan 2014

b. Water - the mauri of water or 'wai' is of great concern in all of the iwi management plans. Wai is considered sacred and a taonga particularly for its life supporting capacity. There is particular concern for water quality as a result of the consequential impacts of its degradation on both marine and terrestrial species. All of the iwi management plans identified that the quantity and allocation of freshwater are of equal interest and concern.
c. Wāhi Tapu – all of the iwi management plans consider that sites of significance and imbued with tapu are a great taonga of great spiritual, historical and cultural significance that need to be protected.
d. Flora and fauna – all of the iwi management plans identified that protecting ecosystems and using land in a sustainable and equitable way is of great importance. Further, all of the iwi management plans noted that particular regard should be given to endemic and endangered fauna and flora that provide not only essential ecosystem services for iwi and hapū, but form part of their historical and cultural association to their rohe.
e. Engagement – All of the iwi management plans consider that the value in the matauranga (knowledge) of iwi and hapū should be acknowledged and considered in the holistic and sustainable management of resources within their rohe. In addition, all of the iwi management plans consider that effective engagement is essential to both equitable and sustainable outcomes, and that effective engagement needs to occur at the outset and across all phases of development. Further, all of the iwi management plans record that greater opportunities must be afforded to tangata whenua to participate in resource management decisions and in undertaking monitoring within their rohe.

2.3.12 Recreation & Tourism

The Recreation and Tourism chapter of the CSP-AEE addresses the recreation and tourism values that exist in close proximity to the Site and is based on a report prepared by Mr Rob Greenaway of Greenaway & Associates Limited. A fully copy of Mr Greenaway's report is attached within **Annexure 3** to this AEE.

Mr Greenaway advises that the Whangārei Harbour, the Harbour entrance, and the marine and coastal marine settings between Marsden Point and Bream Head, are intensely used recreation settings. He goes on to advise that the scale and variety of activities suggests the area is at least of regional significance for recreation and tourism. More specifically, he records that the recreation and tourism activities undertaken include swimming / beach activities, surfing activities, fishing activities, shell fishing areas, diving and snorkelling sites, and boating. We understand Mr Greenaway's advice to be that the reason for the number of recreation activities is due to the quality of the environment (which is high). Mr Greenaway also notes that while these attractions and activities are primarily used by locals, domestic and international tourism is increasing.

Mr Greenaway has prepared maps to show the location of these individual recreational activities and the areas of moderate and high use (which we have copied and entitled **Figure 2.3.12.1** and **Figure 2.3.12.2**; both of which follow).

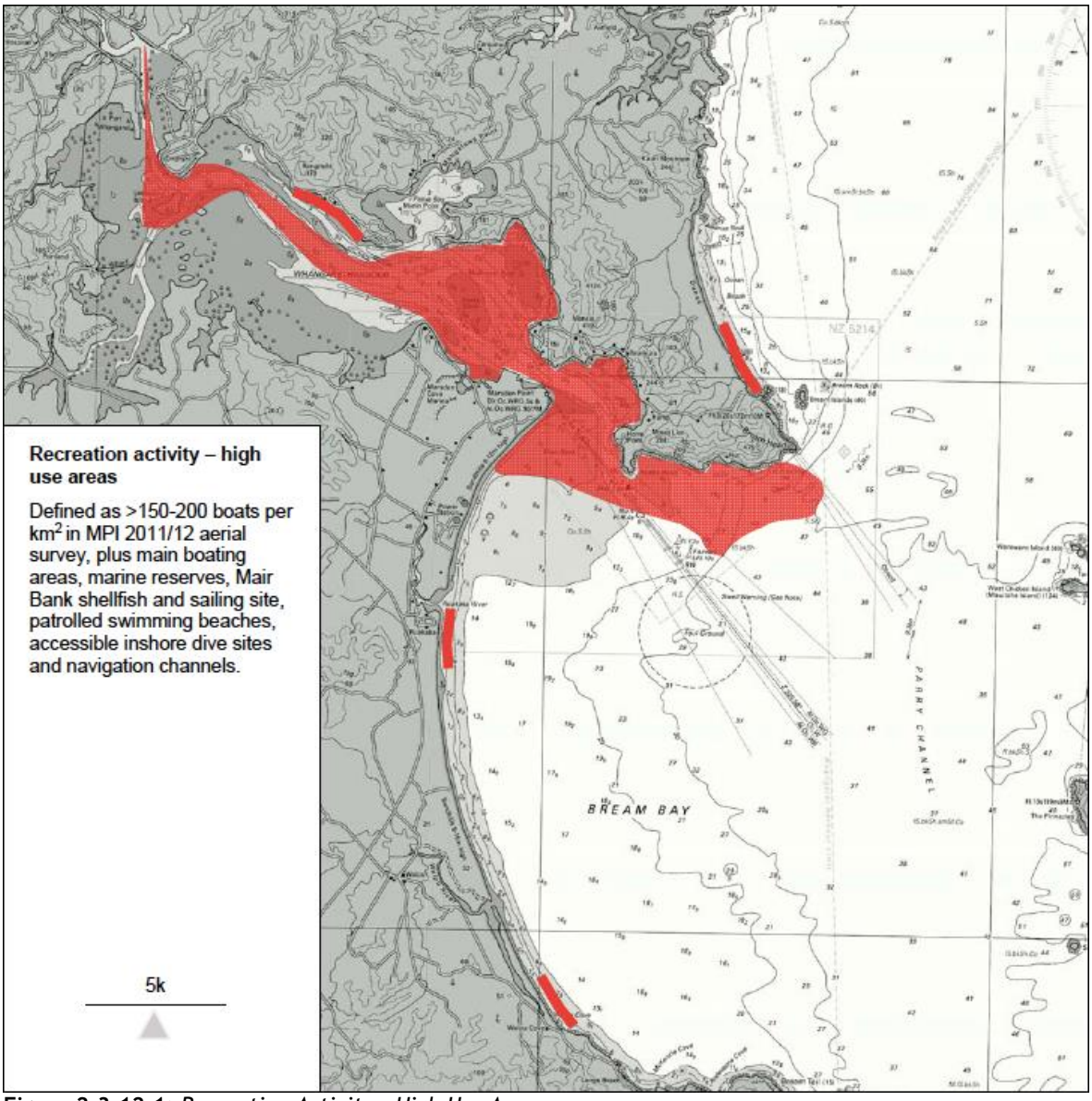


Figure 2.3.12.1: *Recreation Activity – High Use Areas*

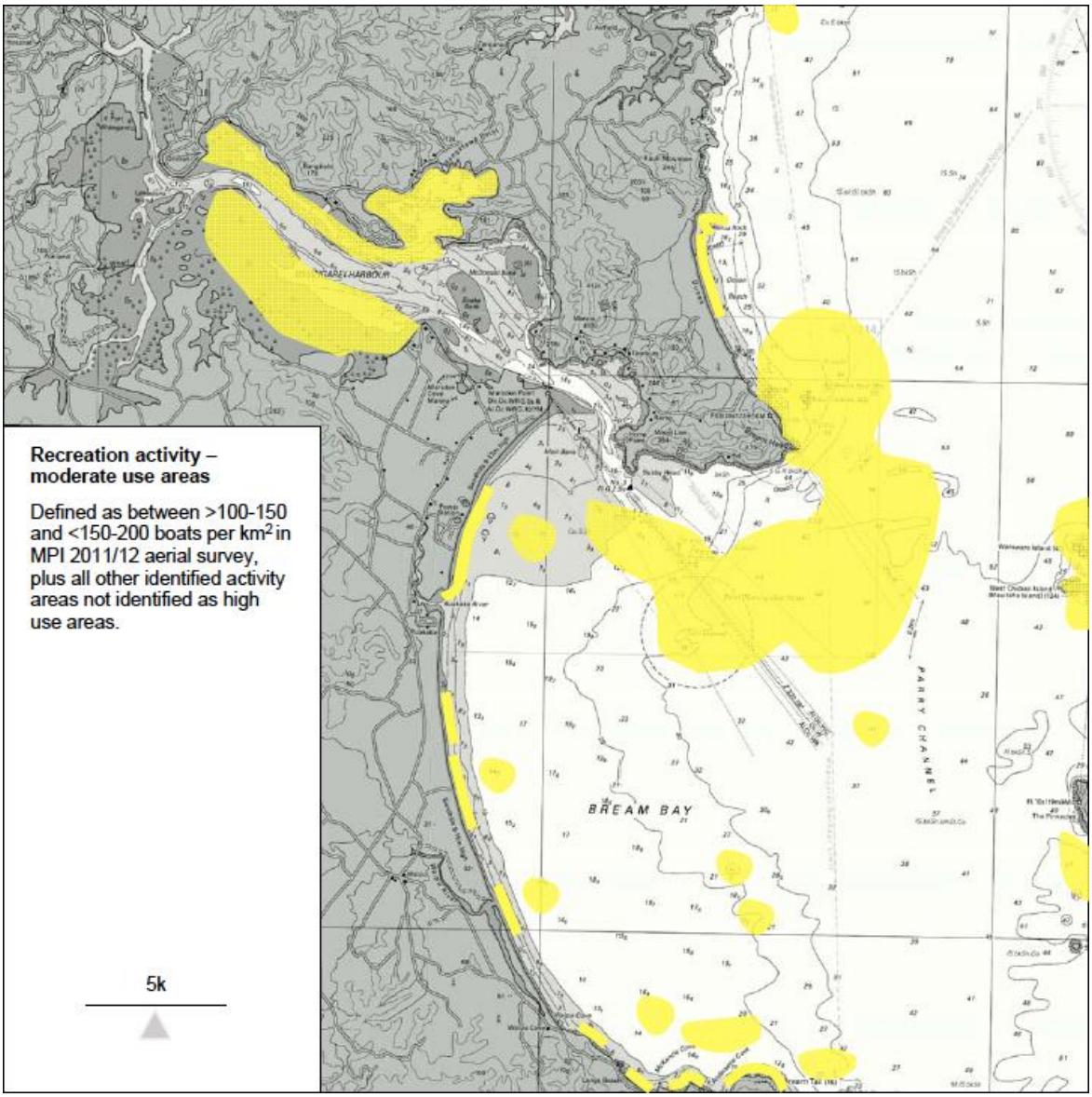


Figure 2.3.12.2: *Recreation Activity – Moderate Use Areas*

Collectively, these maps show that the Site is generally either a site of high or medium recreation use, with the exception of the deeper Bream Bay ocean area.

2.3.13 Economic Considerations

As noted in section 1.2 of this AEE, Mr Peter Clough of the NZIER has prepared an economic assessment for the Proposal[95]. A full copy of this assessment is attached within **Annexure 3** of this AEE[96]. In his assessment Mr Clough describes the existing environment with the Refinery in operation, a counter-factual without reconsenting and the Refinery 'turned off'. We now summarise his key findings.

2.3.13.1 Refining NZ is Pivotal in Supplying Transport Fuels

Mr Clough advises that Refining NZ currently supplies most of New Zealand's demands for petrol, diesel and aviation fuel and all of its fuel oil for shipping. He states further that the Refinery operation is a significant contributor to the Northland regional economy, and was, in 2017, responsible for nearly 7% of regional GDP and 1% of regional employment.

[95] Clough, P. NZIER, *The Value of Consent Renewal- Economic Assessment of Reconsenting Discharges and Structures at the Marsden Point Refinery*. Dated July 2020

[96] Clough, P. NZIER, *The Value of Consent Renewal- Economic Assessment of Reconsenting Discharges and Structures at the Marsden Point Refinery*. Dated July 2020

2.3.13.2 Current Supply of Oil Products in New Zealand

Refining NZ in National Oil Supply

Mr Clough reports that Refining NZ's products are distributed across New Zealand and currently supplies:

- all of New Zealand's fuel oil for ships;
- around 85% of the country's jet fuel;
- 67% of its diesel;
- 58% of its petrol; and
- most bitumen for roading.

He states further that it also produces sulphur that is used in fertiliser manufacture, and carbon dioxide that is used in the food and beverage industries.

Mr Clough also emphasises that the reconsenting of refinery discharges and wharf structures at Marsden Point is crucial for the continued operation of the Refinery and that without the refinery operation, all refined oil products would be imported. He states that as result, economic value added by refining, would be lost to Northland to the benefit of overseas refineries.

2.3.13.3 Current Oil Demand and Supply Security

Mr Clough reports that in 2018, oil was the source of 34% of the primary energy used in New Zealand.[97] Mr Clough notes that oil accounted for 47% of total consumer energy and 99% of all energy used in transport. He then records that transport accounts for about 84% of all oil and oil product consumption in New Zealand and is also a major input underpinning the tourism industry. He indicates that other major users are the primary industries of agriculture forestry and fishing (5.3% for combined primary industries), other industry (6.6%), commercial (2.3%) and residential users (1.3%).

2.3.13.4 Influences on Future Oil Demand

Mr Clough states that New Zealand relies on imports for its oil product supply, as most of the crude oil and condensate produced in New Zealand is exported. Mr Clough notes that in 2018 crude imports accounted for 81% of the primary energy from oil, and imported oil products for the balance. Mr Clough goes on to state that the latest Energy Supply and Demand Forecasts show New Zealand's primary energy growing at 1% per annum on average, with demand for oil growing at 0.6% per annum. While there is a growth in the demand for oil, it fits within a growing demand for all forms of energy. As a consequence, oil's share of primary energy is projected to slip from 34% to 29%.

According to Mr Clough, there are many influences on oil demand and fuel efficiency. In this regard, he states that a change in car ownership patterns, climate change policy and the emergence of alternative fuels and electric vehicles have all been suggested as factors that moderate future demand for oil. He indicates that their influence may be observed in the fact that forecast oil demand is growing slower than general economic growth (although not markedly so) in the next few decades. Mr Clough notes there were around 17,500 electric cars on New Zealand roads at the end of 2019, compared to a light passenger vehicle fleet of over 3.2 million, so on current rates of vehicle purchases it will take many years before use of electric vehicles makes a significant impact on transport oil demand.

He also advises that the passing of the Zero Carbon Act in 2019 and the establishment of a Climate Change Commission to advise and hold Government to account on its emission reduction policies may increase the ambition and enforcement of emission reductions in years ahead, but that effect is not yet reflected in energy and emission forecasts for New Zealand.

2.3.13.5 Covid-19 Economic Impacts

Mr Clough has considered the economic impacts of the Covid-19 pandemic, contemplating both the short-term shock to the New Zealand economy and the projected aftermath. Mr

[97] At time of writing, the latest Energy in New Zealand report is dated 2019, with data for calendar year 2018

Clough considers that the Covid-19 pandemic and subsequent moves to contain its spread, with the closure of international borders and lock downs of sections of national economies, has reduced demand for passenger transport fuels and caused a collapse in oil demand. He notes that this, in turn, has left the global market over-supplied as oil production built up inventories and overwhelmed storage facilities. Mr Clough considers that the oversupply should be a temporary situation as oil production scales down and demand picks up with the loosening of Covid-related restrictions later in 2020.

Mr Clough records that in New Zealand the border closures and lockdown have reduced demand for transport and oil products. He notes that the closures have also affected inbound tourism, forestry and construction and the livelihoods of those who depend on these industries. Mr Clough states that jobs have been shed and some businesses closed due to the disruption of trading in early 2020.

Mr Clough further states there is large uncertainty around how the post-Covid recovery will unfold, both within New Zealand and in the global economy at large. He notes that despite the short term dip in demand for oil products in 2020, he assumes that oil's predominant share of the transport fuels market will continue into the medium term future, with only marginal shifts into new technologies, as while oil remains cheap, there is less incentive to bring alternative energy into use. In the longer term, Mr Clough states that policy shifts to enable achievement of zero carbon by 2050 will increase uptake of new technologies, but oil products will remain in demand, albeit with a declining share of consumer energy, until the stock of oil-using equipment has been transformed by replacement with equipment powered by other energy sources.

2.3.13.6 Regional Implications of the Refining NZ Operation

Mr Clough highlights several implications that are associated with the existence and continued operation of the Refinery. We now summarise his advice in that regard.

Employment

Mr Clough states that Northland is a region that has been struggling in comparison to its resource base and other regions for several decades. He advises that it has a higher share of employment in the primary sector, which is a sector in which employment has been falling. He also reports that it has the highest age dependence ratio (proportion of people under 15 and over 65) of any New Zealand region and highlights that the median household income in the region is approximately 20% lower than median household income in New Zealand. Mr Clough advises that the Refinery is a substantial employer in the Whangārei District, offering relatively highly skilled and highly paid job opportunities. Mr Clough states that the Refinery is a significant driver of economic activity for the region, and that it is recognised as significant infrastructure in both the oWDP, the oRPS and the pRP. Mr Clough also notes that the Refinery has substantial links to other industries and contractors in the region.

Investment

With regard to investment, Mr Clough advises that Refining NZ has substantial value invested in the Refinery and an incentive to sustain its operation and earn a return associated with the same for as long as possible, as the Company has invested substantially in assets that are highly specific to the refining activity and that would become unusable without the consents required to continue its operations.

Mr Clough also advises refining crude oil is a capital-intensive business with a history of investment in capital renewal and upgrading projects, which have injected substantial funds into the regional economy. He reports that over the past 12 years, Refining NZ has invested around $735 million to produce low sulphur diesel, remove benzene from petrol, improve energy intensity, and reduce its carbon emissions profile.

Incomes

Lastly, Mr Clough notes that the incomes earned by Refining NZ staff and contractors directly help retain nearly 500 households in the region and that their consumption of goods and services generates income and employment for local businesses in Whangārei. He then

concludes that the periodic shutdowns and investment provide additional income in the region, and that expenditure by the Company and its employees has a considerable multiplier effect, stimulating other businesses in the local economy.

3.0 THE PROPOSAL

Refining NZ presently undertakes a number of activities from the Site. The Company is seeking resource consents necessary for the Refinery to continue to exist and operate (which we refer to as '**the Proposal**' in this AEE). This section of the AEE sets out the various operations and activities that are undertaken by Refining NZ at the Site.

3.1 Refining Operations

The Refinery presently receives and processes over 40 million barrels of crude oil per year. That crude oil is sourced from a number of different locations and suppliers and is delivered to the Site via ship. The Refinery produces a number of products, which include:

a. Gasoline;
b. Jet fuel A1/ Dual purpose kerosene;
c. Diesel;
d. Fuel oil;
e. Bitumen;
f. Sulphur; and
g. Carbon dioxide.

Figure 3.1.1 (which follows) is a schematic of the products that the Refinery generates and provides to New Zealand from the crude oil it receives.

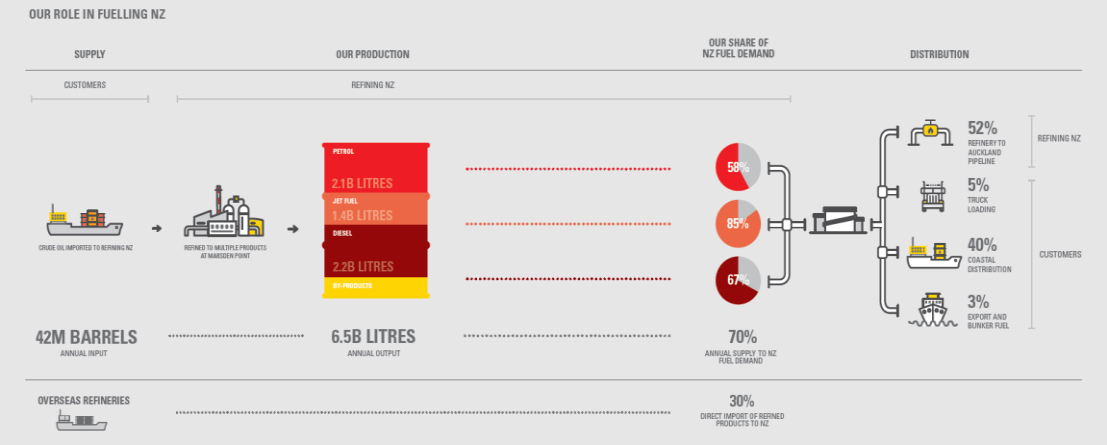


Figure 3.1.1: *Schematic of the Products Generated by the Refinery*

The ultimate objective of the Refinery is to convert crude oil into these various products cheaply and efficiently, while generating the minimum possible adverse impacts on the environment. This is evidenced by Refining NZ's improved compliance record in the last decade and its focus on continuous improvement (in terms of reducing its environmental footprint).

There are three broad refining processes / steps, which we now briefly describe. **Figure 3.1.2**, which follows, summarises these processes.

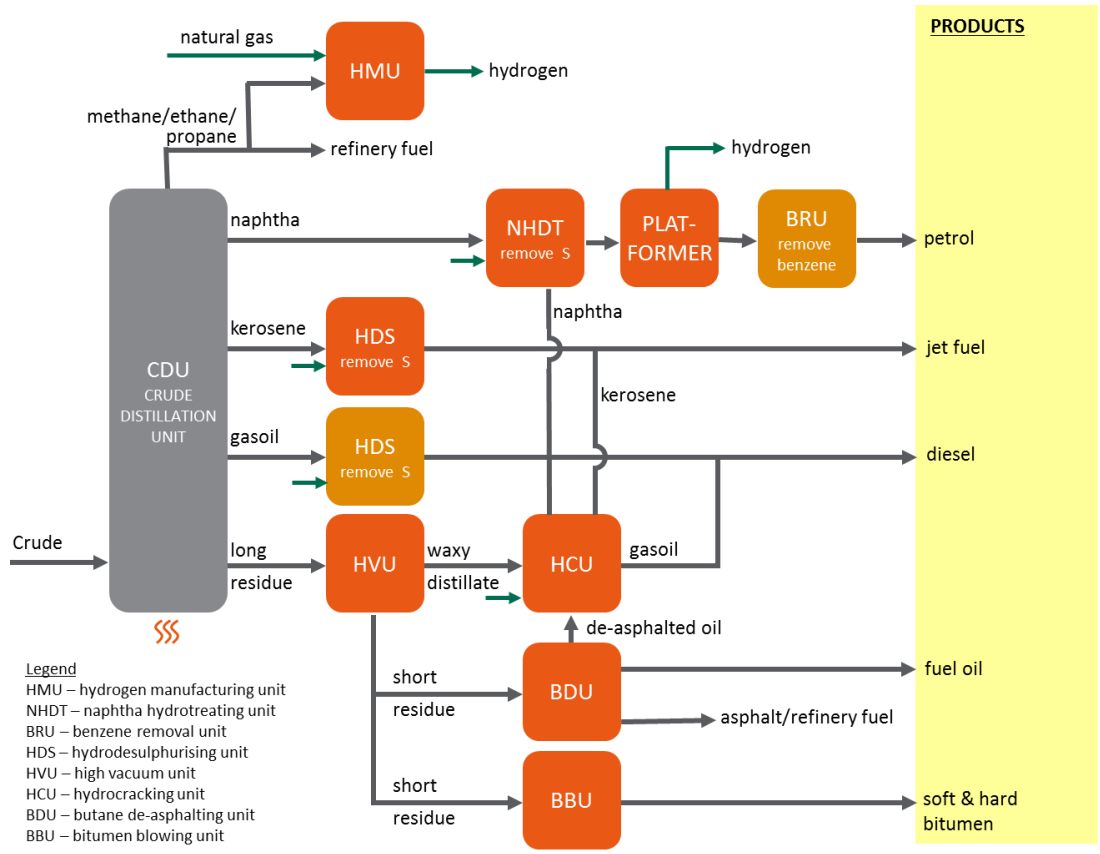


Figure 3.1.2: *Schematic of the Refinery's Processes*

3.1.1 Separation

Shortly after being pumped ashore and stored in above ground storage tanks, the crude oil is sent to the process units to be firstly separated. This typically occurs via distillation. The aim of this part of the process is to separate the crude oil into individual product types, which can then be further upgraded and refined. As part of this process the crude oil is 'washed' to remove any containments such as sea water, sand and other such contaminants.

3.1.2 Conversion

Conversion (or '**upgrading**') is where chemical reactions occur to produce higher grade products. There are a number of means to achieve this upgrading. They consist of processes that include:

a. Desulphurisation to remove sulphur products (which are, themselves, sold as a commodity to customers). This process is, we understand, multifaceted but effective as it sees 99.6% of sulphur recovered from the sulphur removal processes. Of note is that nitrogen products are also removed as part of the desulphurisation process.
b. Restructuring oil molecules via catalytic reforming processes.
c. An air blowing technique that is used to produce 'harder' bitumen.
d. Hydrocracking to convert distillate and deasphalted oil into products such as diesel and kerosene. Of note is that the hydrocracking process requires Refining NZ to manufacture its own hydrogen.
e. Conversion of hydrogen sulphide to liquid sulphur.

3.1.3 Purification

Purification of a product may be required at any stage after the crude oil has been separated. In this respect, it may be required to meet a final quality specification or be necessary to avoid the contamination / poisoning of another catalyst in the refining process. Sulphur, nitrogen, chlorides, heavy metals, and carbon dioxide are all compounds / elements that are removed from some of the products that are produced by the Refinery.

Figure 3.1.3.1, which follows, shows the layout of the Refinery and labels the key facilities and areas contained therein.

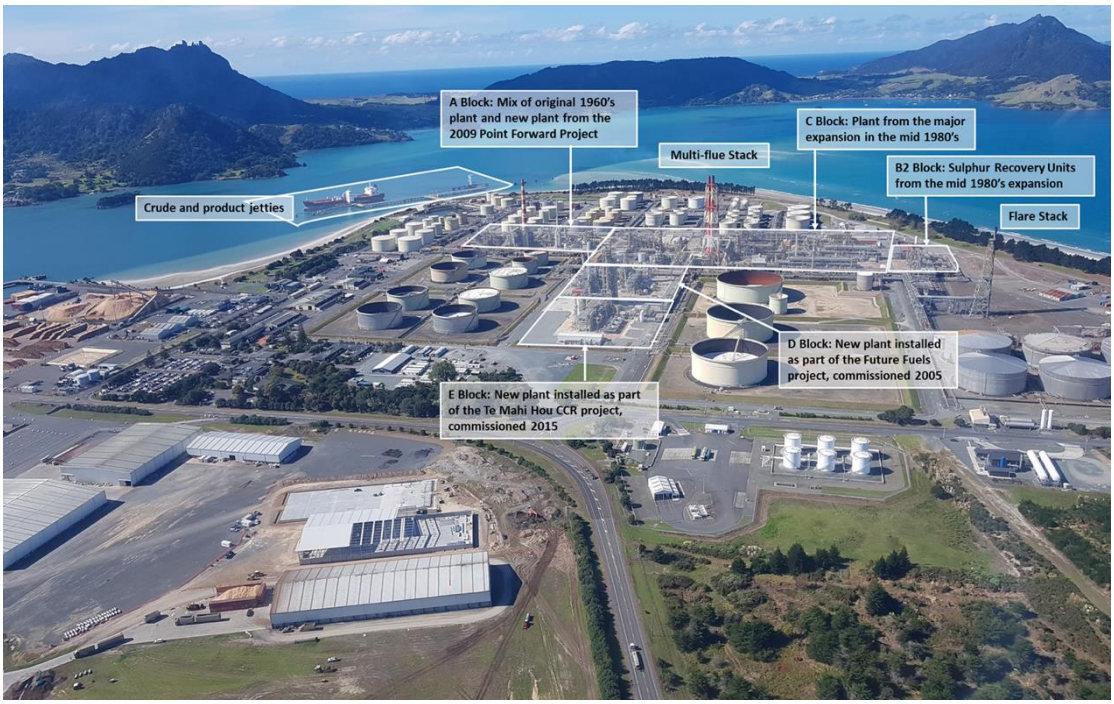


Figure 3.1.3.1: *Layout of the Refinery*

As with any large industrial activity, there are a range of activities and operations that are undertaken to enable the refining process to be completed, and for the Refinery to exist and operate. We now briefly describe those components of the Proposal.

3.2 Coastal Structures and Operations

As we have already noted, crude oil arrives at the Site by tankers. While approximately 52% of all refined product leaves the Site via the RAP, a considerable portion (some 40%) is transported to other domestic centres by coastal tankers.

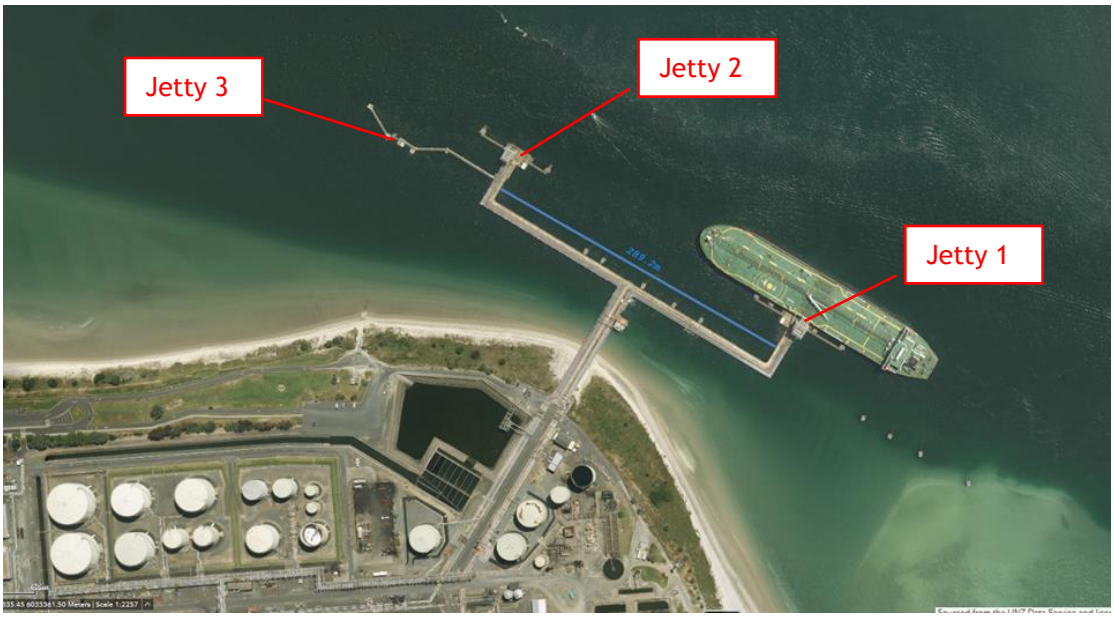
Approximately 210 tankers visit the Refinery each year. The vessels range in size from coastal tankers to Suexmax vessels. We note that while the Suexmax vessels are currently only partially laden when they visit the Site, a future planned dredging programme will enable fully laden vessels of this size to berth and be unloaded at the Refinery.

To enable vessels to safely berth and either unload crude oil or load refined products, the Refinery has three jetties. Two were built in the 1960s and have been regularly maintained. The third (Jetty 3) was built in 2009 to provide loading facilities for a ship bunkering vessel.

Jetty 1 (which is typically referred to as '**the Crude Jetty**') is where tankers bringing crude oil to the Refinery berth to unload. Jetty 2 (which is referred to as '**the Product Jetty**') is where coastal tankers are loaded with refined product from the Site for transportation to other centres / markets. Jetty 2 can also be used to unload vessels as well.

Photograph 3.2.1 shows the location of the jetties.

The following photographs provide a closer view of the jetties and vessels docked at both.



Photograph 3.2.1: *Aerial View of the Jetties*

Photograph 3.2.2: *Two Vessels Docked at the Jetties*

The jetties contain a number of associated tanks, and structures. In that regard, the main jetty structure (which provides access to the three other jetties) houses two diesel tanks and associated diesel-powered firefighting pumps, while jetties 1 and 2 also support 'slops' tanks. The dry slops tanks are all 5 m^3 in capacity and contain the residual quantities of product that is retained in the pipes or hoses after they are used to load / unload the vessels that berth at the jetties. Their content is periodically (and automatically) pumped to the Refinery for treatment. In addition, jetties 1 and 2 also have wet slops tanks which capture stormwater and any material spilt onto the loading deck which are bunded to prevent any discharges from these area to the Harbour. As with the dry slops tanks their content is automatically pumped to the Refinery for treatment. A diffuser, various pipes and loading gantries are also attached to, and effectively form part of the jetties.

In addition to the jetties, Refining NZ has breasting and mooring dolphins that are needed for the mooring of vessels visiting the Refinery. **Photographs 3.2.3** and **3.2.4** show these facilities. The location of these structures can be seen in **Photograph 3.2.2**. Each breasting dolphin occupies an area of approximately 25 m and is attached to the jetty structures. Each of the mooring dolphins occupies approximately 20m^2.

Photograph 3.2.3: *Mooring Dolphin*

Photograph 3.2.4: *Breasting Dolphin*

Refining NZ also holds a suite of resource consents that enable the Company to, amongst other things, dredge the seabed; to both deepen the Harbour in close proximity to the jetty (and to deepen the approaches to the Harbour and the 'turning circle' for vessels) and then to maintain the depth at those levels. Those resource consents expire in 2022 (maintenance dredging consents for the eastern dolphins) and 2052 (maintenance and capital dredging consents for the jetty's 'berth pocket', approaches and turning circle). As a consequence, Refining NZ is not applying to replace those resource consents at this juncture. In this regard, it is seeking the resource consents to retain the existing coastal structures whose consents are due to expire in May 2022 and to maintain them. It is also seeking the right to continue to occupy the areas of the CMA that accommodate its coastal structures.

3.3 Surface Water Related Matters

The Refinery interacts with surface water in two key ways. In this regard, it abstracts surface water for use on the Site, and it discharges water and/or contaminants to the Harbour. We now discuss those interactions.

3.3.1 Surface Water Takes

There are two sources of surface water at the Refinery. In that regard:

a. Potable water is obtained from the WDC's reticulated supply;
b. Seawater is taken for firefighting purposes. Of note is that this water is abstracted continuously, to ensure that the firewater main (which surrounds the entirety of the Site) is kept as a constant state of readiness. The suction lines and pumps associated with this take are capable of abstracting 11,000 m^3/hour from the Harbour.

3.3.2 Discharges to Surface Water

The Refinery has four broad types of discharges, being those associated with its wastewater, those associated with its groundwater abstraction, those associated with its stormwater, and those associated with its firefighting supply. We now describe all of these types of discharges, with the exception of the discharge that is associated with the groundwater abstraction. That discharge is addressed in section 3.5 of this AEE.

3.3.2.1 Wastewater

Wastewater from the Refinery comprises three main streams:

a. Process water;
b. Ship de-ballast water (which is rarely discharged given the modern tanker design); and
c. Ship tank washings.

The process water, ships tank washings and de-ballast water are treated onsite using a 'Biotreater' plant, which forms part of a Water Effluent Treatment Unit. The effluent from the Water Effluent Treatment Unit is then discharged into a Retention Basin for further treatment, and then flows into the SWB. Of note is that the SWB is designed to absorb fluctuations in the flows from the Site (principally from the stormwater discharges as the discharges from the biotreater and groundwater wells tend to be relatively stable / constant). Water levels in the SWB are typically kept low to provide surge capacity (and thus be able to accommodate events such as heavy rainfall). From the SWB the effluent is discharged into the Whangārei Harbour via a submarine diffuser that is attached to the Product Jetty (Jetty 2).

Figures 3.3.2.1 and **3.3.2.2** locate the various components of the treatment system and highlight the location of the diffuser.

As is apparent from **Figure 3.3.2.1**, the two types of drainage system employed by the Refinery are:

a. *The Continuously Oil Contaminated System* (or **'the COC'**). This system intercepts process water, stormwater and tank drainage water that is likely to be contaminated with hydrocarbons and/or compounds from a number of processing and treatment activities on the Site.[98] The COC system consists of the five sewer networks and oil interceptors, oil sumps and pumps.

The oil that is collected in the main oil interceptors is directed to the Site's slops processing unit which recycles the captured hydrocarbons back for reprocessing. The separated water is then pumped to the Water treatment Unit for further treatment. Separated water from the main interceptors (for rainfall events of up to 6mm/hr) is also pumped back to the Water treatment Unit for further treatment.

When the rainfall intensity exceeds 6 mm/hr the treated water from the interceptors is discharged into the AOC – which we describe in paragraph (b.). All of these redirected flood flows pass through devices designed to minimise hydrocarbons in the water released to the AOC system (skimmers, baffle and weir, or goose necks).

The 'main interceptors' service the Refinery's process blocks. The only other areas serviced by the COCs are tank drainage systems and are not subject to significant stormwater inputs. Flows from the tank drainage systems are also scrubbed using interceptors, and then discharged to the slops system. In all but one instance, this sees the interceptors directing the separated water to the biotreater for further treatment during low rainfall events. The exception is the interceptor servicing the product tank area, which discharges to the AOC, even during these low rainfall events. All of the interceptors' discharge to the AOC in high rainfall events.

[98] Such as tank draining, desalter water, flare seals, cooling tower blowdown, equipment cleaning, analyser houses, seal legs, surface water from the COC areas, & pump skids / drains

b. *The AOC*. This system typically collects water that is unlikely to be contaminated by process activities or chemicals, but may, as a consequence of contact, be contaminated by oil. In that regard, it is, in effect, the stormwater system for the Site. The AOC does, however, collect from the firefighting training ground. This area does contain residuals of the foams that are used in the training exercises.

The AOC directs water to the SWB via oil traps. We discuss the AOC in greater detail when we traverse the stormwater that is collected generated on the Site.

The quality of the raw COC waters will vary, but can include oil, suspended solids, soluble components and chemicals.

The Biotreater Unit includes a 'de-oiling' system, a flocculation / flotation unit, an activated sludge unit, a clarifier and a Retention Basin System. It is designed for a flow of up to 3,300 m^3/d. The wastewater treated by the biotreater unit comes from various processes and components of the Refinery, and can include ship tank wash water, ballast water, and water collected from the COC.

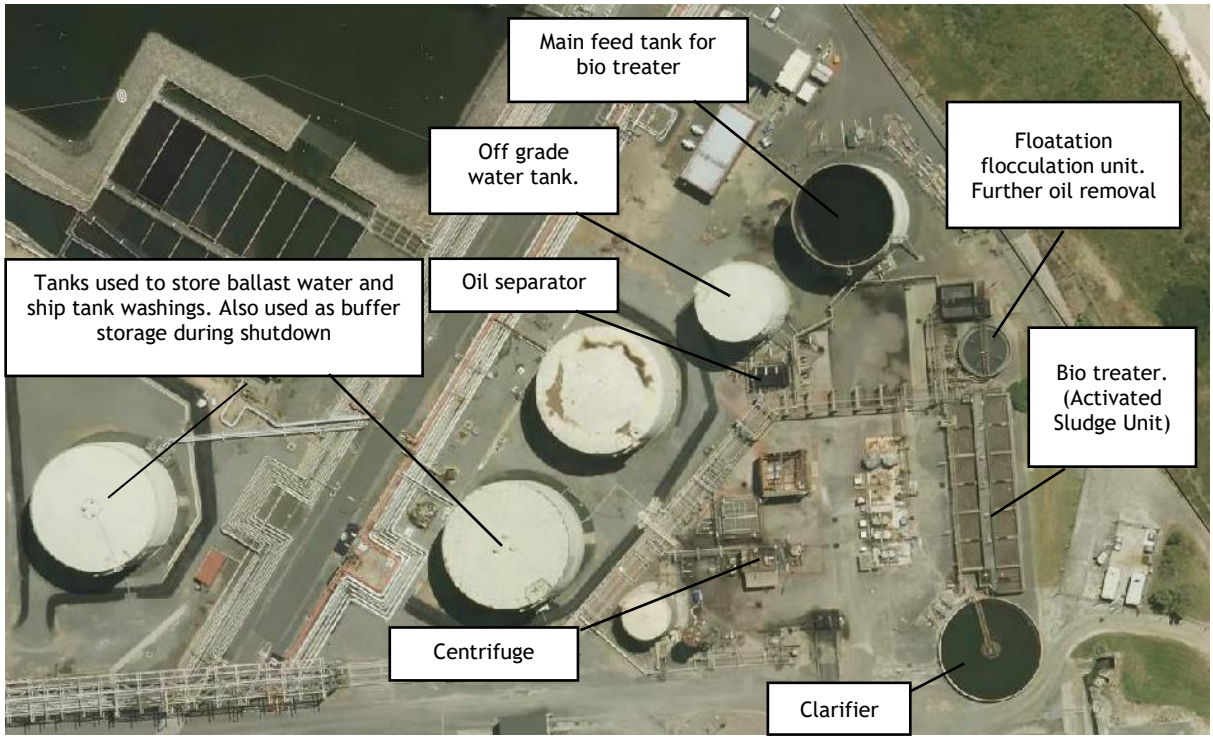


Figure 3.3.2.1: *Layout of the Biotreater*

Figure 3.3.2.1 describes the overall water treatment concept. In summary, however:

a. De-oiling occurs firstly by gravity in oil interceptors and holding tanks, and then in the Flocculation/Flotation Unit;

b. Wastewater from the de-oiling systems is then directed to the Biotreater, which reduces the BOD, ammonia / ammonium and phenol in the wastewater. The Biotreater uses bacteria to break down hydrocarbons and other contaminants. Oxygen is provided to ensure that the bacteria can survive and multiply. Flows from the Biotreater are directed to a clarifier where the treated wastewater is separated from the sludge. The sludge is either recycled back to the Biotreater or diverted to a centrifuge for de-watering and land filled;

c. From there, the treated wastewater is discharged to the AOC, upstream of an oil skimmer and is then discharged to a Retention Basin System for further polishing. This aids with the natural treatment of the wastewater and reduces the levels of contaminants that are present.

d. From the Retention Basin System, the treated wastewater is combined with the groundwater and stormwater that is collected on site and is discharged to the SWB and then to the Harbour.

The SWB has a design capacity of 30,000m^3. While it has four pumps (being two 'Dry Weather Flow Pumps with a combined capacity of 20,000 m^3/d and two Stormflow Pumps with a combined capacity of 44,000 m^3/d), the maximum discharge rate from the SWB is limited to 48,000 m^3/d (with a corresponding hourly discharge rate of 2,000m^3/hr). This reflects the design capacity of the diffuser. Of note, however, is that a bypass around the diffuser was been installed by Refining NZ, which increases its discharge capacity to 65,000 m^3/d. The bypass is used when a heavy rain event is occurring and as a consequence there is a risk of the SWB overtopping. Lastly, in extreme weather events, treated wastewater and stormwater will be discharged from the SWB to the Harbour from a spillway. The spillway has a design capacity to cope with flows from a one on one-hundred-year storm event and is a safety feature; insofar as it is designed to operate to prevent the SWB from being overtopped. The spillway operates infrequently, it has only been used on two occasions since it was installed in 2015. Of note is that the formed spillway does not extend below the MHWS mark. As a consequence, it discharges to the foreshore or water in the CMA.

3.3.2.2 Stormwater

Stormwater from within the Site is collected by the AOC and is discharged into the SWB. Like the treated wastewater, the stormwater is ultimately discharged into the Harbour via the diffusers attached to the jetty. Although as with the treated wastewater, the diffuser can also be bypassed (we note that this only occurs during heavy rainfall events). **Figure 3.3.2.2** highlights the key components of the AOC. We now briefly summarise those components.

Figure 3.3.2.2: *Layout of the AOC*

There is a West AOC and an East AOC. All water entering the West AOC is directed to an oil trap and then to the SWB.

The East AOC also flows to an oil trap, after being combined with groundwater and the treated wastewater from the biotreater area and is discharged to the Retention Basin. As with the West AOC, the East AOC is designed to cater for flows from rainfall of up to 65mm/hr.

From the Retention Basin and holding basins / oil traps, the flows from the West and East AOC's are discharged to the SWB.

Management Approach to Stormwater

Refining NZ has recognised that stormwater discharges can present some risks to the surrounding environment. As a consequence, it implements a number of management practices to ensure that any risks are minimised to the point that is practicable. In summary:

a. *Maintenance Shutdowns*: Prior to all maintenance shutdowns, Refining NZ verifies that all components of the COC are routed to the biotreater, cleans all sumps, implements measures to prevent the contaminants from accessing the AOC via a shutdown drainage plan, and minimises levels in two tanks to use as buffer storage for the biotreater in the case of high strength flow wastewater being generated. Of note is that the activated sludge plant in the biotreater has also received a recent significant upgrade which has increased its resilience to shock loads which could occur during shutdowns. During the maintenance shutdowns, the biotreater is closely monitored and sampled and the chemicals used in the treatment and drainage of wastewater are carefully managed;
b. *Water draining from storage tanks*: This process involves the removal of water that collects within the bottom of the storage tanks of both crude and products. When this activity is being undertaken, the drains are opened to the COC systems;
c. *High Rainfall Conditions*: As we have already noted, this can see water from the COC discharged into the AOC. From its experience on the Site, Refining NZ knows that the discharges from the COC in heavy rainfall do contain hydrocarbons. As the AOC passes all water through oil skimmers before it is discharged to the SWB, and the discharge pumps take water from below the surface, the risk of free phase hydrocarbons being discharged to the Harbour is minimal (this is evidenced by the monitoring data that Refining NZ has gathered). In the event that hydrocarbons escape to the AOC canals, Refining NZ seeks to recover the hydrocarbons. In this regard, Refining NZ has significantly improved its ability to recover the hydrocarbons from the canal network upstream of the skimmers with portable hydrocarbon recovery systems. This further reduces the risk of hydrocarbons being discharged to Harbour;
d. *Tank Wash/De-ballast Water*: This water is rarely discharged to the Refinery as all shipping is now double skinned. It is more common to see tank wash water come ashore due to a change in load. The nature of tank wash water is such that it is very similar to the de-ballast water. This water is initially held in Tanks on Site and discharged to the biotreater after separation for further treatment.
e. *Maintenance & Control*: Refining NZ regularly maintains the COC and AOC. This includes monitoring the biotreater, skimming oil from any oil interceptors / sumps, and ensuring that the holding tanks and Basins that form part of the AOC are desludged.

3.3.3 Firefighting Discharges

The Refinery discharges uncontaminated seawater at three locations. In this regard:

a. A 'service pump' is located on the jetty and is used to maintain pressure in the fire main that bounds the Site. It discharges approximately 28 L/s to the Harbour from the jetty, close to where the seawater is abstracted;
b. When the firefighting system is activated, a small volume of water is diverted from the fire main and used to cool the diesel pumps that are used to abstract the firefighting seawater. This cooling water is also discharged (at an approximate rate of 50 m^3/hr) to the Harbour in close proximity to the point of take (that is, below the jetty); and
c. Seawater can be discharged, at a rate of up to 11,000 m^3/hr, from overpressure valves that are situated on the jetty. The discharge is directly to the Harbour, and only occurs if there is a need to prevent the fire main from being over pressurised.

As we have noted, all of these discharges are of seawater that has not been contaminated by the Refinery. They are necessary for the safe operation of the Refinery.

3.4 Discharges to Air

There are four types of discharges from the Refinery to air. We now discuss where those discharges are from and discuss the compounds / elements that are discharged. We also set out the management regime that the Company has adopted to ensure that the discharges comply with it resource consents.

3.4.1 Sources of the Discharges

There are five key discharges to air from the Site, being:

a. From the furnaces that are used to heat the crude oil and intermediate products. These furnaces are fuelled with gas, fuel oil and asphalt, the combustion of which causes the emission of contaminants to air;
b. Fugitive emissions from various sources[99] that are located throughout the Site;
c. From the flaring of gases from the flare stacks. Flaring serves two purposes, being to safely burn gases that are emitted in an upset / emergency situation and/or excess gases. While Refining NZ operates with the objective of avoiding flares, they are an essential tool for responding safely to upsets and emergencies and thus need to be incorporated as part of the Proposal for which consent is sought;
d. Smoke from the fires started (under controlled situations) to enable the training of firefighters. All such exercises are undertaken in a dedicated training ground on the Site; and
e. From sand / particle blasting activities that occur as part of the recurrent maintenance activities that are undertaken on the Site.

3.4.2 Management Approach

As it has with its stormwater discharges, Refining NZ has implemented a number of management strategies to minimise the effects of its discharges to air. Those strategies include:

a. Extending the durations between shutdowns at the Refinery. This has the effect of reducing the instances when flaring is required;
b. All flares are monitored via a television link, and remedial measures are taken to minimise any smoke effects that arise;
c. Advising all vessels visiting the Refinery of the Site's smoke minimisation requirements and the need for them to comply with those requirements;
d. Operating an effective complaints system, which includes a telephone hotline that operates for 24 hours of each day, 365 days of the year;
e. Actively working to minimise the smoke that is emitted as a consequence of the firefighting exercises. This includes burning only light hydrocarbon fuels, no longer undertaking ground fire practice, minimising the 'burn time' of the exercises, and no longer using authentic smoke in breathing apparatus training that is conducted at the Refinery. Refining NZ also only undertakes exercises during favourable wind conditions to minimise impacts on surrounding nearby communities.

3.5 Groundwater Matters

The Refinery abstracts groundwater, and discharges water / contaminants to ground. This sub-section describes both of these activities, which Refining NZ wishes to continue.

3.5.1 Groundwater Abstraction

In order to contain the impacts of its activities (present day and past), Refining NZ commenced a site-wide groundwater pumping programme in the mid-1980s. While the leaks and spills are minimised through maintenance / repairs / remediation and improved management, Refining NZ has continued to abstract up to 2,700 m^3/d of groundwater. The abstracted water is discharged into the AOC, and thus ultimately to the Harbour.

The pumping serves two key purposes. In this regard:

a. Not all of the hydrocarbons lost to the groundwater can be directly recovered. The pumping programme enables their progressive recovery as the hydrocarbons make their way through the soil profile to the groundwater. Further, it creates a depression in the groundwater table, which encourages the flow of groundwater towards the five abstraction wells (**Figure 3.5.1.1** shows the location of the existing five abstraction wells, and the location of all associated groundwater monitoring wells). The objective of the groundwater recovery pumps is to ensure hydrocarbons in the ground are

[99] Relief valves, pump seals, compressor seals, valves, sample points, and storage tanks

contained thus minimising the risk of hydrocarbons being discharged into the Harbour with the groundwater; and

b. Protects the Control Room from the risk of hydrocarbons or explosive vapour entering it via the concrete floor. The Control Room is constructed below the natural level of the groundwater. While measures have been taken to avoid hydrocarbon vapour entry, the pumping and the associated depression in the groundwater levels is needed to provide the protection that the Control Room requires. For completeness, we note that the Control Room is centrally located in a blast proof building. As the name suggests, it controls the Refinery, and its operation is, therefore, essential for the safe functioning of the Site.

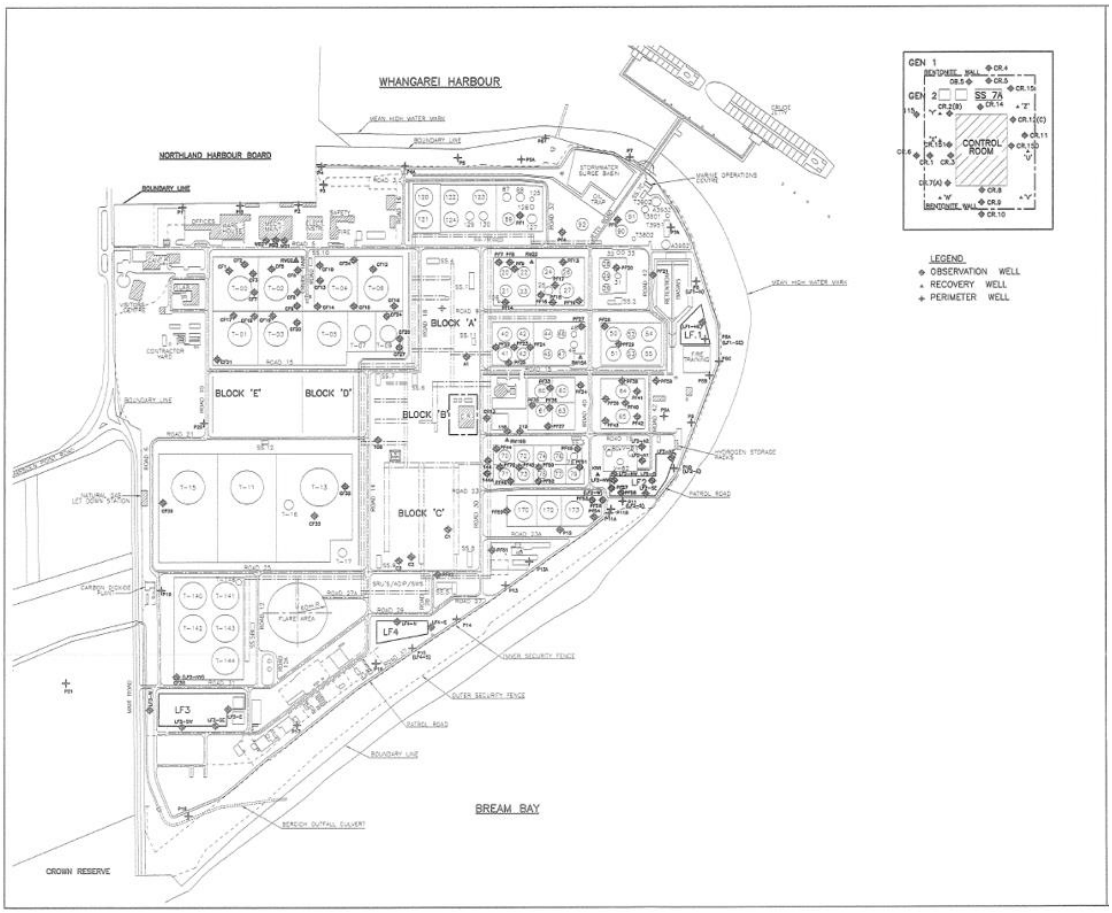


Figure 3.5.1.1: *Location of the Existing Abstraction Wells*

Of note is that Refining NZ is seeking the resource consents necessary for it to abstract up to 2,700 m^3/d over the Site. This could see some, or all, of the existing wells decommissioned over time and new wells established. While the Company will seek any resource consents that are necessary for the construction of the new bores, it does not wish to have to apply for the abstracted groundwater volume. In this respect, it wishes to be able to abstract groundwater from any location within the Refinery, provided the daily maxima of 2,700m^3 is not exceeded.

3.5.2 Discharges to Ground

There are a number of activities within the Refinery that see contaminants being discharged to land. The main potential sources of the contaminants are from the AOC (and stormwater in general) and the COC drainage network and from the tanks (via leakage). While the discharges from the Refinery's historic 'landfarming' activities to ground have occurred (and are no longer occurring), the contaminants that were discharged are still making their way through the soil horizon. As these latter movements of contaminants are addressed in section 2.3.4 of this AEE, and we do not discuss them further within this sub-section.

Some lengths and parts of the AOC are not lined, meaning that they are permeable. As a consequence, Refining NZ expects that stormwater percolates into the ground from some of the AOC drains, and that the contaminants therein make their way over time into the underlying groundwater resource. The contaminants are expected to be predominantly dissolved hydrocarbons, although metals are also known to be present.

The Refinery has three storage facilities on the Site. These comprise the Crude Storage Area, and two product storage areas. While Refining NZ makes every practicable effort to prevent the loss of product[100] from the various storage compounds, experience suggests that some leakage occurs and that the leaked hydrocarbons make their way into the groundwater table. Refining NZ also note that not all parts of the COC are impermeable and expects some discharges to ground to occur from there also.

A fire training area is located on the eastern most point of the Site and comprises a paved surface with training equipment in a central area. This area has been used since the 1980's when it was relocated from its original location North of A Block as part of the Refinery expansion. Fire training included the use of foams which over the years have evolved. Foams containing PFAS compounds have historically been used as part of training. Since 1 January 2019 only training foams have been used, and these are fluorine free compounds.

3.6 Landfarming and Solid Waste Disposal

Landfarming is the practice of placing oil sludges onto land and enhancing the natural microbial degradation processes to breakdown the oil contained within the sludge. We understand that landfarming is common practice at oil refineries and was carried out on the Site from the late 1960s until 1996, when it was discontinued. As a consequence, there are no new discharges from this activity, only the movement of the contaminants through the soil profile.

While, relatively speaking, the solid waste volumes generated by the Refinery are small, they never-the-less require disposal. All wastes are transported to legally authorised landfills for disposal.

3.7 Maintenance Activities

Refining NZ undertakes a number of maintenance activities on the Site each year. In broad terms, the activities these can be categorised into two main areas.

3.7.1 Shutdowns

The Refinery is regularly shutdown (in full or in part) to keep the plant safe and efficient. In many cases the work required is to meet the Company's statutory obligations and can only be undertaken when the plant is shutdown. Typically, shutdowns only involve that part of the plant affected and rarely is the whole plant shutdown. Full Site shutdowns occur every 10 to 14 years. The last full site shutdown was in 2018. Activities that are typical of the shutdowns include:

a. Catalyst exchange or regeneration.
b. Inspections of plant to determine state of equipment of meet statutory obligations.
c. The repair, maintenance or replacement of equipment as required.
d. Recoating of vessels and other equipment including refractory replacement in furnaces and other areas which are subject to high temperatures.

As part of shutdown it is necessary to drain and clean equipment to make the plant safe to work on and in. There are numerous controls in place to manage the shutdown process to ensure any risk of uncontrolled discharge and consequent effect on the environment is minimised to very low levels. This includes dedicated areas for maintenance works (such as the 'Bundle Bay' where 'exchanger bundles' are cleaned). All water from the bundle bay goes through Refining NZ's wastewater treatment system. Other aspects of the shutdown

[100] Which can consist of crude oil, gasoline, jet fuel, fuel oil, bitumen and gas oils – all of which are stored in the storage areas

(such as solid waste management) are controlled to ensure the Company meets its statutory obligations and to minimise impacts on the environment.

Further aspects of the shutdown (such as no liquid waste management) are controlled to ensure Refining NZ meets its statutory obligations and minimises impacts on the environment.

3.7.2 Recurrent (Non-Shutdown) Maintenance

Ongoing maintenance occurs at the Refinery outside of the shutdowns. In this regard, it not only covers the process plant but also other infrastructure within the Refinery. In broad terms, the recurrent maintenance activities include:

3.7.2.1 Process Plant

a. Repair, maintenance and replacement of equipment as required.
b. Tank maintenance including tank bunds, compounds and associate infrastructure.
c. Replacement of old process plant with new improved plant.
d. Upgrades to the Refinery's existing plant such as the sulphur handling systems.
e. Maintenance and repair of civil structures such as foundations, concreted areas, and support structures.
f. Repairs and replacement to pipework both above ground and below ground and associated structures such as pipe supports, valves and pumps.

3.7.2.2 Support Infrastructure

a. Fire system inspection, repair and replacement.
b. Repair and maintenance of existing buildings and the construction of new buildings.
c. Inspection, repair, maintenance and upgrading of the jetty, loading equipment, and the associated infrastructure.
d. Upgrade, replacement and repair to Refining NZ's drainage network sewer, AOC and COC (including of the spillway from the SWB to the Harbour).
e. Repair, maintenance and replacement of roading and footpaths within the Refinery.
f. Maintenance repair and upgrade of the security infrastructure such as fences and camera towers.
g. Repairs, maintenance and new components of the electricity supply network within the Site such as substations, transformers and cabling.
h. Repairs, maintenance and new components of the water supply network such as pipes and pumps valves.

There are numerous controls in place to manage the maintenance processes to ensure any risk of uncontrolled discharge and consequent effect on the environment is kept very low levels. This includes the Bundle Bay, which has been previously cited.

3.7.3 Activities Seeking Consent

Some of these activities will require a degree of land disturbance, vegetation removal and/or earthworks. Refining NZ is ISO 14001 Environmental Systems certified and has process in place to determine if such works are within permitted activity criteria or require a resource consent. If a resource consent is required, it will typically be sought for on a 'project by project' basis (that is, at the time that the project / shutdown is being planned). As a consequence, the majority of these activities are not within the scope of the Proposal (and thus the resource consent applications that have been lodged for the Proposal). The only exception to this is the wet and dry abrasive blasting that is undertaken on land (abrasive blasting that is undertaken over the CMA is not within the scope of the Proposal) to remove existing coatings, thus enabling repair and/or maintenance.

3.8 Alternatives Assessment

Jane Thomson of Refining NZ has considered potential alternatives to the existing discharges to land, water and the air. She states that alternatives in relation to groundwater extraction and marine structures have also been assessed. A full copy of Ms Thomson's *Refining NZ*

Reconsenting Project- Alternatives Assessment[101] is contained within **Annexure 3** of this AEE. We now summarise Ms Thomson's advice.

Ms Thomson advises her assessment was both informed by and prepared in accordance with the requirements of clause 6[102] to the Fourth Schedule and section 105 of the Act.

Ms Thomson notes that a wider assessment of alternative locations or methods for undertaking an activity (that is, for activities other than discharges of contaminants) is only required where it is likely that the activity will result in significant adverse effects on the environment. She indicates that this is not the case in this instance as Refining NZ's independent experts confirm that none of the adverse effects associated with the Proposal will be significant. Ms Thomson goes on to record, however that she has also considered the alternatives relating to groundwater extraction and marine structures that form part of the Proposal.

Ms Thomson records that Refining NZ's independent expert advisors have undertaken a series of thorough assessments of the nature of the discharges for which resource consent is sought, and the sensitivity of the receiving environment to adverse effects. She states that assessments of those various expert advisors have been considered, and where appropriate referenced in her 'Alternatives Assessment report'.

Ms Thomson notes that the concept of 'best practicable option' is of relevance to her assessment. She repeats the definition of 'best practicable option' that is set out within the RMA, and that we have also repeated in the footnotes[103] below.

Ms Thomson goes on to report that the approach adopted by Refining NZ is to consider, for each type of discharge for which resource consent is being sought, whether there are adverse effects on the environment which require prevention or minimisation; and if so, what options are available and the effectiveness of each, having specific regard to the level of effects and sensitivity of the receiving environment, financial implications, technical limitations, and likelihood of successful application. She notes that where they exist, suitable alternative technologies that might aid in achieving a reduction or elimination of adverse effects have been identified and that expert reports regarding alternatives are included as appendices to this report.

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[101] Thomson, J. New Zealand Refining Company Limited. *Refining NZ Reconsenting Project- Alternatives Assessment*. Draft for Internal Circulation. Dated July 2020

[102] She states that Clause 6(1)(d) of Schedule 4 to the RMA requires that an assessment of effects on the environment must include information on:

> *(d) if the activity includes the discharge of any contaminant, a description of—*
> *(i) the nature of the discharge and the sensitivity of the receiving environment to adverse effects; and*
> *(ii) any possible alternative methods of discharge, including discharge into any other receiving environment*

She records further that the requirement to have regard to alternative methods of discharge is also contained in section 105(1) of the RMA, which requires:

> *(1) If an application is for a discharge permit or coastal permit to do something that would contravene section 15 or section 15B, the consent authority must, in addition to the matters in section 104(1), have regard to—*
> *(a) the nature of the discharge and the sensitivity of the receiving environment to adverse effects; and*
> *(b) the applicant's reasons for the proposed choice; and*
> *(c) any possible alternative methods of discharge, including discharge into any other receiving environment*

[103] ***best practicable option****, in relation to a discharge of a contaminant or an emission of noise, means the best method for preventing or minimising the adverse effects on the environment having regard, among other things, to—*
(a) the nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; and
(b) the financial implications, and the effects on the environment, of that option when compared with other options; and
(c) the current state of technical knowledge and the likelihood that the option can be successfully applied

Ms Thomson advises that the conclusions drawn from the data and advice provided by the technical experts that have been commissioned by Refining NZ to inform the Proposal demonstrate that Refining NZ's current methods for discharges to air, sea, land, groundwater extraction and marine structures are effective, fit for purpose, and considered the best practicable options. The rationale for this advice is summarised as follows:

3.8.1.1 Discharge to Air

According to Ms Thomson, SO_2 is the primary contaminant of interest with respect to Refining NZ's discharges to air. She states the only feasible means of reducing SO_2 emissions is to reduce the sulphur in fuels burnt on site. She goes on to note that this would result in a significant increase in operational costs and/or significant refining margin destruction. She then advises that the installation of a SO_2 scrubber to treat furnace flue gas is considered prohibitively expensive, at a cost of around US$150 m (+50%/-20%) with a lead time of around three years.

3.8.1.2 Discharge to Water

Ms Thomson points out that the discharge to water is the preferred method of effluent disposal with a lower material impact on the surrounding environment compared to the alternative, land irrigation. She advises that the resource consent application requirements and the new infrastructure required to construct land irrigation on or off-site mean that discharges to land are not the best practicable options. She states that both on and off-site options are capital intensive and may result in negative environmental impacts with implications on the site groundwater behaviour and quality, as well as reduced recovery rates of free phase hydrocarbons from the groundwater table. Ms Thomson states that the projected actual and potential adverse effects of the proposed discharge to water are considered less than minor therefore, that investment in alternative discharge locations is not warranted.

3.8.1.3 Discharge to Land

In terms of discharge to land Ms Thomson advises that ongoing maintenance work on the Site drain and tankage systems in conjunction with operation of hydrocarbon recovery wells on site has resulted in reduction of the hydrocarbon plume (underneath the Site) and improved performance of drains during heavy rain weather events. She states that refurbishing the entire Site's drain systems such that hydrocarbon leaks are completely eliminated is not the best practicable option which is primarily due to some sections running beneath existing plant, requiring plant demolition for safe access to upgrade and repair these lines. She advises further that even if all drains on site were to be upgraded and/or repaired, leaks would still occur as certain areas of the network are susceptible to leaks and require ongoing maintenance.

3.8.1.4 Groundwater Extraction

Ms Thomson states that various methods to avoid migration of contaminated water and oil over the Site boundary to replace Refining NZ's current pumping and treating methodology were investigated. She advises that based on existing performance data of Refining NZ's groundwater extraction system and the resulting groundwater depression, this was determined as the best practicable option for application on site at the Refinery. She notes further that the cost of installing additional treatment facilities as an add-on to this system outweighs any environmental benefits.

3.8.1.5 Marine Structures

The operation of the Refinery without any jetty facilities, according to Ms Thompson, is not considered a practicable option. She advises that similarly, a reduction in the number of available berths is also not considered practicable as it would place severe constraints on the Refinery operation and impact the Refinery's viability. Ms Thompson states that the adverse effects associated with continued existence, operation and maintenance of the jetty facilities are generally considered less than minor with the exception of moderate to high cultural effects identified by Patuharakeke in the CEA. Ms Thompson notes that their existence provides additional habitat for marine organisms and avifauna, which is considered

to represent a beneficial effect[104]. Ms Thompson further explains that the removal of the structures is not fiscally practicable.

3.8.1.6 Alternatives Assessment Conclusion

Ms Thomson states that the conclusions drawn from the data and advice of experts which are outlined in the *Alternatives Assessment*[105] are that Refining NZ's current methods for discharges to air, sea, land, groundwater extraction and marine structures are effective, fit for purpose and considered the best practicable options.

[104] De Luca, S., and Ross, Dr P., Boffa Miskell, *Assessment of Effects on Marine Ecological Values- Reconsenting of discharges and structures in the CMA*. Dated July 2020.
[105] Thomson, J. New Zealand Refining Company Limited. *Refining NZ Reconsenting Project- Alternatives Assessment*. Draft for Internal Circulation. Dated July 2020

4.0 ASSESSMENT OF ACTUAL AND POTENTIAL ENVIRONMENTAL EFFECTS

4.1 Introduction

Subject to Part 2 of the Act, the Council is required to have regard to any actual and potential effects on the environment that may result from allowing the Proposal to proceed.

As noted in section 2.2 of this AEE, the consent authority may disregard an adverse effect of the activity on the environment if a national environmental standard or plan permits an activity with that effect. For the reasons that have already been set out, we have not applied the permitted baseline in this instance.

The key environmental effects associated with the Proposal are outlined in this section of the AEE. The effects have been broadly classified into the following groups:

a. Landscape, Visual and Natural Character Effects;
b. Groundwater & Contaminated Land Effects;
c. Air quality Effects;
d. Water Quality / Water Chemistry Effects;
e. Marine Ecology Effects;
f. Avifauna Ecology Effects;
g. Marine Mammal Ecology Effects;
h. Terrestrial Ecology Effects;
i. Environmental Health Effects;
j. Archaeological and Historic Heritage Effects;
k. Cultural Effects;
l. Economic Effects;
m. Recreation and Tourism Effects;
n. Social Effects; and
o. Positive Effects.

We now discuss each of these actual and potential effects in turn.

4.2 Landscape, Visual and Natural Character Effects

Mr Stephen Brown of Brown NZ Ltd has considered the actual and potential visual, landscape, amenity and natural character effects of the Proposal. A full copy of Mr Brown's Landscape Assessment[106] is contained within **Annexure 3** of this AEE. The key environmental effects associated with the Proposal in relation to the landscape are outlined in this section of the AEE. The landscape effects have been classified in relation to the following activities:

- Air Emissions - Smoke Plume and Gas Flare;
- Stormwater Discharges; and
- The Refinery Jetty, Oil Unloading Gantries and Berthage Dolphins

We now discuss the actual and potential effects in relation to each of these activities in turn.

4.2.1 Air Emissions - Smoke Plume and Gas Flare

The assessment of air emission effects for the Proposal undertaken by Mr Brown was informed by visual and photographic analysis of the on-going operations at the Refinery that are subject to reconsenting under this Proposal. On a number of site visits, Mr Brown states that smoke discharges and gas flares[107] were viewed in both the morning and afternoon from a variety of locations around Whangārei Harbour and at Ruakaka Beach:

- The intersection of the Marsden Point Highway with Mair Road;

[106] Brown, S. Brown NZ Ltd, *Marsden Point Refinery Re-Consenting Project – Landscape Assessment*. Dated June 2020

[107] A gas flare, alternatively known as a flare stack, is a gas combustion device used in industrial plants such as petroleum refineries

- Marsden Point Beach Car Park;
- Stace Hopper Drive;
- Waitemata Drive;
- One Tree Point Road Near Mariners Haven;
- One Tree Point Road;
- Ruakaka Beach;
- Tamaterau;
- Reotahi; and
- Taurikura.

The specific air emission effects are outlined as follows:

4.2.1.1 Visibility

Mr Brown states that the first point to note in relation to both types of air discharge (smoke and gas) from the Refinery is that the smoke plume from the multi flu stack is often very subtle and hard to clearly see. Further, Mr Brown notes how smoke frequently merges with passing clouds, although its darker colouring occasionally 'silhouettes' the smoke against lighter coloured cloud cover, albeit Mr Brown considers the visibility of smoke to be very subtle for the most part. He indicates that he has witnessed a gas flare on many occasions, but the only smoke visible has been from the multi flu stack, rather than the flare stack. Mr Brown reports that the gas flare from the flare stack is more visible and visually dramatic when viewed from close-up, but often its visibility disappears when viewed over any distance.

Related to viewing distance, Mr Brown indicates that the smoke column was visible from close up (around Marsden Point Highway to Marsden Cove and the near end of One Tree Point Road) and much less visible from One Tree Point Road (near the coastal cliff running through to the yacht club). He notes further that the plume was invisible from Tamaterau and Solomons Point across the Harbour, barely visible from Reotahi and Taurikura Bay, and not visible from Urquharts Bay. He states that the Refinery's gas flare, however, is clearly visible from many of the same locations as the smoke column, but less apparent from Taurikura and more visible from Reotahi.

Mr Brown advises that all of the viewpoints mentioned above have a sufficiently low elevation that both the smoke column and gas flare are viewed against the plane or 'dome' of the open sky, subject to the vagaries of cloud cover and weather, sun lighting angles, and the variable wave lengths of sunlight passing through the atmosphere. As a result, he states that the column and flare are rarely viewed amid a completely open or evenly saturated sky.

4.2.1.2 Changes to Character and Values

Mr Brown advises that none of the views (as referred to in the Visibility section above), reveal the smoke plume and gas flare divorced from the wider array of stacks, tanks and other structures that comprise the highly distinctive, industrial complex of the Marsden Point Refinery. Mr Brown proceeds to state that these are, in effect, the signature features of the Refinery, remaining apparent in view from as close as Marsden Cove and One Tree Point, and as far away as Ruakaka Beach, Tamaterau, Solomons Point and Urquharts Bay.

Mr Brown reports that the plume and flare (when visible) are almost entirely ancillary to the visual statement that the Refinery makes in its own right, regardless of the viewpoint involved. According to Mr Brown, the gas flare adds a 'dynamic quality and touch of drama' to the Refinery, enhancing its identity as one of New Zealand's few major industrial complexes. Overall, however, Mr Brown states that the gas flare and adjacent stack plume add relatively little to the landscape of Marsden Point. Mr Brown regards that there is a visual juxtaposition between the man-made features of Marsden Point's industrial skyline against the natural features of the Harbour, such as its enclosed waters and the clearly defined volcanic landforms of Whangārei Heads. Mr Brown considers that the faint trail of smoke from the multi flu stack and intermittent flames of the flare stack (visible at close distances) add to this visual interplay in an incremental fashion, subtly reinforcing a contrast

between the natural and man-made/industrial landscapes. Mr Brown considers that the air emissions themselves however do not create a juxtaposition.

4.2.1.3 Landscape Effects

Mr Brown discerned that the majority of views towards the Refinery and its air discharges are from across the Harbour. In addition, Mr Brown notes that the ONLs of Manaia, Mt Aubrey, Taurikura and Home Point, Mt Lion and Bream Headline line up behind the vantage points used in his assessment. Mr Brown therefore considers that the areas of highest landscape value near Marsden Point are largely dissociated from the smoke plume and gas flare at the Site. Mr Brown considers smoke plume and gas flare to be firmly linked to the area of greatest modification and development within the Whangārei Harbour / Marsden Point environment.

According to Mr Brown, this situation changes somewhat in the general vicinity of One Tree Point and Marsden Cove. He states that views from much of One Tree Point Road, the expanse of the Harbour, backed by Manaia, Mt Aubrey, Taurikura and Mt Lion dominate the main area of outlook, with both the Refinery and air emissions from it quite peripheral to that main area of viewing. He advises that the view from around the Marsden Cove canals and marina are more truncated, with less of the Harbour area and its 'Heads' backdrop visible. The multi flu stack and smoke from it is often set against, or close to, the profile of Mt Lion, according to Mr Brown. He notes that such views are also dominated by man-made structures and activity, both in the immediate foreground and the crucial middle distance, including boats, masts, bridges, houses, sheds / stores and the stacks that define the Refinery's skyline. He also notes that the smoke and flares emanating from the Refinery stacks are minor elements that simply affirm the already highly developed and modified, nature of such views.

Similarly, Mr Brown states that even though views from Ruakaka are defined and framed to a much greater degree by the natural sweep of the beachfront and its sand dune margin (culminating in the serrated profile of Mt Lion and Bream Head) the profile and silhouette of the Refinery is clearly apparent. Mr Brown considers that tails of smoke at this location would very subtly exacerbate the 'industrial' nature of part of this landscape and that the related interplay of natural features with man-made elements would not greatly alter or change this relationship. Mr Brown goes on to state that the proposed emissions' effect in relation to landscape values are considered to be of a very low order for most vantage points around Marsden Point and Whangārei Harbour, rising to a low or, at times, low-moderate level in relation to views from Ruakaka Beach.

Mr Brown also considers the effects of gas flares from the flare stack at night-time. He concludes that these are intermittent, but can, even in the context of a well-lit Refinery and adjoining Port facility, draw significant attention. He advises that such flares can be both 'dramatic' and, in extreme cases, 'disturbing'. However, he states that their landscape effects would be quite limited: at night-time as the landscape is affectively 'lost' in the darkness. Mr Brown considers that most night-time effects typically relate to perception of the night sky, to feelings of relative isolation and remoteness. Mr Brown considers that the quality of 'darkness' derived from the night sky is unlikely to be effected by the Proposal as the Site, together with the adjacent Northport site are lit at night-time with additional exacerbations from the lighting on berthed vessels and from settlements in the area. Mr Brown ultimately concludes that given this context, any effects on landscape character and values are, in his opinion, of a very low or less than minor level overall and any disturbance associated with the night-time flares is more appropriately addressed as an amenity effect.

4.2.1.4 Natural Character Effects

Mr Brown states that the areas of HNC and ONC respectively identified from Home Point Ocean Beach, within Taurikura and Urquharts Bays, and off Marsden Point's distal spit, relate to the underwater sand banks within the Harbour. Notably these areas include the Mair and Calliope Banks and the rocky, then dune land, and coastlines east of Home Point, outside the Harbour mouth. He goes on to note that the volcanic shoreline margins and 'plug'[108] of Mt

[108] A volcanic plug, also called a volcanic neck or lava neck, is a volcanic object created when magma hardens within a vent on an active volcano

Aubrey are also identified as being an area of ONC. However, he also reports that all of this area reveals an existing intermixing of settlements and mooring areas with more natural coastal margins and parts of the CMA. He points out that all of the Whangārei Heads coastline faces towards both the existing Refinery and Northport, while both sand banks are more notable for their geomorphic qualities than for their visual or aesthetic appeal. Further, he records that they are contextualised by pockets of settlement, moored boats and the industrial complexes that dominate the Marsden Point shoreline and its hinterland. Mr Brown reports that within this setting, the smoke and gas flare would be 'additive' elements that reinforce this interaction, and the related engagement between the more natural, and more developed, parts of the Coastal Environment. He goes on to indicate that almost all views from both sides of the Harbour already reveal this dichotomy, which is reinforced by the open, large scale, 'divide' of the Harbour's entry channel. Given this, Mr Brown concludes that the impact on the perception of the Harbour's natural character values, would be minor relative to that of the existing elements and structures which already define the coastal edge and skyline of Marsden Point. He states further that although both sand banks lie closer to the Refinery and its stacks than the HNC and ONC coastlines behind them, the smoke plume and gas flares from the Refinery wouldn't appreciably alter either the interplay between man-made structures in the Coastal Environment, or the overall level of naturalness associated with Marsden Point and its coastal surrounds. He points out that these are already substantially dictated by the existing Refinery, Northport and other development fringing the Harbour. As a result, he concludes that it can be considered that the natural character effects generated by the Refinery's smoke plume and gas flare would be of a low order.

4.2.1.5 Amenity Effects

Mr Brown indicates that the landscape of Marsden Point, the outer Whangārei Harbour and Whangārei Heads is already characterised by a range of contrasting elements and values. Mr Brown states that this creates a degree of tension between the more natural qualities of Whangārei Heads, and its appeal to a sizeable residential population and the industrialised area of Marsden Point. He notes that the adjacent Northport facilities both reinforce this demarcation and provide a reasonable buffer between the Refinery and the residential community of Marsden Cove merging with One Tree Point.

Mr Brown records that given this existing landscape 'framework', it is considered that the additional effects associated with plumes from the multi flu stack and more intermittent gas flares would have little effect on the overall character, coherence and values of the landscape surrounding Marsden Point. Mr Brown emphasises that the smoke discharges and flares from the Refinery tend to further cement the existing qualities associated with Marsden Point, and the visual juxtaposition of its large industrial complex with both the adjoining Harbour and volcanic Whangārei Heads landscape. He then goes on to note that the identity, or sense of place, associated with these quite different areas is already substantially 'fixed' by the various elements and interplay of values, therefore he concludes that any effects in relation to amenity values would typically be of a very low order.

In relation to the issue of night-time effects, Mr Brown indicates that they primarily relate to the appreciation of the night sky and a Harbour landscape (what can be seen of it), together with appreciation of solitude, remoteness and darkness. He points out that at times, the flares would draw attention to the Refinery from more distant locations, whereas when viewed from those locations closer to the Site, it would amplify the focus on an already extensively lit Refinery complex. According to Mr Brown, on such occasions, the flare would be sufficiently prominent, that it would be regarded as a nuisance by some. He reports that others, however, might well see it as simply one of many features associated with the Refinery, perhaps even one of its more dramatic and dynamic attributes, in a positive sense.

Mr Brown concludes, based on the levels of lighting already associated with both the Refinery and Northport (and other contextual matters already described), that the night-time flares would typically generate a low-moderate level of effect. In this regard he considers that the lighting would adversely affect some qualities of the night-time environment, but not appreciably alter the identity or sense of place associated with Marsden Point and its Harbour setting.

4.2.2 Stormwater Discharges

Mr Brown advises that stormwater is captured and discharged into the Harbour from multiple drains and channels throughout the Refinery and then drained into a retention basin. He points out that within this basin, it is mixed with 'de-ballast water' and water used to clean out ship tanks, which is filtered and treated in the Water Effluent Treatment Unit, then transferred to the SWB before (subject to monitoring) being discharged via a submarine diffuser near the Refinery jetty. He states that during exceptionally heavy rainfall sequences, some treated water is also discharged from the SWB via a 'stormwater basin diffuser bypass' and a 'stormwater basin overflow spillway'. However, he notes that these are only used in exceptional circumstances.

Mr Brown highlights that discharges occur regularly and the discharged water mixes with the Harbour's waters via the diffuser, so that it rapidly spreads out and melds with the Harbour's water column. He indicates that stormwater discharges accelerate during periods of rainfall, when the merging of stormwater with the sea is further masked by the way in which the Harbour's waters are affected by rainfall, overhead cloud cover and other colloidal material released from the margins of the wider Harbour.

Mr Brown emphasises that this is an extremely complex situation that involves nuances of colour, water clarity and turbidity during periods when none of these qualities are easy to isolate and assess. In particular, he states that stormwater plumes would be difficult to see over any distance, with the flat viewing plane from locations like One Tree Point, Taurikura, Urquharts Bay and even the seaward edge of Reotahi adding to the difficulties of trying to distinguish stormwater plumes from the rest of the Harbour waters. According to Mr Brown, it is impossible to realistically gauge the effect that stormwater discharges from the Refinery are having in isolation. He goes on to advise that any such effects are likely to be subordinated by:

- the effects associated with rainfall on the Harbour and its margins as a whole - including the direct effects that rainfall and cloud cover have on perception of the Harbour's surface colour and texture;
- the movement of other colloidal material triggered by rainfall in other parts of the Harbour catchment; and
- tidal flows through an extremely active part of the outer Harbour.

Mr Brown concludes that stormwater discharges would be effectively 'lost' amid the general turmoil and change generated by heavy rainfall sequences. He therefore considers that any effects in relation to landscape, natural character and amenity values would typically be of a very low order, and when expressed in the context provided by the RMA, less than minor in magnitude.

4.2.3 The Refinery Jetty and Dolphins

Mr Brown's assessment of effects for the Refinery jetty and dolphins has utilised photos taken from a range of vantage points around Whangārei Harbour, including:

- Marsden Point Beach;
- Marsden Point Beach Lookout;
- One Tree Point Road;
- Solomons Point;
- Reotahi Bay;
- Reotahi Track; and
- Taurikura.

Mr Brown points out that most of the contextual matters identified in relation to air emissions would affect perception of the jetty and berthage dolphins, including:

- The physical isolation and buffering of the existing Refinery, relative to most residential areas in its vicinity, by both the Harbour and Northport facilities;
- The visual dominance of the Refinery, both on the skyline of Marsden Point and along its Harbour edge;
- The amplification of industrial character by the adjacent Northport site's infrastructure and lighting;
- The clear division of the landscape around Marsden Point and the outer reaches of Whangārei Harbour into parts that are either predominantly natural or very substantially developed / modified;
- The manner in which most views from Whangārei Heads and its settlements towards Marsden Point are framed and backed by the ONLs of Manaia, Mt. Aubrey, Taurikura, Mt. Lion and Home Point, but effectively isolated from those same ONLs.

Mr Brown notes that as a result, many of the comments about the incremental or additive nature of the air emission effects also apply to the wharf and jetty. Looking at this in more detail, Mr Brown assesses the effects as follows:

4.2.3.1 Visibility

Mr Brown outlines that an area from within, which the jetty and the dolphins would be visible is largely confined to the waters and coastal margins of the outer Harbour, from the vicinity of Parua Bay through to Home Point, even though the Refinery remains legible as far west as Onerahi. He then draws our attention to the fact that the jetty would also be visible from the northern end of Bream Bay. He also records that, when viewed from most of these Harbour margins, the feature that stands out in relation to the 'proposed' jetty is its temporary white sheeting, which is wrapped around both unloading gantries.

Mr Brown advises that the white cladding is the one component of the 'proposed' jetty structures and dolphins that draws attention to them. However, he states when viewed from the close-up vantage point of the lookout at Marsden Point Beach, the jetty remains visually subordinate to the fuel tanks and stacks to the right and the serrated profile of volcanic peaks on the far side of the Harbour.

Overall, Mr Brown states that the jetty has a much more recessive profile and notes that in the majority of cross-Harbour views, the jetty and dolphins are therefore largely absorbed visually, by the much greater mass and structural complexity of the Refinery, whereas when viewed from further down the Harbour (including from One Tree Point), it is screened by the Northport berths and hard standing. He concludes that only in views from Marsden Point Beach, does the jetty have any real legibility and visual presence, in its own right.

4.2.3.2 Changes to Character and Values

Mr Brown reports that it is clear that the Refinery and Northport, often viewed together, leave a distinct mark on the Harbour landscape. However, Mr Brown states that as with the aforementioned smoke plume and gas flare, the jetty and dolphins add little to the landscape of Marsden Point. He concludes that the jetty would not, in its own right (and excluding the shipping using it), appreciably change the nature of such views or the Harbour landscape as a whole.

4.2.3.3 Landscape Effects

Mr Brown emphasises that the landscape effects generated by the jetty and its dolphins would be incremental, building subtly on those of the rest of the Refinery. He states further that looking at the Refinery from down-Harbour locations, together with other, relatively remote vantage points, the presence or absence of the jetty would have no effect at all. According to Mr Brown when looking from slightly closer locations, (excluding Reotahi Bay, which is screened from the jetty), the jetty and dolphins would change the nature of some of the Harbour shoreline, but otherwise would be largely absorbed by the Refinery and Northport berths behind it. He then points out that the Refinery and current port facilities would still dominate that part of the coastline in closest association with the jetty.

Mr Brown outlines that the only vantage points that would show the Refinery jetty extending out into Whangārei Harbour are those within Marsden Point Bay, between the eastern end of Northport's berths and log storage area, and the Refinery. Although such views would reveal the jetty jutting out into the Harbour, Mr Brown states that this is contextualised by the various structures and activities associated with both industrial complexes. He stresses that the oil storage tanks alone down the southern edge of the beach are much more prominent than the non-'wrapped' jetty, while the various stacks within the Refinery, the security fencing next to Northport's chip storage area and operations within that part of the Port, all colour perceptions of the immediate environment. According to Mr Brown, it is a landscape full of contradictions, not least of these being a large water body set against both volcanic peaks and storage tanks, and a relatively natural beachfront and coastal shrubland backed by a skyline of stacks and other industrial structures.

Taking all of these factors into account Mr Brown concludes that the jetty (post maintenance) and its dolphins would have a very low level of effect on views from all of the vantage points employed in this assessment, together with adjoining parts of the Harbour coastline which includes vantage points at Marsden Point Beach. He also reports that at night-time, lighting on the jetty could marginally exacerbate the effects of lighting within, and around, the Refinery; however, any such effects would be of a very low order.

4.2.3.4 Natural Character Effects

Mr Brown advises that his commentary in relation to the effects of the Refinery's smoke plume and gas flares is also largely applicable to the proposed jetty and dolphins, although these structures would project out into the Harbour and, conversely, would be screened from locations like Marsden Cove and Ruakaka. He goes on to report that regardless, they would be confined to part of the Whangārei Harbour coastline that is already very appreciably defined by the presence of the Refinery and Northport berths. He emphasises that this situation would not noticeably change, irrespective of the presence of the jetty and berthage dolphins, or otherwise. He then concludes that as a result, it is considered that the natural character effects generated by the Refinery's jetty and dolphins would be of a very low order.

4.2.3.5 Amenity Effects

In a similar vein, Mr Brown emphasises that the jetty would not appreciably alter the nature or values of the outlook currently experienced by residents up and down the Harbour, or across it. He states that the aesthetic character and values of the Harbour landscape would remain intact, without any appreciable reduction in their coherence. As in relation to other values Mr Brown addressed in his report, the overwhelming predominance of the current Refinery and its Northport 'neighbour' in most views both across and down Whangārei Harbour means that the effects of the jetty would be truly incremental and minor. Consequently, he indicates that the identity and sense of place associated with the outer Harbour and its margins would also be little changed by the jetty and its berthage dolphins. Moreover, he reports that the jetty would not generate any appreciable nuisance effects, such as excessive lighting, and at night it would also be largely absorbed by the lighting within the existing Refinery and port compounds. He therefore concludes that, any effects on amenity values, are anticipated as being of a very low order.

4.2.4 Effects Summary

The following table summarises the various rating derived from Mr Brown's assessment of Landscape, Natural Character and Amenity Effects:

	LEGIBILITY / PRESENCE	LANDSCAPE EFFECTS	NATURAL CHARACTER EFFECTS	AMENITY EFFECTS	EFFECTS RATING
Smoke Plume and Gas Flare	**Low**	**Low** (Daytime) **Low** (Night-time)	**Low**	**Very Low** (Daytime)	**Less Than Minor**

				Low to Low Moderate (Night-time)	
Stormwater Discharges	**Very Low**	**Very Low**	**Very Low**	**Very Low**	**Less Than Minor**
Jetty and Berthage Dolphins	**Low**	**Very Low** (Daytime) **Very Low** (Night-time)	**Very Low**	**Very Low** (Daytime) **Very Low** (Night-time)	**Less Than Minor**

Table 4.2.4.1: *Landscape, Natural Character and Amenity Effects Rating*

4.2.5 Landscape and Natural Character Considerations addressed within the CEA

The CEA[109] produced by PTB considers the visual, landscape, amenity and natural character values of Poupouwhenua (the traditional rohe of Patuharakeke) and the wider Whangārei Harbour against the activities to be undertaken by the Proposal. As certain parameters of the CEA are related and intersect with the Landscape Assessment undertaken by Mr Brown, he has addressed some of the key issues and themes arising from the CEA. Mr Brown identifies three specific landscape and character issues that arose from the CEA to be addressed:

- Excessive Flaring;
- The effects of the Refinery jetty and associated structures on the beach of Marsden Point, including its recreational and cultural values / uses. This includes the ceremonial use of the beach to access to Poupouwhenua Mātaitai at the distal end of the Marsden Point spit; and
- The incorporation of a Māori perspective on landscape.

4.2.5.1 Excessive Flaring

Mr Brown addresses the issue of excessive flaring raised in his own Landscape Assessment and by PTB in the CEA. Mr Brown has considered that emergency and plant shut-down procedures that occasionally result in excessive and drastic flaring and smoke discharges are abnormal and quite rare. Mr Brown's discussions with Refining NZ and consideration of Mr Chilton's AQA has confirmed that these events can be anticipated to occur twice or three times a year based on the recording of events of this nature over a three-year period, 2017-2019. Mr Brown therefore considers that these events can generate nuisance effects and perhaps even cause alarm for those living nearby or visiting Marsden Point. Mr Brown concludes, however, that the discussions with Refining NZ staff have been accurate in regard to these events being atypical and he subsequently considers that the visual effects in relation to the smoke and flare discharges of the Refinery are, on the whole, much more subdued. Mr Brown's assessment of the effects remains unchanged, considering that throughout most of the year, the Refinery's smoke discharges and flaring would have very little impact on the landscape and amenity values of Marsden Point and the outer Harbour area. Mr Brown acknowledges that on occasion, this situation changes, but not with sufficient regularity for him to reconsider the findings already outlined within his assessment, other than to acknowledge that these events can, and occasionally do occur when emergencies arise. Mr Brown records that such exceptional discharges have a limited impact on the perception of Marsden Point, the adjoining Harbour, or Whangārei Heads, rather, they remain an 'adjunct' to the industrial profile of the Refinery and the industrial activities that occur within it. Mr Brown concludes that those emergency events that lead to excessive flaring are, in effect, low probability, high impact, incidents.

4.2.5.2 Marsden Beach

Mr Brown considers that the Refinery jetty and its gantries have a significant visual 'presence' at the edge of the Harbour. Mr Brown considers that this 'presence', is reduced by the physical connection of the jetty and its gantries to, and visual association with, the Refinery, including the storage tanks that line its seaward edge. Mr Brown notes that Marsden Point Beach is also enclosed by the Northport wharves adjoining the Refinery, together with the

[109] PTB, *Cultural Effects Assessment Report: Refining NZ Reconsenting*. Dated July 2020

car park, toilet block and tug berth that is a de facto lookout at the western end of the beach. Mr Brown therefore maintains his position that with or without the jetty, the beach area will remain directly framed by both the Refinery and Northport facilities. Mr Browns concludes that the jetty adds incrementally to this 'imposition' on the beach, including its relative naturalness and amenity / recreation values, but no more than that. Mr Brown accepts that the beach may well have cultural values as detailed by the CEA, however, this is not an aspect that Mr Brown considers that he can appropriately comment on.

4.2.5.2 Māori Perspective on Landscape

Mr Brown acknowledges that tangata whenua values are a key component of landscape assessment that need to be recognised. Mr Brown considers that tangata whenua values are considered in landscape assessments under the umbrella term of 'associative values' which consider the connections to, and associations with, landscapes and natural features. Mr Brown considers that research conducted at Lincoln University[110] has concluded that the Māori perspective on generic landscape based on their responses given as part of the study do not differ greatly from non- Māori. Mr Brown further considers that the Māori perspective on landscape differs greatly in relation to physically specific, landscapes and features that are known, appreciated, valued and treasured by iwi and hapū. Mr Brown goes on to note that the issues raised by the CEA, particularly in relation to the Marsden Point Beach area and access to the distal end of the Marsden Point spit, go well beyond the more generic, landscape and amenity considerations addressed in his report. Mr Brown considers that an assessment of landscape has many layers, and acknowledges that the CEA has appropriately assessed certain issues and values regarding the landscape specific to Patuharakeke.

4.2.5.3 Summary of Landscape Assessment and Cultural Effects

Mr Brown considers that the Landscape Assessment appropriately addresses the landscape effects that re-consenting would generate in relation to the broad spectrum of receiving environments and audiences that the Refinery and its activities are exposed to. In addition, Mr Brown considers that the effects in relation to Marsden Point Beach identified in the CEA are, for the most part, very specific, both culturally and spatially. Mr Brown acknowledges that they add another dimension to the overall evaluation that needs to be recognised and taken into account, but that they do not nullify his findings which remain focused on a wider area and range of audiences.

4.3 Groundwater & Land Contamination Effects

Ms Schiess and Mr Simpson of T&T have prepared a hydrogeological conceptual site model[111] to support the application for renewal of existing resource consents for the Marsden Point Refinery. Ms Schiess and Mr Simpson have considered the actual and potential effects of the Proposal on groundwater and land contamination. A full copy of Ms Schiess and Mr Simpson's report[112] is contained within **Annexure 3** of this AEE.

4.3.1 Groundwater Take

Ms Schiess and Mr Simpson state that the proposed groundwater take at the Refinery is no different from that which has been occurring under the existing resource consents, which are for the purpose of hydraulic containment of the shallow coastal groundwater system. They outline that hydraulic containment of the Site is a necessary and proactive management regime due to the presence of dissolved and LNAPL hydrocarbons within the groundwater

[110] John R Fairweather, J.R., Swaffield, S.R., and Simmons, D.G. (2004) *Public Perceptions of Outstanding natural Landscapes in The Auckland Region, Research Report No. 273.*
John R Fairweather, J.R., Swaffield, S.R., and Simmons, D.G. (2000) *Understanding Visitors' and Locals' Experiences of Rotorua Using Photographs of Landscapes & Q Sort. Report No. 13.*
John R Fairweather, J.R., Swaffield, S.R., and Simmons, D.G. (1999) *Public Perceptions of Natural and Modified Landscapes of The Coromandel Peninsula, New Zealand. Research Report No. 241.*
John R Fairweather, J.R., Swaffield, S.R., and Simmons, D.G. (1998) *Understanding Visitors' Experiences in Kaikoura Using Photographs of Landscapes & Q Sort. Report No. 5.*
[111] Schiess, S. and Simpson, C. Tonkin & Taylor Limited, *Hydrogeological Conceptual Site Model for the Marsden Point Refinery.* Dated July 2020
[112] Schiess, S. and Simpson, C. Tonkin & Taylor Limited, *Hydrogeological Conceptual Site Model for the Marsden Point Refinery.* Dated July 2020

system. They then highlight that without hydraulic containment of the Site, there is a potential risk of discharge of contaminants beyond the Site boundary.

Ms Schiess and Mr Simpson record that the history of the Site dewatering and hydrocarbon recovery illustrates the need to have a flexible and pragmatic approach to the taking of groundwater by allowing the volume and location of the takes to be transferable within the Site. As such, they note that it is proposed that the water take volume under a new resource consent is general to the Site and not specific to any particular recovery well (existing wells, or as future needs require).

Ms Schiess and Mr Simpson affirm that an analysis of the past five years of operational data has been undertaken for all of the recovery wells on the Site. They indicate that the observation that LNAPL recovery is seasonally dependent at the Refinery Site and has been well established over the years of operating the wells. This effect, according to Ms Schiess and Mr Simpson, is considered to be caused by the long term lowering of groundwater levels due to pumping that has resulted in the LNAPL-water interface being smeared as it migrates downwards. They note that this means that during winter months when high groundwater levels occur, that the hydrocarbon is trapped and is immobile beneath the water table and that, in contrast, in summer months when groundwater levels drop, the hydrocarbons become mobile and are recoverable again.

Ms Schiess and Mr Simpson point out that the Refinery Site is located within the Marsden-Ruakaka aquifer system. The effect on the resource from the proposed groundwater take by the Refinery is considered to be minor, given that the aquifer is not fully allocated and there remains groundwater available for allocation.

4.3.1.1 Site Sustainable Yield

Ms Schiess and Mr Simpson outline that an assessment of sustainable yield has been undertaken at a site-wide scale to assist in evaluating the potential for effects to results from the proposed groundwater take. They emphasise that this assessment has included a water balance that has calculated volumes of surface water runoff, flowing to the Site drainage system and is based on the measured area of impervious cover on the Site. They then state that the balance of the Site is considered to be the area of soakage and aquifer recharge, due to rainfall. They note further that the pervious areas of the Site consist of either; bare sand, gravel hardstand over sand, or vegetation over sand (limited area) and that, as a consequence of the nature of this cover, and due to the high surface infiltration rates, most of the rainfall enters the groundwater system. Ms Schiess and Mr Simpson indicate that no overland flow is observed on the bare ground due to rainfall at the Refinery Site. In addition to the rainfall recharge to groundwater, they note that some added contribution to groundwater recharge at the Site comes from throughflow across the western site boundary.

Ms Schiess and Mr Simpson record that the groundwater balance indicates that at a site wide scale, rainfall is the main recharge mechanism for the aquifer and groundwater abstraction is the dominant proportion of the discharge. They note that groundwater outflow is, typically, in the order of 30% of the water balance, and that this volume of groundwater outflow (i.e. discharge along the coastline) from the Refinery Site is sufficient to mitigate the ingress of seawater into the aquifer. Further, they state that these calculations support the monitoring observations at the Site that show that the present rates of ground abstraction are sustainable, without causing saline intrusion.

4.3.1.2 Additional recovery wells

Ms Schiess and Mr Simpson advise that Refining NZ operates the containment and recovery system by pumping at locations and at rates that manage the potential for an off-site discharge to occur in a fairly dynamic and responsive manner based on monitoring observations. They state that to this end, it is highly likely that Refining NZ will construct additional recovery wells as needed to achieve their objectives of recovering as much LNAPL as possible. They indicate that while the exact locations of these wells have yet to be determined, it is most likely that they will be positioned within the eastern half of the Site, downgradient of areas where refined (more mobile) bulk product storage occurs nearer the

coastline. Ms Schiess and Mr Simpson go on to note that the western half of the Site is, typically, used for the bulk storage of crude oil and residues which are far less mobile and are distant from the coast. As such, they consider that it is unlikely additional hydrocarbon recovery would be necessary for these areas. Ms Schiess and Mr Simpson conclude that if additional wells are constructed, that the recovery system would continue to operate within the existing maximum daily yield limit of up to 2,700 m^3/d (that is, no change in the maximum daily yield would be needed).

4.3.2 Effects on other users

Ms Schiess and Mr Simpson state that the radius of influence of the recovery wells is limited in lateral extent, given the relatively high transmissivity and unconfined nature of the aquifer system. In summary, they outline that the drawdown effect from the existing recovery wells does not extend beyond the Site boundary and cannot affect other groundwater users. Further, they note that the NRC database does not indicate the presence of any wells used for groundwater supply within the Marsden Point area. Assuming additional recovery wells were constructed within the Site in the future, Ms Schiess and Mr Simpson indicate that any off-site drawdown effects on other wells is likely to be minimal. Overall, Ms Schiess and Mr Simpson state that the potential for other groundwater users to be affected by the proposed groundwater take would be less than minor.

4.3.3 Effects on other aquifers

Ms Schiess and Mr Simpson report that the proposed groundwater take is from the coastal unconfined sand aquifer and this is the uppermost aquifer. They note that while there is bedrock at some 30 m depth beneath the Site, that this is not considered to be a viable source of groundwater due to its low yield and poor quality. Given this, Ms Schiess and Mr Simpson state that any groundwater recharge from the shallow aquifer into a deeper system is expected to be minimal and the taking of shallow groundwater is not expected to affect groundwater levels in the deeper aquifer. They then conclude that the effects on other aquifers from the proposed take is expected to be less than minor.

4.3.4 Effects on surface waters

Ms Schiess and Mr Simpson state that there are no permanent freshwater surface water bodies in the Marsden Point area, and consequently, the effects to surface waters from the proposed groundwater take are expected to be less than minor.

4.3.5 Saline intrusion potential

Ms Schiess and Mr Simpson indicate that the recovery wells at the Refinery have been in operation for many years, and the management philosophy to create hydraulic containment of the Site is to ensure a groundwater divide and an outward gradient are maintained. Accordingly, they note that this philosophy also assists in preventing saline intrusion from occurring. Ms Schiess and Mr Simpson report that over the past decade, there have been two new recovery wells constructed that are downgradient of the bulk storage tanks and are, therefore, closer to the coastline than the other recovery wells.

Ms Schiess and Mr Simpson note that one of the new wells, being the Kiwi Well, operated successfully without any incidence of elevated chloride or breach of the groundwater trigger level for seven years. They state that between May and July 2016, however, both the chloride and groundwater level at P11 exceeded the resource consent limits. Further, they go on to indicate that this was due to the cumulative effects of the Kiwi Well pumping and dewatering associated with the construction of the revetment wall to protect the Site from coastal erosion. In addition, they report that once the dewatering ceased, groundwater levels and quality returned to conditions that are more typical for the area.

Ms Schiess and Mr Simpson state that ultimately, no adverse effects were observed in association with this exceedance, and this experience has been valuable in understanding the threshold of pumping at which point saline intrusion can occur. They note that, considering the monitoring results to date, the balance is well maintained based on the pumping rates employed at the Kiwi Well under usual circumstances. Excessive pumping at this location could, in all reasonable likelihood, result in saline intrusion occurring at that

particular location according to Ms Schiess and Mr Simpson. Given the Kiwi Well is the most coastal of the recovery wells, they state that the risk of saline intrusion occurring due to the pumping at the other recovery wells is to be considered much lower.

Ms Schiess and Mr Simpson note that, in summary, the present regime of pumping is considered to be an appropriate and effective means of avoiding adverse effects associated with saline intrusion because outward hydraulic gradients are maintained. This is supported by the operational data and monitoring for the wells. They go on to state that in the context of planning provisions in the pRP, prevention of saline intrusion is an objective designed to protect a freshwater resource (coastal aquifer) from becoming contaminated such that it cannot be used for other purposes. They record that in the case of the aquifer system beneath the Refinery, it is clear that the resource is already contaminated due to the presence of hydrocarbons in groundwater, and for this reason, the resource has little value for other purposes. Further, they state that, in the case of the Refinery, even if saline intrusion into the aquifer were to occur, seawater is enriched in electron acceptors that promote the natural attenuation of dissolved phase hydrocarbons. So, in this case Ms Schiess and Mr Simpson highlight that saline intrusion could be considered beneficial in that it would reduce the source of aquifer contamination. They also draw our attention to the fact that saline intrusion, if it were to occur, is reversible, so any effect can be considered transient in nature. Ms Schiess and Mr Simpson therefore conclude, that the likelihood of saline intrusion occurring due to the proposed groundwater take, is considered to be low and manageable. The effects of saline intrusion, if it were to occur, are expected to be less than minor and potentially provide positive environmental benefits.

4.3.6 Ground settlement effects

Ms Schiess and Mr Simpson state that lowering of the groundwater level in compressible soils can result in compaction of the pore structure and result in ground settlement effects. They state that here building structures or plant infrastructure are present within the zone of influence of dewatering, and damage can result from ground settlement due to dewatering, should it occur. They go on to note that no detailed geotechnical assessment of settlement has been undertaken as part of this assessment, however, based on the fact that dewatering has been undertaken at the Site recovery wells for decades with no ground settlement having been observed, this is directly attributable to the dewatering. Ms Schiess and Mr Simpson conclude that this is attributed to the limited presence and thickness of compressible soils beneath the Marsden Point Site, and as such, the potential for ground settlement to occur due to the ongoing pumping of the recovery wells is expected to be less than minor.

4.3.7 Net positive benefits

Ms Schiess and Mr Simpson advise that the hydraulic containment provided by the groundwater take is considered overall to be a positive effect as it prohibits the movement of the hydrocarbon products into the marine environment and enables the recovery of LNAPL, thereby reducing the source of contamination over time.

4.3.8 Conclusions

In terms of an overall conclusion, Ms Schiess and Mr Simpson state that the present regime of pumping is considered to be an appropriate and effective means of avoiding adverse effects associated with saline intrusion because outward hydraulic gradients are maintained. They go on to report that this is supported by the operational data and monitoring for the wells. They also report that the prevention of saline intrusion is designed to protect a freshwater resource (coastal aquifer) from becoming contaminated such that it cannot be used for other purposes. According to Ms Schiess and Mr Simpson, in the case of the aquifer system beneath the Refinery, it is clear that the resource is already contaminated due to the presence of hydrocarbons in groundwater and for this reason, the resource has little value for other purposes. Further, in the case of the Refinery, they state that even if saline intrusion into the aquifer were to occur, seawater is enriched in electron acceptors that promotes the natural attenuation of dissolved phase hydrocarbons. They therefore conclude that the saline intrusion could be considered beneficial, in that it would reduce the source of aquifer contamination.

4.4 Air Quality Effects

Mr Richard Chilton of Tonkin and Taylor (**'T&T'**) has considered the actual and potential effects of the Proposal on air quality. A full copy of Mr Chilton's Air Quality Assessment[113] (**'AQA'**) is contained within **Annexure 3** of this AEE. The key environmental effects associated with the Proposal in relation to Air Quality are outlined in this section of the AEE. The Air Quality effects have been classified in relation to the following emissions:

- Combustion Emissions;
- Fugitive Emissions;
- Odour Emissions; and
- Dust Emissions.

We now discuss the actual and potential effects in relation to each of these emissions in turn.

4.4.1 Combustion Emissions

4.4.1.1 Sulphur Dioxide

Mr Chilton advises that the air quality effects of the Site's combustion emissions have been assessed using both dispersion modelling and a review of ambient air quality data for SO_2. The model used in Mr Chilton's assessment predicted maximum 1-hour average, 24-hour average and annual average ground level concentrations (**'GLCs'**) due to SO_2 emissions from the Proposal. Mr Chilton notes that the results of the model indicated that the greatest impacts in terms of SO_2 emissions occur immediately west of the Site boundary over the adjoining industrial land, and also on the opposite side of the Whangārei Harbour when the plumes can be seen as impacting on the elevated terrain. Mr Chilton states that the peak predicted 24-hour average concentration occurs at the immediate west boundary of the Site (73µg/m^3) and then decreases rapidly with distance. In addition, Mr Chilton advises that when the results for SO_2 are evaluated against the assessment criteria of the AQA, the potential adverse effects can be considered as less than minor for the most impacted sensitive location. A comparison between the predicted SO_2 GLCs and assessment criteria is shown in the table below:

Location	Averaging Period	Maximum offsite GLC (µg/m^3)	Cumulative offsite GLC (µg/m^3)[114]	Assessment Criteria (µg/m^3)
Most impacted off-site location	1-hour	330	[25] 355	570/350[115]
	24-hour	73	[7] 80	120
	Annual	3.3	[1] 4.3	10
Most impacted sensitive location	1-hour	230	[25] 255	570/ 350
	24-hour	60	[7] 67	120
	Annual	2.5	[1] 3.5	10

Table 4.4.1.1.1: *A comparison between the predicted SO_2 GLCs*

4.4.1.2 Particulate Matter

PM_{10}[116]

Mr Chilton has focussed his assessment of particulate matter emissions on PM_{10} for the known adverse health effects caused by inhaling fine particulate matter. Mr Chilton records that the predicted pattern of impacts for PM_{10} is similar to that of SO_2. Mr Chilton states that peak impacts occur to the immediate west of the Site boundary over the adjoining industrial land, with elevated levels also occurring on the opposite side of the Harbour where the plumes impact against elevated terrain, such as Mount Aubrey and Mount Mania. Mr Chilton states that predicted maximum off-site 24-hour average PM_{10} GLC is approximately 12 µg/m^3 to the immediate west of the Site boundary and that predicted concentrations reduce rapidly with increasing distance. Mr Chilton considers that the predicted annual average

[113] Chilton, R. Tonkin & Taylor Limited, *Air Quality Assessment*. Dated June 2020
[114] Site discharges plus background. Background concentrations in square brackets
[115] The NESAQ for 1-hour average SO2 includes a concentration of 570 µg/m^3 that must not be exceeded, and a concentration of 350 µg/m^3 that can be exceeded up to nine times in a calendar year
[116] Particulate matter less than 10 microns in diameter.

concentrations are very low, with the most impacted location being immediately to the west of the Site boundary reaching 0.3 µg/m^3, with an annual average background concentration of 15 µg/m^3 therefore cumulatively reaching 15 µg/m^3. Mr Chilton states that on the opposite side of the Harbour, concentrations are lower reaching approximately 0.2 µg/m^3 over Mount Manaia and with levels varying between 0.09 and 0.15 µg/m^3 over Marsden Bay, One Tree Point, Marsden Community Centre and Ruakaka. Mr Chilton states that allowing for an annual average background concentration of 15 µg/m^3, cumulative concentrations will not approach the AAQG[117] PM_{10} annual average concentration value of 20 µg/m^3. Mr Chilton notes further, that when these results for PM_{10} are evaluated against the relevant assessment criteria within the framework set out by the IAQM[118] 2009, that the potential adverse effects can be considered as less than minor for the most impacted sensitive location.

$PM_{2.5}$ [119]

According to Mr Chilton the distribution of $PM_{2.5}$ GLCs is the same as that of PM_{10}. He further advises that predicted annual average $PM_{2.5}$ concentrations are very low, with the most impacted location being immediately to the west of the Site boundary reaching 0.3 µg/m^3. Mr Chilton records that the annual average background cumulative concentration of $PM_{2.5}$ is 5.6 µg/m^3, meaning that cumulative $PM_{2.5}$ levels will not approach the World Health Organisation ('**WHO**') guideline of 10 µg/m^3. Mr Chilton concludes that when the above results for $PM_{2.5}$ are evaluated against the relevant assessment criteria within the framework set out by the IAQM (2009), the potential adverse effects can be considered as less than minor for the most impacted sensitive location.

Nitrogen Dioxide

Mr Chilton records that the greatest impacts concerning nitrogen dioxide occur immediately west of the Site boundary over the adjoining industrial land and also on the opposite side of the Whangārei Harbour, where the plumes can be seen as impacting against the elevated terrain. He states further that model predictions of the annual average NO_2 concentrations are very low (maximum off site concentration of 3 µg/m^3 and 1ug/m^3 at the most impacted sensitive location). With a background concentration of 4 µg/m^3, Mr Chilton concludes that the cumulative concentrations will not approach the WHO guideline[120] of 40 µg/m^3. Mr Chilton also records that when the modelling results for NO_2 are evaluated against the relevant assessment criteria within the framework set out by the IAQM (2009), that the potential adverse effects can be considered as less than minor for the most impacted sensitive location.

Carbon Monoxide

Mr Chilton advises that the cumulative effects of carbon monoxide ('**CO**') that are discharged from the Refinery are extremely low relative to the assessment criteria. Given this result, he deduces that the spatial distribution of impacts is similar to those presented for the other contaminants, described above. Mr Chilton concludes that when the above results for CO are evaluated against the relevant assessment criteria within the framework set out by the IAQM (2009), the potential adverse effects can be considered as negligible for the most impacted sensitive location.

Dioxins & Furans

Mr Chilton indicates that the resulting concentrations of dioxins and furans are compared against the OEHHA guideline[121] of 40 pg/m^3.[122] Mr Chilton then emphasises that the model predictions, which are considered to be very conservative, due to the emission assumptions,

[117] MfE, *National Ambient Air Quality Guidelines*. Dated 2002, https://www.mfe.govt.nz/air/air-guidance-and-wood-burners/ambient-air-quality-guidelines

[118] IAQM 2009. Significance in air quality. Institute of Air Quality Management

[119] Atmospheric particulate matter (PM) that have a diameter of less than 2.5 micrometers, which is about 3% the diameter of a human hair

[120] WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulphur dioxide. Global Update 2005

[121] OEHHA 2016. Acute, 8-hour and chronic reference exposure levels. Office of Environmental Health Hazard Assessment as of June 2016, California. Accessed May 2019. https://oehha.ca.gov/air/general-info/oehha-acute-8-hour-and-chronic-reference-exposure-level-rel-summary

[122] A unit of mass equal to 0.000 000 000 001 grams

indicate very low concentrations relative to the guideline. Accordingly, he concludes that it is considered that the potential adverse effects from dioxin and furan air discharges are negligible.

Metals

Mr Chilton states that when the results of modelling and analysis for the various metals, excluding nickel, are evaluated against the relevant assessment criteria with the framework set out by the IAQM (2009), the potential adverse effects can be considered as less than minor for the most impacted sensitive location. With regard to nickel, Mr Chilton states that the predicted exceedances of the 8-hour average OEHHA guideline results in adverse effects that are less than minor.

Nitrogen & Sulphur Deposition

Mr Chilton advises that nitrogen and sulphur deposition have been modelled to inform the terrestrial ecological assessment. He records that both wet and dry deposition were modelled, and the combined total deposition rates determined. He goes on to state that when added to a background accumulation rate of 1.15 kg/ha/yr, deposition rates are low relative to the assessment criteria of 10 kg/ha/yr.

Mr Chilton records that unlike nitrogen deposition, there is no direct criteria that the cumulative sulphur deposition rates are compared against. That said, he advises that he does not consider them to have any adverse air quality effects which require further characterisation and/or assessment. He also records that the different spatial distribution of nitrogen and sulphur deposition is worth noting. He advises further that in the case of sulphur deposition, the effect of wet deposition is much more pronounced, particularly for sulphate particles.

4.4.2 The Flare

Mr Chilton notes that the assessment of the impacts of emissions from the flare have been treated separately from the other combustion sources. Mr Chilton explains that this assessment was undertaken separately due to the significant variability in the operation of the flare and that different model inputs are required for characterising a flare discharge compared with a normal stack source. Mr Chilton, in his assessment, modelled emissions of SO_2 from the operation of the flare at the Site using as a screening model -SCREEN3,[123] which includes a provision for modelling flare sources where a high heat release occurs. Mr Chilton notes that as a screening model, the results from SCREEN3 were generally expected to be conservative. The model used by Mr Chilton in his assessment has three input parameters:

- Flare stack height - represented in metres (m);
- Total heat release rate - represented as calories per second (cal/s); and
- SO_2 emission rate - represented as grams per second (g/s).

Mr Chilton states that the SO_2 emission rate is derived from the content of hydrogen sulphide (H_2S) in the flare gas and gas flow rate to the flare (assuming that all H_2S is oxidised to SO_2 when combusted). Mr Chilton modelled five scenarios of different flow rates of gas to the flare; the results were outputted as a predicted 1-hour average SO_2 GLCs at varying distances from the flare source (see **Figure 4.4.2.1.**)

[123] Which is an air quality dispersion screening tool

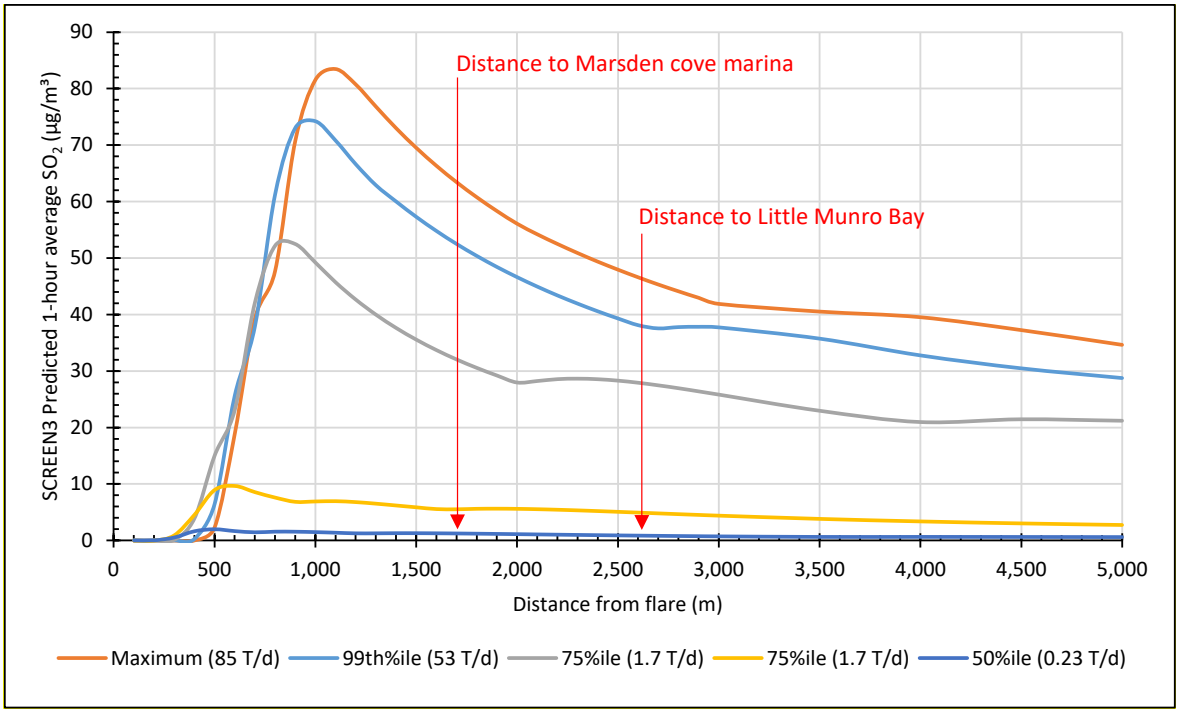

Figure 4.4.2.1: *Predicted 1-hour average SO_2 GLCs due to flare emissions varying by gas flow rate to flare. (Model results do not include contribution from other site sources).*

Mr Chilton considers the peak 1-hour average SO_2 concentrations for all scenarios occurring at least 500 m from the flare have predicted concentrations within the first 500 m of no more than 10 to 15 µg/m³. This leads Mr Chilton to consider that it is unlikely that emissions from the flare will contribute significantly to predicted peak off-site concentrations at the western boundary of the Site due to combustion emissions from the main stacks.

Mr Chilton states that the scenarios representing the large gas flow rates to the flare, give rise to peak impacts that are in the order of 900 m to 1 km from the flare, with concentrations between 50 and 85 µg/m³. Mr Chilton notes that this is beyond the distance where peak SO_2 impacts, due to the main combustion stacks, it is expected to occur (at the eastern Site boundary). At this distance from the flare, the worst case 1-hour average concentration due to stack discharges is approximately 250 µg/m³ (including background), the ambient air quality standard for SO_2 has a threshold concentration in an airshed of 350 µg/m³. Mr Chilton therefore states that adding the predicted 1-hour average SO_2 concentration of up to 85 µg/m³ due to flare emissions, would not result in an exceedance of the NESAQ for SO_2.

4.4.3 Cumulative Effects of the Emissions from Ships at Berth

Mr Chilton outlines that the largest ships are associated with the delivery of crude oil. He records that these ships when berthed, use on-board auxiliary engines fired with heavy fuel oil to run pumps that are used to transfer the crude oil from the ship to the Site's storage tanks. He then advises, that the heavy fuel oil contains a relatively high proportion of sulphur, and is therefore a source of SO_2 emissions, which can have cumulative effects together with the SO_2 emissions from the Refinery.

Although no resource consents are required for the berthing of ships at the jetties, Mr Chilton states that it is appropriate to consider the cumulative effects of the discharge of SO_2 from berthed ships. He then records that in order to assess the cumulative effects of ship discharges, dispersion modelling has been carried out to examine the potential impact of emissions from a berthed crude tanker when operating off its auxiliary engine. He notes that in order to evaluate the cumulative impact of shipping emissions, the model results have been added to those for the Refinery. Having done this, he concludes that the cumulative impacts of the discharges (Refinery site plus shipping), are essentially unchanged.

4.4.4 Detailed Evaluation of Ambient SO_2 Monitoring Data

In addition to his modelling analysis, Mr Chilton records that he also considered the ambient SO_2 monitoring data. He conducted an evaluation to examine the possible cumulative impacts of the flare emissions, which are not able to be modelled. Mr Chilton records that the analysis was undertaken in two parts:

i Evaluating the monitoring data in terms of the wind conditions, to confirm that peak SO_2 concentrations are from the direction of the Refinery, jetty and Northport; and

ii Direct comparison of the model results against monitoring results.

Mr Chilton indicated that overall, three plots show measured SO_2 concentrations originating from the direction of the Refinery that are predominantly being transported in average wind speeds between 5 and 10 m/s. He notes that Little Munro Bay recorded higher concentrations than the other two sites in lower wind speed conditions and stated that this may be due in part to its closer proximity to Refining NZ. He states further that this may also be due to the impact of shipping emissions at this location, and the fact that localised impacts of shipping emissions would likely occur at lower speeds than those associated with the Refinery.

Mr Chilton reports that dispersion modelling has been used to assess the potential cumulative effects of SO_2 emissions from the furnace stacks and that the assessment predicts cumulative concentrations for all relevant periods, which will be below applicable assessment criteria. He emphasises that this includes consideration of naturally occurring background concentrations and the effect of shipping emissions associated with the largest class of ship that can be berthed at the Site's Jetty.

As outlined in section 4.4.2 of the AEE, flaring emissions have been separately evaluated by Mr Chilton using a screening model, which predicts peak impacts from the flare to occur at least 500 m from the flare and for large events at a distance of 900 m to 1 km from the flare. Mr Chilton records at these distances, that the peak SO_2 impacts of the flare will not coincide with the peak impacts of the main stack discharges. Mr Chilton notes this is because of the different manner in which flare emissions will disperse in the atmosphere due, to the significant thermal buoyancy effect of the flare.

The results of the modelling according to Mr Chilton generally compare well with (and tend to over-predict) ambient SO_2 measurements from the opposite (northern) side of the bay. Mr Chilton notes a single exception to this exists in terms of 1-hour SO_2 concentrations, which appear to have coincided with a significant flaring event associated with an unplanned shutdown of the hydrocracker. He advises that this event highlights the potential contribution of the irregular and intermittent emissions from the flare. Mr Chilton records that the comparison of modelled and measured SO_2 concentrations shows that the exclusion of flare emissions from the modelling does not result in under-prediction of the impacts on SO_2 concentrations at sensitive locations. This suggests that the impact of intermittent flare emissions is not significant in the context of the overall effects of site discharges and is consistent with the modelling of the flare emissions. He also notes that given the above, there is no barrier in terms of Regulation 21 of the NESAQ[124] to granting resource consent for the ongoing discharge of SO_2 emissions from the Refinery.

4.4.5 Fugitive Emissions

Mr Chilton advises that the key indicator contaminants are the group of Volatile organic compounds (**'VOCs'**)[125] collectively known as BTEX (benzene, toluene, ethylbenzene and xylene). He notes that ambient BTEX concentrations are relatively straightforward to monitor and when measured over a sufficiently long period, provide a robust indication of

[124] A consent authority must decline an application for a resource consent to discharge sulphur dioxide into air if the discharge to be expressly allowed by the resource consent is likely, at any time, to cause the concentration of sulphur dioxide in the airshed to breach its ambient air quality standard.
[125] Compounds that have a high vapor pressure and low water solubility

actual levels of exposure that may be experienced beyond the Refinery Site. Given this, his assessment of the fugitive emissions from the Refinery was based on an ambient monitoring programme that measured concentrations at several key locations surrounding the Refinery. He then goes on to state that the results of the monitoring programme are evaluated against relevant health-based guidelines for BTEX.

Mr Chilton points out that passive BTEX sampling was undertaken for a period of 18 months between 2002 and 2003 and it was evident that BTEX concentrations were well below the relevant air quality criteria for Little Munro and Reotahi, where continuous human exposure is relevant. He goes on to record that reported levels for Mair Road and the Jetty were below relevant guidelines except for benzene. He does, however, note that at these two locations, continuous human exposure is not relevant, given their industrial location, and therefore he concludes that the benzene exceedance of that guideline is not material.

With respect to the more recent programme of ambient monitoring, Mr Chilton notes that when its results are compared with the results for the historic monitoring, the concentrations for benzene at specific industrial sites have noticeably reduced, with monthly concentrations within the AAQG of 3.6 $\mu g/m^3$. Mr Chilton advises that this change from historic levels is likely due to the changes in the fuel quality standards and subsequent measures taken at the Refinery to reduce benzene levels in the fuel that it produces.

In summary, therefore, Mr Chilton's advice is that the historic monitoring of ambient BTEX levels are well below the relevant assessment criteria for the sensitive locations surrounding the Site where annual average exposure is relevant. He reports that the initial results of the 2019 BTEX monitoring programme currently underway, indicate that concentrations are well within the relevant assessment criteria. He draws our attention to the fact that this includes the results for benzene at the nearest industrial locations. He goes on to state that this apparent reduction in benzene is expected to be as a result of changes to the Refinery process to meet current fuel specifications for benzene.

Mr Chilton ultimately concludes that on the basis of the results from the historic and current BTEX monitoring programmes, the fugitive emissions from the Refinery are having a less than minor effect at sensitive locations beyond the Site boundary.

4.4.6 Odour Emissions

Mr Chilton records that the odour effects associated with the Refinery have been assessed qualitatively in line with Ministry for the Environment ('**MfE**') guidance (MfE 2016b)[126]. He notes further that this includes a review of complaint records, wind information conducive to poor dispersion of odours and an objective evaluation of potential odour impacts in terms of the frequency, duration, intensity and offensiveness of impacts at sensitive locations ('**the 'FIDOL' factors**'[127]).

While it could be contended that odour complaints (or a lack thereof) are not conclusive indicators of odour nuisance effects or an absence of those effects, Mr Chilton states that the record of odour complaints and confirmed incidences of offensive or objectionable odour can provide a broad indication of odour nuisance experienced near existing operations. Mr Chilton notes that records of the frequency of odour complaints received by Refining NZ exclude complaints relating to other environmental issues such as noise. He points out that overall, the level of recorded complaints relating to odour since 2015 has been very low for a large heavy industrial complex such as the Refinery, with only 19 complaints being recorded over that period. He goes on to note that the bulk of these complaints were received in 2016 and 2017 and that further analysis of the complaints over this period indicates that not all of the recorded complaints are likely to have originated from the Refinery.

[126] MfE 2016b. Good Practice Guide for Assessing and Managing Odour. Ministry for the Environment. Publication number: ME 1278. https://www.mfe.govt.nz/sites/default/files/media/Air/good-practice-guide-odour.pdf

[127] The potential for offensive or objectionable odour effects can be objectively assessed by considering the FIDOL factors (frequency, intensity, duration, offensiveness/character and location) for locations where odour may be observed.

According to Mr Chilton, the local meteorology has an important role in the dispersion of odours. He highlights that strong winds will act to rapidly disperse and dilute odours, whereas light winds will poorly disperse and dilute odours and are therefore 'worst-case' in terms of odour effects. He reports that most of the light wind is from the upper Harbour (westerly) and carries odour away from most sensitive residential locations. He notes further, that light winds from the east (which could carry odours towards One Tree Point and Marsden Bay) and winds from the southeast through to south (that could carry odours towards Reotahi, Whangārei Heads and Little Munro Bay) are infrequent, which is consistent with the relatively low number of odour complaints from these locations.

Mr Chilton concludes that on balance, given the relatively low level of recent odour complaints, the infrequent light wind conditions that could transport odours towards sensitive locations, and the overall FIDOL analysis, odour effects as a result of discharges from the Refinery can be considered as less than minor.

4.4.7 Dust Emissions

Mr Chilton advises that the potential adverse dust effects associated with the abrasive blasting activities undertaken at the Site, are assessed using a qualitative approach consistent with MfE guidance (2016c)[128]. He draws our attention to the fact that the approach considers the FIDOL factors in terms of the potential impacts at sensitive locations, and considers the published separation distance criteria, relating to dust impacts associated with the activity.

In terms of the assessment, Mr Chilton highlights that there are no sensitive residential locations within a 500-m radius of the Site infrastructure in which abrasive blasting may be undertaken, although he does note that users of the beach adjacent to the Refinery may be downwind on occasion. He states that the only other activities within this distance are the port and the Carter Holt Harvey plant, but that these are considered to have low sensitivity to dust impacts and will, in themselves, be a source of dust in the wider environment.

In summary, Mr Chilton notes that, given the consideration of the FIDOL factors, the potential for dust nuisance effects is very low, primarily as a function of there being no sensitive human receptors near to the Refinery. He records further that there is the potential for impact on the marine environment through possible contamination of marine sediments resulting from wind-blown deposition of dust. However, he states that this can be avoided by managing blasting activities near the coast and avoiding blasting during winds that could carry material into the marine environment. In conclusion, Mr Chilton advises that the potential adverse air quality effects associated with abrasive blasting at the Site can be managed in a manner that will ensure that effects are less than minor. He goes on to record that this is on the basis that standard industry good practice measures are used to minimise dust emissions, including the use of low silica blasting media.

4.4.8 Mitigation & Monitoring

We now discuss the mitigation and monitoring advice that Mr Chilton offers.

4.4.8.1 Mitigation

Mr Chilton ultimately concludes that except for blasting discharges, no mitigation (beyond that which is already being undertaken) is needed. He states that marine sediments resulting from wind-blown deposition of dust can be mitigated by managing blasting activities near the coast and avoiding blasting during winds that could carry material into the marine environment.

With respect to the mitigation of combustion emissions from the Site, Mr Chilton records that this is already achieved through dispersion of emissions from the Site's tall discharge stacks. He outlines that this is combined with the management of sulphur containing fuels to manage SO_2 emissions daily, to stay within consent limits and avoid excessive discharges. He further

[128] MfE 2016c. Good Practice Guide for Assessing and Managing Dust. Ministry for the Environment. Publication number: ME 1277

notes that the routine maintenance of the combustion plant is also undertaken to ensure efficient combustion conditions that minimise particulate matter discharges.

Mr Chilton states that the installation of flue gas desulphurisation to reduce SO_2 emissions is a control measure that can be employed for new discharge sources and where necessary, to manage potential adverse effects. However, according to Mr Chilton this measure is not considered practicable for an existing plant of the scale and nature of the Refinery where the environmental effects of SO_2 emissions relative to the assessment criteria are considered less than minor.

4.4.8.2 Monitoring

Refining NZ currently undertakes ambient monitoring of SO_2 at three locations on the opposite side of the Whangārei Harbour, and Mr Chilton recommends that this monitoring continues.

In addition to ambient monitoring Mr Chilton notes that Refining NZ undertakes routine stack emission monitoring at nine-month intervals for the purpose of quantifying SO_2, total suspended particulate matter ('**TSP**'), and nitrogen ('**NO_X**'). He recommends that this stack monitoring continue to occur, albeit that the monitoring of TSP be replaced with the monitoring of PM_{10}.

Mr Chilton notes that the opacity (smokiness) of emissions from the stacks, where liquid fuel (fuel oil or asphalt) is used for firing furnaces, is measured continuously in line with existing resource consent requirements. He goes on to record that the Site also undertakes monitoring to determine overall site SO_2 emissions based on a mass balance approach that accounts for fuel burned and the sulphur content of that fuel. He indicates that this is linked to an annual average daily SO_2 emission rate, and that Refining NZ seeks to continue this monitoring requirement.

Mr Chilton states that the historic monitoring of ambient BTEX levels were well below the relevant assessment criteria for the sensitive locations surrounding the site where annual average exposure is relevant. He records that at the two industrial monitoring sites benzene concentrations were below the then ambient air quality guideline (10 $\mu g/m^3$ annual average) but would be above the current guideline level of 3.6 $\mu g/m^3$ (annual average). However, he highlights that continuous exposure over a year would not occur at these locations given the industrial nature of the site and that people would not reasonably be present for 24 hours per day and 365 days per year.

Mr Chilton advises that the preliminary results of the 2019 BTEX monitoring programme currently underway indicates concentrations that are well within the relevant assessment criteria. He notes that this includes the results for benzene at the nearest industrial locations and that this apparent reduction in benzene is expected to be as a result of changes to the Refinery process to meet current fuel specifications for benzene. He then concludes that on the basis of the results from the historic and current BTEX monitoring programmes, it is determined that fugitive emissions from the site are having a less than minor effect at sensitive locations beyond the site boundary. Given this, Mr Chilton advises that the BTEX monitoring should continue.

4.5 Water Quality / Water Chemistry Effects

Dr Mike Stewart of Streamlined Environmental Limited has considered the actual and potential effects of the Proposal on water quality / water chemistry. A full copy of Dr Stewart's Water Quality Assessment[129] is contained within **Annexure 3** of this AEE. We now summarise Dr Stewart's advice as follows:

[129] Stewart, M. Streamlined Environmental Limited, *A Water Quality Assessment at Marsden Point Oil Refinery to Inform Resource Consent Renewal Applications*. Dated July 2020

4.5.1 Modelling

Dr Stewart advises that the hydrodynamic modelling conducted consisted of running year-long simulations within two contrasting historical contexts (El Niño/La Niña episodes), actual events and extreme events. Additionally, Dr Stewart notes that the hydrodynamic modelling considered two scenarios:

- an 'existing' scenario, based on the actual bathymetry of the Harbour, and;
- a 'reclaim' scenario, with an additional proposed berth at Northport (known as Berth 4) and an alternative lower Whangārei Harbour channel design.

Dr Stewart states that only results for the existing scenario are discussed in his report as the reclaim scenario results were virtually identical. Dr Stewart explains that time series of dilutions[130] of the SWB discharge for each scenario were extracted from the model at specific locations. He records that the hydrodynamic modelling revealed that some of the sites of interest are in shallow water, especially those sites close to the coastline which can even be dry at times. Dr Stewart notes that contaminant concentrations are averaged over water depth at each site, which can result in contaminant concentration spikes during periods of low water level. Dr Stewart details that further modelling of the dilutions in the top and bottom metre of water has been undertaken at all sites to better understand the dilution profile at shallow sites, and how this may affect biota at the surface (e.g. mussels attached to rocks) or on the sea floor (benthic organisms).

4.5.2 Assessment of effects on water quality

4.5.2.1 Traditional Contaminants

Dr Stewart advises that for all SWB discharges under the normal-case scenario, all traditional contaminants had a receiving environment risk quotient less than one at all receiving environment sites. He points out that generally, the risk quotients under this scenario were orders of magnitude less than one, indicating a negligible effect on water quality at the edges of and outside the mixing zone.

Dr Stewart notes that under worst-case scenario modelling, ammoniacal nitrogen (**'NH_4-N'**) and FC are the only contaminants in the SWB that may potentially lead to adverse ecological effects outside the mixing zone.

According to Dr Stewart, NH_4-N in the SWB appears to have a negligible effect on water quality outside the mixing zone most of the time. However, he indicates that for a small portion of the time (5%), NH_4-N concentrations at sites outside the mixing zone may temporarily exceed water quality limits. He emphasises that these water quality limits are designed to assess effects from eutrophication and are usually based on annual median data). He then concludes that any short-term increase in NH_4-N concentrations are unlikely to lead to increased risk of eutrophication due to their short duration.

Dr Stewart sets out that under the worst-case scenario, there are a few sites that indicate that the FC risk quotients marginally exceed 1, with the greatest risk quotient being 2.2. He states that the large concentrations of FC were sporadic, occurring approximately once per year. He also notes that these spikes are attributed to a nesting colony of red-billed gulls which inhabit the SWB every summer, with up to 2,000 nesting pairs.

4.5.2.2 Process Chemicals

The Refinery uses a multitude of process chemicals as part of the operation of the plant. Dr Stewart records that of the 18 formulations assessed, 13 are in use every day, two have been associated with spill events, two are used in the Refinery shutdown and one is used for fire training at the Refinery on a routine, but infrequent basis. He notes that of the everyday use process chemicals, six formulations showed a negligible ecotoxicological risk which obviates the need for further receiving environment dilution. Dr Stewart records that for the

[130] Dilution is the process in which a chemical in an ecosystem becomes less concentrated and there is a decrease in the concentration of a solute in solution, usually simply by mixing with more solvent (such as water)

remaining eight everyday use process chemicals, dilution in the receiving environment was sufficient to reduce the risk quotient to less than one.

Dr Stewart records that Cortrol OS7780 may be causing more than minor effects outside the mixing zone. However, he states that Cortrol OS7780 is in the process of being replaced by a more benign alternative formulation, being Cortrol OS5614. Dr Stewart notes that this replacement will lead to a net result of the removal of the toxic component of Cortrol OS7780 (1,4-Benzoquinone) and a negligible increase to the current background concentration of NH4-N in the SWB and receiving environment.

Dr Stewart states that the process chemicals used in the Refinery shutdown led to negligible risk of ecological effects in the receiving environment. He notes that there is a very low chance that diethanolamine could have had short-term (less than 48-hour) minor ecological effects. Dr Stewart goes on to note that the accidental spill of Diisopropanolamine (**'DIPA'**)[131] over a period of five days in May 2018, if unmanaged may have led to short-term more-than-minor ecological effects outside the mixing zone. However, he points out that the ecological effects threshold is extremely conservative, and it is highly unlikely that there were any acute ecotoxicity effects in the receiving environment as a result of the one-off DIPA spill. Dr Stewart reports that ADIP-X[132] spills are infrequent, with the largest spill over the last 15 years being 100 L. In considering the largest spill, he concludes that this scenario, may have led to short-term more-than-minor ecological effects outside the mixing zone. Again, he notes however, that the ecological effects threshold is extremely conservative, and that it is highly unlikely that there were any acute ecotoxicity effects in the receiving environment, as a result of the ADIP-X spill. Dr Stewart states that the fire training foam Solberg DoD3155 is used on a routine but infrequent basis at the Refinery. He highlights that a marginal ecological risk was presented under the normal-use scenario but worst-case dilution in the receiving environment. He deduces that the causative chemical in the formulation cocoamido propyl betaine (**'CPB'**) is readily biodegradable, and as the risk assessment is highly conservative and does not account for biodegradation. Dr Stewart states that CPB will lead to negligible adverse effects on the marine receiving environment.

4.5.3 Cumulative Effects

Dr Stewart revisited his assessment in order to address the concerns that PTB raised in the CEA regarding the cumulative effects of the Proposal. Dr Stewart states that the cumulative effects on the receiving environment from all sources are low with good water, sediment and shellfish quality in Whangārei Harbour. He notes further the maximum dilution required to reduce the toxicity of the SWB discharge water to a no-toxicity threshold is 256x, which is the worst-case scenario for the most sensitive marine species (blue mussel larvae). Dr Stewart states that his analysis of time series data shows that the dilution at mixing zone and receiving environment sites is greater than 256x for 99% of the time. He notes that whole effluent testing of the SWB integrates all contaminants against relevant marine species and that the marine ecology assessments are carried out on a worst-case scenario basis. Dr Stewart notes that although some contaminants in the Refinery SWB have the potential to bioaccumulate, there is no evidence of bioaccumulation to higher trophic species levels. He also notes that process chemicals present in the SWB have extremely low bioaccumulation potential. Dr Stewart explains that any chemical with a bioaccumulation concentration factor (**'BCF'**) >1000 is likely to bioaccumulate. He records that the process chemicals that enter the SWB before being discharged to the receiving environment, have a BCF that ranges from 1 to 4, so they do not bioaccumulate.

4.5.4 Conclusion

Overall Dr Stewart considers the discharges of most contaminants from the Refinery SWB to have a less than minor effect on water quality in the marine receiving environment outside the current mixing zone. He notes that only a few contaminants may exhibit no more than minor and transitory effects, including:

[131] a chemical compound with the molecular formula used as an emulsifier, stabilizer, and chemical intermediate
[132] The Adip-X process is a regenerative amine process, highly suitable for bulk and deep removal of carbon dioxide from gas streams. The process uses aqueous solutions of the tertiary amine, methyldiethanolamine and an additive

- NH_4-N;
- FC; and
- the every-day process formulation of Cortrol OS7780 (soon to be replaced by Cortrol OS5614)

4.6 Marine Ecology Effects

Dr Sharon De Luca together with Dr Phillip Ross have considered the actual and potential effects of the Proposal on marine ecology. A full copy of their Marine Ecology Assessment[133] is contained within **Annexure 3** of this AEE. We now summarise the advice of Dr De Luca and Dr Ross.

4.6.1 Process Chemicals

Dr De Luca and Dr Ross state that the majority of process chemicals used at the Refinery on a daily basis will have a negligible effect on the ecology of the receiving environment. Dr De Luca and Dr Ross note, however, that under worst-case dilutions and event scenarios (up to 5% of the time) and under least favourable conditions Cortrol OS7780 may cause more than minor transitory effects outside the mixing zone. Dr De Luca and Dr Ross go on to note that Cortrol OS7780 is a dissolved oxygen scavenger/metal passivator used in the western AOC trench and that it does not come into contact with petroleum hydrocarbons as part of the refining process.

Dr De Luca and Dr Ross record that as a mitigation measure, Cortrol OS7780 is in the process of being replaced by Refining NZ with an alternative formulation (Cortrol OS5614). They highlight that the use of Cortrol OS5614 will lead to a minor increase (0.048 mg/L) in NH_4-N to the SWB. Further, Dr De Luca and Dr Ross state that under a normal-case scenario (i.e. most of the time), the additional NH_4-N load from Cortrol OS5614 is likely to have a negligible effect on water quality at the edges and outside of the mixing zone.

Dr De Luca and Dr Ross set out that other process chemicals used on a daily basis have been assessed as having a negligible effect on water quality (including Embreak 2050, Optispearse ADJ5150, Embreak 2021, Spectrus NX1100, Inhibitor AZ8104, BetzDearborn, Crystalfloc Cationic Emulsions, Genguard GN8220, Spectrus BD1501E and Optisperse HP2650). They note that the risk is negligible in the SWB, even before allowing for partitioning into oil or for dilution in the receiving environment.

In relation to accidental spills, Dr De Luca and Dr Ross record that the effects of an accidental spill of DIPA[134] would not be considered acutely toxic to fish, invertebrates or algae. They note that an accidental spill of ADIP-X[135] that occurred within the past 15 years, is considered by Dr Stewart as highly unlikely to have resulted in any acute ecotoxicity in the marine receiving environment. Dr De Luca and Dr Ross further note that Refining NZ are currently reviewing and improving the process for mitigating the effects of an accidental spill. This involves stopping the flow of wastewater and recycling through the biotreater before discharge to the SWB. Of the chemicals that are used infrequently at the Refinery, Dr De Luca and Dr Ross note that a fire-fighting foam (Solberg DoD3155) which contains CPB is used at the fire training ground. Dr De Luca and Dr Ross highlight that the report authored by Dr Stewart[136] states that the effects on marine organisms from the infrequent discharge of CPB would be negligible.

In conclusion, Dr De Luca and Dr Ross state that the magnitude of effect of the routine or accidental discharge of process chemicals on marine ecological values is assessed as low, due to the rapid and high dilution afforded by the exchange of water beneath the Refining NZ jetty, low duration of exposure, and low risk to marine organisms.

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[133] De Luca, S., and Ross, Dr P., Boffa Miskell, *Assessment of Effects on Marine Ecological Values- Reconsenting of discharges and structures in the CMA*. Dated July 2020

[134] Base for fatty acid soaps used in polishes, textiles, cutting oils, and insecticide emulsions

[135] a gas removal solvent containing methyldiethanolamine used on the western AOC trench

[136] Stewart, M. Streamlined Environmental Limited, *A Water Quality Assessment at Marsden Point Oil Refinery to Inform Resource Consent Renewal Applications*. Dated July 2020

4.6.2 Discharge of Treated Stormwater & Wastewater

Dr De Luca and Dr Ross advise that modelling and subsequent contaminant concentration calculations indicate that, at the worst-case sites where data was extracted, contaminants contained in discharges from the diffuser, the diffuser bypass and the spillway, are rapidly diluted to below effects thresholds.

They further note that median contaminant concentrations for actual and extreme rainfall events plus the El Niño and La Niña were less than 1% of the SWQG[137] values, which they record, strongly indicate that no effects on marine ecological values are expected. Dr De Luca and Dr Ross then record that maximum contaminant concentrations for actual and extreme rainfall events plus the El Niño and La Niña were significantly below SWQG, with all measured contaminants at concentrations less than 10% of the SWQG. In addition, Dr De Luca and Dr Ross note that the discharge of process chemicals (either daily use or rare accidental discharge) has been assessed by Dr Stewart as having negligible effects on marine organisms.

Dr De Luca and Dr Ross state that three suites of ecotoxicology tests were carried out on water collected from the SWB. These tests indicate that very low dilution (1-9 times) is required to avoid adverse effects on the sensitive test organisms. They note that the exception is blue mussel larvae. Dr De Luca and Dr Ross state in one of the three SWB samples tested, a dilution of 256 times was required to avoid effects on blue mussel larvae. They note that the hydrodynamic modelling data indicates that there are times (based on the 5 percentile) when dilution of discharges from the diffuser can be below 256 times outside of the mixing zone (e.g. the south-east mixing zone boundary, west of Marsden Bank, and Mair Bank). Dr De Luca and Dr Ross state that the modelling and ecotoxicology studies indicate that under certain circumstances, bivalve larvae (or larvae of other sensitive species) could be exposed to SWB water at less than 256 times dilution and adverse effects on those individuals could occur. However, Dr De Luca and Dr Ross state that the duration of exposure to less than 256 times dilution is only 1-3 hours based on the timeseries modelling. Dr De Luca and Dr Ross therefore state that it is anticipated that there would be no adverse effects on organisms at a population level. They consider that the effects on marine ecological values are not expected to be greater than negligible. Dr De Luca and Dr Ross also record that the ecological values at the south-east mixing zone boundary and Mair Bank are high, which indicates that adverse effects on the assemblages are unlikely to be occurring, or at least, not having an adverse effect on marine ecological values as a whole.

Further, Dr De Luca and Dr Ross note that the impact of discharged suspended sediment and potential for the discharge of process chemicals is also expected to have negligible to low adverse effects on marine ecological values respectively.

Dr De Luca and Dr Ross confirm that data indicates contaminant concentrations in the proposed mixing zone are below the effects threshold. Further, Dr De Luca and Dr Ross note that sediment quality and benthic invertebrate assemblages (at all sites within and adjacent to the Refining NZ jetty, including the south-east mixing zone boundary, Marsden and Mair Banks) are in good health. They set out that this is consistent with the timeseries data from the hydrodynamic modelling of dilution which shows that there are no adverse effects brought about by the discharges of treated stormwater and wastewater from the Site. Dr De Luca and Dr Ross therefore conclude that the magnitude of effect of the discharge of treated stormwater and wastewater is negligible to low, and that in combination with high marine ecological values, the level of ecological effect is determined to be very low to low (which in RMA planning terminology is negligible to less than minor).

4.6.3 Discharge of Uncontaminated Seawater

Dr De Luca and Dr Ross describe the discharge of uncontaminated warm seawater to the marine receiving environment from the service pump that maintains pressure in the fire main, and from the cooling of diesel pumps and overpressure valves when the firefighting system is

[137] Surface Water Quality Guideline (SWQG) is a numerical concentration or narrative statement which is recommended to protect a specific use of water. All water contaminant concentration triggers are collectively referred to as surface water quality guidelines

activated. They state that seawater used in the service pump is discharged at approximately ambient temperature, whereas cooling water from intermittent use of diesel engines is discharged at temperatures above an ambient level. They go on to note that the discharge of uncontaminated seawater is assessed as having a negligible magnitude of effect on marine ecological values, as the rapid dilution beneath the Refining NZ jetty will quickly return discharged water to ambient temperature (in the intermittent situation where cooling water has elevated temperature on discharge). In addition, they conclude that the magnitude of effect of the discharge of uncontaminated seawater is negligible and in combination with high marine ecological values, the level of effect is determined to be very low (which in RMA planning terminology is also negligible).

4.6.4 Structures within the CMA

Dr De Luca and Dr Ross state that the jetties occupy approximately 33 m^2 of benthic habitat. In addition to the jetties, Dr De Luca and Dr Ross note that Refining NZ has breasting and mooring dolphins that are needed for the mooring of vessels visiting the Refinery, which occupy approximately 110m^2 of benthic habitat. They state that the benthic substrate is medium-coarse sand, has a relatively high diversity and abundance of benthic organisms and is assessed as having a high ecological value.

Dr De Luca and Dr Ross record that the area of Whangārei Harbour is 101.5 km^2, and that the jetties and dolphins only occupy 0.00014% of it. They also note that, at the scale of the mouth of the Whangārei Harbour (as opposed to the entire Harbour), the area occupied by the jetty structures and dolphins remains very small (approximately 0.01%). While occupying the high value benthic habitat, Dr De Luca and Dr Ross note that the structures provide additional hard shore habitat for sessile organisms. They advise that the invertebrate assemblages that occupy the structures are diverse and of high ecological value.

Dr De Luca and Dr Ross conclude that the magnitude of effect of the structures (jetty and dolphins) being located on / in benthic soft sediment habitat within Whangārei Harbour is assessed as negligible. Further, they state that in combination with high marine ecological values, the level of effect is determined to be very low (which in RMA planning terminology is negligible).

4.6.5 Cumulative Effects

Dr De Luca and Dr Ross emphasise that Whangārei Harbour and Bream Bay receive a range of discharges from non-point source and point source locations, including but not limited to Northport and urban stormwater discharges (many of which are untreated) and wastewater from the Whangārei wastewater treatment plant. They note that wastewater is also likely to be discharged to the marine receiving environment from the Ruakaka wastewater treatment plant in the future.

In addressing Refining NZ's discharges, Dr De Luca and Dr Ross state that the Company's treated stormwater and wastewater discharges are into an area of high tidal flow, with rapid dilution occurring. They advise that the effect of the discharges adds to the background stormwater discharges, wastewater discharges and other runoff, however note, that because of the hydrodynamic characteristics of the discharge location(s), discharges are rapidly diluted to below effects thresholds. Dr De Luca and Dr Ross consider that the discharges from the Refinery are unlikely to contribute to a more than negligible cumulative effect on marine ecological values in Whangārei Harbour or Bream Bay, which, they state, is supported by the presence of diverse marine intertidal and subtidal soft and hard-shore communities.

Dr De Luca and Dr Ross advise that the magnitude of contribution to cumulative effect of the discharge of treated stormwater and wastewater is assessed as negligible. They note that in combination with high ecological values, the level of effect is determined to be very low (which in RMA planning terminology is negligible).

In terms of effects to the benthic habitat, Dr De Luca and Dr Ross record that occupation of a small area of benthic habitat for jetty piles / piers and dolphins adds to the cumulative loss of habitat within the Harbour from structures and reclamations. However, they indicate that

the area occupied by Refining NZ structures is very small and will have a negligible cumulative effect on the functioning of the Harbour.

Dr De Luca and Dr Ross conclude that the magnitude of contribution to cumulative effect of occupation of the benthic habitat by jetty piles / piers and dolphins is assessed as negligible. They then add that in combination with high ecological values, the level of effect is determined to be very low (which in RMA planning terminology is negligible).

4.6.6 Summary of Potential Marine Ecology Effects

According to Dr De Luca and Dr Ross, if water quality and sediment quality at and adjacent to the Refining NZ jetty discharges, or in areas where the discharge is moved to by current and tidal exchange was low, we would expect to see benthic invertebrate assemblages that are dominated by tolerant species. Dr De Luca and Dr Ross state that both water quality and sediment quality are high, and the benthic invertebrate assemblages are diverse and abundant. Further, they state that there is no evidence of adverse effects on marine ecological values within the receiving environment.

Dr De Luca and Dr Ross state that of the potential effects assessed, being the discharge of treated stormwater and wastewater, the discharge of uncontaminated seawater, occupation of the seabed and the cumulative effects of discharges and occupation, were all found to have a negligible or low magnitude of effect. They note that this is based on the robust data collected and data analysis. Dr De Luca and Dr Ross record that the marine environment has high ecological values, and conclude that, with the overall level of effect being low or very low, avoidance or mitigation is not required. Further, they note that there is no evidence of adverse effects on marine ecological values within the receiving environment.

Dr De Luca and Dr Ross advise that the marine environment has high ecological values and conclude that the magnitude of effect of the proposed discharges and occupation range is very low to negligible and as such, the level of effect of the activities proposed, ranges between low and very low. The conclusions made by Dr De Luca and Dr Ross are summarised in **Table 4.6.6.1** below.

Potential Effect	Ecological Value	Magnitude of Ecological Effect	Level of Ecological Effect	RMA Planning Terminology	Avoidance or Mitigation Required?
Discharge of Treated Stormwater and Wastewater	High	Low	Very Low/ Low	Less than Minor	No
Discharge of process chemicals	High	Low	Low	Less than Minor	No
Discharge of Clean Seawater	High	Negligible	Very Low	De minimis	No
Occupation of the seabed for structures associated with the jetty and dolphins	High	Negligible	Very Low	De minimis	No
Cumulative Effects	High	Negligible	Very Low	De minimis	No

Table 4.6.6.1: *Summary of ecological values, magnitude of effect, and level of effect in EIANZ impact assessment guideline terminology and RMA planning terminology.*

4.7 Avifauna Ecology Effects

Mr Don has considered the actual and potential effects of the Proposal on coastal birds. The assessment specifically focusses on the effects of the wastewater discharges, other discharges of site liquids, air discharges and the Refinery's CMA based structures on coastal birds. A full copy of Mr Don's Assessment[138] is contained within **Annexure 3** of this AEE. We now summarise Mr Don's advice as follows:

Mr Don advises that the effects of the discharges to air from process operations at the Refinery were reviewed with respect to coastal birds in general, while concentrating specifically on the elevated breeding colonies of little shags and pied shags on Motukaroro Island and at Home Point, together with the grey-faced petrel nesting colony within the Bream Bay Reserve. He indicates that no other nesting colonies of either shags or petrels were present in the vicinity of the Refinery at the time of the surveys.

As part of his assessment, Mr Don notes that comprehensive surveys were completed in the context of the CSP. These surveys, together with additional surveys undertaken for the Proposal have been drawn upon to inform Mr Don's conclusions. Mr Don also notes that his assessment draws on the conclusions of the assessments of the independent experts engaged by Refining NZ with respect to marine ecology, water quality and terrestrial ecology (that are also addressed in Section 4.0 of this report).

Mr Don states that the report authored by Dr Tim Martin and Ms Jessica Reaburn[139] concludes that 'concentrations and deposition of pollutants in the air discharges are lower than critical levels and loads at which detectable adverse ecological effects are predicted to occur for all-natural areas within the receiving environment'. Further, he states that T&T[140] within their assessment similarly determined that the ongoing discharges to air from the Refinery will have a less than minor effect on the environment. Mr Don therefore concludes that the effects of the air discharges on coastal birds at all life stages are considered to be less than minor. In addition, he states that there would be no adverse effects on the diversity, abundance or breeding potential of coastal birds within the receiving environment.

According to Mr Don, the water quality conclusion from the Streamlined Environmental report[141] is of particular interest, specifically regarding those birds using Mair Bank for feeding. In this respect, he notes that the SWB water was found to be non-toxic to pipi at almost no dilution. He indicates that Pipi colonising Mair Bank are predated by a nationally significant population of variable oystercatcher as well as other species. Further, he records that there has been a documented decline of the Mair Bank pipi population over the last ten years, the precise cause of which has not been determined. Mr Don states that any changes in the water quality over Mair Bank (including Marsden Bank) would have a negligible effect on coastal birds and concludes that the proposed reconsenting would not change that situation or decrease the significance of the Bank to variable oystercatcher.

Addressing the SWB water discharge effects, a potential area of ponded discharge water at low tide was identified by Boffa Miskell[142] between the shoreline and the edge of Marsden Bank. Mr Don outlines that Boffa Miskell concluded that there could potentially be an adverse effect within a small pooled area, but that that effect would only apply in the case of extended exposure to sensitive life stages (e.g. larval forms) of sensitive species. He notes that that particular pool is within the survey area for coastal birds using Mair Bank and that it is clear from a number of surveys that it is a well-utilised feeding area for coastal birds, especially variable oystercatcher, and if any effects have resulted, they have been less than minor in the context of the Bank's habitat.

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[138] Don, G. Bioresearches Limited, *Coastal Birding Assessment*. Dated June 2020
[139] Martin, T. and Reaburn, J. Wildlands Limited, *Assessment of Ecological Effects for Air Discharges from the Marsden Point Oil Refinery*. Dated June 2020
[140] Chilton, R. Tonkin & Taylor Limited, *Air Quality Assessment*. Dated June 2020
[141] Stewart, M. Streamlined Environmental Limited, *A Water Quality Assessment at Marsden Point Oil Refinery to Inform Resource Consent Renewal Applications*. Dated July 2020
[142] De Luca, S., and Ross, Dr P., Boffa Miskell, *Assessment of Effects on Marine Ecological Values- Reconsenting of discharges and structures in the CMA*. Dated July 2020

Mr Don records that the Boffa Miskell report states that, having addressed the marine ecological effects using a robust database, including the effects of the various discharges, cumulative effects and occupation of the seabed, there is "*no evidence of adverse effects on marine ecological values within the receiving environment*". In considering this, he concludes that the implications to coastal birds are that there will be no adverse effects on the diversity and abundance of their food organisms, and therefore, no effect on the viability of local coastal bird populations or their ability to nest and raise juveniles.

Mr Don advises that the Mooring Dolphins and Refinery Jetty structures provide attractive resting and roosting habitats for a variety of coastal birds. He indicates that the most notable example is the use of the western side of the Refinery Jetty by significant numbers of white-fronted tern, which is an at-risk species. Mr Don therefore concludes that the Refinery structures located within the CMA have an overall positive effect, due to being coastal bird habitat features used by white-fronted tern in particular.

Overall, Mr Don states that based on the detailed assessments of the various independent experts engaged by Refining NZ to consider the effects of the air discharges, wastewater and other liquid discharges; their resulting conclusions regarding existing water and sediment quality, toxicity testing and the occupation of the seabed; and the information gained from the various coastal bird surveys; that the effects of the reconsenting Proposal on coastal birds at all of their life stages is considered negligible. Further, Mr Don notes that there is no demonstrable or predicted effect on the habitat of coastal birds that could adversely affect their feeding, resting, roosting or breeding. He states that the Refinery Jetty and associated structures in the CMA provide well-used roosting habitat which is an overall positive effect. Similarly, Mr Don indicates that there is no evidence that the Refinery complex itself has a significant adverse effect on coastal birds. He concludes that by providing resting, roosting and nesting habitat for species that are considered to be at risk on a national basis, that the Proposal has an overall positive effect. He also advises that no avoidance or remediation measures are required regarding coastal birds and similarly, that no regular monitoring is recommended with respect to the Proposal.

4.8 Marine Mammal Ecology Effects

Dr Clement of the Cawthron Institute has prepared an Assessment of the Effects on Marine Mammals for the Proposal[143], a full copy of which is attached within **Annexure 3** to this AEE. We now summarise Dr Clement's advice below in relation to identified effects.

Dr Clement advises that marine mammals are often referred to as 'marine sentinel organisms' and can be considered as barometers for current ocean health issues. Indeed, for Patuharakeke, regular visits by whales, in particular, to Whangārei are viewed as 'obvious indicators' of both ecological and cultural health and wellbeing[144]. She indicates that with long life spans, high trophic level diets and coastal residency, marine mammals are vulnerable to the bioaccumulation of anthropogenic contaminants. Dr Clement records that measurable amounts of chemical pollutants have been found in virtually every species of marine mammal world-wide. She draws our attention to the fact that once contaminants are retained within an animal, they are not easily eliminated except during pregnancy and lactation, during which, some contaminants can be passed to the offspring.

Dr Clement records that a comprehensive review of pollutant concentrations across Southern Hemisphere marine mammals found that coastal species in higher trophic levels (fish-eating) and those with smaller bodies tend to have greater concentrations of most pollutants. Further, she states that as a result, local marine mammals are often considered when assessing the potential effects of various discharges and/or contaminants on marine ecosystem health. Dr Clement notes that key factors that influence the severity of potential effects from the discharge of contaminants on marine mammals include:

[143] Clement, D. Cawthron Institute Limited, *Marsden Point Refinery Re-consenting: Marine Mammal Assessment of Effects*. Dated June 2020
[144] PTB, *Cultural Effects Assessment Report: Refining NZ Reconsenting*. Dated July 2020

- the type of contaminant;
- the pathways of exposure;
- sensitivity to the contaminant; and
- baseline health.

4.8.1 Types of contaminants

Dr Clement reports that the focus on contaminants of concern for marine mammals has shifted over the decades from heavy metals to legacy pollutants,[145] many of which are known for their endocrine disrupting potential (potential to affect reproductive and/or immune functions). She goes on to state that oil leaks, spills and indirect discharges are also a major concern for marine wildlife and alludes to the fact that the chemicals of concern for marine mammals are not the aromatics, despite their toxicity. Dr Clement explains that the high volatility of aromatics means they are found in large concentrations only immediately after a spill and generally disperse quickly. She goes on to emphasise that the less volatile PAHs are more persistent contaminants with a wide range of adverse effects, including endocrine disruption. She outlines further that more recently, emerging organic contaminants (**'EOCs'**) have become a global focus of concern as little is known about their fate or effects on the environment.

4.8.2 Pathways of exposure

Dr Clement reports that the three main routes of contaminant exposure in cetaceans,[146] as in most animals, are respiratory, dermal, and oral. She also states that some chemical and biological pollutants can concentrate in sea-surface microlayers (appearing as slicks) and/or bind to floating debris that can be directly ingested by coastal marine mammal species. She highlights that due to the aggregating effect of coastal currents and frontal zones, baleen whales may swim through and feed directly on several pollutants. In terms of other species that feed on fish, Dr Clement sets out that exposure to chemical contaminants may occur via the food chain, or indirectly via the skin if they are in close proximity to areas influenced by high levels of industry or agriculture. She also highlights that exposure during critical periods of development for marine mammals can occur via maternal transfer to their young, either via the placenta during gestation, or when young are suckling.

Dr Clement defines bioaccumulation as a process where an organism absorbs and stores a chemical substance (natural or anthropogenic) in its tissues at a higher rate than the substance is broken down or excreted from its body. She advises that high chemical stability and resistance to metabolic degradation means that a range of substances can remain active within the environment through several generations. She draws our attention to the fact that the build-up of pollutants within lower trophic organisms is later passed on in greater concentrations through the trophic levels, a process known as biomagnification. She states that due to biomagnification, continued exposure, and thus storage, of a particular substance within the tissue(s) of an organism, chronic concentrations can occur even when environmental levels of the same substance are low or no longer existent.

Dr Clement stresses that understanding the concentration of a contaminant being discharged into the environment can help with evaluating how likely a species will encounter the contaminant within their habitat at levels of potential concern. She indicates that even with a sound knowledge of effluent quality, predicting the possible exposure of a marine mammal to chemical and biological pollutants and the animal's subsequent response is confounded by many still unknown factors. Hence, Dr Clement points out that there are currently no national or international guidelines used for monitoring contaminant exposure in marine mammals in relation to single sources. She explains that exposure concentration is sometimes used as a broad-scale indicator of the likelihood of lethal effects. However, according to Dr Clement, current best practice for assessing exposure risk in the case of a

[145] Legacy pollutants are generally persistent contaminants that have been left in the environment by sources that are no longer discharging them. As they are very hard to break down and often are not soluble in water, they remain long after the source disappears

[146] a marine mammal of the order *Cetacea* ; a whale, dolphin, or porpoise

discharge is based mainly on the quality of effluent, (i.e. wastewater) or the sediments and water column in the vicinity of an outfall. She states further that the quality of effluent is largely dependent on the original source of the wastewater (e.g. domestic or industrial), the level of treatment (e.g. secondary), final concentrations and persistence of any effluent contaminants (as compared to the most relevant standards or guidelines), and any mitigating factors such as additional dilution via a diffuser and/or dispersion within the receiving environment. She goes on to state that these indicators are then considered against the likelihood of the species' exposure risk. She notes that specific life-history characteristics that potentially increase the degree to which a species might be exposed to discharges include a preference for shallower, inshore waters along urbanised regions, year-round residency within a restricted home-range near to the discharge, or a carnivorous diet based mainly on prey species that are regularly exposed to the discharge .

4.8.3 Susceptibility and baseline health

According to Dr Clement, natural resistance is normally effective enough to protect healthy animals from infectious disease or pollutants until specific immune responses are induced. She notes, however, that when the physiological integrity of an individual is compromised by chronic pollutant levels, particularly during more sensitive life stages (such as during foetal or egg development), this may lead to immune suppression. Dr Clement states that such a condition may lead to outbreaks of disease from pathogens already present in the environment or to pathogens already held by a host under a normal non-stressed situation.

Dr Clement sets out that a comprehensive review of pollutant concentrations across Southern Hemisphere marine mammals found that the species that tended to accumulate the greatest levels of pollutants were mainly smaller ones that inhabited coastal regions and were higher trophic level (fish-eating) animals. She reports that species that are present year-round will be more susceptible to both chronic (small amounts over several different periods) and acute (one large event) exposure than species with seasonal movement patterns. She concludes that species that are in the area to feed or breed will also be more susceptible to contaminants than those that are just traveling through a region.

4.8.4 Assessment of risk

Dr Clement states that predicting the possible impacts of discharge effluents on New Zealand marine mammal species is complex and is based mainly on the quality and type of effluents and the species' expected exposure risks. She states that the assessment of marine ecological values observed invertebrate assemblages (both soft sediment benthic and hard shore species) currently beneath and adjacent to the existing Refining NZ jetty at the point of discharge to be both diverse and abundant. In addition, she states that body burden[147] contaminant levels of shellfish within these locations were also generally found to be low. Within her assessment, Dr Clement outlines that the results of the ecotoxicology testing conducted indicates that different rates of dilution are needed to ensure no toxicological effects on test organisms. Based on the evidence before her, she concludes that the level of effect on marine ecological values from all the various Refining NZ discharge activities range from low to very low.

Dr Clement advises that the marine mammal species with the highest potential exposure are individual bottlenose or common dolphins, leopard or fur seal and orca, and to a much lesser extent, Bryde's, humpback or southern right whales. However, Dr Clement considers that even for these, overall exposure risk from the various Refining NZ discharges is expected to be low. She reports that the most probable pathway for exposure to discharge waters is expected to occur via the food chain (through prey species). However, she notes that those marine mammal species known to visit and travel through the Harbour entrance and associated areas of the modelling domains, tend to be generalist feeders that potentially range and forage throughout the entire Northland coastline and beyond. Additionally, Dr Clement sets out that other visiting species such as whales, do not feed while migrating, while more offshore species feed mostly on deep water prey such as squid. Further, she

[147] The body burden is the total and measurable amount of toxic chemicals and pollutants that have accumulated in the body of a human being since birth

indicates that the absence of any year-round resident marine mammals that regularly and consistently forage within the Harbour entrance waters means that there would be a very low-level chance of an individual animal ingesting prey or swimming through waters exposed to the discharge.

Dr Clement reports that the renewal of existing discharge activities is not expected to result in significant habitat loss for any marine mammals frequenting this region, nor result in any significant long-term or indirect effects on marine mammal species. She outlines that this conclusion is based on the following:

- There being no population of marine mammal species that reside year-round within the Harbour, discharge mixing zone and/or nearby Bream Bay waters.
- Generally, there being little evidence that the Harbour entrance or waters potentially affected by the associated discharge activities serve as important, unique and/or rare habitat for any marine mammal species in terms of feeding, breeding and/or migratory activities.
- Seasonal trends in occurrence indicate that both bottlenose and common dolphins, as well as orca, are more likely to visit these inshore areas over winter and spring months rather than regularly year-round.
- Very few whales migrating past this region each winter would venture close to the vicinity of the Harbour and most do not feed while migrating.
- Based on the generalist diet and roving nature of these species (e.g. leopard seal), it is expected that contact between individual animals and prey species exposed to the discharge would be very limited.
- Generally low levels of contaminants found in Refining NZ discharge waters or the receiving environment, including waters, sediments and organisms.

4.8.5 Conclusion

Dr Clement states that marine mammals are vulnerable to the bioaccumulation of anthropogenic contaminants due to their long-life spans, high trophic level diets, and coastal residency. As a result, she notes that local marine mammals are often considered when assessing the potential effects of discharges and contaminants on marine ecosystem health, globally as well as locally by Tangata Whenua.

Dr Clement reports that the more common species occurring along the Whangārei coastline, and therefore those most likely to be affected by the proposed project, include bottlenose and common dolphins, orca and Bryde's whales. Several other species that visit the area less frequently have also been considered by Dr Clement because they are held in high cultural regard, or because of various life history dynamics (e.g. low population numbers). However, she states that the habitats within Whangārei Harbour, its entrance, or those associated with nearby Bream Bay are not considered to be unique or limited for any marine mammal species in terms of feeding, breeding or migrating activities. Further, she indicates that there is no species known to reside year-round within the Proposal area, nor any solely reliant on foraging habitats in the area.

Based on the findings of contaminant testing (both traditional and process chemicals) and hydrodynamic modelling, Dr Clement notes no marine mammals visiting or passing through the Proposal area are likely to be exposed to contaminant concentrations that exceed threshold levels for potential effects. She states that additional mitigating factors, such as the temporary presence and generalist diet of these particular species, as well as the dilution and dispersion of the discharge into a high-energy marine environment, limit the exposure risk for individual marine mammals to discharge contaminants taken up from exposed prey. Dr Clement concludes that on this basis, potential effects on marine mammals from the Proposal are considered negligible, and no mitigation is warranted.

4.9 Terrestrial Ecology Effects

Dr Martin and Ms Reaburn of Wildlands Consultants Limited (**'Wildlands'**) have considered the actual and potential effects of the Proposal on Terrestrial Ecology. A full copy of Dr Martin and Ms Reaburn's Assessment of Terrestrial Ecological Effects for the Proposal[148] is contained within **Annexure 3** of this AEE. We now summarise their advice as follows:

In order to contextualise the effects, Dr Martin and Ms Reaburn describe SO_2 and NOx as entering the atmosphere primarily through the combustion of fossil fuels and note that they are more harmful in combination than when present on their own. They go on to record that when in contact with atmospheric moisture they form acids, which can fall to the ground as 'acid rain' and point out that SO2 and NOx can also enter the ecosystem through dry deposition[149].

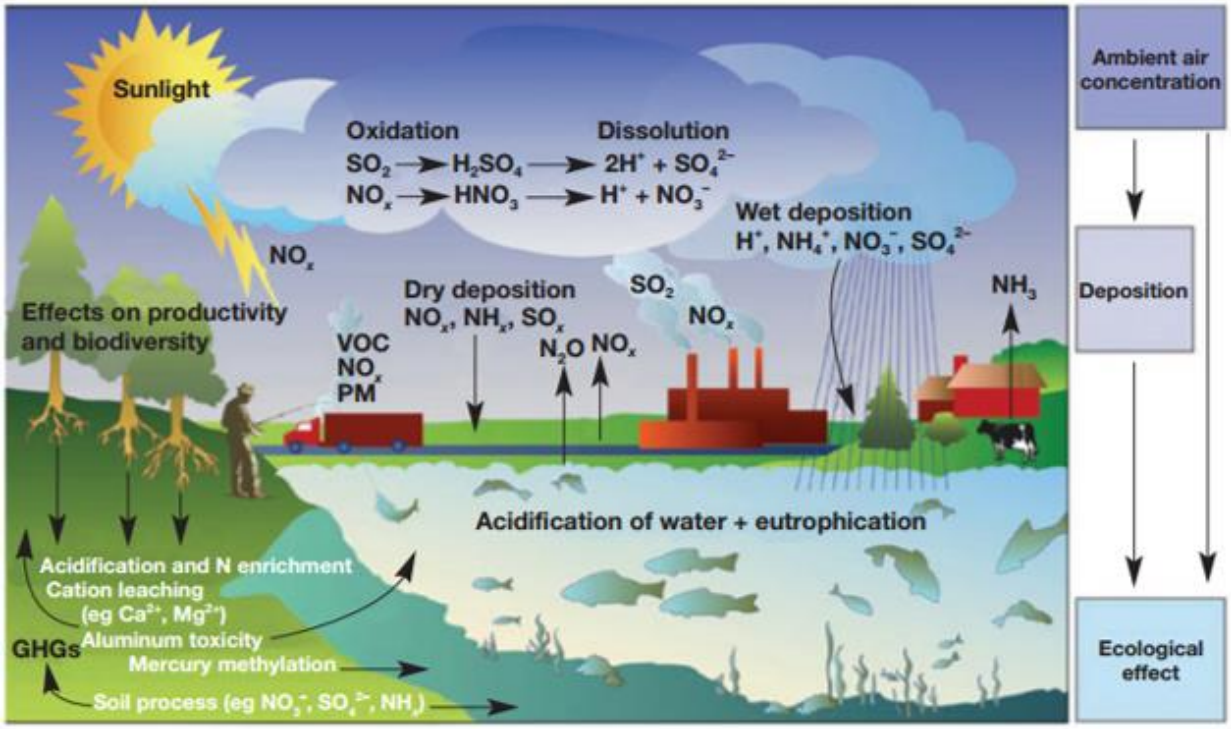

Figure 4.9.1: *Simplified diagram of the ecological effects caused by nitrogen and sulphur air pollution*

Dr Martin and Ms Reaburn advise that the assessment of ecological effects has been undertaken with consideration of assessment methods commonly referred to in New Zealand, such as the EIANZ[150]. They note that the overall level of effect has been determined by considering the characteristics of the ecosystems within the receiving environment, pollutant concentrations, magnitude of effect, and proposed management, if any is required.

The approach that was taken for the ecological assessment of effects is outlined by Dr Martin and Ms Reaburn as being focused on establishing the following:

- Potential adverse effects of SO_2, sulphur, NO_X, and nitrogen on terrestrial ecology;
- What level of pollutant discharge would cause these adverse effects, relative to ecosystem type and species groups present in the receiving environment; and
- Whether the proposed discharges of pollutants from the Marsden Point Refinery are likely to exceed the levels at which adverse effects on terrestrial ecology may occur, including cumulatively over time.

[148] Martin, T. and Reaburn, J. Wildlands Limited, *Assessment of Ecological Effects for Air Discharges from the Marsden Point Oil Refinery*. Dated June 2020

[149] Gravitational sedimentation of particles during periods without precipitation

[150] Ecological Impact Assessment Guidelines for New Zealand 2nd Edition 2018,- prepared by a group of ecologists to contribute to raising the standard of practice of ecological assessment in New Zealand, and provide a reference document for students and practitioners

4.9.1 Effects of historic air discharges on terrestrial ecology

Dr Martin and Ms Reaburn state that baseline data for the presence and abundance of indicator species is not available for the oil refinery discharge. They record that a brief assessment of the likely historic effects of the Refinery discharge (1964-present) is therefore based on the following:

a. Predicted concentrations of pollutants relative to the expected background levels for rural and urban environments in New Zealand; and
b. Diversity, chemistry and health of lichen communities within the receiving environment of the air discharge, and at a site beyond the extent of the air discharge, with particular reference to species known to be sensitive to air pollution.

4.9.1.1 Nitrogen dioxide and sulphur dioxide

Dr Martin and Ms Reaburn advise that most of the receiving environment (i.e. further than two km from the discharge point) is predicted to be exposed to less than 3.5 $\mu g/m^3$ for SO_2, and 5.0 $\mu g/m^3$ for NO_2, as an annual average, including both ambient concentrations and refinery discharges. They go on to note that the SO_2 concentrations do not exceed the WHO (1996) critical level guidelines,[151] and conclude that sensitive ecosystems are unlikely to be subject to 'significant direct effects.' Given that the peak concentration for SO_2 is within the range expected for rural and urban areas, Dr Martin and Ms Reaburn state that a significant historic effect of the existing discharge on ecosystems is unlikely.

Dr Martin and Ms Reaburn report further that where sites are within or on the boundary of pasture that receives fertiliser inputs, any nitrogen deposition attributable to discharge (as in the case of the Refinery) is likely to be a very small percentage of the overall nitrogen load, and consequently unlikely to have resulted in any detectable effects for indigenous ecosystems. According to Dr Martin and Ms Reaburn, historic sulphur deposition, from the ambient sulphur loads and the air discharge combined, has not resulted in higher levels of soil sulphur at monitored impact sites.

4.9.1.2 Monitoring

Advice from Dr Martin and Ms Reaburn is that the existing diversity and health of lichen communities, both within and beyond the receiving environment, can be used as an indication of the likely historic effects of discharges from the Refinery. They state that the biannual monitoring of lichens confirms the presence of species sensitive to air pollutants at sites within the receiving environment of the discharge. They note further that the legacy effects of the proposed discharge allow for the persistence of sensitive lichen species at the monitoring sites in the Manaia Ecological District. In addition, they record that sulphur and nickel concentrations in the lichen tissue were sampled for Mount Aubrey, Home Point Upper, and Ody Road respectively, and the similarity between sites of higher and lower SO_2 concentration suggests that the existing discharge is unlikely to have resulted in elevated levels of sulphur in lichen tissue. They go on to emphasise that the two sites within the receiving environment that were tested for nickel in lichen tissues had a lower concentration of nickel than the proposed control site.

4.9.1.3 Lichen Health

Dr Martin and Ms Reaburn advise that laboratory analysis of lichen tissues at the Whangārei Heads and Refinery Grounds suggest that damage to lichens from the discharge may be occurring, and if so, is more frequent at the site of the discharge, where concentrations of pollutants reach their peak. In this regard, they state that no lichen specimens had 'normal morphology,[152]' and that the most common damage class[153] for both lichen types were 'significant effects'. They note however, that at Rama Road, one km southwest of the

[151] *WHO Air quality guidelines* offer global guidance on thresholds and limits for key air pollutants that pose health risks
[152] Despite the wide diversity of the basic growth forms, all lichens have a similar internal morphology
[153] Categories of damage caused by the discharge

discharge point, no specimens were assessed[154] as having the highest damage class of 'significant effects', and the most frequent damage class was 'minor effects.'

Dr Martin and Ms Reaburn record that the examination of lichens collected from the grounds of the Refinery indicate that there is localised damage to lichens at this location and that annual means for SO_2 are below the levels at which a detectable effect on lichens is likely. They conclude that some lichen species known to be sensitive to air pollution, persist at the quantitative lichen monitoring sites within the receiving environment at Whangārei Heads and that any legacy effects of the air discharge have therefore not led to the loss of these sensitive species within the receiving environment at Whangārei Heads.

4.9.2 Effects of proposed air discharge on terrestrial ecology

In line with international guidelines, Dr Martin and Ms Reaburn determine that the ecological values of the receiving environment, and the potential adverse effects of the discharge, are largely assessed at an ecosystem level. They report further that effects are assessed at a taxonomic group[155] level where these taxonomic groups are noted as being sensitive to the effects of the modelled pollutants (e.g. in the case of lichens).

4.9.2.1 Sulphur dioxide

Ecosystems

Dr Martin and Ms Reaburn state that the total SO_2 within the receiving environment of the Refinery, as an annual mean at ground level, ranges from less than 1.5 $\mu g/m^3$ to 5.0 $\mu g/ m^3$. They point out that the highest peak of 5.0 $\mu g/m^3$ occurs immediately to the southwest of the Refinery in an area characterised by agricultural land use, industrial land use, and stands of exotic trees. They also note that the area of highest SO_2 concentration has no areas of indigenous vegetation or habitats and is of low ecological value.

According to Dr Martin and Ms Reaburn, the natural areas exposed to the highest concentrations of SO_2 are the northern end of the Ruakaka Dunelands, and the Northport Corporation Ponds. They record that based on the critical levels for SO_2, the natural areas that are closest to the Site and exposed to the highest concentrations, are likely to have no detectable effects resulting from SO_2 emissions at an ecosystem level. They also report that none of the peaks for SO_2 (as a predicted winter average) exceed any of the peaks for the annual average and as such, the shorter duration winter averages are not likely to result in any detectable effects on an ecosystem basis.

Species or Species Groups

Dr Martin and Ms Reaburn indicate that based on the literature review and the modelling undertaken, no bats, birds, herpetofauna or invertebrates within the receiving environment are likely to be exposed to concentrations of SO_2 that exceed critical levels. They go on to conclude that air discharge is therefore unlikely to result in any detectable adverse effects for indigenous terrestrial fauna. However, they note that the literature provides incomplete coverage on a species or species group basis, and more weight should be given to the effects of pollutants at an ecosystem level.

Level of Effect on Lichen Communities Close to the Discharge Point

Dr Martin and Ms Reaburn advise that analysis of lichen health has indicated that the air discharge may be the cause of damage to lichens within the grounds of the Refinery, due to the peaks at this location. They however note this effect is very localised and is restricted to common lichen species that would be expected to be present in highly modified environments. Further, they record that the magnitude of the effect on lichen communities within or close to the refinery grounds can be described as 'low'[156]. They also record that the magnitude of effect on the habitats present as a whole (i.e. the plantings of indigenous and exotic trees, which provide habitat for epiphytic lichens), can be described as

[154] Lichen health assessments showed a similar pattern for abnormalities and presence of particulates at four study sites, and no clear pattern for the frequency of bleaching
[155] A group of organisms within a species that differ in trivial ways from similar groups
[156] Applying criteria provided in the EIANZ guidelines (Roper-Lindsay *et al.*, 2018)

'negligible'. They also highlight that the ecological values of the habitats and associated lichen communities within or close to the Refinery grounds were scored as 'low' in relation to prescribed ecological attributes, with an overall ecological value of 'negligible'.

Dr Martin and Ms Reaburn then address the level of effect on lichen communities close to the discharge point stating that they can be described by combining the magnitude of effect with the value of the ecological feature. They advise that a low or negligible magnitude effect on a feature of low ecological value can be described as having a 'very low' level of effect. They record that the EIANZ guidelines state that very low-level effects can generally be classed as 'not more than minor' effects. They also however note that the EIANZ guidelines do not have a category for a 'negligible' or 'less than minor' level of effect, which is an appropriate assessment of the level of effect on habitats close to the Refinery grounds, for the following reasons:

- The habitats comprise a mix of planted and exotic trees that are not recognised as a significant natural area in the Waipu Ecological District;
- If the lichens present here are of lower abundance or health due to the discharge, this would have a low level of effect for this small biotic component of the habitat; and
- The modelled SO_2 concentrations for these habitats are not predicted to cause any detectable effect for the habitats as a whole.

4.9.2.2 Sulphur

Ecosystems

Dr Martin and Ms Reaburn state that sulphur deposition within the receiving environment of the Refinery, in kg/ha/yr peaks at 11.8 kg /ha/yr within the grounds of the Refinery, the area of agricultural land and exotic trees, and at the northern end of Marsden Point. They note that except for the Ruakaka Dunelands, this is a highly modified area with low ecological value, and they state further that sulphur deposition rapidly declines within two to four km of the plant to 6.8 kg/ha/year. They then conclude that the receiving environment for sulphur is unlikely to include any ecosystems sensitive to acid deposition at the modelled concentrations and that effects on ecosystems from sulphur deposition are therefore likely to be less than minor.

Species

Dr Martin and Ms Reaburn advise that based on the literature review, soil invertebrates within the receiving environment are unlikely to have critical levels for sulphur deposition that are exceeded by the soil sulphur levels at the monitoring sites. They report that air discharges are unlikely to result in any detectable adverse effects for soil invertebrates and that the assessment of the adverse effects of sulphur deposition therefore needs to be assessed at an ecosystem level. They also note that based on the acid neutralising capabilities of these catchment systems, sulphur deposition is not expected to result in any detectable adverse effects on indigenous ecosystems or their associated terrestrial or aquatic species.

4.9.2.3 Nitrogen oxides

Ecosystems

Dr Martin and Ms Reaburn note that the total oxides of NO_X within the receiving environment of the Refinery, as an annual mean at ground level, are approximately 6.5 $\mu g/m^3$ within 500 m of the discharge point, which then decline to concentrations less than 4.5 $\mu g/m^3$ within one to two km of the discharge point. Except for the northern end of the Ruakaka Dunelands and the Northport Corporation Ponds, according to Dr Martin and Ms Reaburn, all identified SNAs are exposed to concentrations less than 5.5 $\mu g/m^3$. They go on to report that the highest annual means for NO_X within the receiving environment, at 6.5 $\mu g/m^3$, is well below the accepted critical level therefore not expected to result in any detectable adverse effects for ecosystems.

Species or Species Groups

Dr Martin and Ms Reaburn advise that based on the literature review and the modelling undertaken, no bats, birds or invertebrates present within the receiving environment are likely to be exposed to NO_X at concentrations that exceed critical levels. They go on to note

that discharges to air from the Refinery are therefore unlikely to result in any detectable adverse effects for indigenous terrestrial fauna. They indicate however, that it should be noted that the literature provides incomplete coverage on a species or species group basis and that more weight should therefore be given to the assessment of effects of NO_X at an ecosystem level, which incidentally suggests that there will not be any detectable effects from the discharge.

4.9.2.4 Nitrogen

Ecosystems

Dr Martin and Ms Reaburn report that the total nitrogen deposition within the receiving environment ranges from less than 1.25 kg N/ha/yr to approximately 1.95 kg N/ha/yr. They state further that the distribution of the deposition is similar to that for SO_2, with the highest peak occurring to the southwest of the Refinery, in the area characterised by highly modified land uses. They point out that most of New Zealand ecosystems are nitrogen limited and that on this basis it is suggested that the prediction of no effect at deposition rates of up to 5 kg N/ha/yr would be a conservative approach, if the potential adverse effect being detected is an increase in exotic plant species. They then note that as the highest rates of deposition for nitrogen are 1.75 kg N/ha/yr at Mount Aubrey, and the environments most sensitive for nitrogen deposition are predicted to receive less than 1.65 kg N/ha yr, there are no likely adverse effects for terrestrial ecology due to nitrogen deposition.

Species or Species Groups

Based on the literature review and the modelling undertaken Dr Martin and Ms Reaburn report that no soil invertebrates or flora species sensitive to nitrogen deposition, within the receiving environment, are likely to be exposed to nitrogen at concentrations above critical loads. They state further that the air discharge is therefore unlikely to result in any detectable adverse effects for indigenous terrestrial fauna and flora. According to Dr Martin and Ms Reaburn literature provides very incomplete coverage for nitrogen deposition on a species or species group basis, and therefore more weight should be given to the effects of this pollutant at an ecosystem level. They also report that nitrogen deposition may have localised positive effects on ecosystems where guano-depositing bird species have been reduced or lost.

4.9.2.5 Assessment of alternatives

Dr Martin and Ms Reaburn advise that assessment of alternatives for the air discharge has been prepared and that the only feasible means to reduce emissions of SO_2 is to reduce the sulphur in the fuels burnt at the Site. They record that this would 'result in a significant increase in operational costs and/or significant refining margin destruction'. They then indicate that a further reduction in SO_2 emissions is possible but is not justified as the adverse effects of the discharge are less than minor. In addition, they note that overall, the methods for discharges to air are effective, fit for purpose, and are in their opinion the best practicable options and therefore recommend that the existing controls and limits are retained.

4.9.3 Conclusion

In conclusion, Dr Martin and Ms Reaburn emphasise that the potential adverse effects of discharges of SO_2, NO_x, sulphur, and nitrogen on terrestrial ecology in the receiving environment have been assessed. They state that based on the assessment, it is expected that the concentrations of SO_2 and NO_X, and deposition rates of sulphur and nitrogen, are below the levels at which adverse effects are likely to occur, for significant indigenous vegetation and significant habitats of indigenous fauna. They also advise that adverse effects on significant natural areas are likely to be avoided, and, as such, mitigation actions are not considered necessary. Identification and comparisons of critical levels and critical loads were also carried out for species groups likely to utilise habitat within the receiving environment, based on existing literature, although, where possible, more weighting has been given to ecosystem-based information.

Dr Martin and Ms Reaburn go on to state concentrations and deposition of pollutants in the air discharges are lower than the critical levels and critical loads at which detectable adverse

ecological effects on terrestrial effects on terrestrial fauna and vegetation are predicted to occur, within the receiving environment. They therefore do not expect that the air discharges will result in any detectable adverse effects for indigenous terrestrial ecosystems. They advise that the air discharge is probably the cause of some adverse effects for lichens within one km of the discharge point at Marsden Point. However, they state that this adverse effect is very localised, restricted to modified habitats of low ecological value such as amenity gardens or shelter belts of exotic trees, and on an ecological basis, the level of effect of the air discharge on habitats at Marsden Point is less than minor.

These conclusions have been reviewed as part of the CEA for the application,[157] and generally accepted in relation to the expected less than minor effects on terrestrial ecology.

Dr Martin and Ms Reaburn propose the continued monitoring of the potential effects of air discharges on terrestrial ecology. They advise further that an existing monitoring programme has been reviewed and critiqued, with an amended monitoring regime proposed to ensure the potential adverse effects of air discharges on terrestrial ecology are effectively monitored and managed throughout the life of the consent.

4.10 Human Health Effects

Dr Francesca Kelly of Environmental Medicine Limited has prepared a health effects assessment[158] a full copy of which is attached within **Annexure 3** to this AEE. We now summarise Dr Kelly's advice as follows:

Dr Francesca Kelly states that the potential to produce health effects from exposure to the identified hazardous contaminants depends on the amount and duration of exposure. She notes that some groups of people are generally recognised to be more vulnerable than others to adverse effects from contaminants in food, water or air. She states that another possible susceptibility is when exposures to more than one contaminant are at a concentration to produce health effects (i.e. cumulative effect of more than one contaminant). She indicates that where exposure concentrations are low or below detection, combined effects are unlikely to be a particular issue.

We now summarise the effects in relation to exposure to contaminants through inhalation, shellfish (kaimoana) consumption and drinking water addressed by Dr Kelly, as follows:

4.10.1 Inhalation

Dr Kelly states that the hazards among discharges to air primarily give rise to a risk of health effects through inhalation exposure to the ambient air and that the likelihood of effects depends on exposure patterns. She records that T&T have assessed[159] the discharges to air within the assessment area using current MfE recommended assessment criteria. They have found the effects of exposure to SO_2 to have al low to negligible effect.

She reports that the majority of days and locations tested were found to have low or negligible exposure to SO_2. She notes further that the maintenance of ambient monitoring for SO_2 was found to be important at several community locations, however, the outcomes from the most recent assessment does not indicate a necessity for sulphur removal technologies. She notes that this is primarily because elevated ambient concentrations for SO_2 arise sporadically and this lowers the potential for effects.

Given the analysis undertaken by T&T and their findings, Dr Kelly concludes that the risks for health effects are less than minor for SO_2 acute exposure and indicates that at most locations, the risks for health effects are less than minor for chronic exposure to SO_2 because exposure is negligible on most days. She does however note that at elevated locations across the Harbour from the Site infrequent days have concentrations for SO_2 predicted to be higher

[157] Prepared by PTB as part of the Mana Whenua Engagement Process in relation to the Reconsenting of Refining NZ's Operations at Marsden Point
[158] Kelly, F. Environmental Medicine Limited, *Health Effects Assessment prepared for Refining NZ*. Dated July 2020
[159] Chilton, R. Tonkin & Taylor Limited, *Air Quality Assessment*. Dated June 2020

than other locations. She concludes further that the risk for effects from exposure to SO_2 may be minor on some days, but the risk is less than minor most of the year.

Dr Kelly states that particulate PM_{10} and $PM_{2.5}$ from the discharges are predicted to add low amounts to background concentrations, and cumulatively do not present a risk to human health using the conservative background estimation assessment[160] undertaken by T&T. She states the risks for health effects from the discharges are less than minor for particulate matter because the additional exposures from the Refining NZ discharges are very low. Dr Kelly highlights that nitrogen dioxide predictions were all below corresponding assessment criteria. She also states that exposure to nickel in ambient air is not important as a source of health effects and concludes that the risks for health effects are less than minor for nickel and other metallic contaminants.

Further, Dr Kelly advises that the risks for health effects are less than minor for: fugitive emissions of BTEX, dioxins and furans, petroleum hydrocarbons, nitrogen dioxide and carbon monoxide. She goes on to note that all other contaminants among discharges to air are present in very low or non-detectable amounts and are not specifically assessed.

4.10.2 Shellfish (kaimoana) Consumption

Dr Kelly indicates that trace elements concentrations of contaminants in shellfish vary among species at some locations and on particular sampling occasions. She states that while arsenic was detected in some environmental samples it has not been selected for specific assessment as arsenic in seafood is typically present as sugar compounds such as arsenobetaine and these compounds are non-toxic to humans. Dr Kelly notes that varying amounts of copper and zinc were found within shellfish in the assessment area. She states that copper and zinc have very low public health significance when consumed in variable amounts in a mixed diet, as such the effects associated with consumption of these contaminants are considered to be low / negligible. She goes on to state that PAH concentrations from recent samples are below relevant assessment criteria for health from the European Food Safety Authority. She also indicates that while other compounds including BTEX, phenols and TPH have been found to be present within shellfish in the assessment area, that they are either low or below detection levels and are therefore do not need to be further assessed.

Overall, Dr Kelly outlines that there is a variation in the metal contaminant concentrations in shellfish at locations that are considered to be significant as traditional food sources. However, in drawing on the findings within the Boffa Miskell report[161] she concludes that the Refinery is unlikely to be a significant contributor of chromium and nickel, which are predominant contaminants. Dr Kelly concludes that the risk of health effects from consumption of shellfish that have been exposed to the discharges from Refining NZ to be less than minor.

4.10.3 Drinking Water

With regard to drinking water within the assessment area, Dr Kelly notes that deposited metals were assessed for potential to impact roof collection for drinking water purposes. She states that while nickel (in particular) was found to be present, there were no exceedances of the NZ drinking water standards for metals or other contaminants expected from the air discharges. As such, Dr Kelly concludes that risk for health effects associated with rooftop drinking water collection is less than minor.

4.10.4 Coastal Recreation

In considering the quality of the coastal water Dr Kelly states that the coastal water does not contain any contact recreation risk from contaminant metals or compounds from the discharges. She notes that the NRC monthly enterococci and faecal coliform measurements at One Tree Point indicate a very low microbiological risk for contact recreation. She however concludes that there are no exceedances of safety criteria for contact recreation

[160] Chilton, R. Tonkin & Taylor Limited, *Air Quality Assessment*. Dated June 2020
[161] De Luca, S., and Ross, Dr P., Boffa Miskell, *Assessment of Effects on Marine Ecological Values- Reconsenting of discharges and structures in the CMA*. Dated July 2020

brought about by contaminants discharged from the Site, therefore the risk of associated health effects is negligible.

4.10.5 Combined Exposures

Overall Dr Kelly concludes that when considering all the potential health effects and the findings of the assessments undertaken by Boffa Miskell, T&T, Streamlined Limited and NRC, that the risk of adverse health effects from the discharges brought about by the Proposal are less than minor.

4.11 Archaeological & Historic Heritage Effects

As we have already recorded, Dr Rod Clough has considered the actual and potential for the Crude Shipping Project to adversely affect historic heritage effects. A full copy of his report is attached within **Annexure 3** of this AEE. We have drawn upon that assessment in the preparation of this section of our AEE.

As we noted in section 2.3.10 of this AEE, the Site does not contain any recorded archaeological sites, nor are there any historic heritage sites listed within the oWDP that are of relevance to the Proposal. Further, the CEA confirms that the Proposal "*will not impact on any individual archaeological sites or wāhi tapu*."[162] Dr Clough advises, however, that a number of archaeological sites have been identified on the land at the entrance to the Harbour. These sites include evidence of both Māori and European settlement, agriculture and marine exploitation over the past few hundred years. He indicates further that both the recorded archaeological sites and historical records demonstrate that the pipi beds at Mair Bank, the cockle beds at Snake Bank and the broader fishing resource have been important to populations living around the Harbour for several hundred years.[163]

Given Dr Clough's advice, we are confident that the Proposal will not adversely affect any recorded archaeological sites.[164] It is also important for us to record that resource consent is not, in this instance, being sought for any earthworks or new activities. The discharges to air, water and land, the groundwater abstraction and the occupation of the coastal marine area are not new activities and do not further disturb land / seabed or directly impact on a heritage or archaeological site / value, the same conclusion applies to these aspects of the Proposal.

4.12 Cultural Effects

PTB has prepared a CEA[165] for the Proposal which has considered the actual and potential cultural effects of the Proposal on Patuharakeke cultural values. A full copy of the CEA is contained within **Annexure 3** of this AEE. PTB considers that cultural effects or values are often narrowly pigeon-holed as matters relating to wāhi tapu or heritage, which Patuharakeke regard as only a subset of the effects and values to be considered. PTB has structured its assessment of the cultural effects of the Proposal under headings associated with the four well-beings (being the social, economic, environmental and cultural well-beings)[166]. PTB states that an assessment of the cultural effects of the Proposal must consider all of these well-beings.

Within sections 4.12.1 – 4.12.4 we summarise PTB's assessment of the cultural effects of the Proposal in accordance with the four well-being headings. We note that peer reviews of the technical reports associated with the Proposal have been conducted by NRC. The peer review reports of Dr Rob Bell and Dr Drew Loher of NIWA and that prepared by Melean Absolum Ltd were provided to PTB by Refining NZ, together with the response provided by the authors of

[162] PTB, *Cultural Effects Assessment Report: Refining NZ Reconsenting*. Dated July 2020, page 28
[163] Clough, Dr R, Marsden Refinery, Whangārei Harbour Dredging: Archaeological Assessment. Dated July 2017
[164] Clough, Dr R, page 25, "Marsden Refinery, Whangārei Harbour Dredging: Archaeological Assessment. Dated July 2017
[165] PTB, *Cultural Effects Assessment Report: Refining NZ Reconsenting*. Dated July 2020
[166] The four well-beings were reinstated in the Local Government (Community Well-being) Amendment Act 2019 after firstly being included in the Local Government Act 2002. Further, the four well-beings are included in the purpose and principles of the RMA under Part 2

the technical reports commissioned by Refining NZ. Further, Refining NZ's technical experts have sought to address the points raised in the CEA.

4.12.1 Environmental

The environmental category of the assessment of cultural effects is an extensive component of the CEA and is informed by the peer reviews of Dr Rob Bell and Dr Drew Lohrer. PTB has expressed concern regarding particular environmental effects associated with the Proposal, these will now be addressed in relation to the corresponding technical report. PTB record that in relation to the Ecological Assessment, the Marine Mammals Assessment and the Coastal Bird Assessment that it generally accepts the findings of these reports.

4.12.1.1 Water Quality

PTB has raised concerns with regard to the discharges to water associated with the Proposal, noting that these have implications on the mauri of wai and are contrary to tikanga. The water quality assessment[167] prepared by Dr Stewart was peer reviewed by Dr Bell. According to PTB, Dr Bell determined that overall, the general conclusions of the report are "*probably sound, where only a few contaminants exceed water quality thresholds during adverse discharge events*." Dr Stewart notes how Dr Bell in his peer review raised certain issues which were considered by Refining NZ and therefore informed the decision for MetOcean Solutions to undertake further modelling[168].

Dr Stewart has also given consideration to the comments made by Dr Bell and PTB in relation to what constitutes reasonable mixing and the appropriateness of the size of the mixing zone. Dr Stewart notes that several applicable planning documents contain provisions that are relevant to the concept of reasonable mixing and mixing zones.[169] Dr Stewart states that the mixing zone associated with the Proposal reflects the extant consents of which Refining NZ seeks to renew and is identified in the planning maps of both the oRCP and the pRP. Further, Dr Stewart states that in his opinion, the mixing zone proposed / used (being the status quo, maintaining the mixing zone at the current size) is appropriate.

4.12.1.2 Marine Ecology

PTB have expressed concerns regarding effects on marine ecology in relation to Poupouwhenua Mātaitai and include some of the comments made by Dr Lohrer within its CEA on that matter. PTB consider that potential cumulative effects on water quality and on Poupouwhenua Mahinga mātaitai (marine ecology) are more than minor. PTB state that the potential for cumulative effects still exists due to the potential for some effects beyond the mixing zone in shallow areas under certain conditions. In responding to the concerns raised within the CEA, Dr De Luca and Dr Ross state that the potential for cumulative effects is based on the result of a single ecotoxicology test of Refining NZ's stormwater discharge on blue mussel larvae where contaminant concentrations were found to have adverse effects on the larvae of blue mussel, and therefore could affect other shellfish larvae and juvenile shellfish dispersal. Dr De Luca and Dr Ross consider that such effects are unlikely, as several factors would need to occur simultaneously, conferring that the ecotoxicology test appears as an outlier, or unusual result. Dr De Luca and Dr Ross note that the duration of exposure to high contaminant concentrations is very low (1-3 hours) compared to the exposure period of the ecotoxicology test on blue mussel larvae (48 hours). Further, Dr De Luca and Dr Ross maintain their opinion that cumulative effects are negligible.

PTB has also expressed concern regarding the uncertainty of the stressors on shellfish and effects on juvenile dispersal. Dr De Luca and Dr Ross state that the decline of the of pipi population at Mair Bank has been assessed as part of the Proposal and the cause remains unclear. Dr De Luca and Dr Ross note that none of the scientific data collected for the Proposal and past Refining NZ projects support a cause and effect link between the pipi

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[167] Stewart, M. Streamlined Environmental Limited, *A Water Quality Assessment at Marsden Point Oil Refinery to Inform Resource Consent Renewal Applications*. Dated July 2020

168 MetOcean Solutions, *Waste Water Dispersion Modelling. A report prepared for Refining New Zealand*, Version 3, Dated 7th July 2020

[169] Stewart, M. Streamlined Environmental Limited, *A Water Quality Assessment at Marsden Point Oil Refinery to Inform Resource Consent Renewal Applications*. Dated July 2020, page 24

decline at Mair Bank and the activities of Refining NZ. Given this, Dr De Luca and Dr Ross maintain their opinion that Refining NZ discharges are not the cause of the pipi decline on Mair Bank.

PTB have also raised concern that studies conducted in 2019 and 2020[170] found abnormalities in the gills of pipi at Mair and Marsden Bank. Dr De Luca and Dr Ross note that in the studies undertaken in 2019 and 2020 other sites were also surveyed for pipi health and presented similar histology, microbiology and presence of symbiotic bacteria. Dr De Luca and Dr Dross further note that the study concluded that no cause and effect could be identified for the results observed.

In addition, PTB have expressed concerns regarding the effects of structures in the CMA, and state that it considers there are positive and negative impacts for marine ecology in regard to coastal structures. PTB confer with the assessment made by Dr De Luca and Dr Ross that the structures provide additional hard shore habitat for sessile organisms. PTB have raised concerns, however, that the invertebrate assemblages that occupy the structures that are diverse and of high ecological value could be affected by maintenance dredging of the turning basin. In responding to this concern, Dr De Luca and Dr Ross note that capital dredging projects at other ports, for example, Tauranga Harbour, have not precluded the recovery of pipi.

Further, PTB state that shipping activity and coastal structures provide a mechanism (transport on hulls, ballast etc) and the preferred habitat (man-made structures) for biosecurity risks such as marine pest species to establish, such as Mediterranean Fanworm – in close proximity to their mātaitai. Dr De Luca and Dr Ross record that in relation to biosecurity, Refining NZ have expressed that they would be happy to become involved in the collaborative 'Marine Biosecurity Toolbox' project that Patukarakeke are currently working on led by the Cawthron Institute as part of a collaborative effort to address biosecurity risks.

PTB states that the prevailing view of mana whenua around the Harbour is that the Refinery as the immediate neighbour to the Poupouwhenua Mātaitai contributes, at least in part, to the decline of mauri and kaimoana in the vicinity. In considering this, Dr De Luca and Dr Ross state that there is little evidence to support the hypothesis that the decline of pipi is related to the activities of Refining NZ. Dr De Luca and Dr Ross record that Refining NZ has been operating at Marsden Point since 1964, yet the decline of pipi has only occurred in the last 10 years. Dr De Luca and Dr Ross consider as there is no evidence of contaminants accumulating in the Harbour and based on the fact that pipi are unlikely to live for more than 10 years, the collapse of the pipi population if caused by the activities of Refining NZ would have occurred in the early decades of the Refinery's operation and not in the last 10 years when discharges are the cleanest they have ever been. Further, Dr De Luca and Dr Ross consider that there is no evidence of adverse effects on marine ecological values within the receiving environment.

4.12.1.3 Coastal Bird Assessment

PTB have expressed concern regarding their experience of observing a number of dead red-billed gulls around the SWB and have asked for clarification on this matter. Mr Don has addressed the concern of PTB directly by amending his technical report. Mr Don, who has prepared a Coastal Bird Assessment[171] for the Proposal concludes that there is no indication that the mortality of red-billed gulls is a widespread issue. He also notes that the comprehensive coastal bird surveys did not produce any observations of dead gulls, but notes that some mortality can be expected on a regular basis for a variety of reasons. Mr Don states that the reported mortality of red-billed gulls at the SWB does not alter his conclusions.

4.12.1.4 Air Quality Assessment

[170] Howell, J., 2019. Report on shellfish health. Prepared for Patuharakeke. LM38430 W19_07304
Howell, J., 2020. Report on shellfish health. Prepared for Patuharakeke. LM38430 W20 648
[171] Don, G. Bioresearches Limited, *Coastal Bird Assessment*. Dated June 2020

In considering the air quality discharges associated with the Refinery, PTB has expressed concerns regarding the effects of discharges on the mauri of air. PTB has considered the AQA prepared by Mr Chilton as part of the Proposal, and record that data used in the modelling from 2013-2018 suggests that flaring and exceedances are anomalies whereas in the experience of Patuharakeke, these are now regular and serious occurrences. In response to the concerns recorded within the CEA, Mr Chilton states that flares are only used for emergency flaring. Mr Chilton has presented in section 3.2 of his report a timeseries chart of the daily gas flow rates to the flare from 2017 to 2019 (see figure 4.12.1.4.1).

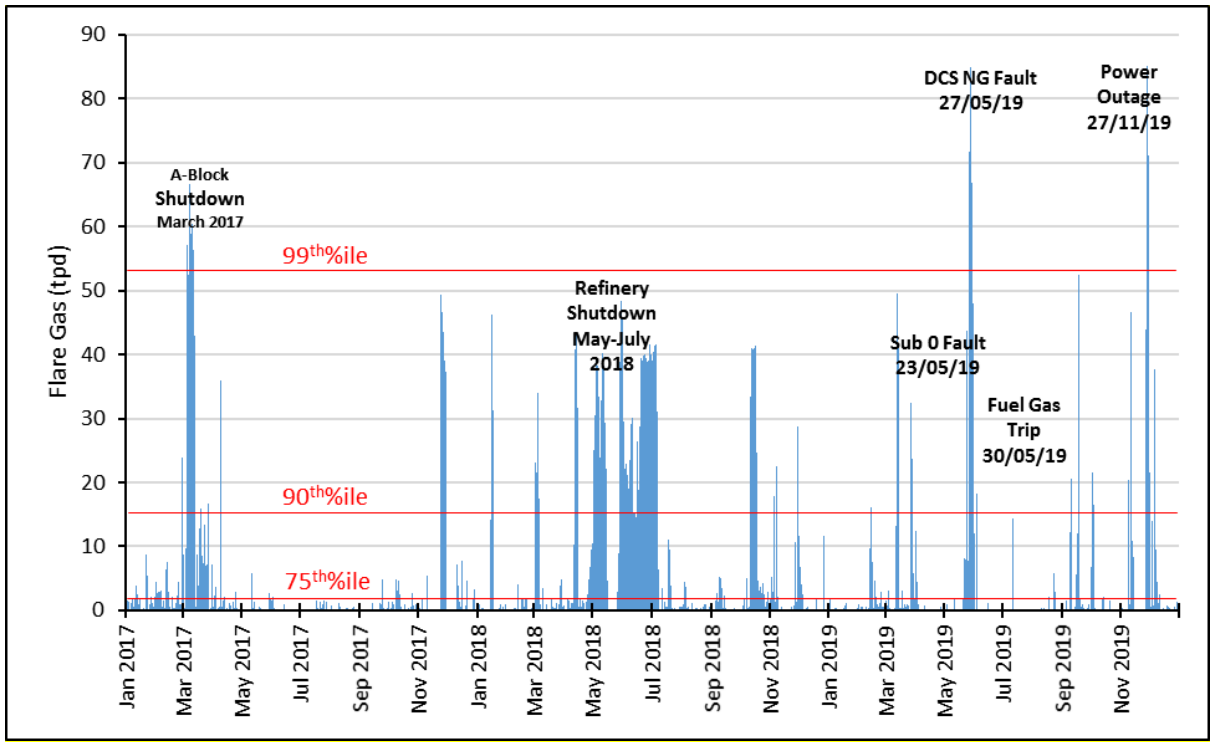

Figure 4.12.1.4.1: *Gas flow rates to the fare, 2017 to 2019 inclusive. Redlines and text annotate the percentile gas flow rates to the flare. Black text annotation highlights various significant flaring events.*[172]

Mr Chilton notes that the timeseries chart highlights several periods of significant emergency and process-shutdown flaring events between 2017 and 2019. Mr Chilton states that, in relation to the effects of flaring emissions, specific regard has been given to the environmental and health effects of flare emissions as highlighted by PTB in the CEA. Mr Chilton explains that flaring emissions have been separately evaluated using a screening model and concludes that the impact of intermittent flare emissions is not significant in the context of the overall effects of Site discharges. Mr Chilton states that his analysis of the cumulative effects of the flare modelling results with those of the main stack discharges (including naturally occurring background concentrations of SO_2 and the effect of shipping emissions) indicates that the NESAQ for SO_2 should not be exceeded. Mr Chilton maintains his assessment that the potential adverse effects of discharges on air quality are considered to be less than minor. In conclusion, we note that PTB state within the CEA that overall, Patuharakeke consider that "*potential cumulative effects on air quality are minor*."[173]

4.12.2 Cultural

PTB records that the Proposal will not impact on any individual archaeological sites or wāhi tapu. PTB note, however, that Poupouwhenua is a significant ancestral site and that along with other areas of Whangārei Terenga Parāoa that Poupouwhenua is of cultural significance

[172] Chilton, R. Tonkin & Taylor Limited, *Air Quality Assessment*. Dated June 2020
[173] PTB, *Cultural Effects Assessment Report: Refining NZ Reconsenting*. Dated July 2020, page 28

to Patuharakeke as this site and the surrounding area collectively makes up Patuharakeke's cultural landscape and seascape.

Within its CEA, PTB records that it agrees with the conclusions drawn by Mr Brown within his Landscape Assessment[174] that the effects of the air emissions and stormwater discharges on Patuharakeke cultural landscapes are of a low magnitude. Further to this, PTB indicate that the peer review undertaken by Melean Absolum Ltd takes a corresponding view to Mr Brown that the Proposal would adhere to the maxim of concentrating new development and related effects within parts of the CMA and coastal environment that are already significantly modified.

Mr Brown has considered the CEA and he acknowledges, within his assessment, that the emergency events that lead to excessive flaring would generate 'nuisance' effects for the community in the Patuharakeke rohe. Mr Brown considered the advice contained within the CEA and concludes that emergency and plant shut-down procedures that occasionally result in excessive flaring and smoke discharges are abnormal and quite rare. Mr Brown has come to this conclusion from discussions with Refining NZ staff and by considering Mr Chilton's AQA[175], both confer that these events are likely to occur twice or three times a year based on the recording of events of this nature over a three-year period, 2017-2019. Mr Brown concludes that on the occasion that there are exceptional discharges they would have a limited impact on the visual perception of Marsden Point, the adjoining Harbour or Whangārei Heads as they remain an 'adjunct' to the industrial profile of the Refinery and the industrial activities that occur within it.

In considering Mr Brown's conclusions, PTB notes that it diverges from the conclusions drawn in Mr Brown's assessment in relation to the effects of the coastal structures on the Poupouwhenua cultural landscape, stating that the effects on the cultural landscape in this location could be moderate to high. PTB goes on to note that regardless of the industrial activity already present at the Site, the coastal structures constitute a marked change from a cultural landscape perspective particularly in regard to recreational values. Mr Brown records that the jetty adds incrementally to the 'imposition' on the beach, including its relative naturalness and amenity/recreation values, but no more than that. Mr Brown acknowledges that the proposed jetty would affect Marsden Point Beach from a cultural perspective as stipulated by PTB in the CEA. Mr Brown also records that the assessment made by PTB in the CEA that the jetty structure is considered to be a physical barrier with an effect on access to the Takutai Moana is quite specific to Patuharakeke.

PTB considers that the potential effects of the coastal structures of the Proposal on the cultural landscapes, seascapes and customary access to the Takutai Moana are moderate to high. Mr Brown maintains his conclusion that the proposed air emissions, stormwater discharges and jetty would typically have a very low level of effect (less than minor) on the landscape, natural character and amenity values of Whangārei Harbour, Whangārei Heads and Bream Bay. Mr Brown states that the CEA does not undermine his findings and conclusions within the Landscape Assessment as they have focussed on the Harbour environs and the general public. Mr Brown acknowledges that the CEA authored by PTB adds another dimension to the range of effects that he has already addressed, and that PTB have more focused concerns of the effects on Patuharakeke.

4.12.3 Social

PTB consider that there is a strong link between the health of Whangārei Harbour and Bream Bay with the health and well-being of their people. PTB notes that it has found it difficult to obtain localised health data for its rohe or to isolate any health impacts that are directly related to the Refinery. Within its CEA, PTB acknowledges the findings of Dr Kelly's assessments in relation to inhalation, shellfish consumption, drinking water and coastal recreation that predict the effects of the Proposal on human health to be less than minor.

[174] Brown, S. Brown NZ Ltd, *Marsden Point Refinery Re-Consenting Project – Landscape Assessment*. Dated June 2020
[175] Chilton, R. Tonkin & Taylor Limited, *Air Quality Assessment*. Dated June 2020

PTB states, however, that the averages applied from the NZ Total Diet Study in Dr Kelly's assessment would be unlikely to apply to Māori coastal communities that rely on kaimoana as a staple part of their diet. PTB sets out that traditionally kaimoana was a staple of the Patuharakeke diet, and that despite the temporary closure associated with Marsden Bank and Mair Bank to harvest shellfish,[176] that Patuharakeke are seeking to return to a state where they can rely on kaimoana within their rohe. PTB therefore record that Māori coastal communities such as Patuharakeke, if they were able, would consume high levels of shellfish, which in turn would increase their exposure to the trace levels of contaminants. Dr Kelly has acknowledged the CEA in her assessment,[177] in relation to the aspirations of Patuharakeke to return to a traditional diet abundant in kaimoana collected from within their rohe. Dr Kelly states that the potential for health effects from the discharges related to kaimoana remain less than minor.

PTB record that the environmental effects of the Proposal are intertwined with the cultural wellbeing of their people. Patuharakeke as kaitiaki of all the natural resources within the rohe, tāngata whenua have a cultural and spiritual responsibility to ensure the mauri of these resource (taonga tuku iho) is maintained, protected and enhanced. PTB states that the inability to manage their own taonga has meant that the mauri has been diminished, this has flow on impacts to their mana. PTB notes that the mana of Patuharakeke as tangata whenua, is affected by their inability to practise manaakitanga to gather kaimoana for the table both for their families and manuhiri (visitors). PTB state that constraints to their participation today will affect the next generation and continue to transfer onwards to their future tamariki (children) and mokopuna (grandchildren).

PTB notes that Patuharakeke has a long-standing relationship with Refining NZ that was formalised through a Memorandum of Understanding (**'MOU'**) two decades ago. Further, PTB records that it is currently and working through a collaborative process with Refining NZ to refresh the MOU to create a Whakahononga Relationship Agreement to assist an effective, stronger working relationship between the two parties. PTB also consider that of the various schedules to be developed in a Whakahononga Relationship Agreement, the Pou Taiao monitoring programmes will provide contemporary means of exercising kaitiakitanga for Patuharakeke.

PTB note that Mr Chilton's assessment of the Proposal's effects on air quality in relation to odour could be looked at across a number of the well-beings, however the CEA records that PTB have decided that they should be assessed under social effects. PTB do not agree with Mr Chilton's assessment[178] that odour effects are considered less than minor based on two aspects; firstly, that the assessment is made on the basis of a low number of recent odour complaints and secondly, that Poupouwhenua is considered as a low sensitivity area to any odour impacts. PTB records that Mr Chilton has stated that while odour complaints (or a lack thereof) are not conclusive indicators of odour nuisance effects or an absence of those effects, the record of odour complaints and confirmed incidences of offensive or objectionable odour can provide a broad indication of odour nuisance experienced near existing operations. PTB considers that the potential effects on Patuharakeke social well-being, including physical (hauora) and cultural health (mauri ora) along with the effects on values such as amenity brought about by the reconsenting of Refining NZ's operations will be minor to more than minor.

4.12.4 Economic

In the CEA, PTB acknowledge that the Refinery is a sizeable local employer and note that some Patuharakeke whanau work there, either as permanently employed or contracted staff for specific projects. PTB considers that over the last half century during which the industrialisation of Poupouwhenua has taken place, Patuharakeke has not shared in the economic benefits gained from past development of the area. PTB considers, however, that

[176] Fisheries (Marsden Bank and Mair Bank Temporary Closure) Notice 2018 www.legislation.govt.nz/regulation/public/2018/0097/latest/whole.html
[177] Kelly, F. Environmental Medicine Limited, *Health Effects Assessment prepared for Refining NZ*. Dated July 2020
[178] Chilton, R. Tonkin & Taylor Limited, *Air Quality Assessment*. Dated June 2020

the current exercise to refresh and refocus Patuharakeke's relationship with Refining NZ, will likely bring about opportunities to explore pathways for training, education and employment.

Within the CEA, PTB has considered the economic assessment authored by Mr Clough, and have raised a number of points and issues within the CEA which Mr Clough has sought to address. In this regard, PTB has highlighted that the assessment prepared by Mr Clough was undertaken in December 2019 preceding the full extent of the Covid-19 pandemic and the announcement of Refining NZ's strategic review in April 2020. As the economic context of the Proposal has changed, Mr Clough has revisited his economic assessment to account for the same and to directly address comments made by PTB in the CEA.

PTB considers that the Proposal will have a neutral effect on Patuharakeke economic wellbeing. PTB states that it recognises the benefits to the local and regional economy, however from a tangata whenua perspective PTB is unsure that the economic benefits outweigh the historic cost on their culture and values. PTB records that it needs to understand more about what the future holds for the Refinery and seek a meaningful relationship that enables Patuharakeke to be a positive part of whatever that future holds. PTB has therefore made recommendations that part of the Whakahononga Relationship Agreement have an economic provision.

4.12.5 Cultural Effects Conclusion

PTB notes that Refining NZ has engaged with Patuharakeke with regard to the Proposal and have supported the preparation of this CEA. PTB states that although the technical reports do not identify any significant adverse effects, a challenge for Patuharakeke is that they consider Whangārei Terenga Parāoa is in a degraded state which is unable to support a range of cultural and traditional uses.

PTB state that in relation to the Proposal, they consider "*a number of the potential effects identified on cultural relationships and values are less than minor.*"[179] PTB considers that some aspects of the Proposal have effects on cultural relationships and values that are minor, or more than minor. PTB note that some of the effects of discharges on the mauri of water and air that impacts the health of Poupouwhenua Mātaitai and the hauora / health and mauriora / cultural health of Patuharakeke are considered to be minor, or more than minor. PTB state that in regard to effects on cultural landscapes and seascapes and customary access, the effects of the coastal structures are considered to be moderate to high. PTB considers that these effects will be acceptable, provided that the suite of recommendations to avoid, remedy or mitigate adverse effects proposed by PTB are implemented.

4.13 Economic Effects

Mr Peter Clough of the New Zealand Institute of Economic Research (**'NZIER'**) has considered the actual and potential effects of the Proposal on the economy. A full copy of Mr Clough's Economic Assessment[180] is contained within **Annexure 3** of this AEE. We now summarise Mr Clough's advice as follows:

4.13.1 Alternative Futures

Mr Clough states that there are a series of alternative future scenarios for the Refinery all with varying economic effects. Mr Clough goes on to state that the recent decline in global oil prices which has been caused by supply running ahead of demand, weakening margins at the end of 2019 and the significant short-term shock of the Covid-19 pandemic, has created some uncertainty over the future of the Refinery. Mr Clough notes that the demand drop caused by Covid-19 has put increasing pressure on small refinery margins and increases the likelihood of further small refinery closures across the globe, with newer and larger refineries increasing their share of the global market. Mr Clough considers how Refining NZ has faced challenges and how, in April 2020, the Company embarked upon a strategic review of its future. Mr Clough further states that the strategic review includes examining options such

[179] PTB, *Cultural Effects Assessment Report: Refining NZ Reconsenting*. Dated July 2020, page 36
[180] Clough, P. NZIER, *The Value of Consent Renewal- Economic Assessment of Reconsenting Discharges and Structures at the Marsden Point Refinery*. Dated July 2020

as closing the Refinery and continuing to operate as an import terminal for imported oil products or conversion of the Refinery to produce alternative fuels to assist New Zealand's transition to a low carbon future. In addition, Mr Clough states that in order for Refining NZ to operate either as a refinery or in some alternative fashion being considered in the strategic review, the reconsenting sought by the Proposal is still required regardless. Mr Clough has assessed the economic effects of the alternative futures as they relate to the outcome of the consents sought by the Proposal.

4.13.1.1 Future without Consent Renewal

Mr Clough states that if the Refinery ceased operating, all of its current expenditures and payments to suppliers of inputs and labour in the region would cease. He also states that Refining NZ would be faced with the decommissioning and rehabilitation of the Site being brought forward in time which may inject some spending into the region over the short term, however, that otherwise Northland would be faced with around 7% of its regional GDP contribution not continuing into the future. Mr Clough considers that some labour and other input resources would be redeployed to other industries in the region, however, he notes that these would be less productive uses than those currently found in the Refinery (if that were not the case, labour would be already departing the Refinery). Mr Clough records that some labour with highly specialised oil industry skills would have difficulty finding alternative employment in the region, or even in New Zealand, so would likely relocate, and their earning potential and spending capacity would therefore be lost to the region. Mr Clough notes that releasing labour from the Refinery would increase the supply of labour relative to the demand in the region, potentially lowering the average level of wages and incomes in the region. He states that this may provide a boost to other industries in the region, thus, while the initial impact may be to reduce regional GDP by 7% in the short to medium term, some of that would be recovered by increased activity in other sectors. Mr Clough considers that overall, the regional economy would face some disruption and shrinkage of economic activity, to the detriment of regional well-being.

4.13.1.2 Future with Consent Renewal under tighter restrictions

Mr Clough states that if consents are issued but with more restrictive conditions than under the former consents, that the Refinery and terminal may continue operating but will face increased costs in complying with the new conditions. He notes that Refining NZ faces competition from more scale efficient refineries in Asia, and raising compliance costs through more restrictive consent conditions would squeeze its margins and create further challenges for its continued operation. Mr Clough highlights that a number of refineries in Australia have recently closed or been converted to refined product import terminals (with a workforce of about a tenth of that of the refinery operation), including Shell Clyde (Sydney 2015), Caltex Kurnell (Sydney 2012) and BP Bulwer Island (Brisbane 2015). He states that all these closures have been attributed to competition from more modern, larger and efficient refineries in the Asian region, driving structural change to the supply chain. Mr Clough records that competition from larger refineries offshore exerts continuous pressure on refinery margins which at some point could cause production to no longer be viable. Mr Clough records that Refining NZ might choose to shut down the Refinery and New Zealand would then need to move to importing all of its refined oil products. Mr Clough notes that Refining NZ's expenditures and employment in Northland would then cease, except to the extent that it would retain some oil terminal operations to receive imported products and feed them into the RAP.

4.13.1.3 Future with partial Consent Renewal

Mr Clough considers that the two distinct elements of the Proposal to reconsent discharges and wharf structures have varying economic effects on the outcome of a partial consent renewal. Mr Clough goes on to record that without the reconsenting of activities relating to discharges, the Refinery would not be able to operate unless an as yet unknown technology emerges which is more cost effective in dealing with processing discharges than the current operations which discharge to air, land and water. Mr Clough notes that this outcome would reduce the Refinery's economic contribution to the regional economy to about 10% of its current level. He considers that this outcome would mean that the Marsden Point wharf and tank farm could continue to be used as an oil product import terminal, supplying oil products

to Northland by truck and via pipeline to Auckland, but that the refining activity would cease. Mr Clough notes, however, that oil terminals make some discharges to air, land and water, therefore the decline of all discharge consent applications would mean Refining NZ could not provide even this reduced regional economic contribution.

Mr Clough considers that the effects of not reconsenting the wharf structures, which include jetties and mooring dolphins, are more severe. In this respect, Mr Clough highlights that without reconsenting these structures the Marsden Point wharf could not be used to import either crude or refined oil products, therefore the Refinery and most of the oil terminal equipment would be closed down as redundant, unless repurposed for some use other than oil storage. This outcome, Mr Clough records, would result in virtually all of the Refinery's current contribution to the regional economy ceasing. Mr Clough notes that some of the labour and other resources would be redeployed in other activities, which can be expected to be less productive than their current uses, or may even result in labour relocating out of the region.

14.13.1.4 Future with Consent Renewal

Mr Clough highlights that if consents are renewed with current conditions, the Refinery can continue its current operation, refining crude oil into oil products and distributing to Auckland via the RAP and to the rest of New Zealand via coastal tankers. Mr Clough considers that if consents are renewed under the current conditions that Refining NZ would retain its competitiveness, maintaining its spending and employment in the Northland regional economy.

Effects on the Local Economy

Mr Clough outlines that the direct impact of the reconsenting involves retention of the spending and income generation[181] of the Refinery in the Northland regional economy (i.e. the local economy). He notes that the main effect on the local economy is derived from maintaining the Refinery's competitiveness[182] and its effect of increasing its ability to continue its current operations. According to Mr Clough, this will prolong the period over which the Refinery can deliver its economic contribution to the regional economy.

Effects on the Wider Economy

Mr Clough indicates that a principal difference between the outcome with and without the reconsenting of the Refinery is that in reconsenting the Refinery's discharges and structures, this avoids or defers an increase in imports of refined products, by retaining the operational viability of the Refinery. He advises that increasing imports can have impacts on the balance of payments and put pressure on the exchange rate. He goes on to note, as the value difference between imported crude and imported refined product is a small proportion of the cost of supplying oil products to New Zealand, that such macro-economic effects will not be significant.

Mr Clough emphasises that if consents for the structures of jetty and mooring dolphins are not renewed, the Marsden Point Refinery could no longer access feedstock to continue operating, and it is unlikely that many of the oil terminal facilities would continue to be used. He indicates that if consents are not granted there is a risk of stranded assets and of bringing forward site remediation costs and new investments in the oil distribution network within New Zealand. He states that the principal assets potentially at risk are the RAP, which handles direct transport into Auckland and the Refinery terminal infrastructure. He points out that although the RAP would continue to be the least costly way of transporting product, its use, the volume of product carried, and its cost advantage would be substantially reduced if crude oil or refined oil products were no longer able to be landed at Marsden Point.

Mr Clough concludes that refined products would most likely be imported directly into other coastal terminals in New Zealand to avoid the double handling of imported products, so the

[181] Earnings and spending associated with the Refinery will remain in the local economy, due to the reconsenting, which will directly enable the continued operation of the refinery

[182] the ability and performance of a firm/ company to sell and supply goods and services in a given market, in relation to the ability and performance of other firms/ companies

distribution of refined product from the Refinery through coastal shipping would cease and states that this would ultimately result in the contraction of the shipping business at Marsden Point.

Effects on the natural environment

Mr Clough records that the effects on the natural environment fall into four broad categories being:

- effects on air quality;
- effects on water quality;
- effects on broadly defined cultural amenity; and
- effects on other vessels and activities sharing the Harbour entrance.

He points out that economic valuations of environmental protection are rarely explicitly used in RMA settings because of practical difficulties in estimation, but that economic principles still apply to the consideration of environmental effects. Mr Clough notes that separate assessments relating to effects on a range of environmental disciplines have been commissioned from other consultants with respect to this Proposal. Mr Clough states that he only comments on the economic implications of changes, as summarised in the table below:

Without Reconsenting	Comment	With Reconsenting
Reduction in Marsden Point's contribution to air quality deterioration and associated health costs in Whangārei and surroundings.	This depends on Marsden Point's share of discharges in airsheds and the strength and direction of prevailing winds. The Refinery would need to have a large share of the discharges in order significantly impact on health costs.	Continuation of current impacts
Reduction in Marsden Point's contribution to water quality deterioration and associated restrictive activities and risks.	This depends on Marsden Point's share of discharges into the Harbour and the level of water use and contact. The Refinery would need to have a large share of the discharges into the Harbour in order significantly impact on costs.	Continuation of current impacts
Reduction in broadly defined cultural impacts of discharges and structures, e.g. displacement of activities from water space (recreation) and encroachment onto other areas of interest (visual impacts, iwi sensibilities).	Refining NZ's structures occupy a small share of Harbour and substitute sites for recreation and visual appreciation are not scarce. Refining NZ's structures would need to cause large displacement to incur significant costs.	Continuation of current impacts
Reduction in vessel movements around Marsden Point and approach channel, if non-renewal of consents for structures closes the ability to land product at the terminal.	This would reduce vessel movements around Whangārei Harbour but increase them elsewhere in NZ. It would reduce spending brought to the region by vessel movements and increase cost of oil product distribution elsewhere across NZ.	Continuation of current impacts

Table 4.13.4.1: *Effects of Reconsenting*

4.13.2 Longer term prospects

In looking to the future, Mr Clough states that the Government is pursuing a policy of Net Zero Carbon by 2050 as a measure of climate change amelioration. He concludes if that if this is achieved, demand for oil product faces a finite timeline before transport systems are converted to alternative, low emission propulsion sources (e.g. vehicles powered by electricity or hydrogen fuel). He then emphasises that net zero carbon does not mean no

greenhouse gas emissions or use oil products, rather, that emissions that arise in future will need to be offset by emission reductions or carbon sequestration (such as tree planting), elsewhere.

Mr Clough states that the timing of vehicle electrification is unlikely to significantly affect the economic gains from reconsenting, as most of the changes are likely to be many years ahead, when the present value of costs and benefits will be diminished. Mr Clough considers that new technologies like electric vehicles require a lead time to become commercially viable, and then to achieve sufficient market penetration to transform the national vehicle stock. He notes that oil-based fuels will still be required for other transport, like aviation, for the foreseeable future. Mr Clough considers the likely period required to turn over the vehicle fleet to alternative fuel source vehicles will be considerable, even if the Net Zero Carbon by 2050 target is on track. He further notes that foreign vehicle suppliers and governments in the United Kingdom and France have indicated that they expect continued manufacture of internal combustion powered vehicles until around 2040. Given this, Mr Clough records that it may be many years before a sufficiently broad range of alternatively fuelled vehicle models becomes available for importing into New Zealand and makes serious inroads into the national stock of vehicles.

Mr Clough considers that the time within which the Refinery operation becomes uneconomic due to falling petrol demand is likely to arrive between 2042 (with forecast high Electric Vehicle uptake) and 2048 (with base forecast Electric Vehicle uptake). He states further that this leaves almost three decades in which petrol is likely to remain in demand and in which the Refinery and or the oil terminal facilities are likely to remain of value to Refining NZ and the regional economy. He goes on to record that continued operation of the Refinery could also help facilitate and fund the transitional energy developments over that period such as blended biofuels, hydrogen production, and possibly rendering plastic waste into Refinery feedstock.

According to Mr Clough, reconsenting will prolong the operational life of the Refinery and push back its future decommissioning and in doing so, reduce the present value of the costs of that decommissioning. He also reports that it will be less disruptive on the regional economy to ease into a future Zero Carbon world, by maintaining operation with gradual adjustments over 20-30 years, than to endure a sudden sharp shock contraction of activity due to consents being declined. He notes that this would almost certainly result in a reduction in jobs, incomes and well-being within the regional economy for an indefinite period, until other industries arise to provide alternative employment. Further, Mr Clough considers that markets are gradually developing the technologies to transform the transport fleet, and it will be less costly if that transformation occurs gradually than if the withdrawal of the Refinery's consents forces sudden disruption of New Zealand's oil product distribution, interim fixes to maintain oil based fuel supplies, and later transformation to alternative fuels.

Mr Clough records that Refining NZ has substantial investment in the Marsden Point Site and its workforce. Given this, he notes that the Company has incentive not to write off its investment, but rather adapt to changing market conditions and regulatory requirements, such as those arising from the Zero Carbon Act. He notes that some of the Site and its equipment has potential for use in other production in the transition to a low carbon economy, such as blending of biofuels, or production of hydrogen, which could be used to power transport in future. Mr Clough records that the viability of the Site for such transitional services could be undermined if consents are not renewed for discharges, wharf structures and jetties, forgoing an opportunity for a New Zealand firm to supply the country with alternative fuels and contribute expenditure, value add, and employment to a constituent part of the Northland economy.

4.13.3 Conclusions

Mr Clough states that reconsenting defers the date at which the Refinery Site would need to be decommissioned and rehabilitated. He states that although decommissioning would inject some initial short-term spending into the region and result in a Site available for other

activities, there are substantial resource costs in decommissioning, the cost of which is smaller the further that decommissioning is deferred into the future.

Mr Clough states that the reconsenting of the Refinery is required to enable the continuation of its operations at Marsden Point. He records that in 2018 these operations contributed $430 million per year in GDP to the Northland economy, about 6.8% of the region's total, together with providing 655 jobs that year for employees (390) and contractors (265). Mr Clough notes that this is about (16 % of the Whangārei total and 1% of the Northland total). He notes that the corresponding averages over the past three years are contributions of $428m in GDP and 636 jobs, so the contribution has been relatively stable in absolute terms, although declining slightly in proportion to the Northland economy as it has grown.

Conversely, Mr Clough notes that the most direct economic effects of not reconsenting the Refinery discharges and structures will be a loss in average year annual contribution of around $312 million of regional GDP and around $48 million in regional incomes for employees. He notes there will also be indirect impacts in loss of business flowing from the Refinery to suppliers of its inputs and to the businesses that benefit from higher levels of expenditure enabled by higher earning employees in the Refinery. Mr Clough states that the reconsenting of the Refinery will bring about continued funding available to invest in environmental improvements, which, in turn, will have positive effects on social, cultural and environmental well-being. Mr Clough states that reconsenting would give Refining NZ more options to explore transitional energy investments, such as a solar power plant on the Company's Site, and new innovative re-purposing of refinery infrastructure to provide lower carbon emitting fuels.

Mr Clough highlights that the Refinery is the only one in New Zealand and therefore occupies a pivotal position in supplying oil products which he regards will continue to fuel transport in New Zealand over the medium to long term future. Mr Clough additionally states that enabling the Refinery to continue to operate would contribute to regional well-being by continuing to provide incomes and spending in Northland, enable resource use efficiency by not prematurely stranding infrastructure assets, and would enable Refining NZ to extract more return from its investment and maintain an efficient operating asset. Mr Clough's assessment of the effects are summarised in the table below adapted from Mr Clough's Economic Assessment[183] contained within **Annexure 3** of this AEE:

Without Reconsenting	**With Reconsenting**
After cessation of Refining NZ's regional contributions to: - Value Added: $118m/year ($312 million reduction in GDP) - Incomes: $29m/year ($48m reduction in incomes) - Employment: reduced due to loss of jobs at the Refinery - Exodus of skilled oil industry professionals to areas outside Northland - Redeployment of remaining labour and resources to less productive uses in other industries within Northland.	Refining NZ's Regional contributions to: - Value Added $430million /year to regional GDP - Income $77million /year ($56million for wage and salary payments to RNZ employees and $21million in payments to contractors) - Employment: 476 full-time employment of employees and contractors averaged over past three years - Population retention due to job continuity
Immediate need for the Refinery to be decommissioned, at a cost of $300 million.	Present value ('**PV**') cost and (saving) of deferring date of the Refinery decommissioning by: 10 years PV$167million (PV$133million) 20 years PV$93million (PV$207million)

[183] Clough, P. NZIER, *The Value of Consent Renewal- Economic Assessment of Reconsenting Discharges and Structures at the Marsden Point Refinery*. Dated June 2020

	35 years PV$39million ($261million)
Increased cost of oil supply and distribution	
Sudden transition to new interim fuel distribution pending transition to Zero Carbon	Gradual transition to low carbon power sources such as renewable electricity, biofuels and hydrogen
Avoidance of the Refinery's share of discharges to air and associated impacts	Refinery share of discharges to air and associated health and productivity impacts
Avoidance of the Refinery's share of discharges to water and associated impacts	Refinery share of discharges to water and associated health and productivity impacts
Avoidance of the Refinery's intrusion on recreation, amenity and cultural interest	Refinery share of intrusion on recreation, amenity and cultural interest

Table 4.13.3.1: *Effects of Reconsenting*

4.14 Recreation and Tourism Effects

The Recreation and Tourism chapter of the CSP-AEE addresses the recreation and tourism values that exist in close proximity to the Site and is based on a report prepared by Mr Greenaway of Greenaway & Associates Limited. A full copy of Mr Greenaway's report is attached within **Annexure 3** to this AEE.

As we have already recorded, Mr Greenaway advises that the Whangārei Harbour, the Harbour entrance, and the marine and coastal marine settings between Marsden Point and Bream Head, are intensely used recreation settings. He records that the recreation and tourism activities undertaken include swimming / beach activities, surfing, fishing, shell fishing, diving and snorkelling and boating. We understand Mr Greenaway's advice to be that the reason for the number of recreation activities is due to the quality of the environment (which is high). We now consider the potential impact of the Proposal on the environment as it relates to tourism and recreation.

The potential impact of air quality on tourism and recreation is negligible as Mr Chilton in his Assessment of Air Quality[184] for the Proposal finds that the ongoing discharges to air from the Refinery will have a less than minor effect on the environment. He also indicates that odour effects as a result of discharges from the Refinery are less than minor which is supported by the relatively low level of recent odour complaints and the infrequent light wind conditions that could transport odours towards sensitive locations. According to Mr Chilton the potential for dust nuisance effects is also very low and indicates that wind-blown deposition of dust can be avoided by managing blasting activities near the coast and avoiding blasting during winds that could carry material into the marine environment. Given Mr Chilton's conclusions we consider that the effects of odour and dust are minor or less and their effects on recreation and tourism could be considered minor or less.

Dr Martin and Ms Reaburn in their Assessment of Terrestrial Ecological Effects[185] for the Proposal, state that they do not expect that the air discharges will result in any detectable adverse effects for indigenous terrestrial ecosystems. They find that no bats, birds, herpetofauna or invertebrates within the receiving environment are likely to be exposed to concentrations of SO_2 that exceed critical levels, and go on to note that air discharge is unlikely to result in any detectable adverse effects for indigenous terrestrial fauna and therefore the effects would be less than minor. Given their conclusions we consider that the effects of air discharge are minor or less and its effects on recreation and tourism could be considered minor or less.

[184] Chilton, R. Tonkin & Taylor Limited, *Air Quality Assessment*. Dated June 2020
[185] Martin, T. and Reaburn, J. Wildlands Limited, *Assessment of Ecological Effects for Air Discharges from the Marsden Point Oil Refinery*. Dated June 2020

According to Dr De Luca and Dr Ross in their Assessment of Effects on Marine Ecological Values[186] for the Proposal, it is known that both water quality and sediment quality are high, and the benthic invertebrate assemblages are diverse and abundant. They record that the impact of discharged suspended sediment and potential for the discharge of process chemicals are also expected to have negligible to low adverse effects on marine ecological values respectively. They state further that because of this data, there is no cause for concern about adverse effects from the Proposal on marine ecological values. Dr De Luca and Dr Ross then advise that the marine environment has high ecological values and concludes that the magnitude of effect of the proposed discharges and occupation range is from very low to negligible. They further note that the discharges from Refining NZ is unlikely to contribute to a more than negligible cumulative effect on water quality in Whangārei Harbour or Bream Basin. Therefore, we consider that the overall impact of discharges on activities such as swimming / beach activities, surfing activities, fishing activities, shell fishing areas, diving and snorkelling will in turn be negligible. Given their conclusions we consider that the effects of discharges on the activities referred to above to be minor or less, and their effects on recreation and tourism could be considered minor or less.

Mr Brown indicates in his landscape assessment[187] that addresses the reconsenting of both activities and structures that are currently associated with the Refinery and Northport. He reports that with the smoke plume and gas flare the jetty and dolphins add little to the landscape of Marsden Point and records that the jetty would not appreciably alter the nature or values of the outlook currently experienced by residents up and down the Harbour, or across it. He therefore notes that the aesthetic character and values of the Harbour landscape remain intact, without any appreciable reduction in their coherence. He also records that the identity and sense of place associated with the outer Harbour and its margins are hardly changed by the jetty and its berthage dolphins. According to Mr Brown, the jetty does not generate any appreciable nuisance effects, such as excessive lighting, that at night-time is largely absorbed by the wealth of lighting within the existing Refinery and port compounds. Any effects on amenity values are therefore anticipated as being less than minor. Given Mr Brown's conclusions, we consider that impact on tourism and recreation from an amenity perspective would also be less than minor.

Overall, when all things are considered, the actual and potential recreation and tourism effects of the Proposal are expected to be less than minor.

4.15 Social Effects

We understand that, in broad terms, a 'social effect' is something that could impact on the 'social fabric' and/or 'social infrastructure' of the community. It incorporates considerations such as the well-being of individuals, families and interest groups / stakeholders.

In order to determine if the Proposal results in social effects, we are of the opinion that regard must be paid to all of the technical reports that have been summarised in section 4.0 of this AEE and the conclusions drawn within the same. Further, the outcomes of the consultation undertaken by Refining NZ must be considered. Having considered the consultation outcomes and technical analysis, we are of the opinion that the Proposal is unlikely to generate unacceptable adverse social effects and that it is likely to generate impacts that benefit individuals, families and communities.
In this regard:

1. The Refinery has existed since the 1960s and is therefore an established activity that sits within an area that has been substantially modified. Mr Brown advises that having considered the Proposal in the context of the existing landscape, amenity and natural character values of the Site and the environs that the areas supporting outstanding natural character and landscape values would not be directly impacted by the Proposal.

[186] De Luca, S., and Ross, Dr P., Boffa Miskell, *Assessment of Effects on Marine Ecological Values- Reconsenting of discharges and structures in the CMA*. Dated December 2019
[187] Brown, S. Brown NZ Ltd, *Marsden Point Refinery Re-Consenting Project – Landscape Assessment*. Dated June 2020

2. In terms of discharges, while it is not possible to avoid all adverse effects that are associated with the discharges to water, we understand that these have been remedied or mitigated to the point where they are considered to be less than minor by a number of respected experts. In this regard, we understand the advice of Dr Stewart to be that the Refinery does not generate adverse water quality effects that could compromise the maintenance of coastal water quality. Further, we understand the advice of Mr Chilton to be that the discharges do not cause the emission of any objectionable odour.
3. While it is also not possible to avoid adverse effects arising as a consequence of the discharges to air, Mr Chilton's advice is that any adverse effects of this nature will be less than minor. Experts such as Dr Kelly and Dr Martin / Ms Raeburn conclude that the human health and terrestrial ecology effects associated with the discharges to air are also small.
4. The adverse effects associated with the Refining NZ structures within the CMA are predicted to be small by the various experts advising Refining NZ. The structures have an operational need to be sited within the CMA and they are important to the on-going existence and functioning of the Refinery. Refining NZ indicates that all of its structures within the CMA will be maintained in good order and will be maintained using construction materials that are appropriate to its location.
5. Mr Greenaway notes that the environs within and in close proximity to the Site support a number of recreation and tourism values, some of which are significant. We are of the opinion that it is important to note that those values coexist with the Refinery and the continued existence and operation of the Refinery has not prevented those values from arising. The combined advice of Dr De Luca, Dr Ross, Dr Martin and Ms Raeburn, the ecologists retained by Refining NZ, together with the advice provided by Mr Brown leads us to the conclusion that nothing is proposed that will cause those existing values to be noticeably changed or substantially diminished. Having considered the body of advice that is available to us, we note that any adverse effects on recreation should be, at worst, less than minor.
6. The Proposal does not interfere with the public's existing ability to gain access to and/or along the CMA. We are therefore of the opinion that it will maintain the levels of accessibility that presently exists. While Refining NZ proposes to retain some restrictions that limit public access to and/or along the CMA, the restrictions are needed for public health and safety reasons, and as they assist the Company with the security of the Refinery Site.
7. The area surrounding the Site is recorded as being 'relatively significant' from an archaeological perspective. While earthworks or discharges that cause erosion could reveal unrecorded archaeological sites, it is important to note that no earthworks are proposed as part of the Proposal, and that the proposed discharges have not (to date), revealed any archaeological resources. For these reasons, we do not expect any adverse archaeological or historic effects to occur as a consequence of the Proposal.
8. Shellfish is an important food resource to tangata whenua. Dr Kelly notes that the risk of health effects from consumption of shellfish *(kaimoana)* that have been exposed to the discharges from Refining NZ to be less than minor.
9. Overall Dr Kelly finds that the risk of adverse human health effects from the discharges brought about by the Proposal are less than minor.
10. We are advised by Mr Clough through the NZIER Assessment[188] that Northland has the highest age dependence ratio (proportion of people under 15 and over 65) of any New Zealand region, and this ratio is forecast to significantly increase as able-bodied people move to other regions in search of jobs, therefore the employment opportunities provided by Refining NZ are essential for the retention of able-bodied people within the region.

[188] Clough, P. NZIER, *The Value of Consent Renewal- Economic Assessment of Reconsenting Discharges and Structures at the Marsden Point Refinery*. Dated July 2020, page 10

11. Mr Clough records, the Refinery is important to the economic wellbeing of Northland and beyond. In this regard, Refining NZ employs around 390 staff, with an extended team of approximately 265 local contractors. Further, the current average remuneration of Refinery staff and contractors is well above the average remuneration of employees in Northland, as set out within Mr Clough's assessment[189]. As a substantial employer in the Northland Region, offering relatively highly skilled and highly paid job opportunities[190], the Refinery is a significant driver of economic activity and in turn, a provider of social benefits for the region.
12. In addition to the 'steady' annual employment Refining NZ also employs additional staff for annual shutdowns. We are advised by Mr Clough that these vary in size and duration each year but can offer work for around 500 people for a period of 3 to 4 weeks. This is also important to the economic and social well-being of the Northland region, where we understand that unemployment rates are generally high.
13. Mr Clough states that if consents are not renewed and the Refinery could not remain in operation, New Zealand would be reliant on imported refined product for all its transport needs. The Marsden Point Site might still function as an oil import terminal, but according to Mr Clough overseas experience suggests this would reduce expenditures and employment to about 1/10 of their current level[191], with corresponding contraction of spending and incomes earned in other industries in the region.
14. Further to the above we understand that the Refinery is a significant driver of economic activity for the Northland region and the incomes earned by Refining NZ staff and contractors directly help retain nearly 500 households in the region. In turn, their consumption of goods and services generates income and employment for local businesses in and around Whangārei.
15. As we have noted, the investment associated with the continued existence and on-going operation of the Refinery (including those structures that are situated within the CMA) is significant. Further, as no new activities are proposed, the actual and potential effects of those structures that are required to be located within the CMA are well known and have been assessed to be very small. In contrast, the positive effects that are generated by the Refinery (of which the coastal structures are an integral and significant component) are notable, which brings about a number of equally notable positive social effects.

4.16 Positive Effects

There are a number of actual and potential positive effects associated with the Proposal. We now provide a list of the key beneficial effects associated with the Proposal. When considered collectively, we are of the opinion that they represent a significant beneficial impact.

1. Ms Schiess and Mr Simpson in the T&T report[192] advise that the continued hydraulic containment of the shallow coastal groundwater system provided by the groundwater take at the Refinery is considered overall to bring about a positive effect as it prohibits the movement of the hydrocarbon products into the marine environment and enables the recovery of LNAPL, thereby reducing the source of contamination over time.
2. The Refinery Jetty creates a hard shore habitat and there is a wide variety of hard shore organisms on the piles as per photographs 2.3.5.6.1 to 2.3.5.6.4. The Refinery grounds also provide roosting and nesting habitat respectively for nationally at-risk

[189] Clough, P. NZIER, *The Value of Consent Renewal- Economic Assessment of Reconsenting Discharges and Structures at the Marsden Point Refinery*. Dated July 2020, page 20

[190] Based on data from Refining NZ annual report and Infometrics we estimate that average annual earnings per employee / contractor working at Refining NZ in 2015 was in excess of $120,000 compared with an average of $50,000 across the region.

[191] Clough, P. NZIER, *The Value of Consent Renewal- Economic Assessment of Reconsenting Discharges and Structures at the Marsden Point Refinery*. Dated July 2020, page i

[192] Schiess, S. and Simpson, C. Tonkin & Taylor Limited, *Hydrogeological Conceptual Site Model for the Marsden Point Refinery*. Dated July 2020

species. Given this, Mr Don in the Bioresearches report[193] considers that the Refinery structures (and the continued existence of the same) are positive features within the coastal bird habitat.

3. Refining NZ is a significant contributor to both the local and national economies, employing approximately 390 staff, with an extended team of approximately 265 local contractors (significantly more during plant shutdowns). Given this, the Refinery generates significant income and spending within the Northland region. Mr Clough in the NZIER report[194] advises that the direct impact of the reconsenting Proposal (should consent be granted) involves retention of the spending and income generation of the Refinery in the Northland regional economy, prolonging the period over which the Refinery can deliver its economic contribution (which was 6.8% of GDP in 2018).[195] Closure of the Refinery, with its large workforce and its contribution to business expenditures in the region, would have, we understand, a significant negative impact on regional economic activity.
4. The national economy and the Auckland/Northland/Waikato regions are all heavily dependent on the continuous operation of the Refinery and the RAP as they are responsible for approximately 97% of the Auckland region's road transport and aviation fuel needs. Indeed, the Auckland International Airport is totally dependent on the Refinery and the RAP for supply of its aviation fuels. As such, and as addressed by Mr Clough within his economic assessment[196], the reconsenting Proposal plays a crucial role in energy security in that it avoids or defers an increase the import of refined products.
5. The Proposal will contribute to the supply of secure and reliable energy for Northland and, indeed, New Zealand. While this benefit is secured using fossil fuels, we understand that such energy is needed in the foreseeable future.
6. In addition, Mr Clough advises[197] that should the Proposal be implemented, the operational life of the Refinery will be prolonged, and its future eventual decommissioning will be pushed further out. In turn, this will reduce the present value of the costs of that decommissioning, defer costs associated with site remediation, and be less disruptive on the economy as it eases into a future zero carbon world.

[193] Don, G. Bioresearches Limited, *Coastal Birding Assessment*. Dated June 2020
[194] Clough, P. NZIER, *The Value of Consent Renewal- Economic Assessment of Reconsenting Discharges and Structures at the Marsden Point Refinery*. Dated July 2020
[195] Clough, P. NZIER, *The Value of Consent Renewal- Economic Assessment of Reconsenting Discharges and Structures at the Marsden Point Refinery*. Dated July 2020, page 21
[196] Clough, P. NZIER, *The Value of Consent Renewal- Economic Assessment of Reconsenting Discharges and Structures at the Marsden Point Refinery*. Dated July 2020, page 16
[197] Clough, P. NZIER, *The Value of Consent Renewal- Economic Assessment of Reconsenting Discharges and Structures at the Marsden Point Refinery*. Dated July 2020

5.0 CONSULTATION

5.1 General Approach

With regard to consultation, Refining NZ's intention was to seek to understand who is likely to be affected by the Proposal, and then to proactively engage with them in a manner that is, in our opinion and experience, genuine, transparent, and open (insofar as the outcome was not preconceived) and provided sufficient time for parties to consider the 'consultation draft' material and respond. This approach has afforded Refining NZ sufficient time to adequately consider feedback provided, and to respond to that feedback by incorporating it into its AEE where appropriate. Further, it is important to note that this consultation was undertaken despite Section 36A of the RMA recording that there is no duty to consult any person regarding applications for resource consent (although we note the requirement to notify and seek the views of applicants for customary marine title under the Marine and Coastal Area (Takutai Moana) Act 2011 ('**MACA Act**')).

The consultation strategy employed by Refining NZ was informed by the recent CSP consent process as the relationships with stakeholders that would likely have an interest in the reconsenting of the Refinery's activities had already been established through that process. Consequently, Refining NZ has consulted with staff, stakeholders, independent experts, and representatives from the NRC and Tangata Whenua as to any other groups that would likely have an interest in the current Proposal. These groups are categorised as the following:

- Tangata Whenua and iwi groups with an interest in the Proposal and the environs that could be affected;
- Applicants for customary marine title under the MACA Act;
- NRC officers and independent consultants;
- The applicable stakeholder groups; and
- The general public.

Having developed an initial list, Refining NZ then engaged with a number of parties early in the Proposal's development. The engagement typically began by Refining NZ detailing the resource consents required and the technical experts engaged, followed by a general progress update on the various components of the Proposal. They also sought feedback as to the issues in the Proposal that would need to be addressed and the studies to be commissioned. This approach was seen as being critical for the Company in order for it to maintain, improve, and renew existing relationships with the parties that had previously been identified and utilised, and to develop new (effective) relationships where none had previously existed.

In recognition of their status as Tangata Whenua, consultation initially began with the hapū and iwi that could be potentially affected by the Proposal. That focus was, however, quickly expanded to include the likes of applicants for customary marine title under the MACA Act, the WDC's iwi representative group (Te Huinga), various stakeholders and interested parties, and the general public.

A record of consultation was established to monitor ongoing engagement and can be viewed in **Annexure 7**. We now summarise the consultation that was undertaken with Tangata Whenua, the general public, and stakeholders.

5.2 Tangata Whenua Consultation

The initial engagement strategy was informed by the experience of the CSP which was developed following discussions with the PTB and with the NTB, both of whom have signed memoranda of understanding with Refining NZ. Te Parawhau was also approached given the interest shown during the CSP. Refining NZ also approached the Regional Council and PTB to recommend a method to consult with Tangata Whenua which resulted in meetings taking place with Te Huinga.[198] We therefore consider that Refining NZ has attempted to establish

[198] Te Huinga includes representatives from all hapū from around the Whangārei Harbour and the wider Whangārei area

relationships with Tangata Whenua groups, in and around the Whangārei Harbour and Bream Bay, who are likely to have an interest in the Proposal.

From these discussions, a more substantive Tangata Whenua engagement methodology was developed with actions that included:

1. Inviting parties to prepare a Cultural Effects Assessment / Cultural Impact Assessment ('**CEA**' or '**CIA**');
2. Undertaking a hui so as to provide an accessible forum for discussion of the Proposal with PTB, and offering a pan-hapū hui to be organised by Te Parawhau (however, we note that this did not eventuate);
3. Providing consultation draft reports to PTB, NTB and Te Parawhau for review and feedback and making Refining NZ's independent experts available to discuss the findings in those draft reports; and
4. Providing the offer to fund independent experts to review technical documents on behalf of tangata whenua and to provide assistance to tangata whenua as required.

From March 2019 until the lodging of this resource consent application and AEE, regular meetings with PTB's Resource Management Unit Manager, Juliane Chetham were undertaken to ensure that PTB was provided updates in relation to the Proposal and the technical reports that have informed the same. Refining NZ attempted to meet with the other relevant Tangata Whenua groups also, however no further meetings were undertaken.[199] Additionally, the pre-application consultation draft reports and studies by independent experts were shared with Te Parawhau, NTB and PTB in December 2019 – January 2020. The latest versions of these reports were put together as a summary pack that was circulated in April 2020 and discussed during a hui with PTB (held via a Zoom videoconference due to COVID-19 restrictions) on the 9th of May 2020 at which a number of Refining NZ's independent experts attended. The purpose for this ongoing engagement has been for Tangata Whenua to identify cultural values on the Poupouwhenua (Marsden Point) and around the Harbour. It also allowed Tangata Whenua representatives to put their concerns regarding each element of the Proposal, directly to the relevant technical expert and Refining NZ staff member.

5.3 Feedback from Tangata Whenua on the consultation process

A summary of feedback received on the consultation process is listed as follows:

1. At the start of the engagement process PTB and Te Parawhau indicated their interest in preparing a CIA / CEA for the Proposal.
2. NTB stated that they were happy to defer to PTB in the development of a CEA on the 26th of June 2019. This position was confirmed again in an email on the 27th of May 2020.
3. PTB expressed interest in holding a future workshop to discuss the Proposal. PTB also recommended reaching out to Te Huinga, WDC's Tangata Whenua representative group, as an option to capture feedback from other local hapū that may have an interest in the Proposal.
4. An offer to meet directly was made to all groups at the Te Huinga meeting, however while Ms Wakefield (on behalf of the Rewarewa D Māori Incorporation) expressed some interest, she deferred to Te Parawhau who had otherwise already accepted this offer.
5. As set out in section 5.2 above, a Hui between Refining NZ representatives, technical experts and PTB members was conducted via a Zoom videoconference on the 9th of May 2020. The Hui allowed the two parties to discuss the findings of the various technical expert reports, and any questions they had regarding the Proposal. This information was then used to inform the Patuharakeke CEA, the draft of which was provided to Refining NZ on the 19th of June 2020, followed by the final version on the 7th of July 2020.
6. Refining NZ has also consulted with representatives of Te Parawhau, both by independently engaging Ms Mira Norris to discuss the application, and via the Te Parawhau representative on Te Huinga. The meeting with Te Huinga resulted in a

[199] Te Parawhau cancelled a scheduled meeting and have since provided no response; NTB deferred to PTB who has met with Refining NZ; and no other approaches from Te Huinga apart from Ms Wakefield who was happy for Te Parawhau to be the key contact.

request for further contact from Ms Wakefield of the Rewarewa D Māori Incorporation. However, Ms Wakefield also had links to Te Parawhau, thus noted that she was happy for Ms Norris of Te Parawhau to be the key contact in ongoing engagement with Te Parawhau. As part of that continued engagement, Te Parawhau proposed that a CIA be prepared, supported by technical reports provided by the Refinery's experts and reviewed by Auckland University Services. On numerous occasions between January and May 2020[200], Refining NZ sought an update from Te Parawhau on the status of their CIA proposal. Refining NZ is still yet to receive a formal CIA proposal from Te Parawhau. Refining NZ will continue to engage with Te Parawhau moving forward.

5.4 Consultation with Applicants for Customary Marine Title

Under the MACA Act, Refining NZ is required to notify and seek the views of applicants for customary marine title on the reconsenting project. On 24 June 2020 Refining NZ notified 36 applicants, a list of whom can be viewed in **Annexure 15** as attached to this AEE. To date, no substantive responses have been received.

5.5 Public Consultation

Refining NZ has targeted community groups over the past year to let them know that the Company is working on the reconsenting Proposal and associated technical assessments.

Refining NZ has decided to wait until post-lodgement to establish an ongoing strategy for consultation and engagement with the general public, in order to assist with an understanding of the Application and to provide an avenue to address any questions the public might have during the submission process. However, given the relatively low level of effects which have been assessed to be associated with the Application there may be no (or minimal) further public consultation required. We agree this is an appropriate approach.

In the meantime, Refining NZ has instead focused its consultation efforts on engaging with Tangata Whenua and relevant stakeholder groups.

5.6 Stakeholder Group Consultation

As with Tangata Whenua, engagement began on the back of already existing relationships between the Refinery and various stakeholder groups. Throughout the consultation process, the applicable groups have been briefed on the Proposal, either by staff of Refining NZ attending regular meetings of these groups (notably, residents and ratepayers' associations), by separate appointment, or via email and/or telephone contact, starting in May 2019. The objective of this engagement has been to provide progress updates on the reconsenting project and to provide these groups with a forum for comment on the same.

The stakeholder groups that were consulted included residents' groups, local government, environmental groups, Harbour users, local land and business owners, and a local school. Each engagement has been noted in a consultation database held by Refining NZ. A full list of the applicable stakeholders is repeated in this Footnote below[201].

On the 20th of December 2019, pre-application 'consultation draft' independent expert reports were made available to NRC. These were subsequently made available to DoC, Northport, MMH (and also to PTB, NTB, and Te Parawhau) in January 2020. These related to the following disciplines: Air Quality; Ecological Assessment; Marine Ecological Values; Marine Mammal Assessment; Water Quality; Hydrological Conceptual Site Model; Economic Assessment; and Landscape Assessment. A consultation draft Alternatives Assessment prepared by Refining NZ was also shared with stakeholders on this date. Feedback provided from Tangata Whenua and Stakeholder groups has been responded to and expert reports have

[200] 15 January - phone call; 4 February - phone call; 25 February - phone call; 25 February - email; 19 March - scheduled meeting cancelled; 3 April - email; 22 April - email; 14 May - email.

[201] Residents Groups: Marsden Point Liaison Committee; Whangārei Heads Citizens Association; and Ruakaka Ratepayers Association; Public sector/Local Government: Northland DHB; WDC; and NRC; Significant landowners/users: Northport; Marsden Maritime Holdings; Air Liquide; BOC Gas; Environmental Groups: Department of Conservation; Marine Reserve Advisory Committee; and Bream Head Conservation Trust; and local Schools: Bream Bay College ;(and Whangārei Heads Primary School post-lodgment)

been updated accordingly as needed. Further feedback was sought in April 2020 on a package of the latest versions of the technical reports which were provided as 'Draft Findings for consultation' (the '**summary pack**'). A list of draft report summaries included in this package is included as a Footnote[202]. Offers were also made to other parties to review the expert reports as Refining NZ's consultation process progressed, however most noted that they were happy with the summary pack previously provided.

5.7 Feedback from Public and Stakeholder Groups on the consultation process

The majority of the feedback received was a request for continued engagement. As a result of ongoing consultation, together with the provision of the latest information pack, Refining NZ has received approval from a number of parties. The most recent feedback from each party is summarised as follows:

1. The Department of Conservation ('**DoC**') provided a letter in response to Refining NZ's draft reports on the 5th of May 2020. In its letter, DoC stated that further to reviewing the draft reports, it did not have any additional comments on the Proposal at this stage of the process, aside from the need for information regarding emergency plans in the case of natural disasters. In considering the assessment of effects on the ecological values of fauna, flora and the adjoining CMA, DoC noted that the reports provided were sufficient, although it highlighted that its response did not constitute affected party approval.
2. WDC Reserves Team was consulted, given their ownership of neighbouring reserve land. WDC requested a number of the technical reports to review. Further to their receipt and review of the technical reports, in an email on the 2nd of July 2020, WDC stated that it was comfortable with the Proposal and would provide affected party approval, however it would need to undertake a final review of the application document before doing so.
3. As noted above, pre-application 'consultation draft' reports prepared on behalf Refining NZ were provided to NRC in December 2019. NRC's expert advisors undertook a pre-application review of those reports and provided feedback in February-March 2020. Refining NZ's independent experts considered that feedback and responded as appropriate, including by updating the draft reports and/or providing an explanatory response to NRC. Those responses were provided to NRC in April 2020. The responses to NRC were also provided to PTB in order that the information could be considered, as relevant, for the preparation of the CEA.
4. Marsden Point Liaison Committee ('**MPLC**') (which also includes representatives from Ruakaka Residents and Ratepayers Association ('**RRRA**'), Whangārei Heads Citizens Association ('**WHCA**'), and a representative of NRC) has been meeting with Refining NZ on a six-monthly basis. In this regard, Refining NZ undertakes scheduled six-monthly meetings with the MPLC to discuss discharges and other activities that occur on the Refinery site. At its latest meeting on the 11th of June 2020, the attendees also discussed the summary pack provided in April 2020. The outcome of this discussion was that Refining NZ was to set-up meetings with both WHCA and RRRA (we note that the meeting with RRRA may take place post-lodgement).
5. Refining NZ undertook a meeting with WHCA on the 8th of July 2020.
6. A meeting was held between representatives of the Northland District Health Board ('**NDHB**') and Refining NZ in February 2020. Following this meeting the NDHB was provided with the summary pack for its consideration. NDHB personnel have also reviewed the draft Environmental Health Assessment and stated on the 30th of June 2020 that they will endeavour to provide their findings in a timely manner. However, to date, no further comment has been received from NDHB.
7. Bream Heads Conservation Trust ('**BHCT**') has been consulted regularly throughout the duration of the reconsenting project. The summary pack was provided to BHCT on the 5th of June 2020 in preparation for the next meeting between Refining NZ and

[202] Air Quality (Tonkin & Taylor); Terrestrial Ecology (Wildlands); Groundwater and Contaminated Land (Tonkin & Taylor and GWS Ltd.); Water Quality (Streamlined Environmental); Marine Ecology (Boffa Miskell); Marine Mammals (Cawthron Institute); Environmental Health (Environmental Medicine Ltd.); Avifauna (Bioresearches); and Landscape (Brown NZ Ltd.)

BHCT. In the latest meeting with the BHCT on the 11th of June 2020, the Trust raised specific issues with regard to notification. Further comment on the Proposal is anticipated from BHCT, however it is noted that this has not been received to date.

8. On the 13th of November 2019, the Marine Reserve Advisory Committee ('**MRAC**') expressed its interest in reviewing the technical reports once they were available, noting that it would like a further opportunity to engage with Refining NZ regarding any concerns it may have with the Proposal post review of the same.
9. Northport has been consulted regularly throughout the Reconsenting Project. The summary pack was provided to Northport and briefly discussed in a meeting on the 27th of May 2020. On the 16th of June 2020, a written letter of approval was provided by Northport to Refining NZ.
10. Air Liquide, as a neighbouring business, has been consulted regarding the Proposal by Refining NZ. Written approval was provided by Air Liquide to Refining NZ on the 18th of June 2020.
11. BOC Gas, as a neighbouring business was similarly consulted regarding the Proposal, and was provided the summary pack and draft technical reports of interest and draft technical reports of interest. At a meeting undertaken between Refining NZ and BOC Gas on the 16th of June 2020, BOC Gas confirmed that it did not have any concerns regarding the Proposal. Subsequently, BOC Gas provided a letter of written approval to Refining NZ regarding the Proposal on the 2nd of July 2020.
12. Wiri Oil Services Limited ('WOSL') who operate the adjacent oil products truck loading facility, have also been consulted regarding the Proposal. WOSL was provided the Proposal summary pack on the 29th of May, and copies of requested reports on the 18th of June. No further comment has been received by WOSL to date.
13. Carter Holt Harvey ('**CHH**') has been consulted regarding the Proposal. CHH was provided the Proposal summary pack on the 8th of June, and copies of requested reports on the 12th of June. No further comment has been received by CHH to date.
14. Consultation with Marsden Maritime Holdings ('**MMH**') regarding the Proposal commenced in September 2019. The latest meeting between MMH and Refining NZ occurred on the 10th of June 2020 to discuss the Proposal and the summary pack which was provided in advance. MMH stated that it did not have any specific issues regarding the Proposal, and subsequently provided a written letter of approval on the 6th of July 2020.
15. Bream Bay College was initially consulted by Refining NZ regarding the Proposal in September 2019.

5.8 Written Approvals

A number of parties have provided their written approval for the Proposal. These parties include the following:

1. Northport provided its written letter of approval on the 16th of June 2020;
2. BOC Gas provided its written letter of approval to Refining NZ regarding the Proposal on the 2nd of July 2020;
3. Air Liquide provided its written letter of approval for the Proposal on the 18th of June 2020.
4. MMH provided its written letter of approval to the Proposal on the 6th of July 2020.

While noting that it did not constitute a letter of approval, DOC provided a letter in response to Refining NZ's draft reports on the 5th of May 2020, stating that further to reviewing the draft reports, it did not have any additional comments on the Proposal and that the information provided was sufficient.

These letters of approval are included within **Annexure 6**.

5.9 Further Consultation

Further consultation is planned to be undertaken on an ongoing basis. Additional consultation is planned for should the resource consent application for the Proposal is notified. The objective of this phase of consultation will be to convey information in order to inform the submission process.

We also note that further engagement with Tangata Whenua is anticipated post-lodgement of the AEE to discuss the outcomes of the CEA.

Further, should the application be notified, then once the submission period has closed an additional phase of consultation will commence. This 'post submission/pre-hearing' consultation will see further engagement with submitters in an effort to see if any concerns raised can be addressed, and to determine if issues can be resolved or confined prior to a hearing. For completeness, the record of the consultation undertaken to date is provided in **Annexure 7**.

6.0 STATUTORY PLANNING ASSESSMENT

6.1 What Resource Consents Are Required?

A fundamental question facing the Proposal is whether it requires a resource consent(s) to proceed. Should a resource consent(s) be required, a further question is 'what considerations are relevant under both the Act and the applicable planning instruments (both statutory and non-statutory)?'

In order to determine if a resource consent is required, regard needs to be paid to Part 3 of the Act and then to the applicable provisions of the statutory planning instruments.

6.1.1 Part 3 of the Act

Part 3 of the Act contains 14 sections. Of those sections, 9 to 15C set out the instances where certain types of activities require a resource consent. We now discuss those sections that are relevant to the Proposal.

Section 9 of the Act is very clear when it states that no person may use land in a manner that contravenes a national environmental standard (section 9(1)) or a regional rule (section 9(2)) unless it is allowed by a resource consent or section 20A of the Act. We note that the term 'land' is defined within section 3 of the Act to, for the purpose of the NRC's functions, include all land that is outside of the bed of rivers and lakes. Section 9(6) of the Act also states that land within the coastal marine area does not fall within the ambit of section 9.

Section 12(1)(b) of the Act places restrictions on the structures that can be erected, altered, reconstructed, removed, placed (or fixed) or demolished in, on or under the seabed or foreshore. Section 12(1)(c) restricts disturbance activities that either have or are likely to have an adverse effect on the foreshore and seabed. Further, section 12(1)(d) restricts the deposition of material in, on or under the foreshore or seabed, where it could have an adverse effect on either of these two areas (the foreshore and seabed). The disturbance, damage or destruction of the foreshore and seabed is also restricted where it has adversely affected, or could adversely affect flora and fauna, or their habitat; or historic heritage (refer to sections 12(1)(e) and 12(1)(g) of the Act). Section 12(2) only allows a person to occupy part of the 'common' CMA if it is a permitted activity or if a resource consent is first obtained. Section 12(3) makes it plain that proposals that contravene a rule of an applicable statutory planning instrument may only occur / be undertaken where they have first secured a resource consent.

Sections 14(2) and 14(3) restrict the taking, use, damming and diversion of coastal water (being within the likes of the Whangārei Harbour) and freshwater (including from the ground). In summary, unless the taking of the coastal water and freshwater is permitted as of right by a relevant statutory planning instrument, a resource consent is required for the activity to proceed.

Section 15(1)(a) of the Act restricts the discharge of contaminants or water to water, contaminants onto land where it may enter water, contaminants from any industrial or trade premise to air, or contaminant from any industrial or trade premise to land unless it is expressly allowed by an applicable statutory planning instrument, or by a resource consent. Sections 15(2) and 15(3) apply a similar requirement for discharges to into the air or into / onto land where it contravenes a national environmental standard or regional rule.

Given sections 12, 14 and 15 of the Act, the Proposal may only proceed if it is permitted as of right, or if a resource consent has first been secured for all of its component parts. In order to determine if a resource consent is required, regard has been paid to the rules of the applicable planning instruments. In that regard, the following planning instruments contain rules / regulations that are relevant to the Proposal:

a. The operative Regional Air Quality Plan for Northland – 22 November 2008 ('**the oAQP**');
b. The operative Regional Coastal Plan for Northland – 2nd of February 2016 ('**the oRCP**');
c. The operative Regional Water and Soil Plan for Northland – 15th of July 2014 ('**the oWSP**');

d. The proposed Regional Plan for Northland (Appeals Version) – June 2020 (‘**the pRP**’);
e. The NESHDW; and
f. The NESAQ.

6.1.2 Environmental Notations

The oAQP, oRCP, oWSP and the pRP all highlight areas or values that are of note, and which impact on the resource consents that are required (to varying extents). We now provide a concise summary of the values that apply to the Refinery or within close proximity to it.

6.1.2.1 oWSP

The planning map associated with the oWSP records that land to the south west of the Refinery is prone to erosion. That notation does not, however, extend into the Site.

6.1.2.2 oAQP

Map 1 of the oAQP records that the Refinery is situated within the Marsden Point Airshed. The Airshed is a planning mechanism that has been developed to reflect the existing discharges to air that occur from the Refinery and its neighbouring industrial uses. In this regard (and by way of a summary) comment, it focusses attention on the air quality issues that exists, and that could exist if further industrial development is advanced.

6.1.2.3 The oRCP

Jetty 1, Jetty 2 and all of the associated morning breasting’s and dolphins are located within the Marine 5 (Port Facilities) Management Area (or ‘**M5MA**’), which is effectively a zone that applies over a portion of the CMA. The M5MA also applies over the area that is occupied by Northport. As the name suggests, this zone applies to areas that accommodate ports, and are managed for port-related purposes.

Maps A3, B24, B25 and C13 also highlight that:

a. Mair Bank and Marsden Bank are within the Marine 1 (Protection) Management Area (‘**M1MA**’). This zone applies to the areas of Northlands CMA that are identified as being ‘Areas of Important Conservation Value’. Appendix 6 to the oRCP states that Mair and Marsden banks are amongst a number of ‘Outer Harbour sandbanks’ that support ecosystems, birds, habitats and coastal landforms. The intertidal areas are said to provide international significant habitat for bird species, some of which are threatened.
b. The areas of the Harbour that are outside of the M1MA and M5MA are within the Marine 2 (Conservation) Management Area (‘**M2MA**’). This is an omnibus zone that applies to the areas that are not otherwise zoned. Areas with within the M2MA are to be managed to conserve ecological, cultural and amenity values.
c. A Prohibited Anchorage Area extends across Mair and Marsden banks to the South East of the Refinery. It seems to protect an underwater cable that is associated with an unlit beacon.
d. A number of lit and unlit beacons and buoys exist in close proximity to the Refinery.
e. The CMA that abuts the Refinery to the North, east and south east is classified ‘CA’ (general quality), while a ‘mixing zone for major discharges’ extends to the North of the Refinery and applies to, it would seem, the proposed discharge from the diffusers and spillway.

6.1.2.4 The pRP

The planning maps associated with the pRP highlight that areas within or immediately adjacent to those that will be disturbed by the Proposal support a number of values. In that regard, and noting that parts of the pRP are subject to appeal, including by Refining NZ:

a. The jetties associated with the Refinery are situated with the Marsden Point Port Zone that also includes Northport.
b. Mair Bank and Marsden Bank situated within the General Marine Zone. This zone also abuts the Refinery adjacent to its eastern and southern coastlines.
c. Mair Bank and Marsden Bank are also highlighted as being a significant ecological area (‘or ‘**SEA**’). These two areas are valued for their shellfish resource. Of note is that this value is acknowledged despite the relatively recent (being in the last 10 years)

drop off in shellfish biomass. The notation of Mair and Marsden Banks as SEAs is the subject of an appeal by Refining NZ.

d. Mair Bank and Marsden Bank are both recorded as being within a 'Significant Bird Area: Whangārei Harbour'. This large area is said to contain 'wide habitat diversity' which supports an abundance of bird species (including 'threatened' and 'at risk' species). A 'strip' of coastal habitat in Bream Bay (which commences from the South of Mair and Marsden Banks) is recorded as being within the Bream Bay Significant Bird Area. While modified (ranging from 'little modified' to 'developed'), they support a number of 'threatened' and at 'risk species'.
e. Portions of Mair Bank and Marsden Bank are also identified as a 'high natural character area'. The pRP records that the natural character in this area is impacted by non-natural sounds and 'anthropogenic light effects' from the nearby shipping and the Refinery.
f. Mair Bank, Marsden Bank and the coastline to the south of the Refinery are within the 'Site and Areas of Significance to Tangata Whenua: Te Poupouwhenua'. This area is significant for a number of reasons, including as a site of conflict, mahinga kai and matauranga.
g. The groundwater under the Refinery is within the 'Coastal Aquifer' Groundwater Management Unit.
h. A 'Mixing Zone for Major Discharges' Coastal Water Quality Management Unit sits to the North East of the Refinery. A 'Estuary' Coastal Water Quality Management Unit applies around the Mixing Zone for Major Discharges and extends out to the mouth of the Whangārei Harbour (which, in approximate terms, extends from Marsden Point to Home Point). An 'Open Coast' Coastal Water Quality Management Unit applies within Bream Bay.
i. Much of the Refinery sits within a 'Priority Catchments: Whangārei' notation.
j. The Whangārei Harbour and Bream Bay are recorded as being a significant habitat for marine mammals and sea birds.
k. The Whangārei Harbour from, in approximate terms, Marsden Point to Busby Head, sits within the Whangārei 'enclosed water area'.
l. The 'Racecourse' and 'PowerStation' surf breaks (both of which are to the north of the Ruakaka River mouth) are deemed to be regionally significant.
m. The pRP defines a series of Hill Country and lowland areas. The Refinery sits within an 'Other' area.
n. While none exists within the Refinery, the coastal margin to the South of the Site is recorded as being 'Erosion Prone Land'.
o. The Refinery is located within the Marsden Point Airshed, which applies to a large area that extends to the North, South, East and West of the Site.

We note, for completeness, that the operative Northland Regional Policy Statement – 14th of June 2018 ('**the oRPS**') also highlights environmental notations that apply to the Refinery and its surrounds. In that regard, it records that:

a. The Refinery sits entirely within the Coastal Environment.
b. A portion of Mair and Marsden banks are deemed to have 'High Natural Character'. While the values present have been impacted by activities such as the Refinery, the planning maps record that water quality is relatively high, the intertidal and subtidal sands are clean, and mainly indigenous benthic biota are supported.
c. At Appendix 3 that the Refinery is 'regionally significant infrastructure'.

6.1.3 Resource Consents Required

We provided a summary of the resource consents that are required for the Proposal to continue in section 1.5 of this AEE. We do not repeat that summary or the analysis here. Rather, we simply record that a number of resource consents are required, and that, given that they are inextricably linked, the applications should be 'bundled' and assessed against the most activity restrictive classification, which in this instance is a **Discretionary Activity**. Given this, we have assessed the Proposal as a Discretionary Activity.

6.1.4 Are Other Resource Consents Required?

We are not aware of any other resource consents that are or may be required for the Proposal to proceed.

6.2 Statutory Criteria

The requirements of the Act that relate to the decision-making process are contained within sections 104 to 116. Section 104(1) is of particular relevance. This section states:

"When considering an application for resource consent and any submissions received, the consent authority must, subject to Part 2, have regard to –

(a) any actual and potential effects on the environment of allowing the activity; and

(b) any relevant provisions of –

(i) a national environmental standard,

(ii) other regulations,

(iii) a national policy statement,

(iv) a New Zealand coastal policy statement,

(v) a regional policy statement or proposed regional policy statement,

(vi) a plan or proposed plan; and

(c) *any other matters the consent authority considers relevant and reasonably necessary to determine the application.*

(*2A) When considering an application affected by section 124 or 165ZH(1)(c), the consent authority must have regard to the value of the investment of the existing consent holder."*

As section 104(1) is 'subject to' Part 2 of the Act, some have interpreted this to mean that the purpose and principles of the Act are paramount. Put another way, should there be a conflict between any of the matters listed in section 104(1) and Part 2, Part 2 is to prevail. Recent case law has, however, suggested that there are only limited instances where a consent authority should consider a resource consent application against Part 2 of the Act (being where there is invalidity, incomplete coverage or uncertainty of meaning in the statutory planning instruments), the premise appearing to be that the statutory planning instruments give effect to Part 2, and thus are the paramount consideration. Put another way, we understand the line of reasoning to be that if a proposal is consistent with the planning instruments, they are also deemed to be consistent with the Act's purpose and thus that there is no need to consider Part 2 explicitly. We have assessed the Proposal, in a forensic manner, against the relevant planning instruments. Having done so, we are of the opinion that there are no issues of invalidity, incomplete coverage or uncertainty as to the meaning of the statutory instruments. As such, we have not addressed Part 2 of the Act in this AEE.

In the context of the obligations arising out of section 104(1) of the Act:

1. The actual and potential effects of the Proposal (both positive and negative) are set out in section 4.0 of this AEE.
2. The relevant provisions of the various statutory planning instruments are discussed in section 6.0 of this AEE.
3. The various Iwi Management Plans and the Statutory Acknowledgements are considered in section 2.3 of this AEE.
4. Given the absence of any invalidity, incomplete coverage or uncertainty of meaning in the statutory planning instruments, we have not addressed Part 2 in this AEE.

We note that there are several other sub-sections of section 104 that have relevance to the Proposal. We discuss those sub-sections (such as section 104(2)) elsewhere in this AEE.

Section 104B of the Act states that after considering an application for a Discretionary Activity the Council may grant or decline it. If granted, conditions of consent can be imposed under section 108 of the Act.

Section 104(2A) is also of particular relevance to the Proposal. In this regard, it requires the NRC to, in this instance, have regard to the value of the investment of the existing consent holder. As we set out in section 2.3 of this AEE, the expert advice of Mr Peter Clough is that

Refining NZ has substantial value invested in the Refinery, and that, that investment drives a number of notable economic benefits for Northland. Of note is Mr Clough's advice that Refining NZ has invested in excess of $700,000,000.00 in the Refinery in the last 12-years. This represents, in our opinion, an extremely significant investment, that weighs in favour of the grant of the resource consents sought by Refining NZ. Mr Clough states that as consent holder Refining NZ has substantial value in this investment and incentive to sustain its operation and earn return as long as possible. Refining NZ's 2018 Annual Report shows its tangible assets of plant and equipment had a book value of $1,082 million,[203] including $784 million in refining plant which would become largely redundant without the ability to continue to import and process crude. Mr Clough notes that this represents a substantial investment in assets in the region that are highly specific to the refining activity and that would become stranded and unusable without the consents to land crude at the wharf and continue discharges to air and water from its operations. He indicates that there may be alternatives to the current discharge regime but these are all likely to be more costly than current arrangements, otherwise Refining NZ would likely have sought to implement them already to save costs.

Section 108 of the Act is a lengthy provision that contains 10 sub-sections. In summary, it regulates the type of consent conditions that can be imposed on the grant of resource consent. The discretion section 108 provides the Consent Authority is wide, but not limitless. By way of a broad summary, a condition may be imposed if it falls within the broad ambit of section 108, serves a resource management purpose, fairly relates to the Proposal, and is not unreasonable. While conditions of consent are yet to be developed, Refining NZ has committed to developing a comprehensive suite of conditions that accords with the requirements of section 108 of the Act and, indeed, good planning and resource management practice. The expectation is that these conditions will be developed and shared (for comment) before the report from the Council's processing officer (otherwise known as '**the section 42A Report**') is exchanged with the parties involved in the processing of this application. Given this, section 108 is not discussed further in this AEE.

6.2.1 Matters Relating to the Grant of Discharge Permits

In addition to the preceding framework, the Act (section 105) lists matters that a Consent Authority must have regard to when considering resource consent applications for discharge permits that would contravene section 15 of the Act.

Furthermore, section 107(1) of the Act restricts the grant of a resource consent application for the discharge of contaminants into water, or onto land in circumstance where it may enter water, if it will cause certain (listed) adverse effects in receiving waters after reasonable mixing.

We now specifically address these two sections of the Act.

6.2.1.1 Section 105

Section 105 of the Act requires the consent authority to have regard to the following matters when considering resource consent applications for discharge permits:

"a. The nature of the discharge and the sensitivity of the receiving environment to adverse effects; and
b. The applicant's reasons for the proposed choice; and
c. Any possible alternative methods of discharge, including discharge into any other receiving environment."

The nature of the discharge is discussed in sections 2.0 and 3.0 of this AEE. The sensitivity of the CMA, groundwater and air to adverse effects is addressed in sections 2.0 of this AEE. Refining NZ's reasons for selecting the Proposal (from the various alternatives considered) are briefly discussed in section 3.8 of this AEE, and are set out in some detail within,

[203] Covering the categories of Buildings and jetties, refining plant, refinery to Auckland pipeline and capital work in progress

principally, the reports of Ms Thomson. Given that the matters raised by section 105 have previously been addressed, we do not address them further in this section. Suffice to say, however, that we are of the opinion, based on the information that is before us, that the matters raised by section 105 have been addressed to a level of detail that corresponds with the nature and scale of the Proposal.

6.2.1.2 Section 107

Section 107 states that no discharge permit shall be issued for the discharge of contaminants to water, or land where it may enter water, if after reasonable mixing, the contaminant or water discharged (either by itself or in combination with the same, similar, or other contaminants or water), is likely to give rise to all or any of the following effects in the receiving waters:

"c. The production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
d. Any conspicuous change in the colour or visual clarity;
e. Any emission of objectionable odour;
f. The rendering of fresh water unsuitable for consumption by farm animals;
g. Any significant adverse effects on aquatic life."

We note, for completeness, that section 107(2) does provide some exceptions to the prohibition established by section 107(1). In this regard, a Consent Authority may grant a discharge consent that would cause an effect of the nature listed in section 107(1), where, in summary, exceptional circumstances exist, the discharge is of a temporary nature, or the work is associated with maintenance activity, and it would be consistent with the Act's purpose to grant the discharge consent.

We have considered the requirements of section 107 in the context of the advice provided by Dr Stewart and Dr De Luca. Having done so, we understand both experts to conclude that either the matters listed in this section of the Act will not arise or that they are not relevant considerations to the Proposal.

Given this, and again on the information that is before us, we are of the opinion that section 107 does not present a bar to the resource consent application lodged by Refining NZ being assessed on its merits.

6.3 Planning Instruments & 'Other Matters'

The planning instruments and documents of particular relevance to this application are:

6.3.1 National Statutory Planning Instruments

- The NZCPS;
- The National Policy Statement for Freshwater Management 2014 – Updated on the 7th of September 2017 ('**the NPSFM**');
- The NESHDW; and
- The NESAQ.

6.3.2 Regional Statutory Planning Instruments

- The oRPS;
- The oRCP;
- The oAQP;
- The oWSP; and
- The pRP.

6.3.3 Other Planning Instruments

- Ngātiwai Trust Board, Ngātiwai Iwi Environmental Policy Document 2015[204];

[204] The Draft Ngātiwai Iwi Hapū Draft Strategic & Environmental Management Plan 2019 has recently been developed

- Patuharakeke Te Iwi Trust Board, Hapū Environmental Management Plan 2015 (or '**H**EMP'); and
- Te Uri O Hau Statutory Acknowledgement.

We note that the NRC is in the process of reviewing all of its operative regional plans, with the intention of combining them all into one, omnibus regional plan– the pRP. Decisions have been issued to the submissions and further submissions that were lodged to the content of the pRP. A number of appeals have been lodged to the NRC's decisions, some of those appeals have been resolved, others are close to being resolved and the remainder seem destined for a hearing before the Environment Court. Given that the pRP is not yet fully operative, we have considered the relevant provisions of all of the applicable documents. As, however, the pRP is well advanced, we are of the opinion that it should be afforded greater weight than any of the operative regional plans in the consideration of the Proposal. That said, we have addressed the relevant provisions of all of the regional plans, for completeness and out of an abundance of caution.

The applicable iwi management plans and the Te Uri O Hau Statutory Acknowledgement are addressed in section 2.3 of this AEE, insofar as they have been used to describe the existing environment and the cultural issues that are 'alive' within and adjacent to the Site. We note that the Patuharakeke HEMP is also discussed in the CEA, and in the section of this AEE that addresses the Proposal's actual and potential cultural effects. Given this discussion, the various iwi management plans and the Statutory Acknowledgment are not addressed specifically in the following sub-sections of this AEE.

Lastly, we note that of the National Environmental Standards that apply to the Proposal, none contain objectives, policies or assessment criteria that need to be considered in this instance. Given this, we also have not addressed the NESHDW and NESAQ in the following sub-sections of the AEE.

6.3.4 Relevant Provisions of the Planning Instruments

We now address the relevant provisions of the various planning instruments. We start with the more 'general' instruments and move to the more specific. In discussing each instrument, we set out (in table form) the notable provisions, and then list the opinions we have reached regarding the same. In an attempt to keep this analysis targeted, we have kept our comments concise. Please note that all of the provisions that are cited in the tables are repeated in **Annexures 8-14** of this AEE.

6.3.4.1 NZCPS

The NZCPS took effect from the 3rd of December 2010 and has continued since then without amendment. The NZCPS contains seven objectives and 29 policies and provides the resource management framework for the coastal environment. As we have already noted, the Refinery is situated within the 'defined' coastal environment. Only Jetty 1, Jetty 2, the mooring breastings, spillway and dolphins extend below MHWS, and thus are within the CMA.

Form, Functioning, Resilience & Integrity of the Coast Environment, & Sustaining Its Ecosystems

The provisions of the NZCPS that relate the geomorphological processes and ecology of the coastal environment and that are relevant to the Proposal are set out in **Table 6.3.4.1.1**.

Objectives	Policies
Objective 1	Policy 5
	Policy 11
	Policy 21
	Policy 23

Table 6.3.4.1.1: *Form, Functioning, Resilience & Integrity of the Coast Environment, & Sustaining Its Ecosystems*

Having considered the Proposal against the provisions listed in **Table 6.3.4.1.1** we note that:

a. The expert advice of Dr De Luca, Dr Ross, Dr Stewart, Mr Don, Dr Clement and Dr Martin / Ms Raeburn is central to the consideration of Objective 1 and its associated policies. We understand these experts to conclude that the Proposal will cause, in the great majority of instances, less than minor adverse ecological effects, with a limited number of the adverse effects being said to be, at worst, minor. When the effects are minor, we understand the advice to be that they are transitory.
b. We further understand that all of the foregoing, but most notably Dr De Luca, Dr Ross, Dr Stewart and Dr Martin / Ms Raeburn, have considered the potential for the Proposal to impact on land and water held or managed by others for a conservation and/or protection purpose; including the rahui that is presently in place over Mair and Marsden banks. We are unaware of any publicly notified proposals for the protection of land and/or waters near the Refinery.
c. It is clear from the collective advice of the experts cited in Limb (a.) of this analysis that the Proposal will not adversely affect activities that are significant for the purposes that the land and water are held. Equally, we note that all of these experts have considered the reasons for which the land and waters are held, and turned their minds to whether remediation or mitigation measures are needed. Ultimately, no remediation or mitigation measures are recommended. This reflects, we understand, the very low magnitude of the adverse ecological effects that are anticipated.
d. While the ecological advice that is before us records that there are a number of species of flora and fauna and habitats that fall within the ambit of Policy 11(a), we understand that the potential adverse effects on these species are, at worst, minor and transitionary. As we have already recorded, the majority of the adverse effects on these species / habitats are recorded as being less than minor. Further, we understand that this level of adverse effect corresponds with the level of protection that is required by Policy 11(a).
e. Equally, we understand that no significant adverse effects are anticipated should the Proposal secure the resource consents that are sought.
f. We understand the advice of the ecologists to be that the water quality that exists within or in close proximity to the Site is not significantly impacting on the ecological values that are present within and around the Refinery. Indeed, we note that the ecological values that exist, some of which are significant, do so with the discharges that are already occurring. Refining NZ is not seeking to change what it discharges or to increase the limits / thresholds set in its existing resource consents. As we also record in Section 4.14 of this AEE, the expert advice that is available leads us to the opinion that the recreational and tourism values that exist in close proximity to the Site will not be appreciably impacted. Again, we note that these values exist with the Refinery in existence and operating. Lastly, we note the advice of Dr Kelly that the discharges pose limited to no risk to those gathering / consuming shellfish in the areas that could be impacted by the Proposal.
g. Refining NZ have been careful to engage with Tangata Whenua over the cultural values that are a feature of the existing coastal environment (most particularly the coastal waters that have the potential to be impacted by the Proposal); the objective of the engagement being to understand the values that exist, the nature of the actual and potential adverse effects that could be generated by the Proposal, and the measures that are available to avoid, remedy or mitigate those effects. As is apparent from an earlier section of this AEE, the CEA and the other available documentation set out the cultural values that are present within and around the Site, a number of which are significant. The potential for the Proposal to impact upon those values is also clearly stated, and a range of remediation and mitigation strategies are offered. Refining NZ is committed to working with Tangata Whenua with the aim of ensuring that the actual and potential cultural effects are addressed to the point where they are acceptable.
h. We understand the advice of Dr Stewart, Dr De Luca, Dr Ross, Mr Don and Dr Clement to be that the Proposal will not result in significant adverse effects on ecosystems or habitats after reasonable mixing, and that the proposed mixing zone is the smallest needed to achieve the applicable water quality guidelines. We also understand the ecological advice to be that effects on the life supporting capacity of the coastal waters within the mixing zone are being minimised. We understand this to be, at least in part, as a consequence of the treatment that Refining NZ is undertaking prior to the

discharge occurring. The Alternatives Assessment concludes that the treatment measures represent the practicable steps that can be taken in this instance.

Given the foregoing, we are of the opinion that the Proposal can be advanced in a manner that achieves the outcomes of the objectives and policies that are listed in **Table 6.3.4.1.1**.

Natural Character & Natural Features / Landscapes

The provisions of the NZCPS that relate natural character and natural features / landscapes are relevant to the Proposal are set out in **Table 6.3.4.1.2.**

Objectives	Policies
Objective 2	Policy 13
	Policy 14
	Policy 15

Table 6.3.4.1.2: *Natural Character & Natural Features / Landscapes*

Having considered the Proposal against the provisions listed in **Table 6.3.4.1.2** we note that:

a. The advice of Stephen Brown is central, in our opinion, to the consideration of the Proposal against this group of provisions. Having considered the Proposal in the context of the existing landscape, amenity and natural character values of the Site and the environs close to the same, we understand his advice to be that the areas supporting outstanding natural character and landscape values would not be directly impacted by the Proposal. Further, we understand his advice to be that the Proposal would not generate significant adverse natural character or landscape effects on those areas and features not deemed to be outstanding. A key reason for this seems to be the significantly modified nature of the Site and the surrounding environs. We take this advice to mean that the Proposal is not an inappropriate use and development, in the context of the characteristics and qualities that contribute to the Site's natural character, natural features and natural landscapes.
b. As a consequence, the Proposal appears aligned with both limbs (1)(a.) and 1(b.) of Policy 13, insofar as any adverse effects on the areas of outstanding natural character are avoided, and that only minor adverse effects (at worst) are projected for all other areas of natural character.
c. In a similar vein to our analysis of Policy 13, the Proposal appears aligned with both limbs (1)(a.) and 1(b.) of Policy 15, insofar as any adverse effects on the areas that support outstanding landscape values are avoided, and that only minor adverse effects (at worst) are projected for all other areas of natural character.
d. Neither Mr Brown, Dr Martin / Ms Raeburn nor Dr De Luca and Dr Ross have recommended activities which could restore or rehabilitate the natural character of the coastal environment. In this regard, we understand their advice to be that such initiatives are not warranted by the level of adverse effects that the Proposal will cause. This leads us to the corresponding opinion that it would not be practicable to impose such conditions of consent.

Given the foregoing, we are of the opinion that the Proposal can be advanced in a manner that achieves the outcomes of the objectives and policies that are listed in **Table 6.3.4.1.2**.

Treaty of Waitangi, Kaitiakitanga, Tangata Whenua Involvement & Historic Heritage

The provisions of the NZCPS that relate to Treaty of Waitangi, kaitiakitanga, Tangata Whenua involvement, and historic heritage are set out in **Table 6.3.4.1.3**.

Objectives	Policies
Objective 3	Policy 2
	Policy 17

Table 6.3.4.1.3: *Treaty of Waitangi, Kaitiakianga & Tangata Whenua Involvement*

Having considered the Proposal against the provisions listed in **Table 6.3.4.1.3** we note that:

a. As we have already discussed, it is for Tangata Whenua to set out the values, functions and relationships that they associate with the coastal environment, and to say how those values, functions and relationships will be impacted by the Proposal. It is clear from the preceding sections of this AEE that the Proposal has the potential to impact on some of the values, functions and relationships that Tangata Whenua have with the Site, all of which is within the coastal environment. As we have also already noted, however, Refining NZ is committed to working with Tangata Whenua to both recognise and enable (the latter to the point that they can) the role of Tangata Whenua has kaitiaki. As is apparent from the engagement that Refining NZ has completed in the lead up to this AEE being prepared and in its day to day activities where the role of Patuharakeke as kaitiaki is provided for where it is practicable to do so, Refining NZ recognises that Tangata Whenua has an on-going and enduring relationship with the coastal environment. The Company has worked to both understand and to protect those areas that are of special value and that could be impacted by the on-going existence and operation of the Refinery.
b. The applicable iwi management plans were considered in the preparation of both the CEA that has informed this AEE, and in the completion of the AEE itself. This reflects Refining NZ's commitment to understanding and responding to the cultural values that exist.
c. Refining NZ has considered how it can effectively engage Tangata Whenua in the monitoring of the natural resources that exist within the Site, and/or that could be effected by the Proposal. This is aligned with the outcomes sought by Patuharakeke in its CEA.
d. There are no known recorded archaeological or historical sites that could be impacted by the Proposal.

As a consequence of the foregoing, we are of the opinion that the Proposal can be advanced in a manner that achieves the outcomes sought in the provisions cited in Table 6.3.4.1.3.

Public Open Space & Recreation Opportunities

The provisions of the NZCPS that relate to public open space and recreation that are relevant to the Proposal are set out in **Table 6.3.4.1.4**.

Objectives	**Policies**
Objective 4	Policy 18
	Policy 19

Table 6.3.4.1.4: *Public Open Space & Recreation Opportunities*

Having considered the Proposal against the provisions listed in **Table 6.3.4.1.4** we note that:

a. The Proposal seeks to, in essence, maintain the status quo. As Mr Greenaway has recorded, the environs within and in close proximity to the Site support a number of recreation and tourism values, some of which are significant. We are of the opinion that it is important to remember that those values coexist with the Refinery. Put another way, the continued existence and operation of the Refinery has not prevented those values from arising. The combined advice of Dr Stewart, Mr Chilton, the ecologists retained by Refining NZ and Mr Brown leads us to the conclusion that nothing is proposed that will cause those existing values to be noticeably changed or substantially diminished.
b. While the jetties and the associated mooring structures do restrict public access to some parts of the CMA, health and safety reasons necessitate these restrictions. While it is arguable whether this is an exceptional reason (in the context of the second bullet point to Objective 4), we are of the opinion that it would be inappropriate (and irresponsible) to provide access to those limited areas where public access is constrained. We note that this level of restriction is also consistent with Limb (3)(e.) of Policy 19. Lastly, we are also of the opinion that the level of constraint proposed is minimal in the context of the size of the Proposal and the nature of the activities undertaken within the Refinery.

As a consequence, we are of the opinion that the Proposal accords with the direction and outcomes that are sought by those provisions of the NZCPS that are listed in **Table 6.3.4.1.4**.

Activities in the Coastal Environment, Ports, Integration & the Precautionary Principle
The provisions of the NZCPS that relate to activities in the coastal environment, ports, integration and the precautionary principle, and that are relevant to the Proposal are set out in **Table 6.3.4.1.5**.

Objectives	Policies
Objective 6	Policy 3
	Policy 6
	Policy 9
	Policy 25

Table 6.3.4.1.5: *Activities in the Coastal Environment, Ports, Integration & the Precautionary Principle*

Having considered the Proposal against the provisions listed in **Table 6.3.4.1.5** we note that:

a. As Mr Peter Clough records, the Refinery is important to the economic wellbeing of Northland and beyond. In our opinion, that level of contribution and benefit weights in favour of the consents being granted. While actual and potential cultural effects have been identified, measures to ensure that they are avoided, remedied or mitigated are set out with the CEA. We understand that Refining NZ is committed to working with Tangata Whenua to ensure that appropriate measures are agreed and advanced, such that their level of cultural wellbeing will be at least maintained.
b. As Mr Brown advises, the Refinery exists with an area that is already heavily modified. While its location is arguably not an 'urban area' or 'coastal settlement', we are of the opinion that the Refinery's continued existence within what is a modified environment accords with the 'consolidation' theme that is evident in Limb (c.) of Policy 6. We are also of the opinion, given the predicted low level of the adverse environmental effects, that the continued existence and operation of the Refinery is an example of a development that is in an appropriate place and that can operate within appropriate limits, and that it can exist and operate in a manner that does not appreciably impact on the contribution that the habitats of living marine resource make to the wellbeing of people and communities.
c. It is clear that the Refinery requires a coastal location, and that the structures which extend into the CMA are critical for its continued operation. We note, for completeness, that Refining NZ holds the resource consents needed for coastal protection structures to be constructed and maintained. These resource consents, and the works they enable, ensure that the Refinery will be protected from coastal hazards within the coastal marine area.
d. The Proposal can continue to exist and operate in a manner that does not substantively compromise the areas of the coastal environment that are formally protected, or the historic heritage that is evident within the CMA.
e. The precautionary approach does not need to be applied in this instance as the actual and potential effects of the Proposal are certain, known and understood and are not predicted to be significantly adverse.
f. The Proposal does not adversely impact on the efficient and safe operation of Northport. It follows, that the continuation of the Proposal will also not impact on the Refinery's own jetties and their efficient / safe operation. We also note that the Refinery is situated within a zone (under both the oRCP and the pRP) that caters specifically for both its and Northport's operations.
g. While the location of the Refinery means that it could be impacted by coastal hazards over the next 100 years (as any coastal location could be), the advice before us suggests that the Proposal will not increase the risk that exists. In that regard, and as we have noted, the Proposal is, for all intents and purposes, maintaining the status quo. Equally, given the level of existing investment in the Refinery, it appears unrealistic to expect the Refinery to relocate (in full or in part) and impracticable for it to avoid the coastal environment (which we expect will always have an element of hazard risk).

Given the proceeding opinions, we are also of the opinion that the Proposal accords with the direction and outcomes that are sought by those provisions of the NZCPS that are listed in **Table 6.3.4.1.5**.

6.3.4.2 NPSFM

The NPSFM was gazetted in 2014 and updated in 2017. A further review of this planning instrument is being undertaken now, and a new version of the NPSFM is expected to be gazetted in the first half of 2020. Until, however, such a time as the new version of the NPSFM is operative, there is no requirement to have regard to it under section 104(1)(b)(iii) of the Act. We have therefore only addressed the operative version of the NPSFM in this AEE.

Of note is that the NPSFM only applies to freshwater. It addresses considerations such the allocation of this resource (water quantity) and its contamination from direct (or 'point') and diffuse sources and introduces the concept of 'Te Mana o te Wai'; which it defines as the integrated and holistic well-being of a freshwater body.

Te Mana o te Wai

The provisions of the NPSFM that relate to the concept of Te Mana o te Wai and that are relevant to the Proposal are set out in **Table 6.3.4.2.1**.

Objectives
Objective AA1

Table 6.3.4.2.1 *Te Mana o te Wai*

Having considered the Proposal against the objective listed in Table 6 we note that:

a. The technical investigations that have been undertaken to support and define the Proposal are, in our opinion, comprehensive. In that regard they recognise the connection that exists between the land that the Refinery occupies, the nature of, and thus impact of freshwater (with its contaminant load) that is discharged from the Site to ground and then to the CMA or directly to the CMA. They also address the groundwater that is to be abstracted as part of the Proposal, and the impact that the discharges have on, amongst other things, ecosystem health, natural character, recreation and tourism, human health and cultural values. This all-encompassing approach reflects the need to understand the entire impact of the Proposal, and to consider it both in terms of its potential to effect, a value (or group of values) and the environment as a whole. As a consequence, we are of the opinion that this approach is aligned with the concept of Te Mana o te Wai; as it is expressed in Objective AA1 and defined by Limb (a.) of Policy AA1, and gives effect to the requirement that this concept be both recognised and considered.

Given the above, we are of the opinion that the Proposal can be advanced so as to accord with Objective AA1.

Water Quality

The provisions of the NPSFM that relate water quality are relevant to the Proposal are set out in **Table 6.3.4.2.2**.

Objectives	**Policies**
Objective A1	Policy A3
	Policy A7

Table 6.3.4.2.2 *Water Quality*

Having considered the Proposal against the provisions listed in **Table 6.3.4.2.2** we note that:

a. We understand the technical advice received by Refining NZ to be that there are no ecosystem processes or indigenous species of surface freshwater bodies or courses that could be impacted by the Proposal. We note, however, that the term 'fresh water' is defined by the Act to mean 'all water, except coastal and/or geothermal water'. It follows, therefore that the potential for the Proposal to impact on the life supporting

capacity of the groundwater is a relevant consideration, as is the potential for the groundwater to impact on the health of people and communities should they come into contact with the groundwater (via, for instance, abstraction). The advice of Dr Stewart, Dr Kelly, and Ms Schiess and Mr Simpson is, in our opinion, directly relevant to these impacts. We understand this advice to collectively be that there are no surface water resources within Marsden Point that have a connection to the aquifer, recharge from the impacted shallow aquifer is limited, and that the historic contamination of the shallow aquifer means that it is not a viable source of water for other uses. We understand the advice of Dr Kelly to be that the treatment of the abstracted groundwater ensures that it does not present a notable health risk.

b. The pumping of the groundwater and its treatment is an effective means of ensuring that the freshwater does not unacceptably contaminate the surrounding seawater, and of sustainably managing freshwater quality.
c. We are of the opinion that conditions of consent can be imposed to address the findings and advice from Dr Stewart to ensure the treatment of the abstracted groundwater achieves the applicable marine water quality limits. A key condition will be imposing the maximum concentrations of the contaminants present within the discharge to the CMA.

As a consequence, we are of the opinion that the Proposal can be advanced in a manner that accords with the provisions set out in **Table 6.3.4.2.2**.

Water Quantity

The provisions of the NPSFM that relate to water quantity are set out in **Table 6.3.4.2.3**

Objectives	**Policies**
Objective B1	Policy B5
Objective B2	Policy B8
Objective B3	
Objective B4	
Objective B5	

Table 6.3.4.2.3: *Water Quantity*

Having considered the Proposal against the provisions listed in Table 8 we note that:

a. We understand the advice of Ms Schiess and Mr Simpson to be that the abstraction of the groundwater proposed will be within the prescribed allocation limits, will result in adverse environmental effects that are less than minor in magnitude and will generate a positive environmental effect with no detectable hydrocarbons leaving the Site.
b. The proposed abstraction of groundwater represents both efficient allocation of water and an efficient use. In this regard, the abstraction is within the prescribed allocation limit and is needed to ensure that hydrocarbon contaminated groundwater does not enter the Harbour or Bream Bay. Similarly, the volume of groundwater abstracted is the minimum necessary to achieve this outcome. With respect to the issue of use, the treatment of the abstracted water and its discharge to the Harbour, in our opinion, it is an efficient and effective means of ensuring that the groundwater does not generate environmental outcomes that have the potential to be unacceptable or unsustainable.
c. The abstraction of groundwater is fundamental to ensuring that the Refinery can continue to exist and operate in a manner that accords with the surrounding environs. As a consequence, it helps Northland and beyond to provide for its economic well-being.

It follows, therefore, that we are of the opinion that the Proposal can also be advanced in a manner that accords with the direction and outcomes sought by the provisions that are listed in **Table 6.3.4.2.3**.

Tangata Whenua Roles & Interests

The provisions of the NPSFM that relate to Tangata Whenua Roles and Interests are set out in **Table 6.3.4.2.4**

Objectives	Policies
Objective D1	Policy D1

Table 6.3.4.2.4: *Tangata Whenua Roles & Interests*

Having considered the Proposal against the provisions listed in Table 9 we note that:

a. Refining NZ has, via its engagement with Tangata Whenua, invited comment on all aspects of the Proposal. This has included freshwater considerations (which are principally confined to how the contaminated wastewater and stormwater is captured and treated prior to its discharge, and the groundwater matters). As we have already noted, Refining NZ has confirmed that it will be reengaging with Tangata Whenua once the resource consent applications for the Proposal are lodged, with the objective of agreeing measures that address the Proposal's cultural effects, including those effects that are associated with the Site's freshwater resources.

Given the foregoing, we are of the opinion that the Proposal can be advanced in a manner that accords with the outcomes sought in the provisions cited in Table 6.3.4.2.4.

6.3.4.3 oRPS

The Regional Council developed a second-generation regional policy statement to the point that it was made operative (with the exception of three discreet revisions that have no relevance to the Proposal) on the 9th of May 2016.

Region-Wide Water Quality & Quantity

The provisions of the oRPS that relate to region-wide water quality and quantity that are relevant to the Proposal are set out in **Table 6.3.4.3.1**.

Objectives	Policies
Objective 3.2	Policy 4.2.1
	Policy 4.3.3

Table 6.3.4.3.1: *Region-wide Water Quality & Quantity*

Having considered the Proposal against the provisions listed in **Table 6.3.4.3.1** we note that:

a. We understand the advice of Dr Kelly to be that the discharges from the Proposal will not impact on the quality of registered drinking water supplies or the quality of existing potable water drinking water sources. Further, we understand the advice of Ms Schiess and Mr Simpson to be that while contamination of the underlying groundwater has occurred as a consequence of the Refinery, the proposed on-going abstraction and treatment of the groundwater will ensure that this does not noticeably impact on the Harbour and Bream Bay. Lastly, we understand the advice of Dr Stewart to be that while faecal coliforms can be present in the discharge from the SWB, that this is due to nesting birds rather than the operation of the Refinery. We understand the advice from Dr Kelly to be that the risk posed by this discharge (via contact recreation) is very low.

b. The advice from Dr Stewart and Ms Schiess and Mr Simpson leads us to the opinion that the groundwater abstraction and treatment measures employed by Refining NZ are effectively addressing any groundwater quality effects that the Proposal is causing. Further, we understand that Refining NZ is committed to further reducing its discharges to groundwater should it become practicable to do so. Indeed, the Company's commitment to continuous practicable improvements is evidenced by the work it has undertaken in the last decade to reduce such discharges, and to monitor the groundwater resource and drill new wells to ensure that the contaminated groundwater is abstracted and treated.

c. The advice of Dr Stewart leads us to the opinion that the wastewater treatment system is effectively treating the stormwater and process water that is generated by the Refinery. As a consequence, we are also of the opinion, that the stormwater and process water that is discharged cannot be classified as being 'poorly treated' in the context of Policy 4.2.1(b.).

d. As we have already recorded, the advice of Ms Schiess and Mr Simpson is that the groundwater allocation sought by Refining NZ is within the defined allocation. For the reasons we set out in our discussion of the NPSFM, we are of the opinion that the allocation of this water and its use is both efficient and an appropriate use of the groundwater resource. Indeed, without it, higher concentrations of contaminated groundwater could make its way into those portions of the CMA that abut the Refinery.

Given the foregoing, we are of the opinion that the Proposal is aligned with the outcomes sought by the provisions listed in **Table 6.3.4.3.1**.

Indigenous Ecosystems & Biodiversity

The provisions of the oRPS that relate to indigenous ecosystems and biodiversity and that are relevant to the Proposal are set out in **Table 6.3.4.3.2.**

Objectives	Policies
Objective 3.4	Policy 4.4.1
	Policy 4.7.1

Table 6.3.4.3.2*: Indigenous Ecosystems & Biodiversity*

Having considered the Proposal against the provisions listed in **Table 6.3.4.3.2** we note that:

a. As we have stated in our discussion of the NZCPS, the body of water quality and ecological advice that has been received by Refining NZ leads us to the opinion that the continued existence and operation of the Refinery will not impact on the ecological integrity of Northland. In this regard, while adverse water quality and ecological effects are anticipated, we understand that they will not threaten the extent and diversity of indigenous ecosystems and habitats or cause significant vegetation / habitats of indigenous fauna to be impacted to levels which cut across the direction that is set by the NZCPS.
b. The ecological experts advising Refining NZ, have considered the need for the Company to mitigate the adverse ecological effects that are anticipated. Such mitigation could include enhancing ecosystems and habitats. None have recommended mitigation which, we understand, reflects the very minor nature of the adverse effects that are expected, the effectiveness of existing (and proposed) mitigation measures (such as the pumping of contaminated groundwater and both its treatment and the treatment of the other liquid waste streams generated by the Refinery prior to their discharge), and the ecological benefits that accrue as a consequence of the Refinery's existence (which is, principally, achieved via the predator control that enhances nesting success for avifauna within the Site).
c. The adverse ecological effects that are projected by the various ecological experts are very small, and do not offend any of the thresholds set out in Policy 4.4.1. In that regard, Dr De Luca states that all adverse marine ecology effects will be de minimis to less than minor. Mr Don states that any adverse effects on avifauna will be negligible, as does Dr Clement with respect to impacts that could be felt by marine mammals. Dr Martin and Ms Raeburn state that any adverse effects on terrestrial ecology values will be less than minor (at worst) and will be avoided in a number of instances.
d. Mr Don records that the pest control that is conducted within the Site benefits a notable indigenous bird species. The continuation of this programme represents, in our opinion, active management.

As a consequence of the opinions that we have reached, we are also of the view that the Proposal can be advanced so as to accord with the objectives and policies set out in **Table 6.3.4.3.2**.

Enabling Economic Wellbeing

The provisions of the oRPS that relate to enabling economic wellbeing and that are relevant to the Proposal are set out in **Table 6.3.4.3.4**.

Objectives	Policies

Objective 3.5	Nil

Table 6.3.4.3.4: *Enabling Economic Wellbeing*

Having considered the Proposal against the provisions listed in **Table 6.3.4.3.4** we note that:

a. It is clear, given the advice of Mr Clough, that the continued existence and operation of the Refinery will improve the economic wellbeing of Northland and its communities. Further, given the body of advice that Refining NZ has received, we are of the opinion that the Proposal constitutes the sustainable management of natural and physical resources.

As a consequence of the foregoing, we are confident that the Proposal can be advanced so as to accord with Objective 3.5 of the oRPS.

Regionally Significant Infrastructure, Efficiency & Effectiveness, & Security of Energy Supply

The provisions of the oRPS that relate to regionally significant infrastructure, efficient and effective infrastructure and the security of energy supply, and that are relevant to the Proposal are set out in **Table 6.3.4.3.5.**

Objectives	Policies
Objective 3.7	Policy 5.1.2
Objective 3.9	Policy 5.3.1
	Policy 5.3.2
	Policy 5.3.3
	Policy 7.1.4

Table 6.3.4.3.5: *Regionally Significant Infrastructure, Efficient & Effectiveness, & Security of Energy Supply*

Having considered the Proposal against the provisions listed in **Table 6.3.4.3.5** we note that:

a. As we have already stated, the Refinery falls within the ambit of the RPS's definition of the term 'regionally significant infrastructure'. The advice before us is that the continued existence and operation of the Refinery will generate significant economic and social benefits. Such benefits need to be recognised, in our opinion, and weigh in favour of Refining NZ's resource consent applications being granted.
b. The Proposal will contribute to the supply of secure and reliable energy for Northland and, indeed, New Zealand. While this benefit is secured using fossil fuels, we understand that such energy is needed in the foreseeable future. We note that this point is recognised on page 43 of the oRPS.
c. The Proposal is existing, in an area that Mr Brown states is highly modified. As a consequence, granting the consents sought accords with the oRPS's desire for development to be consolidated, and takes into account the values of the adjoining and adjacent land.
d. The Refinery has been developed in a manner that maintains a high level of public access to the CMA. We understand that its continued existence also does not notably impact on coastal processes (including on any surf breaks of national significance) or ecosystems.
e. As we have already set out, the anticipated actual and potential adverse effects of the Proposal have been comprehensively assessed and found to be very small. Indeed, in the vast majority of instances the effects are deemed to be less than minor, which is the same as negligible. In those limited instances where larger effects are anticipated, their magnitude is still predicted to be small, with all also being transient in nature. As a consequence, their impact on the various resources and values within the coastal environment accords with the level of protection sought by the NZCPS and with policies 4.4.1, 4.6.1 and 4.6.2 of the oRPS.
f. We understand the advice of Dr Stewart to be that the Proposal does not cause the established water quality limits to be exceeded (which we understand means that from a water quality perspective, the receiving environment is not over allocated), while the advice of Ms Schiess and Mr Simpson is that the proposed groundwater abstraction does not cause the established allocation to be exceeded.

g. The Refinery is defined within the Civil Defence Emergency Management Act as a 'lifeline utility', which further reinforces its significance.
h. As is apparent from section 3.8 of this AEE, a range of alternatives have been assessed by the Refinery as part of the process associated with defining the Proposal. As is apparent from that analysis, while additional measures are available to reduce the effects of the Proposal, none are considered to be a practicable response at this juncture. Further, while alternatives are available to aspects of the Proposal, the analysis in section 3.8 shows that a number are likely to cause adverse effects that are greater than those associated with what is proposed.
i. Lastly, while no significant adverse effects are anticipated, monitoring is proposed to ensure that the effects of the Proposal accord with those that have been predicted within this AEE.

We are, therefore, confident that the Proposal accords with the outcomes sought by the provisions cited in **Table 6.3.4.3.5** of this AEE.

Use & Allocation of Common Resources

The provisions of the oRPS that relate to the use and allocation of common resources and that are relevant to the Proposal are set out in **Table 6.3.4.3.6.**

Objectives	Policies
Objective 3.10	Policy 4.8.1
	Policy 4.8.3
	Policy 4.8.4

Table 6.3.4.3.6: *Use & Allocation of Common Resources*

Having considered the Proposal against the provisions listed in **Table 6.3.4.3.6** we note that:
a. While aspects of the Refinery occupy parts of the CMA and portions of the coastal berm above MHWS, the area that is occupied is relatively confined – insofar as it is principally limited to the footprint of the Jetty, SWB spillway, Refinery boat ramp (not part of this application) and the associated mooring structures. Further, public access is facilitated to most areas, with restrictions limited only to the Refinery itself and to the Jetty / mooring structures.
b. The structures forming part of the Proposal which occupy the CMA have a functional need to be located there and it is not feasible that they be replaced with structures on dry land. No new structures are proposed, with all of the existing structures having been legally authorised for some time. It is not possible for Refining NZ to use existing structures owned by others.
c. In order for the structures to exist and operate it is necessary to occupy an area of the CMA. While the public is excluded from the areas occupied, this is necessary to ensure their health and safety.
d. As we have noted, the investment associated with the continued existence and on-going operation of the Refinery (including those structures that are situated within the CMA) is significant. Further, as no new activities are proposed, the actual and potential effects of those structures that are required to be located within the CMA are well known and have been assessed to be very small. These factors serve to support both the grant of the resource consent applications that have been lodged by Refining NZ and the 35-year consent term that has been sought.
e. The definition of the term 'environment' (as defined by the Act) is broadly cast and all encompassing. It is not just the biophysical or metaphysical considerations associated with, for example, the ecology or cultural values that are supported by the CMA. It includes peoples and communities. The biophysical effects of the structures within the CMA are, we understand, well known and very small. The CEA is also clear that the structures forming part of the Proposal that are located within the CMA could generate adverse cultural effects. Of note, however, is the advice, also within the CEA, that measures can be employed to address those adverse effects to the point that they are deemed to be acceptable. As we have noted, Refining NZ has confirmed that it will engage with Tangata Whenua following the lodgement of these resource consent applications with the objective of reaching a mutually acceptable outcome. As a

consequence, when considered in the round, we are of the opinion that the actual and potential adverse effects of the structures and the associated occupation can be avoided, remedied or mitigated to the extent that they are small and/or acceptable. In contrast, the positive effects that are generated by the Refinery (of which the coastal structures are an integral and significant component) are notable, which brings about a number of equally notable positive social effects. When everything is considered, it is reasonable to expect, in our opinion, that a net environmental benefit arises from the structures and their continued existence.

Given the foregoing, we are also of the opinion that the Proposal can be advanced in a manner that is consistent with the objective and policies listed in **Table 6.3.4.3.6.**

Tangata Whenua Role in Decision Making

The provisions of the NRPS that relate to Tangata Whenua's role in decision making and that are relevant to the Proposal are set out in **Table 6.3.4.3.7.**

Objectives	Policies
Objective 3.12	Policy 8.1.1
	Policy 8.1.2
	Policy 8.2.1
	Policy 8.3.1

Table 6.3.4.3.7: *Tangata Whenua's Role in Decision Making*

Having considered the Proposal against the provisions listed in **Table 6.3.4.3.7** we note that:

a. As we have already noted, Refining NZ has, in our opinion, sought to recognise and provide for, to the degree that it can, the kaitiaki role that is fulfilled by Tangata Whenua. The commenced by the Company seeking the input of Tangata Whenua groups, having regard to their iwi management plans and by commissioning the CEA. Refining NZ is working with Tangata Whenua groups with the aim of agreeing acceptable measures that address the adverse actual and potential cultural impacts that have been highlighted in the CEA.

b. Refining NZ has sought to both recognise and provide for the relationship of Tangata Whenua with their culture and traditions, enable the exercise of kaitiakitanga, and take account of the applicable principles of the Treaty of Waitangi. In doing so, it has sought to enable the Regional Council to fulfil the obligations set out in Part 2 of the Act (which are repeated in Policy 8.1.2) when it processes this resource consent application. The Company has sought to do this principally by engaging early and frequently with Tangata Whenua groups who have expressed a desire to engage, and by seeking the advice of, and responding appropriately to the advice of Tangata Whenua.

Given the foregoing, we are also of the opinion that the Proposal can be advanced in a manner that is consistent with the objective and policies listed in **Table 6.3.4.3.7.**

Natural Character, Outstanding Natural Features, Outstanding Natural Landscapes & Historic Heritage

The provisions of the oRPS that relate to natural character, outstanding natural features and landscapes, and historic heritage, and that are relevant to the Proposal are set out in **Table 6.3.4.3.8**.

Objectives	Policies
Objective 3.14	Policy 4.6.1
	Policy 4.6.2
	Policy 4.7.3

Table 6.3.4.3.8: *Natural Character, Outstanding Natural Features, Outstanding Natural Landscapes & Historic Heritage*

Having considered the Proposal against the provisions listed in **Table 6.3.4.3.8** we note that:

a. As we recorded in our discussion of the NZCPS, we understand the advice of Mr Brown to be that the Proposal can proceed in a manner that does not effect, to more than a minor extent, the qualities and characteristics that 'make up' the areas of outstanding natural character and the outstanding natural features / landscapes. This response accords, we also understand, with the level of protection that is advanced by the NZCPS and Policy 4.6.1 of the oRPS, and thus causes the Proposal, in our opinion, to be an appropriate use and development.
b. As we set out in section 4.11 of this AEE, no new land disturbance activities are proposed; while the discharges and coastal structures already exist and are to continue as they presently are. As a consequence, we expect that the historic resources that surround the Site will not be noticeably impacted by the Proposal. The conclusions drawn with the CEA confirm this, at least in relation to the known archaeological and historic sites. Where sites and/or locations / values of cultural importance have been identified, Refining NZ has worked to understand the Proposal's potential to impact upon the same, and is committed to engaging with Tangata Whenua (post the lodgement of this AEE and the associated resource consent applications) with the intention of reaching a mutually acceptable response to the cultural effects that have been highlighted.
c. Mr Brown has considered the need for Refining NZ to rehabilitate and restore natural character. In a similar vein, all of the ecological consultants have considered the need for the Company to rehabilitate or restore the ecosystems that are in close proximity to the Site. This is relevant to the broader question of natural character given the role that ecosystems play in what is a broadly cast legal construct. None of these experts have recommended any restoration or rehabilitation works. As a consequence, we are of the opinion that restoration / rehabilitation of the natural character is not a matter that the NRC needs to 'promote' in its consideration of the resource consent applications for the Proposal.

Given these opinions, we are also of the view that the Proposal can be advanced so as to achieve the outcomes sought in the provisions listed in **Table 6.3.4.3.8**.

Active Management

The provisions of the oRPS that relate to the use and allocation of common resources and that are relevant to the Proposal are set out in **Table 6.3.4.3.9**.

Objectives	Policy
Objective 3.15	Policy 4.7.1

Table 6.3.4.3.9: *Active Management*

Having considered the Proposal against the active management provisions listed in **Table 6.3.4.3.9** we note that:

a. The continuation of the status quo, which is, in essence, what is proposed will, ensure that the various values listed in Objective 3.15 are maintained.
b. The experts advising Refining NZ have considered the need for the Company to undertake additional avoidance, remediation or mitigation (which includes the concept of offsetting). The collective advice has been that only limited additional measures are needed (all of which have been accepted by the Company and are proposed). Despite this, we understand that all of the experts engaged by Refining NZ support the Company continuing to look at its activities (as it exercises any new resource consent), and reducing its environmental footprint when it is practicable to do so (as we have already recorded, Refining NZ has an impressive track record of doing this). Further, we note that Mr Don supports the continuation of Refining NZ's existing predator control activities given the beneficial impact they are having on indigenous avifauna within the Site.

As a consequence of the foregoing, we are of the opinion that the Proposal can be advanced so as to accord with the provisions listed in **Table 6.3.4.3.9**.

6.3.4.4 oWSP

The oWSP became operative on the 21st of August 2004 and was amended / changed in 2007, 2010, 2011 and 2014. It is a comprehensive document that seeks to promote the sustainable management of water and soil resources in Northland. It's policy framework alone is 99 pages long. We have considered all of the objectives, policies and methods and now discuss those that we consider to be of relevance to the Proposal.

As with the NZCPS, NPSFM and RPS, we discuss the relevant provisions of the oWSP by topic. In that regard, the relevant provisions are recorded in a series of 'topic-based' tables, and then our analysis of the Proposal against them is set out in a series of bullet points. Further, all of the provisions cited in the tables of this section are repeated, in full, in **Annexure 11** to this AEE.

Māori, Their Culture & Traditions

The provisions of the OWSP that relate to the recognition of and provision for Māori, their culture and traditions, and that are relevant to the Proposal, are set out in **Table 6.3.4.4.1**.

Objectives	Policies
Objective 6.3.1	Policy 6.4.1
	Policy 6.4.2
	Policy 6.4.3

Table 6.3.4.4.1: *Māori, Their Culture & Traditions*

Having considered the Proposal against the provisions listed in **Table 6.3.4.4.1** we note that:

a. As we have already noted, Refining NZ has sought to engage with Tangata Whenua to understand the values and relationships that they have with the Site and the surrounding environs. The Company has also sought direction from the iwi management plans that apply to the Site and has commissioned and received the CEA. This work has shown the Site to be part of the broader area that is of cultural significance. It also highlights that the existence and operation of the Refinery has impacted on the land, cultural landscape and freshwater resources. Refining NZ is already implementing measures to maintain and reduce that impact. Ceasing 'land farming' on the Site, the pumping and treatment of contaminated groundwater and the measures taken in recent years to reduce leaks from the processing, storage and treatment infrastructure within the Refinery (which were conducted as part of 'Project Kleenex') are all examples of the work that the Company has completed to reduce its impact on the freshwater and soil resource. As we have already also noted, Refining NZ is to undertake further engagement with Tangata Whenua following the lodgement of this AEE with the aim of agreeing mitigation measures which ensures that any adverse cultural effects are minimised to the point that they are acceptable.
b. Refining NZ is already working with Tangata Whenua to monitor the impacts of the Refinery on the resources and values of note. The Company recognises that this is a central (but not sole) function of Tangata Whenua exercising kaitiakitanga over both the Site and the adjacent environs. Asking Tangata Whenua to identify the relationships and values that exist within and around the Site, seeking advice as to the effects that the Proposal could have on those values / relationships, and then working with Tangata Whenua with the aim of agreeing mutually acceptable mitigation measures are further examples of Refining NZ seeking to facilitate kaitiakitanga.

Given the foregoing, we are of the opinion that the Proposal is being advanced in a manner that seeks to give effect to the direction set out in the provisions in Table 6.3.4.4.1.

Water Quality

The provisions of the oWSP that relate to water quality and are relevant to the Proposal are set out in **Table 6.3.4.4.2**.

Objectives	Policies
Objective 7.4.1	Policy 7.5.4

	Policy 7.5.7
	Policy 7.8.1
	Policy 7.8.2

Table 6.3.4.4.2: *Water Quality*

Having considered the Proposal against the provisions listed in **Table 6.3.4.4.2** we note that:

a. We understand the advice of Ms Schiess and Mr Simpson to be that the groundwater below the Refinery is not 'potentially useable' due to historic contamination. As a consequence, the oWSP seeks the maintenance and enhancement of groundwater quality so that it protects the use of the receiving water body – which in this instance is the Harbour and Bream Bay. With the proposed pumping and treatment of the groundwater we understand that any impacts on the receiving environments will be very small, and that the water quality of the marine environment and groundwater will be maintained at the boundary. It follows that we understand that the ability of the receiving waters to be used will not be changed from what currently exists. It should be noted that work is also being undertaken to reduce discharges to land associated with Project Kleenex, where improvements are being made to the drain network. Further, a maintenance programme is in place, which seeks to reduce hydrocarbon egress to ground.
b. We also understand that the abstraction and treatment of the groundwater and the natural biological process under the ground will ensure that the groundwater is treated before it can make its way into the Harbour and Bream Bay.
c. As we have already noted in our discussion of the provisions listed in Table 6.3.4.4.1, we are of the opinion that the Proposal is being advanced in a manner whereby the impacts of the Refinery on the Site and the underlying groundwater resource are reduced. While this cannot avoid or completely remedy the adverse cultural effects that the Refinery has had on these resources, it represents an improvement over the cultural effects that have historically been felt by Tangata Whenua. We note, also, that even the removal of the Refinery would not see these effects being avoided or completely remediated. In that regard, the landform is changed, and some historic contamination of the groundwater resource would persist. The Proposal, when coupled with the Company's commitment to working with Tangata Whenua over the life of the new resource consents to further minimise, as practicable, the generation of cultural effects is evidence of Refining NZ having particular regard to the cultural values and traditional uses of the Site.
d. We further understand the advice of Dr De Luca, Dr Ross, Mr Don and Dr Clement to be that the discharges will not impact the life supporting capacity of the ultimate receiving environment (being the Harbour and Bream Bay). While the groundwater will continue to be impacted by discharges from the soils below the Refinery, this impact is not new, will not cease should the Refinery cease to exist and operate, and is effectively being addressed by the Company's abstraction and treatment response. We understand the advice of Dr Kelly to be that parties coming into contact with the treater groundwater will not be substantively adversely affected; insofar as their health will not be impacted. At a broader level, the proposed abstraction and treatment regime will ensure that the groundwater does not noticeably impact on the human health of those using the CMA.

Given the forgoing, we are of the opinion that the Proposal can be advanced in a manner that accords with the outcomes sought by those provisions listed in **Table 6.3.4.4.2**.

Discharges

The provisions of the oWSP that relate to discharges are set out in **Table 6.3.4.4.3**.

Objectives	**Policies**
Objective 8.6.1	Policy 8.7.1
Objective 8.6.2	Policy 8.7.3
	Policy 8.7.4
	Policy 8.15.1
	Policy 8.15.2
	Policy 8.17.1

	Policy 8.17.2
	Policy 8.17.4
	Policy 8.17.5
	Policy 8.17.6
	Policy 8.17.7
	Policy 8.20.1
	Policy 8.20.2

Table 6.3.4.4.3: *Discharges*

Having considered the Proposal against the provisions listed in **Table 6.3.4.4.3** we note that:

a. As is apparent from the advice that is summarised in section 4.0 of this AEE, the effective capture / containment and treatment of the trade and stormwater discharges is proposed. Indeed, any adverse effects associated with the discharges are expected to be small.

b. As we have noted, while none of the experts engaged by Refining NZ have recommended that the discharges require further treatment, Refining NZ is committed to reducing its environmental footprint when it is practicable to do so. Indeed, the Company has a track record of improving its operations and assets in a manner that minimises the contaminants that are lost to the ground or discharged to the Harbour.

c. Refining NZ has considered all of the discharges to ground and the treatment of the stormwater and trade waste that is captured on the Site. This analysis, which is summarised in section 3.8 of this AEE, has been reviewed by the experts advising the Company, all of whom, we understand, support the conclusions that Refining NZ has reached. As a consequence, the Company has concluded that the discharges and the proposed treatment regime represents the Best Practicable Option.

d. While we understand that the discharge does contain 'organic content', Dr Stewart advises that the levels present post treatment and reasonable mixing are acceptable from a water quality perspective. In this respect, Dr Stewart advises that most of the contaminants that are discharged will have less than minor effects, while others will be minor but transitionary. While these impacts are clearly discernible, Mr Don, Dr De Luca, Dr Ross and Dr Clement do not expect any unacceptable adverse ecological effects to arise. Dr Kelly does not expect any human health effects to arise that are greater than negligible in their magnitude. While the CEA highlights concerns regarding the adverse cultural effects of the proposed discharges, measures are recommended to address those impacts to a point where they are acceptable. As we have noted, Refining NZ is to continue to engage with Tangata Whenua following the lodgement of this AEE (and its associated resource consent applications) with the objective of agreeing mutually acceptable mitigation measures.

e. We are advised that Refining NZ is committed to monitoring its discharges to ground and to the CMA, and to applying its Environmental Management System to further address the adverse effects that arise from the discharges of the contaminants it generates where it is practicable to do so. This, in our opinion, represents a pragmatic and appropriate response.

f. We understand that the stormwater system on the Site safeguards against flooding and ensures that contaminated stormwater is intercepted and treated where it is (both geographically and temporally) appropriate to do so. Equally, we understand that the treatment system that is employed on Site is appropriate, in the opinion of both Refining NZ and Dr Stewart to the environment and ensures that the effects of the stormwater discharges less than minor, while others will be minor but transitionary.

As a consequence of the foregoing and while we accept that the Proposal does not accord, in a strict sense, with all of the wording of the objectives and policies, we are of the opinion that the Proposal accords with the outcomes set out in the provisions that we list in **Table 6.3.4.4.3.**

Groundwater Management

The provisions of the oWSP that relate to groundwater management, and that are relevant to the Proposal are set out in **Table 6.3.4.4.4**.

Objectives	Policies
Objective 10.4.1	Policy 10.5.1
Objective 10.4.2	Policy 10.5.2
Objective 10.4.3	Policy 10.5.4
	Policy 10.5.5
	Policy 10.5.7
	Policy 10.5.8
	Policy 10.5.9
	Policy 10.8.1

Table 6.3.4.4.4: *Groundwater Management*

Having considered the Proposal against the provisions listed in **Table 6.3.4.4.4** we note that:

a. The advice of Ms Schiess and Mr Simpson is, in our opinion, key to the consideration of these provisions of the oWSP. We understand their advice to be that any adverse environment effects associated with the discharge of contaminants to groundwater, and its pumping / treatment will be less than minor. As is apparent from section 4.3 of this AEE, this includes impacts on deeper aquifers, other potential users and ground settlement considerations. Indeed, we understand Ms Schiess and Mr Simpson to conclude that the abstraction and treatment of groundwater represents a nett environmental benefit. These conclusions lead us to the opinion that the proposed abstraction and treatment of groundwater (which represents the 'use' of the abstracted groundwater) represents a sustainable use of groundwater.

b. We understand the advice of Mr Simpson to be that the groundwater abstraction proposed can generally be managed (based upon the experience gained to date) so that it does not cause saline intrusion. That said, however, some locations remain susceptible to saline intrusion occurring, particularly during low flow conditions. With respect to this possible intrusion, we also note Mr Simpson's advice that any intrusion which did occur as a consequence of the Proposal would likely have beneficial effects in the long term, insofar as it would aid in the treatment of an already contaminated groundwater aquifer. Put another way, we understand that should saline intrusion occur, it will not generate adverse environmental effects, but rather will generate positive environmental outcomes. As a consequence, and applying the rationale set down by the Supreme Court (refer to *Environmental Defence Society Inc v The New Zealand King Salmon Co Ltd* [2014] NZSC 38) for the interpretation of the term 'avoid', any instances of saline intrusion that do occur will not generate adverse environmental effects that need to be avoided. This outcome accords, in our opinion, with those being sought by the applicable policies of the oWSP.

c. We understand that the proposed abstraction does not impact the operation of bores not owned and operated by Refining NZ, or cause impacts on surface water resources. Indeed, the abstraction acts to improve the quality of the adjacent coast and Harbour. We note that some of the neighbouring bores are also owned by parties that have given their written approval to the Proposal. Where this has occurred, the effects of the proposed abstraction on those bores cannot be considered by the Regional Council in its consideration of the resource consent applications that Refining NZ has lodged.

d. For the reasons we have already discussed, we are of the opinion that the proposed abstraction can be advanced in a manner that reflects the cultural values that apply for both the Site and the underlying groundwater resource, and to the adjacent coastal marine area.

It follows, therefore, that we consider that the Proposal can be advanced in a manner that accords with the direction and outcomes sought by the provisions listed in **Table 6.3.4.4.4**.

6.3.4.5 oAQP

The oAQP was made operative in 2003 and changed in 2005 and 2008. Its purpose is to, in summary, assist the NRC and resource users to promote the sustainable management of Northland's air resources. Its policy framework is 15 pages long.

As with the preceding planning instruments, we now discuss the relevant provisions of the oAQP by topic. All of the provisions cited in the tables of this section are repeated, in full, in **Annexure 12** to this AEE.

Resource Policy

The provisions of the oAQP that relate to the air quality resource in Northland (in general) and that are relevant to the Proposal are set out in **Table 6.3.4.5.1.**

Objectives	Policies
Objective 6.6.1	Policy 6.7.1
Objective 6.6.2	Policy 6.7.2
Objective 6.6.3	Policy 6.7.3
	Policy 6.7.4
	Policy 6.7.5
	Policy 6.7.6
	Policy 6.7.7
	Policy 6.7.10
	Policy 6.9.1
	Policy 6.11.3
	Policy 6.15.1

Table 6.3.4.5.1: *Resource Policy*

Having considered the Proposal against the objective listed in **Table 6.3.4.5.1** we note that:

a. The advice of Mr Chilton is, in our opinion, central to the assessment of the Proposal against the provisions listed in **Table 6.3.4.5.1**. As is apparent from section 4.4 of this AEE, the Proposal has the potential to generate a number of adverse air quality effects. Having, however, considered the historical monitoring data held by the Company, data from monitoring that has recently been completed by Refining NZ and having completed modelling of the discharge plumes that are predicted, Mr Chilton concludes that any adverse air quality effects will be, at worst, less than minor. In reaching this conclusion we understand him to conclude that the existing mitigation measures (such as stack heights) employed by Refining NZ are appropriate, and to recommend a modification to the abrasive blasting methodology, whereby blasting would not occur when it could see sediment transported over and deposited into the CMA. This finding, and the implementation of the existing mitigation measures and the proposed abrasive blasting measure, lead us to the opinion that the proposed discharges to air will not prevent Northland's air resource from being sustainably managed.

b. The Proposal, including the mitigation measures will, we understand from Mr Chilton, continue to ensure that the air quality / quality of the environment is maintained; and that only temporary and infrequent noxious, dangerous, offensive or objectionable air quality effects will arise (including odours). This includes from the emission of dust / fugitive emissions and from those effects that arise when fuels are burnt. It should be noted that given the relatively low level[205] of recent odour complaints, the infrequent light wind conditions that could transport odours towards sensitive locations, and the overall FIDOL analysis, it is considered that odour effects as a result of discharges from the Refinery are less than minor.

c. While the discharges from the Site contain greenhouse gases and ozone depleting substances, Refining NZ is committed to seeing the discharge of such gases reduced. This is evident from the Company's commitment to the development of New Zealand's largest solar farm and to working with the New Zealand government to achieve a carbon neutral future.

d. Dr Kelly has considered the actual and potential health effects that could arise as a consequence of the discharges that form part of the Proposal. We understand her advice to be that any adverse health effects would be less than minor in magnitude.

e. As we have previously foreshadowed, Refining NZ has completed an assessment of alternatives in order to determine what is the best practicable option in relation to,

[205] The level of recorded complaints relating to odour since 2015 has been very low for a large heavy industrial complex such as the Refinery, with only 19 complaints being recorded over the 4.5-year period.

amongst other things, its discharges. This includes its discharges to air. That analysis has confirmed the status quo as being the best practicable option in relation to its discharges to air, with the exception of the additional management measure that Mr Chilton has recommended when the Company is undertaking its abrasive blasting activities.

Again, we are of the opinion that the Proposal can be advanced on the basis that the outcomes sought by the provisions listed in **Table 6.3.4.5.1** can be achieved.

Marsden Point

The provisions of the oAQP that relate to Marsden Point and that are relevant to the Proposal are set out in **Table 6.3.4.5.2**.

Objectives	Policies
Nil	Policy 6.17.1
	Policy 6.17.2

Table 6.3.4.5.2: *Marsden Point*

Having considered the Proposal against the provisions listed in **Table 6.3.4.5.2** we note that:

a. We understand Mr Chilton's advice to be that the Proposal accords with the broad approach and strategic outcomes that are set within the Marsden Point Air Quality Strategy, to the extent that they remain relevant to the Proposal.
b. The Proposal does not conflict with the NESAQ and accords, we understand from Mr Chilton's advice, with the relevant Ambient Air Quality Guidelines. We also understand Dr Kelly's advice to be that the discharges to air do not present an unacceptable risk to the health of people and communities in Northland.

The foregoing leads us to the opinion that the Proposal can be advanced so as to accord with the two policies listed in **Table 6.3.4.5.2**.

6.3.4.6 oRCP

The oRCP was made operative on the 30th of June 2004. It has been the subject of five plan change processes (three in 2010, and one each in 2014 and 2016), all of which are now operative.

The RCP assists the NRC to promote sustainable management of natural and physical resources in the CMA. As a consequence, it has effect from MHWS to the 12nm (22.3km) limit of New Zealand's territorial sea. It is important to note that the NRC chose to confine the application of the oRCP to the CMA, and not the broader Coastal Environment.

It is also notable that the oRCP highlights that it adopts a 'cautious approach to use and development' in the CMA, due to a limited amount of information being available (at the time when the oRCP was drafted) on the environmental values that are supported in the coastal waters, and an 'increased awareness' within the Council of the need to protect the natural and physical resources that exist. That is not to say, however, that the oRCP precludes use and development within the CMA. Rather, it enables such use and development where:

a. Adverse effects are avoided, remedied or mitigated in accordance with the direction advanced by the Plan's provisions;
b. Activities are located in management areas that already contain similar uses and developments;
c. The environmental effects of the use and development are monitored; and
d. Areas of high conservation value are afforded 'special protection' from the adverse effects of the use and development[206].

[206] Pages 31 & 32, section 5.4 of the RCP

The objectives and policies applying within the oRCP extend over 207 pages. Those of relevance to the Proposal are discussed below, in the order that they are raised within the RCP. We reiterate that the provisions listed in the tables that follow are repeated, in full, in **Annexure 13**.

Marine Management Areas

As we have already highlighted, the NRC chose to use a series of 'Marine Management Areas' to regulate the type of activities that can be undertaken in the CMA of Northland.

The marine management area provisions that relate to the Proposal are set out in **Table 6.3.4.6.1.**

Objectives	Policies
Objective 6.3	Policy 6.4.1
Objective 25.3.1	Policy 6.4.2
Objective 26.3.1	Policy 6.4.5
Objective 26.3.2	Policy 25.4.1
Objective 29.3.1	Policy 26.4.1
	Policy 26.4.2
	Policy 29.4.1
	Policy 29.4.2
	Policy 29.4.4

Table 6.3.4.6.1: *Marine Management Areas*

Having considered the Proposal against the provisions listed in **Table 6.3.4.6.1** we note that:

a. It is clear to us that the marine management areas are a key mechanism to enable the oRCP to achieve its desired outcomes. As we have noted, areas such as Mair and Marsden banks are situated within the M1MA. While these areas will be adversely affected by the Proposal, the magnitude of the effects are expected to be small. Indeed, we understand the ecological advice that Refining NZ has received to be that these effects will not prevent the protection of the conservation values that are zoned M1MA. While we note that the oRCP talks of giving priority to avoiding adverse effects on the important conservation values, this threshold is more lenient than the more directive threshold that is applied in the NZCPS. Being able to comply with the threshold set out in the NZCPS, means, in our opinion that, the Proposal is also consistent with the direction that the oRCP sets for the areas deemed to be M1MA.

b. A key part of the Proposal is the continued existence and operation of the jetties and the associated mooring structures. As a consequence, we are of the opinion that the Proposal provides for the continuation of the Marden Point Port area (which encompasses both the Refinery and Northport) in a manner that minimises adverse effects (including those associated with ships berthing at the Jetties and unloading their cargoes) and promotes positive effects. This, in our opinion, represents an appropriate outcome that accords with both the Act's sustainable management purpose and the purpose of the M5MA zone.

c. While the Proposal does not encroach into the area of the Harbour and Bream Bay that is zoned M2MA, it is expected to cause effects that extend out into areas that have this zoning. Of note, however, is that the effects are all small, and are not expected to generate unacceptable outcomes. In that regard, we understand the advice to be that the existing natural and amenity values will be maintained by the Proposal, and that enhancement of the various values supported by the areas zoned M2MA is not needed in this instance, given the small adverse effects that are anticipated. In terms of the cultural values, while the existence and operation of the Refinery has impacted on the cultural values and sites in the CMA, the impacts are, for the most part, minor or more than minor. The key exception to this seems to be the impact of the of the Refinery on the cultural landscape. Significantly, however, a range of possible measures have been recommended in the CEA to address these effects to levels that Tangata Whenua feel will be acceptable. As we have noted, Refining NZ is committed to engaging with Tangata Whenua further with the objective of agreeing mutually acceptable mitigation

measures. As a consequence, we are of the opinion that the Proposal does not cut across the purpose of the M2MA zone.

d. Given (i) that the Proposal seeks to, in essence, maintain the status quo, (ii) the amount of environmental monitoring that has been undertaken by the Company, and (iii) the considerable volume of work that has been completed to support the Proposal, there is no justification, in our opinion, for the Council to 'adopt a cautious approach to decision making' in this instance.

As a consequence of the foregoing, we are of the opinion that the Proposal is consistent with the outcomes sought in the objective and policies listed in **Table 6.3.4.6.1**.

Preservation of Natural Character

The natural character provisions of the oRCP that relate to the Proposal are set out in **Table 6.3.4.6.2**.

Objectives	Policies
Objective 7.3	Policy 7.4.1
	Policy 7.4.2
	Policy 7.4.4
	Policy 7.4.6
	Policy 7.4.7

Table 6.3.4.6.2: *Preservation of Natural Character*

Having considered the Proposal against the provisions listed in **Table 6.3.4.6.2** we note that:

a. We have discussed the Proposal's potential to impact on the natural character of the coastal environment when we considered both the NZCPS and the oRPS. In both instances, we highlighted the advice of Mr Brown and his conclusions that any natural character effects would be, at worst, 'low'. This amounts to a minor effect (at worst), which achieves the level of protection required by the highest order planning instrument (the NZCPS) for all areas of natural character (being those of outstanding, high or another value). Equally, we note the considerable body of ecological advice (which is a very relevant consideration to natural character), and the conclusion that all actual and potential adverse effects are expected to be very small. Lastly, and given the direction of Policy 20.4.1 of the oRCP, we note T&T's[207] advice is that the Proposal's impact on ambient air quality is very small (less than minor). This body of advice leads us to the opinion that the level of protection required by the higher order planning instruments will be achieved should be Proposal obtain the resource consents that are sought. Given this, we are also of the opinion that the natural character values that are present within and adjacent to the Site will be preserved to the levels required by the various planning instruments, and that the Proposal is not an inappropriate activity.

b. The Proposal is an established activity that sits within an area that has been substantially modified. Indeed, the Refinery has existed since the 1960s. It follows, therefore, that the natural character values that are recognised within the planning instruments exist with the Refinery in place and operating. The continuation of the status quo therefore accords, in our opinion, with the concept that 'use and development' should continue within the areas that are already 'compromised'.

c. While the environs within and adjacent to the Site have been modified as a consequence of development (which has had a consequential impact on the natural character values that are present), Mr Brown's advice is that restoration and rehabilitation is not warranted.

It follows, therefore, that the Proposal can, in our opinion, be advanced in accordance with the natural character related outcomes that are sought within the oRCP.

Natural Features & Landscapes

[207] Chilton, R. Tonkin & Taylor Limited, *Air Quality Assessment*. Dated June 2020

The natural features and landscape provisions of the oRCP that relate to the Proposal are set out in **Table 6.3.4.6.3**.

Objectives	Policies
Objective 8.3	Policy 8.4.1
	Policy 8.4.2
	Policy 8.4.3
	Policy 8.4.4

Table 6.3.4.6.3: *Natural Features & Landscapes*

Having considered the Proposal against the provisions listed in **Table 6.3.4.6.3** we note that:

a. The advice of Mr Brown is that the Proposal will not directly impact on any outstanding natural features or landscapes.
b. Mr Brown also advises that the Proposal will have only low to very low landscape effects on all of the landscape values within the Site and that could be impacted by it. We understand this to mean that the Proposal will cause, at worst, minor adverse landscape effects. Given Mr Brown's advice and his conclusions as to the actual and potential landscape effects of the Proposal, we are of the opinion that the continued existence and operation of the Refinery is not an inappropriate use and development – when considered in a landscape and natural features context.

Given Mr Brown's advice we are of the opinion that the Proposal accords with the provisions listed in **Table 6.3.4.6.3**.

Indigenous Vegetation

The indigenous vegetation provisions of the oRCP that relate to the Proposal are set out in **Table 6.3.4.6.4**.

Objectives	Policies
Objective 9.1.3A	Policy 9.1.4.1
	Policy 9.1.4.5
	Policy 9.1.4.8

Table 6.3.4.6.4: *Indigenous Vegetation*

Having considered the Proposal against the provisions listed in **Table 6.3.4.6.4** we note that:

a. Dr Martin and Ms Raeburn, and Dr De Luca assessed the potential for the Proposal to impact on the terrestrial and marine ecology values within and in close proximity to the Site. This included the indigenous flora and lichens. Dr Martin and Ms Raeburn conclude that effects on areas of significant vegetation are expected to be avoided, and advise that all other effects should be undetectable, with the exception of lichens within one kilometre of the sources of the discharge – where less than minor effects are anticipated. Dr De Luca advises that all of the actual and potential effects on marine ecosystems / ecology will be de minimis to less than minor. While none of the three experts conclude that no effects occur as a consequence of the Proposal, the predicted magnitude of the effects offers the level of protection required by the higher order planning instruments, such as the NZCPS. We are of the opinion that this outcome accords with the level of protection that is required by the Act's sustainable management purpose.
b. As we have noted, all of the ecological consultants advising the Company on the project have considered the need for restoration and / or rehabilitation to be undertaken. This includes the need to restore or rehabilitate the indigenous vegetation. None are of the opinion that such restoration or rehabilitation is required in this instance.

Given the foregoing, we are of the opinion that the Proposal accords with the outcomes sought by the objective and policies listed in **Table 6.3.4.6.4**.

Habitats of Indigenous Fauna

The indigenous fauna provisions of the oRCP that relate to the Proposal are set out in **Table 6.3.4.6.5.**

Objectives	Policies
Objective 9.2.3	Policy 9.2.4.1
	Policy 9.2.4.2
	Policy 9.2.4.3
	Policy 9.2.4.4

Table 6.3.4.6.5*: Habitats of Indigenous Fauna*

Having considered the Proposal against the provisions listed in **Table 6.3.4.6.5** we note that:

a. It is important to highlight that all of the provisions listed in **Table 6.3.4.6.5** refer to the 'habitats' of indigenous fauna, and not to the fauna themselves. This is relevant as while Dr De Luca, Dr Ross, Dr Martin / Ms Raeburn and Mr Don all identify significant habitats of indigenous fauna in close proximity of the Site, Dr Clement does not. As a consequence, we are of the opinion that where the provisions of the oRCP seek to protect 'significant habitats' that this does not apply to the habitat that exists within and in close proximity to the site for marine mammals.
b. As we have noted, the ecological advice to Refining NZ is that areas within and adjacent to the Site are significant habitats for indigenous fauna. We understand the advice of Dr Clement to be that while significant species are known to frequent the Harbour and Bream Bay, they do not qualify as significant habitats. Irrespective of this, it is notable that all of the ecologists (including Dr Clement) advising Refining NZ conclude that any adverse effects will be very small. In that regard, all advise that, at their worst, any effect will be less than minor in magnitude. Further, it is also notable that Mr Don concludes that the predator control undertaken by Refining NZ is benefiting those indigenous bird species nesting within the Site. Given this advice, and the guidance provided by the superior planning instruments, we conclude that the Proposal is affording the habitats of indigenous fauna (be they significant or not) the level of protection that is appropriate and required.
c. As we have already acknowledged, Refining NZ has commissioned four ecological assessments that are specific to the Proposal. They do not identify any significant adverse effects.

Having considered the provisions and the opinions we have reached in relation to them, we are confident that the Proposal can be advanced in a manner that is consistent with the provisions listed in **Table 6.3.4.6.5.**

Public Access

The public access provisions of the oRCP that relate to the Proposal are set out in **Table 6.3.4.6.6.**

Objectives	Policies
Objective 10.3.1	Policy 10.4.1
	Policy 10.4.3

Table 6.3.4.6.6: *Public Access*

Having considered the Proposal against the provisions listed in **Table 6.3.4.6.6** we note that:

a. As we have discussed in relation to the NZCPS and oRPS, the Proposal does not interfere with the public's existing ability to gain access to and/or along the CMA. As a consequence, we are of the opinion that it will maintain the levels of accessibility that presently exists.
b. While Refining NZ proposes to retain some restrictions that limit public access in relation to the Jetties and around the dolphins, these restrictions are needed for public health and safety reasons, and as they assist the Company with the security of the Refinery Site. We note that public access to the beach is not restricted.

As a consequence of these opinions, we are also of the opinion that the Proposal accords with the policy direction set by those provisions that are cited in **Table 6.3.4.6.6.**

Māori Culture & Traditions

The Māori culture and traditions provisions of the oRCP that relate to the Proposal are set out in **Table 6.3.4.6.7.**

Objectives	Policies
Objective 11.3	Policy 11.4.1
	Policy 11.4.2
	Policy 11.4.4

Table 6.3.4.6.7: *Māori Culture & Traditions*

Having considered the Proposal against the provisions listed in **Table 6.3.4.6.7** we note that:

a. We have already discussed the actions that Refining NZ has undertaken to ensure that it both understands and is in a position to respond to the cultural values and relationships that exist within and adjacent to the Site. We do not repeat that discussion here, other than to note that this approach recognises and respects, in our opinion, the relationships that Tangata Whenua have with the coast and the Harbour.
b. Similarly, the engagement that has occurred and that is to occur is focussed on understanding and then trying to ensure that the concerns raised by Tangata Whenua are addressed so that any residual adverse cultural effects are acceptable. This outcome is consistent with the protection of the natural and physical resources within the coastal marine area to the extent that is practicable.
c. While accepting that Tangata Whenua would prefer that the discharges of treated wastewater and stormwater to the coastal marine area did not occur, there is no practicable means of achieving that outcome. Indeed, we understand the alternatives assessment ultimately conclude that the measures proposed by Refining NZ to minimise the impacts of the discharges to the coastal marine area are the best practicable option.
d. As we have noted, Refining NZ currently engages Tangata Whenua in the monitoring the coastal environment.

Given bullet points (a.) to (d.), we are of the opinion that the Proposal can be advanced so as to accord with the direction set out in the provisions cited in Table 6.3.4.6.7.

Cultural Heritage Values

The cultural heritage values provisions of the oRCP that relate to the Proposal are set out in **Table 6.3.4.6.8**.

Objectives	Policies
Objective 12.3.1	Policy 12.4.1
Objective 12.3.2	Policy 12.4.2
	Policy 12.4.3

Table 6.3.4.6.8: *Cultural Heritage Values*

Having considered the Proposal against the provisions listed in **Table 6.3.4.6.8** we note that:

a. We have already highlighted (in our consideration of the various policy frameworks that apply to the Proposal) that Refining NZ has sought advice from Tangata Whenua as to the location of the places, areas and sites of cultural significance. The Company has also sought to understand how those places, sites and areas could be impacted by the continued existence and operation of the Proposal. This approach accords with the level of recognition that is required to be paid to the areas, sites and places of cultural importance by the objectives and policies of the oRCP. To ensure that these sites, areas and places are afforded the appropriate level of protection, Refining NZ has commissioned an array of technical assessments, to determine the level of actual and potential adverse effects that the Proposal could cause. Where these assessments have recommended the adoption of measures to avoid, remedy or mitigate adverse effects, they have been adopted. Further, and as we have also noted, the Company is committed to its continued engagement with Tangata Whenua over the measures that

could practicably be implemented to ensure that any residual adverse cultural effects are minimised to the point that they are acceptable.

b. We set out our understanding of the archaeological and historic sites in section 2.3.10 of this AEE. In that regard, it is our understanding that there is one recorded archaeological site that was uncovered during coastal erosion dune works. The area surrounding the Site is recorded as being 'relatively significant' from an archaeological perspective. While earthworks or discharges that cause erosion could conceivably reveal unrecorded archaeological sites, it is important to note that no earthworks are proposed as part of the Proposal, and that the proposed discharges have not (to date) revealed any archaeological resources. As a consequence, we do not expect any adverse archaeological or historic effects to occur as a consequence of the Proposal.

As a consequence of these conclusion, we are confident that the Proposal can be advanced so as to be consistent with the provisions listed in **Table 6.3.4.6.8**.

Water Quality

The water quality provisions of the oRCP that relate to the Proposal are set out in **Table 6.3.4.6.9.**

Objectives	Policies
Objective 13.3	Policy 13.4.1
	Policy 13.4.2

Table 6.3.4.6.9: *Water Quality*

Having considered the Proposal against the provisions listed in **Table 6.3.4.6.9** we note that:

a. We have addressed the various water quality conclusions that have been drawn by Dr Stewart previously. In summary, we understand that most of the anticipated adverse water quality effects will be very small, with only a few being of a magnitude that could be considered 'minor'. We understand Dr Stewart's advice to be that these minor effects will be transitionary only. These conclusions, and the Refinery's proposal to, in essence, retain the status quo (in terms of the consented discharge rates, contaminant loads and quantities) lead us to the opinion that water quality will be maintained should the resource consents sought by the Refinery be granted.

b. We understand the advice of Dr Stewart to be that the water quality standards set by the oRCP for the receiving waters will be achieved except ammoniacal-nitrogen, which is due to a low regulatory guideline for ammoniacal-nitrogen in the oRCP. The information before us suggests that this exceedance will not cause notable adverse effects. In that regard, any adverse water quality effects will be, at worst, minor and transitionary.

c. We also understand the advice of Dr Stewart to be that no part of the CMA will be significantly degraded as a consequence of the proposed discharges.

Given the foregoing, we conclude that the Proposal accords with the outcomes promoted by the objective and the policies listed in **Table 6.3.4.6.9.**

Air Quality

The air quality provisions of the oRCP that relate to the Proposal are set out in **Table 6.3.4.6.10.**

Objectives	Policies
Objective 14.3.1	Policy 14.4.2
	Policy 14.4.3
	Policy 14.4.4

Table 6.3.4.6.10: *Air Quality*

Having considered the Proposal against the provisions listed in **Table 6.3.4.6.10** we note that:

a. As with our discussion of the oRCP's water quality provisions, we have previously addressed Mr Chilton's advice in relation to the air quality that exists within and adjacent to the Site, and the manner in which the Proposal could impact upon the same. We do not propose to reiterate our understanding of his advice other than to note his conclusions that the various air quality impacts that could be generated by the Proposal will be very small, including where they over the CMA. We understand Mr Chilton's response to be that the Proposal's effects will not impact on existing air quality to the extent that it will be degraded from its current condition, which we understand is good.
b. Mr Chilton has considered the potential for the Proposal to impact land above and below the MHWS mark. This, in our opinion, is consistent with the concept on the air quality being managed in an integrated manner.
c. Mr Chilton has also considered the different receiving environments, and the different users of those environments. Further, Mr Chilton's advice has also been utilised to inform other assessments, such as those undertaken by Dr Kelly and Dr Martin / Ms Raeburn. This body of work needs to be viewed together to determine what is adverse air quality effects are acceptable and what are not. We understand that all of the applicable experts, including Mr Chilton, ultimately conclude that the anticipated air quality effects (and their consequential impact on human health and the ecological values supported by the Site and its surrounds) will be acceptable.

As a consequence of being able to draw the preceding opinions, we are also of the opinion that the Proposal can be advanced so as to be consistent with the outcomes sought by the provisions listed in **Table 6.3.4.6.10**. In this instance, that involves the retention of the existing discharges and mitigation measures, and the implementation of an additional mitigation measure to control the actual and potential effects that could arise as a consequence of the abrasive blasting that the Company wishes to periodically undertake.

Recreation

The recreation provisions of the oRCP that relate to the Proposal are set out in **Table 6.3.4.6.11**.

Objectives	Policies
Objective 16.3	Policy 16.4.3

Table 6.3.4.6.11: *Recreation*

Having considered the Proposal against the provisions listed in **Table 6.3.4.6.11** we note that:

a. As we set out in section 2.3 of this AEE, a number of notable recreation values exist in close proximity to the Site. Having considered the body of advice that is available to us (which is principally made up of the CSP-AEE and the technical reports that have been prepared in support of the Proposal), we observe (in section 4.14 of this AEE) that any adverse effects on recreation should be, at worst, less than minor. It follows that we are of the opinion that the Proposal should not hinder 'the provision for recreational activities in the CMA'.
b. The jetties and the associated mooring structures are an essential part of the Proposal. While their existence and the associated occupation of space in the CMA do have a consequential impact on the recreation utilisation of the areas occupied, we do not think that this impact can be considered 'unnecessary'. The term 'unnecessary' suggests, to us, an impact on recreation values that can be avoided. The only means of avoiding the impact caused by the continued existence and operation of the jetties and associated structures is to remove them, which would have, we understand, a significant detrimental impact on the Refinery. The removal of such structures also seems unwarranted, in our opinion, given the limited adverse effects they are expected to have on recreation usage in the CMA. Indeed, we note that the recreation values described by Mr Greenaway exist with the Refinery in place and operating.

On the basis of the foregoing, we are of the opinion that the Proposal can be advanced so as to accord with the outcomes sought by the provisions listed in **Table 6.3.4.6.11.**

Structures

The structures provisions of the oRCP that relate to the Proposal are set out in **Table 6.3.4.6.12**.

Objectives	Policies
Objective 17.3	Policy 17.4.1
	Policy 17.4.3
	Policy 17.4.8

Table 6.3.4.6.12: *Structures*

Having considered the Proposal against the provisions listed in **Table 6.3.4.6.12** we note that:

a. The adverse effects associated with the structures within the CMA are predicted to be small by the various experts advising Refining NZ. Further, the structures have an operational need to be sited within the CMA, are, we understand, the best practicable alternative, and are a part of a wider existing development that occurs above the MHWS mark. These factors and their importance to the on-going existence and functioning of the Refinery lead us to the opinion that they are appropriate to their environs.
b. No new structures are proposed. In that regard, all of the structures exist. The Proposal will enable their continued existence and lawful use.
c. We are advised (by the Company) that all of its structures within the CMA will be maintained in good order and will be maintained using construction materials that are appropriate to its location. In this respect, Refining NZ has a civil inspection programme for all structures in the CMA. The structures are regularly inspected and where issues are identified, maintenance/remedial works are scheduled and undertaken to ensure all structures are fit for purpose.

As a consequence of our preceding opinions, we are also of the opinion that the Proposal can be advanced so as to accord with the provisions listed in **Table 6.3.4.6.12**.

Discharges to Water

The discharges to water provisions of the RCP that relate to the Proposal are set out in **Table 6.3.4.6.13**.

Objectives	Policies
Objective 19.3	Policy 19.4.1
	Policy 19.4.3
	Policy 19.4.4

Table 6.3.4.6.13: *Discharges to Water*

Having considered the Proposal against the provisions listed in **Table 6.3.4.6.13** we note that:

a. While it is not possible to avoid all adverse effects that are associated with the discharges forming part of the Proposal, they have been remedied or mitigated to the point where they are predicted to be small by a number of respected experts.
b. We understand the alternatives assessment that was completed by Refining NZ to conclude that discharges, and their associated remediation and mitigation measures represent the best practicable option when all relevant considerations (including the predicted magnitude of the residual adverse effects) are considered.
c. We understand the Refining NZ's advice to be that the discharges do not, after reasonable mixing, produce conspicuous oil or grease films, scums or foams or floatable or suspended materials or a conspicuous change in colour or visual clarity. We also understand Dr Stewart's advice to be that the discharges do not by themselves or in tandem with others do not generate adverse water quality effects that could compromise the maintenance of coastal water quality.

d. We understand the advice of Mr Chilton to be that the discharges do not cause the emission of objectionable odour of any note or duration. In that regard, we understand that any issues of this nature are infrequent and/or transient.
e. We further understand the body of ecological advice to be that the discharges will not generate significant adverse ecological effects.

Given the preceding, we are also of the opinion that granting the resource consent applications lodged by the Company would not cut across the outcome sought by the provisions listed in **Table 6.3.4.6.13**.

Discharges to Air

The discharges to water provisions of the RCP that relate to the Proposal are set out in **Table 6.3.4.6.14**.

Objectives	Policies
Objective 20.3	Policy 20.4.1
	Policy 20.4.2
	Policy 20.4.3

Table 6.3.4.6.14: *Discharges to Air*

Having considered the Proposal against the provisions listed in **Table 6.3.4.6.14** we note that:

a. While it is also not possible to avoid adverse effects arising as a consequence of the discharges to air, Mr Chilton's advice is that any adverse effects of this nature will be small. As we have already noted, experts such as Dr Kelly and Dr Martin / Ms Raeburn conclude that the human health and terrestrial ecology effects associated with the discharges to air are also small. While the majority of the existing mitigation measures for the air discharges are supported by the technical experts advising Refining NZ, Mr Chilton has recommended the addition of another targeted mitigation measure when land based abrasive blasting is undertaken on the Site. This additional measure has been accepted by Refining NZ. With these measures in place, we understand that all adverse air discharge effects will be appropriately avoided, remedied or mitigated.
b. When we considered the 'natural character' objectives and policies of the oRCP, we included the potential for the Proposal to impact on ambient air quality matters. Even with these factors included, we are of the opinion that the Proposal does not impact on natural character to the point that cuts across the outcomes sought in the oRCP.
c. We understand that the discharges to air and the various mitigation measures that are supported or recommended by Mr Chilton represent the best practicable option.

As a consequence of the foregoing opinions, we are also of the opinion that the Proposal can be advanced so as to accord with the provisions listed in **Table 6.3.4.6.14.**

6.3.4.7 pRP

As we have noted, the NRC is in the process of preparing a new, omnibus statutory planning instrument that regulates almost all of the environmental considerations that fall within its remit under the Act. As we have also noted, the pRP is presently before the Environment Court, and thus, while not yet operative, is well advanced and thus needs to be afforded considerable weight in the consideration of the Proposal.

We now list the relevant provisions of the pRP's policy framework and assess the Proposal against them. As we have done for the preceding statutory planning instruments, we now highlight the relevant provisions in a series of tables and then set out the findings of our assessment. We reiterate that all of the provisions cited are repeated, in full, in **Annexure 14** of this AEE. It is also important for us to record that we have relied on the 'Appeals Version – 20 June 2020' of the pRP when completing this analysis. We have done so as we understand it to be the most up to date version of this planning instrument.

Tangata Whenua

The provisions of the pRP that address Tangata Whenua matters and that are relevant to the Proposal are set out in **Table 6.3.4.7.1.**

Objectives	Policies
Objective F.1.8	Policy D.1.1
	Policy D.1.2
	Policy D.1.4

Table 6.3.4.7.1: *Tangata Whenua*

Having considered the Proposal against the provisions listed in **Table 6.3.4.7.1** we note that:

a. This AEE includes a comprehensive assessment of the Proposal's actual and potential cultural effects. This assessment has been derived from the outcomes of consultation, the CEA and the commentary and guidance that is provided by the relevant iwi management plans.
b. As we have noted, Patuharakeke has prepared a comprehensive CEA which accords with the broad outcomes that are sought within Policy D.1.2. Ngātiwai has supported the CEA. At the date of writing[208], the only other Tangata Whenua group (Te Parawhau) that expressed a desire to complete a CEA has not provided one to date.
c. While the CEA identifies that the Proposal will generate some adverse cultural effects that are more than minor, an array of measures have been recommended to avoid, remedy or mitigate those effects to the point that the CEA states will be acceptable. As we have already noted, Refining NZ has confirmed that it will be engaging with Tangata Whenua following the lodgement of this AEE (and the associated resource consent application forms) with the objective of securing mutually acceptable mitigation measures.

Given the foregoing, the Proposal can be advanced, in our opinion, so as to accord with the direction provided by the provisions listed in Table 6.3.4.7.1.

<u>General</u>

The provisions that set the 'general direction' for the pRP and that are relevant to the Proposal are set out in **Table 6.3.4.7.2**.

Objectives	Policies
Objective F.1.3 **Objective F.1.4** **Objective F.1.5** **Objective F.1.10** **Objective F.1.11** **Objective F.1.13**	Policy D.2.2
	Policy D.2.3
	Policy D.2.4
	Policy D.2.5
	Policy D.2.6
	Policy D.2.7
	Policy D.2.8
	Policy D.2.11
	Policy D.2.12
	Policy D.2.13
	Policy D.2.14
	Policy D.2.15
	Policy D.2.16
	Policy D.2.17
	Policy D.2.18

Table 41: *General*

Having considered the Proposal against the provisions listed in **Table 6.3.4.7.2** we note that:

a. The report of Mr Clough is clear that the Proposal will generate a number of positive economic effects. These positive effects are, in our opinion, especially noteworthy given, as Policy D.2.2 recognises, the number of people that are directly or indirectly employed by the Company. We are also of the opinion that these economic benefits

[208] Being the 13th of July 2020

correlate in a positive social effect that is felt in Whangārei. The CEA records that these effects generate a neutral cultural effect. It follows that the social and economic benefits weigh in favour of the resource consent applications for the Proposal being approved, while the neutral cultural economic effect is benign (insofar as it neither weights in favour of, or against the grant of the resource consent applications that have been sought).

b. We understand that the potential for the effects of climate change to impact on the Proposal has been considered by the relevant experts, although it is not always specifically addressed within their reports. We also understand their advice to be that these effects will not alter, to a material extent, the effects that they have predicted.

c. Adaptive management responses are not needed in this instance. In this regard, the available environmental information and data are sufficient for a robust and accurate description of the receiving environment to be provided. Furthermore, the effects of the Proposal are well known and have been monitored and reported for several years.

d. Quite aside from the social and economic benefits that are associated with the Proposal, the continued existence and operation of the Refinery assists New Zealand in the supply of essential products (such as aviation fuels, diesel, and petroleum). The importance of this benefit can be seen by the 2018 failure of the Refinery to Auckland Pipeline, and the impact that this failure had on aviation in New Zealand's largest international airport (Auckland International Airport). It follows that these benefits also weigh in favour of the Proposal's resource consent applications being approved.

e. Almost all of the actual or potential adverse effects of the Proposal are assessed as being, at worst, minor and transitionary. The vast majority of the adverse effects are assessed as being less than minor. With respect to the Proposal's actual and potential cultural effects, while the CEA states that a number of these effects have the potential to be minor or more, avoidance, remediation and mitigation measures are available to reduce them to levels that Tangata Whenua advise are acceptable. This accords with the direction that is advanced by the provisions listed in Table 6.3.4.7.1 (which address Tangata Whenua matters).

f. The anticipated actual and potential environmental effects that arise from the maintenance of the various components of the Refinery are reported to be very small. In this regard, none are projected to be significant, and all are temporary. Further, the effects of the Proposal are expected to be the same or similar following the completion of the maintenance events.

g. The only actual or potential effects that may need to be considered against the direction set by Policy D.2.8 are the Proposal's cultural effects. In this regard, while measures exist to ensure that they are, in the opinion of Tangata Whenua, are acceptable, they could be more than minor. This potential does not cause the Proposal to become inappropriate, however. In this regard:

    i. As we have noted, the beneficial effects associated with the Proposal weigh heavily in favour of these resource consent applications being granted.

    ii. The Refinery has a demonstrated and functional need to be located in its present location. It is not realistic to expect that this facility could be efficiently relocated to another Site. The Refinery also reflects a significant sunk cost.

    iii. Considerable care has been taken to minimise the Proposal's adverse environmental effects, and the Refinery is committed to working with Tangata Whenua with the aim of developing mutually acceptable mitigation measures to address the Refinery's adverse cultural effects.

    iv. Alternatives have been considered to every substantive aspect of the Proposal. The collective advice that arises from this analysis is that the Proposal represents the best practicable option.

    v. The Refinery is a 'lifeline utility' and meets the reasonably foreseeable needs of Northland and contributes to the reasonably foreseeable needs of New Zealand.

    vi. The magnitude of the actual and potential effects cannot be practicably reduced from those predicted in the technical assessments, or, we expect, from what is ultimately agreed with Tangata Whenua to address the actual and potential cultural effects of the Proposal.

h. Refining NZ is aware of the potential for marine pests to be bought into the Harbour on the vessels visiting the Refinery and acknowledges that they could have significant

and irreversible effects. The Company is, however, actively working with the Regional Council to monitor invasive species in and around the Jetties and dolphins and will take action to remove these pests when detected. It is also important to record that as the Proposal is well established, any risk posed is neither new nor novel.

i. A 35-year consent term has been sought by Refining NZ for this suite of resource consents. In our opinion this term is appropriate as:
   i. The investment in the Refinery is significant. In this respect, it has a market valuation in large and significant.
   ii. There is little, if any administrative benefit associated with aligning the expiry date of the Refinery's resource consents with those of its neighbours. In this respect, both its environmental effects and its contribution to the quality of the environment are well known and predicted, with the exception of the adverse cultural effects to be small. Should alignment in monitoring programmes or water allocation be needed, they can be achieved by a review of the conditions of consent under section 128 of the Act.
   iii. The resource consents sought are needed for a regionally significant piece of infrastructure to continue to exist and operate;
   iv. Refining NZ has a good compliance record for a facility of its size and complexity and is committed to continuous improvement with its compliance record. The Company is also renowned for acknowledging, investigating and responding to any environmentally focussed complaints that are made.
   v. The Company has a history of implementing measures (voluntarily) to improve its environmental performance and minimise its environmental impact. 'Project Kleenex' is a recent example of this commitment.

j. Regard has been paid to the Marsden Point Air Quality Strategy ('**the MPAQS'**), which is the only known strategy document or plan of relevance to the Proposal. In that regard, the MPAQS has been considered by Mr Chilton, who advised that it anticipates an existing environment that does not exist and thus is of limited relevance to the Proposal.

k. The Proposal will not impact on any recorded archaeological site or known historic site that still exists. While the Proposal will occur on an area that is culturally significant, the Proposal will not worsen the effects that have been incurred in the past. Rather, it will continue to remedy the effects of these values by adopting measures to further reduce the Refinery's environmental footprint.

l. We have addressed the Proposal's potential to impact upon natural character, and outstanding natural landscapes and outstanding natural features. We do not repeat that discussion here, other than to note that:
   i. The advice of Stephen Brown the areas supporting outstanding natural character and landscape values would not be directly impacted by the Proposal and that the continued existence and operation of the Refinery would not generate significant adverse natural character or landscape effects on those areas and features not deemed to be outstanding.
   ii. Neither Mr Brown, Dr Martin / Ms Raeburn nor Dr De Luca or Dr Ross have recommended activities which could restore or rehabilitate the natural character of the coastal environment. In this regard, we understand their advice to be that such initiatives are not warranted by the level of adverse effects that the Proposal will cause.
   iii. Any disturbance to the seabed and any vegetation removal from the Harbour will be confined to maintenance activities and thus would be very limited and temporary.

m. We have also previously considered the Proposal's potential to impact of indigenous biodiversity. For the same reasons we have already stated, we expect that the Proposal can be advanced so as to be consistent with Policy D.2.16(1.), insofar as any adverse ecological effects will be, at worst, minor and transitionary. As we have noted, the vast majority of the ecological effects within the coastal environment are predicted to be less than minor. No significant adverse effects are predicted. Equally, all adverse ecological effects outside of the coastal environment (which are a function of the discharge to air) are predicted to be less than minor.

n. We understand that the Proposal's potential to impact on indigenous biodiversity is well understood, and that is the very limited scientific[209] uncertainty regarding the potential for the Proposal to impact on significant indigenous biodiversity. As a consequence, we understand the advice of the ecological and water quality experts to be that there was no need for a more conservative position to be adopted. That said, Dr Stewart's approach is, we understand, very conservatively cast.

Given the foregoing, we are of the opinion that the Proposal can be advanced in a manner that achieves the outcomes of the objectives and policies that are listed in **Table 6.3.4.7.2.**

Air

The provisions of the pRP that relate to air quality and that are relevant to the Proposal are set out in **Table 6.3.4.7.3.**

Objectives	Policies
Objective F.1.12	Policy D.3.1
	Policy D.3.1A
	Policy D.3.2
	Policy D.3.3
	Policy D.3.5

Table 6.3.4.7.3: *Air*

Having considered the Proposal against the provisions listed in **Table 6.3.4.7.3** we note that:

a. We understand the advice of Mr Chilton and Dr Kelly to be that the discharges to air will not significantly affect human health, ambient air quality, cultural values, amenity values or, more generally, the environment.

b. We also understand that Mr Chilton's assessment of the Proposal's discharges to air has been undertaken in accordance with the direction set out in bullet points ((2.) to (8.) and (10.) of Policy D.3.1.

c. For the reasons that we set out in our discussion of the provisions cited in Table 6.3.4.7.2, the 35-year term sought by Refining NZ is, in our opinion, appropriate. Further, we note that the projected air quality, human health and terrestrial ecology effects of the proposed discharges to air are all very small (even on those land uses and values that a sensitive), the benefits arising from the continued existence and operation are very noteworthy, and the Proposal has been assessed as being the best practicable option.

d. In addition, and in the context of bullet point (11.) of Policy D.3.1, we reiterate that the alternatives to the discharges to air have been considered, and the Proposal found to be the best practicable option. We further reiterate that no significant adverse effects are predicted as a consequence of the continuation of the proposed discharges.

e. All of the mitigation measures recommended by Mr Chilton have been adopted by Refining NZ to ensure that the air quality effects arising from the Proposal are avoided, remedied or mitigated to so they are very small, including on areas that could be sensitive to the discharge of contaminants generated by the Refinery. Equally, we understand the advice of Mr Chilton and Dr Kelly is that the discharges (to air) from the Refinery will be neither dangerous nor toxic. These outcomes accord with Policy D.3.1A.

f. While some 'burning' is proposed, it is confined to the proposed fire training exercises, the flaring of excess gases and/or the generation of heat for use on the Refinery. As a consequence, no burning of waste materials is proposed. We note also that all burning is conducted in accordance with a 'smoke management plan' which accords with the requirements set out in bullet point (4.) of Policy D.3.2.

f. Out of an abundance of caution, a dust management plan is to be developed by the Company to regulate the abrasive blasting activities. It will accord with the requirements of bullet point (1.) of Policy D.3.3.

[209] Noting that irrespective of how good the available information, modelling and datasets is, that there will always be some scientific uncertainty

g. As we have already noted in our discussions of the provisions cited in Table 6.3.4.7.2, Mr Chilton has considered the Proposal in light of the MPAQS. His advice is that the current version of the MPAQS is of limited relevance to the Proposal. That said, he has also advised that the discharges of sulphur dioxide to air from the Refinery will only impact on the adjacent regionally significant infrastructure (which includes Northport) to a less than minor extent. We understand that this level of actual or potential effect accords with the level of protection that Policy D.3.5 requires. We also note that Northport and a number of the other neighbouring land uses have given their written approval to the Proposal, meaning that any impact on it cannot be considered by the Regional Council in its consideration of the Proposal.

We are therefore confident that the Proposal can be advanced so as to be consistent with the outcomes sought by the provisions listed in Table 6.3.4.7.3.

Land & Water

The provisions of the pRP that relate to land and water considerations, and that are relevant to the Proposal are set out in **Table 6.3.4.7.4.**

Objectives	Policies
Objective F.1.1 **Objective F.1.2** **Objective F.1.13**	Policy D.4.1
	Policy D.4.2
	Policy D.4.4
	Policy D.4.5
	Policy D.4.6
	Policy D.4.7
	Policy D.4.10
	Policy D.4.15
	Policy D.4.17
	Policy D.4.19

Table 6.3.4.7.4: *Land & Water*

Having considered the Proposal against the provisions listed in **Table 6.3.4.7.4** we note that:

a. The quality and attributes (physical, chemical and biological) of groundwater and coastal waters have been researched and reported, and the Proposal's impact on those attributes has been assessed. In summary, the advice to Refining NZ is that any adverse effects on the water quality will be very small (at most, minor and transitionary) and will not impact on the species or uses that depend on that water quality. This level of protection accords with the direction set by the superior planning instruments (principally the NZCPS) and ensures that the overall water quality is maintained.
b. The coastal sediment quality guidelines contained within section H.3 of the pRP have been considered by Dr Stewart in his assessment of the Proposal's actual and potential water quality effects. Indeed, we understand that Dr Stewart has considered all of the applicable water quality standards set out in section H3 of the pRP in his water quality assessment. While highlighting some instances where the guidelines cannot be met, Dr Stewart's overarching advice is that only less than minor to minor (but transitory) adverse effects are expected.
c. The proposed discharges to groundwater and the coastal marine area have been found to be the best practicable option when all practicable alternatives are assessed.
d. Dr Stewart has considered the proposed mixing zone against, amongst other planning provisions, Policy D.4.4. His advice is that the proposed mixing zone is the smallest necessary to achieve the standards set out in Policy D.4.1 most of the time. Dr De Luca and Dr Ross's advice is that the contaminant concentrations and levels of dissolved oxygen will not cause acute toxicity effects on the aquatic ecosystems present within the mixing zone.
e. As the proposed discharges are not new, and as no change or increase to the discharges to freshwater is proposed, Policy D.4.5 does not apply to the Proposal.
f. The herbicides to be used at the Refinery are approved (under the Hazardous Substances and New Organisms Act 1996) for application to land and/or water. The

other hazardous substances present on site and used in the Refining process are collected and treated before they are discharge to the CMA or disposed via an approved route such as but not limited to high temperature incineration. Refining NZ also works to ensure, as a first priority, that the process chemicals are not discharged to water or land accidentally, and that any incidental spills are quickly identified and addressed by trained personnel using the appropriate spill containment and recovery equipment. The Company has also worked to progressively contain, in impermeable, bunded surfaces, the parts of the Refinery that are storing, conveying or processing these chemicals. Lastly, Refining NZ also monitors the environment, collects and treats its process wastewater and pumps groundwater from below the Refinery so it can be treated before it is discharged to the coastal marine area.

g. The land below the Refinery is contaminated with chemicals, which in turn has contaminated the underlying groundwater aquifer. Though actions such as 'Project Kleenex' Refining NZ has worked to minimise the Refinery's ongoing contribution of contaminants to the contamination that exists. Furthermore, to ensure that the contaminated land and groundwater does not impact on amenity values, human health, or the marine ecosystems, the Company monitors and pumps the groundwater to the surface of the Site and treats it prior to it being discharged to the marine environment. In that regard, Refining NZ has sought the resource consents needed for it to be able to drill new bores to access pockets of contaminated groundwater as they are detected. This represents, in our opinion, an appropriately nimble response that is aimed at ensuring that the pumping programme is always operating effectively. As we have noted, the advice of Dr Stewart, Dr De Luca and Dr Ross is that the discharge of the treated wastewater (which includes the abstracted groundwater) causes less than minor to minor (but transitory) adverse water quality and marine ecology effects. Dr Kelly has also advised that the discharge does not impact on human health in a substantive way. We also understand Dr Kelly's advice to be that the discharge of treated wastewater and/or the groundwater contamination will not impact on any potable water supply. Lastly, we understand from the alternatives assessment that this approach represents the best practicable option, which we equate to meaning that it also represents 'best practice contaminated land management'.

h. We understand the advice of Mr Simpson to be that the proposed abstraction will not cause the allocation limits set in section H.4 of the pRP to be exceeded. We understand this to mean that granting the groundwater allocation sought by Refining NZ will not result in the aquifer being over allocated.

i. Mr Simpson has completed an assessment of reasonable and efficient use for the proposed groundwater take.

j. Refining NZ is comfortable that the conditions of consent required by Policy D.4.17 can be imposed on the proposed groundwater take, to the point that they are relevant.

k. As the proposed groundwater take is not new, and as there is no change in the character, intensity or scale of proposed abstraction which could result in more than a minor adverse change, Policy D.4.19 does not apply to the Proposal.

As a consequence of the opinions that we have been able to draw from the expert advice to Refining NZ (which are summarised in the preceding bullet points), we are also of the opinion that the Proposal can be advanced in a manner that achieves the outcomes sought in the provisions listed in Table 6.3.4.7.4.

<u>Coastal</u>

The provisions of the pRP that relate to coastal matters and that are relevant to the Proposal are set out in **Table 6.3.4.7.5**.

Objectives	**Policies**
Objective F.1.7	Policy D.5.8
	Policy D.5.9
	Policy D.5.24
	Policy D.5.25

Table 6.3.4.7.5: *Use & Allocation of Common Resources*

Having considered the Proposal against the provisions listed in **Table 6.3.4.7.5** we note that:

a. The Proposal is consistent with the purpose of the MPPZ as the granting of the resource consent sought by the Company will enable the continued existence and operation of the components of the Refinery that are situated within the coastal marine area.
b. Equally, the Proposal is entirely consistent with the current use of the Site (which includes the existing development on both sides of the mean high-water springs mark), and the development that is anticipated within the Whangārei District Plan (as it applies to the Refinery).
c. Any disturbance activities that are associated with the Proposal are confined to the maintenance of the Jetties and other components of the Refinery that exist in the coastal marine area. These activities are confined and temporary and are not expected to cause any long-term erosion or damage any existing structure. We note that these activities are also needed to enable the continued existence and operation of the Refinery, which is both existing 'infrastructure' and existing 'regionally significance infrastructure'.

It follows, therefore, that we are of the opinion that the Proposal accords with the outcomes sought by the provisions listed in Table 6.3.4.7.5.

Catchments

The provisions of the pRP that relate to catchments within Northland and that are relevant to the Proposal are set out in **Table 6.3.4.7.6**.

Objectives	**Policies**
Objective E.1.1	Policy E.2.1

Table 6.3.4.7.6: *Catchments*

Having considered the Proposal against the provisions listed in **Table 6.3.4.7.6** we note that:

a. We have addressed the relevant outcomes that are sought by the provisions listed in Table 6.3.4.7.6 in our analysis of the preceding objectives and policies of the pRP. In summary, however:
    i. We understand that the Proposal will not preclude the on-going recreational and cultural use of the coastal waters in the Harbour, and that the continued pumping and treatment of groundwater prior to its discharge is expected to see a continual reduction in the discharge of contaminants (from that pathway) to the coastal waters beyond. While further improvements to the discharge quality are probable over the term of the resource consents that are sought, they are not currently practicable to implement. Further, it is questionable if the expected effects of the proposed discharge warrant further treatment.
    ii. The ecosystems within and around the Site are to be protected in accordance with the direction set out in all of the planning instruments that apply to the Proposal.

As a consequence of these conclusions, we are of the opinion that the Proposal accords with the outcomes sought by the provisions listed in Table 6.3.4.7.6.

6.3.4.8 Overall Summary

As is apparent from the preceding analysis, we are of the opinion that the Proposal can be advanced so as to accord with the outcomes sought with the applicable statutory planning instruments. This level of compliance is a function of the manner in which Refinery NZ has engaged, the approaches that have been adopted to the numerous technical effects assessments, and the overall findings of those technical assessments.

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