Todd Kapuni
Gas Treatment Plant

Monitoring Programme

Annual Report

2020-2021

Technical Report 2021-51

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Taranaki
Regional Council

Taranaki Regional Council
Private Bag 713
Stratford

ISSN: 1178-1467 (Online)
Document: 2855056 (Word)
Document: 2953329 (Pdf)
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Executive summary

Todd Petroleum Mining Company Ltd (the Company) operates a gas treatment plant (Kapuni Gas Treatment Plant, KGTP) located on Palmer Road at Kapuni, in the Kapuni catchment, South Taranaki.

During the monitoring period, the Company demonstrated an overall high level of environmental performance.

This report for the period July 2020 to June 2021 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess the Company's environmental and consent compliance performance during the period under review. The report also details the results of the monitoring undertaken and assesses the environmental effects of the Company's activities.

During the year the Company held seven resource consents, which included a total of 72 conditions setting out the requirements that they must satisfy. The Company held one consent to allow it to take water, two consents to discharge effluent /stormwater into the Kapuni Stream, two consents to discharge to land, one land use permit, and one consent to discharge emissions into the air at the site.

The Council's monitoring programme for the year under review included four inspections, six water samples collected for physicochemical analysis and inter-laboratory comparisons, a review of four biomonitoring surveys and two fish surveys of receiving waters. A review of monthly consent holder provided effluent data and surface water abstraction data was undertaken throughout the monitoring period. Daily surface water abstraction data was also assessed.

The monitoring indicated that the discharge of process and stormwater was undertaken in a complaint manner for the duration of the monitoring period.

The Council review of the independent biological assessment of the Kapuni Stream catchment concluded that the Kapuni Stream was in 'good' to 'excellent' health and there was no discernible impact from any industrial activity at Kapuni.

The findings of the fish survey concluded that overall there was no indication that the KGTP was having any significant adverse effects on fish communities in the Kapuni catchment.

There were no unauthorised incidents recording non-compliance in respect of this consent holder during the period under review.

During the year, the Company demonstrated a high level of environmental and administrative performance with the resource consents.

For reference, in the 2020-2021 year, consent holders were found to achieve a high level of environmental performance and compliance for 86% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 11% of the consents, a good level of environmental performance and compliance was achieved.

In terms of overall environmental and compliance performance by the consent holder over the last several years, this report shows that the consent holder's performance remains at a high level in the year under review.

This report includes recommendations for the 2021-2022 year.

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1 Introduction

1.1 Compliance monitoring programme reports and the Resource Management Act 1991

1.1.1 Introduction

This report is for the period July 2020 to June 2021 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by Todd Petroleum Mining Company Ltd (the Company). The Company operate the Kapuni Gas Treatment Plant (KGTP) which is situated on Palmer Road, at Kapuni, in the Kapuni catchment, South Taranaki.

This report includes the results and findings of the monitoring programme implemented by the Council in respect of the consents held by the Company that relate to abstractions and discharges of water within the Kapuni catchment, and the air discharge permit held by the Company to cover emissions to air from the site.

One of the intents of the *Resource Management Act 1991* (RMA) is that environmental management should be integrated across all media, so that a consent holder's use of water, air, and land should be considered from a single comprehensive environmental perspective.

Accordingly, the Council generally implements integrated environmental monitoring programmes and reports the results of the programmes jointly. This report discusses the environmental effects of the Company's use of water, land and air, and is the thirtieth combined annual report by the Council for the site.

1.1.2 Structure of this report

Section 1 of this report is a background section. It sets out general information about:

- consent compliance monitoring under the RMA and the Council's obligations;
- the Council's approach to monitoring sites though annual programmes;
- the resource consents held by the Company in the Kapuni catchment;
- the nature of the monitoring programme in place for the period under review; and
- a description of the activities and operations conducted in the Company's site/catchment.

Section 2 presents the results of monitoring during the period under review, including scientific and technical data.

Section 3 discusses the results, their interpretations, and their significance for the environment.

Section 4 presents recommendations to be implemented in the 2021-2022 monitoring year.

A glossary of common abbreviations and scientific terms, and a bibliography, are presented at the end of the report.

1.1.3 The Resource Management Act 1991 and monitoring

The RMA primarily addresses environmental 'effects' which are defined as positive or adverse, temporary or permanent, past, present or future, or cumulative. Effects may arise in relation to:

a. the neighbourhood or the wider community around an activity, and may include cultural and social-economic effects;
b. physical effects on the locality, including landscape, amenity and visual effects;
c. ecosystems, including effects on plants, animals, or habitats, whether aquatic or terrestrial;

d. natural and physical resources having special significance (for example recreational, cultural, or aesthetic); and

e. risks to the neighbourhood or environment.

In drafting and reviewing conditions on discharge permits, and in implementing monitoring programmes, the Council is recognising the comprehensive meaning of 'effects' in as much as is appropriate for each activity. Monitoring programmes are not only based on existing permit conditions, but also on the obligations of the RMA to assess the effects of the exercise of consents. In accordance with Section 35 of the RMA, the Council undertakes compliance monitoring for consents and rules in regional plans, and maintains an overview of the performance of resource users and consent holders. Compliance monitoring, including both activity and impact monitoring, enables the Council to continually re-evaluate its approach and that of consent holders to resource management and, ultimately, through the refinement of methods and considered responsible resource utilisation, to move closer to achieving sustainable development of the region's resources.

1.1.4 Evaluation of environmental and administrative performance

Besides discussing the various details of the performance and extent of compliance by the Company, this report also assigns them a rating for their environmental and administrative performance during the period under review.

Environmental performance is concerned with actual or likely effects on the receiving environment from the activities during the monitoring year. Administrative performance is concerned with the Company's approach to demonstrating consent compliance in site operations and management including the timely provision of information to Council (such as contingency plans and water take data) in accordance with consent conditions.

Events that were beyond the control of the consent holder and unforeseeable (that is a defence under the provisions of the RMA can be established) may be excluded with regard to the performance rating applied. For example loss of data due to a flood destroying deployed field equipment.

The categories used by the Council for this monitoring period, and their interpretation, are as follows:

Environmental Performance

High: No or inconsequential (short-term duration, less than minor in severity) breaches of consent or regional plan parameters resulting from the activity; no adverse effects of significance noted or likely in the receiving environment. The Council did not record any verified unauthorised incidents involving environmental impacts and was not obliged to issue any abatement notices or infringement notices in relation to such impacts.

Good: Likely or actual adverse effects of activities on the receiving environment were negligible or minor at most. There were some such issues noted during monitoring, from self-reports, or during investigations of incidents reported to the Council by a third party but these items were not critical, and follow-up inspections showed they have been dealt with. These minor issues were resolved positively, co-operatively, and quickly. The Council was not obliged to issue any abatement notices or infringement notices in relation to the minor non-compliant effects; however abatement notices may have been issued to mitigate an identified potential for an environmental effect to occur.

For example:

- High suspended solid values recorded in discharge samples, however the discharge was to land or to receiving waters that were in high flow at the time;
- Strong odour beyond boundary but no residential properties or other recipient nearby.

Improvement required: Likely or actual adverse effects of activities on the receiving environment were more than minor, but not substantial. There were some issues noted during monitoring, from self-reports, or during investigations of incidents reported to the Council by a third party. Cumulative adverse effects of a persistent minor non-compliant activity could elevate a minor issue to this level. Abatement notices and infringement notices may have been issued in respect of effects.

Poor: Likely or actual adverse effects of activities on the receiving environment were significant. There were some items noted during monitoring, from self-reports, or during investigations of incidents reported to the Council by a third party. Cumulative adverse effects of a persistent moderate non-compliant activity could elevate an 'improvement required' issue to this level. Typically there were grounds for either a prosecution or an infringement notice in respect of effects.

Administrative performance

High: The administrative requirements of the resource consents were met, or any failure to do this had trivial consequences and were addressed promptly and co-operatively.

Good: Perhaps some administrative requirements of the resource consents were not met at a particular time, however this was addressed without repeated interventions from the Council staff. Alternatively adequate reason was provided for matters such as the no or late provision of information, interpretation of 'best practical option' for avoiding potential effects, etc.

Improvement required: Repeated interventions to meet the administrative requirements of the resource consents were made by Council staff. These matters took some time to resolve, or remained unresolved at the end of the period under review. The Council may have issued an abatement notice to attain compliance.

Poor: Material failings to meet the administrative requirements of the resource consents. Significant intervention by the Council was required. Typically there were grounds for an infringement notice.

For reference, in the 2020-2021 year, consent holders were found to achieve a high level of environmental performance and compliance for 86% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 11% of the consents, a good level of environmental performance and compliance was achieved. [1]

1.2 Process description

The KGTP was originally owned and operated by Vector Limited, known originally as National Gas Company (NGC). It was built during 1969-1970. KGTP was acquired by Todd Petroleum Mining Company Ltd on 1 April 2020.

The original plant was designed to process high carbon dioxide Kapuni gas to a quality suitable for use in general domestic, commercial and industrial appliances. The process involves the removal of carbon dioxide from the gas, which is then dried and chilled to remove some of the heavier hydrocarbons which could affect pipeline operation and appliance efficiency. The pipeline quality gas is then distributed via the transmission distribution network.

The first of several plant expansions occurred in 1973 with the addition of plant to process the heavier hydrocarbons into LPG (liquefied petroleum gas) and natural gas. In 1979-1980, further additions were

[1] The Council has used these compliance grading criteria for more than 17 years. They align closely with the four compliance grades in the MfE Best Practice Guidelines for Compliance, Monitoring and Enforcement, 2018

made to process Maui gas and to recover, purify and liquefy some of the carbon dioxide from the gas. The liquid carbon dioxide is used in the beverage, food processing and refrigeration markets.

Photo 1 Kapuni Gas Treatment Plant (KGTP) during three train operation

In 1985, KGTP was expanded with the installation of the low temperature separation (LTS) gas conditioning plant which processed the high carbon dioxide content Kapuni gas for water and heavy hydrocarbon removal only. The conditioned gas was supplied to the region's methanol plants so that it could be blended with the much lower carbon dioxide content Maui gas for more efficient methanol production. Methanex reduced its production capacity and as a result the gas conditioning plant was mothballed in May 2005.

During 1997, the KGTP refrigeration systems were upgraded, enabling more natural gas liquids to be removed from the raw gas. Reliability and efficiencies were further improved with the completion in 1998 of a $25 million, three-year refurbishment of the plant's processes and control systems.

The Company and Todd Energy were 50:50 partners in Kapuni Energy which had developed a $37 million, 25MW cogeneration plant within the Company's gas treatment plant complex at Kapuni. It provides the electricity and steam requirements of the KGTP and Fonterra's Lactose factory at Kapuni. It also exports excess electricity into the national grid.

During the 2004-2005 period, NGC completed a $7 million upgrade of the treatment plant, involving re-commissioning one of the plant's three process trains, adding a further 100 tonnes of LPG storage, and installing a reverse osmosis water treatment plant.

In April 2006 NGC changed its name to Vector Ltd. NGC remains a legal entity holding previously issued consents, but consents applied for after this date were granted in the name of Vector Gas Ltd and more recently, Vector Ltd.

The gas supply for the plant comes from the adjacent Kapuni Gas Production Station formerly operated by Shell Taranaki Ltd and now by Todd Petroleum Mining Company Ltd.

Water is drawn from the Kapuni Stream via the intake structure and raw water supply line for Hawera water treatment plant. Water discharges are from the gas treatment process, plant utilities, domestic effluent and site stormwater. Solid waste discharges are from settling basins for water treatment and waste storage. Air discharges are from the gas treatment process.

The KGTP site was acquired by Todd Petroleum Mining Company Ltd in April 2020, whom currently own and operate the site.

1.3 Resource consents

During the 2020-2021 monitoring period the Company held seven resource consents.

A summary of the various consent types issued by the Council is included in Appendix I, as are copies of all permits held by the Company during the period under review.

Table 1 Summary of resource consents held by the Company

Consent Number	Purpose	Consent Granted/ Commencement Date	Change to Conditions Date	Next Review Date	Expiry Date
Discharge to Air Permits					
4087-2	Discharge emissions to air from on-site activities and ancillary activities	Jan 1997	-	2023	2029
Discharge to Water Permits					
1123-3	Discharge cooling and wastewater to Kapuni Stream	Jun 2012	-	2023	2035
7755-1	Discharge stormwater from (non-process areas) containing natural gas into Kapuni Stream	Jun 2012	-	2023	2035
Discharge to Land Permits					
1225-3	Discharge up to 13.5 m^3/day (0.97 L/s) of treated sewage and process wastes to land	Jun 2012	-	2023	2035
7043-1	Discharge stormwater, settling and filter backwash ponds sludge to land	Jan 2010	-	2023	2023
Water Use Permits					
1125-4	Take up to 33 L/s from Kapuni Stream	Jun 2012	-	2020	2035
Land Use Permits					
5090-1	Structures for pipeline crossings above and around the Motumate Stream and an unnamed tributary of the Waiokura Stream for electrical supply	Jan 1997	-	2023	2032

1.4 Monitoring programme

1.4.1 Introduction

Section 35 of the RMA sets obligations upon the Council to gather information, monitor and conduct research on the exercise of resource consents within the Taranaki region. The Council is also required to assess the effects arising from the exercising of these consents and report upon them.

The Council may therefore make and record measurements of physical and chemical parameters, take samples for analysis, carry out surveys and inspections, conduct investigations and seek information from consent holders.

The monitoring programme for the Company consisted of four primary components.

1.4.2 Programme liaison and management

There is generally a significant investment of time and resources by the Council in:

- ongoing liaison with resource consent holders over consent conditions and their interpretation and application;
- discussion over monitoring requirements;
- preparation for any consent reviews, renewals or new consent applications;
- advice on the Council's environmental management strategies and content of regional plans; and
- consultation on associated matters.

1.4.3 Site inspections

The site was visited on four occasions during the monitoring period. With regard to consents for the abstraction of or discharge to water, the main points of interest were plant processes with potential or actual discharges to receiving watercourses, including contaminated stormwater and process wastewaters. Air inspections focused on plant processes with associated actual and potential emission sources and characteristics, including potential odour, dust, noxious or offensive emissions. Sources of data being collected by the Company were identified and accessed, so that performance in respect of operation, internal monitoring, and supervision could be reviewed by the Council. The neighbourhood was surveyed for environmental effects.

1.4.4 Chemical sampling

Chemical sampling undertaken by the Council in this monitoring period was focused on the discharge from the facility and the effects on the receiving waters. The Company holds consent 1123-3. This allows for the discharge of cooling and waste waters to the Kapuni Stream throughout the year. The process of the discharge is controlled by the facility and checked through chemical analysis prior to the discharge occurring. The analysis of the discharge is provided to the Council in the form of a monthly report.

In order to ascertain the quality of the results provided by the Company, the Council conducted inter-laboratory comparison exercises which encompassed the following methodology.

A sample of the discharge waters is collected and split between two samples. The same is performed on the upstream and the downstream (below the discharge point) sample locations.

These samples are then analysed separately, (one set is analysed at the Company, the other by the Council via Hill Laboratories in Hamilton) and the results compared.

Table 2 Inter-laboratory comparison analytes

Discharge sample analytes	Upstream and downstream sample analytes
Chlorine (Free)	Conductivity
Chlorine (Total)	Dissolved reactive phosphate (DRP)
Conductivity	Potassium
Dissolved reactive phosphate (DRP)	Sodium
Hydrocarbon	Ammonia and un-ionised
Potassium	pH
Sodium	Temperature
Ammonia and un-ionised	Turbidity
pH	Vanadium
Suspended solids	
Temperature	
Turbidity	
Vanadium	
Zinc	

1.4.5 Biomonitoring surveys

A biological macroinvertebrate survey was performed on four occasions during the 2020-2021 monitoring year by the third party consultant Stark Environmental. In addition, an electric fish netting survey was also carried out. These were undertaken in the Kapuni Stream and associated tributaries at established monitoring locations. The Council reviews the reports submitted by Stark Environmental. The review is provided within this report and is also available on request.

2 Results

2.1 Water

2.1.1 Inspections

Four inspections of the Company site were undertaken this monitoring period by an officer of the Council. The inspections were undertaken on 23 September, 30 November 2020, 05 May and 24 June 2021. Inspections covered the following:

- Upcoming operations and current operation;
- Heat recovery steam generator operation;
- Discharge process effluent and stormwater management;
- Kapuni Stream monitoring;
- Liquid transfer system;
- Dry and wet chemical storage;
- On-site sewage treatment system;
- Land treatment;
- River gauging;
- LPG load out facility; and
- Housekeeping.

Overall, the plant was found to be in a very tidy condition, with staff knowledgeable about processes and compliance requirements. Further liaison with the Company was also undertaken through inter-laboratory comparison exercises. Stream gauging to establish Kapuni Stream flows was undertaken during summer low flows. A programme of increased flow gauging is planned to be undertaken by the Council.

2.1.2 Abstraction and discharge monitoring

Surface water abstraction

Water for KGTP is drawn from the Kapuni Stream, about 1.4 km above the plant, via the intake structure and raw water supply line for Hawera water treatment plant. South Taranaki District Council (STDC) holds land use permit 7413-1 for the structure and water permit 0146-2 to take.

Under its own water permit 1125-4, the Company must install and maintain a meter and datalogger at the point where the water enters the supply line for the Company site. The monitoring equipment must be certified by an appropriately qualified person at least every five years.

The water permit conditions are consistent with the Resource Management (Measurement and Reporting of Water Takes) Regulations 2011, which required the Company by 10 November 2012 to keep daily records of volume taken, and thereafter supply by 31 July each year the record for the preceding 1 July to 30 June period. By stipulating a monitoring point other than the take location, the grant of consent 1125-4 constitutes an approval by Council under the Regulations.

Volumes supplied to the Company had been measured and recorded on STDC's supervisory control and data acquisition (SCADA) system since 6 January 2010. Telemetry directly to Council was connected in January 2014.

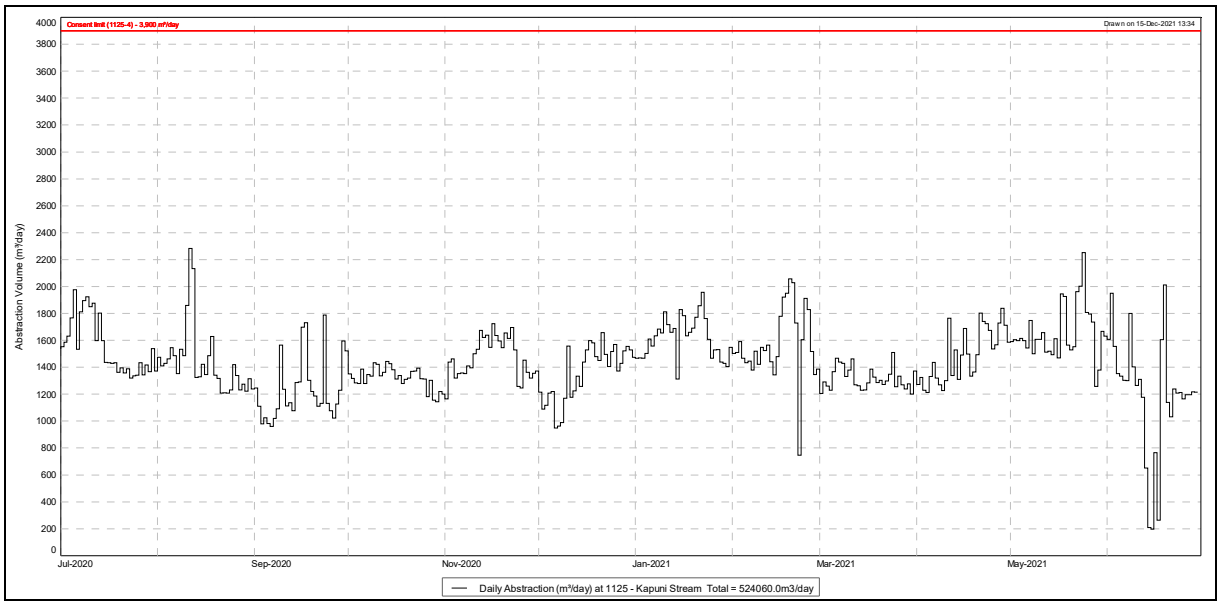

Figure 1 Surface water abstraction data from the Kapuni Stream consent 1125-1 20-21 monitoring period

The daily surface water extraction record is provided above in Figure 1. Consent 1125-4 allows for a maximum daily surface water abstraction of 3,900 m^3 per day. In this monitoring period the Company were well below this limit. The total volume abstracted was recorded at 524,060 m^3.

This is an increase of 5,530 m^3 when compared to the 2019-2020 monitoring period. The Company only utilised 36.8% of its total abstraction allowance in the 2020-2021 monitoring period.

2.1.3 Provision of consent holder data

Monitoring of the discharge constituents and the Kapuni Stream is undertaken by the Company, prior to each discharge and one hour following commencement of the discharges authorised by discharge consent 1123-3.

Consent 1123-3 requires the preparation of an effluent disposal management plan. The plan includes the reporting on the exercise of the consents. As such the Company provided, at approximately monthly intervals, discharge data in relation to these consents for the monitoring period.

On two occasions in this monitoring period the Council carried out inter-laboratory comparisons with the KGTP laboratory. The results are discussed in the following section 2.14.

The Company discharge and stream monitoring data was provided to the Council at monthly intervals throughout the year. This has been assessed by the Council and summarised below.

Temperature

Temperature is recorded continuously by the Company both upstream and downstream of the discharge point. In 2020-2021, the maximum temperature differential recorded was 0.9°C. This occurred on 28 April 2021, on one occasion. This was within consent limits, which stipulates a maximum allowable increase of 2.0°C.

pH

Consent 1123-3 requires the discharge to not cause the pH within the Kapuni Stream to be outside the range 6.5-9.0 pH when measured at the downstream (KPN000293) monitoring location. Results provided by the Company detailed that compliance was achieved throughout the monitoring period. In 2020-2021, the maximum recorded pH at the downstream sampling site was 7.87 pH recorded on the 13 June 2021. The

corresponding upstream pH was 7.76 pH. The minimum pH recorded downstream was 6.61 pH recorded on the 27 September 2021. The corresponding upstream pH value was 6.75 pH.

Ammonia

Special condition 6 of consent 1123-3 limits the concentration of unionised-ammonia to not exceed 0.006 g/m^3 when measured at the downstream monitoring location on the Kapuni Stream except under specific circumstances. On all occasions, the discharge shall not cause the concentration of un-ionised ammonia to exceed 0.025 g/m^3 in the Kapuni Stream at this point. This limit was set for the protection of aquatic species.

Results provided by the Company show that compliance was achieved throughout the monitoring period. In 2020-2021, unionised ammonia was recorded above the Company limit of detection (>0.001g/m^3) on the 29 March 2021 with a concentration of 0.005 g/m^3. This was within the consent limit.

Both inter-laboratory comparison samples collected by the Council (which is assessed to a lower concentration than the periodic batch testing undertaken by the Company) indicated values of 0.0024 g/m^3 (September 2020) and 0.0001 g/m^3 (May 2021) for NH_3 at the downstream monitoring location of KPN000293. This was also confirmed by the KGTP laboratory during the inter-laboratory comparisons, with both results below the limit of detection.

Sodium

Special condition 7 of consent limit 1123-3 limits the sodium concentration of the Kapuni Stream to 40 g/m^3. The sodium concentration is also further limited to 22 g/m^3 in accordance with an agreement with the Company's neighbours; Ballance.

Results provided by the Company in this monitoring period indicated that compliance was achieved for this condition. During the 2020-2021 monitoring period the results indicated that the maximum recorded downstream sodium concentration was 13.30 g/m^3. This was recorded on the 23 March 2021. The corresponding upstream value was 9.80 g/m^3.

Vanadium

Special condition 8 of consent 1123-3 stipulates the discharge shall not cause the total vanadium concentration of the Kapuni Stream to exceed 0.08 g/m^3, when measured 50 m downstream of the discharge point.

Analysis provided by the Company indicated compliance with this condition. There were however seven occasions when this concentration was exceeded in samples, ranging 0.08-0.010 g/m^3. However, these concentrations were recorded prior to the discharge occurring.

Water treatment chemicals

Special condition 12 of consent **1123-3** requires the consent holder to notify the Council of any change in water treatment chemical or increase in maximum concentration of any water treatment chemical at least one month prior to change of a water treatment programme.

In this monitoring period the Council received notification (27 January 2021) that the Company intended to replace Solisep MPT150 with Klariad PC1192P. This change was accepted and no other chemicals changes were communicated.

2.1.4 Results of receiving environment monitoring

The Council carried out compliance monitoring checks on the Company's wastewater discharge and impact on the receiving environment on 23 September 2020 and 5 May 2021.

Split samples were collected by the Company and the Council from the Company's discharge point, and from the Kapuni Stream, both upstream and downstream of the discharge point. Results are presented in Table 3.

Table 3 Inter-laboratory comparison KGTP and Council 23 September 2020 and 5 May 2021

Date	23/09/2020						5/05/2021					
Sampler	KGTP	TRC	KGTP	TRC	KGTP	TRC	KGTP	TRC	KGTP	TRC	KGTP	TRC
Parameter	Upstream KPN000290		Downstream KPN000293		A-705 Outfall IND002008		Upstream KPN000290		Downstream KPN000293		A-705 Outfall IND002008	
Time (NZST)	11:10		10:55		11:05		10:45		11:05		10:50	
Temperature (°C)	12	12.1	12.4	12.4	18.8	18.8	11.8	11.7	12.1	12.4	20.3	20.7
pH	7.62	7.8	7.57	7.7	7.82	7.7	7.59	7.5	7.67	7.6	7.2	7.4
Free Ammonia (g/m^3)	<0.001	0.00019	0.0025	0.0024	0.1183	0.059	<0.001	0.00022	<0.001	0.0001	0.0024	0.00025
Ammonia (g/m^3)	0.01	0.02	0.31	0.21	5.06	3.40	0.02	0.03	0.03	0.01	0.37	0.03
Sodium (g/m^3)	9.4	9.3	10.8	10.7	31.9	31	8.7	8.8	10	10.3	33.5	34
Potassium (g/m^3)	3.6	3.8	4.1	4.1	11	11.3	3.3	3.4	3.5	3.7	7.3	7.5
Vanadium (g/m^3)	0.01	0.0023	0.01	0.0126	0.4	0.19	0.01	0.0018	0.01	0.0066	0.26	0.103
Chlorine (Free)	-	-	-	<0.007	-	-	-	-	-	-	-	-
Chlorine (Total)	-	-	-	<0.007	-	-	-	-	-	-	-	-
Dissolved Zinc (g/m^3)	-	-	-	-	-	0.136	-	-	-	-	-	0.059
Conductivity (uS/m)	123.1	117	131.1	125	251	238	109.6	109	116.1	116	233	225
Dissolved reactive phosphorus (g/m^3)	-	0.014	-	0.046	-	0.66	-	0.016	-	0.053	-	0.91
Total suspended solids (g/m^3)	-	-	-	-	-	28	-	-	-	-	-	19
TPH (C7-C36)	-	-	-	-	-	<4	-	-	-	-	-	<4
Turbidity NTU	-	-	-	-	-	13.9	-	-	-	-	-	11.4
Turbidity FNU	-	0.87	-	1.59	-	-	-	0.59	-	0.99	-	-

The results of the inter-laboratory comparisons (Table 3) undertaken in this period indicated the following:

- All temperatures were within consent limits and there appeared to be very good agreement between both parties, with little to no variation recorded.
- pH results across all samples also remained relatively stable, with the largest variation recorded (0.2 pH) on the outfall samples (A-705, May 2021), which is minimal.
- Un-ionised ammonia concentrations demonstrated reasonably good agreement between both parties across all but one sample set. Some variation was noted on the discharge sample (A705, September 2020). With the Company double the Council's concentration.
- Ammonia concentrations were found to contain some variation during the initial September 2020 monitoring round. The Company were informed of this variation through the comparison process. However, while there were variations noted. The following May 2021 round, indicated the reasonable agreement.
- Sodium results were compliant, with no result recorded at the downstream monitoring location of KPN000293 above the consent limit (40 g/m^3). Good agreement was seen between both sets of results.

- Potassium results also recorded good agreement between both parties.
- In similarity to the previous monitoring period, the vanadium results indicated slight variations. The largest variation (0.21 g/m^3) was recorded at the outfall on the 23 September 2020. The reason for this variation is well understood by the Council. It is due to the method of analysis undertaken by the Company. The Company need a swift result as they are required to discharge almost daily. The Company infers vanadium concentration based on the ratio between vanadium and potassium in the Benfield solution (this is the source of vanadium in the KGTP effluent).
  As potassium concentrations may increase from other sources in the process effluent, it results in an over-estimate of the true vanadium in the effluent. The Company treats the effluent vanadium value as true which allows for a margin of error with respect to the discharge concentration.
- Dissolved reactive phosphorus (DRP) was recorded in all samples analysed by the Council. On both occasions the concentrations of DRP increased below the discharge. The increase in surface water concentration for DRP on both occasions (0.032 and 0.037 g/m^3) remained quite constant.
  It is noted that currently under the National Policy Statement for Fresh Water Management in New Zealand (NPS-FM 2020) there is no bottom line for DRP in surface waters.
- In terms of electrical conductivity (EC), the concentration of EC increased slightly as a process of the discharge to surface water.
- Suspended solid concentrations within the A-705 discharge were low (<100 g/m^3) on both occasions sampled.

2.1.5 Review of Biomonitoring in Kapuni catchment 2020-2021

Four macroinvertebrate surveys and two fish surveys were scheduled for the Kapuni Catchment for the 2020-2021 monitoring period (Table 4). The reports are summarised here, please refer to the specific reports for full details (available upon request from the Council).

Table 4 Overview of the monitoring programme for the Kapuni Catchment

Survey dates	Report number	Taxa	Number of sites	
			Kapuni Stream	Tributaries
28/07/20	2020-07	Macroinvertebrate	7	2
6-7/10/20	2020-08	Fish	11	
6-7/10/20	2020-09	Macroinvertebrate	11	2
27/01/21	2021-01	Macroinvertebrate	7	2
28/04/21	2021-04	Fish	7	
28/04/21	2021-05	Macroinvertebrate	7	2

Figure 2 Biomonitoring sites in the Kapuni catchment

Macroinvertebrate monitoring

Targets for MCI values have been set for the Kapuni main stem and gully system. For the Kapuni Stream a hard bottom MCI (MCI-hb) target of 100 has been obtained from historical data and the expected mild enrichment in the mid-catchment. The gully system (site 5, Figure 2) has a MCI target 73 units. Site 13 has a tentative target of MCI-sb 90.

During all four surveys, the Kapuni Stream had scores above 100 MCI-hb indicating 'excellent' to 'good' macroinvertebrate health, while the two tributary sites had MCI-sb scores between 84 to 98 indicating 'fair' health.

All sites, apart from Opunake Road and site 13, exhibited a statistically significant positive trend over the entire date range (e.g. since 1982). The Opunake Road and site 13 sites had positive, non-significant trends. The last 5-10 years show a levelling off or decrease in scores, but as some of the control sites were also plateauing or decreasing, it appears to be due to factors unrelated to activities associated with Ballance Kapuni.

Overall, the Kapuni Stream was in 'good' to 'excellent' health and there was no discernible impact from any industrial activity at Kapuni.

Electric fishing

Two reports detail the monitoring of fish communities undertaken in the Kapuni Stream on 6-7 October 2020 (11 sites) and 28 April 2021 (7 sites). The full reports are available upon request from the

Council. The total area of streambed fished in the Kapuni Stream was approximately 384 m^2 in October and 245 m^2 in May. The tributaries were not fished in either survey.

Table 5 Results of spring fish survey in the Kapuni Stream conducted 6-7 October 2020

Site	Brown trout	Redfin bully	Koaro	Bully	Eels	Koura	Total number of species
O	-	-	3	-	-	-	3
P	-	-	-	-	-	3	3
E	1	-	-	-	-	-	1
9	5	1	-	-	-	2	8
11	5	-	-	-	-	-	5
12	1	1	-	1	-	-	3
10	1	1	-	-	-	-	2
6	-	-	-	-	-	-	0
7	2	1	-	-	-	-	3
8/K	-	-	-	-	2	-	2
N	1	1	-	-	-	-	2
Total	**16**	**5**	**3**	**1**	**2**	**5**	**32**

Table 6 Results of fish survey in the Kapuni Stream 28 May 2021

Site	Brown trout	Redfin bully	Koaro	Eels	Koura	Total number of species
9	-	-	-	-	-	0
11	-	-	1	-	-	1
12	-	-	-	-	-	0
10	-	-	-	-	-	0
6	-	1	-	1	-	2
7	-	1	-	-	-	1
8/K	-		-	-	-	0
N	-	1	-	-	-	1
Total		**3**	**1**	**1**		**5**

All sites were surveyed for fish using the single pass electric fishing technique. The results of these surveys are given in Table 5 and 6.

A total of 27 fish, in five taxa, and five koura, were caught during the October 2020 survey. During the May 2021 survey, only five fish in three taxa were caught. The October survey result was within the range (3-221) of total numbers and variety (2-8 taxa) recorded in previous years; the May survey had the third lowest

recorded numbers to date but was within the range of taxa caught. Typically, the autumn survey has lower numbers and taxa recorded than the spring survey.

In October 2020, brown trout were the most abundant taxa comprising 50% of the total number of animals recorded. Eels are normally the dominant fish recorded from the Kapuni Stream.

In May 2021, redfin bully, eels and koaro were present. The poor results were likely caused by fine sand deposition and significant freshes and were very similar to the May 2020 results.

It has been noted in previous reports that fine sand has been a dominant feature on the streambed, due in part to the erosion on Taranaki Maunga. This has continued in both reports reviewed and it is likely to have reduced the suitability of habitat for some taxa, such as koura. It is thought that this reduction in available habitat is also responsible for a reduction in the numbers of brown trout recorded per site. The catch per unit effort has dropped from a high of 4.27 brown trout per site in 1982 – 1983 to 0.54 trout per site from late 2008 to mid 2012. An improvement was recorded in the October 2020 survey. However, none were recorded during the May 2021 survey.

Overall, these electric fishing results from the Kapuni catchment do not provide any indication that the petrochemical industries are having any significant adverse effects on fish communities in the Kapuni catchment, with results being affected by sedimentation, and a significant number of preceding freshes.

2.1.6 Air Quality

There were no noted issues pertaining to visible plumes or odour during the four inspections undertaken this period. No complaints were received from the public with respect to potential odour generation from this facility in the 2020-2021 monitoring period.

2.1.7 Provision of consent holder data

Special condition 4 of the Company's air discharge permit (4087) states:

That the consent holder shall provide to the General Manager, Taranaki Regional Council, by 1 June 1999 and every three years thereafter a written report:

a. *Reviewing any technological advances in the reduction or mitigation of discharges to air from the site, and the costs and benefits of these advantages; and*

b. *Detailing an inventory of the discharges to air from the site of such contaminants as the General manager may from time to time specify following consultation with the consent holder; and*

c. *Detailing any measures that have been taken by the consent holder to improve the energy efficiency of the site's activities and processes; and*

d. *Addressing any other issue relevant to the minimisation or mitigation of discharges of contaminants to air from the site that the General Manager, Taranaki Regional Council, considers should be included.*

Such reports have been provided in 1999, 2002, 2005, 2009, 2011, 2014, 2017, with the latest report received in October 2020 and accepted by the Council. The most recent report is included and discussed in the previous compliance monitoring report (2020-03).

2.2 Incidents, investigations, and interventions

The monitoring programme for the year was based on what was considered to be an appropriate level of monitoring, review of data, and liaison with the Company. During the year matters may arise which require additional activity by the Council, for example provision of advice and information, or investigation of potential or actual causes of non-compliance or failure to maintain good practices. A pro-active approach, that in the first instance avoids issues occurring, is favoured.

For all significant compliance issues, as well as complaints from the public, the Council maintains a database record. The record includes events where the individual/organisation concerned has itself notified the Council. Details of any investigation and corrective action taken are recorded for non-compliant events.

Complaints may be alleged to be associated with a particular site. If there is potentially an issue of legal liability, the Council must be able to prove by investigation that the identified individual/organisation is indeed the source of the incident (or that the allegation cannot be proven).

In the 2020-2021 period, the Council was not required to undertake significant additional investigations and interventions, or record incidents, in association with the Company's conditions in resource consents or provisions in Regional Plans.

3 Discussion

3.1 Discussion of site performance

Site performance by the Company in the 2020-2021 monitoring period had been compliant across all consent related requirements. Water abstraction was undertaken and no exceedance was reported with respect to maximum daily extractable volumes. The Company drew slightly more water (5,530 m^3) than the previous monitoring period. However, this was only 36.8% of their total annual allowance.

Discharge monitoring of effluent and stormwater was undertaken by the Company and reported monthly to the Council. The monthly reports were found to be compliant with consent conditions. Inter-laboratory sample analysis were also undertaken on two occasions this monitoring period and the results indicated good agreement across parameters. Some variation was observed, but did not indicate a cause for concern when considered in context of detection limits and uncertainty of measurement at low concentrations. Continued calibration of key instruments is encouraged as well as participation in inter-laboratory comparison procedures.

Communication between the Company and the Council is regular and open during inspections as well as throughout the monitoring period. This also includes when discussing monitoring requirements, operational adjustments and equipment malfunctions.

Inspections indicated that the site was well managed with good housekeeping apparent across all areas. This included chemical storage areas, catch basins and discharge locations.

The Company were proactive by informing the Council of potential discharges from the site and their response to contain these.

Kapuni Stream flow gauging was undertaken by the Council this monitoring period. This was assessed against low flows in the Kapuni Stream. Further gauging's are planned to be undertaken by the Council's hydrological department in the upcoming monitoring period. These are intended to assess flow within the Kapuni Stream

3.2 Environmental effects of exercise of consents

Minimal environmental effects were noted during the monitoring period. A review of the Company's independent biological monitoring, on the Kapuni Stream catchment, was undertaken by one of the Council's biologists. The review indicated that overall, the MCI scores for nearly all sites were similar to or higher than their respective means. The Kapuni Stream was in 'good' to 'excellent' health and there was no discernible impact from any industrial activity at Kapuni.

The findings of the fish survey concluded that the petrochemical industries were not having any significant adverse effects on fish communities in the Kapuni catchment. The results were affected by sedimentation, and a significant number of preceding freshes.

3.3 Evaluation of performance

A tabular summary of the consent holder's compliance record for the year under review is set out in Tables 9-16.

Table 7 Summary of performance for consent 1125-4

Purpose: *To take water from the Kapuni Stream in association with the operation of a gas processing facility*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Limits to volume of water abstracted	Volume measurement by the Company and review of records by Council	Yes
2. Defines three take locations	Inspection by Council	Yes
3. Limit take duration at alternative locations	Not required by the Company this period	N/A
4. Adopt best practicable option to prevent or minimise adverse effects	Inspection and review of the Company records	Yes
5. Installation and maintenance of water meter and data logger	Inspection by Council. Telemetry to Council via STDC system established January 2014	Yes
6. Certification of water measuring equipment	Provision of certificate. Certification testing carried out 30 October 2014	Yes
7. Notification of equipment failure	Liaison with the consent holder	Not required this period
8. Metering equipment accessible to Council	Inspection	Yes
9. Details of take recording	Records in format required	Yes
10. Notification of details of emergency takes	Not required during period under review	N/A
11. Fish screen	Check screen, and intake design	Yes
12. Financial contributions for riparian planting and fencing in Kapuni catchment	Payments received, no further obligation	N/A
13. Option for Council to review consent conditions	Optional review in 2023	Yes
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of administration performance in respect of this consent		**High**

N/A = not applicable

Table 8 Summary of performance for consent 1123-3

Purpose: *To discharge process effluent and stormwater to the Kapuni Stream*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Adopt best practicable option to prevent or minimise adverse effects	Inspection and liaison with consent holder	Yes
2. Limit on stormwater catchment area	Inspection	Yes
3. Monitor temperature from discharge and keep within limits	Company records and measurement, with review and checking by Council,	Yes
4. Monitor pH levels and keep within range	Company records and sampling, with review and checking by Council. Variation identified in previous monitoring period in relation to Kapuni Stream pH monitoring, now rectified	Yes
5. Discharge cannot produce visible effects on the surface of Kapuni Stream	Inspection	Yes
6. Concentration of un-ionised ammonia in Kapuni Stream not to exceed limits as a result of the discharge	Company records and sampling, with review and checking by Council	Yes
7. Concentration of sodium in Kapuni Stream not to exceed limits as a result of the discharge	Company records and sampling, with review and checking by Council	Yes
8. Concentration of vanadium in Kapuni Stream not to exceed limit as a result of the discharge	Company records and sampling, with review and checking by Council	Yes
9. Discharge not to contain free available chlorine	Company records and sampling, with review and checking by Council	Yes
10. Submission of effluent disposal management plan to Council	Provision of plan as required	Yes
11. Effluent disposal management plan to be followed	Company records, inspection and sampling	Yes
12. Provision of programmes of water treatment and notification of any changes	Inspection and provision of information. Chemical changes notified. Also discharge conductivity monitoring implemented for contingency discharge by the Company	Yes
13. Review of programmes of chemical cleaning treatment and notification of any changes	Inspection and provision of information	Yes
14. Optional review provision re water treatment or chemical cleaning programmes	No review required this period	N/A
15. Option for Council to review consent conditions	Option next available June 2023	N/A

Purpose: *To discharge process effluent and stormwater to the Kapuni Stream*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of administration performance in respect of this consent		**High**

N/A = not applicable

Table 9 Summary of performance for consent 1225-3

Purpose: *To discharge domestic sewage, tri-ethylene glycol, methanol and some water treatment chemicals (i.e. phosphate corrosion inhibitor) from an aerated sewage treatment plant onto and into land*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Adopt best practicable option to prevent or minimise adverse effects	Inspection and liaison with consent holder	Yes
2. No direct discharge to surface water	Inspection	Yes
3. Discharge limit	Data provided by consent holder	Yes
4. Option for Council to review consent conditions	Option next available June 2023	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of administration performance in respect of this consent		**High**

N/A = not applicable

Table 10 Summary of performance for consent 7043-1

Purpose: *To discharge sludge, and some liquid, from two stormwater retention ponds, a filter backwash pond and a settlement pond onto and into land*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Adopt best practicable option to minimise adverse effect	Inspection and company records	Yes
2. Exercise to be in accordance to submission	Inspection	Yes
3. Specific sludge sources	Inspection	Yes
4. Liquids may be discharged as alternative when stream in low flow	Action not required during period under review	N/A
5. Disposal area specified	Inspection	Yes

Purpose: *To discharge sludge, and some liquid, from two stormwater retention ponds, a filter backwash pond and a settlement pond onto and into land*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
6. Minimum distance to and no discharge to surface water	Inspection	Yes
7. Keeping of records	Not requested in period under review	Yes
8. Relocation of soil to approval of Council	Inspection, no soil moved	N/A
9. No adverse effects on any water body	Inspection and biomonitoring	Yes
10. Compliance with soil and groundwater guidelines	Sampling and provision of records	Not assessed this period
11. Advice to District Council on land use	Company records	Yes
12. Option for Council to review conditions of consent	Expiry 2023	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of administration performance in respect of this consent		**High**

N/A = not applicable

Table 11 Summary of performance for consent 4087-2

Purpose: *To discharge emissions into the air from the treatment of natural gas, cogeneration, other on-site activities and other related and ancillary activities*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**[2]
1. Adopt best practicable option to prevent or minimise adverse effects	Inspection and records	Yes
2. Emissions maintained to a minimum	Inspection, company records and sampling	Yes
3. Approval for alterations affecting discharge to be gained from Council	Notifications	Yes
4. Three yearly written report to Council	Report received October 2020	Yes

[2] Assessed on basis of most recent triennial report

Purpose: *To discharge emissions into the air from the treatment of natural gas, cogeneration, other on-site activities and other related and ancillary activities*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?[2]**
5. Written report reviewing technological advances	Report provided to Council 1 June 1996	Yes
6. Written report evaluating risk to human health	Report provided to Council 1 June 1996	Yes
7. Annual report on gross emission of carbon dioxide	Change to RMA - no longer required. CO_2 emission data provided in triennial report	N/A
8. Control of discharges to air of carbon monoxide	Company records of monitoring undertaken in 2004 and 2008 indicated compliance with this condition Additional monitoring undertaken in the 2019-2020 monitoring period	Yes
9. Control of discharges to air of nitrogen dioxide	Company records of monitoring undertaken in 2004 and 2008 indicated compliance with this condition Additional monitoring undertaken in the 2019-2020 monitoring period	Yes
10. Option for Council to review conditions re excess of carbon monoxide or nitrogen dioxide limits	Not exercised	N/A
11. Concentration of benzene not to exceed limits	Not assessed since 2019 as LTS not in operation at present. Other BTEX sources removed Council monitoring 2018-2019 in area indicated 'good' category for benzene in air	Yes
12. Control all other discharges as to not exceed limits	Company records and sampling	Yes
13. Discharge of odour	Inspections did not find offensive or objectionable odour	Yes
14. Depressurisation to avoid dense black smoke	Inspection and Company records	Yes
15. No adverse ecological effect on eco-systems	Inspection and biomonitoring	Yes

Purpose: *To discharge emissions into the air from the treatment of natural gas, cogeneration, other on-site activities and other related and ancillary activities*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?[2]**
16. Notice to review consent conditions	Option next available June 2023	N/A
17. Site contingency plan	Provided	Yes
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of administration performance in respect of this consent		**High**

Table 12 Summary of performance for consent 5090-1

Purpose: *To erect, place, use and maintain two above ground pipelines, an electrical ring main and associated structures over beds of various streams between and including the Motumate Stream and an unnamed tributary of the Waiokura Stream for steam and electricity supply purposes*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Structures constructed and maintained according to submission	Inspection	Yes
2. Notification of initial construction and maintenance work	No maintenance undertaken during monitoring period	N/A
3. Option for Council to review conditions of consent	Option next available June 2023	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of administration performance in respect of this consent		**High**

N/A = not applicable

Table 13 Summary of performance for consent 7755-1

Purpose: *To discharge stormwater from site areas of a natural gas treatment plant where no industrial processes occur (e.g. landscaped areas and roads) into the Kapuni Stream*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Adopt best practicable option to prevent or minimise adverse effects	Inspection and liaison with consent holder	Yes
2. Limit on stormwater catchment area	Inspection	Yes
3. Controls on effect of discharge in receiving water	Inspection and biological monitoring by Council	Yes

Purpose: *To discharge stormwater from site areas of a natural gas treatment plant where no industrial processes occur (e.g. landscaped areas and roads) into the Kapuni Stream*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
4. Discharge cannot produce visible effects on the surface of Kapuni Stream	Inspection	Yes
5. Maintenance of contingency plan	Receipt and review of plan	Yes
6. Maintenance of stormwater management plan	Receipt and review of plan	Yes
7. Provision for lapse of consent		N/A
8. Option for Council to review consent conditions	Option next available June 2023	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of administration performance in respect of this consent		**High**

N/A = not applicable

Table 14 Evaluation of environmental performance over time

Year	Consent no	High	Good	Improvement req	Poor
2008-2009	1123-2, 1124-2, 1225-3, 4087-1, 5007-1, 5008-1, 5090-1, 5126-1, 5496-1, 7043-1	10			
2010-2012	1123-2, 1124-2, 1125-3, 1225-2, 4087-2, 5007-1, 5008-1, 5090-1, 5126-1, 5496-1, 7043-1	11			
2012-2014	1125-3		1		
	1123-2, 1225-2, 4087-2, 5090-1, 5496-1, 7043-1, 7755-1	7			
2015-2016	1123-3, 1125-4, 1225-3, 4087-2, 5090-1, 5496-1, 7043-1, 7755-1	8			
2016-2017	1123-3, 1125-4, 1225-3, 4087-2, 5090-1, 5496-1, 7043-1, 7755-1	8			
2017-2018	1123-3, 1125-4, 1225-3, 4087-2, 5090-1, 7043-1, 7755-1	7			
2018-2019	1123-3, 1125-4, 1225-3, 4087-2, 5090-1, 7043-1, 7755-1	7			

Year	Consent no	High	Good	Improvement req	Poor
2019-2020	1123-3, 1125-4, 1225-3, 4087-2, 5090-1, 7043-1, 7755-1	7			
Total		65	1	0	0

During the year, the Company demonstrated a high level of environmental and high level of administrative performance with the resource consents as defined in Section 1.6. The Company has maintained this high level of environmental performance for a number of years (Table 16).

3.4 Recommendations from the 2019-2020 Annual Report

In the 2019-2020 Annual Report, it was recommended:

1. THAT in the first instance, monitoring of consented activities at the Company site in the 2020-2021 year continue at the same level as in 2019-2020.
2. THAT should there be issues with environmental or administrative performance in 2020-2021, monitoring may be adjusted to reflect any additional investigation or intervention as found necessary.

Recommendation one was implemented, while additional investigation or monitoring as per recommendation two was not required.

3.5 Alterations to monitoring programmes for 2021-2022

In designing and implementing the monitoring programmes for air/water discharges in the region, the Council has taken into account:

- the extent of information already made available through monitoring or other means to date;
- its relevance under the RMA;
- the Council's obligations to monitor consented activities and their effects under the RMA;
- the record of administrative and environmental performances of the consent holder; and
- reporting to the regional community.

The Council also takes into account the scope of assessments required at the time of renewal of permits, and the need to maintain a sound understanding of industrial processes within Taranaki exercising resource consents.

It is proposed that for the 2021-2022 monitoring period that the monitoring of consented activities at the KGTP continue at the same level as 2020-2021.

It should be noted that the proposed programme represents a reasonable and risk-based level of monitoring for the site in question. The Council reserves the right to subsequently adjust the programme from that initially prepared, should the need arise if potential or actual non-compliance is determined at any time during 2021-2022.

4 Recommendations

1. THAT in the first instance, monitoring of consented activities at the Kapuni Gas Treatment Plant in the 2021-2022 year continue at the same level as in 2020-2021.
2. THAT should there be issues with environmental or administrative performance in 2021-2022, monitoring may be adjusted to reflect any additional investigation or intervention as found necessary.

Glossary of common terms and abbreviations

The following abbreviations and terms may be used within this report:

AAQG	Ambient Air Quality Guidelines 2002.
Biomonitoring	Assessing the health of the environment using aquatic organisms.
Conductivity	Conductivity, an indication of the level of dissolved salts in a sample, usually measured at 25°C and expressed in µS/cm.
DRP	Dissolved reactive phosphorus.
Fresh	Elevated flow in a stream, such as after heavy rainfall.
$g/m^2/day$	grams/metre^2/day.
g/m^3	Grams per cubic metre, and equivalent to milligrams per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures.
Incident	An event that is alleged or is found to have occurred that may have actual or potential environmental consequences or may involve non-compliance with a consent or rule in a regional plan. Registration of an incident by the Council does not automatically mean such an outcome had actually occurred.
Intervention	Action/s taken by Council to instruct or direct actions be taken to avoid or reduce the likelihood of an incident occurring.
Investigation	Action taken by Council to establish what were the circumstances/events surrounding an incident including any allegations of an incident.
Incident register	The Incident Register contains a list of events recorded by the Council on the basis that they may have the potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan.
L/s	Litres per second.
m^2	Square Metres.
MCI	Macroinvertebrate community index; a numerical indication of the state of biological life in a stream that takes into account the sensitivity of the taxa present to organic pollution in stony habitats.
mS/m	Millisiemens per metre.
MfE	Ministry for the Environment.
NES	National Environmental Standards.
NH_4	Ammonium, normally expressed in terms of the mass of nitrogen (N).
NH_3	Unionised ammonia, normally expressed in terms of the mass of nitrogen (N).
NO_3	Nitrate, normally expressed in terms of the mass of nitrogen (N).
NTU	Nephelometric Turbidity Unit, a measure of the turbidity of water.
O&G	Oil and grease, defined as anything that will dissolve into a particular organic solvent (e.g. hexane). May include both animal material (fats) and mineral matter (hydrocarbons).
pH	A numerical system for measuring acidity in solutions, with 7 as neutral. Numbers lower than 7 are increasingly acidic and higher than 7 are increasingly alkaline. The scale is logarithmic i.e. a change of 1 represents a ten-fold change in strength. For example, a pH of 4 is ten times more acidic than a pH of 5.

Physicochemical	Measurement of both physical properties (e.g. temperature, clarity, density) and chemical determinants (e.g. metals and nutrients) to characterise the state of an environment.
PM_{10}, $PM_{2.5}$, $PM_{1.0}$	Relatively fine airborne particles (less than 10 or 2.5 or 1.0 micrometre diameter, respectively).
Resource consent	Refer Section 87 of the RMA. Resource consents include land use consents (refer Sections 9 and 13 of the RMA), coastal permits (Sections 12, 14 and 15), water permits (Section 14) and discharge permits (Section 15).
RMA	*Resource Management Act 1991* and including all subsequent amendments.
SS	Suspended solids.
SQMCI	Semi quantitative macroinvertebrate community index.
Temp	Temperature, measured in °C (degrees Celsius).
Turb	Turbidity, expressed in NTU.
Zn*	Zinc.

*an abbreviation for a metal or other analytes may be followed by the letters 'As', to denote the amount of metal recoverable in acidic conditions. This is taken as indicating the total amount of metal that might be solubilised under extreme environmental conditions. The abbreviation may alternatively be followed by the letter 'D', denoting the amount of the metal present in dissolved form rather than in particulate or solid form.

For further information on analytical methods, contact a Science Services Manager.

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Appendix I

Resource consents held by Todd Kapuni GTP

(For a copy of the signed resource consent
please contact the TRC Consents department)

Water abstraction permits

Section 14 of the RMA stipulates that no person may take, use, dam or divert any water, unless the activity is expressly allowed for by a resource consent or a rule in a regional plan, or it falls within some particular categories set out in Section 14. Permits authorising the abstraction of water are issued by the Council under Section 87(d) of the RMA.

Water discharge permits

Section 15(1)(a) of the RMA stipulates that no person may discharge any contaminant into water, unless the activity is expressly allowed for by a resource consent or a rule in a regional plan, or by national regulations. Permits authorising discharges to water are issued by the Council under Section 87(e) of the RMA.

Air discharge permits

Section 15(1)(c) of the RMA stipulates that no person may discharge any contaminant from any industrial or trade premises into air, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations. Permits authorising discharges to air are issued by the Council under Section 87(e) of the RMA.

Discharges of wastes to land

Sections 15(1)(b) and (d) of the RMA stipulate that no person may discharge any contaminant onto land if it may then enter water, or from any industrial or trade premises onto land under any circumstances, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations. Permits authorising the discharge of wastes to land are issued by the Council under Section 87(e) of the RMA.

Land use permits

Section 13(1)(a) of the RMA stipulates that no person may in relation to the bed of any lake or river use, erect, reconstruct, place, alter, extend, remove, or demolish any structure or part of any structure in, on, under, or over the bed, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations. Land use permits are issued by the Council under Section 87(a) of the RMA.

Coastal permits

Section 12(1)(b) of the RMA stipulates that no person may erect, reconstruct, place, alter, extend, remove, or demolish any structure that is fixed in, on, under, or over any foreshore or seabed, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations. Coastal permits are issued by the Council under Section 87(c) of the RMA.

Discharge Permit

Pursuant to the Resource Management Act 1991
a resource consent is hereby granted by the
Taranaki Regional Council

Name of Consent Holder:	Todd Petroleum Mining Company Limited PO Box 802 New Plymouth 4340
Decision Date	18 June 2012
Commencement Date	18 June 2012

Conditions of Consent

Consent Granted:	To discharge process effluent and stormwater to the Kapuni Stream
Expiry Date:	1 June 2035
Review Date(s):	June 2023, June 2029
Site Location:	Kapuni Gas Treatment Plant, 298 Palmer Road, Kapuni
Grid Reference (NZTM)	1700945E-5629537N
Catchment:	Kapuni

For General, Standard and Special conditions
pertaining to this consent please see reverse side of this document

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General condition

a. The consent holder shall pay to the Taranaki Regional Council all the administration, monitoring and supervision costs of this consent, fixed in accordance with section 36 of the Resource Management Act 1991.

Special conditions

1. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this consent.

2. The discharge of stormwater shall be from a catchment area not exceeding 3.37 ha.

3. The discharge shall not raise the temperature of the Kapuni Stream by greater than 2 degrees Celsius, when measured 50 metres downstream of the discharge point and all practicable steps shall be taken by the consent holder to minimise the temperature rise in the Kapuni Stream. Further, the consent holder shall continuously monitor the temperature of the wastewater, and receiving water upstream and downstream of the discharge point.

4. The discharge shall not cause the pH of the Kapuni Stream to be outside the range 6.5 to 9.0 when measured 50 metres downstream of the discharge point. Further, the consent holder shall continuously monitor the pH of the wastewater, and receiving water upstream and downstream of the discharge point.

5. After allowing for reasonable mixing, within a mixing zone extending 50 metres downstream of the discharge point, the discharge shall not produce any visible oil or hydrocarbon films, scums or foams on the surface of the Kapuni Stream.

6. The discharge shall not cause the concentration of un-ionised ammonia in the Kapuni Stream to exceed 0.006 grams per cubic metre when measured 50 metres downstream of the discharge point, unless agreement is given by the holder of consent 0598-3. In any case, the discharge shall not cause the concentration of un-ionised ammonia in the Kapuni Stream to exceed 0.025 grams per cubic metre.

7. The discharge shall not cause the concentration of sodium in the Kapuni Stream to exceed 15 grams per cubic metre when measured 50 metres downstream of the discharge point, unless agreement is given by the holder of consent 0598-3. In any case, the discharge shall not cause the concentration of sodium in the Kapuni Stream to exceed 40 grams per cubic metre.

8. The discharge shall not cause the total vanadium concentration of the Kapuni Stream to exceed 0.08 grams per cubic metre when measured 50 metres downstream of the discharge point.

9. The discharge shall not contain free available chlorine.

10. Prior to the exercise of this consent, the consent holder shall submit an effluent and stormwater management plan for approval by the Chief Executive, Taranaki Regional Council, acting in a certification capacity. The management plan shall detail the procedures and processes that will be followed to ensure that the conditions of this consent are met, including but not limited to:

    i) controlling the effluent and stormwater discharge rate;
    ii) measuring and recording the discharge;
    iii) measuring and recording the Kapuni Stream (chemical and biological);
    iv) calibration of monitoring equipment;
    v) co-ordination with the holder of consent 0598-3 on discharge of ammonia and sodium;
    vi) minimisation of free phosphate in the discharge, and how this can be achieved;
    vii) minimisation of the temperature increase to the receiving environment;
    viii) contingency events (including discharging in extended low flow events and the use of alternative receiving environments); and
    ix) reporting on exercise of consent.

11. The consent shall be exercised in accordance with the approved effluent and stormwater management plan required by condition 10. Within one months notice given by the Taranaki Regional Council, the consent holder shall review the management plan and resubmit the plan for approval by the Chief Executive, Taranaki Regional Council.

12. The consent holder shall forward to the Chief Executive, Taranaki Regional Council, details of any programmes of water treatment used at the Gas Treatment Plant, including raw water, boiler water and cooling water. Further, the consent holder shall notify the Chief Executive, Taranaki Regional Council, of any change in water treatment chemical, or increase in maximum concentration of any water treatment chemical, at least one month prior to change of a water treatment programme.

13. The consent holder shall forward to the Chief Executive, Taranaki Regional Council, details of any programmes of chemical cleaning used at the gas treatment plant. Further, the consent holder shall notify the Chief Executive, Taranaki Regional Council, of any change in chemical cleaning agent, or increase in concentration of any chemical cleaning agent used, where the effluent is to be disposed of to the Kapuni Stream, at least one month prior to change of a chemical cleaning programme.

14. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice within three months of notification of proposed changes in water treatment or chemical cleaning programmes under special conditions 12 and 13, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

15. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2017, and/or June 2023 and/or June 2029 for the purpose of:

    a. ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time; and/or

    b. requiring any data collected in accordance with the conditions of this consent to be transmitted directly to the Council's computer system, in a format suitable for providing a 'real time' record over the internet.

Transferred at Stratford on 1 April 2020

For and on behalf of
Taranaki Regional Council

A D McLay
Director - Resource Management

Water Permit

Pursuant to the Resource Management Act 1991
a resource consent is hereby granted by the
Taranaki Regional Council

Name of Consent Holder:	Todd Petroleum Mining Company Limited PO Box 802 New Plymouth 4340
Decision Date	19 June 2012
Commencement Date	19 June 2012

Conditions of Consent

Consent Granted:	To take water from the Kapuni Stream in association with the operation of a gas processing facility
Expiry Date:	1 June 2035
Review Date(s):	June 2020, June 2023, June 2029
Site Location:	Kapuni Gas Treatment Plant, 298 Palmer Road, Kapuni
Grid Reference (NZTM)	1701464E-5630826N
Catchment:	Kapuni

For General, Standard and Special conditions
pertaining to this consent please see reverse side of this document

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General condition

a. The consent holder shall pay to the Taranaki Regional Council all the administration, monitoring and supervision costs of this consent, fixed in accordance with section 36 of the Resource Management Act 1991.

Special conditions

1. The volume of water taken from the Kapuni Stream shall not exceed 3,900 m^3 at a rate no greater than:

   (a) 52 litres/second under normal operating conditions; or

   (b) 58 litres/second in the event of an emergency shutdown situation, or equipment breakdown/failure; or

   (c) 58 litres/second in the event that the taking of water under 1(a) or 1(b) cannot occur.

2. Water shall be taken from the South Taranaki District Council intake structure, except at times when water is taken in accordance with special condition 1(c), when water shall be taken from the Kapuni Stream at or about the following locations:

   (a) (NZTM) 1701160E-5629699N; or
   (b) (NZTM) 1700943E-5629620N; or
   (c) (NZTM) 1700952E-5629494N.

3. The taking of water from an alternative location, as specified in special condition 1(c) of this consent, shall only be exercised for up to five days (120 hours) per calendar year, or such longer period as approved by the Chief Executive, Taranaki Regional Council for emergency or other purposes.

4. At all times the consent holder shall adopt the best practicable option as defined in the Resource Management Act 1991, to prevent or minimise any actual or likely adverse effect on the environment associated with the taking of water from the Kapuni Stream, including, but not limited to, the efficient and conservative use of water.

5. Before exercising this consent, the consent holder shall install, and thereafter maintain, a water meter and a datalogger at the point where the water enters the supply line for the Kapuni Gas Treatment Plant (i.e. (NZTM) 1701293E-5629885N). The water meter and datalogger shall be tamper-proof and shall measure and record the rate and volume of water taken to an accuracy of $\pm$ 5%. Records of the date, the time and the rate and volume of water taken at intervals not exceeding 15 minutes, shall be made available to the Chief Executive, Taranaki Regional Council at all reasonable times.

   Note: Water meters and dataloggers must be installed, and regularly maintained, in accordance with manufacturer's specifications in order to ensure that they meet the required accuracy. Even with proper maintenance water meters and dataloggers have a limited lifespan.

6. The consent holder shall provide the Chief Executive, Taranaki Regional Council with a document from a suitably qualified person certifying that water measuring and recording equipment required by the conditions of this consent ('the equipment'):

   (a) has been installed and/or maintained in accordance with the manufacturer's specifications; and/or

   (b) has been tested and shown to be operating to an accuracy of ± 5%.

   The documentation shall be provided:

   (i) within 30 days of the installation of a water meter or datalogger;

   (ii) at other times when reasonable notice is given and the Chief Executive, Taranaki Regional Council has reasonable evidence that the equipment may not be functioning as required by this consent; and

   (iii) no less frequently than once every five years.

7. If any measuring or recording equipment breaks down, or for any reason is not operational, the consent holder shall advise the Chief Executive, Taranaki Regional Council immediately. Any repairs or maintenance to this equipment must be undertaken by a suitably qualified person.

8. The water meter and datalogger shall be accessible to Taranaki Regional Council officers at all reasonable times for inspection and/or data retrieval.

9. The records of water taken shall:

   (a) be in a format that, in the opinion of the Chief Executive, Taranaki Regional Council, is suitable for auditing;

   (b) specifically record the water taken as 'zero' when no water is taken; and

   (c) for each 12-month period ending on 30 June, be provided to the Chief Executive, Taranaki Regional Council within one month after end of that period.

10. At times when water is taken from an alternative location, as specified in special condition 1(c) of this consent, the consent holder shall advise the Chief Executive, Taranaki Regional Council, within 12 hours of taking water, and within 2 days of ceasing, shall provide details of the length and time the take occurred and the volume and rate of take (cubic metres per day and litres per second).

11. The consent holder shall ensure that the intake is screened to avoid fish entering the intake or being trapped against the screen.

12. The consent holder shall make three annual payments of $16,667 (plus GST) to the Taranaki Regional Council as a financial contribution for the purpose of providing riparian planting and fencing in the Kapuni Stream catchment. These payments shall be made no later than 1 September each year from 2012 to 2014.

13. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2017 and/or June 2020 and/or June 2023 and/or June 2029 for the purposes of:

    (a) ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time; and/or

    (b) to require any data collected in accordance with the conditions of this consent to be transmitted directly to the Council's computer system, in a format suitable for providing a 'real time' record over the internet.

Transferred at Stratford on 1 April 2020

For and on behalf of
Taranaki Regional Council

A D McLay
Director - Resource Management

Discharge Permit

Pursuant to the Resource Management Act 1991
a resource consent is hereby granted by the
Taranaki Regional Council

Name of Consent Holder:	Todd Petroleum Mining Company Limited PO Box 802 New Plymouth 4340
Decision Date	20 June 2012
Commencement Date	20 June 2012

Conditions of Consent

Consent Granted:	To discharge domestic sewage, tri-ethylene glycol, methanol and some water treatment chemicals (i.e. phosphate corrosion inhibitors) from an aerated sewage treatment plant onto and into land
Expiry Date:	1 June 2035
Review Date(s):	June 2023, June 2029
Site Location:	Kapuni Gas Treatment Plant, 298 Palmer Road, Kapuni
Grid Reference (NZTM)	1700726E-5629194N
Catchment:	Kapuni

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General condition

a. The consent holder shall pay to the Taranaki Regional Council all the administration, monitoring and supervision costs of this consent, fixed in accordance with section 36 of the Resource Management Act 1991.

Special conditions

1. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this consent.

2. There shall be no direct discharge of any contaminant into a surface water body.

3. The discharge shall not exceed 13.5 m^3 per day (0.97 litres per second), which shall be spread as evenly as practicable to a disposal area of not less than 1,325 m^2.

4. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2017 and/or June 2023 and/or June 2029, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Transferred at Stratford on 1 April 2020

For and on behalf of
Taranaki Regional Council

A D McLay
Director - Resource Management

Discharge Permit

Pursuant to the Resource Management Act 1991
a resource consent is hereby granted by the
Taranaki Regional Council

Name of Consent Holder:	Todd Petroleum Mining Company Limited PO Box 802 New Plymouth 4340
Decision Date	27 January 1997
Commencement Date	27 January 1997

Conditions of Consent

Consent Granted:	To discharge emissions into the air from the treatment of natural gas, cogeneration, other on-site activities and other related and ancillary activities
Expiry Date:	1 June 2029
Review Date(s):	June 2023
Site Location:	Palmer Road, Kapuni
Grid Reference (NZTM)	1700840E-5629660N
Catchment:	Kapuni

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General conditions

(a) That on receipt of a requirement from the Chief Executive, Taranaki Regional Council (hereinafter the Chief Executive), the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.

(b) That unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.

(c) That the consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:

(i) the administration, monitoring and supervision of this consent;
(ii) charges for the carrying out of the Council's functions under section 35 in relation to this consent; and
(iii) charges authorised by regulations.

Special conditions

1) That the consent holder shall at all times adopt the best practicable option to prevent or minimise any actual or likely adverse effects on the environment arising from discharges to air from the site. `Best practicable option' shall be determined by the Chief Executive, Taranaki Regional Council, taking into account the information supplied by the consent holder under conditions 4, 5 and 6 of this consent, and following review as set out under condition 16 of this consent.

2) That the consent holder shall at all times operate, maintain, supervise, monitor and control all processes so that emissions authorised by this consent are maintained at a practicable minimum.

3) That prior to undertaking any alterations to the plant, processes or operations which may significantly change the nature or quantity of contaminants discharged to air from the site, the consent holder shall consult with the Chief Executive, Taranaki Regional Council, and shall obtain any necessary approvals under the Resource Management Act 1991.

4) That the consent holder shall provide to the Chief Executive, Taranaki Regional Council, by 1 June 1999 and every three years thereafter a written report:

(a) reviewing any technological advances in the reduction or mitigation of discharges to air from the site, and the costs and benefits of these advances; and
(b) detailing an inventory of the discharges to air from the site of such contaminants as the Chief Executive may from time to time specify following consultation with the consent holder; and
(c) detailing any measures that have been taken by the consent holder to improve the energy efficiency of the site's activities and processes; and
(d) addressing any other issue relevant to the minimisation or mitigation of discharges of contaminants to air from the site that the Chief Executive, Taranaki Regional Council, considers should be included.

5) That in addition to the requirements of condition 4, the consent holder shall provide to the Chief Executive, Taranaki Regional Council, by 1 June 1996 a written report reviewing any technological advances in the reduction or mitigation of discharges of benzene, toluene, ethyl benzene, and xylene, from the glycol towers, and discussing how these might be applicable and/or implemented at the Gas Treatment Plant, and the costs and benefits of these advances.

6) That by 1 June 1996 the consent holder shall provide to the Chief Executive, Taranaki Regional Council, a written report evaluating the risk to human health presented by the discharge to air of benzene, toluene, ethyl benzene, and xylene from the site. The report shall be to such detail as is required by the Chief Executive, Taranaki Regional Council.

7) That the consent holder shall provide to the Chief Executive, Taranaki Regional Council, on an annual basis the gross emissions of carbon dioxide from the site.

8) That the consent holder shall control all discharges to air from the site of carbon monoxide, in order that the maximum concentration of carbon monoxide measured under ambient conditions at or beyond the site boundary arising from discharges to air from the site does not exceed 30 mg/m3 (one-hour average exposure) or 10 mg/m3 (eight-hour average exposure).

9) That the consent holder shall control all discharges to air from the site of nitrogen dioxide, in order that the maximum ambient concentration of nitrogen dioxide measured under ambient conditions at or beyond the site boundary arising from discharge to air from the site does not exceed 300 µg/m3 (one-hour average exposure) or 100 µg/m3 (twenty-hour average exposure).

10) That should an off-site concentration of carbon monoxide or of nitrogen dioxide in the vicinity of the site be found to exceed a limit established in condition 8 or 9 above, then the Taranaki Regional Council may review any or all of the conditions of this consent pursuant to section 128(1)(a) of the Resource Management Act.

11) That the consent holder shall control all discharges of benzene to air from the site, in order that the maximum concentration measured under ambient conditions at or beyond the site boundary arising from discharges to air from the site, shall not exceed 16 µg/m3 (annual average of twenty-four-hour average exposure), nor 3.2 mg/m3 at any time, nor 0.32 mg/m3 (any eight-hour average exposure).

12) That the consent holder shall control all discharges to air from the site other than of carbon dioxide, carbon monoxide, nitrogen oxides and benzene, so that the maximum concentration measured under ambient conditions at or beyond the boundary of the site, arising from the exercise of this consent, does not exceed:

    (a) more than 1/30th of the relevant Occupation Threshold Value (Time Weighted Average); or
    (b) the Short Term Exposure Limit at any time (Workplace Exposure Standards and Biological Exposure Indices for New Zealand, 1992, Department of Labour).

13) That the discharges authorised by this consent shall not give rise to an odour at or beyond the boundary of the site that in the opinion of at least one officer of the Taranaki Regional Council is offensive or obnoxious or objectionable.

14) That whenever practicable depressurisation of the plant or sections of the plant shall be so controlled as to avoid dense black smoke from being discharged from any flare.

15) That the discharges authorised by this consent shall not give rise to any significant adverse ecological effect on any ecosystems, including but not limited to habitats, plants, animals, microflora and microfauna.

16) That pursuant to the provisions of section 128(1)(a) of the Resource Management Act the Council may within six months of receiving a report prepared by the consent holder subject to conditions 4, 5, or 6 of this consent or otherwise by giving notice of review during June 1999 and/or June 2005 and/or June 2011 and/or June 2017 and/or June 2023 serve notice that it intends to review any condition of this resource consent for the purposes of:

    (a) dealing with any significant adverse effect on the environment arising from the exercise of this consent; or
    (b) requiring the consent holder to adopt the best practicable option to remove or reduce any adverse effect on the environment caused by the discharge.

17) That the consent holder shall prepare a site contingency plan to the satisfaction of the Chief Executive, Taranaki Regional Council, no later than six months after the granting of this consent. The contingency plan shall be reviewed and if necessary updated to the satisfaction of the Chief Executive, Taranaki Regional Council, annually.

Transferred at Stratford on 1 April 2020

For and on behalf of
Taranaki Regional Council

A D McLay
Director - Resource Management

Land Use Consent

Pursuant to the Resource Management Act 1991
a resource consent is hereby granted by the
Taranaki Regional Council

Name of Consent Holder:	Todd Petroleum Mining Company Limited PO Box 802 New Plymouth 4340
Decision Date	27 January 1997
Commencement Date	27 January 1997

Conditions of Consent

Consent Granted:	To erect place use and maintain two above ground pipelines, an electrical ring main and associated structures over beds of various streams between and including the Motumate Stream and an unnamed tributary of the Waiokura Stream for steam and electricity supply purposes
Expiry Date:	1 June 2032
Review Date(s):	June 2023
Site Location:	Palmer Road To Manaia Road Kapuni
Grid Reference (NZTM)	1700840E-5629760N
Catchment:	Waiokura
Tributary:	Motumate

For General, Standard and Special conditions
pertaining to this consent please see reverse side of this document

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General conditions

(a) That on receipt of a requirement from the Chief Executive, Taranaki Regional Council (hereinafter the Chief Executive), the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.

(b) That unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.

(c) That the consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:

(i) the administration, monitoring and supervision of this consent;
(ii) charges for the carrying out of the Council's functions under section 35 in relation to this consent; and
(iii) charges authorised by regulations.

Special conditions

1. That the structures licensed by this consent shall be constructed and maintained in accordance with the documentation submitted in support of application 96/322.

2. That the consent holder shall notify the Taranaki Regional Council at least 48 hours prior to, and again upon completion of initial construction works, and again 48 hours prior to and upon completion of any subsequent maintenance works which may result in disturbance of the stream beds and/or discharges to the streams.

3. That the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during the month of June 1999 and/or June 2005 and/or June 2011 and/or June 2017 and/or June 2023 and/or June 2029, for the purpose of ensuring that the conditions are adequate to deal with any significant adverse effects of the discharge on the receiving environment arising from the exercise of this consent, which were not foreseen at the time the application was considered and which it was not appropriate to deal with at the time.

Transferred at Stratford on 1 April 2020

For and on behalf of
Taranaki Regional Council

A D McLay
Director - Resource Management

Discharge Permit

Pursuant to the Resource Management Act 1991
a resource consent is hereby granted by the
Taranaki Regional Council

Name of Consent Holder:	Todd Petroleum Mining Company Limited PO Box 802 New Plymouth 4340
Decision Date	25 January 2010
Commencement Date	25 January 2010

Conditions of Consent

Consent Granted:	To discharge sludge, and some liquid, from two stormwater retention ponds, a filter backwash pond and a settlement pond onto and into land
Expiry Date:	1 June 2023
Site Location:	Kapuni Gas Treatment plant, 298 Palmer Road, Kapuni
Grid Reference (NZTM)	1700973E-5629335N
Catchment:	Kapuni

For General, Standard and Special conditions
pertaining to this consent please see reverse side of this document

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General conditions

a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.

b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.

c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:

   i) the administration, monitoring and supervision of this consent; and
   ii) charges authorised by regulations.

Special conditions

1. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this consent.

2. The exercise of this consent shall be undertaken generally in accordance with the documentation submitted in support of applications 4506 and 6313. In the case of any contradiction between the documentation submitted in support of applications 4506 and 6313 and the conditions of this consent, the conditions of this consent shall prevail.

3. The consent holder shall ensure that only sludge generated in the stormwater retention ponds, filter backwash ponds and from settlement of Kapuni Stream water in the northern pond is discharged.

4. During times when the Kapuni Stream is in low flow, or when equipment failure prevents discharge to the stream, the discharge may include liquids [excluding demineralisation wastes] that normally reside in these ponds as an alternative to discharging them to the stream.

5. No disposal shall occur outside the area specified in application 4506.

6. The discharge onto and into land shall occur a minimum of 25 metres from any surface water body or property boundary. Discharge shall be onto and into land and there shall be no discharge of any contaminant to surface water.

7. The consent holder shall keep records of the following:

   a) Analysis of a representative sample of sludge each time the stormwater ponds and filter backwash pond is de-sludged, and soil quality after each discharge (analysing for arsenic, cadmium, chromium, copper, lead, nickel, mercury and zinc)
   b) Volumes of material discharged
   c) Dates and times of discharge events

   and shall provide the results to the Chief Executive, Taranaki Regional Council, on request.

8. Any relocation of soil from within the defined disposal area shall only occur if it can be shown to the satisfaction of the Chief Executive, Taranaki Regional Council that the standards, terms, and conditions of Rule 29 of the Regional Freshwater Plan for Taranaki will be complied with.

9. The discharge authorised by this consent shall not give rise to any of the following effects in any water body:

   a) the production of conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
   b) any conspicuous change in the colour or visual clarity;
   c) any emission of objectionable odour;
   d) the rendering of fresh water unsuitable for consumption by farm animals;
   e) any significant adverse effects on aquatic life.

10. At all times, the consent holder shall comply with the guidelines for industrial sites developed by the Australian National Environmental Protection Council (Assessment of Site Contamination) Schedule B(1): Guideline on the Investigation Levels for Soil and Groundwater (1999).

11. The consent holder shall advise the South Taranaki District Council that the disposal area is being used for disposal of contaminated silts at levels and rates expected to result in the soil of that area exceeding agricultural land use guidelines, but not exceeding industrial land use guidelines.

12. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2011 and/or June 2017, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Transferred at Stratford on 1 April 2020

For and on behalf of
Taranaki Regional Council

A D McLay
Director - Resource Management

Discharge Permit

Pursuant to the Resource Management Act 1991
a resource consent is hereby granted by the
Taranaki Regional Council

Name of Consent Holder:	Todd Petroleum Mining Company Limited PO Box 802 New Plymouth 4340
Decision Date	20 June 2012
Commencement Date	20 June 2012

Conditions of Consent

Consent Granted:	To discharge stormwater from site areas of a natural gas treatment plant where no industrial processes occur (e.g. landscaped areas and roads) into the Kapuni Stream
Expiry Date:	1 June 2035
Review Date(s):	June 2023, June 2029
Site Location:	Kapuni Gas Treatment Plant, 298 Palmer Road, Kapuni
Grid Reference (NZTM)	1700830E-5629418N
Catchment:	Kapuni

For General, Standard and Special conditions
pertaining to this consent please see reverse side of this document

47 Cloten Road · Private Bag 713 · Stratford 4352 · New Zealand
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www.facebook.com/TaranakiRegionalCouncil twitter.com/TaranakiRC
Please quote our document number in your reply

General condition

a. The consent holder shall pay to the Taranaki Regional Council all the administration, monitoring and supervision costs of this consent, fixed in accordance with section 36 of the Resource Management Act 1991.

Special conditions

1. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this consent.

2. The stormwater discharged shall be from a catchment area not exceeding 9.39 ha.

3. After allowing for reasonable mixing, the discharge shall not, either by itself or in combination with other discharges, give rise to any or all of the following effects in the receiving water:

    a. the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
    b. any conspicuous change in the colour or visual clarity;
    c. any emission of objectionable odour;
    d. the rendering of fresh water unsuitable for consumption by farm animals; and
    e. any significant adverse effects on aquatic life.

4. The consent holder shall maintain a contingency plan (which is incorporated into the contingency plan for the entire site). The contingency plan shall be adhered to in the event of a spill or emergency and shall, to the satisfaction of the Chief Executive, Taranaki Regional Council, detail measures and procedures to be undertaken to prevent spillage or accidental discharge of contaminants not authorised by this consent and measures to avoid, remedy or mitigate the environmental effects of such a spillage or discharge.

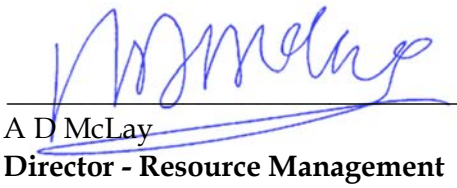
5. The consent holder shall maintain a stormwater management plan (which is incorporated into the stormwater management plan for the entire site). This plan shall be adhered to at all times and shall, to the satisfaction of the Chief Executive, Taranaki Regional Council document how the site is to be managed in order to minimise the contaminants that become entrained in the stormwater.

6. This consent shall lapse on 30 June 2017, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.

7. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2017 and/or June 2023 and/or June 2029, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Transferred at Stratford on 1 April 2020

For and on behalf of
Taranaki Regional Council



A D McLay
Director - Resource Management

Appendix II

Triennial report as per special condition 4 under consent 4087

REPORT

Tonkin+Taylor

Kapuni Gas Treatment Plant

Report on Special Condition 4 of Air Discharge Permit 4087 - November 2019 to February 2020

Prepared for
Todd Petroleum Mining Company Ltd
Prepared by
Tonkin & Taylor Ltd
Date
October 2020
Job Number
1015030

Exceptional thinking together
www.tonkintaylor.co.nz

Document Control

Title: Kapuni Gas Treatment Plant - Report on Special Condition 4 of Air Discharge Permit 4087					
Date	**Version**	**Description**	**Prepared by:**	**Reviewed by:**	**Authorised by:**
10/09/2020	1.0	Draft for client review	D Vernall	R Chilton	G Nicholson
09/10/2020	2.0	Report issue	D Vernall	R Chilton	G Nicholson

Distribution:

Todd Petroleum Mining Company Ltd	1 PDF copy
Tonkin & Taylor Ltd (FILE)	1 PDF copy

Table of contents

1 Introduction

The Kapuni Gas Treatment Plant (KGTP) is owned and operated by Todd Petroleum Mining Company Ltd (TPMC). TPMC holds resource consent (no 4087-2) authorising the discharge of contaminants to air from the treatment of natural gas, cogeneration, and other related activities at the KGTP.

Special Condition 4 of resource consent no 4087-2 requires that TPMC provides a written report to the Taranaki Regional Council (TRC) every three years on discharges to air from the site. The purpose of this monitoring report is to fulfil the requirements of Special Condition 4 for the most recent three year reporting period (September 2017 to August 2020)

Tonkin & Taylor Limited (T+T) has prepared this report for TPMC in accordance with our letter of engagement dated 30 July 2020.

2 Scope of this report

Resource consent no. 4087-2 was granted by the TRC on 7 February 1996.

Special condition 4 of resource consent 4087-2 requires that TPMC provide a written report every three years on the discharges to air from the site, including the following:

a Reviewing any technological advances in the reduction or mitigation of discharges to air from the site, and the costs and benefits of these advantages.

b Detailing an inventory of the discharges to air from the site of such contaminants as the General Manager may from time to time specify following consultation with the consent holder.

c Detailing any measures that have been taken by the consent holder to improve the energy efficiency of the site's activities and processes.

d Addressing any other issue relevant to the minimisation or mitigation of discharges of contaminants to air from the site that the General Manager, Taranaki Regional Council, considers should be included.

This report is the eighth report produced in accordance with Special Condition 4, with previous reports being prepared in 1999, 2002, 2005, 2009, 2011, 2014 and 2017[1]. Accordingly, this report covers the reporting period of September 2017 to August 2020.

3 Condition 4(d): Process description

3.1 Background

The KGTP was built in 1969/70 and processes raw natural gas to produce specification gas for reticulation and a number of other by-products.

Under the present operation, all raw natural gas entering the KGTP comes from the Kapuni Gas Production Station (KGPS), which is also operated by TPMC. Raw Kapuni gas contains approximately 43% carbon dioxide (CO_2) by volume. The KGTP receives approximately 660,000 tonnes of CO_2 annually in its Kapuni gas, with most of this being vented to atmosphere as a result of treatment processes.

[1] Only the 2009 monitoring report was prepared by T+T.

3.2 Historical process change

The KGTP is designed to process high CO_2 content Kapuni gas to a quality suitable for use in general domestic, commercial, and industrial appliances. The process involves the removal of CO_2 from the gas using the Benfield Hot Potassium Carbonate technology. The gas is then dehydrated and chilled to recover natural gas liquids (LPG, natural gasoline) from the gas. The product gas is then compressed, odorised, and distributed via the transmission distribution network as specification gas (compliant with NZS 5442:2008).

The KGTP has undergone several plant expansions and upgrades, which are summarised in Table 3.1.

Table 3.1: Historical expansions, upgrades and changes of ownership of the Kapuni Gas Treatment Plant

Year(s)	Expansion/upgrade
1973	LPG separation and fractionation.
1979-80	Additional CO_2 removal capacity added to process Maui gas and facilities to recover, purify, and liquefy some of the CO_2.
1985	The treatment plant was expanded with the installation of the low temperature separation (LTS) Gas Conditioning Plant that processed the high CO_2 content Kapuni gas for water and heavy hydrocarbon removal only. The condition gas was supplied to the region's methanol plants so it could be blended with the much lower CO_2 content Maui gas for more efficient methanol production.
1996-97	TRC issued air discharge permit 4087 on 7 February 1996 to the Natural Gas Corporation of New Zealand Ltd (NGC). In late 1996, NGC sought a change to 4087 to account for the installation of a new cogeneration facility and other ancillary operations associated with the refurbishment of the KGTP. The application was granted by TRC on 27 January 1997.
1997	The KGTP refrigeration systems were upgraded, enabling more natural gas liquids to be removed from the raw gas.
1998	Reliability and efficiencies were further improved with the completion of a $25 million, 3-year refurbishment of the plant's processes and control systems. The NGC and Todd Energy Kapuni Energy Joint Venture commissioned a 25 MW cogeneration plant within the KGTP complex. The cogeneration plant provides electricity and steam requirements of the KGTP and Fonterra's lactose factory at Kapuni. Excess electricity is sold to the national grid.
2003-04	An upgrade of the gas treatment plant was conducted, involving the recommissioning of one of the plant's three process trains, debottlenecking the dehydration and chilling process, adding a further 100 tonnes of LPG storage, and installing a new reverse osmosis water treatment plant.
May 2005	Methanex reduced its production capacity and as a result the LTS Gas Conditioning Plant was mothballed.
2004-06	NGC was sold to Vector Limited. In July 2006 NGC changed its name to Vector Gas Limited.
Apr 2020	Vector transferred ownership of the KGTP to TPMC. This includes the KGTP and related assets and Vector's 50% interest in the Kapuni Energy Joint Venture.

3.3 Annual emissions of carbon dioxide from the Kapuni gas treatment plant

CO_2 emissions arise from a range of sources within the KGTP site. Most of the CO_2 emissions are from plant and equipment. A notable exception is the cogeneration facility (owned by TPMC), which produces both steam and electricity for the KGTP site and the Fonterra lactose factory. The cogeneration facility also exports electricity to the national grid.

CO_2 emissions from the KGTP relate to the Benfield CO_2 removal system, CO_2 recovery plant, pipeline compressors, stabiliser compressor, operation of the boilers and cogeneration, KGTP electricity generation (prior to cogeneration) and flaring.

Food grade CO_2 is produced at the KGTP and is re-sold for food purposes. During the monitoring period around 4-6% of the CO_2 received in the raw gas processed at the site was sold as liquid food grade CO_2. Food grade CO_2, and CO_2 which remains in the treated gas (i.e. not removed by the Benfield process) are not included in the annual CO_2 emissions data for the KGTP as these emissions would occur off-site.

Figure 3.1 shows the KGTP annual CO_2 emission figures for the period 2000-2019. These figures have been presented in the same format as that reported to the Ministry for the Environment (MfE) for input into the New Zealand Greenhouse Gas Inventory, which is categorised emissions as follows:

- CO_2 vented to atmosphere from the Benfield process.
- CO_2 produced by fuel combustion at the KGTP.

Annual CO_2 vented to atmosphere has generally decreased since 2004. The reduction in CO_2 emissions in recent years is generally due to reduced quantities of gas processed by the KGTP compared to previous years.

Additionally, the amount of CO_2 from fuel combustion at the KGTP has reduced since 2008. This is because the site previously used its boilers to raise steam, whereas now all the steam used by the site is produced from the cogeneration facility.

The amount of annual CO_2 released to atmosphere from the site between 2017 and 2019 is similar to the quantities released to atmosphere in 2016.

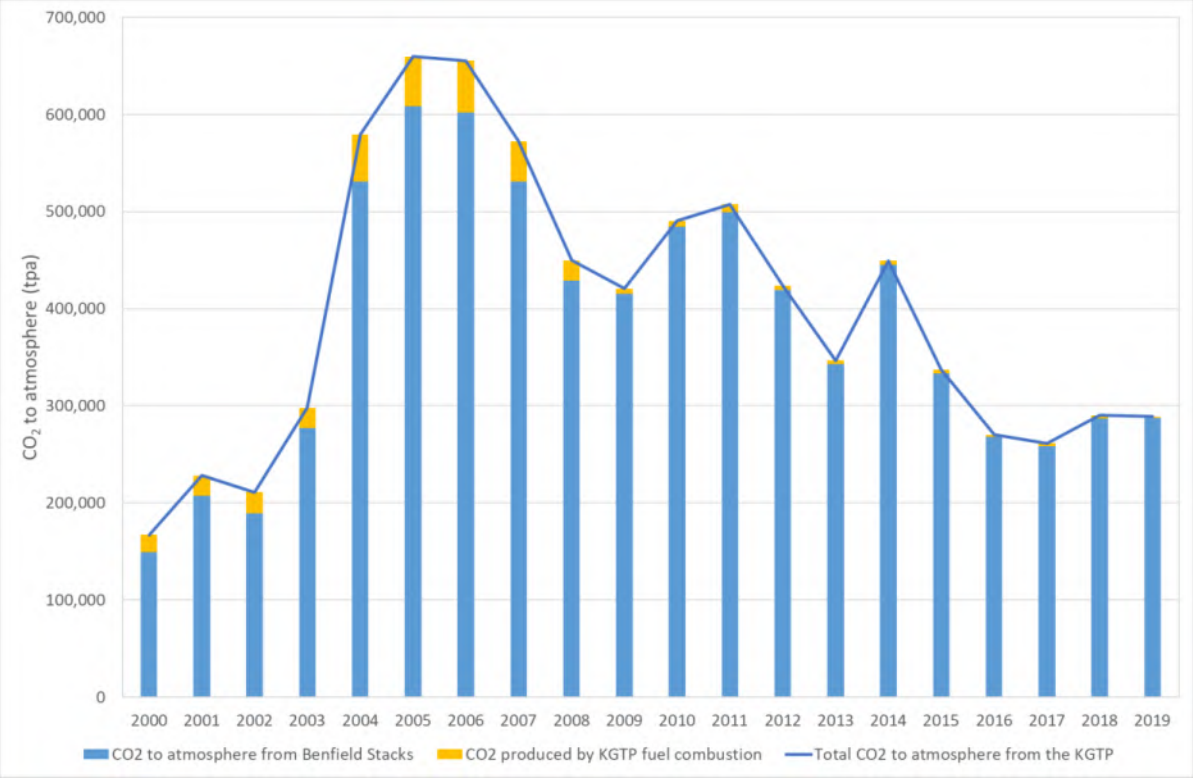


Figure 3.1: Annual CO_2 emissions from the Kapuni Gas Treatment Plant

3.4 Significant flaring

Flaring is an important safety consideration for the site as it allows flammable material to be safely released into the environment in a non-combustible form in the event of either processing upsets or contingency situations arising at the site. There are no circumstances where TPMC gains a financial advantage from flaring. Any flaring is a financial loss; hence there is a strong drive to minimise any flaring activity.

The largest flaring episodes occur during emergency depressurisation (EDP) tests. This test is carried out to establish that all emergency shutdown and depressurisation valves actuate. This results in only a fraction of the total hydrocarbon inventory being flared. These tests have been carried out on an annual basis since 1997 to achieve the design reliability requirements, and in accordance with international practice.

With the exception of EDP tests, TPMC reports that there have been no flaring events since 2017.

4 Condition 4(c): Process & operational enhancements at the Kapuni Gas Treatment Plant

The annual steam use (in tonnes) per terajoule of gas processed at the KGTP is used as a Key Performance Indicator (KPI) to monitor the efficiency of steam use in the CO_2 removal process.

In previous triannual reports the steam use per unit of CO_2 removed has been presented as a KPI for measuring the efficiency of steam use in the Benfield trains. The KPI of comparing steam use to the amount of gas processed is a better measure of the efficiency of the whole CO_2 removal process, rather than just the Benfield trains.

Figure 4.1 shows the annual steam use per unit of gas processed between 2004 and 2019. The figure generally shows a reduction in the amount of steam used at the site per unit of gas processed since 2004. Since 2010, the annual steam use per unit of gas processed has been at relatively similar levels. This indicates that there has been an overall improvement in the CO_2 removal efficiency at the site. The recent plateau may indicate the site may be approaching a limit on further improvements to efficiency are possible with the current plant.

TPMC reports that there have been no further upgrades to improve energy efficiency at the KGTP in the reporting period.

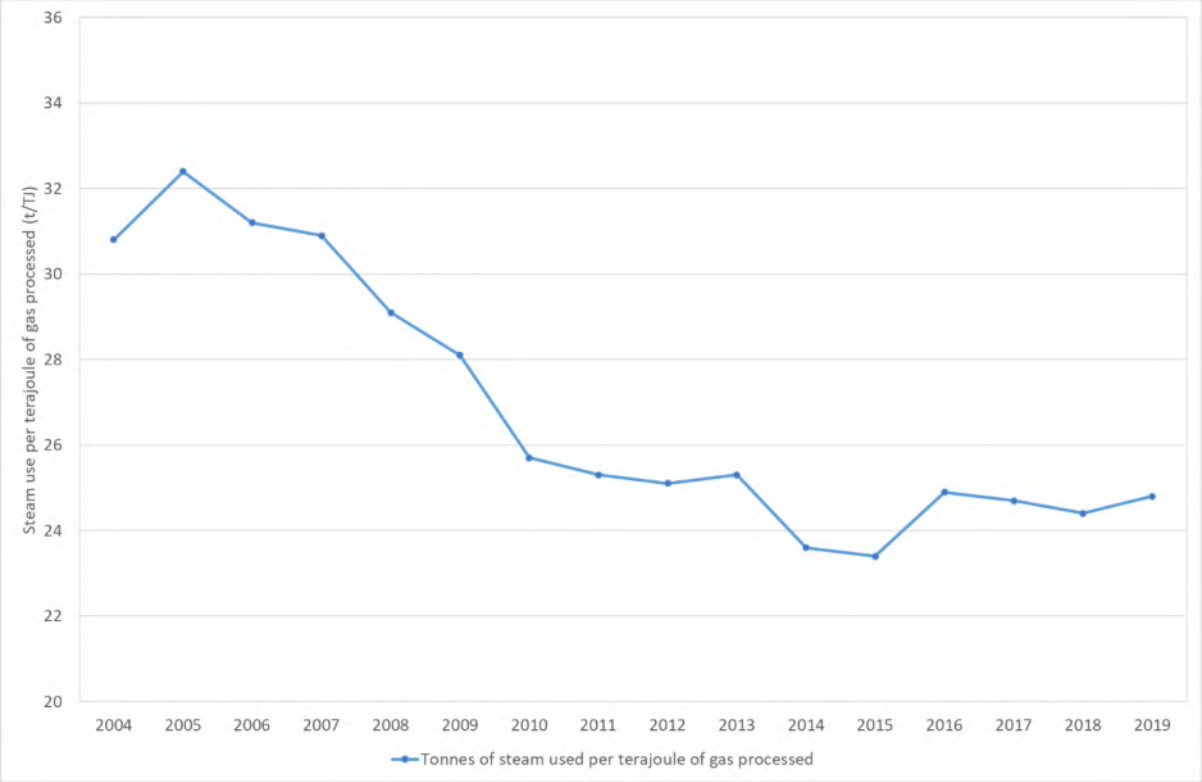


Figure 4.1: Tonnes of steam used per terajoule of gas processed per annum, 2004-2019

5 Condition 4(a): Technology review

TPMC reports that there have been no technological enhancements of the KGTP in the reporting period.

6 Condition 4(b): Ambient air monitoring

6.1 Nitrogen dioxide and carbon monoxide air monitoring study

6.1.1 Monitoring locations

Figure 6.1 shows the location of the air quality monitoring station at the boundary of the KGTP. This location is consistent with monitoring undertaken at the site.

The KGTP is located close to two other industrial activities, which have the potential for nitrogen oxide (NO_X) and carbon monoxide (CO) emissions. The TPMC Kapuni Gas Production Station is immediately adjacent to the north of the KGTP, and the Balance Agri-Nutrients Ammonia Urea plant is located to the west of the site as indicated in Figure 6.1.

Figure 6.1: Monitoring locations for the air monitoring study. The KGTP site boundary is outlined in red, the TPMC Kapuni Gas Production Station site boundary is outlined in orange, and Balance Agri-Nutrients site boundary is outlined in blue.

6.1.2 Monitoring methods

In 2019, Watercare Services Ltd was commissioned to undertake active and passive ambient air quality monitoring at the KGTP by TPMC. Continuous monitoring of CO, nitrogen dioxide (NO_2) and meteorological parameters (wind speed, wind direction & ambient temperature) was carried out at the north-eastern perimeter of the plant. The above parameters were recorded for the period 1 November 2019 to 30 January 2020.

The monitoring shed and sample inlet were sited in accordance with AS/NZ 3580.1.1 – 2016: Ambient Air – Guide for the Siting of Sampling Units. The sampling location is consistent with previous continuous monitoring studies undertaken in 2004 and 2008.

Measurements of CO and NO_2, wind speed, wind direction and temperature were made in accordance with the following standards:

- AS 3580.7.1 – 2011: Determination of carbon monoxide – Direct-reading instrumental method.
- AS 3580.5.1 – 2011: Determination of oxides of nitrogen – Direct-reading instrumental method.
- AS 3580.14 – 2014: Meteorological monitoring for ambient air quality monitoring applications.

With the mothballing of the low temperature separation gas conditioning plant, the BTEX emissions at KGTP have been eliminated. In consultation with TPMC prior to monitoring commencing, Taranaki Regional Council agreed that BTEX monitoring for the 2020 study was unnecessary.

6.1.3 Data validity

The MfE 'Good Practice Guide for Air Quality Monitoring and Data Management'[2] suggests that it is difficult to reach anything close to 100 % valid data for long-term monitoring. As such, the MfE recommends that data capture should be evaluated against a target data capture rate of 95 %.

Table 6.1 shows the monthly valid data capture during the reporting period. Data capture for NO_X, CO and meteorological parameters were above 95% for the monitoring period and therefore meet the reporting requirements of the MfE.

Table 6.1: Monthly valid data capture

Parameter	Averaging period	Percentage valid data		
		November 2019	December 2019	January 2020
Nitrogen oxides (NO_X, NO and NO_2)	10-minutes	98 %	98 %	98 %
Carbon monoxide	10-minutes	97 %	98 %	98 %
Wind speed	10-minutes	100 %	100 %	100 %
Wind direction	10-minutes	100 %	100 %	100 %
Air temperature	10-minutes	100 %	100 %	100 %
Relative humidity	10-minutes	100 %	100 %	100 %

6.1.4 Meteorological conditions

Figure 6.2 shows a wind direction and wind speed frequency rose for the monitoring period. During the monitoring period, the predominant wind was from the west-southwest to northwest directions with secondary prevalence of winds from the north and south-southeast.

Figure 6.3 shows a time series of 24-hour average ambient temperature and relative humidity measured at the site. Temperature and humidity were relatively consistent across the monitoring period.

[2] Ministry for the Environment. *Good Practice Guide for Air Quality Monitoring and Data Management 2009*. April 2009.

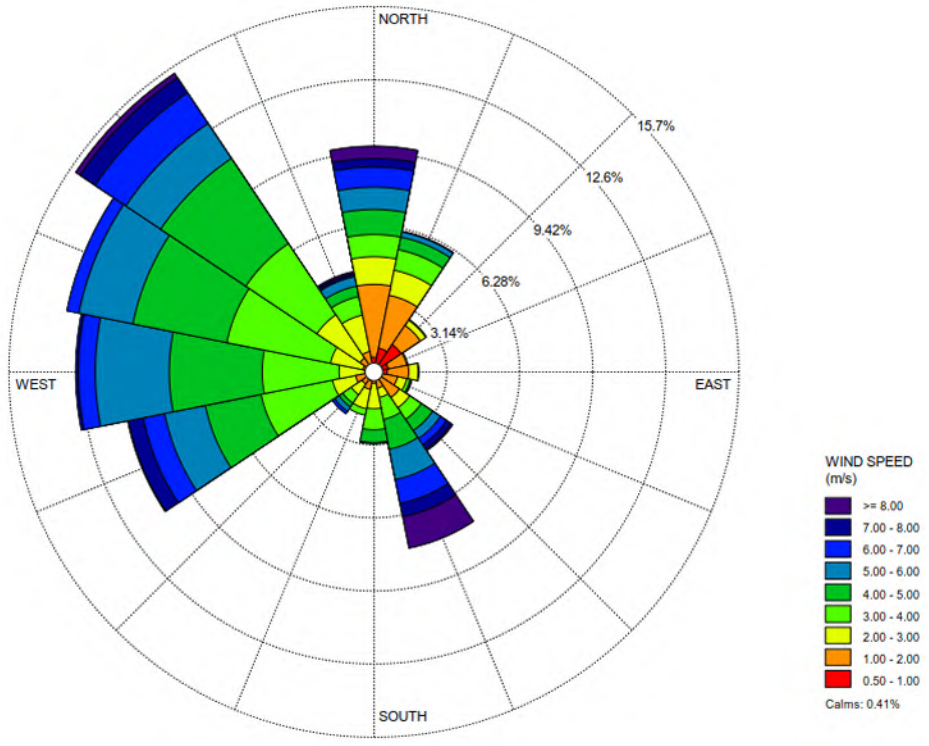


Figure 6.2: Wind direction and wind speed frequency rose, 1-hour averages, blowing-from, November 2019 to January 2020.

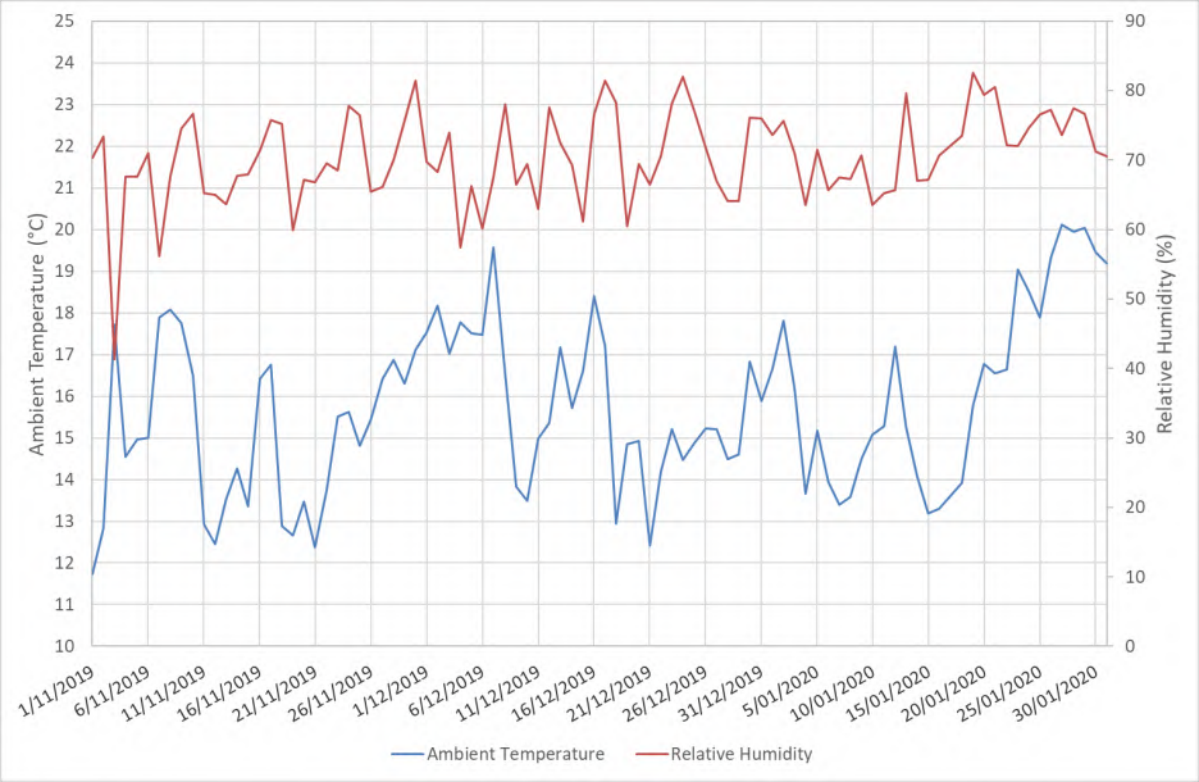


Figure 6.3: 24-hour average ambient temperature and relative humidity time-series, November 2019 to January 2020.

6.1.5 Ambient air quality criteria

Conditions 8 and 9 of resource consent no. 4087-2 sets out limits for maximum concentrations at or beyond the site boundary CO and NO_2 arising from discharges to air from the site.

The Resource Management (National Environmental Standards for Air Quality) Regulations 2004 (NESAQ) specifies standards for certain contaminants, including carbon monoxide and nitrogen dioxide. A key aspect to note is that the NESAQ specifies a 1-hour average concentration limit for nitrogen dioxide of 200 µg/m^3 with an allowance for 9 exceedances per year.

Although the NESAQ for nitrogen dioxide is lower than the consent limit, the consent limits in the air discharge consent prevails because the air discharge consent was granted prior to the commencement of the NESAQ[3]. The consent limits will continue to prevail over the NESAQ until the air discharge consent expires or a review of the air discharge consent conditions is undertaken under Section 128(1)(ba) of the Resource Management Act. The monitoring results have been assessed against the consent limits set out in Table 6.2 below.

Table 6.2: Ambient air quality limits applicable to the Kapuni Gas Treatment Plant

Pollutant	Averaging period	Consent limit (µg/m^3)
Carbon monoxide (CO)	1-hour	30,000
	8-hours	10,000
Nitrogen dioxide (NO_2)	1-hour	300
	24-hours	100

6.1.6 Nitrogen dioxide results

Table 6.3 summarises the maximum measured concentrations of NO_2 over the monitoring period. The 1-hour average and 24-hour average NO_2 concentrations were below the consented limits of 300 µg/m^3 and 100 µg/m^3, respectively. Additionally, the maximum measured 1-hour average NO_2 concentration was below the NESAQ standard of 200 µg/m^3.

Table 6.3: Maximum ambient nitrogen dioxide concentrations (November 2019 – January 2020)

Pollutant	Averaging period	Air quality criteria (µg/m^3)	Maximum concentration (µg/m^3)		
			November 2019	December 2019	January 2020
Nitrogen dioxide (NO_2)	1-hour	300	94	99	72
	24-hours	100	53	62	29

The pollution roses in Figure 6.4 show the relationship between NO_2 concentrations and wind direction. Analysis of these wind characteristics show that the highest NO_2 concentrations were measured in winds blowing from the west to northwest directions. Potential sources of NO_2 in the vicinity of the monitoring site in these wind directions are the KGTP (west to northwest of the monitoring site), Ballance Agri-Nutrients (located west to west-northwest of the monitoring site),and the TPMC Kapuni Production Station (located west-northwest to northwest of the monitoring site).

[3] Section 43(b)(6a) and (6Aa) provide for discharge permits to prevail of a national environmental standard where those permits were grated before the NES was notified in the *Gazette*. This is applicable to the site's air discharge permit as consent no .4087-2 was granted in 1996 prior to the NESAQ being notified in the *Gazette* in 2004.

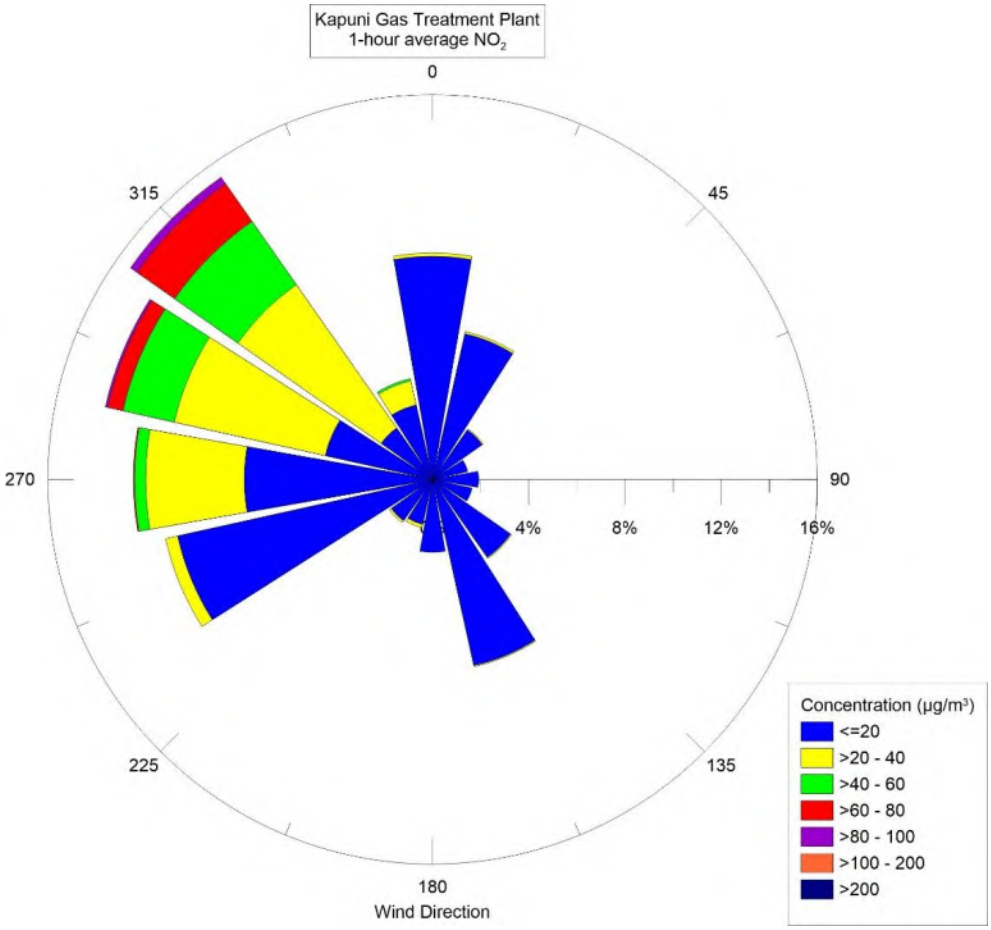


Figure 6.4: 1-hour average nitrogen dioxide pollution rose (1 November 2019 to 31 January 2020)

6.1.7 Carbon monoxide results

Continuous monitoring of CO was carried out at the site boundary for the period 1 November 2019 to 31 January 2020. Table 6.4 summarises the maximum measured concentration of CO over the monitoring period.

Over the monitoring period, 1-hour average and 8-hour average CO concentrations were below the consented limits.

Table 6.4: Maximum measured carbon monoxide concentrations (November 2019 – January 2020)

Pollutant	Averaging period	Air quality criteria (µg/m³)	Maximum concentration (µg/m³)		
			November 2019	December 2019	January 2020
Carbon monoxide (CO)	1-hour	30,000	594	1238	1652
	8-hours	10,000	428	894	680

The pollution rose in Figure 6.5 shows the relationship between CO concentrations and wind direction. Analysis of these wind characteristics show that the highest NO_2 concentrations were measured in winds blowing from the west-northwest to northwest directions. Potential sources of CO in the vicinity of the monitoring site in these wind directions are the KGTP (located west-northwest to northwest of the monitoring site), Ballance Agri-Nutrients (located west-northwest of

the monitoring site),and the TPMC Kapuni Production Station (located northwest of the monitoring site).

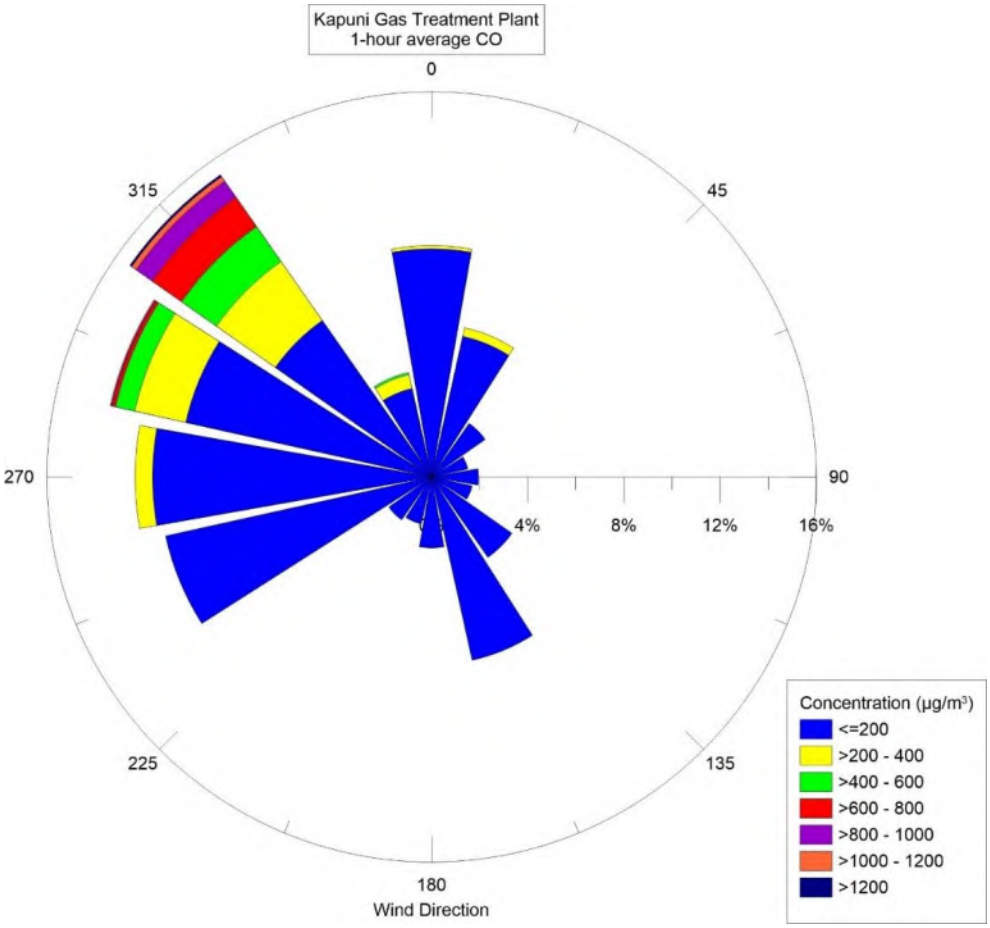


Figure 6.5: 1-hour average carbon monoxide pollution rose (1 November 2019 to 31 January 2020)

6.1.8 Comparison with environmental performance indicators

Environmental Performance Indicators (EPI) can be used to provide an overall picture of air quality with respect to ambient guidelines. The definition of each EPI (air quality category), is shown in Table 6.5 below. The EPIs were set against the NESAQ and MfE Ambient Air Quality Guidelines (AAQG) for NO_2 and CO. We note that the 1-hour NESAQ for NO_2 of 200 µg/m^3 used in this comparison is more stringent than the consent limit of 300 µg/m^3.

Table 6.5: Environmental Performance Indicators

Category	Measured value	Concentration (µg/m^3)			
		NO_2 - 1-hour average	**NO_2 - 24-hour average**	**CO - 1-hour average**	**CO - 8-hour average**
Action	Exceeds the guideline value.	>200	>100	>30,000	>10,000
Alert	Between 66% and 100% of the guideline value.	>132 and ≤200	>66 and ≤100	>19,800 and ≤30,000	6,600> and ≤10,000
Acceptable	Between 33% and 66 % of the guideline value.	>66 and ≤132	>33 and ≤66	>9,900 and ≤19,800	3,300> and ≤6,600

Category	Measured value	Concentration (µg/m³)			
		NO_2 - 1-hour average	NO_2 - 24-hour average	CO - 1-hour average	CO - 8-hour average
Good	Between 10% and 33% of the guideline value.	>20 and ≤66	>10 and ≤33	>3,000 and ≤9,900	>1,000 and ≤3,300
Excellent	Less than 10% of the guideline value.	≤20	≤10	≤3,000	≤1,000

Figure 6.6 shows a histogram of the monitoring results presented in EPI categories for NO_2 and CO measured at the boundary ambient monitoring site. Measured 1-hour average and 24-hour average NO_2 concentrations were within the "excellent" to "acceptable" categories for the monitoring period of November 2019 to January 2020. All measured 1-hour and 8-hour average CO concentrations were in the "excellent" category for the monitoring period.

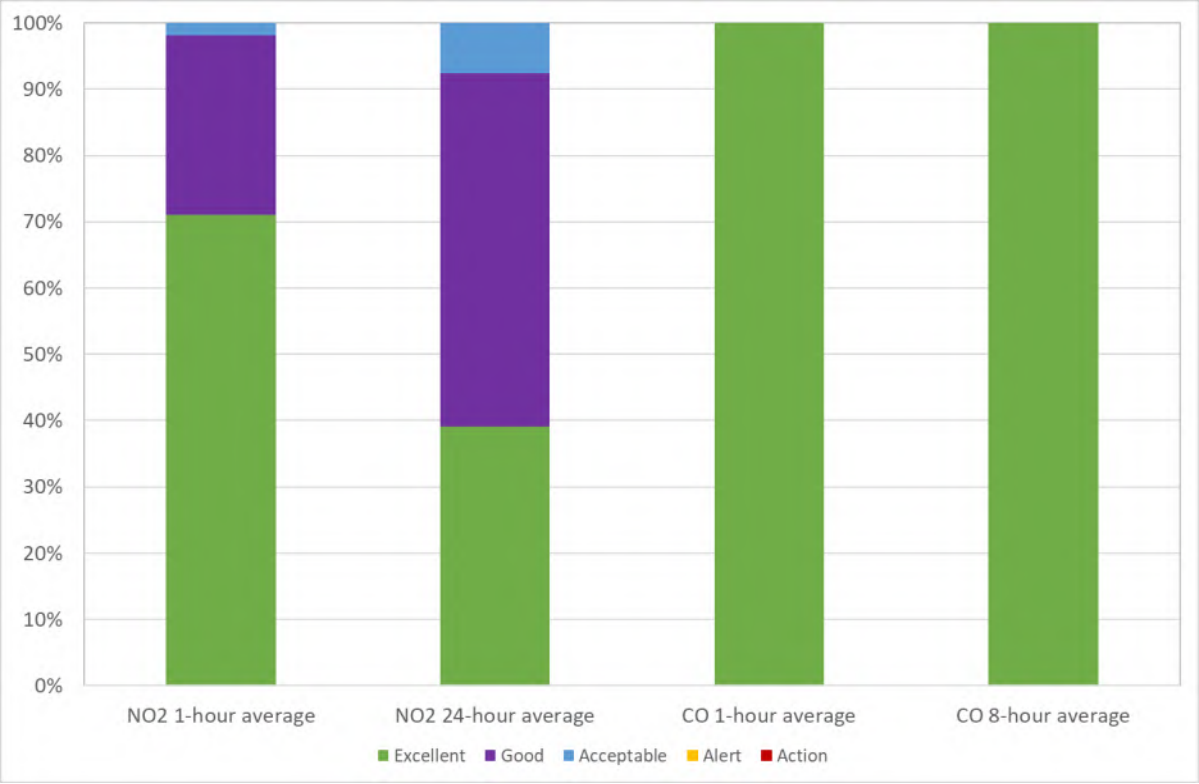


Figure 6.6: Comparison of monitored concentrations of NO_2 and CO to EPI categories, November 2019 to January 2020

6.2 Trace metal deposition monitoring

Trace metal deposition monitoring around the KGTP was undertaken as part of the air monitoring study. Dust deposition gauges were deployed by TPMC staff at three locations at the KGTP, which were located immediately south and east of the main processing area (refer to Figure 6.7). The dust deposition gauges were collected at 1-month intervals for the months of November 2019, December 2019 and January 2020. The dust deposition samples were analysed for a suite of metals by Watercare Services Ltd.

Figure 6.7: Metal deposition monitoring locations.

There are no ambient air criteria for deposited metals. Therefore, metal deposition rates have been compared to monitoring undertaken in previous years. Deposition rates at the three monitoring locations have historically been highest for potassium, vanadium and zinc. Graphical summaries of the potassium, vanadium and zinc deposition rates between 2008 and 2020 are presented in Figure 6.8 to Figure 6.10. The deposition rates of these metals have generally decreased since 2008, and deposition rates were similar during the reporting period (2017 to 2020).

The laboratory transcripts of dust deposition analysis carried out in November 2019, December 2019 and January 2020 are provided in Appendix A.

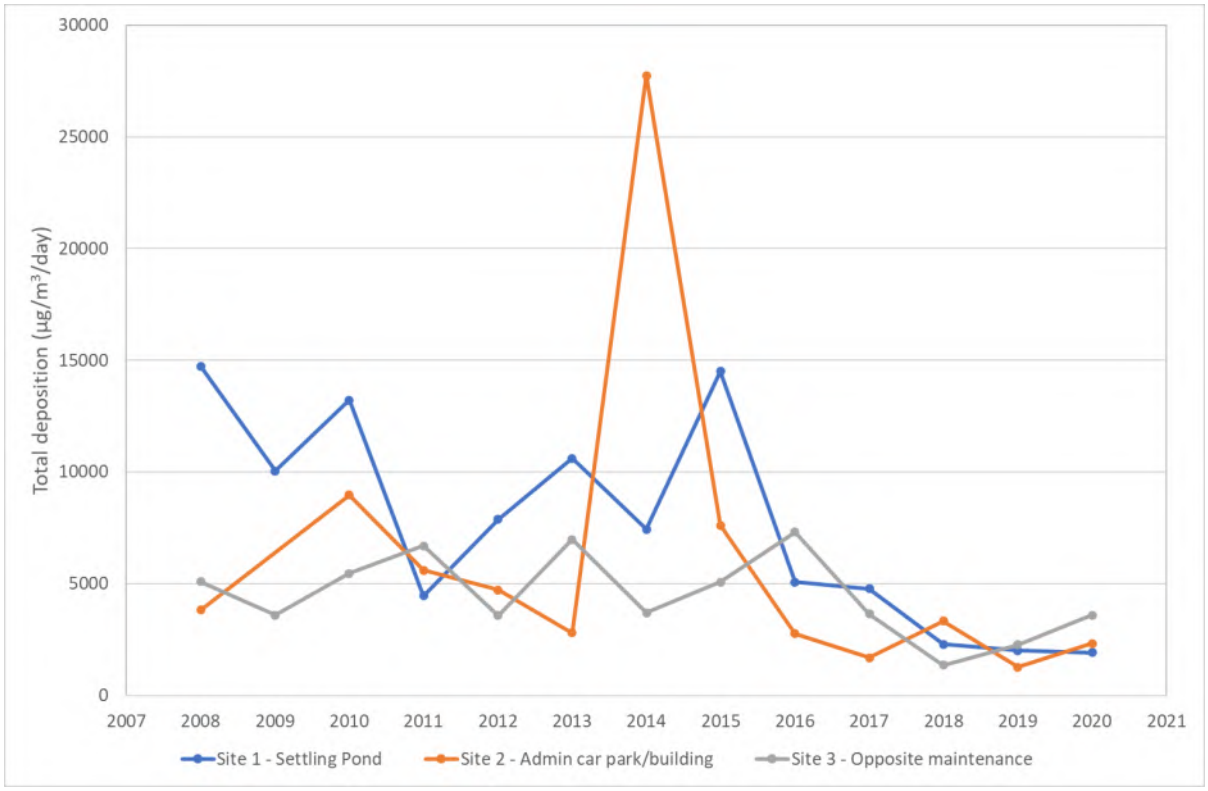


Figure 6.8: Total potassium deposition rates, 2008 - 2020

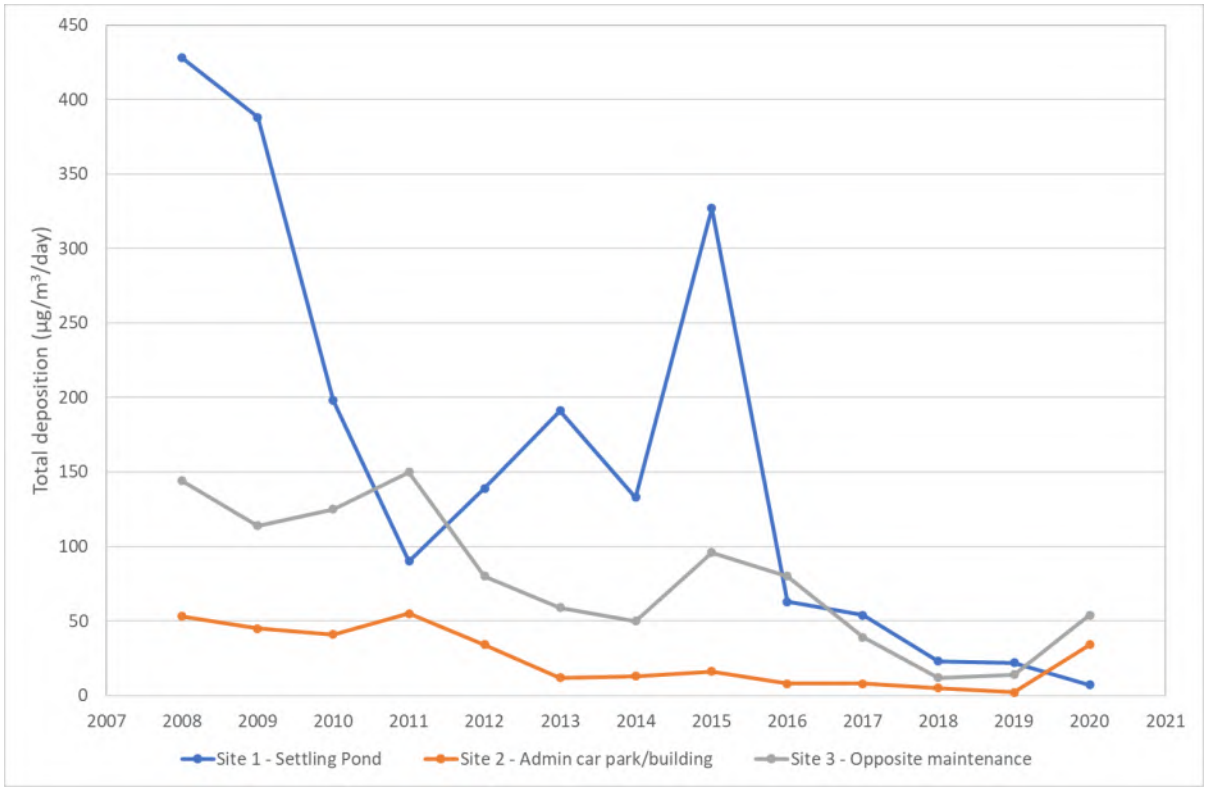


Figure 6.9: Total vanadium deposition rates, 2008 - 2020

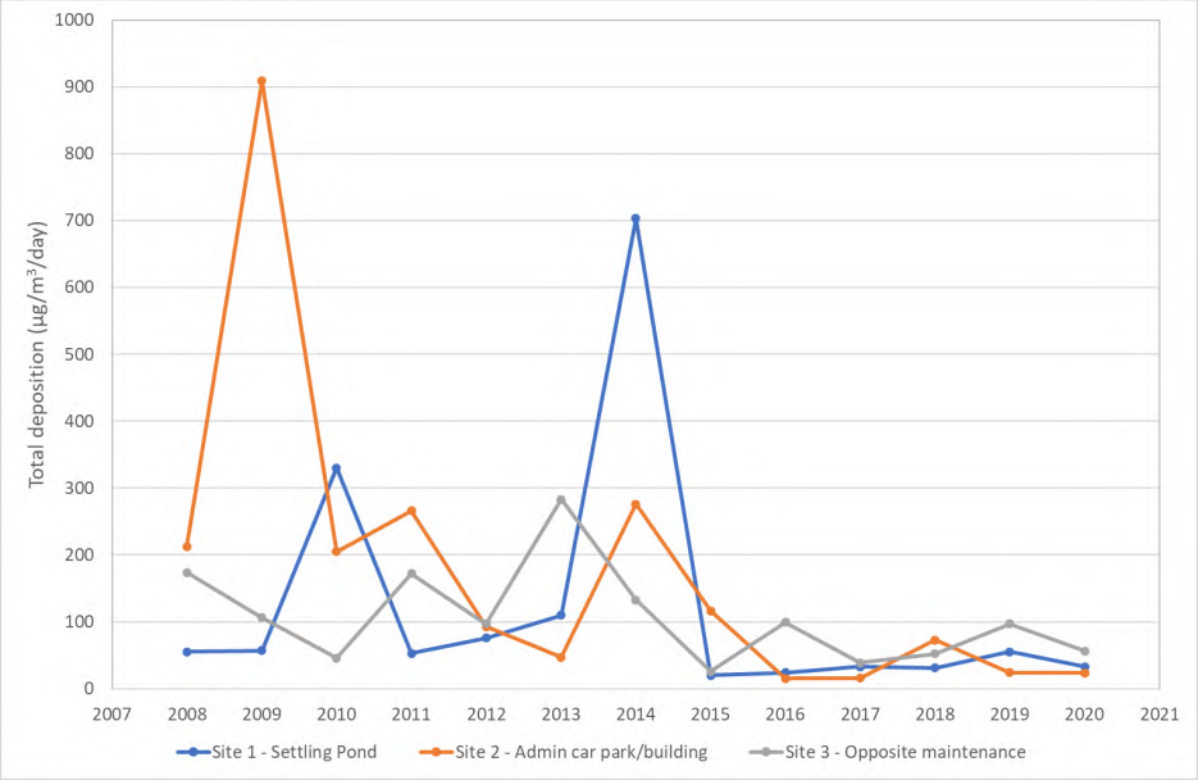


Figure 6.10: Total zinc deposition rates, 2008 - 2020

7 Conclusion

The triannual reporting required by Special Condition 4 of resource consent no. 4087-2 for the period September 2017 to August 2020 has been summarised in this report, with the following conclusions made:

- Vector transferred ownership of the KGTP to TPMC on 1 April 2020. This includes the KGTP and related assets and Vector's 50% interest in the Kapuni Energy Joint Venture.
- Annual CO_2 emissions to atmosphere from the KGTP have reduced between 2004 and 2019. Annual CO_2 emissions to atmosphere between 2017 and 2019 were consistent with previously reported emissions from 2016. The reduction in CO_2 emissions in recent years reflects reduced quantities of gas processed by the plant compared to previous years.
- The steam use per unit of gas processed at the site removed has decreased since 2004. This indicates a general improvement in the efficiency of CO_2 removal at the site over time. Since 2010, the annual steam use per unit of gas processed has been at relatively similar levels. The recent plateau may indicate the site is approaching a limit on further improvements to efficiency are possible with the current plant.
- TPMC reports that there have been no technological enhancements or further upgrades to improve energy efficiency at the KGTP in the reporting period.
- Ambient NO_2 and CO monitoring was undertaken between November 2019 and January 2020:
  - Data capture for nitrogen oxides, carbon monoxide and meteorological parameters were above 95% for the monitoring period.
  - There were no exceedances of the consented limits or the NESAQ for NO_2 and CO during the monitoring period.

  - Measured 1-hour average and 24-hour average NO_2 concentrations were win the "excellent" to "acceptable" categories during the monitoring period.
  - All measured 1-hour and 8-hour average CO concentrations were in the "excellent" category during the monitoring period.
- Metal deposition monitoring has been undertaken at the site between November 2019 and January 2020.
  - There are no ambient air criteria for deposited metals. Therefore, metal deposition rates have been compared to monitoring undertaken in previous years.
  - Deposition rates at the three monitoring locations have historically been highest for potassium, vanadium and zinc. The deposition rates of these metals have decreased since 2008, and deposition rates were similar during the reporting period (2017 to 2020).

8 Applicability

This report has been prepared for the exclusive use of our client Todd Petroleum Mining Company Ltd, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that this report will be used by Taranaki Regional Council in undertaking its regulatory functions in connection with air discharge permit.

Tonkin & Taylor Ltd

Report prepared by:	Authorised for Tonkin & Taylor Ltd by:
	
.....	.....
Dylan Vernall	Glen Nicholson
Environmental Scientist	Project Director

Report technically reviewed by: Richard Chilton – Senior Air Quality Scientist

DV
\\ttgroup.local\corporate\auckland\projects\1015030\issueddocuments\20201009.kgtp.aq monitoring report v2.docx

Appendix A: Metal deposition laboratory transcripts

Watercare Services Limited
52 Aintree Ave, Auckland Airport, Auckland, 2150
PO Box 107028, Auckland, 2150
T: (09) 539 7600
F: (09) 539 7601
clientsupport@water.co.nz
www.watercarelabs.co.nz

Certificate of Analysis
Laboratory Reference:191205-111

Attention:	Vilani Abeyratne	*Final Report:*	**355084-1**	*Replaces Report*	**355084-0**
Client:	**WATERCARE SERVICES LTD**	*Report Issue Date:*	**25-Feb-2020**		
Address:	**52 Aintree Avenue, Mangere, 2022**	*Received Date:*	**05-Dec-2019**		
Client Reference:	**Vector Kapuni**				
Purchase Order:	**LA-000590**	*Quote Reference :*	**10615**		

Note:
All dust guages were dry. 500 mL water was added to each dust guage for analysis. 100mL was used for metals analysis.
The remainder was used for suspended solids testing (all dust guages were then rinsed with 100 mL water to get all dust out, used entire remaining aliquots - 500mL - for Suspended Solids).
Total Beryllium included in Amended Certificate of Analysis

Sample Details		WATERS	WATERS	WATERS
Lab Sample ID:		**191205-111-1**	**191205-111-2**	**191205-111-3**
Client Sample ID:		31/10/19 - 02/12/19	31/10/19 - 02/12/19	31/10/19 - 02/12/19
Sample Date/Time		02/12/2019 13:45	02/12/2019 13:50	02/12/2019 13:55
Description:		Admin	Workshop	Ponds
General Testing				
Total Suspended Solids	mg/L	170	50	70
Volume (at room temp c. 20 °C)	mL	0 *	0 *	0 *
Metals				
Dissolved Metals by ICP-MS—Trace				
Antimony (Dissolved)	mg/L	<0.001	<0.001	<0.001
Arsenic (Dissolved)	mg/L	0.00035	<0.0001	<0.0001
Beryllium (Dissolved)	mg/L	<0.00005	<0.00005	<0.00005
Cadmium (Dissolved)	mg/L	0.00041	0.000056	<0.00005
Chromium (Dissolved)	mg/L	<0.0005	<0.0005	<0.0005
Cobalt (Dissolved)	mg/L	0.00019	<0.00003	<0.00003
Copper (Dissolved)	mg/L	0.0098	0.0014	0.0012
Iron (Dissolved)	mg/L	0.012	<0.002	<0.002
Lead (Dissolved)	mg/L	0.00015	<0.0001	<0.0001
Mercury (Dissolved)	mg/L	<0.00005	<0.00005	<0.00005
Molybdenum (Dissolved)	mg/L	0.00051	<0.0003	0.0033
Nickel (Dissolved)	mg/L	0.0011	0.00013	0.00014
Potassium (Dissolved)	mg/L	7.8	1.0	0.39
Selenium (Dissolved)	mg/L	<0.0005	<0.0005	<0.0005
Vanadium (Dissolved)	mg/L	0.006	0.034	0.0051
Zinc (Dissolved)	mg/L	0.014	0.012	0.016
Total Metals by ICP-MS—Trace (Default Digest)				
Antimony (Total)	mg/L	<0.001	<0.001	<0.001
Arsenic (Total)	mg/L	0.001	0.00018	<0.0001
Beryllium (Total)	mg/L	0.000053	<0.00005	<0.00005
Cadmium (Total)	mg/L	0.002	0.0001	<0.00005
Chromium (Total)	mg/L	0.0032	<0.0005	<0.0005
Cobalt (Total)	mg/L	0.00076	0.000064	0.000074
Copper (Total)	mg/L	0.04	0.0029	0.0025
Iron (Total)	mg/L	1.3	0.13	0.16
Lead (Total)	mg/L	0.0041	0.0011	0.00037
Mercury (Total)	mg/L	0.000072	<0.00005	<0.00005
Molybdenum (Total)	mg/L	0.0011	<0.0003	0.0036
Nickel (Total)	mg/L	0.0034	0.00028	0.00037
Potassium (Total)	mg/L	8.9	1.1	0.48
Selenium (Total)	mg/L	<0.0005	<0.0005	<0.0005

Sample Details (continued)		WATERS	WATERS	WATERS
Lab Sample ID:		**191205-111-1**	**191205-111-2**	**191205-111-3**
Client Sample ID:		31/10/19 - 02/12/19	31/10/19 - 02/12/19	31/10/19 - 02/12/19
Sample Date/Time:		02/12/2019 13:45	02/12/2019 13:50	02/12/2019 13:55
Description:		Admin	Workshop	Ponds
Metals				
Total Metals by ICP-MS—Trace (Default Digest)				
Vanadium (Total)	mg/L	0.019	0.038	0.007
Zinc (Total)	mg/L	0.14	0.03	0.03

*Results marked with * are not accredited to International Accreditation New Zealand*

Where samples have been supplied by the client they are tested as received. A dash indicates no test performed.

Reference Methods

The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
General Testing				
Total Suspended Solids by Gravimetry	In House based on APHA (online edition) 2540 D, E	1 mg/L	All	Auckland
Volume (at room temp c. 20 °C) by Volumetry	Not Applicable	mL	All	Auckland
Metals				
Dissolved Metals by ICP-MS—Trace				
Antimony (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	All	Auckland
Arsenic (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	All	Auckland
Beryllium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00005 mg/L	All	Auckland
Cadmium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00005 mg/L	All	Auckland
Chromium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.0005 mg/L	All	Auckland
Cobalt (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00003 mg/L	All	Auckland
Copper (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.0002 mg/L	All	Auckland
Iron (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.002 mg/L	All	Auckland
Lead (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	All	Auckland
Mercury (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00005 mg/L	All	Auckland
Molybdenum (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.0003 mg/L	All	Auckland
Nickel (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	All	Auckland
Potassium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.05 mg/L	All	Auckland
Selenium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.0005 mg/L	All	Auckland
Vanadium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	All	Auckland
Zinc (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	All	Auckland
Total Metals by ICP-MS—Trace (Default Digest)				
Antimony (Total)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	All	Auckland
Arsenic (Total)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	All	Auckland
Beryllium (Total)	APHA (online edition) 3125 B by ICPMS	0.00005 mg/L	All	Auckland
Cadmium (Total)	APHA (online edition) 3125 B by ICPMS	0.00005 mg/L	All	Auckland
Chromium (Total)	APHA (online edition) 3125 B by ICPMS	0.0005 mg/L	All	Auckland
Cobalt (Total)	APHA (online edition) 3125 B by ICPMS	0.00003 mg/L	All	Auckland
Copper (Total)	APHA (online edition) 3125 B by ICPMS	0.0002 mg/L	All	Auckland
Iron (Total)	APHA (online edition) 3125 B by ICPMS	0.002 mg/L	All	Auckland
Lead (Total)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	All	Auckland
Mercury (Total)	APHA (online edition) 3125 B by ICPMS	0.00005 mg/L	All	Auckland
Molybdenum (Total)	APHA (online edition) 3125 B by ICPMS	0.0003 mg/L	All	Auckland
Nickel (Total)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	All	Auckland
Potassium (Total)	APHA (online edition) 3125 B by ICPMS	0.05 mg/L	All	Auckland
Selenium (Total)	APHA (online edition) 3125 B by ICPMS	0.0005 mg/L	All	Auckland
Vanadium (Total)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	All	Auckland
Zinc (Total)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	All	Auckland
Preparations				
0.45 µm Filtration for Dissolved Metals	APHA (online edition) 3010B (modified)		All	Auckland
Digest for Total Metals in Liquids	In House (4:1 Nitric:Hydrochloric Acid, 95°C 2 hours)		All	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Operations Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

Watercare Laboratory Services is a division of Watercare Services Limited .

Anel Du Preez
KTP Signatory

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www.watercarelabs.co.nz

Certificate of Analysis
Laboratory Reference:200110-133

Attention:	Vilani Abeyratne	*Final Report:*	**350563-0**
Client:	**WATERCARE SERVICES LTD**	*Report Issue Date:*	**21-Jan-2020**
Address:	**52 Aintree Avenue, Mangere, 2022**	*Received Date:*	**10-Jan-2020**
Client Reference:	**Vector Kapuni**		
Purchase Order:	**LA-000590**	*Quote Reference :*	**10615**

Sample Details		WATERS	WATERS	WATERS
Lab Sample ID:		**200110-133-1**	**200110-133-2**	**200110-133-3**
Client Sample ID:		02/12/19 - 03/01/20	02/12/19 - 03/01/20	02/12/19 - 03/01/20
Sample Date/Time		03/01/2020 01:45	03/01/2020 01:55	03/01/2020 01:50
Description:		Admin	Workshop	Ponds
General Testing				
Total Suspended Solids	mg/L	78	29	50
Volume (at room temp c. 20 °C)	mL	3 *	3 *	4 *
Metals				
Dissolved Metals by ICP-MS—Trace				
Antimony (Dissolved)	mg/L	<0.001	<0.001	<0.001
Arsenic (Dissolved)	mg/L	0.00014	0.00015	0.00039
Beryllium (Dissolved)	mg/L	<0.00005	<0.00005	<0.00005
Cadmium (Dissolved)	mg/L	0.00011	0.0004	0.0002
Chromium (Dissolved)	mg/L	<0.0005	<0.0005	<0.0005
Cobalt (Dissolved)	mg/L	0.000038	<0.00003	0.000068
Copper (Dissolved)	mg/L	<0.0002	0.00031	0.00089
Iron (Dissolved)	mg/L	<0.002	<0.002	0.009
Lead (Dissolved)	mg/L	<0.0001	<0.0001	0.00042
Mercury (Dissolved)	mg/L	<0.00005	<0.00005	<0.00005
Molybdenum (Dissolved)	mg/L	<0.0003	<0.0003	0.0032
Nickel (Dissolved)	mg/L	<0.0001	0.00012	<0.0001
Potassium (Dissolved)	mg/L	0.38	2.4	0.99
Selenium (Dissolved)	mg/L	<0.0005	<0.0005	<0.0005
Vanadium (Dissolved)	mg/L	<0.001	0.033	0.0083
Zinc (Dissolved)	mg/L	0.0097	0.033	0.15
Total Metals by ICP-MS—Trace (Default Digest)				
Antimony (Total)	mg/L	<0.001	<0.001	<0.001
Arsenic (Total)	mg/L	0.00021	0.00023	0.00049
Beryllium (Total)	mg/L	<0.00005	<0.00005	<0.00005
Cadmium (Total)	mg/L	0.0007	0.00059	0.00022
Chromium (Total)	mg/L	<0.0005	<0.0005	<0.0005
Cobalt (Total)	mg/L	0.000084	0.000031	0.000077
Copper (Total)	mg/L	0.002	0.00092	0.0013
Iron (Total)	mg/L	0.045	0.034	0.026
Lead (Total)	mg/L	0.00015	0.00027	0.0012
Mercury (Total)	mg/L	<0.00005	<0.00005	<0.00005
Molybdenum (Total)	mg/L	<0.0003	<0.0003	0.0033
Nickel (Total)	mg/L	0.00016	0.00032	0.0002
Potassium (Total)	mg/L	0.58	3.1	1.2
Selenium (Total)	mg/L	<0.0005	<0.0005	<0.0005
Vanadium (Total)	mg/L	<0.001	0.038	0.0095
Zinc (Total)	mg/L	0.024	0.044	0.18

*Results marked with * are not accredited to International Accreditation New Zealand*

Where samples have been supplied by the client they are tested as received. A dash indicates no test performed.

Reference Methods

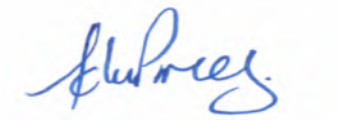
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
General Testing				
Total Suspended Solids by Gravimetry	In House based on APHA (online edition) 2540 D, E	1 mg/L	All	Auckland
Volume (at room temp c. 20 °C) by Volumetry	Not Applicable	mL	All	Auckland
Metals				
Dissolved Metals by ICP-MS—Trace				
Antimony (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	All	Auckland
Arsenic (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	All	Auckland
Beryllium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00005 mg/L	All	Auckland
Cadmium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00005 mg/L	All	Auckland
Chromium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.0005 mg/L	All	Auckland
Cobalt (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00003 mg/L	All	Auckland
Copper (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.0002 mg/L	All	Auckland
Iron (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.002 mg/L	All	Auckland
Lead (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	All	Auckland
Mercury (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00005 mg/L	All	Auckland
Molybdenum (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.0003 mg/L	All	Auckland
Nickel (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	All	Auckland
Potassium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.05 mg/L	All	Auckland
Selenium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.0005 mg/L	All	Auckland
Vanadium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	All	Auckland
Zinc (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	All	Auckland
Total Metals by ICP-MS—Trace (Default Digest)				
Antimony (Total)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	All	Auckland
Arsenic (Total)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	All	Auckland
Beryllium (Total)	APHA (online edition) 3125 B by ICPMS	0.00005 mg/L	All	Auckland
Cadmium (Total)	APHA (online edition) 3125 B by ICPMS	0.00005 mg/L	All	Auckland
Chromium (Total)	APHA (online edition) 3125 B by ICPMS	0.0005 mg/L	All	Auckland
Cobalt (Total)	APHA (online edition) 3125 B by ICPMS	0.00003 mg/L	All	Auckland
Copper (Total)	APHA (online edition) 3125 B by ICPMS	0.0002 mg/L	All	Auckland
Iron (Total)	APHA (online edition) 3125 B by ICPMS	0.002 mg/L	All	Auckland
Lead (Total)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	All	Auckland
Mercury (Total)	APHA (online edition) 3125 B by ICPMS	0.00005 mg/L	All	Auckland
Molybdenum (Total)	APHA (online edition) 3125 B by ICPMS	0.0003 mg/L	All	Auckland
Nickel (Total)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	All	Auckland
Potassium (Total)	APHA (online edition) 3125 B by ICPMS	0.05 mg/L	All	Auckland
Selenium (Total)	APHA (online edition) 3125 B by ICPMS	0.0005 mg/L	All	Auckland
Vanadium (Total)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	All	Auckland
Zinc (Total)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	All	Auckland
Preparations				
0.45 µm Filtration for Dissolved Metals	APHA (online edition) 3010B (modified)		All	Auckland
Digest for Total Metals in Liquids	In House (4:1 Nitric:Hydrochloric Acid, 95°C 2 hours)		All	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Operations Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

Watercare Laboratory Services is a division of Watercare Services Limited .



Anel Du Preez
KTP Signatory

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clientsupport@water.co.nz
www.watercarelabs.co.nz

Certificate of Analysis
Laboratory Reference:200214-181

Attention:	Kath Mcleod	*Final Report:*	**355766-0**	*Replaces Report*	**355092-1**
Client:	**WATERCARE SERVICES LTD**	*Report Issue Date:*	**03-Mar-2020**		
Address:	**52 Aintree Avenue, Mangere, 2022**	*Received Date:*	**14-Feb-2020**		
Client Reference:	**Vector Kapuni**				
Purchase Order:	**LA-000590**	*Quote Reference :*	**10615**		

Amended report: Original report failed to generate.

Sample Details		WATERS	WATERS	WATERS
Lab Sample ID:		**200214-181-1**	**200214-181-4**	**200214-181-5**
Client Sample ID:				
Sample Date/Time		04/02/2020 15:35	04/02/2020 15:50	04/02/2020 15:40
Description:		Admin	Workshop	Ponds
General Testing				
Total Suspended Solids	mg/L	59	47	57
Volume (at room temp c. 20 °C)	mL	500 *	500 *	500 *
Metals				
Dissolved Metals by ICP-MS—Trace				
Antimony (Dissolved)	mg/L	<0.001	<0.001	<0.001
Arsenic (Dissolved)	mg/L	<0.0001	0.00029	0.00024
Beryllium (Dissolved)	mg/L	<0.00005	<0.00005	<0.00005
Cadmium (Dissolved)	mg/L	0.00051	0.00025	0.000067
Chromium (Dissolved)	mg/L	<0.0005	<0.0005	<0.0005
Cobalt (Dissolved)	mg/L	0.000078	0.000091	0.000099
Copper (Dissolved)	mg/L	0.0023	0.0043	0.0058
Iron (Dissolved)	mg/L	0.0037	0.0094	0.014
Lead (Dissolved)	mg/L	<0.0001	0.00026	0.00055
Mercury (Dissolved)	mg/L	<0.00005	<0.00005	<0.00005
Molybdenum (Dissolved)	mg/L	<0.0003	0.00071	0.011
Nickel (Dissolved)	mg/L	0.00029	0.00048	0.00094
Potassium (Dissolved)	mg/L	1.8	6.5	16
Selenium (Dissolved)	mg/L	<0.0005	<0.0005	<0.0005
Vanadium (Dissolved)	mg/L	0.018	0.1	0.24
Zinc (Dissolved)	mg/L	0.013	0.027	0.038
Total Metals by ICP-MS—Trace (Default Digest)				
Antimony (Total)	mg/L	<0.001	<0.001	<0.001
Arsenic (Total)	mg/L	0.00029	0.00069	0.00055
Beryllium (Total)	mg/L	<0.00005	<0.00005	<0.00005
Cadmium (Total)	mg/L	0.00085	0.00061	0.00013
Chromium (Total)	mg/L	0.00052	0.00083	0.0017
Cobalt (Total)	mg/L	0.00018	0.00031	0.00035
Copper (Total)	mg/L	0.0045	0.0076	0.0092
Iron (Total)	mg/L	0.32	0.45	0.69
Lead (Total)	mg/L	0.0015	0.0088	0.0086
Mercury (Total)	mg/L	0.000052	<0.00005	0.00046
Molybdenum (Total)	mg/L	<0.0003	0.00084	0.012
Nickel (Total)	mg/L	0.00052	0.0019	0.0038
Potassium (Total)	mg/L	2.1	9.8	20
Selenium (Total)	mg/L	<0.0005	<0.0005	<0.0005
Vanadium (Total)	mg/L	0.023	0.13	0.31
Zinc (Total)	mg/L	0.033	0.069	0.13

*Results marked with * are not accredited to International Accreditation New Zealand*

Where samples have been supplied by the client they are tested as received. A dash indicates no test performed.

Reference Methods

The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
General Testing				
Total Suspended Solids by Gravimetry	In House based on APHA (online edition) 2540 D, E	1 mg/L	All	Auckland
Volume (at room temp c. 20 °C) by Volumetry	Not Applicable	mL	All	Auckland
Metals				
Dissolved Metals by ICP-MS—Trace				
Antimony (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	All	Auckland
Arsenic (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	All	Auckland
Beryllium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00005 mg/L	All	Auckland
Cadmium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00005 mg/L	All	Auckland
Chromium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.0005 mg/L	All	Auckland
Cobalt (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00003 mg/L	All	Auckland
Copper (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.0002 mg/L	All	Auckland
Iron (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.002 mg/L	All	Auckland
Lead (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	All	Auckland
Mercury (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00005 mg/L	All	Auckland
Molybdenum (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.0003 mg/L	All	Auckland
Nickel (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	All	Auckland
Potassium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.05 mg/L	All	Auckland
Selenium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.0005 mg/L	All	Auckland
Vanadium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	All	Auckland
Zinc (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	All	Auckland
Total Metals by ICP-MS—Trace (Default Digest)				
Antimony (Total)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	All	Auckland
Arsenic (Total)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	All	Auckland
Beryllium (Total)	APHA (online edition) 3125 B by ICPMS	0.00005 mg/L	All	Auckland
Cadmium (Total)	APHA (online edition) 3125 B by ICPMS	0.00005 mg/L	All	Auckland
Chromium (Total)	APHA (online edition) 3125 B by ICPMS	0.0005 mg/L	All	Auckland
Cobalt (Total)	APHA (online edition) 3125 B by ICPMS	0.00003 mg/L	All	Auckland
Copper (Total)	APHA (online edition) 3125 B by ICPMS	0.0002 mg/L	All	Auckland
Iron (Total)	APHA (online edition) 3125 B by ICPMS	0.002 mg/L	All	Auckland
Lead (Total)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	All	Auckland
Mercury (Total)	APHA (online edition) 3125 B by ICPMS	0.00005 mg/L	All	Auckland
Molybdenum (Total)	APHA (online edition) 3125 B by ICPMS	0.0003 mg/L	All	Auckland
Nickel (Total)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	All	Auckland
Potassium (Total)	APHA (online edition) 3125 B by ICPMS	0.05 mg/L	All	Auckland
Selenium (Total)	APHA (online edition) 3125 B by ICPMS	0.0005 mg/L	All	Auckland
Vanadium (Total)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	All	Auckland
Zinc (Total)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	All	Auckland
Preparations				
0.45 µm Filtration for Dissolved Metals	APHA (online edition) 3010B (modified)		All	Auckland
Digest for Total Metals in Liquids	In House (4:1 Nitric:Hydrochloric Acid, 95°C 2 hours)		All	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Operations Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

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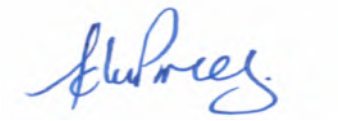

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Certificate of Analysis
Laboratory Reference:200130-211

Attention:	Kath Mcleod	*Final Report:*	**355335-0**
Client:	**WATERCARE SERVICES LTD**	*Report Issue Date:*	**26-Feb-2020**
Address:	**52 Aintree Avenue, Mangere, 2022**	*Received Date:*	**30-Jan-2020**
Client Reference:	**Vector Kapuni**		
Purchase Order:	**LA-000590**	*Quote Reference :*	**10615**

Sample Details		WATERS
Lab Sample ID:		**200130-211-1**
Client Sample ID:		
Sample Date/Time		30/01/2020
Description:		Blank - Preservative
General Testing		
Volume (at room temp c. 20 °C)	mL	1000 *
Metals		
Dissolved Metals by ICP-MS—Trace		
Antimony (Dissolved)	mg/L	<0.002
Arsenic (Dissolved)	mg/L	<0.0002
Beryllium (Dissolved)	mg/L	<0.00005
Cadmium (Dissolved)	mg/L	<0.0001
Chromium (Dissolved)	mg/L	<0.001
Cobalt (Dissolved)	mg/L	<0.00006
Copper (Dissolved)	mg/L	<0.0004
Iron (Dissolved)	mg/L	<0.004
Lead (Dissolved)	mg/L	<0.0002
Mercury (Dissolved)	mg/L	<0.0001
Molybdenum (Dissolved)	mg/L	<0.0006
Nickel (Dissolved)	mg/L	<0.0002
Potassium (Dissolved)	mg/L	<0.1
Selenium (Dissolved)	mg/L	<0.001
Vanadium (Dissolved)	mg/L	<0.002
Zinc (Dissolved)	mg/L	<0.002
Total Metals by ICP-MS—Trace (Default Digest)		
Antimony (Total)	mg/L	0.0012
Arsenic (Total)	mg/L	0.00013
Beryllium (Total)	mg/L	<0.0001
Cadmium (Total)	mg/L	<0.00005
Chromium (Total)	mg/L	<0.0005
Cobalt (Total)	mg/L	<0.00003
Copper (Total)	mg/L	<0.0002
Iron (Total)	mg/L	<0.002
Lead (Total)	mg/L	<0.0001
Mercury (Total)	mg/L	<0.0001
Molybdenum (Total)	mg/L	<0.0003
Nickel (Total)	mg/L	<0.0001
Potassium (Total)	mg/L	<0.05
Selenium (Total)	mg/L	<0.001
Vanadium (Total)	mg/L	<0.001
Zinc (Total)	mg/L	<0.001

*Results marked with * are not accredited to International Accreditation New Zealand*

Where samples have been supplied by the client they are tested as received. A dash indicates no test performed.

Reference Methods

The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
General Testing				
Volume (at room temp c. 20 °C) by Volumetry	Not Applicable	mL	All	Auckland
Metals				
Dissolved Metals by ICP-MS—Trace				
Antimony (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	All	Auckland
Arsenic (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	All	Auckland
Beryllium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00005 mg/L	All	Auckland
Cadmium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00005 mg/L	All	Auckland
Chromium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.0005 mg/L	All	Auckland
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Copper (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.0002 mg/L	All	Auckland
Iron (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.002 mg/L	All	Auckland
Lead (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	All	Auckland
Mercury (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00005 mg/L	All	Auckland
Molybdenum (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.0003 mg/L	All	Auckland
Nickel (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.00010 mg/L	All	Auckland
Potassium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.05 mg/L	All	Auckland
Selenium (Dissolved)	APHA (online edition) 3125 B by ICPMS	0.0005 mg/L	All	Auckland
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Total Metals by ICP-MS—Trace (Default Digest)				
Antimony (Total)	APHA (online edition) 3125 B by ICPMS	0.001 mg/L	All	Auckland
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0.45 µm Filtration for Dissolved Metals	APHA (online edition) 3010B (modified)		All	Auckland
Digest for Total Metals in Liquids	In House (4:1 Nitric:Hydrochloric Acid, 95°C 2 hours)		All	Auckland

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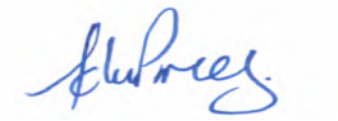

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Appendix III

Ambient air quality monitoring
November 2019- January 2020

Vector, Kapuni

Ambient Air Quality Monitoring Summary Report November 2019 to January 2020

Prepared for

Vector, Kapuni

By

Watercare Laboratory Services

IANZ ACCREDITED LABORATORY

Tests indicated as not accredited are outside the scope of the laboratory's accreditation

Air Quality Department

AQ-2020-042

Ambient Air Quality Monitoring
November 2019 to January 2020

A report for:

Vector, Kapuni
298 Palmer Road
Kapuni
New Zealand

14 April 2020

Prepared by:

Watercare Services Limited
Laboratory Services – Air Quality Department
52 Aintree Avenue
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Manukau, 2022

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Watercare report number: AQ-2020-042
Watercare reference: 19-58678

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Ambient Data - Team Leader & KTP
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Watercare Services Ltd

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Tables

Figures

Summary

This report contains ambient air quality results for Vector Limited, Kapuni in Taranaki. The parameters were monitored from November 2019 to January 2020. The pollutants monitored for this report were:

- Carbon Monoxide (CO)
- Nitrogen Oxides (NO and NO_2)
- Meteorological parameters (Ambient Temperature, Relative Humidity, Wind Speed and Wind Direction,

The monitoring was conducted by Watercare, on behalf of Vector, Kapuni. This monitoring was undertaken to compare the results with previously conducted ambient air quality monitoring projects.

Ambient air quality monitoring at Vector, Kapuni for the period of November 2019 to January 2020 showed:

- Carbon Monoxide (CO)
  - The CO maximum 1-hour average concentration was 1.7 mg/m³ (27/01/2020 08:00).
  - The CO maximum 8-hour average concentration was 0.9 mg/m³ (07/01/2020 05:00).
  - Valid data for CO monitored was 98%.
  - On average CO concentrations were higher during December 2019.
  - Very slightly elevated CO hourly concentrations occurred from 20:00 to 10:00.
  - There were higher (>1.0 mg/m) CO hourly concentrations from the west-northwest and northwest.
  - CO environmental performance indicators were all in the excellent category.
- Nitrogen Oxides (NO and NO_2)
  - The NO_2 maximum 1-hour average concentration was 98.6 µg/m³ (05/12/2019 16:00).
  - The NO_2 maximum 24-hour average concentration was 98.6 ppb (21/01/2020 09:00).
  - Valid data for NO_2 monitored was 98%.
  - On average NO_2 concentrations for September and October were similar and higher than November.
  - Elevated (>10 ppb) NO_2 hourly concentrations occurred from 22:00 to 09:00 except for 03:00 (during automatic calibrations).
  - There were higher (>100 ppb) NO_2 hourly concentrations from the west-northwest and northwest.
  - NO_2 environmental performance indicators were in the acceptable to excellent categories.
- Meteorological parameters
  - Valid data for ambient temperature and relative humidity was 100%.
  - Valid data for wind speed and wind direction was 100%.
  - The predominant wind direction was from the northwest.

1 Introduction

Vector Limited, Kapuni commissioned Watercare to conduct continuous monitoring of carbon monoxide (CO), oxides of nitrogen (NO and NO_2) and meteorological parameters at the Vector, Kapuni in Taranaki. The monitoring was carried out to examine ambient air quality east of the plant operations.

For the reporting period from November 2019 to January 2020, the gaseous instruments have been adjusted for span and zero instrument drift using the results from automatic and manual calibrations. All data in this report have been validated. Quality assurance checks have been carried out to ensure that invalid and calibration data are not reported.

This report presents:

- a summary of ambient air quality guidelines and standards
- an overview of the relevant guideline and standards
- monitoring site descriptions
- an overview of the methods used to monitor parameters
- site performance
- comparison to the relevant ambient air quality guidelines and standards
- data summary and statistics
- analyser instrument history

2 Ambient Air Quality Guidelines and Standards

The measurements of air quality made at vector, Kapuni can be compared with various air quality guidelines or standards. The Ministry for the Environment (MfE) National Environmental Standards (NES) for air quality superseded the Ambient Air Quality Guidelines (AAQG) 2002 in some areas. These limits are listed in Table 1.

Table 1: AAQG (2002) and NES

Contaminant	Averaging Period	MfE AAQG	MfE NES
Carbon Monoxide (CO)	1-hour	30 mg/m³	No standard
	8-hour	10 mg/m³	10mg/m³ with 1 exceedence per year
Nitrogen Dioxide (NO_2)	1-hour	200 µg/m³	200µg/m³ with 9 exceedences per year
	24-hour	100 µg/m³	No standard

3 New Zealand Environmental Performance Indicators

In order to provide guidance on when improvement should be required, the MfE has provided Environmental Performance Indicators (EPI) for air quality, as set out in Table 2. These indicators can act as both indicators of poor air quality and goals which policy can work towards achieving.

Table 2: Environmental Performance Indicators for Air Quality

Category	Maximum Measured Value	Comment
Action	Exceeds guideline	Completely unacceptable by national and international standards
Alert	Between 66% and 100% of the guideline	Warning level, which can lead to guidelines being exceeded if trends are not curbed
Acceptable	Between 33% and 66% of the guideline	A broad category, where maximum values might be of concern in some sensitive locations, but are generally at a level which does not warrant dramatic action
Good	Between 10% and 33% of the guideline	Peak measurements in this range are unlikely to affect air quality
Excellent	Less than 10% of the guideline	Of little concern. If maximum values are less than a tenth of the guideline, average values are likely to be much less

4 Site Description

Vector, Kapuni			
Site Address	298 Palmer Road, Kapuni, Taranaki		
Site ID	AQGLTAR001	**Site Class**	Industrial
Site Coordinates (NZTM)		E1701101	N5629536

Description

Kapuni is approximately 50 kilometres south of New Plymouth. Vector is located north east of the small Kaponga township. The local topography is flat farmland with Mount Taranaki to the north. Neighbouring industrial sites include Shell Todd Oil Services which lies adjacent to the plant in the north and Ballance Agri-Nutrients to the west (across the road).

The ambient air quality monitoring station (Figure 1) was located 10 m from the eastern boundary of Vector, Kapuni, 330 m east of Palmer Road and 60m south of the Kapuni Stream. The site was commissioned on 31 October 2019 and decommissioned on the 27 February 2020. Valid data commenced 01 November 2019 and ended 27 February 2020. The equipment was owned and operated by Watercare Services Ltd on behalf of Vector, Kapuni.

The shed and sample inlet were sited in accordance with AS/NZ 3580.1.1 - 2016 Ambient Air – Guide for the Siting of Sampling Units. The ambient air quality monitoring station location was selected by Vector, Kapuni. Previous continuous ambient monitoring with Watercare were undertaken at this location in 2004 and 2008.

Pollutants (at 3m)	CO and NO_x
Weather Parameters (at 6m)	Wind, Ambient Temperature and Relative Humidity

Site Location

Figure 1: Map of the Air Quality Monitoring Site

5 Methods

5.1 Quality Assurance

All monitoring services undertaken by Watercare were in accordance with the MfE 'Good Practice Guide for Air Quality Monitoring and Data Management' (GPG) 2009. Watercare is accredited by International Accreditation New Zealand (IANZ) for the following relevant methods:

- AS 3580.7.1 – 2011: Determination of carbon monoxide – Direct-reading instrumental method.
- AS 3580.5.1 – 2011: Determination of oxides of nitrogen – Direct-reading instrumental method.

All pollutant results in this summary report have been validated and calculated to standard temperature (0°C) and pressure (1 atm). The instruments continuously measure the parameters allowing data to be analysed and reported from 10-minute data points to a variety of average periods, including 1-hour, 24-hour and one year. All data are stored as time ending averages and at New Zealand Standard Time (NZST). Watercare provided the following monitoring services:

- Instrument operation, calibration and maintenance:
  This included monthly visits and the use of automatic alternate day calibration systems for all continuous gas monitors. This ensured that the requirements of the relevant Australian Standards for weekly calibration of continuous analysers were met.
- Data logging, daily polling, checking, validation, peer review and reporting:
  This encompassed the entire data quality assurance process ensuring that the final data set reported is correct and valid data capture is achieved. Data was logged onsite and download at regular intervals during the day via a wireless router to Watercare's data management and reporting software. Subsequently, the data is checked, validated and reported in line with the GPG.

5.2 Carbon Monoxide

Measurements were made in accordance with AS 3580.7.1 – 2011 using an API model T300. The instrument was an infrared absorption gas analyser which continuously measures carbon monoxide. The CO analysers operated with a full-scale measurement range of 0 – 50 ppm. The estimated relative expanded uncertainty of measurement at the 95% confidence interval for CO was 11.3% of the reading.

5.3 Nitrogen Oxides

Measurements were made in accordance with AS 3580.5.1 – 2011 using an API model 200E. The instrument was a chemiluminescence gas analyser which continuously measures nitrogen oxides. The NO_2 analysers operated with a full-scale measurement range of 0 - 1000 ppb. The estimated relative expanded uncertainty of measurement at the 95% confidence interval for NO_2 was 10.7% of the reading.

5.4 Meteorological Parameters

Measurements were made with reference to AS 3580.14 – 2014: Meteorological monitoring for ambient air quality monitoring applications and Watercare's quality system. Watercare is not accredited for method AS 3580.14 – 2014. Ambient temperature, relative humidity, wind speed and wind direction were measured using a Vaisala model WXT520.

6 Results

This section provides the site performance and an overview of the results for CO, NO_2 and meteorological parameters.

6.1 Site Performance

The MfE GPG 2009 suggests that it is difficult to reach anything close to 100% valid data for long-term monitoring. As such site performance has been evaluated against a target of 95%. The per cent of valid data is defined as the per cent of valid data following quality assurance adjustments. Table 2 describes overall site performance

Table 3: Site Performance – November 2019 to January 2020

Parameter	Averaging period	Valid data (%)	Site notes
CO	10-min	98%	-
NO_2	10-min	98%	-
Ambient Temperature	10 min	100	-
Relative Humidity	10 min	100	-
Wind Speed	10 min	100	-
Wind Direction	10 min	100	-

6.2 Carbon Monoxide (CO)

Table 4 presents a statistical summary of validated CO 1-hour and 8-hour averages that have been calculated from 10-minute averages. There were no exceedences of the ambient air quality standard or guidelines listed in Table 1. The results of CO measured from November 2019 to January 2020 are shown graphically in Figure 2 to Figure 6.

Table 4: CO Statistics and Exceedences – November 2019 to January 2020

CO (mg/m^3)	Maximum	Minimum	Average	Exceedence(s)
November 2019				
CO 1-hour	0.6	0.0	0.1	None
CO 8-hour	0.4	0.0	0.1	None
December 2019				
CO 1-hour	1.2	0.0	0.2	None
CO 8-hour	0.9	0.0	0.2	None
January 2020				
CO 1-hour	1.7	0.0	0.1	None
CO 8-hour	0.7	0.0	0.1	None
November 2019 to January 2020				
CO 1-hour	1.7 27/01/2020 08:00	0.0 06/12/2019 05:00	0.1	None
CO 8-hour	0.9 05/12/2019	0.0 24/12/2019	0.1	None

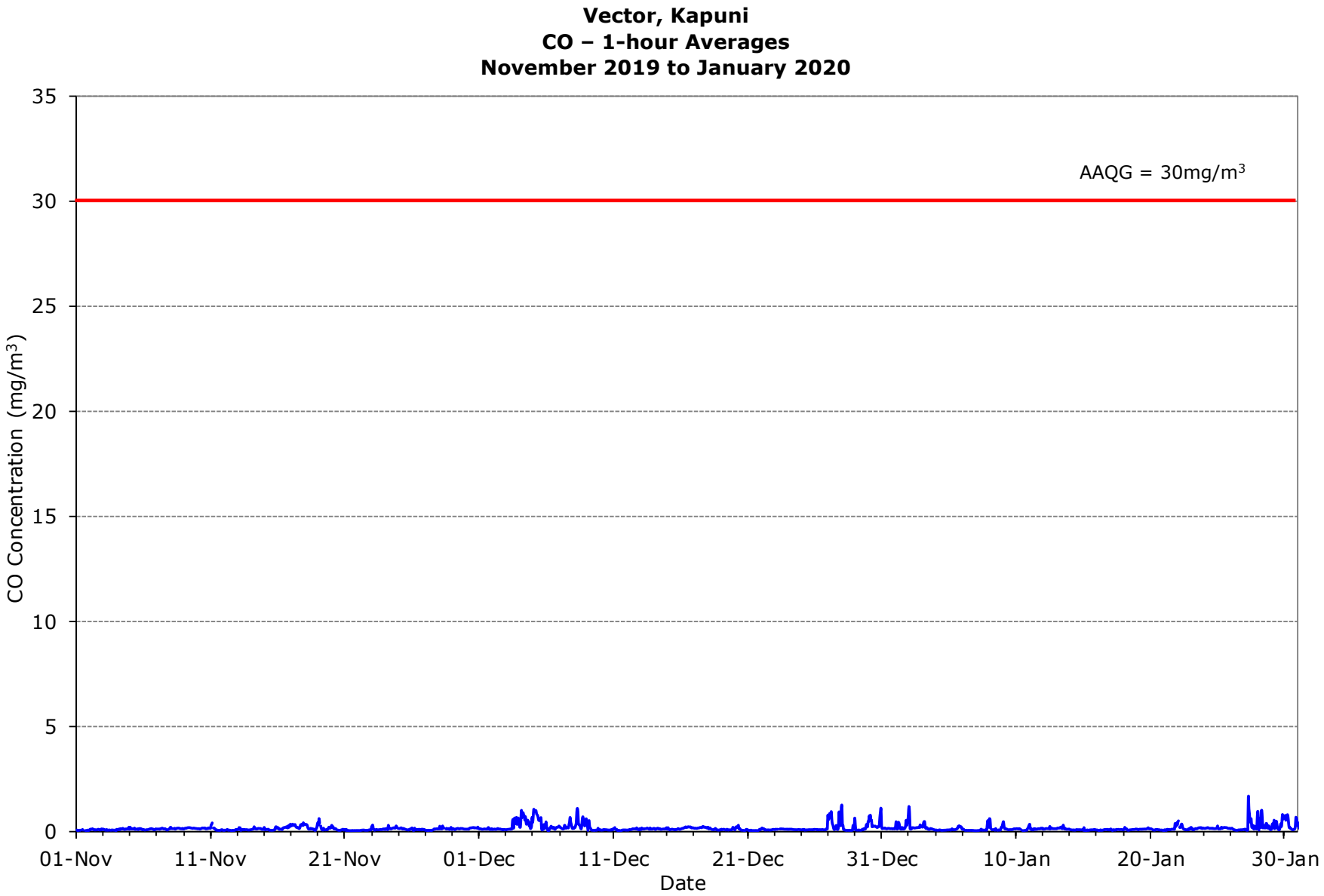


Figure 2: Vector, Kapuni: CO (1-hour averages)

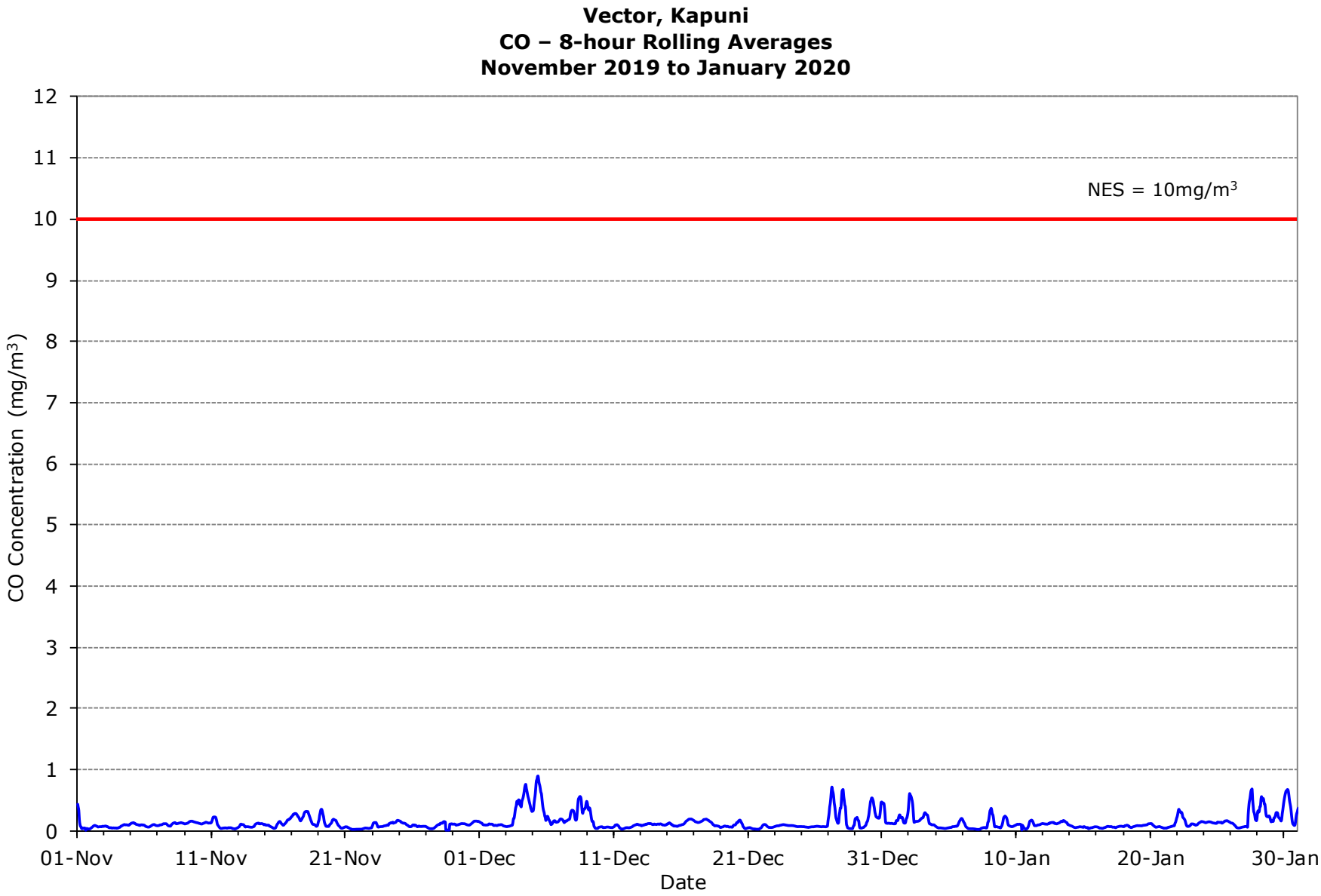


Figure 3: Vector, Kapuni: CO (8-hour rolling averages)

Vector, Kapuni
CO Pollution Rose – 1-hour Averages
November 2019 to January 2020

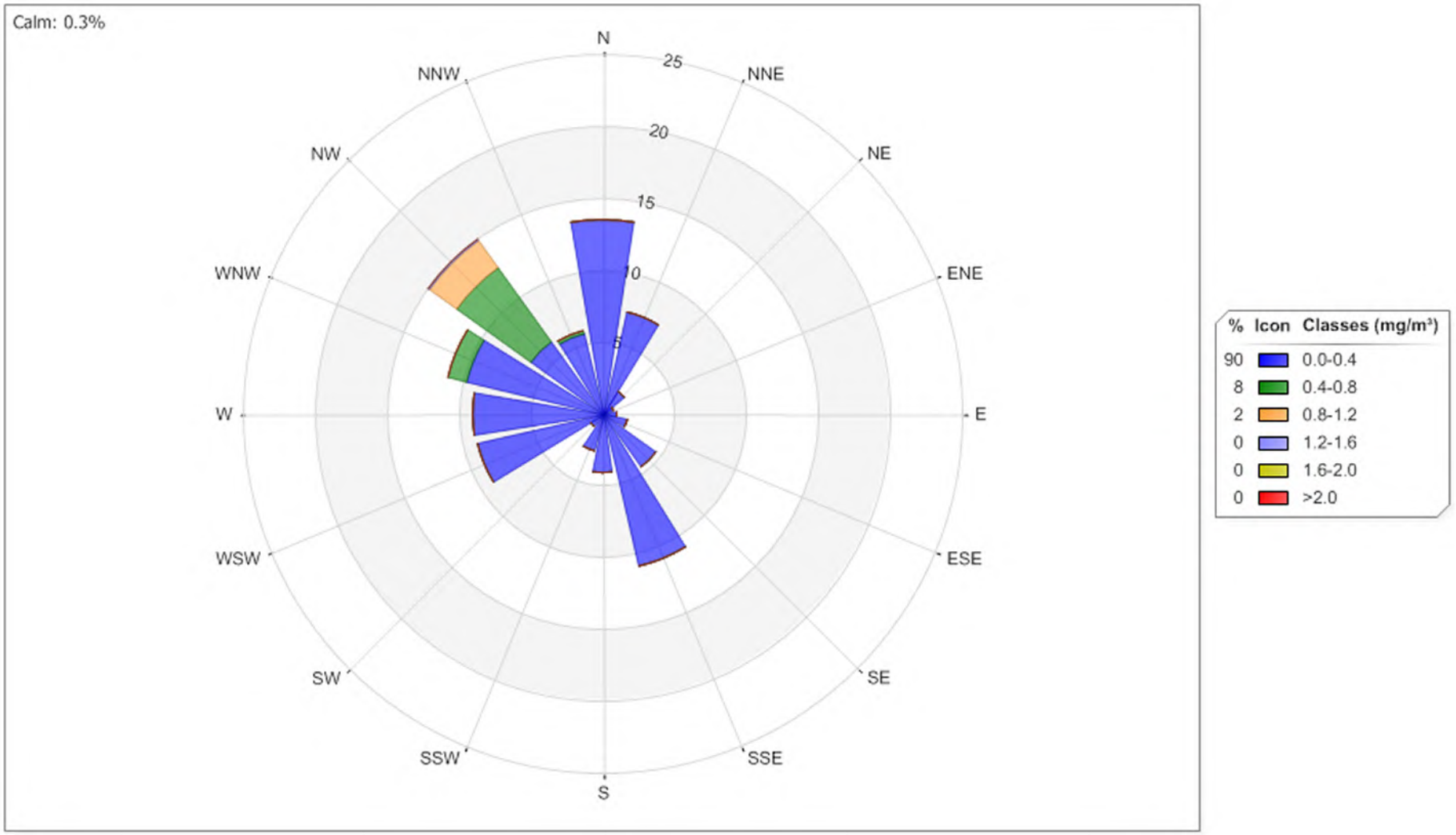


Figure 4: Vector, Kapuni: CO Pollution Rose (1-hour averages)

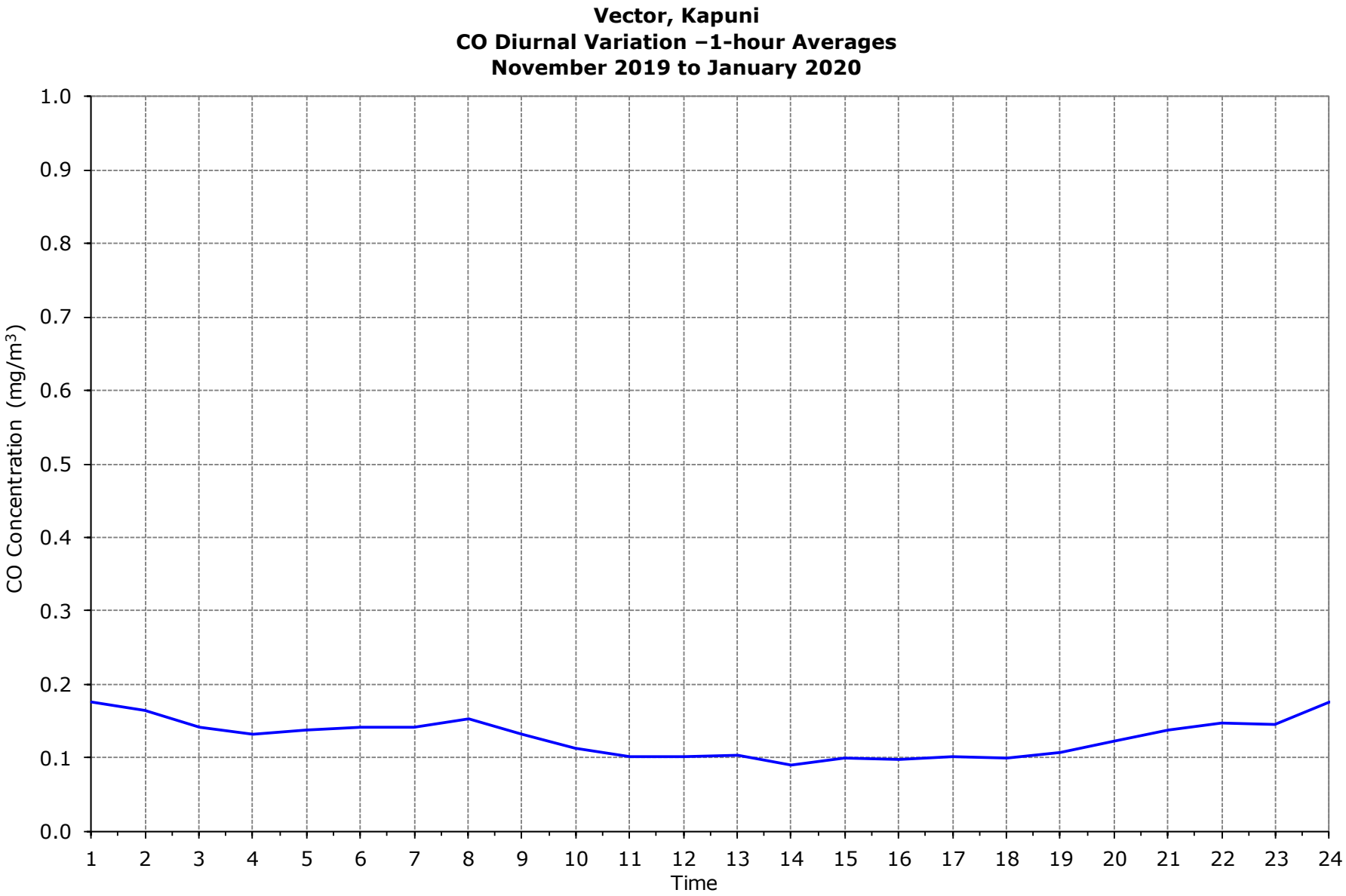
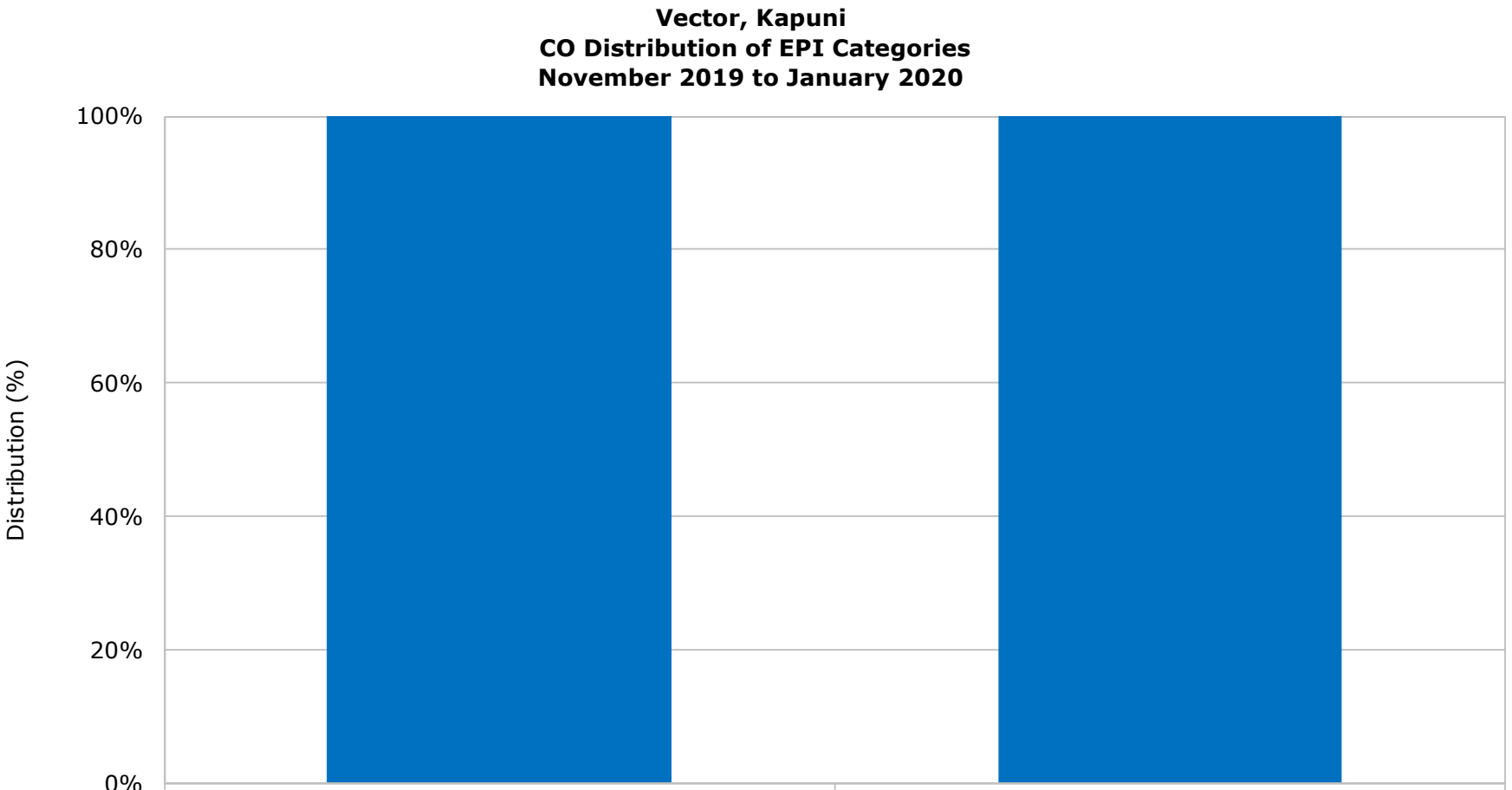


Figure 5: Vector, Kapuni: CO Diurnal Variation (1-hour averages)



Site	Vector, Kapuni 1hr	Vector, Kapuni 8hr
Action	0.0%	0.0%
Alert	0.0%	0.0%
Acceptable	0.0%	0.0%
Good	0.0%	0.0%
Excellent	100.0%	100.0%

Figure 6: Vector, Kapuni: CO Comparison of EPI Categories (1-hour and 8-hour averages)

6.3 Nitrogen Dioxide (NO_2)

Table 5 presents a statistical summary of validated NO_2 1-hour and 24-hour averages that have been calculated from 10-minute averages. There were no exceedences of the ambient air quality standard or guidelines listed in Table 1. The results of NO_2 measured from November 2019 to January 2020 are shown graphically in Figure 7 to Figure 12.

Table 5: NO_2 Statistics and Exceedences – November 2019 to January 2020

NO_2 (µg/m^3)	Maximum	Minimum	Average	Exceedence(s)
November 2019				
NO_2 1-hour	93.5	0.4	15.9	None
NO_2 24-hour	52.7	2.2	15.9	None
December 2019				
NO_2 1-hour	98.6	0.4	14.7	None
NO_2 24-hour	61.6	1.4	14.1	None
January 2020				
NO_2 1-hour	71.6	0.3	15.0	None
NO_2 24-hour	29.2	3.1	14.8	None
November 2019 to January 2020				
NO_2 1-hour	98.6 05/12/2019 16:00	0.3 19/01/2020 13:00	15.2	None
NO_2 24-hour	61.6 05/12/2019	2.7 24/12/2019	15.2	None

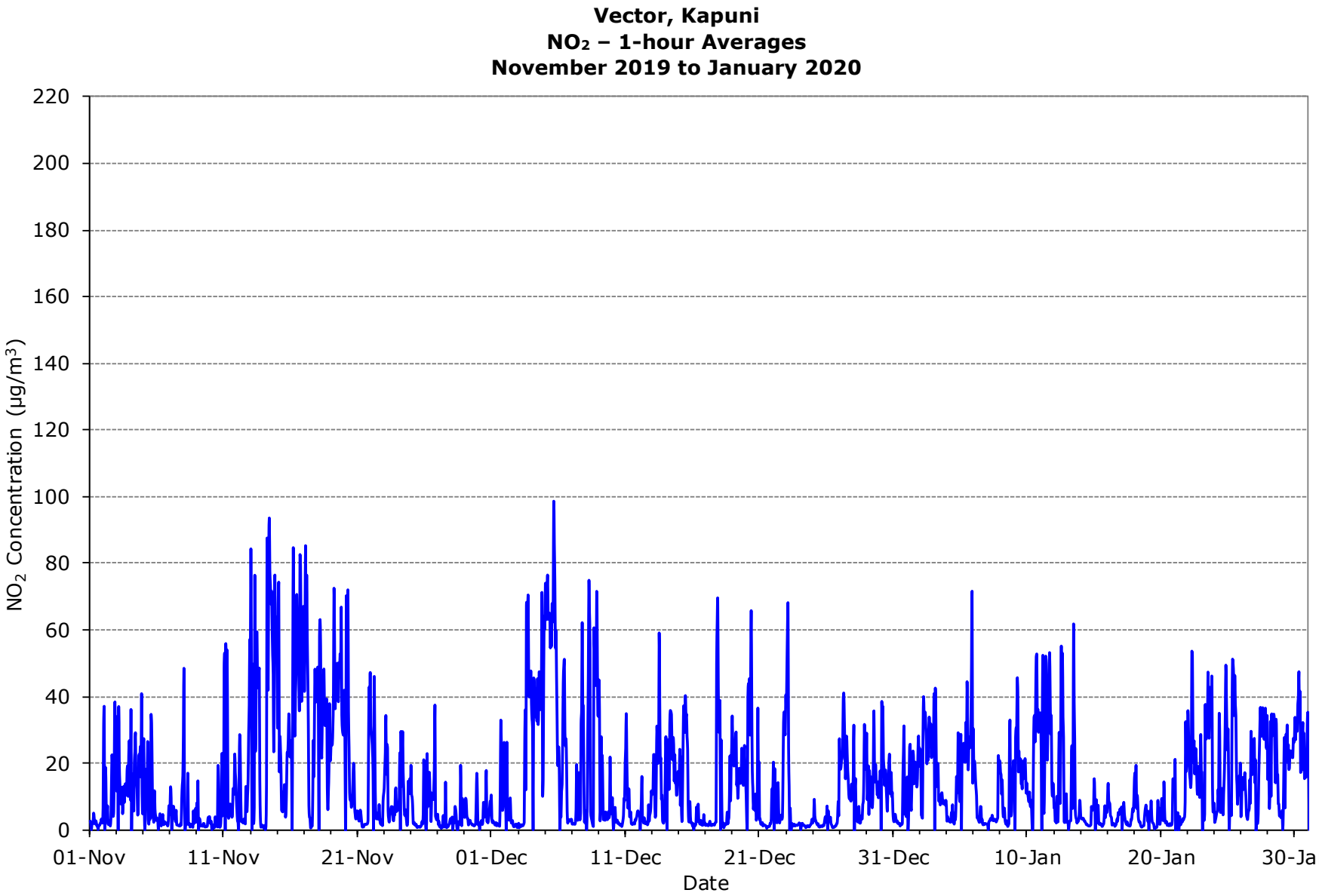


Figure 7: Vector, Kapuni: NO_2 (1-hour averages)

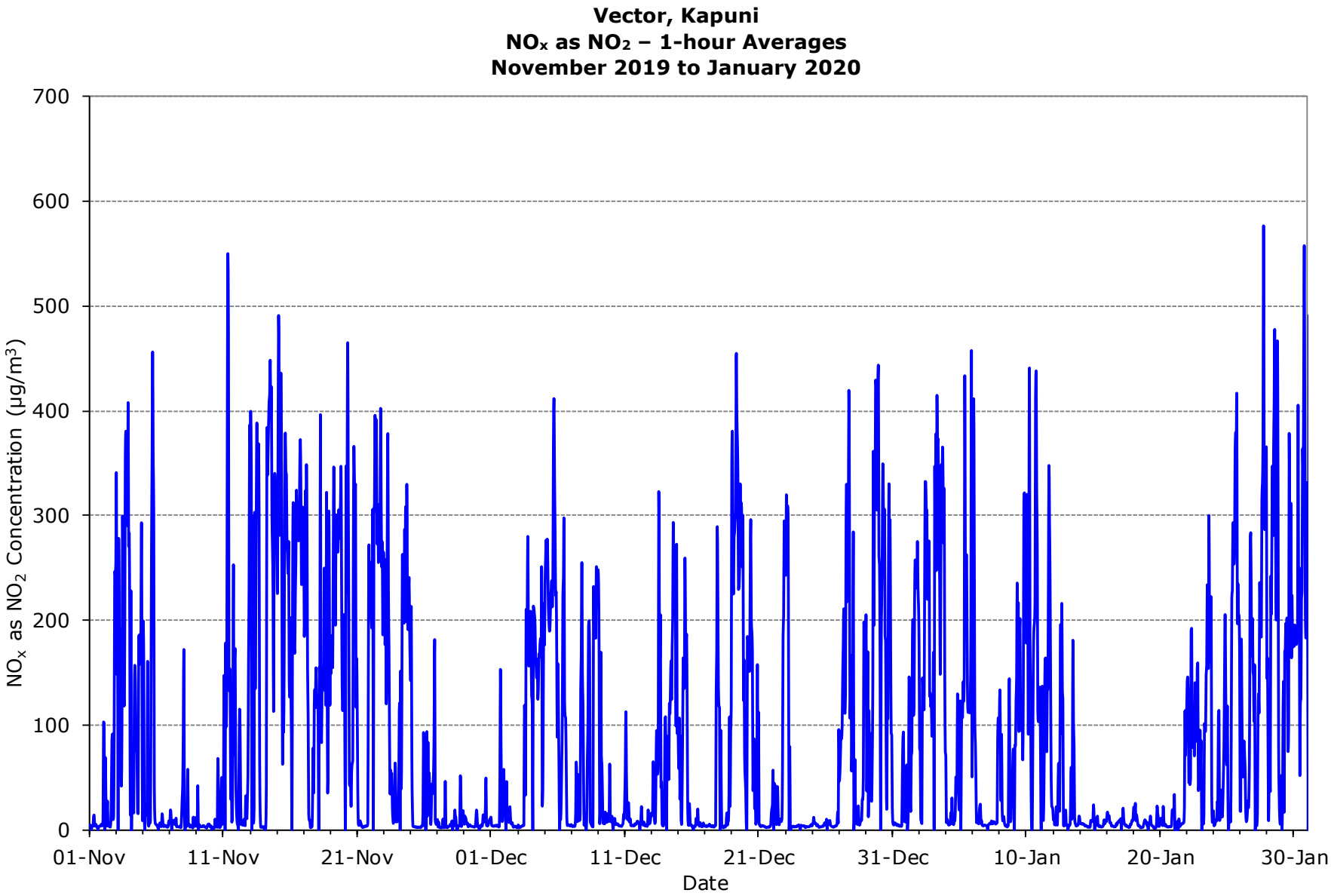


Figure 8: Vector, Kapuni: NO_x as NO_2 (1-hour averages)

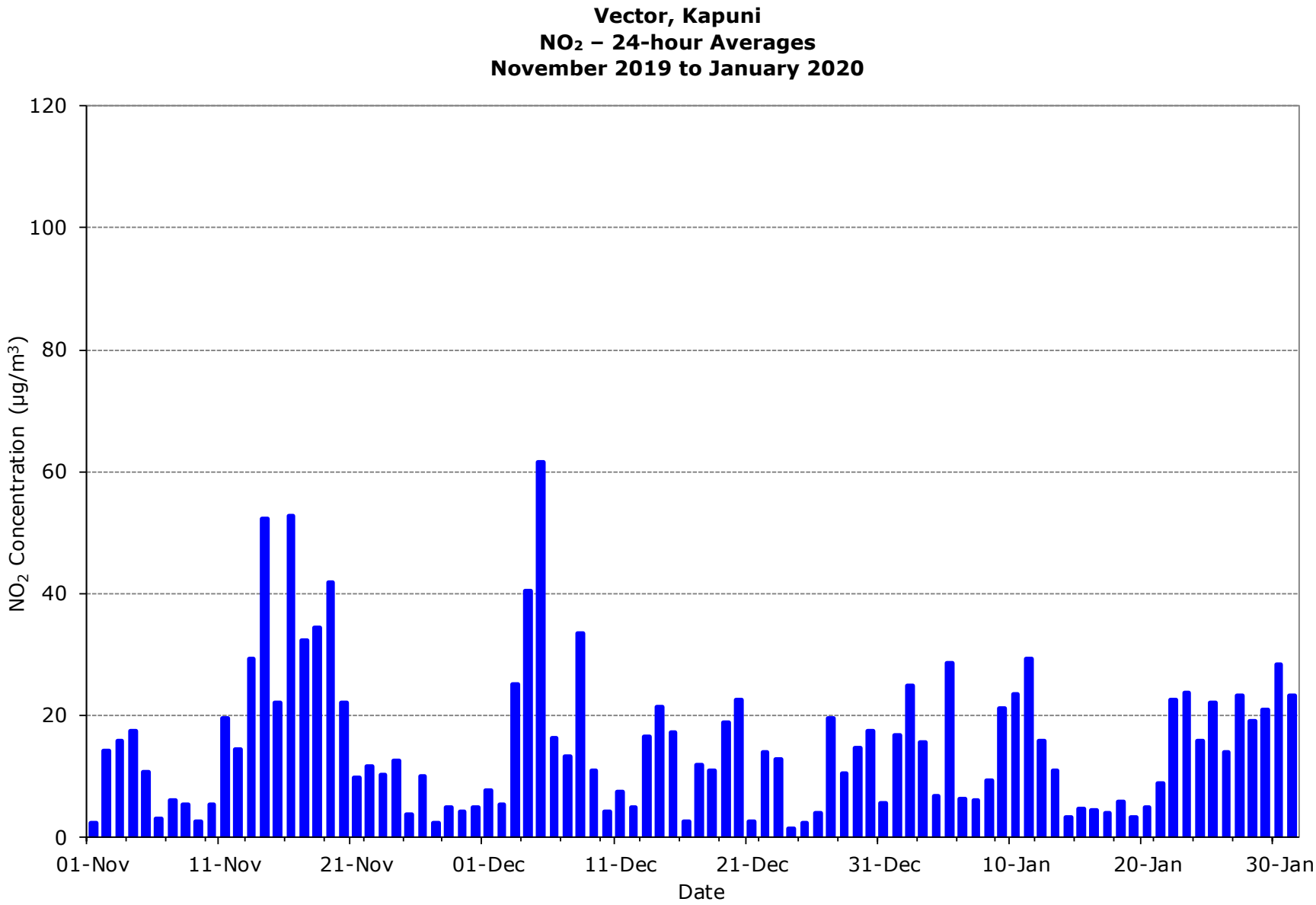


Figure 9: Vector, Kapuni: NO_2 (24-hour averages)

Vector, Kapuni
NO_2 Pollution Rose – 1-hour Averages
November 2019 to January 2020

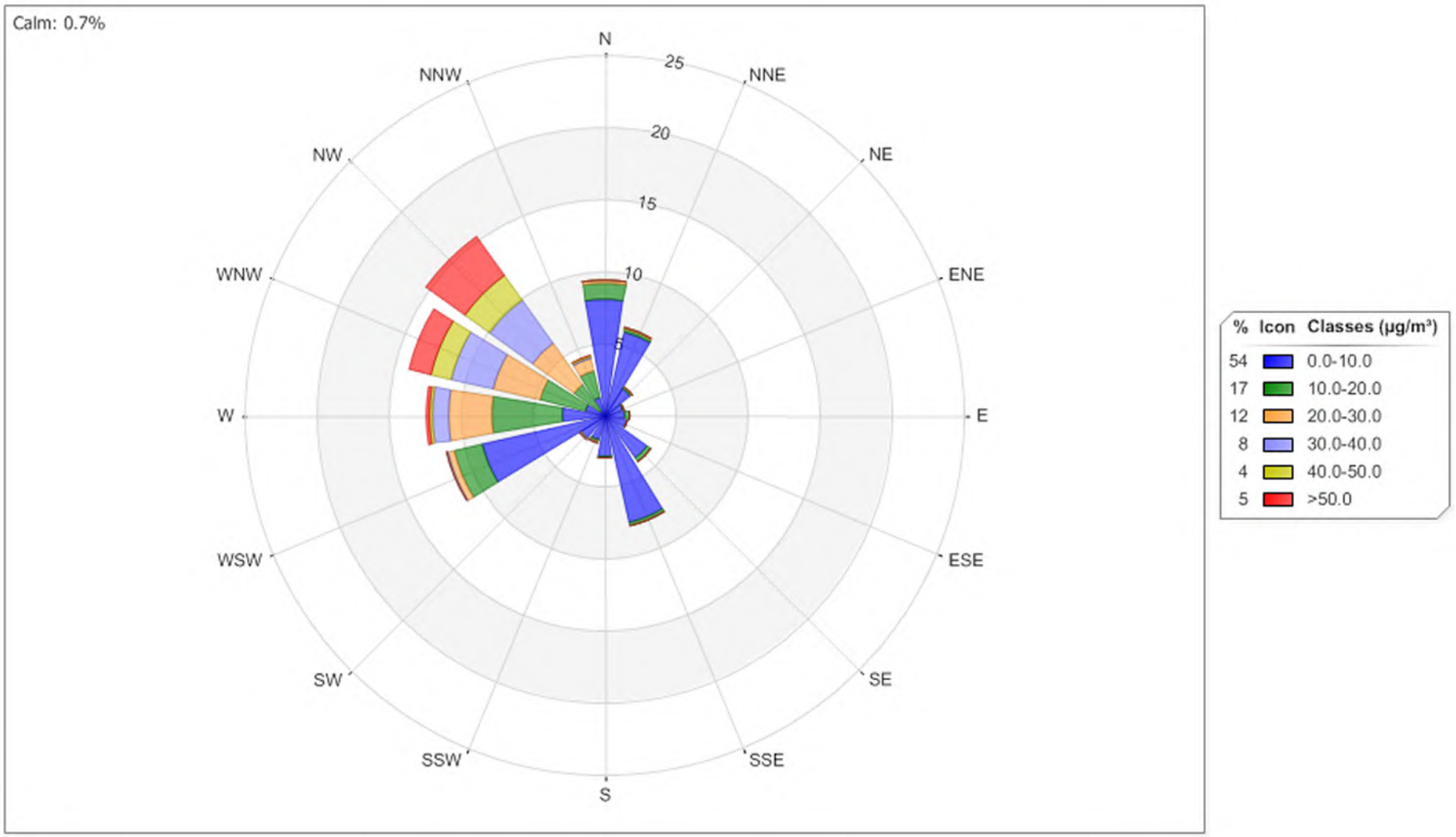


Figure 10: Vector, Kapuni: NO_2 Pollution Rose (1-hour averages)

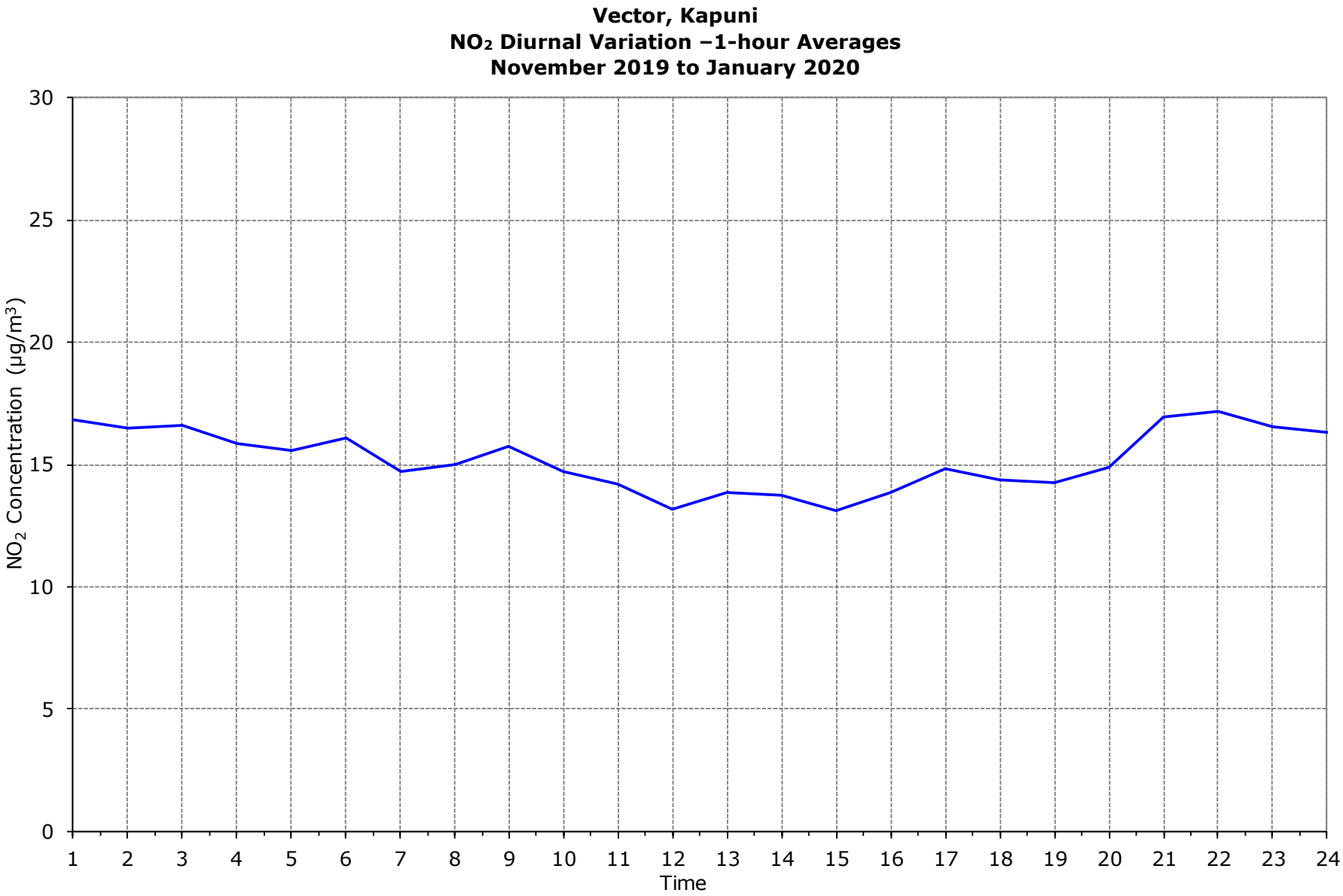
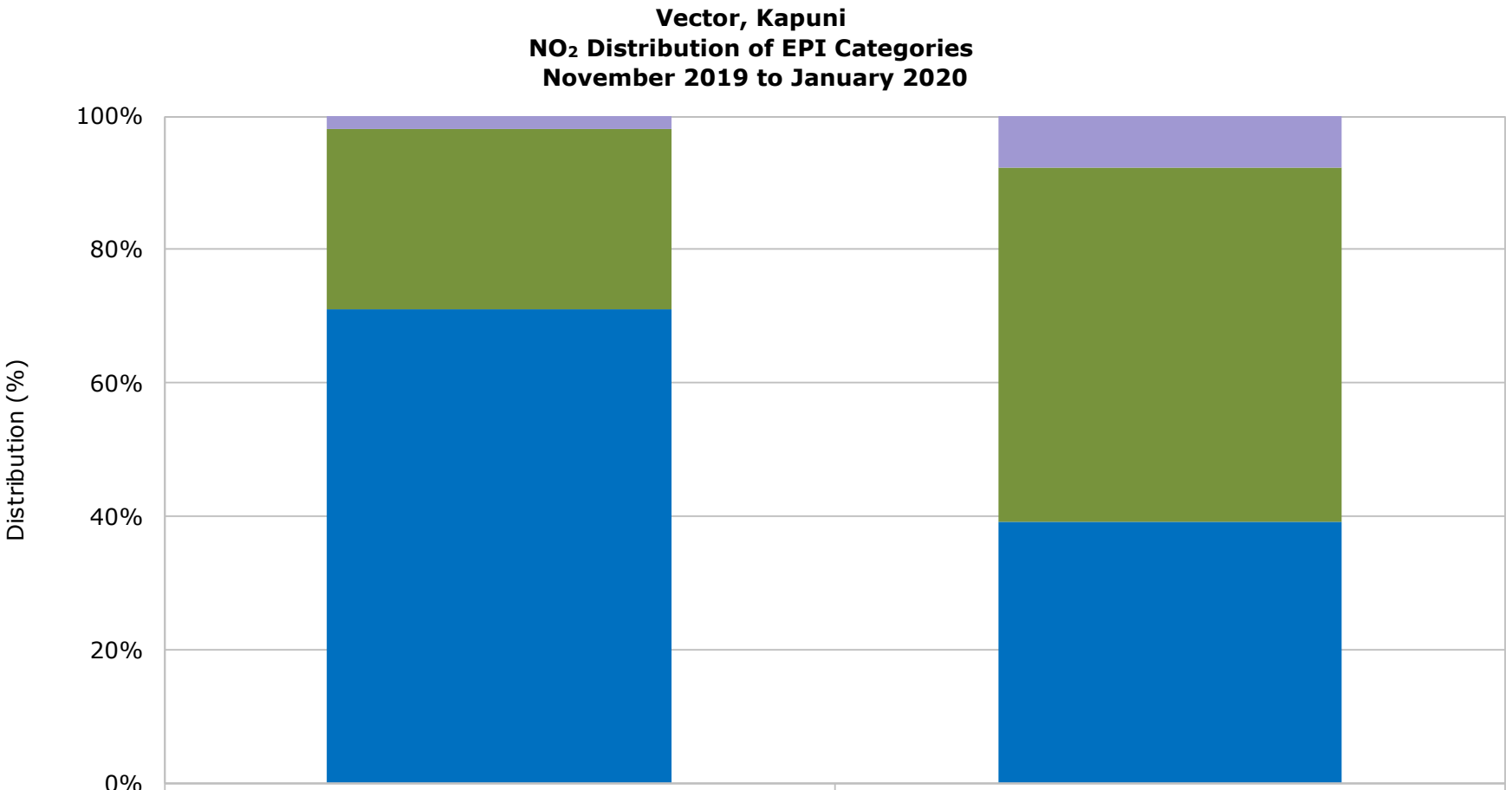


Figure 11: Vector, Kapuni: NO_2 Diurnal Variation (1-hour averages)



Site	Vector, Kapuni 1hr	Vector, Kapuni 24hr
Action	0.0%	0.0%
Alert	0.0%	0.0%
Acceptable	1.9%	7.6%
Good	27.0%	53.3%
Excellent	71.0%	39.1%

Figure 12: Vector, Kapuni: NO_2 Comparison of EPI Categories (1-hour and 24-hour averages)

6.4 Meteorological Parameters

6.4.1 Ambient Temperature and Relative Humidity

Table 6 presents a statistical summary of validated ambient temperature 1-hour and 24-hour averages that have been calculated from 10-minute averages. The results of ambient temperature measured from November 2019 to January 2020 are shown graphically in Figure 13 to Figure 15.

Table 7 presents a statistical summary of validated relative humidity 1-hour and 24-hour averages that have been calculated from 10-minute averages. The results of relative humidity measured from November 2019 to January 2020 are shown graphically in Figure 13.

Table 6: Ambient Temperature Statistics – November 2019 to January 2020

Ambient Temperature (°C)	1-hour average	24-hour average
Maximum	24.1 27/01/2020 14:00	20.1 27/01/2020
Average	15.7	15.7
Minimum	6.8 26/11/2019 03:00	11.7 1/11/2019

Table 7: Relative Humidity Statistics – November 2019 to January 2020

Relative Humidity (%)	1-hour average	24-hour average
Maximum	90.8 30/11/2019 07:00	82.6 19/01/2020
Average	70.4	70.4
Minimum	22.7 03/11/2019 22:00	41.4 3/11/2019

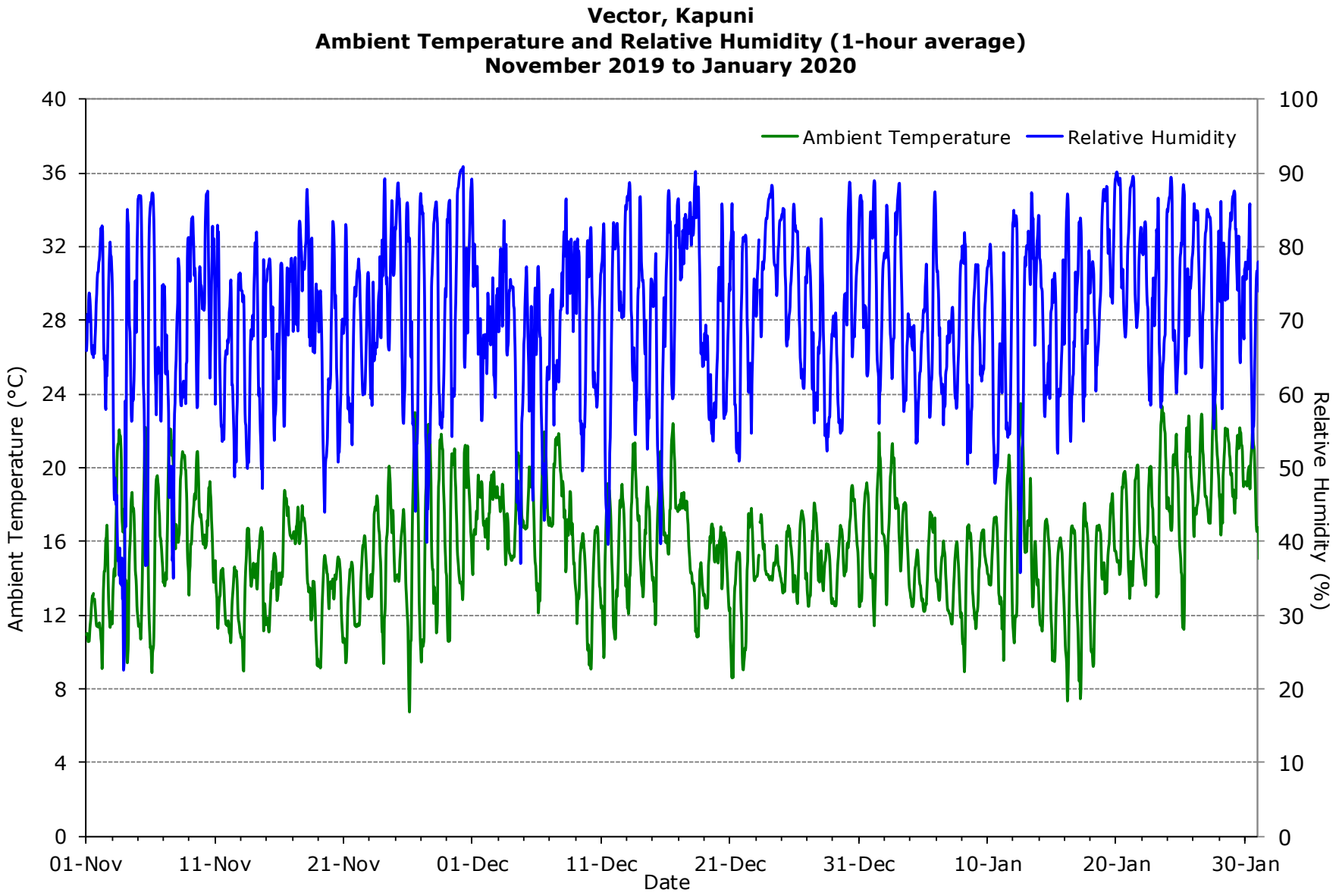


Figure 13: Vector, Kapuni: Ambient Temperature and Relative Humidity (1-hour averages)

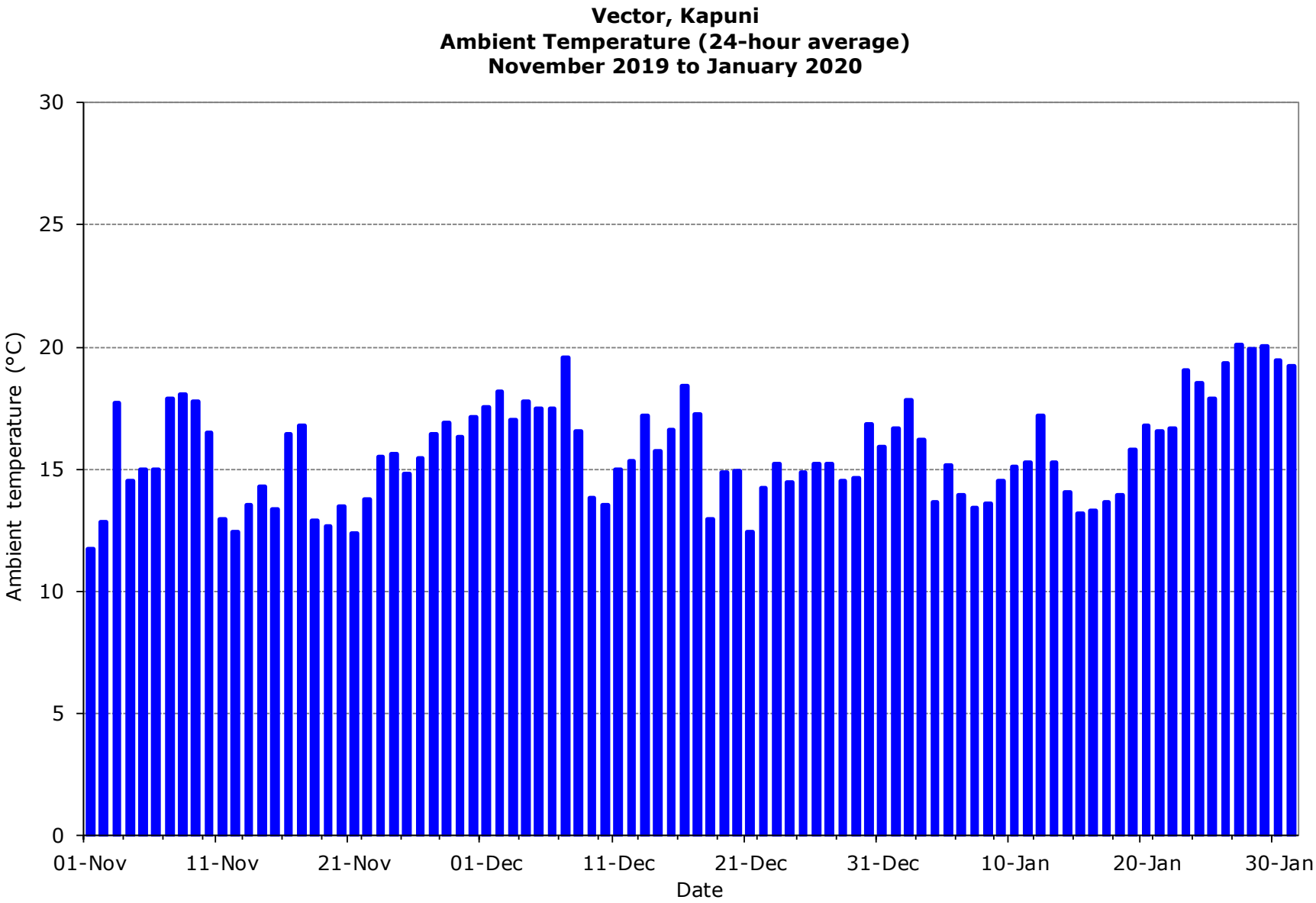


Figure 14: Vector, Kapuni: Ambient Temperature (24-hour averages)

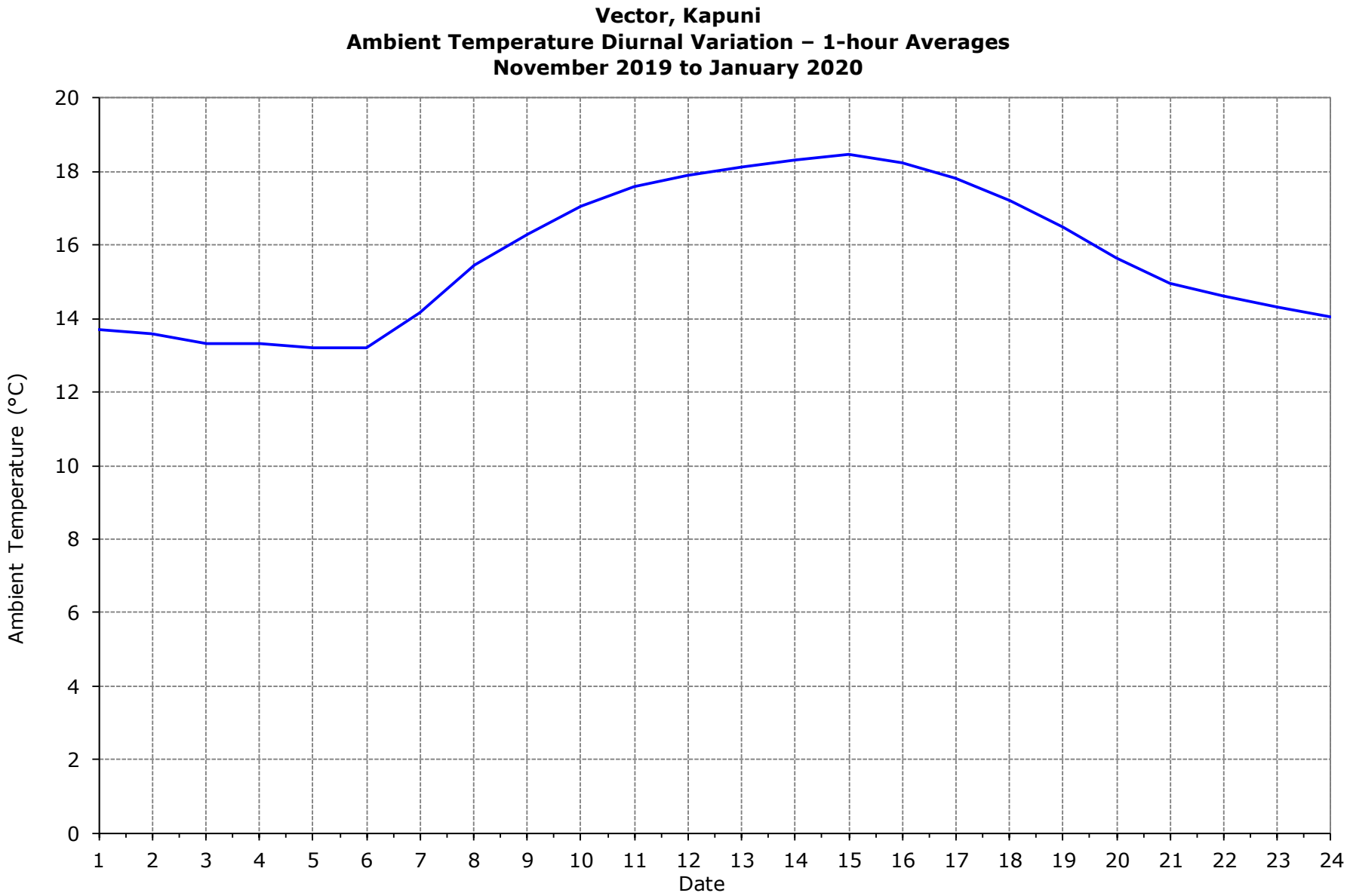


Figure 15: Vector, Kapuni: Ambient Temperature Diurnal Variation (1-hour averages)

6.4.2 Wind Speed and Direction

Table 8 presents a statistical summary of validated wind speed and wind direction 1-hour and 24-hour averages that have been calculated from 10-minute averages. Calm phases occurred when the wind speed was less than 0.5 m/s. These results from November 2019 to January 2020 are shown graphically in Figure 16 to Figure 19.

Table 9 shows the proportion of wind strengths at each wind direction. Strong winds, greater than 10 m/s, were observed from the north and south-southeast. The predominant wind direction was from the northwest.

Table 8: Wind Statistics – November 2019 to January 2020

Wind	1-hour average
Maximum Wind Speed (m/s)	11.8 03/12/2019 08:00
Average Wind Speed (m/s)	3.7
Main Wind Direction(s)	NW
Wind Calm (%)	0.6

Table 9: Wind Speed and Wind Direction summary (1-hour average)

	Wind speed time (hours)							
Wind Direction	0.5 – 2.0m/s	2.0 – 4.0m/s	4.0 – 6.0m/s	6.0 – 8.0m/s	8.0 – 10.0m/s	>10.0m/s	**Total (hours)**	**% of total**
N	83	46	47	23	5	7	211	9.6
NNE	76	45	16	2	0	0	139	6.3
NE	51	6	0	0	0	0	57	2.6
ENE	32	1	0	0	0	0	33	1.5
E	34	6	0	0	0	0	40	1.8
ESE	24	12	2	0	0	0	38	1.7
SE	29	26	21	12	2	0	90	4.1
SSE	16	32	58	36	22	7	171	7.8
S	10	44	10	0	0	0	64	2.9
SSW	17	27	0	0	0	0	44	2.0
SW	15	22	7	3	0	0	47	2.1
WSW	18	99	95	35	1	0	249	11.3
W	4	106	146	16	0	0	272	12.3
WNW	14	133	143	12	0	0	302	13.7
NW	17	134	130	52	5	0	338	**15.3**
NNW	21	53	20	2	2	0	98	4.4
All	**461**	**793**	**696**	**193**	**37**	**14**	**2194**	**99**
Calm	14						14	0.6

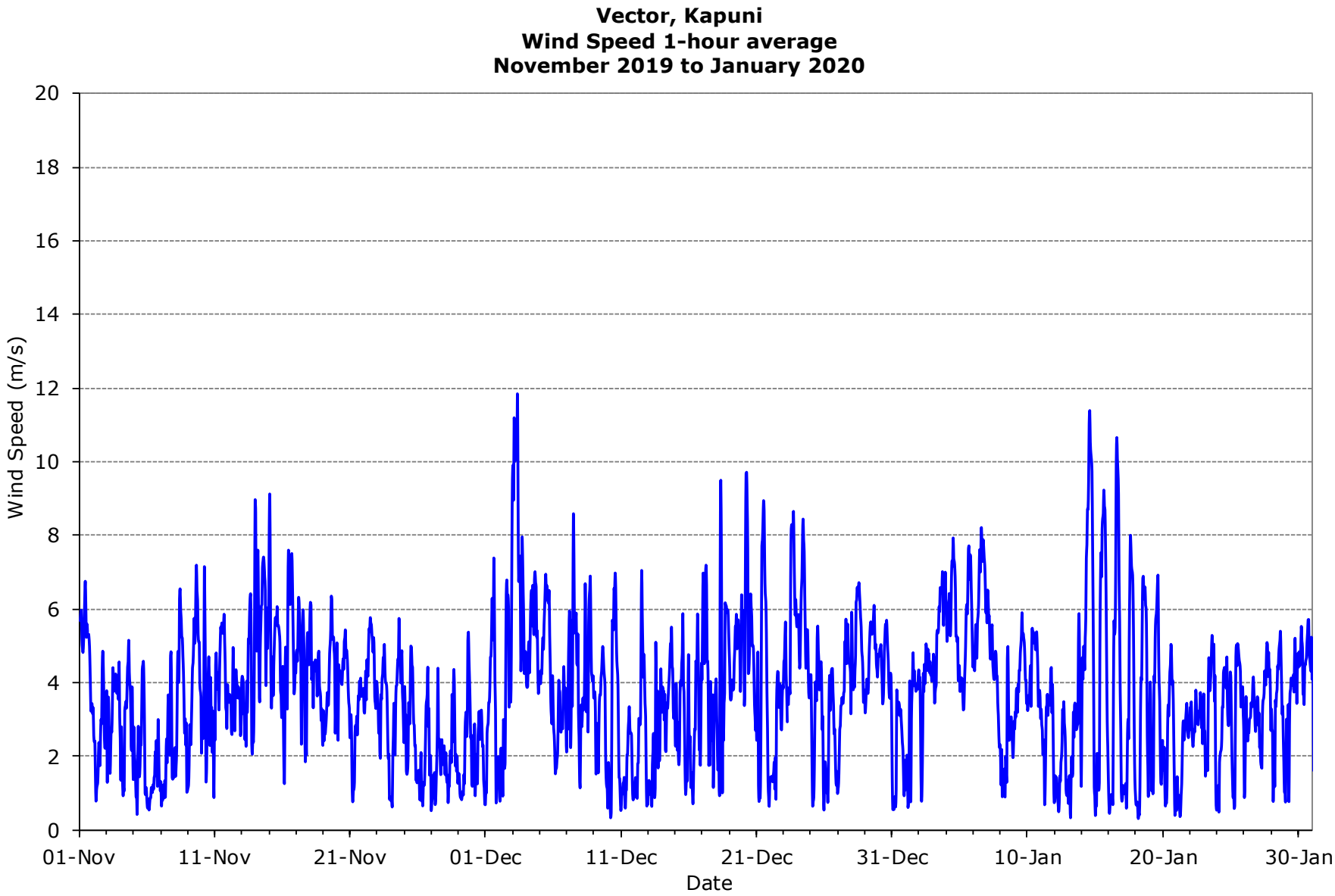


Figure 16: Vector, Kapuni: Wind Speed (1-hour averages)

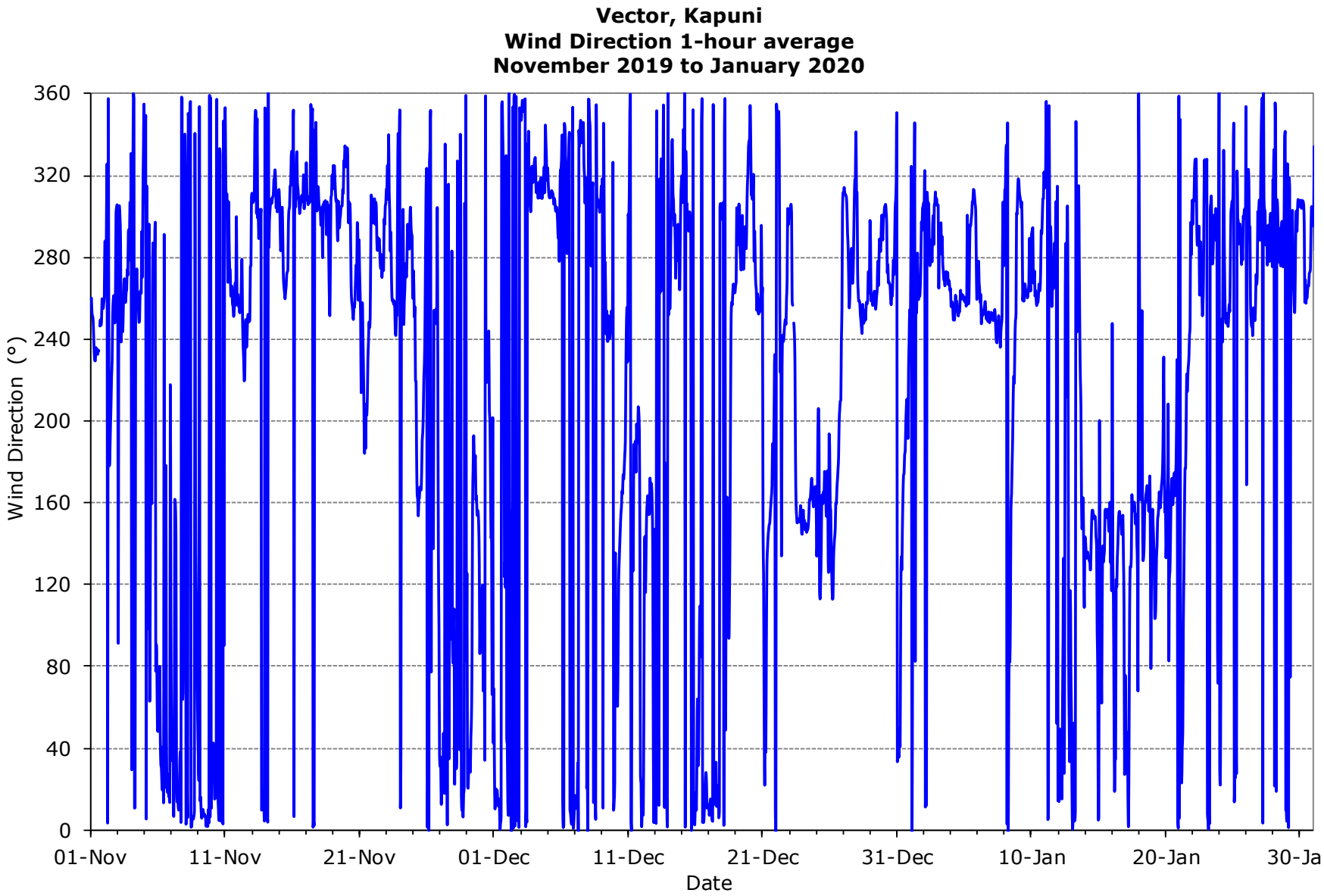


Figure 17: Vector, Kapuni: Wind Direction (1-hour averages)

Vector, Kapuni
Wind Rose 1-hour average
November 2019 to January 2020

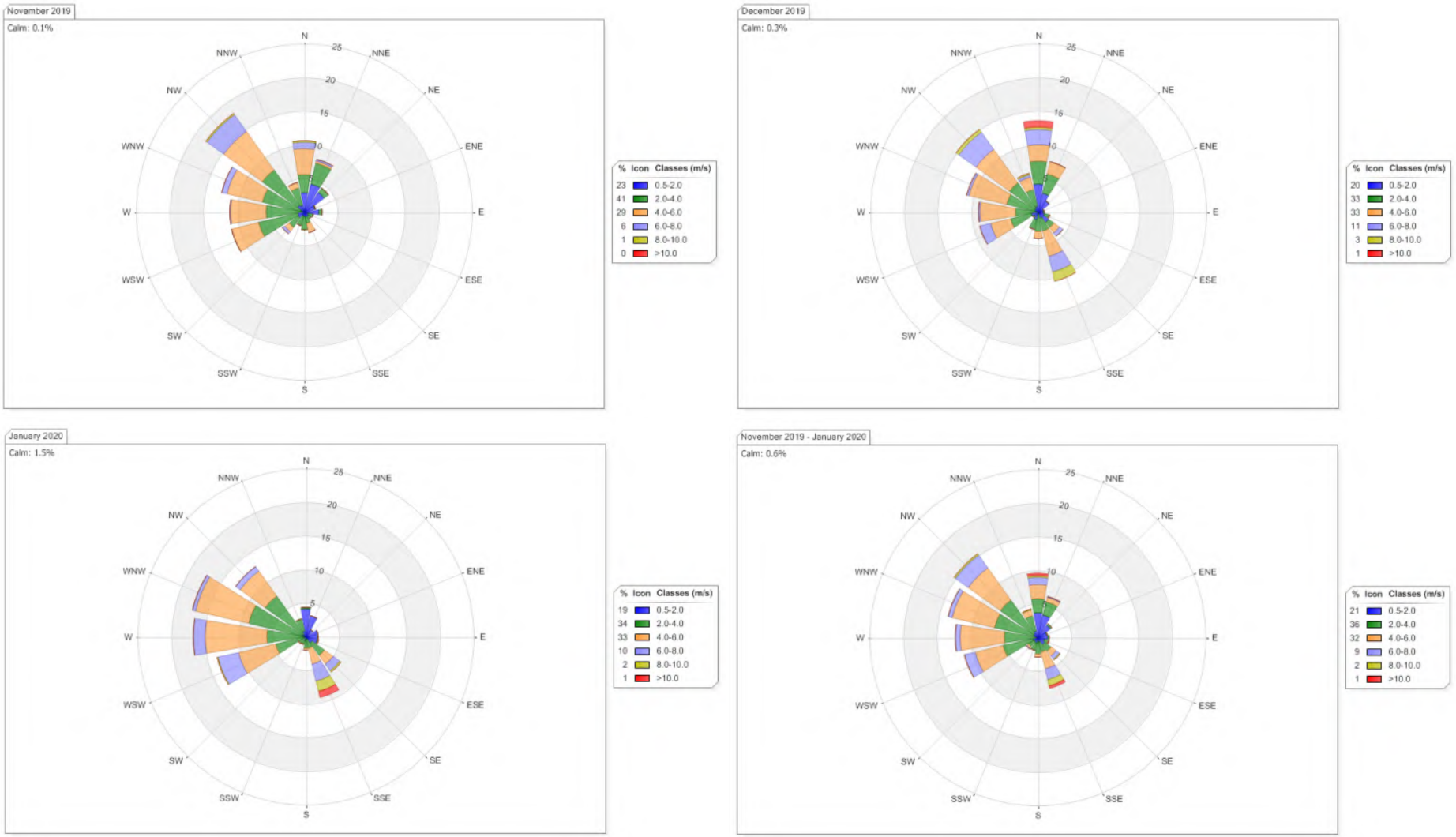


Figure 18: Vector, Kapuni: Wind Roses (1-hour averages)

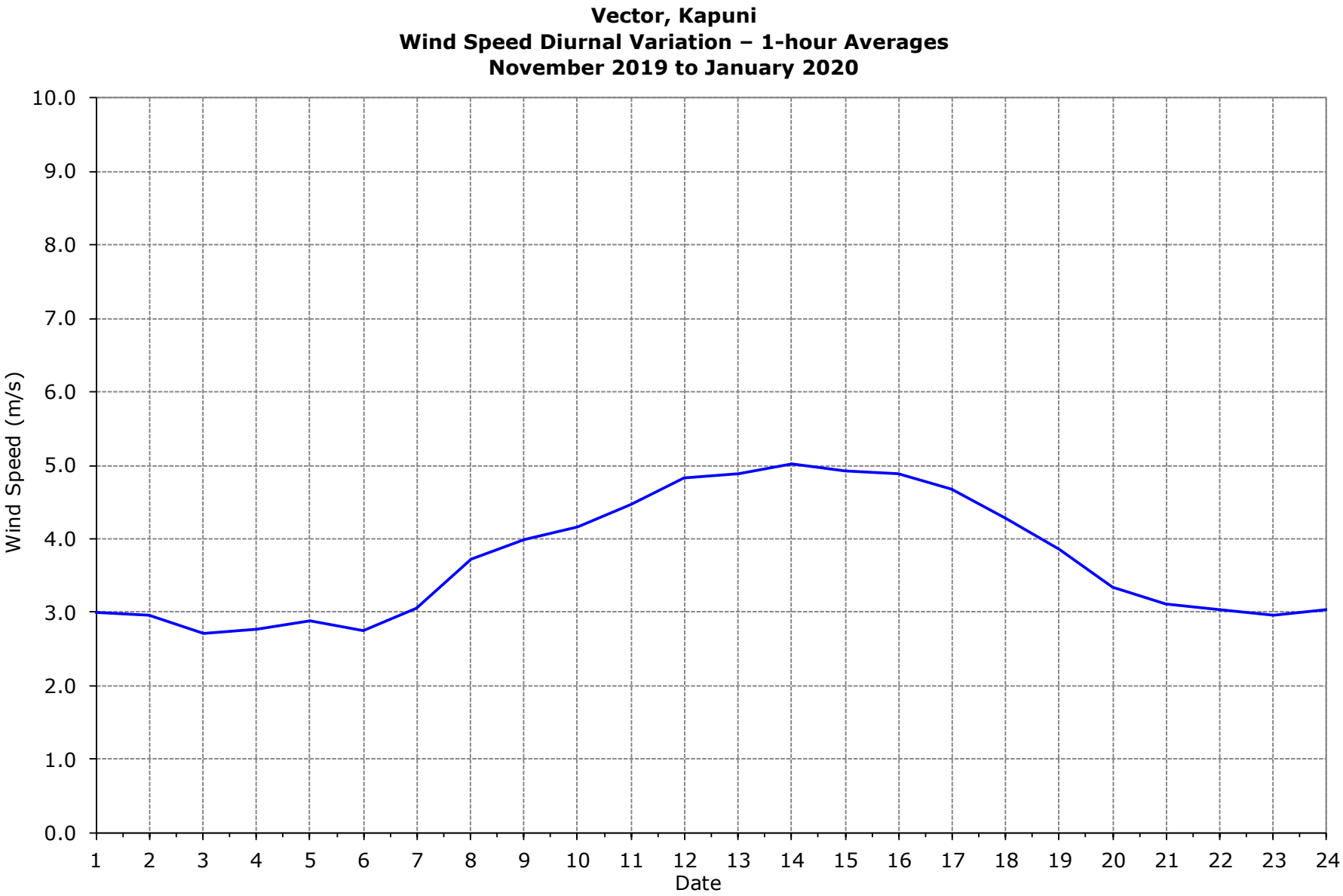


Figure 19: Vector, Kapuni: Wind Speed Diurnal Variation (1-hour averages)

7 Instrument History

Vector, Kapuni

Instrument	Date	Unit ID	Make and Model	Planned Maintenance	Service Information	Technician
Gas Analyser – Carbon Monoxide						
	31/10/2019	10087358	API T300	Six-Monthly Maintenance	Commissioned	B Kaushal
	28/11/2019	10087358	API T300	Monthly Maintenance	Recalibration	H MdAli
	23/12/2019	10087358	API T300	Monthly Maintenance	Recalibration	H MdAli
	10/01/2020	10087358	API T300	Monthly Maintenance	Audit Calibration	B Kaushal
	27/02/2020	10087358	API T300	Monthly Maintenance	Decommissioned	B Kaushal
Gas Analyser – Nitrogen Oxides						
	31/10/2019	10028345	API 200E	Six-Monthly Maintenance	Commissioned	B Kaushal
	28/11/2019	10028345	API 200E	Monthly Maintenance	Recalibration	H MdAli
	23/12/2019	10028345	API 200E	Monthly Maintenance	Recalibration	H MdAli
	10/01/2020	10028345	API 200E	Monthly Maintenance	Recalibration	B Kaushal
	27/02/2020	10028345	API 200E	Monthly Maintenance	Decommissioned	B Kaushal
Meteorological Sensor						
	31/10/2019	10080278	WTX520	Six-Monthly Maintenance	Commissioned	B Kaushal
	27/02/2020	10080278	WTX520	Monthly Maintenance	Decommissioned	B Kaushal
Air Quality Location						
	31/10/2019	T001	Vector, Kapuni	Annual Maintenance	Commissioned	B Kaushal
	27/02/2020	T001	Vector, Kapuni	Monthly Maintenance	Decommissioned	B Kaushal

8 References

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