KEMENTERIAN
ALAM SEKITAR DAN AIR
Ministry of Environment and Water

JABATAN ALAM SEKITAR MALAYSIA

LAPORAN KUALITI ALAM SEKELILING
ENVIRONMENTAL QUALITY REPORT

2020

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PRAKATA / FOREWORD

"Alam Sekitar,Tanggungjawab Bersama
Environment, Our Shared Responsibility."

Saya amat berbesar hati untuk membentangkan Laporan Kualiti Alam Sekeliling 2020 seperti yang dikehendaki di bawah Seksyen 3(1)(i) Akta Kualiti Alam Sekeliling 1974.

Berdasarkan Indeks Pencemar Udara (IPU), kualiti udara keseluruhan bagi Malaysia pada tahun 2020 telah menunjukkan peningkatan kualiti udara yang ketara yang terjemahkan dalam bentuk peratus IPU berstatus baik dan sederhana yang lebih baik. Aktiviti industri, komersial dan sosial yang terhad sepanjang tempoh PKP ini telah meningkatkan kualiti udara di Malaysia berbanding dengan tahun 2019. Dalam pada itu, keadaaan cuaca yang lebih lembap dan tiada kejadian jerebu merentas sempadan pada tahun 2020 turut menyumbang kepada keadaan kualiti udara yang lebih baik di Malaysia.

It is my pleasure to present the Environmental Quality Report 2020 as required under Section 3(1)(i) of the Environmental Quality Act 1974.

Based on the Air Pollutant Index (API), the overall air quality for Malaysia in 2020 showed a significant increase in air quality indicated from the good and moderate levels achieved when compared with the API during the same period in 2019. Limited industrial, commercial and social activities during the MCO period made an impact, resulting in improved air quality in Malaysia compared to 2019. Moreover, the wet weather conditions and no transboundary haze in 2020 further contributed to better air quality conditions in Malaysia.

WAN ABDUL LATIFF BIN WAN JAFFAR

Ketua Pengarah Kualiti Alam Sekeliling Malaysia /
Director-General of Environmental Quality Malaysia

Kualiti air sungai yang ditentukan dari segi Indeks Kualiti Air (IKA) telah menunjukkan peningkatan pada tahun 2020. Peratus bilangan sungai yang dikategorikan sebagai bersih pada tahun 2020 adalah sebanyak 66% daripada 672 sungai yang diawasi. Peratus bilangan sungai yang dikategorikan sebagai sederhana tercemar adalah sebanyak 29%, manakala peratus bilangan sungai yang dikategorikan sebagai tecemar adalah sebanyak 5%.

The river quality in terms of Water Quality Index (WQI) showed an increase in 2020. Out of the 672 rivers monitored, 66% showed clean water quality in 2020. The percentage of slightly polluted rivers and polluted rivers were 29% and 5% respectively.

Pada tahun 2020, kualiti air tanah menunjukkan pematuhan terhadap Standard Kualiti Air Tanah Bagi Rawatan Air Mentah Secara Konvensional (Air Minuman) bagi semua parameter yang diawasi kecuali parameter mangan (Mn), jumlah kolifom, besi (Fe) dan sebatian fenol yang mempunyai peratusan julat nilai pematuhan yang rendah.

The groundwater quality in 2020 showed compliance with the Groundwater Quality Standards for Conventional Raw Water Treatment (Drinking Water) except for manganese (Mn), total coliform, iron (Fe) and phenolics which showed low percentage of compliance.

Dalam tahun 2020, daripada 368 stesen pengawasan kualiti air marin bagi pantai, muara sungai dan pulau di negara ini, sebanyak 104 stesen adalah terbaik, 56 stesen baik, 190 stesen sederhana manakala 18 stesen yang lain dikategorikan tercemar. 4 daripada stesen tercemar berada di kawasan pantai, 13 di kawasan muara sungai dan 1 stesen di kawasan pulau.

In 2020, out of the 368 marine water quality monitoring stations at coastal, estuary and islands in the country, 104 stations were excellent, 56 were good, 190 were moderate while the remaining 18 stations were categorised as poor. 4 of the poor stations were located at the coastal, 13 were located at estuary while the remaining 1 was located at the island.

Pada tahun 2020 sebanyak 7,185,227.76 tan metrik buangan terjadual telah dihasilkan. Ini mewakili peningkatan keseluruhan sebanyak 79.04% berbanding 4,013,189.03 tan metrik yang dilaporkan pada 2019. JAS akan terus mengukuhkan dan melaksanakan strategi, program dan aktivitinya dengan berkesan dalam menguruskan alam sekitar secara lestari.

In 2020, a total of 7,185,227.76 metric tonnes of scheduled wastes were generated. This represents an overall increase of 79.04% as compared to 4,013,189.03 metric tonnes reported in 2019. DOE will continue to strengthen and implement its strategies, programmes and activities effectively in managing the environment sustainably.

BAB 1
CHAPTER 1

KUALITI UDARA
AIR QUALITY

KUALITI UDARA / AIR QUALITY

PENGAWASAN KUALITI UDARA

Pada tahun 2020, dunia telah dikejutkan dengan kehadiran virus Covid-19 yang diisytiharkan sebagai pandemik oleh Pertubuhan Kesihatan Sedunia (WHO) pada 11 Mac 2020. Sebagai tindakan kawalan penyebaran virus ini di Malaysia, arahan Perintah Kawalan Pergerakan (PKP) telah dikeluarkan di mana premis dan sekolah ditutup, orang ramai diarahkan untuk duduk di rumah dan hanya sektor yang perlu sahaja dibenarkan untuk beroperasi. Pelaksanaan PKP ini telah memberi kesan kepada status kualiti udara di dalam negara.

Status kualiti udara di Malaysia ditunjukkan menerusi bacaan Indeks Pencemar Udara (IPU) dan bacaan IPU seluruh negara sentiasa dipaparkan di laman sesawang Jabatan Alam Sekitar (JAS), Air Pollutant Index Management System (APIMS). IPU adalah dikira berdasarkan kepekatan enam (6) bahan pencemar utama iaitu ozon di permukaan bumi (O_3), karbon monoksida (CO), nitrogen dioksida (NO_2), sulfur dioksida (SO_2), habuk halus bersaiz kurang dari 10 mikron (PM_{10}) dan habuk halus bersaiz kurang dari 2.5 mikron ($PM_{2.5}$). IPU ini dikategorikan sebagai baik, sederhana, tidak sihat, sangat tidak sihat dan berbahaya seperti yang dinyatakan dalam **Jadual 1.1.**

AIR QUALITY MONITORING

In early 2020, the world was shocked and shaken by the Covid-19 virus, and a pandemic was declared by the World Health Organization (WHO) on March 11, 2020. In an effort to control the spread of the virus in Malaysia, a Movement Control Order (MCO) was issued where premises and schools were closed, people were instructed to stay at home and only essential sectors were allowed to operate. The implementation of this MCO affected the status of air quality in the country.

The air quality status is reflected as the Air Pollutant Index (API) and this is reported in the website of the Department of Environment (DOE) in its Air Pollutant Index Management System (APIMS) . The API is calculated based on the concentration of six (6) major pollutants in the air, which are ground level ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), particulate matter of less than 10 microns in size (PM_{10}) and particulate matter of less than 2.5 microns in size ($PM_{2.5}$). The API is categorized as good, moderate, unhealthy, very unhealthy and hazardous as presented in **Table 1.1**.

Jadual 1.1 : Indeks Pencemar Udara (IPU)
Table 1.1 : Air Pollutant Index (API)

IPU / API	STATUS KUALITI UDARA / AIR QUALITY STATUS
0 – 50	Baik / Good
51 – 100	Sederhana / Moderate
101 – 200	Tidak Sihat / Unhealthy
201 – 300	Sangat Tidak Sihat / Very Unhealthy
> 300	Berbahaya / Hazardous

STATUS KUALITI UDARA

Kesan daripada beberapa siri arahan PKP yang telah dikeluarkan oleh Kerajaan sepanjang tahun 2020, IPU bagi keseluruhan Malaysia pada tahun 2020 telah menunjukkan peningkatan kualiti udara yang ketara yang terjemahkan dalam bentuk peratus IPU berstatus baik dan sederhana yang lebih baik. Aktiviti industri, komersial dan sosial yang terhad sepanjang tempoh PKP ini telah meningkatkan kualiti udara di Malaysia berbanding dengan tahun 2019. Dalam pada itu, keadaaan cuaca yang lebih lembap dan tiada kejadian jerebu merentas sempadan pada tahun 2020 turut menyumbang kepada keadaan kualiti udara yang lebih baik di Malaysia. Ini ditunjukkan di dalam tren kepekatan harian $PM_{2.5}$ di kawasan Klang, yang kebiasaannya merekodkan bacaan IPU yang tinggi setiap tahun tetapi didapati lebih rendah pada tahun 2020 berbanding dengan tahun 2019. Walau bagaimanapun kepekatan $PM_{2.5}$ di Klang adalah agak tinggi sedikit pada awal tahun sebelum arahan PKP seperti yang ditunjukkan di dalam **Rajah 1.1(a)**.

Rajah 1.1(b) menunjukkan perbandingan kepekatan harian $PM_{2.5}$ bagi tiga (3) jenis kategori stesen terpilih di kawasan bandar (Klang), pinggir bandar (Kuantan) dan luar bandar (Kapit). Tren menunjukkan kepekatan $PM_{2.5}$ adalah lebih tinggi di kawasan bandar berbanding kawasan pinggir bandar dan luar bandar. Walau bagaimanapun, tren kepekatan bagi tiga (3) kategori ini masih di bawah standard kualiti udara ambien yang ditetapkan bagi kepekatan harian $PM_{2.5}$. Standard kualiti udara ambien bagi tahun 2020 adalah menggunakan Standard Kualiti Udara Ambien Malaysia IT-2 seperti yang ditunjukkan dalam **Jadual 1.2**. Peningkatan $PM_{2.5}$ di pinggir bandar dan di luar bandar sering dikaitkan dengan aktiviti pembakaran terbuka setiap tahun. Ini menunjukkan bahawa pergerakan dan aktiviti sosial orang awam yang terhad sepanjang PKP di kawasan-kawasan tersebut mengurangkan aktiviti pembakaran terbuka dan secara langsung menurunkan bacaan kepekatan $PM_{2.5}$.

AIR QUALITY STATUS

As a result of a series of MCO directives by the Government in 2020, the overall API for Malaysia in 2020 showed a significant increase in air quality indicated from the good and moderate levels achieved when compared with the API during the same period in 2019. Limited industrial, commercial and social activities during the MCO period made an impact, resulting in improved air quality in Malaysia compared to 2019. Moreover, the wet weather conditions and no transboundary haze in 2020 further contributed to better air quality conditions in Malaysia. This is shown in the $PM_{2.5}$ daily concentration trend in the Klang area, which normally records high API readings each year but was notably lower in year 2020 compared to 2019. However, the concentration of $PM_{2.5}$ in Klang was relatively high at the beginning of the year before the imposed MCO, as shown in **Figure 1.1 (a)**.

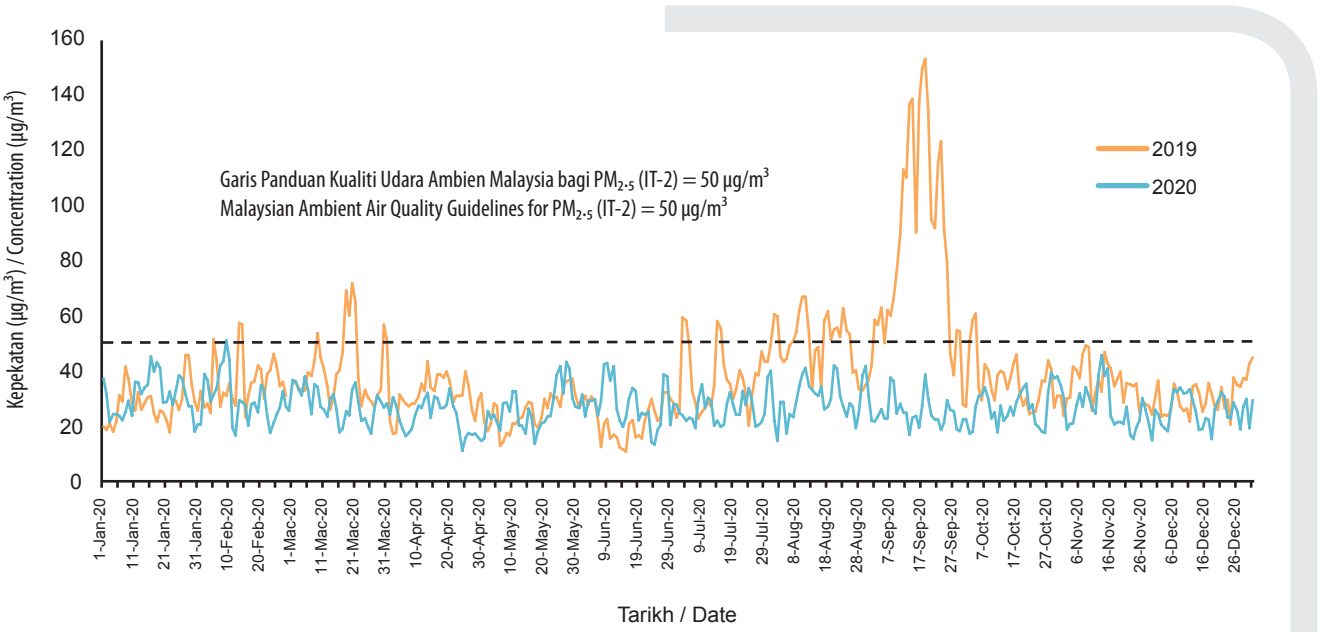
Figure 1.1(b) shows the daily concentrations of $PM_{2.5}$ for the three (3) selected stations in urban (Klang), suburban (Kuantan) and rural (Kapit) areas in the country. The trend showed higher levels of $PM_{2.5}$ in the urban area compared with the suburban and rural ones. However, the concentration trend for these three (3) stations was still below the ambient air quality standard set for the daily concentration of $PM_{2.5}$. The ambient air quality standard for 2020 is referred to as the Malaysia Ambient Air Quality Standard IT-2 as shown in **Table 1.2**. The increase in $PM_{2.5}$ in suburban and rural areas is often associated with annual open burning activities. The readings for 2020 indicates that the limited movement and social activities of public in these areas, imposed by the MCO reduced open burning activities and directly lowered $PM_{2.5}$ concentration in the air.

Selain $PM_{2.5}$, pencemar udara lain yang sangat signifikan adalah parameter ozon di permukaan bumi (O_3). Ia terhasil akibat tindak balas sebatian-sebatian organik meruap (Volatile Organic Compounds, VOCs) dan oksid-oksid nitrogen (NO_x) dengan kehadiran cahaya matahari. Cuaca panas terik menggalakkan lagi pembentukan pencemar O_3 . Punca utama VOCs dan NO_x adalah dari pelepasan industri dan ekzos kenderaan bermotor terutama di bandar-bandar besar. Ini disebabkan dari peningkatan kepekatan O_3 di beberapa lokasi di Lembah Klang dan negeri-negeri berdekatan Lembah Klang iaitu Perak dan Negeri Sembilan.

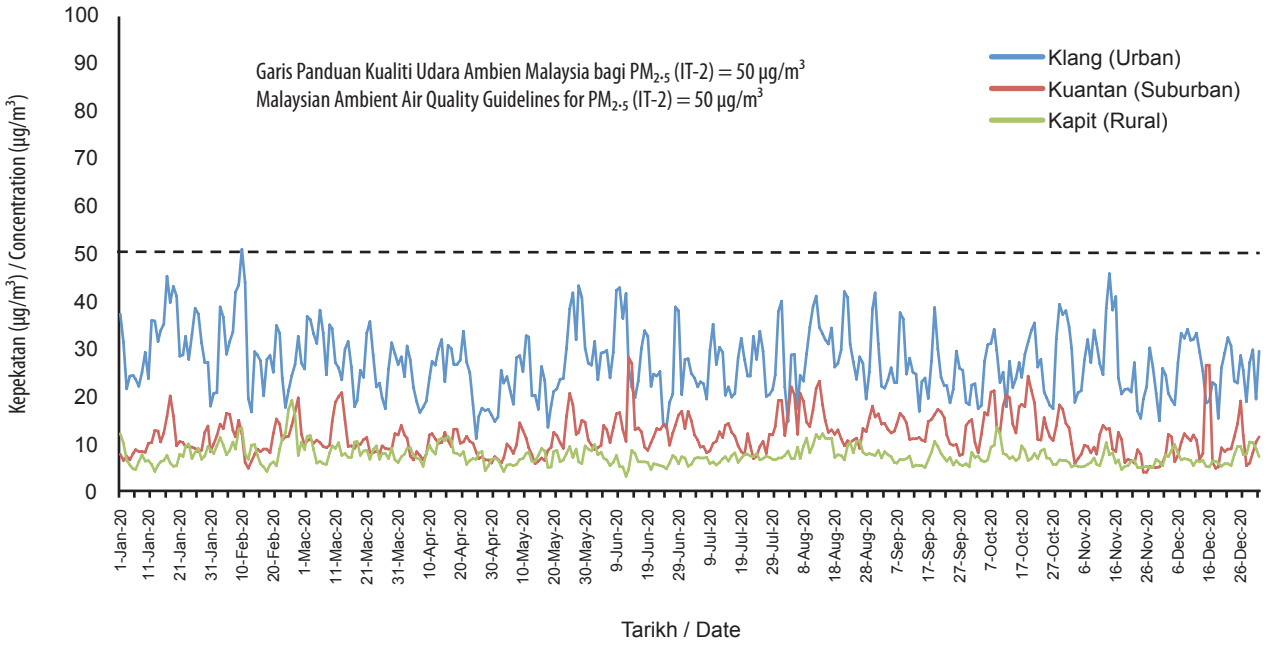
Kadangkala terdapat kepekatan maksimum harian bagi parameter O_3 dalam tempoh 1 jam adalah melebihi Standard Kualiti Udara Ambien Malaysia terutamanya di beberapa kawasan di Lembah Klang, Perak dan Negeri Sembilan seperti yang ditunjukkan dalam **Rajah 1.1(c), Rajah 1.1(d) dan Rajah 1.1(e).** Keadaan ini adalah disebabkan oleh pelepasan gas pencemar O_3 iaitu di kawasan-kawasan pusat perniagaan yang tinggi dan berkepadatan trafik. Semasa PKP, bilangan kenderaaan di jalan raya berkurangan dan didapati kepekatan O_3 bagi kawasan-kawasan tersebut di bawah daripada Standard Kualiti Udara Ambien Malaysia yang ditetapkan.

Apart from $PM_{2.5}$, another significant air pollutant is the ground level ozone (O_3) parameter. O_3 pollutants are formed when volatile organic compounds (VOCs) and nitrogen oxides (NO_x) react in the atmosphere in the presence of sunlight. Formation of O_3 is compounded during hot and sunny days. Major sources of VOCs and NO_x emissions are primarily from industries and motor vehicle emissions, particularly in urban areas. This is seen in the increase in O_3 at various locations in the Klang Valley and states adjacent to Klang Valley such as Perak and Negeri Sembilan.

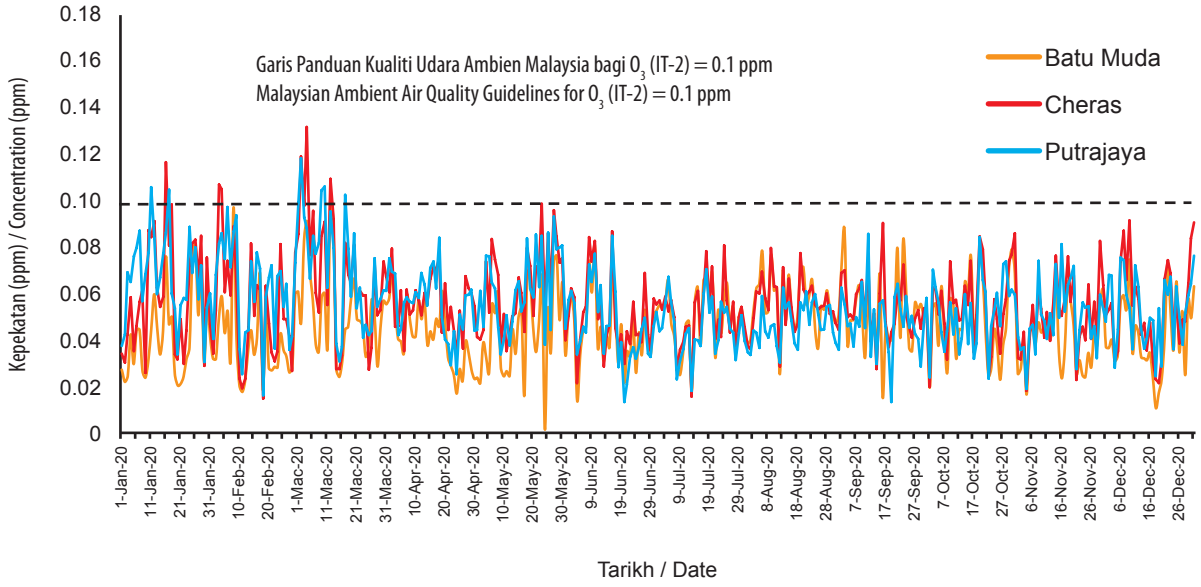
Occasionally, the daily maximum 1-hour concentration of O_3 exceeds the Malaysian Ambient Air Quality Standard, at several stations in the Klang Valley, Perak and Negeri Sembilan as shown in **Figure 1.1(c), Figure 1.1(d) and Figure 1.1(e).** This is due to the release of ground ozone level precursors for pollutant gases in some areas especially in the central business areas with heavy traffic volume. During the MCO, the number of vehicles on the road decreased resulting in O_3 concentrations for those areas being below the Malaysian Ambient Air Quality Standards.



Rajah 1.1(a) Tren Kepekatan 24 jam bagi Habuk Halus ($PM_{2.5}$), Klang 2019 dan 2020
Figure 1.1(a) Trend of 24-hour Concentration of Particulate Matter ($PM_{2.5}$), Klang 2019 and 2020

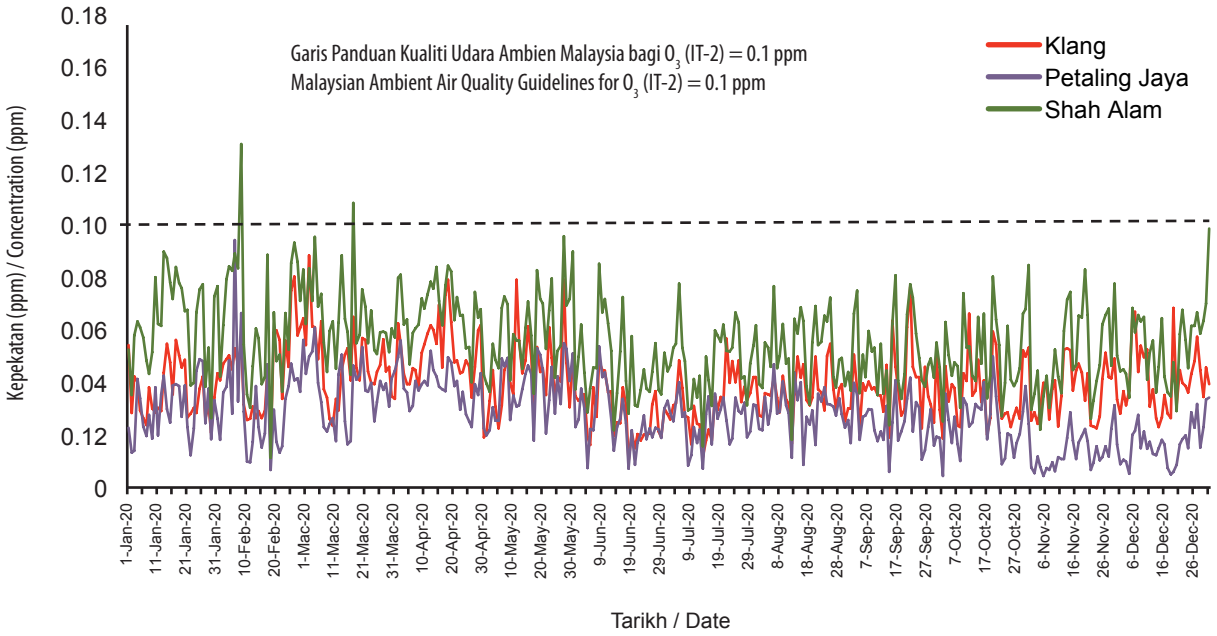


Rajah 1.1(b) : Tren Kepekatan 24 jam bagi Habuk Halus ($PM_{2.5}$), 2020
Figure 1.1(b) : Trend of 24-hour Concentration of Particulate Matter ($PM_{2.5}$), 2020



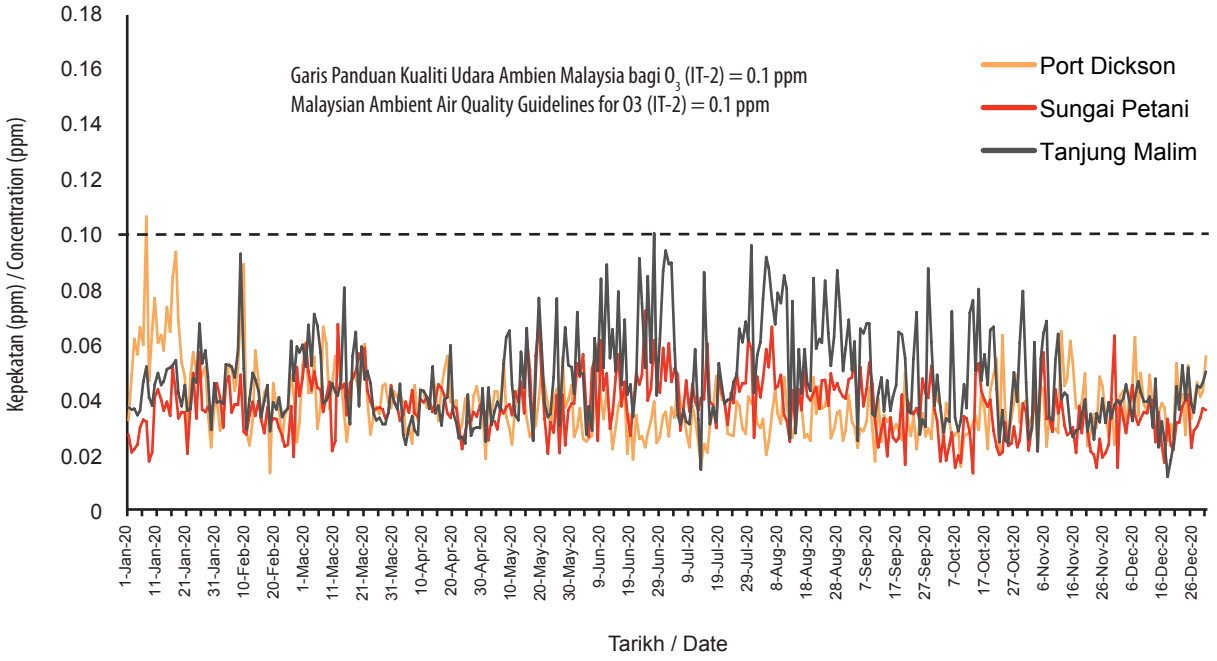
Rajah 1.1(c) : Tren Kepekatan Maksimum Harian Ozon (O_3) 1 Jam, Lembah Klang, 2020
Figure 1.1(c) : Trend of Daily Maximum 1-hour Concentration of Ozone (O_3), Klang Valley 2020

Kuantan, Pahang



Rajah 1.1(d) : Tren Kepekatan Maksimum Harian Ozon (O_3) 1 Jam, Lembah Klang, 2020

Figure 1.1(d) : Trend of Daily Maximum 1-hour Concentration of Ozone (O_3), Klang Valley 2020



Rajah 1.1(e) : Tren Kepekatan Maksimum Harian Ozon (O_3) 1 Jam, 2020

Figure 1.1(e) : Trend of Daily Maximum 1-hour Concentration of Ozone (O_3) 2020

STATUS KUALITI UDARA DI PANTAI BARAT

Lembah Klang

Pada tahun 2020, status kualiti udara di semua stesen di Lembah Klang menunjukkan kebanyakan bacaan adalah tahap baik dan sederhana. Status kualiti udara di Lembah Klang secara keseluruhannya ditunjukkan seperti di **Rajah 1.2.** Beberapa stesen mencatatkan bacaan IPU yang tidak sihat terutama di kawasan yang mempunyai kepadatan trafik yang tinggi iaitu Putrajaya (4 hari), Cheras (3 hari), Petaling Jaya (2 hari) dan Shah Alam (1 hari). Ini adalah disebabkan paras kepekatan O_3 yang tinggi berpunca dari trafik.

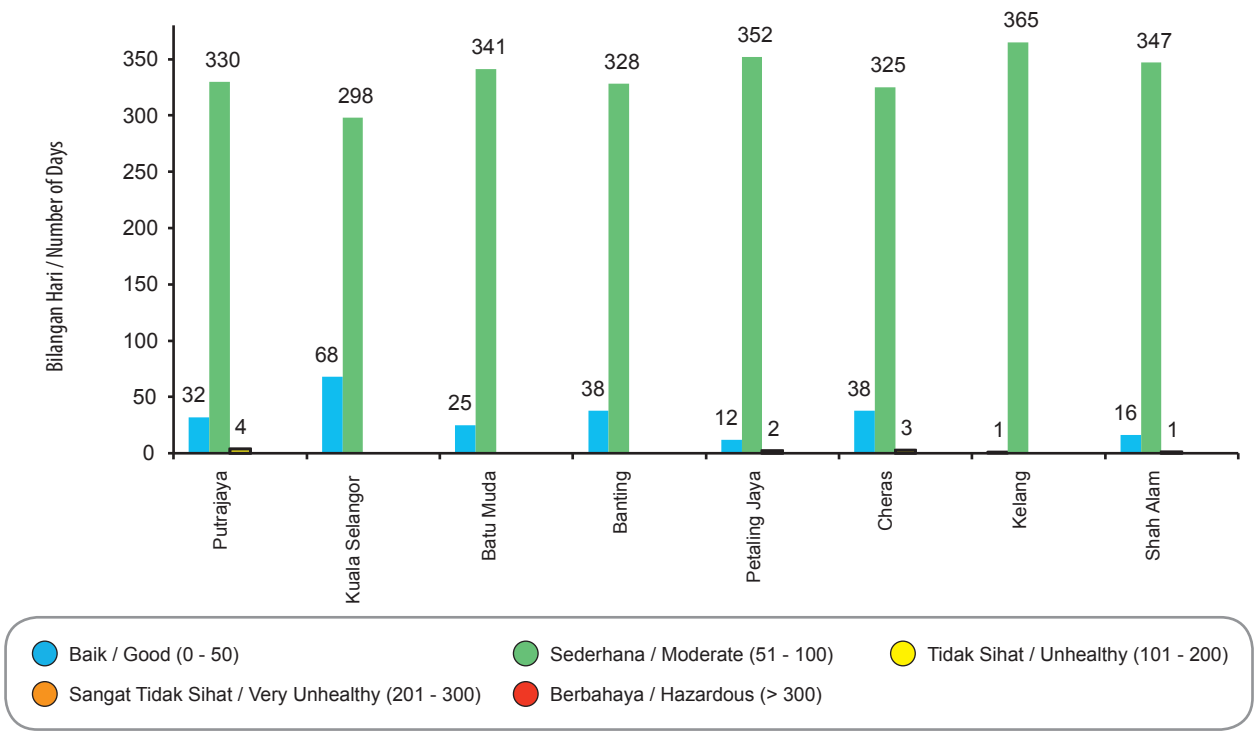
Kepekatan $PM_{2.5}$ tidak mempengaruhi bacaan IPU yang tinggi di Lembah Klang sepanjang tahun 2020. Keadaan ini juga telah menyebabkan semua stesen di Lembah Klang mencatatkan bilangan hari yang tidak sihat yang lebih rendah pada tahun 2020 jika dibandingkan dengan tahun 2019 seperti yang ditunjukkan di dalam **Rajah 1.2(a)**.

AIR QUALITY STATUS IN THE WEST COAST

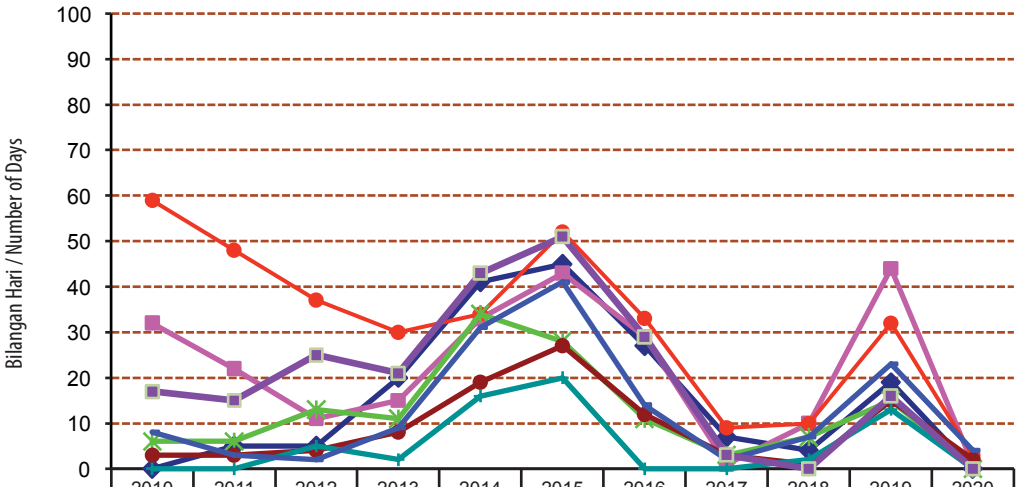
Klang Valley

In 2020, the air quality status at all stations in Klang Valley showed that most readings were at good and moderate levels. The overall air quality status in Klang Valley is shown in **Figure 1.2**. Several stations recorded a few days of an 'unhealthy' API reading; especially those areas with high density of traffic which were Putrajaya (4 days), Cheras (3 days), Petaling Jaya (2 days) and Shah Alam (1 day). This was due to a high concentration of O_3 as a result of heavy traffic.

The $PM_{2.5}$ concentration did not influence the API readings in the Klang Valley in 2020. These resulted in stations in Klang Valley recording lower numbers of unhealthy days in 2020 compared to 2019 as depicted in **Figure 1.2(a).**



Rajah 1.2 : Status Kualiti Udara, Lembah Klang 2020
Figure 1.2 : Air Quality Status, Klang Valley 2020



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Banting	0	5	5	20	41	45	27	7	5	19	0
Shah Alam	32	22	11	15	33	43	29	1	10	45	1
Cheras	59	48	37	30	34	52	33	9	10	32	3
Klang	6	6	13	11	34	28	11	3	8	16	0
Petaling Jaya	3	3	4	8	19	27	12	3	1	16	2
Kuala Selangor	0	0	5	2	16	20	0	0	2	13	0
Putrajaya	8	3	2	9	31	41	14	2	7	25	4
Batu Muda	17	15	25	21	43	51	29	3	1	17	0

Nota: Bacaan adalah berdasarkan IPU Maksimum Harian
Note: Reading based on daily Maximum API

Rajah 1.2(a) : Bilangan Hari Tidak Sihat, Lembah Klang, 2010-2020
Figure 1.2(a) : Number of Unhealthy Days, Klang Valley, 2010-2020

Kuala Lumpur

Wilayah Utara

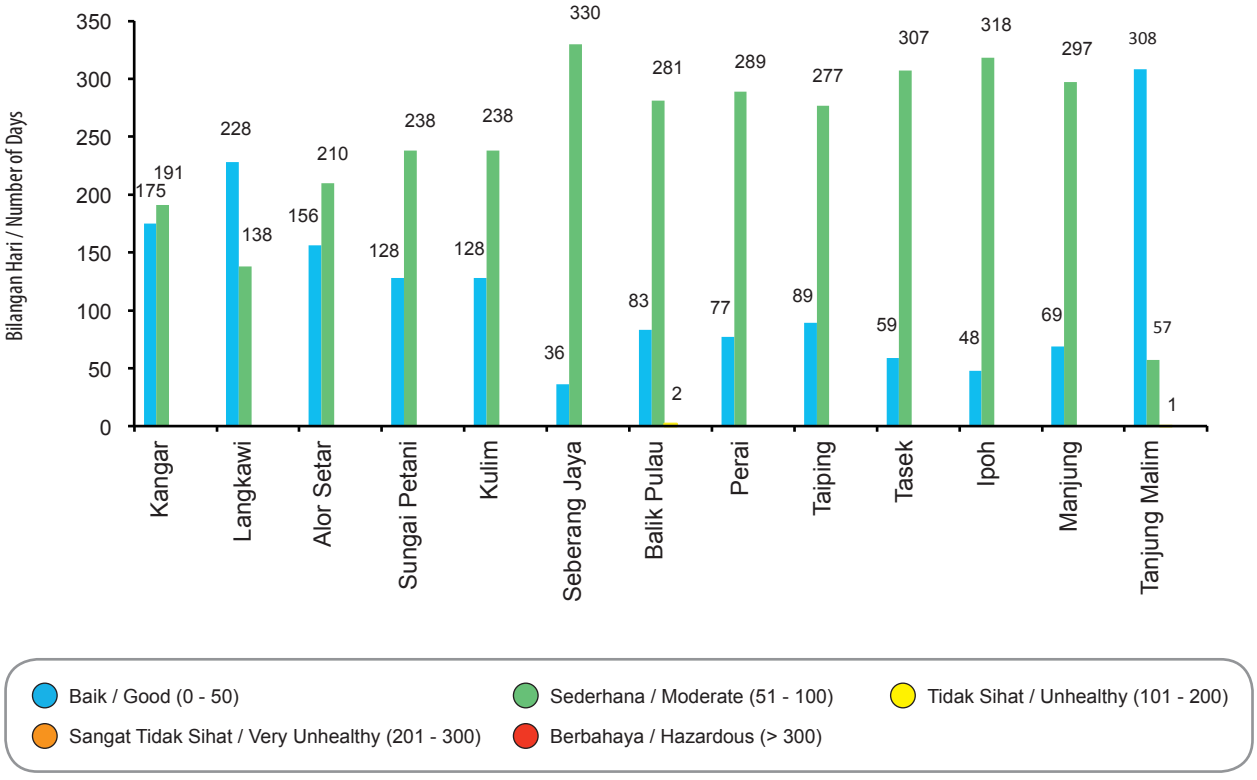
Secara keseluruhan, status kualiti udara di utara Pantai Barat Semenanjung Malaysia yang meliputi Perlis, Kedah, Pulau Pinang dan Perak adalah pada tahap baik dan sederhana sepanjang masa. Tanjung Malim mencatatkan bacaan IPU baik yang lebih tinggi (308 hari) berbanding stesen-stesen yang lain. Hanya dua (2) stesen yang mencatatkan bacaan IPU tidak sihat sepanjang tahun 2020 iaitu Balik Pulau (2 hari) dan Tanjung Malim (1 hari) yang disebabkan oleh kepekatan gas pencemar O_3 yang tinggi di udara.

Rajah 1.3 menunjukkan status kualiti udara keseluruhan bagi wilayah utara di Pantai Barat Semenanjung Malaysia.

Northern Region

The overall air quality status of the northern region of the West Coast of Peninsular Malaysia covering Perlis, Kedah, Pulau Pinang and Perak, was mostly at good and moderate levels. Tanjung Malim recorded an impressive 308 days of good API readings compared with the other stations. Only two (2) stations recorded unhealthy API readings during 2020, namely Balik Pulau (2 days) and Tanjung Malim (1 day) due to the high concentration of O_3 pollutant gas in the air.

Figure 1.3 shows the overall air quality status for the northern region of the West Coast of Peninsular Malaysia.



Rajah 1.3 : Status Kualiti Udara, Wilayah Utara Pantai Barat Semenanjung Malaysia, 2020
Figure 1.3 : Air Quality Status, Northern Region of The West Coast Peninsular Malaysia, 2020

Wilayah Selatan

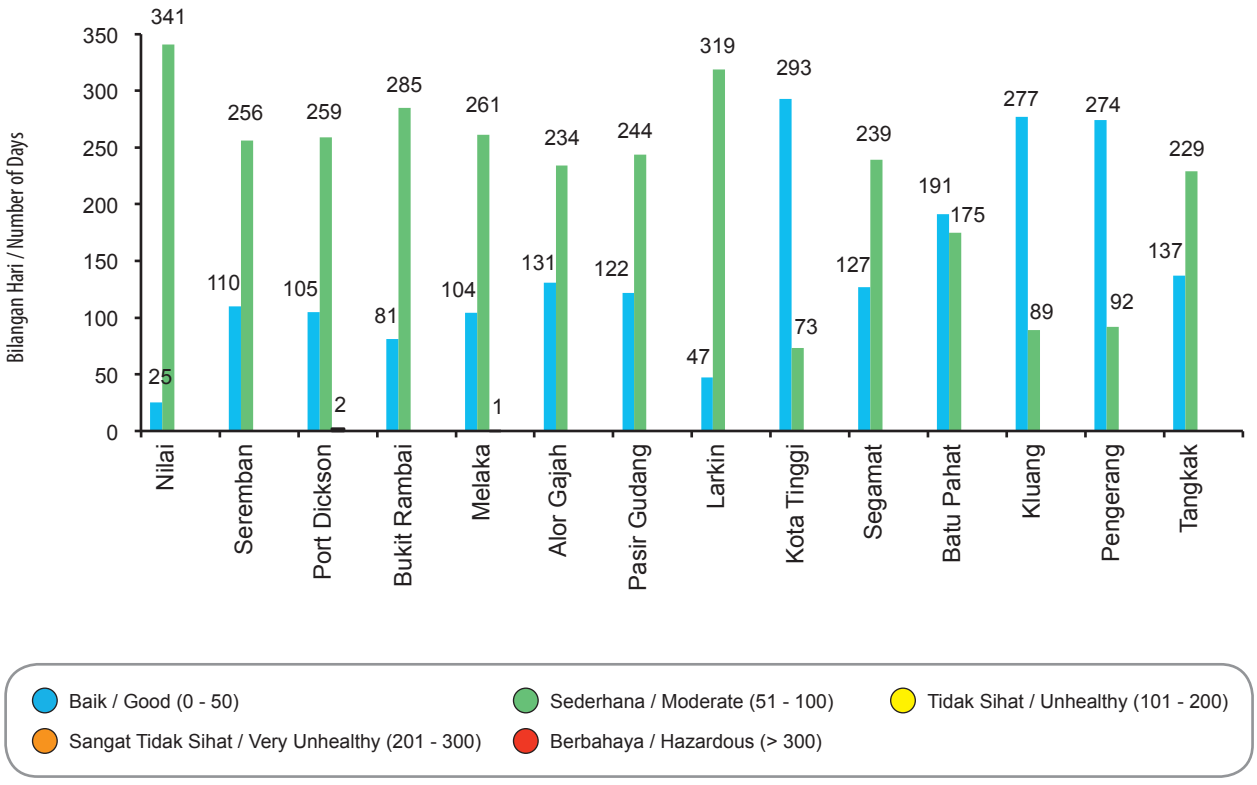
Kualiti udara di Wilayah Selatan Pantai Barat Semenanjung Malaysia (N. Sembilan, Melaka dan Johor) adalah tahap IPU baik dan sederhana pada kebanyakan masa. Kota Tinggi mencatatkan bilangan hari bacaan IPU baik yang tertinggi di wilayah selatan iaitu 293 hari. Hanya dua (2) stesen yang mencatatkan bacaan IPU yang tidak sihat iaitu Port Dickson (2 hari) dan Melaka (1 hari). Keadaan ini disebabkan pencemaran ozon aras bumi daripada peningkatan trafik sebelum dan selepas PKP di kawasan-kawasan tersebut.

Rajah 1.4 menunjukkan status kualiti udara secara keseluruhan bagi wilayah selatan di Pantai Barat Semenanjung Malaysia.

Southern Region

In the southern region of the West Coast of Peninsular Malaysia (N. Sembilan, Melaka and Johor) the API was at good and moderate levels most of the time. Kota Tinggi recorded the highest good API readings in the southern region with 293 days. Only two (2) stations recorded unhealthy API readings namely Port Dickson (2 days) and Melaka (1 day). This situation was due to ground level ozone and could have been because of an increase in traffic before and after MCO in these areas.

Figure 1.4 shows the overall air quality status for the southern region of the West Coast of Peninsular Malaysia.



Rajah 1.4 : Status Kualiti Udara, Wilayah Selatan Pantai Barat Semenanjung Malaysia, 2020
Figure 1.4 : Air Quality Status, Southern Region of The West Coast Peninsular Malaysia, 2020

STATUS KUALITI UDARA DI PANTAI TIMUR

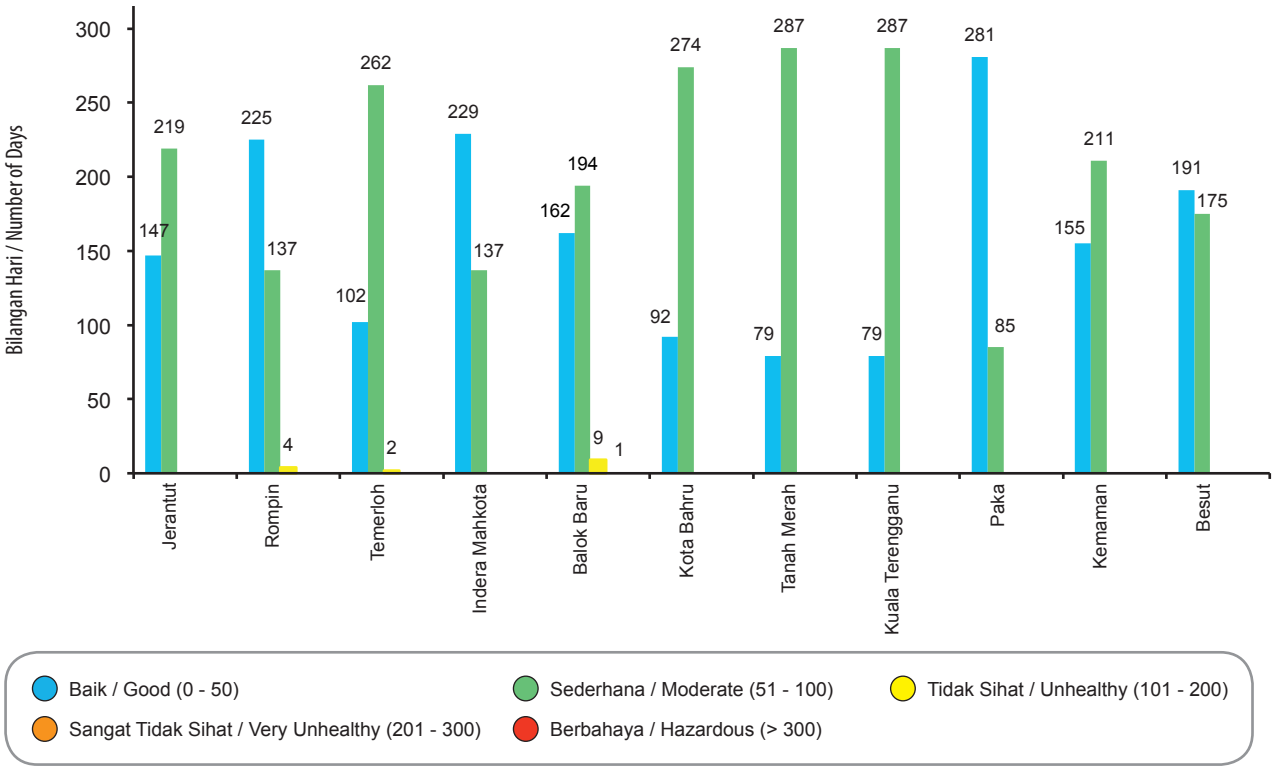
Kualiti udara di Pantai Timur Semenanjung Malaysia (Pahang, Terengganu, Kelantan dan timur Johor) bagi tahun 2020 berstatus baik dan sederhana pada kebanyakan masa. Paka mencatatkan bilangan hari bacaan IPU tertinggi di Pantai Timur iaitu 281 hari. Hanya tiga (3) stesen mencatatkan status kualiti udara tidak sihat sepanjang tahun iaitu Balok Baru (9 hari), Rompin (4 hari) dan Temerloh (2 hari) yang disebabkan oleh peningkatan kepekatan $PM_{2.5}$ akibat pembakaran terbuka di kawasan setempat. Walau bagaimanapun, stesen Balok Baru mencatatkan bacaan sangat tidak sihat selama satu (1) hari yang disebabkan oleh kesan pelepasan gas SO_2 yang tinggi dari sebuah premis di Kawasan Perindustrian Gebeng dan arah angin telah menghala ke stesen Balok Baru. Premis berkenaan telah disiasat dan diambil tindakan perundangan oleh JAS.

Status kualiti udara di Pantai Timur Semenanjung Malaysia secara keseluruhan adalah seperti di **Rajah 1.5**.

AIR QUALITY STATUS IN THE EAST COAST

In the East Coast of Peninsular Malaysia (Pahang, Terengganu, Kelantan and East Johor) the air quality remained at good and moderate levels most of the time. Paka recorded the highest good API reading in east coast region for 281 days. Only three (3) stations recorded unhealthy air quality status throughout the year, namely Balok Baru (9 days), Rompin (4 days) and Temerloh (2 days) due to the increase in $PM_{2.5}$ concentration as a result of open burnings. However, Balok Baru station recorded very unhealthy readings for one (1) day due to high SO_2 released into the air from a premise in Gebeng Industrial Area, Kuantan and downwind movement towards the air quality station. The premise was investigated and enforcement action was taken by DOE.

The overall air quality status in the East Coast of Peninsular Malaysia is shown in **Figure 1.5**.



Rajah 1.5 : Status Kualiti Udara, Pantai Timur Semenanjung Malaysia, 2020
Figure 1.5 : Air Quality Status, East Coast Peninsular Malaysia, 2020

STATUS KUALITI UDARA DI SABAH, LABUAN DAN SARAWAK

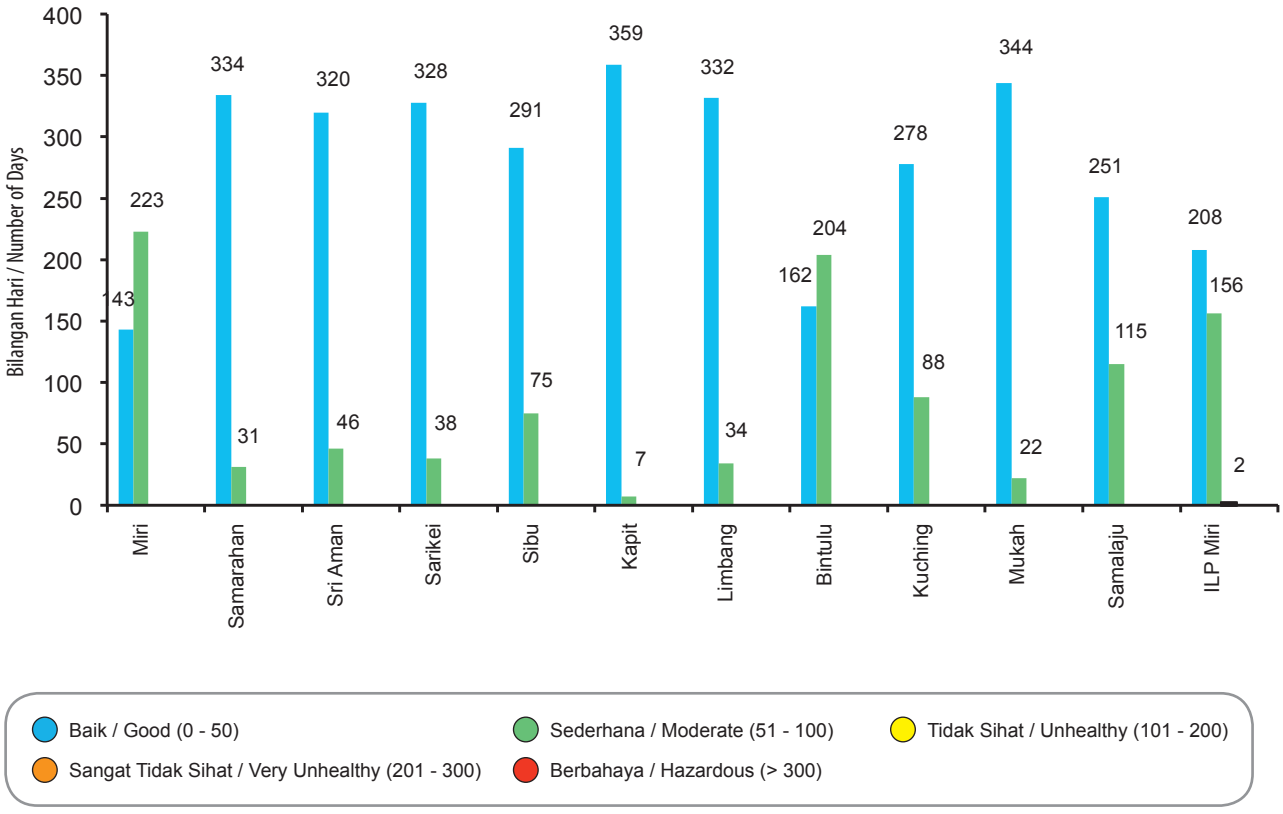
Kualiti udara di Sabah, Labuan dan Sarawak adalah pada tahap baik dan sederhana di kebanyakan masa. Stesen Kapit merekodkan bacaan IPU baik yang paling tinggi di Sarawak iaitu 359 hari manakala stesen Tawau merekodkan bacaan IPU baik yang tertinggi di Sabah iaitu 358 hari. Tiada stesen di Sarawak, Sabah dan Labuan mencatatkan bacaan tidak sihat bagi tahun 2020 kecuali ILP Miri mencatatkan bacaan IPU tidak sihat selama dua (2) hari disebabkan oleh kebakaran di kawasan belukar dan hutan setempat.

Status kualiti udara di Sarawak secara keseluruhan ditunjukkan dalam **Rajah 1.6** dan di Sabah dan Labuan ditunjukkan dalam **Rajah 1.7.**

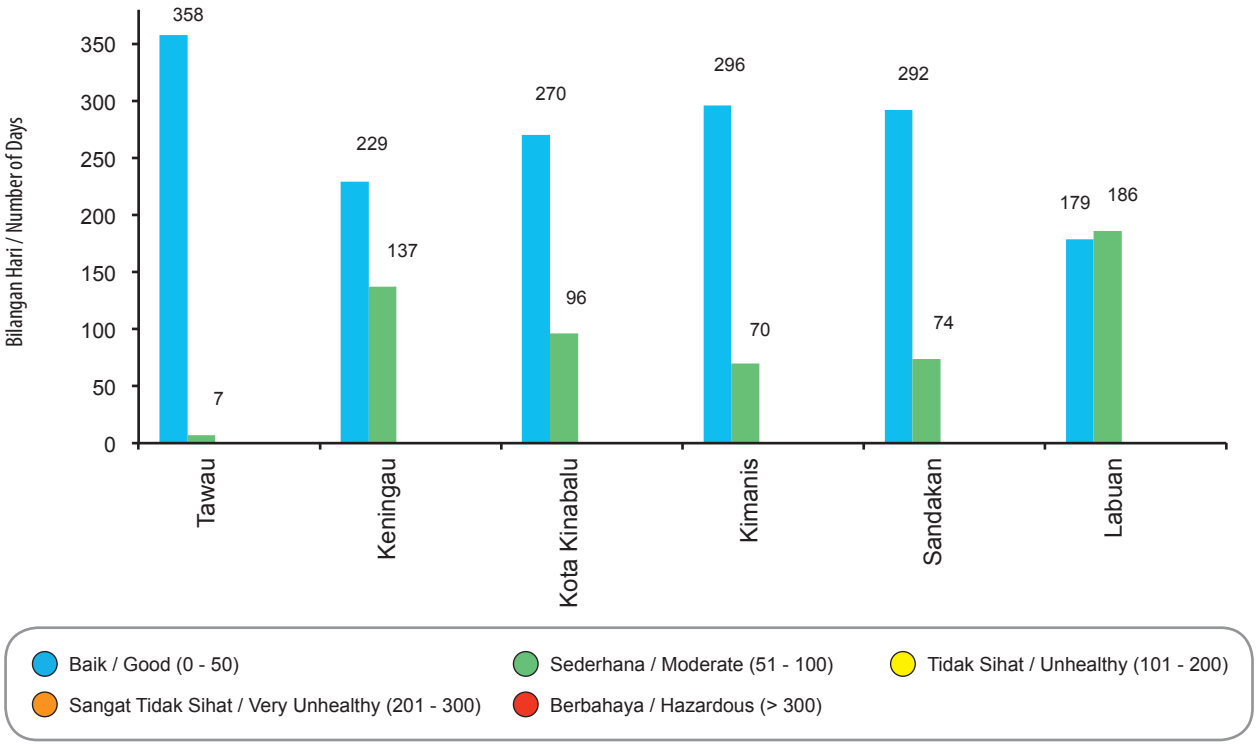
AIR QUALITY STATUS IN SABAH, LABUAN AND SARAWAK

The air quality in Sabah, Labuan and Sarawak remained between good to moderate levels most of the time. Kapit recorded good API reading in Sarawak and maintained that for 359 days while Tawau recorded good API reading in Sabah for 358 days. No station in Sarawak, Sabah and Labuan recorded unhealthy days in 2020 except in ILP Miri, which recorded API unhealthy readings for two (2) days due to local bush and forest fires.

The overall air quality status in Sarawak is shown in **Figure 1.6** and **Figure 1.7** shows the overall air quality in Sabah and Labuan.



Rajah 1.6 : Status Kualiti Udara, Sarawak, 2020
Figure 1.6 : Air Quality Status, Sarawak, 2020



Rajah 1.7 : Status Kualiti Udara, Sabah dan Labuan, 2020
Figure 1.7 : Air Quality Status, Sabah and Labuan, 2020

Ranau, Sabah

TREN KUALITI UDARA

Enam (6) pencemar udara iaitu habuk halus bersaiz 10 mikron (PM_{10}), habuk halus bersaiz 2.5 mikron ($PM_{2.5}$), ozon permukaan bumi (O_3), sulfur dioksida (SO_2), nitrogen dioksida (NO_2) dan karbon monoksida (CO) dipantau secara berterusan di 65 buah lokasi. Parameter $PM_{2.5}$ mula dipantau sepenuhnya pada tahun 2018. Tren kualiti udara dari tahun 2010 hingga 2020 ditentukan dengan mengambilkira purata data kualiti udara tahunan daripada stesen-stesen pengawasan dan merujuk kepada Standard Kualiti Udara Ambien Malaysia seperti yang ditunjukkan dalam **Jadual 1.2**. Bagi tahun 2020, Standard Kualiti Udara Ambien Malaysia IT-2 digunakan.

AIR QUALITY TREND

Six (6) air pollutants, namely particulate matter (PM_{10}), particulate matter ($PM_{2.5}$), ground level ozone (O_3), sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and carbon monoxide (CO) are monitored continuously at 65 locations. The parameter of $PM_{2.5}$ is being fully monitored since 2018. The air quality trend for the period 2010 to 2020 was calculated by averaging annual air quality data received from the monitoring sites and with reference to Malaysia Ambient Air Quality Standard as shown in **Table 1.2**. For 2020, Malaysia Ambient Air Quality Standard IT-2 is used.

Jadual 1.2 : Standard Kualiti Udara Ambien Malaysia
Table 1.2 : Malaysian Ambient Air Quality Standard

PARAMETER	MASA PURATA / AVERAGING TIME	UNIT	GARIS PANDUAN SEDIA ADA / EXISTING GUIDELINES	STANDARD KUALITI UDARA AMBIEN MALAYSIA / MALAYSIAN AMBIENT AIR QUALITY		
				IT-1 (2015)	IT-2 (2018)	STANDARD (2020)
PM_{10}	1 Tahun	µg/m³	50	50	**45**	40
	24 Jam	µg/m³	150	150	**120**	100
$PM_{2.5}$	1 Tahun	µg/m³	–	35	**25**	15
	24 Jam	µg/m³	–	75	**50**	35
SO_2	1 Jam	µg/m³	350	350	**300**	250
		ppm	0.135	0.135	**0.115**	0.095
	24 Jam	µg/m³	105	105	**90**	80
		ppm	0.040	0.040	**0.035**	0.030
*CO	1 Jam	mg/m³	35	35	**35**	30
		ppm	30.6	30.6	**30.6**	26.2
	8 Jam	mg/m³	10	10	**10**	10
		ppm	8.75	8.75	**8.75**	8.75
NO_2	1 Jam	µg/m³	320	320	**300**	280
		ppm	0.170	0.170	**0.160**	0.150
	24 Jam	µg/m³	75	75	**75**	70
		ppm	0.040	0.040	**0.040**	0.037
O_3	1 Jam	µg/m³	200	200	**200**	180
		ppm	0.100	0.100	**0.100**	0.090
	8 Jam	µg/m³	120	120	**120**	100
		ppm	0.060	0.060	**0.060**	0.050

Nota: *mg/m³ IT-Interim Tier (tahun)

HABUK HALUS (PM_{10})

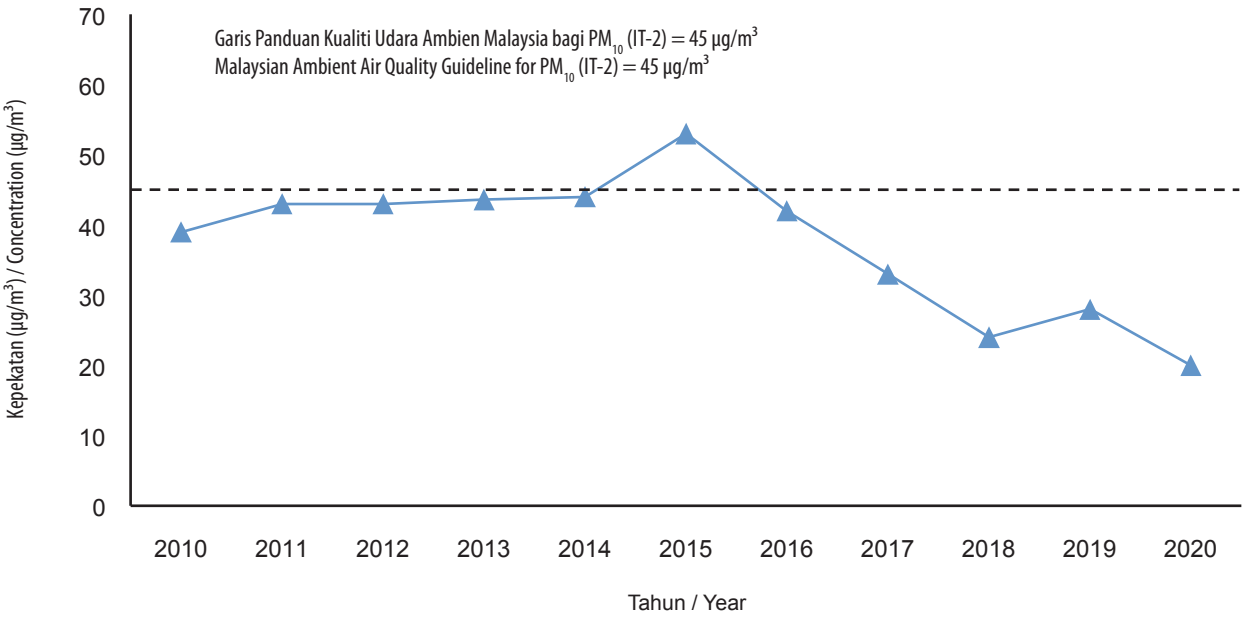
Pada tahun 2020, nilai purata tahunan PM_{10} dalam udara ambien adalah 20 µg/m³ iaitu masih belum melebihi had yang ditetapkan dalam Standard Kualiti Udara Ambien Malaysia bagi IT-2 iaitu sebanyak 45 µg/m³ seperti yang ditunjukkan dalam **Rajah 1.8**. Bacaan PM_{10} bagi tahun 2020 adalah paling rendah yang pernah dicatatkan di dalam tempoh 2010 hingga 2020. PKP yang telah dikenakan oleh Kerajaan menghadkan aktiviti industri, komersial dan sosial orang awam telah berjaya mengurangkan pencemaran udara dalam negara terutamanya kepekatan habuk halus $PM_{2.5}$ di udara.

Tren purata tahunan kepekatan PM_{10} dalam udara ambien bagi tahun 2010 hingga tahun 2020 adalah seperti yang ditunjukkan dalam **Rajah 1.8**. Berdasarkan kategori guna tanah, kawasan bandar merekodkan bacaan PM_{10} yang lebih tinggi berbanding kawasan yang lain. Walaubagaimanapun, nilai kepekatan PM_{10} pada tahun 2020 adalah mematuhi Standard Kualiti Udara Ambien Malaysia IT-2 seperti yang ditunjukkan dalam **Rajah 1.8 (a).**

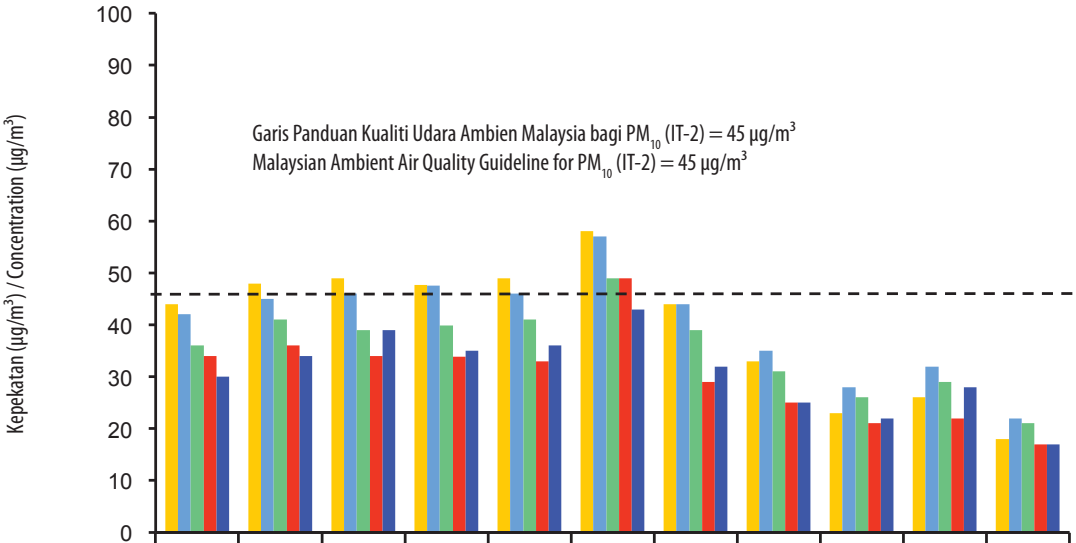
PARTICULATE MATTER (PM_{10})

In 2020, the annual average value of PM_{10} in the ambient air was 20 µg/m³ which is lower than the Malaysian Ambient Air Quality Standard IT-2 Guideline value, shown in **Figure 1.8**, of 45 µg/m³. The PM_{10} reading for 2020 was the lowest ever recorded in the period 2010 to 2020. The MCO imposed by the Government that restrained industrial, commercial and social activities successfully reduced air pollution particularly the concentration of fine particles $PM_{2.5}$ in the air.

The trend of the annual average levels of PM_{10} concentration in the ambient air from 2010 to 2020 is shown in **Figure 1.8**. With regard to the annual average based on land use, urban areas recorded higher PM_{10} readings than other areas. It must be noted though that the PM_{10} concentration value in 2020 is in compliance with the Malaysian Ambient Air Quality Standard IT-2 Guideline as shown in **Figure 1.8(a)**.



Rajah 1.8 : Purata Kepekatan Tahunan Habuk Halus (PM_{10}), 2010-2020
Figure 1.8 : Annual Average Concentration of Particulate Matter (PM_{10}), 2010-2020



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Industri / Industrial	44	48	49	48	49	58	44	33	23	26	18
Bandar / Urban	42	45	46	48	46	57	44	35	28	32	22
Pinggir Bandar / Suburban	36	41	39	40	41	49	39	31	26	29	21
Latarbelakang / Background	34	36	34	34	33	49	29	25	21	22	17
Pendalaman / Rural	30	34	39	35	36	43	32	25	22	28	17

Rajah 1.8(a) : Purata Kepekatan Tahunan Habuk Halus (PM_{10}) mengikut Guna Tanah, 2010 - 2020
Figure 1.8(a) : Annual Average Concentration of Particulate Matter (PM_{10}) by Land Use, 2010 - 2020

HABUK HALUS ($PM_{2.5}$)

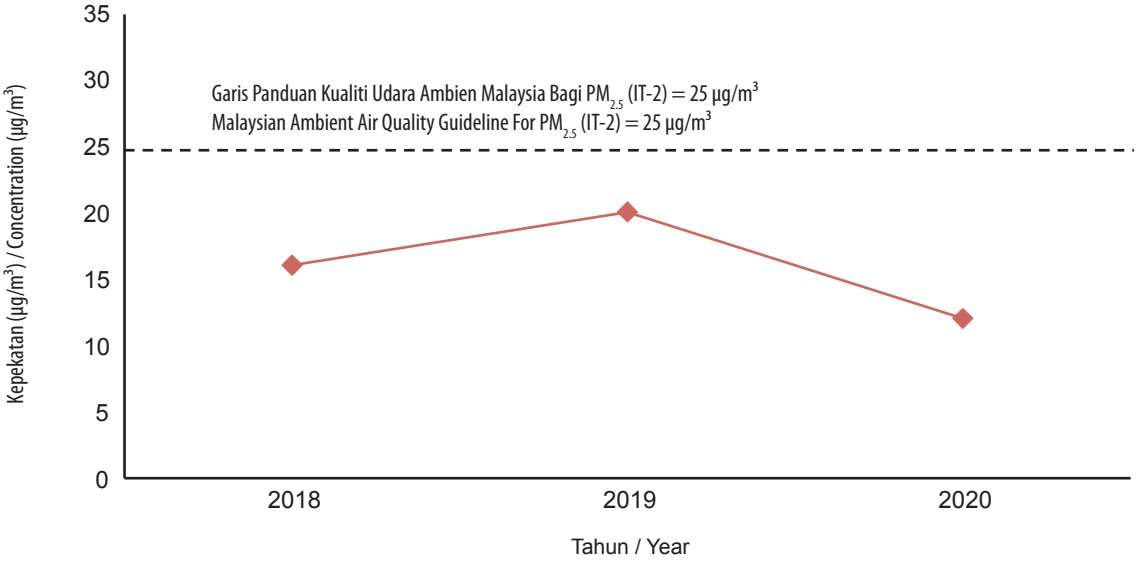
$PM_{2.5}$ mula diukur dan dianalisis bermula pada pertengahan tahun 2017 dan dilaporkan pada tahun 2018. Nilai purata tahunan $PM_{2.5}$ dalam udara ambien bagi tahun 2020 adalah 12 µg/m³ dan masih belum melebihi had yang ditetapkan dalam Standard Kualiti Udara Ambien Malaysia bagi IT-2 iaitu sebanyak 25 µg/m³. Bacaan $PM_{2.5}$ bagi tahun 2020 adalah lebih rendah berbanding dengan tahun 2019 disebabkan oleh keadaan cuaca yang lebih lembab, pengurangan kes-kes kebakaran hutan dan belukar di dalam negara dan tiada kejadian jerebu merentas sempadan yang direkodkan di dalam tahun 2020.

PARTICULATE MATTER ($PM_{2.5}$)

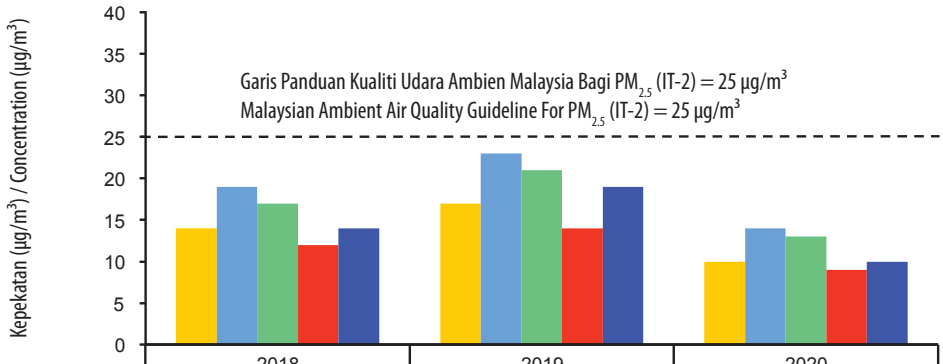
$PM_{2.5}$ started being measured and analysed since 2017 and reported in 2018. The annual average value of $PM_{2.5}$ in the ambient air for the year 2020 was 12 µg/m³ which was lower than the Malaysian Ambient Air Quality Standard IT-2 Guideline value of 25 µg/m³. $PM_{2.5}$ concentration in the year 2020 was much lower compared to that in 2019 due to humid weather conditions, a reduction of forest and bush fire cases in the country and the absence of transboundary haze incidents in 2020.

Berdasarkan kategori guna tanah, nilai kepekatan $PM_{2.5}$ pada tahun 2020 adalah mematuhi Standard Kualiti Udara Ambien Malaysia IT-2 seperti yang ditunjukkan dalam **Rajah 1.8 (b).** Daripada rajah tersebut, kepekatan $PM_{2.5}$ tertinggi mengikut guna tanah adalah di kawasan bandar dan diikuti dengan kawasan pinggir bandar.

On the basis of land use categories, $PM_{2.5}$ concentrations in 2019 was in compliance with Malaysian Ambient Air Quality Standard IT-2 as shown in **Figure 1.8(b)**. From the figure, the highest concentration of $PM_{2.5}$ according to land use was urban areas followed by suburban areas.



Rajah 1.8 (b) : Purata Kepekatan Tahunan Habuk Halus ($PM_{2.5}$), 2018-2020
Figure 1.8 (b) : Annual Average Concentration of Particulate Matter ($PM_{2.5}$), 2018-2020



	2018	2019	2020
Industri / Industrial	14	17	10
Bandar / Urban	19	23	14
Pinggir Bandar / Suburban	17	21	13
Latarbelakang / Background	12	14	9
Pendalaman / Rural	14	19	10

Rajah 1.8(c) : Purata Kepekatan Tahunan Habuk Halus ($PM_{2.5}$) mengikut Guna Tanah, 2018-2020
Figure 1.8(c) : Annual Average Concentration of Particulate Matter ($PM_{2.5}$) by Land Use, 2018- 2020

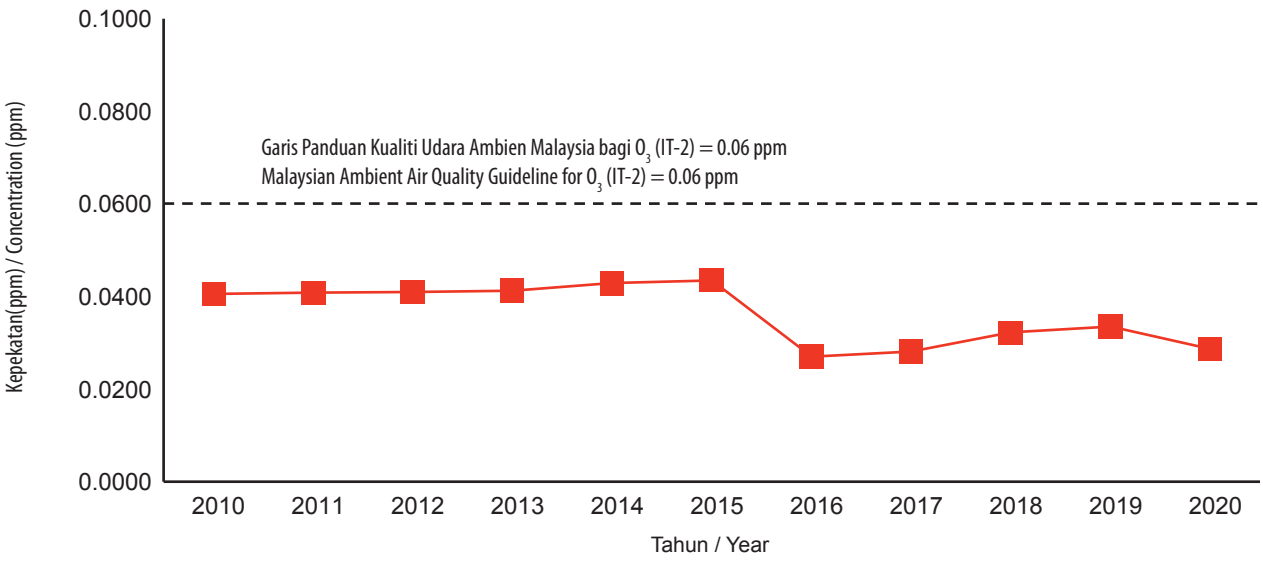
Kuala Lumpur

OZON ARAS BUMI (O_3)

Pada tahun 2020, purata tahunan kepekatan maksimum harian ozon didapati sedikit menurun berbanding dengan tahun 2019 dengan bacaan 0.0287 ppm. Secara keseluruhannya, tren purata tahunan kepekatan maksimum ozon tempoh lapan jam dalam udara ambien dari tahun 2010 hingga 2020 adalah mematuhi had sebanyak 0.06 ppm seperti yang ditetapkan dalam Standard Kualiti Udara Ambien Malaysia IT-2 dan tren tersebut adalah seperti yang ditunjukkan dalam **Rajah 1.9.**

GROUND LEVEL OZONE (O_3)

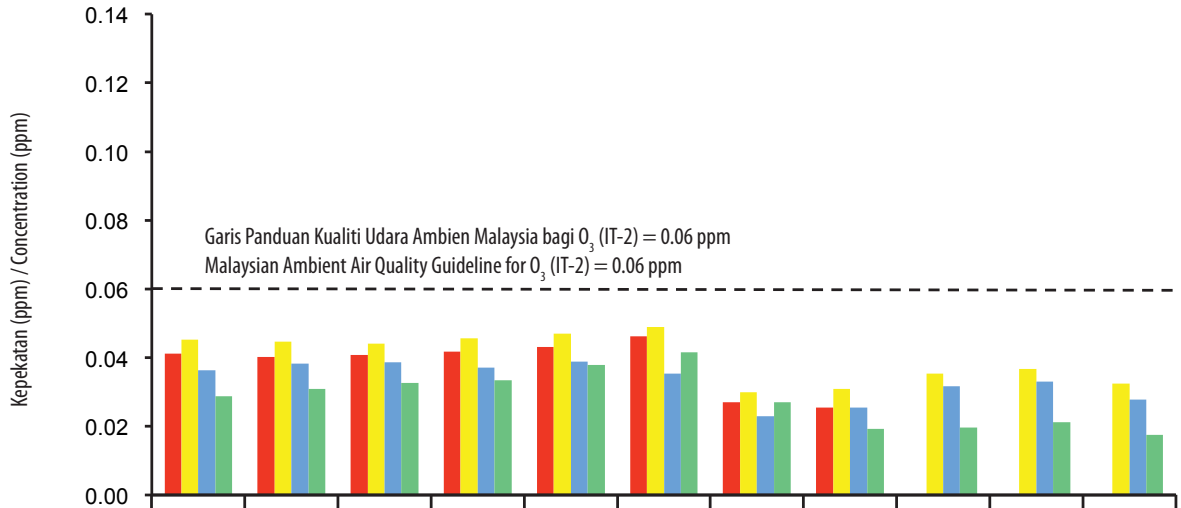
In 2020, the annual average daily maximum ozone concentrations slightly decreased compared to the year 2019 with a reading of 0.0287 ppm. Overall, it must be noted that the trend for the annual average maximum eight-hour ozone concentrations in ambient air from 2010 to 2020 were well below the limit of 0.06 ppm as stipulated in the Malaysian Ambient Quality Standard IT-2 as shown in **Figure 1.9**.



Rajah 1.9 : Purata Kepekatan Tahunan Ozon (O_3), 2010-2020
Figure 1.9 : Annual Average Concentration of Ozone (O_3), 2010-2020

Rajah 1.9(a) menunjukkan kepekatan ozon aras bumi untuk pelbagai kategori guna tanah dari tahun 2010 hingga 2020. Bermula tahun 2018, tiada pemantauan pencemar ozon aras bumi dilakukan di kawasan industri kerana untuk memberi keutamaan pemantauan ozon di kawasan bandar. Kawasan bandar mencatatkan bacaan ozon lebih tinggi disebabkan oleh jumlah trafik yang lebih tinggi dan keadaan atmosfera yang kondusif menyebabkan pembentukan ozon. Pencemaran ozon aras bumi juga ketara di beberapa kawasan pinggir bandar dan pedalaman disebabkan oleh pergerakan angin yang membawa pencetus pencemar ozon aras bumi iaitu oksida-oksid nitrogen (NO_x) dan sebatian organik meruap (VOC) yang kebanyakannya dilepaskan daripada kenderaan bermotor dan industri.

Figure 1.9(a) shows the ground level ozone concentration for various land use categories between 2010 and 2020. Starting from 2018, there was no monitoring of ground level ozone in industrial areas as the priority was given to the urban area monitoring. Urban areas recorded higher level of ground level ozone due to higher traffic volume and conducive atmospheric conditions resulting in ozone formation. Ground level ozone pollution was also dominant in some suburban and rural areas due to downwind movement of ground level ozone pollutant precursors namely nitrogen oxides (NO_x) and volatile organic compounds (VOCs) emitted mainly from motor vehicles and industries.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Industri / Industrial	0.0412	0.0402	0.0407	0.0417	0.0431	0.0463	0.0270	0.0254	0.0000	0.0000	0.0000
Bandar / Urban	0.0453	0.0447	0.0441	0.0457	0.0469	0.0489	0.0300	0.0309	0.0353	0.0367	0.0325
Pinggir Bandar / Suburban	0.0364	0.0383	0.0386	0.0370	0.0388	0.0354	0.0230	0.0254	0.0316	0.0330	0.0278
Latarbelakang / Background	0.0287	0.0309	0.0327	0.0335	0.0378	0.0416	0.0270	0.0193	0.0197	0.0212	0.0175

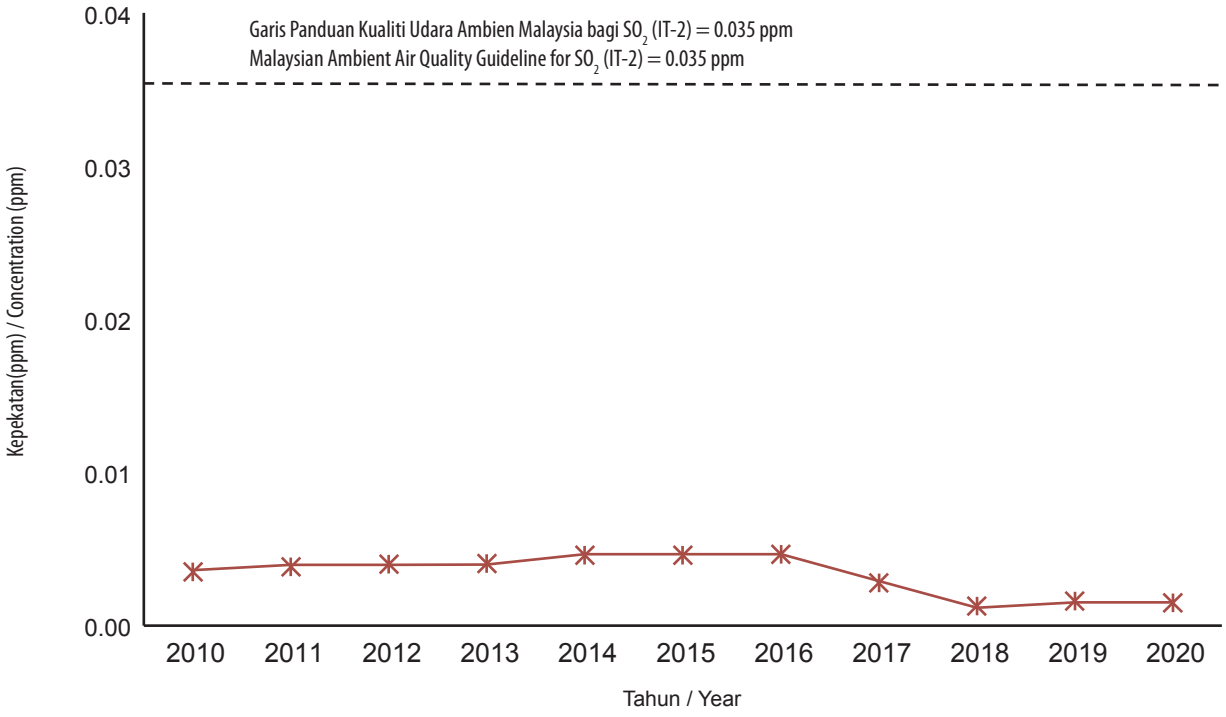
Rajah 1.9(a) : Purata Kepekatan Tahunan Ozon (O_3) mengikut Guna Tanah, 2010-2020
Figure 1.9(a) : Annual Average Concentration of Ozone (O_3) by Land Use, 2010-2020

SULFUR DIOKSIDA (SO_2)

Purata kepekatan tahunan SO_2 yang direkodkan pada tahun 2020 adalah sama seperti tahun 2019 iaitu 0.0011 ppm. Secara umumnya, purata kepekatan tahunan SO_2 menunjukkan tren penurunan dari tahun 2010 hingga 2020 (**Rajah 1.10**) dan ia adalah jauh di bawah had sebanyak 0.035 ppm seperti yang ditetapkan dalam Standard Kualiti Udara Ambien Malaysia IT-2. Ini kemungkinan disebabkan oleh penggunaan bahan api berkualiti EURO2M diesel yang lebih baik di negara ini bermula dari bulan September 2009 dan penggunaan EURO5 Diesel yang mengandungi kandungan sulfur kurang dari 10 mg/l yang telah diperkenalkan di pasaran sejak November 2015. Standard pelepasan SO_2 yang lebih ketat dalam Peraturan-Peraturan Kualiti Alam Sekeliling (Udara Bersih) 2014, penggunaan gas asli secara meluas dalam proses industri dan kegunaan kenderaan serta kenderaan elektrik turut menyumbang kepada tren penurunan pelepasan SO_2 di kawasan industri dan bandar.

SULPHUR DIOXIDE (SO_2)

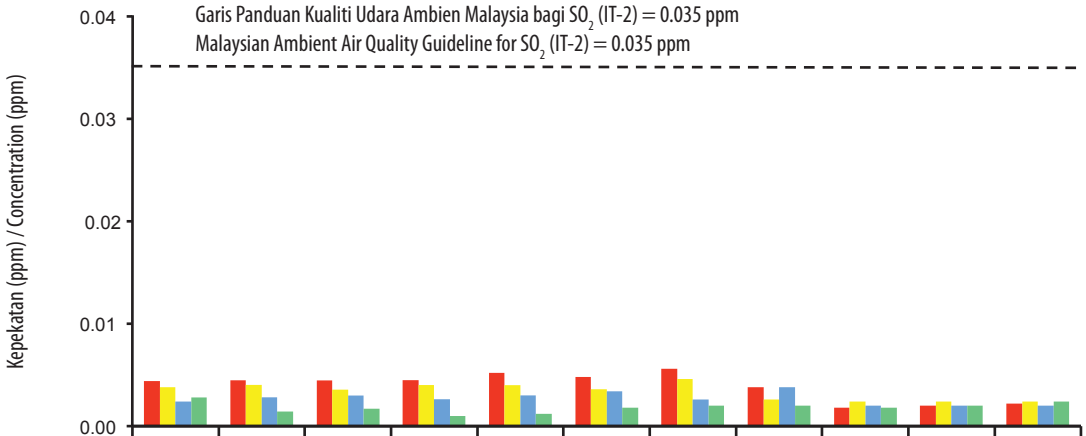
The average annual concentration of SO_2 recorded in 2020 is the same as in 2019 which is 0.0011 ppm. Generally, the annual average SO_2 concentration shows a declining trend between 2010 and 2020 (**Figure 1.10**) and it is well below the limit of 0.035 ppm stipulated in the Malaysian Ambient Air Quality Standard IT-2. The reason could be the use of better fuel quality of EURO2M diesel in this country, which began in September 2009 and EURO5 Diesel with less sulphur content than 10 mg/l that had been introduced in the market in November 2015. More stringent Environmental Regulations (Clean Air) 2014, use of natural gas for industrial combustion process and vehicles and use of electric vehicles could also have contributed to the declining trend of SO_2 in urban and industrial areas.



Rajah 1.10 : Purata Kepekatan Tahunan Sulfur Dioksida (SO_2), 2010-2020
Figure 1.10 : Annual Average Concentration of Sulphur Dioxide (SO_2), 2010-2020

Rajah 1.10 (a) menunjukkan kepekatan purata tahunan bagi sulfur dioksida mengikut kategori guna tanah. Berdasarkan kepada rajah tersebut, keadaan menunjukkan bahawa kepekatan SO_2 di kawasan-kawasan industri dan latarbelakang pada tahun 2020 adalah lebih tinggi sedikit berbanding dengan tahun 2019. Ini menunjukkan bilangan kenderaan di jalan raya tidak memberi kesan kepada peningkatan gas SO_2 di udara. Sedikit peningkatan SO_2 pada tahun 2020 berkemungkinan disebabkan loji janakuasa beroperasi secara optimum ketika PKP.

Figure 1.10(a) shows the annual average concentrations of sulphur dioxide from different categories of land use. Readings show that the concentration of SO_2 in industrial and background areas in 2020 was slightly higher than in 2019. It is evident that the number of vehicles on the road did not affect the increase of SO_2 gas in the air. The slight increase SO_2 in 2020 could be due to power plants being operated at optimum level during MCO.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Industri / Industrial	0.0022	0.0022	0.0022	0.0022	0.0026	0.0024	0.0028	0.0019	0.0009	0.0010	0.0011
Bandar /Urban	0.0019	0.0020	0.0018	0.0020	0.0020	0.0018	0.0023	0.0013	0.0012	0.0012	0.0012
Pinggir Bandar / Suburban	0.0012	0.0014	0.0015	0.0013	0.0015	0.0017	0.0013	0.0019	0.0010	0.0010	0.0010
Latarbelakang / Background	0.0014	0.0007	0.0009	0.0005	0.0006	0.0009	0.0010	0.0010	0.0009	0.0010	0.0012

Rajah 1.10(a) : Purata Kepekatan Tahunan Sulfur Dioksida (SO_2) mengikut Guna Tanah, 2010-2020
Figure 1.10(a) Malaysia : Annual Average Concentration of Sulfur Dioxide (SO_2) by Land Use, 2010-2020

NITROGEN DIOKSIDA (NO_2)

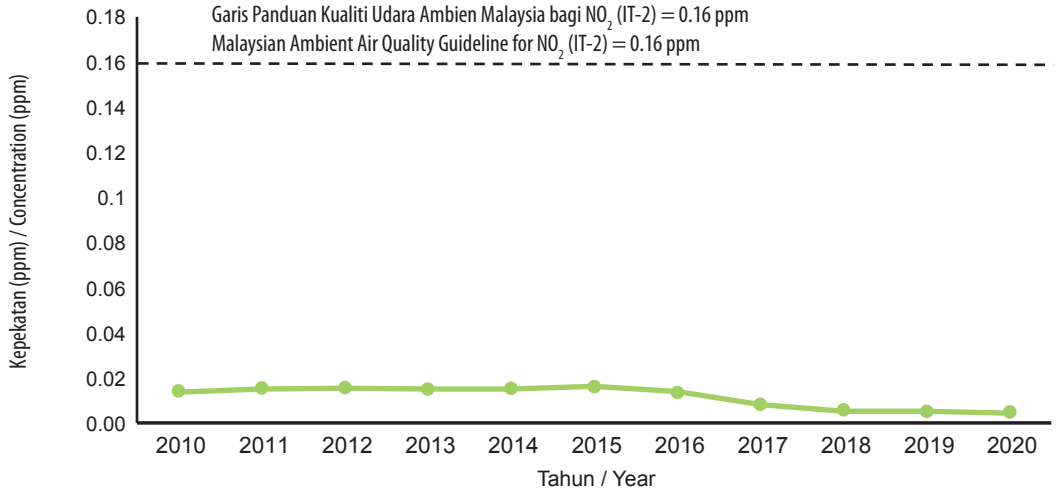
Pada tahun 2020, kepekatan NO_2 adalah lebih rendah berbanding dengan tahun 2019 iaitu dengan bacaan 0.0057 ppm. Keadaan ini adalah disebabkan oleh bilangan kenderaan yang berkurangan di jalan raya ekoran arahan PKP yang dikeluarkan oleh Kerajaan bermula 18 Mac 2020 disebabkan pandemik Covid-19. Walau bagaimanapun, kepekatan NO_2 kekal tinggi di kawasan bandar. Anggaran beban pelepasan NO_2 menunjukkan sebanyak 66 peratus adalah daripada loji janakuasa, 25 peratus daripada pelepasan kenderaan

NITROGEN DIOXIDE (NO_2)

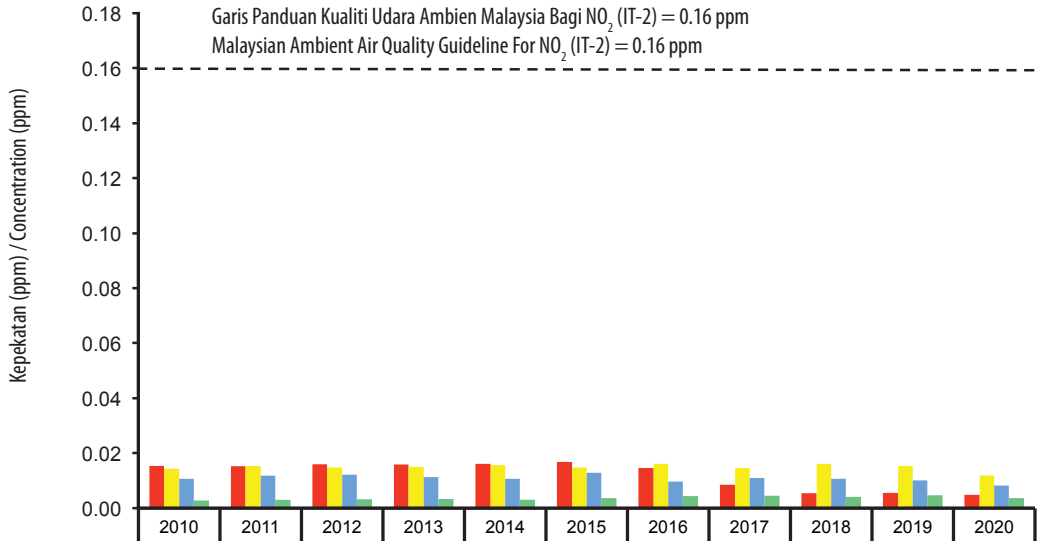
In 2020, NO_2 concentration was lower than in 2019 with a reading of 0.0057 ppm. This situation could be due to the declining number of vehicles on the road following the MCO directive issued by the Government on 18 March 2020 to prevent the spread of Covid-19. However, the NO_2 concentration remained high in urban areas. An estimation of NO_2 emission load indicated that 66 percent were from powerplants while 25 percent were from motor vehicles, 7 percent from industries and 2 percent from other sources. The annual average concentration

bermotor, 7 peratus daripada industri dan 2 peratus daripada lain-lain sumber. Kepekatan purata tahunan NO_2 dalam udara ambien dari tahun 2010 hingga 2016 adalah hampir konstan dan menunjukkan tren penurunan sejak 2016 hingga 2020 serta jauh berada di bawah had yang ditetapkan dalam Standard Kualiti Udara Ambien Malaysia IT-2. (**Rajah 1.11** dan **Rajah 1.11(a)**)

of NO_2 in the ambient air from 2010 to 2016 remained almost constant and starts a declining trend after 2016 and continues until 2020 well below the Malaysia Ambient Air Quality Standard IT-2. (**Figure 1.11** and **Figure 1.11(a)**)



Rajah 1.11 : Purata Kepekatan Tahunan Nitrogen Dioksida (NO_2), 2010-2020
Figure 1.11 : Annual Average Concentration of Nitrogen Dioxide (NO_2), 2010-2020



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Industri / Industrial	0.0105	0.0104	0.0109	0.0109	0.0110	0.0115	0.0100	0.0058	0.0037	0.0038	0.0033
Bandar / Urban	0.0098	0.0105	0.0101	0.0103	0.0107	0.0101	0.0110	0.0100	0.0110	0.0105	0.0081
Pinggir Bandar / Suburban	0.0073	0.0081	0.0083	0.0077	0.0073	0.0088	0.0066	0.0075	0.0073	0.0069	0.0056
Latarbelakang / Background	0.0019	0.0021	0.0022	0.0023	0.0021	0.0025	0.0030	0.0031	0.0028	0.0032	0.0025

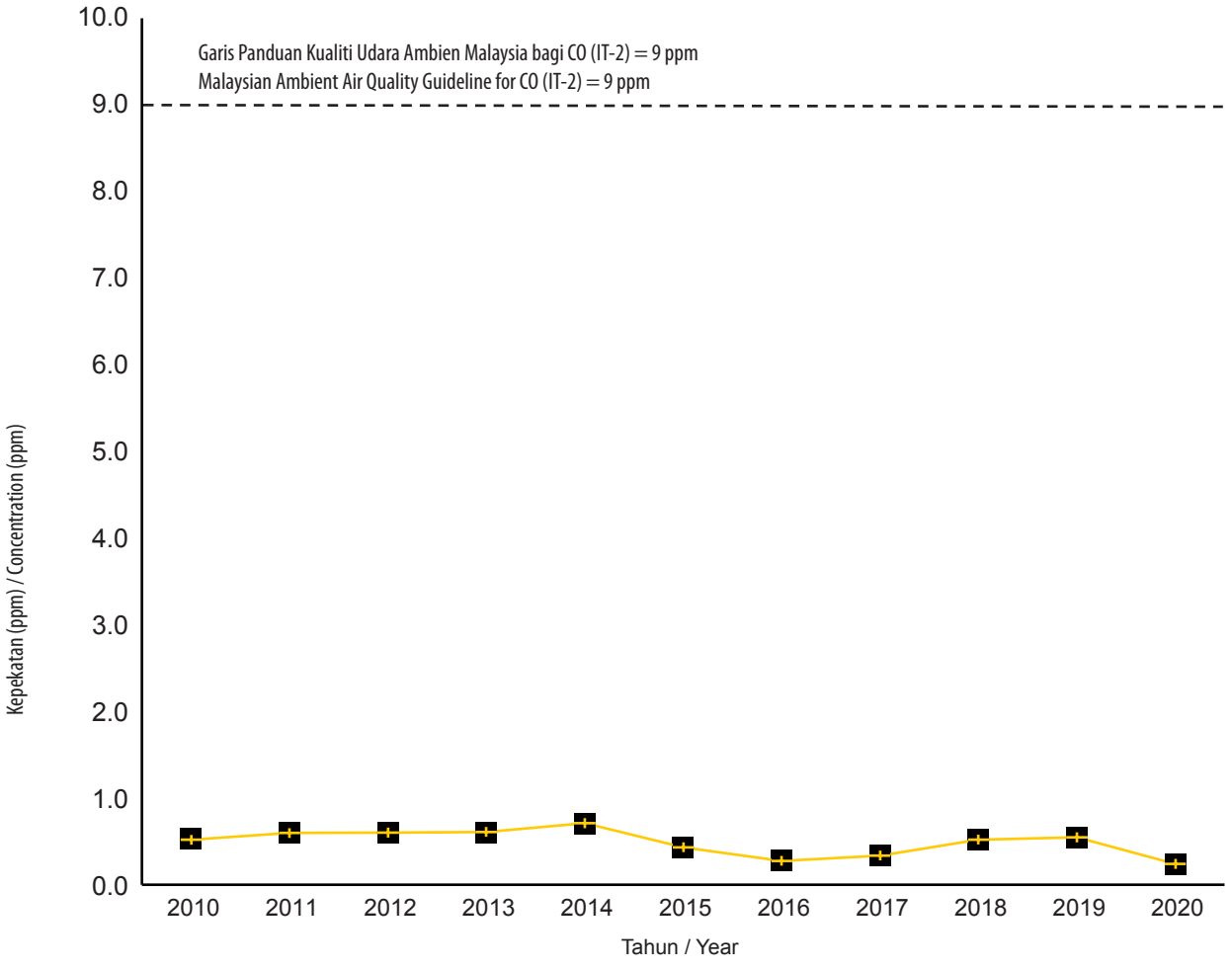
Rajah 1.11(a) : Purata Kepekatan Tahunan Nitrogen Dioksida (NO_2) mengikut Guna Tanah, 2010-2020
Figure 1.11(a) : Annual Average Concentration of Nitrogen Dioxide (NO_2) by Land Use, 2010-2020

KARBON MONOKSIDA (CO)

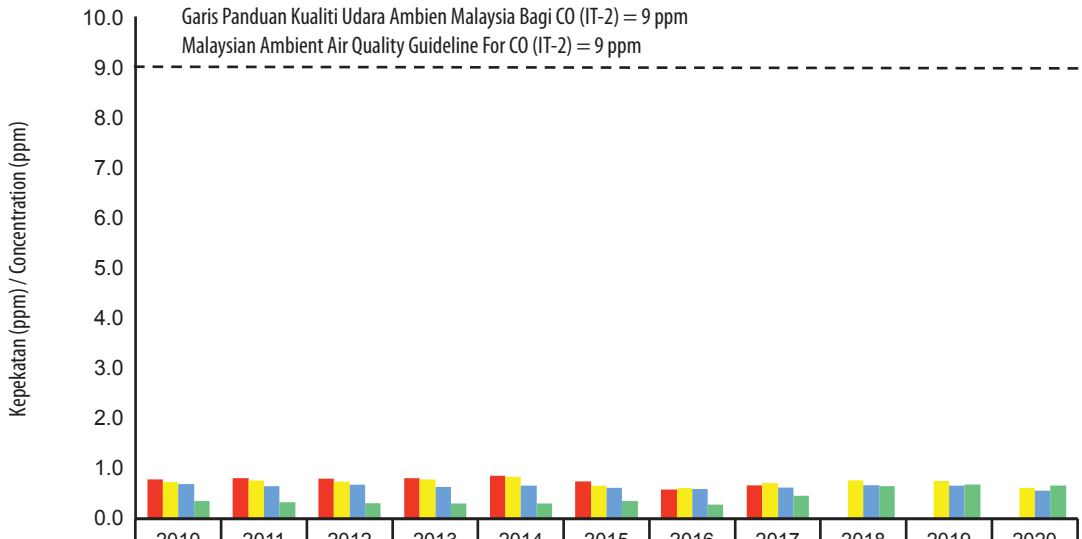
Kepekatan CO pada tahun 2020 menunjukkan penurunan berbanding tahun 2019 iaitu dengan bacaan 0.5451 ppm. Tahap kepekatan yang dicatatkan juga mematuhi Standard Kualiti Udara Ambien Malaysia IT-2 (**Rajah 1.12**). Selain daripada pengurangan bilangan kenderaan di jalan raya, pengurangan bilangan kejadian kebakaran hutan dan belukar di dalam negara juga turut menyumbang kepada penurunan kepekatan CO. Kepekatan CO yang signifikan adalah disebabkan oleh pelepasan dari ekzos kenderaan motor yang menyumbang sebanyak 95 peratus daripada beban pelepasan CO pada tahun 2020. **Rajah 1.12(a)** menunjukkan kepekatan CO untuk pelbagai kategori guna tanah.

CARBON MONOXIDE (CO)

There was a slight decrease in CO levels in 2020 compared to 2019 with a reading of 0.5451 ppm. The levels recorded were well in compliance with the Malaysian Ambient Air Quality Standard IT-2 (**Figure 1.12**). Apart from the reduction in the number of vehicles on the road, the reduction in the number of forest and bush fire incidents in the country also contributed to the decrease in CO concentration in the air for 2020. A significant contribution to concentration of CO would be the motor vehicle exhaust emissions that contributed to 95 percent of the CO emission load in 2020. **Figure 1.12(a)** shows CO concentrations for various categories of land use.



Rajah 1.12 : Purata Kepekatan Tahunan Karbon Monoksida (CO), 2010-2020
Figure 1.12 : Annual Average Concentration of Carbon Monoxide (CO), 2010-2020



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Industri / Industrial	0.7439	0.7662	0.7576	0.7670	0.8116	0.7050	0.5527	0.6303	0.0000	0.0000	0.0000
Bandar / Urban	0.6933	0.7221	0.7004	0.7418	0.7923	0.6219	0.5784	0.6745	0.7247	0.7126	0.5831
Pinggir Bandar / Suburban	0.6541	0.6146	0.6447	0.6012	0.6258	0.5840	0.5637	0.5889	0.6329	0.6250	0.5304
Latarbelakang / Background	0.3357	0.3123	0.2932	0.2899	0.2886	0.3357	0.2680	0.4340	0.6170	0.6476	0.6265

Rajah 1.12(a) : Purata Kepekatan Tahunan Karbon Monoksida (CO) mengikut Guna Tanah, 2010-2020
Figure 1.12(a) : Annual Average Concentration of Carbon Monoxide (CO) by Land Use, 2010-2020

STATUS KUALITI UDARA SEBELUM DAN SEPANJANG TEMPOH PERINTAH KAWALAN PERGERAKAN (PKP)

Pihak Kerajaan telah mengeluarkan arahan Perintah Kawalan Pergerakan (PKP) bermula dari 18 Mac hingga 3 Mei 2020 bagi mengekang penularan wabak virus COVID-19 di negara ini. Keadaan ini telah menyebabkan aktiviti industri, komersial dan sosial terhenti kecuali bagi sektor-sektor industri dan perkilangan yang perlu sahaja. Perintah Kawalan Pergerakan Bersyarat (PKPB) mula dilaksanakan dari 4 Mei 2020 sehingga 9 Jun 2020 di mana kebanyakan premis komersial dibenarkan untuk beroperasi dan sebahagian orang ramai dibenarkan untuk keluar bekerja. Kerajaan juga telah mengumumkan bahawa pelaksanaan Perintah Kawalan Pergerakan Pemulihan (PKPP) bermula pada 10 Jun sehingga 31 Ogos 2020 di mana lebih banyak kelonggaran yang diberikan kepada premis komersial dan industri untuk beroperasi dan orang ramai dibenarkan untuk keluar melakukan aktiviti masing-masing.

AIR QUALITY STATUS BEFORE AND DURING THE MOVEMENT CONTROL ORDER (MCO) PERIOD

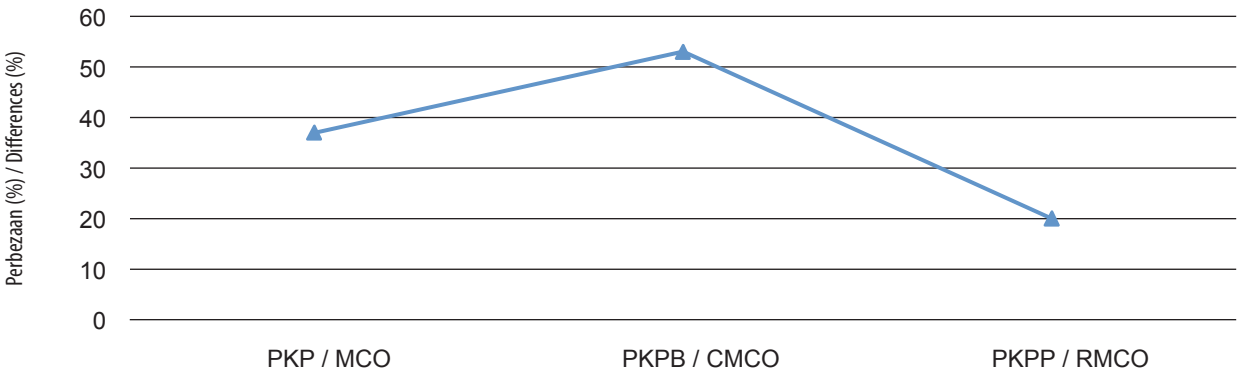
The Government imposed the Movement Control Order (MCO) from 18 March to 3 May 2020 to curb the spread of the COVID-19 virus in the country. This resulted in industrial, commercial and social activities being brought to a halt except for the essential industrial and service sectors. The Conditional Movement Control Order (CMCO) came into force from 4 May to 9 June 2020 when most commercial premises were allowed to operate and the workforce was, with conditions, allowed to go out to work. The Government then announced the implementation of the Recovery Movement Control Order (RMCO) from 10 June to 31 August 2020 where more flexibilities were given to commercial and industrial premises to operate and the public was allowed to go out to do their respective activities.

JAS telah membuat pemantauan dan analisis perbandingan terhadap IPU dan juga gas-gas pencemar udara yang lain semasa PKP, PKPB dan PKPP dan dibandingkan dengan keadaan sebelum arahan PKP dikeluarkan iaitu dari 1 Mac 2020 hingga 17 Mac 2020.

Rajah 1.13 menunjukkan ringkasan peratus perbezaan perbandingan bagi IPU bilangan hari baik di seluruh negara sebelum PKP, semasa PKP dan PKPB serta PKPP. Bilangan bacaan IPU baik merekodkan peratus bacaan yang lebih tinggi semasa PKP, PKPB dan PKPP berbanding sebelum PKP iaitu masing-masing dengan peratus peningkatan IPU baik sebanyak 37%, 53% dan 20%.

DOE conducted comparative monitoring and analysis of the API as well as other air pollutants during MCO, CMCO and RMCO and compared with the situation before the MCO directive was issued from 1 March 2020 to 17 March 2020.

Figure 1.13 shows a summary of the percentage difference in comparison for the number of good API days throughout the nation before MCO, during MCO and during CMCO and RMCO periods. The number of 'good' API readings recorded a higher percentage during MCO, CMCO and RMCO compared to before MCO - an increase of good API days by 37%, 53% and 20% respectively.



Rajah 1.13 : Perbezaan Peratus IPU Bilangan Hari Baik Semasa PKP, PKPB dan PKPP
Figure 1.13 : Percentage Differences of API in the Number of Good Days During MCO, CMCO and RMCO

STATUS KUALITI UDARA SEBELUM DAN SEPANJANG TEMPOH PERINTAH KAWALAN PERGERAKAN DI LEMBAH KLANG

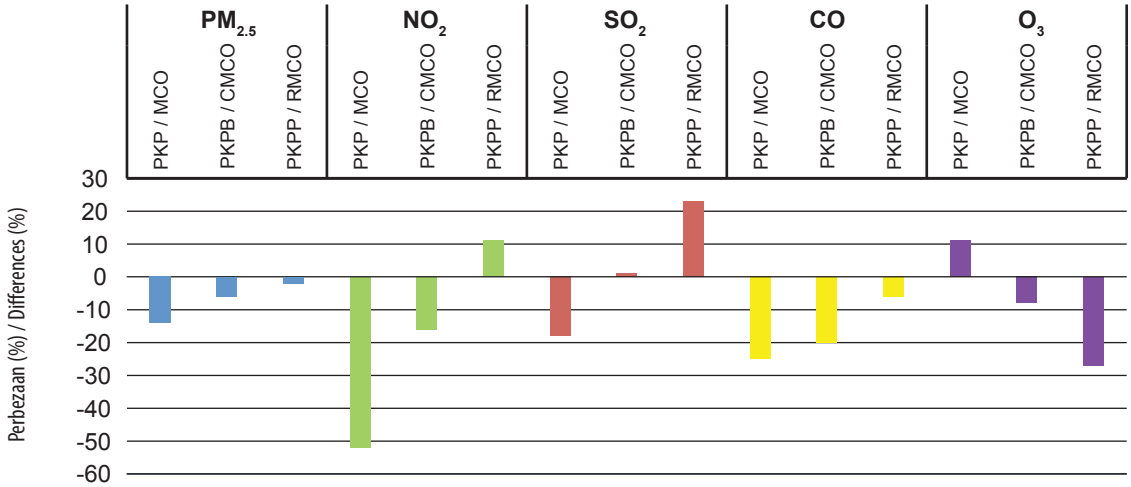
Analisis terperinci telah dijalankan ke atas beberapa parameter utama iaitu habuk halus bersaiz diameter 2.5 mikron ($PM_{2.5}$), sulfur dioksida (SO_2), nitrogen dioksida (NO_2), karbon monoksida (CO) dan ozon (O_3) di beberapa stesen pengawasan kualiti udara di Lembah Klang iaitu di Batu Muda, Cheras, Putrajaya, Petaling Jaya, Shah Alam, Klang dan Banting bagi tempoh PKP, PKPB dan PKPP dan dibandingkan dengan tempoh sebelum PKP.

AIR QUALITY STATUS BEFORE AND DURING THE PERIOD OF MOVEMENT CONTROL ORDER IN KLANG VALLEY

Detailed analyses were conducted on several key parameters namely particulate matter of 2.5 microns in diameter size ($PM_{2.5}$), sulphur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO) and ozone (O_3) at several air quality monitoring stations in the Klang Valley, namely in Batu Muda, Cheras, Putrajaya, Petaling Jaya, Shah Alam, Klang and Banting during MCO, CMCO and RMCO periods and were compared to levels before the MCO period.

NO_2 menunjukkan peratus penurunan kepekatan yang tertinggi semasa PKP iaitu 52% dan diikuti oleh CO 25%, SO_2 18% dan $PM_{2.5}$ 14%. Hanya O_3 yang menunjukkan peningkatan semasa PKP iaitu sebanyak 11% yang disebabkan oleh proses penitratan di antara NO dan O_3. Penurunan kepekatan NO_2 secara tidak langsung meningkatkan kepekatan ozon di atmosfera. Walaubagaimanapun, NO_2 dan SO_2 menunjukkan peningkatan apabila arahan PKPP dikeluarkan di mana sekatan untuk industri beroperasi dilonggarkan dan bilangan kenderaan di jalan raya semakin bertambah manakala kepekatan $PM_{2.5}$ masih menunjukkan peratus penurunan semasa PKP, PKPB dan PKPB. Tren perubahan peratus setiap kepekatan pencemar ditunjukkan di dalam **Rajah 1.14**.

NO_2 showed the highest decline during MCO of 52% followed by CO at 25%, SO_2 at 18% and $PM_{2.5}$ at 14%. Only O_3 showed an increase during MCO of 11% due to the nitration process between NO and O_3. A decrease in concentration levels of NO_2, indirectly increases the concentration of ozone gas in the atmosphere. However, NO_2 and SO_2 showed an increase when RMCO directives were issued in which restrictions on the operating industries were lifted and the number of vehicles on the road increased while $PM_{2.5}$ concentrations still showed a decrease during MCO, CMCO and RMCO. The trend of change in percentage of each pollutant concentration is shown in **Figure 1.14**.



Rajah 1.14 : Perbezaan Peratus Pencemar Udara Semasa PKP, PKPB dan PKPP di Lembah Klang
Figure 1.14 : Percentage Differences of Air Pollutants During MCO, CMCO and RMCO in Klang Valley

STATUS KUALITI UDARA SEBELUM DAN SEPANJANG TEMPOH PERINTAH KAWALAN PERGERAKAN DI BANDAR UTAMA IN MALAYSIA

Analisis kualiti udara turut dijalankan ke atas stesen pengawasan kualiti udara di bandar-bandar utama di seluruh Malaysia seperti di Pulau Pinang, Ipoh, Shah Alam, Kuantan, Seremban, Melaka, Pasir Gudang, Kuching dan Kota Kinabalu bagi tempoh yang sama dan tren perubahan peratus bagi setiap kepekatan pencemar ditunjukkan di dalam **Rajah 1.15**.

AIR QUALITY STATUS BEFORE AND DURING THE PERIOD OF MOVEMENT CONTROL ORDER IN MAIN CITIES OF MALAYSIA

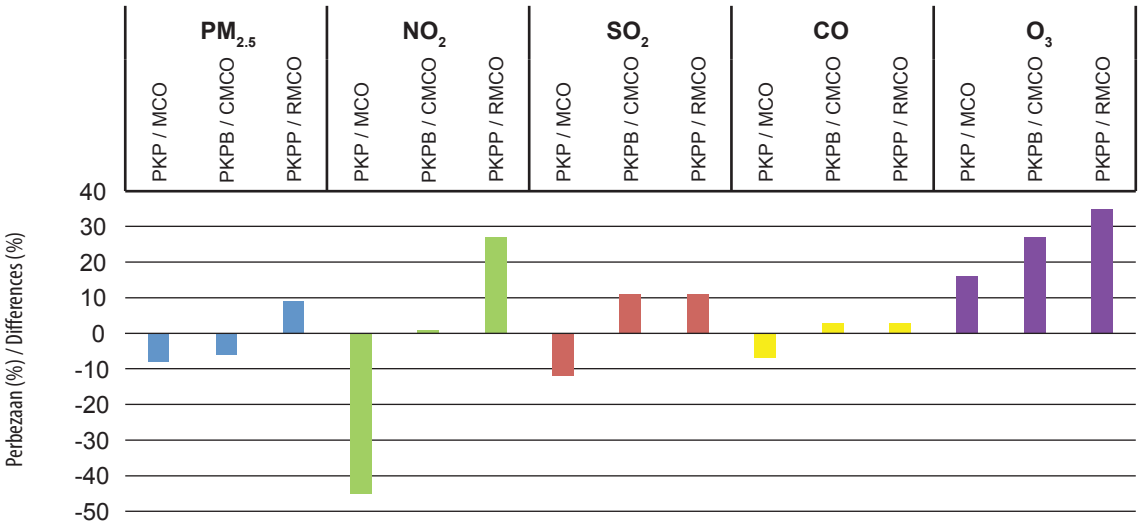
Air quality analyses were also conducted on air quality monitoring stations in major cities throughout Malaysia such as Penang, Ipoh, Shah Alam, Kuantan, Seremban, Melaka, Pasir Gudang, Kuching and Kota Kinabalu for the same period and the percentage of change for each concentration of pollutant is shown in **Figure 1.15**.

NO_2 menunjukkan peratus perbezaan penurunan kepekatan yang lebih tinggi semasa PKP iaitu 45% dan diikuti oleh SO_2 12%, $PM_{2.5}$ 8 % dan CO 7%. Hanya O_3 yang menunjukkan peningkatan semasa PKP iaitu sebanyak 16%. Walau bagaimanapun, semua parameter pencemar udara menunjukkan peningkatan apabila arahan PKPB dan PKPP dilaksanakan. Keadaan ini adalah dipengaruhi oleh kegiatan industri yang berjalan secara aktif, aktiviti perkapalan di pelabuhan serta pengoperasian janakuasa tenaga secara optimum di bandar-bandar utama semasa tempoh PKPB dan PKPP.

Kesimpulannya, peningkatan bilangan kenderaan di jalanraya dan juga aktiviti industri memainkan peranan penting dalam mempengaruhi tren kualiti udara di dalam negara. Ini adalah terbukti apabila Kerajaan telah melonggarkan PKP kepada PKPB dan PKPP, terdapat peningkatan parameter pencemar udara walaupun aktiviti sosial dan industri tidak sepenuhnya beroperasi. Walau bagaimanapun, tahap pencemaran kualiti udara semasa tempoh PKP, PKPB dan PKPP masih lagi baik sehingga akhir tahun 2020 jika dibandingkan dengan tempoh sebelum PKP dilaksanakan. Ini juga kemungkinan dipengaruhi oleh cuaca yang basah dalam negara dalam tempoh tersebut.

NO_2 showed a marked decrease during MCO of 45% followed by SO_2 with 12%, $PM_{2.5}$ with 8% and CO with 7%. Only O_3 showed an increase during the MCO of 16%. However, all air pollutant parameters showed an increase when the CMCO and RMCO were implemented. This was primarily due to active industrial activities, shipping activities in ports as well as the optimal operation of power stations in major cities during the CMCO and RMCO periods.

In conclusion, the increasing number of vehicles on the road as well as industrial activities play an important role in influencing air quality trends in the country. This is evident when the Government lifted the MCO and moved to CMCO and RMCO conditions. There was an increase in air pollutant parameters even though the social and industrial activities were not fully operational. Nevertheless, the level of air quality during the MCO, CMCO and RMCO periods remained good through to the end of 2020 compared to the period before the MCO was implemented. This could also be attributed to the wet weather in the country during that period.



Rajah 1.15 : Perbezaan Peratus Pencemar Udara Semasa PKP, PKPB dan PKPP bagi Bandar Utama di Malaysia
Figure 1.15 : Percentage Differences of Air Pollutants During MCO, CMCO and RMCO for Main Cities in Malaysia

BAB 2
CHAPTER 2

KUALITI AIR SUNGAI
RIVER WATER QUALITY

KUALITI AIR SUNGAI / RIVER WATER QUALITY

PROGRAM PENGAWASAN KUALITI ALAM SEKITAR (EQMP)

EQMP merupakan satu program inisiatif kerajaan untuk memantapkan pemantauan kualiti alam sekitar. Program ini melibatkan pengumpulan data kualiti air sungai di seluruh Malaysia bagi tujuan untuk melaporkan tahap sebenar kualiti alam sekitar Negara dalam usaha untuk memantau, mencegah dan mengawal pencemaran.

EQMP ini adalah penambahbaikan daripada sistem pengawasan kualiti alam sekitar yang telah digunapakai oleh Jabatan Alam Sekitar (JAS) sejak tahun 1995 sehingga 2015 bagi pengawasan kualiti air sungai.

PENGAWASAN KUALITI AIR SUNGAI MANUAL

JAS meneruskan program pengawasan kualiti air sungai pada tahun 2020 bagi menentukan kualiti air sungai dan mengesan perubahan ke atas kualiti air sungai. Sampel-sampel air sungai diambil daripada stesen-stesen yang telah ditetapkan dan diukur kualitinya secara in-situ serta dihantar ke makmal untuk dianalisis bertujuan menentukan kriteria dari segi fizik-kimia dan biologi. Indeks Kualiti Air (IKA) digunakan untuk mengukur tahap pencemaran dan kesesuaian jenis guna air seperti yang digariskan oleh Standard Kualiti Air Kebangsaan (**ANNEX**). IKA telah mengambilkira parameter Oksigen Terlarut (DO), Keperluan Oksigen Biokimia (BOD), Keperluan Oksigen Kimia (COD), Ammoniakal Nitrogen (AN), Pepejal Terampai (SS) dan pH. Pada tahun 2020, kualiti air sungai telah dinilai berdasarkan sejumlah 8,098 sampel air sungai yang telah diambil daripada sejumlah 1,353 stesen pengawasan manual yang merangkumi 672 sungai di Malaysia.

THE ENVIRONMENTAL QUALITY MONITORING PROGRAMME (EQMP)

EQMP is a Government initiative to consolidate and strengthen the monitoring of environmental quality. The programme involves data collection of river water quality throughout Malaysia for the purpose of reporting the actual level of environmental quality in the country in order to effectively monitor, prevent and control pollution.

The EQMP is an improvement of the environmental quality monitoring system that had been adopted by the Department of Environment (DOE) from 1995 to 2015 for river water quality monitoring.

MANUAL RIVER WATER QUALITY MONITORING

The DOE continued the river water quality monitoring programme in 2020 to determine the status of river water quality and to detect changes in river water quality. Water samples were collected from designated stations for in-situ and laboratory analysis to determine the physic, chemistry and biological characteristics. The Water Quality Index (WQI) is used to indicate the level of pollution and the corresponding suitability in terms of water uses according to the National Water Quality Standards for Malaysia (NWQS) (**ANNEX**). The WQI takes into consideration parameters including Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Ammoniacal Nitrogen (AN), Suspended Solids (SS) and pH-levels. In 2020, river water quality was assessed based on 8,098 samples taken from a total of 1,353 manual monitoring stations covering 672 rivers in Malaysia.

STATUS KUALITI AIR SUNGAI

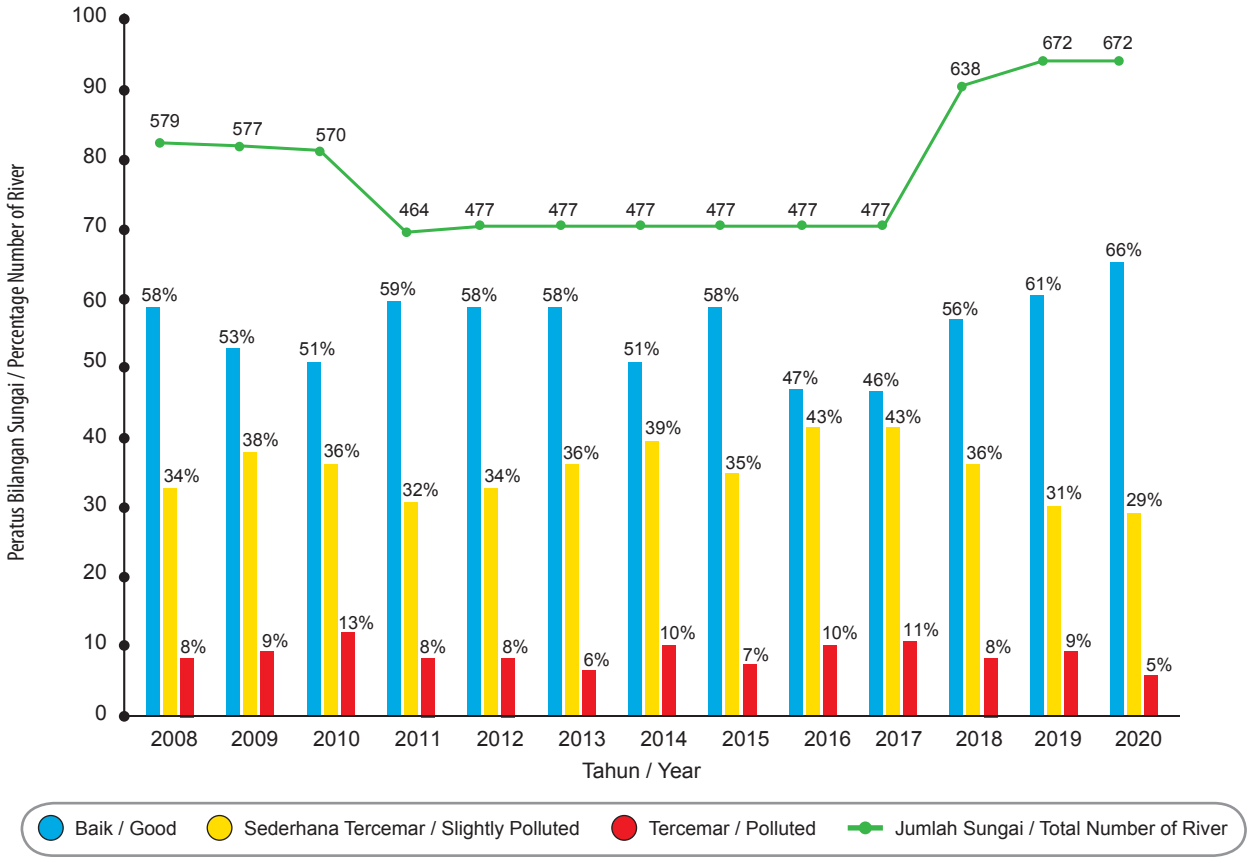
Sejumlah 443 (66%) sungai daripada 672 sungai yang dipantau telah menunjukkan indeks kualiti air bersih, 195 (29%) adalah sederhana tercemar dan 34 (5%) adalah tercemar (**Rajah 2.1**). Status kualiti air bagi sungai-sungai yang dipantau adalah seperti dalam **Jadual 2.1, Jadual 2.2** dan **Jadual 2.3**.

Keperluan BOD, AN, dan SS masih menjadi punca kepada pencemaran sungai. BOD yang tinggi kerap kali dikaitkan dengan pengolahan sisa kumbahan yang tidak mencukupi, atau akibat pelepasan efluen daripada industri-industri pengilangan dan berasaskan pertanian. Punca utama AN, pula boleh dikaitkan dengan aktiviti penternakan dan kumbahan domestik manakala punca utama SS adalah kerja-kerja tanah yang tidak teratur dan aktiviti pembukaan tanah.

RIVER WATER QUALITY STATUS

Out of the 672 rivers monitored, 443 (66%) showed good water quality, 195 (29%) were slightly polluted while 34 (5%) were polluted (**Figure 2.1**). The monitored rivers and their overall quality status are as in **Tables 2.1, Table 2.2** and **Table 2.3.**

As in previous years, the BOD, AN and SS remained significant parameters in terms of river pollution. High BOD can be attributed to inadequate treatment of sewage or effluent from agro-based and manufacturing industries. The main sources of AN may be linked to animal farming and domestic sewage, while the sources for SS were mainly due to improper earthworks and land clearing activities.



Rajah 2.1 : Tren Kualiti Air Sungai, 2008-2020
Figure 2.1 : River Water Quality Trend, 2008-2020

Jadual 2.1 : Status Kualiti Air bagi Sungai Bersih, 2020
Table 2.1 : Water Quality Status of Clean Rivers, 2020

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	2019			2020		
				IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS	IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS
Perlis	Sg. Perlis	Sg. Arau	2	82	B/C	II	83	B/C	II
		Sg. Empangan Timah Tasoh	1	87	B/C	II	93	B/C	I
		Sg. Jarum	1	83	B/C	II	88	B/C	II
		Sg. Jernih	2	86	B/C	II	91	B/C	II
		Sg. Kok Mak	1	86	B/C	II	88	B/C	II
		Sg. Ngulang	1	82	B/C	II	90	B/C	II
		Sg. Pelarit	1	91	B/C	II	94	B/C	I
		Sg. Serai	1	76	ST/SP	III	82	B/C	II
		Sg. Terusan Mada	2	85	B/C	II	88	B/C	II
		Sg. Wang Kelian	1	94	B/C	I	95	B/C	I
Kedah	Sg. Kedah	Sg. Ahning	1	88	B/C	II	92	B/C	II
		Sg. Changlun	1	77	ST/SP	II	87	B/C	II
		Sg. Janing	1	91	B/C	II	93	B/C	I
		Sg. Napoh	1	80	ST/SP	II	82	B/C	II
		Sg. Padang Terap	5	87	B/C	II	86	B/C	II
		Sg. Pedu	1	90	B/C	II	91	B/C	II
		Sg. Pendang	1	77	ST/SP	II	81	B/C	II
		Sg. Sintok	1	81	B/C	II	92	B/C	II
		Sg. Tekai	1	80	ST/SP	II	88	B/C	II
		Sg. Temin	1	77	ST/SP	II	84	B/C	II
		Sg. Terusan Lengkuas	1	89	B/C	II	86	B/C	II
		Sg. Terusan Mada Selatan	1	88	B/C	II	89	B/C	II
		Sg. Terusan Tengah	1	89	B/C	II	88	B/C	II
	Sg. Kisap	Sg. Kisap	1	90	B/C	II	95	B/C	I
	Sg. Kuah	Sg. Kuah	1	74	ST/SP	III	81	B/C	II
	Sg. Merbok	Sg. Bukit Merah	1	80	ST/SP	II	92	B/C	II
		Sg. Bukit Nanas	1	93	B/C	I	95	B/C	I
		Sg. Tok Pawang	2	88	B/C	II	90	B/C	II
		Sg. Tupah	1	93	B/C	I	94	B/C	I
	Sg. Muda	Sg. Chepir	1	87	B/C	II	89	B/C	II
		Sg. Gunung Inas	1	92	B/C	II	93	B/C	I
		Sg. Karangan	1	81	B/C	II	85	B/C	II
		Sg. Ketil	1	85	B/C	II	87	B/C	II
		Sg. Muda	12	86	B/C	II	87	B/C	II
		Sg. Pegang	1	93	B/C	I	95	B/C	I
		Sg. Sedim	2	87	B/C	II	89	B/C	II
		Sg. Tawar	3	90	B/C	II	88	B/C	II

Jadual 2.1 : Status Kualiti Air bagi Sungai Bersih, 2020
Table 2.1 : Water Quality Status of Clean Rivers, 2020

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	2019			2020		
				IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS	IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS
Kedah	Sg. Ulu Melaka	Sg. Melaka	3	82	B/C	II	90	B/C	II
		Sg. Petang	1	93	B/C	I	96	B/C	I
		Sg. Saga	1	76	ST/SP	III	81	B/C	II
		Sg. Tuba	1	88	B/C	II	94	B/C	I
P. Pinang	Sg. Juru	Sg. Ara	1	66	ST/SP	III	82	B/C	II
	Sg. Pinang	Sg. Air Terjun	1	93	B/C	I	95	B/C	I
		Sg. Batu Feringghi	2	87	B/C	II	92	B/C	II
		Sg. Satu	1	93	B/C	I	96	B/C	I
P. Pinang / Kedah	Sg. Perai	Sg. Kulim	5	91	B/C	II	89	B/C	II
P. Pinang / Kedah / Perak	Sg. Kerian	Sg. Kechil	2	85	B/C	II	86	B/C	II
		Sg. Kerian	6	83	B/C	II	86	B/C	II
		Sg. Selama	3	87	B/C	II	88	B/C	II
		Sg. Semang	1	76	ST/SP	III	81	B/C	II
		Sg. Terusan Bagan Serai	1	91	B/C	II	93	B/C	I
Perak	Sg. Bruas	Sg. Bruas	3	90	B/C	II	90	B/C	II
		Sg. Dandang	1	86	B/C	II	91	B/C	II
		Sg. Licin	1	95	B/C	I	96	B/C	I
		Sg. Rotan	2	89	B/C	II	89	B/C	II
	Sg. Kurau	Sg. Air Hitam	1	76	ST/SP	III	95	B/C	I
		Sg. Ara	2	92	B/C	II	93	B/C	I
		Sg. Kurau	4	86	B/C	II	86	B/C	II
	Sg. Perak	Sg. Batang Padang	3	82	B/C	II	88	B/C	II
		Sg. Behrang	1	94	B/C	I	97	B/C	I
		Sg. Berok	1	92	B/C	II	96	B/C	I
		Sg. Bidor	3	84	B/C	II	84	B/C	II
		Sg. Chenderiang	2	91	B/C	II	93	B/C	I
		Sg. Chepor	1	94	B/C	I	96	B/C	I
		Sg. Cuar	1	83	B/C	II	87	B/C	II
		Sg. Ibol	1	93	B/C	I	94	B/C	I
		Sg. Kampar	2	87	B/C	II	92	B/C	II
		Sg. Kangsar	3	88	B/C	II	91	B/C	II
		Sg. Kerbau	2	92	B/C	II	94	B/C	I
		Sg. Kinjang	1	94	B/C	I	96	B/C	I
		Sg. Kinta	9	76	ST/SP	III	83	B/C	II
		Sg. Klah	2	89	B/C	II	91	B/C	II
		Sg. Klian Baru	2	76	ST/SP	III	81	B/C	II
		Sg. Klian Gunong	1	93	B/C	I	96	B/C	I
		Sg. Kuang	1	80	ST/SP	II	81	B/C	II

Jadual 2.1 : Status Kualiti Air bagi Sungai Bersih, 2020
Table 2.1 : Water Quality Status of Clean Rivers, 2020

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	2019			2020		
				IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS	IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS
Perak	Sg. Perak	Sg. Manong	1	95	B/C	I	95	B/C	I
		Sg. Pelus	2	85	B/C	II	88	B/C	II
		Sg. Perak	18	88	B/C	II	89	B/C	II
		Sg. Pulau	1	94	B/C	I	95	B/C	I
		Sg. Raia	2	82	B/C	II	86	B/C	II
		Sg. Rui	2	91	B/C	II	94	B/C	I
		Sg. Sungkai	4	88	B/C	II	91	B/C	II
		Sg. Sungkai Mati	2	76	ST/SP	III	81	B/C	II
		Sg. Tapah	1	95	B/C	I	96	B/C	I
		Sg. Teja	1	78	ST/SP	II	82	B/C	II
		Sg. Tesong	1	94	B/C	I	96	B/C	I
		Sg. Woh	1	94	B/C	I	96	B/C	I
	Sg. Raja Hitam	Sg. Manjong	2	85	B/C	II	86	B/C	II
		Sg. Nyior	1	95	B/C	I	95	B/C	I
	Sg. Sepetang	Sg. Batu Tegoh	5	82	B/C	II	90	B/C	II
		Sg. Jana	2	86	B/C	II	83	B/C	II
		Sg. Lidin	1	75	ST/SP	III	84	B/C	II
		Sg. Limau	1	90	B/C	II	91	B/C	II
		Sg. Nyior	2	88	B/C	II	96	B/C	I
		Sg. Temerloh	2	86	B/C	II	88	B/C	II
		Sg. Trong	2	93	B/C	I	95	B/C	I
	Sg. Wangi	Sg. Wangi	2	79	ST/SP	II	81	B/C	II
Perak / Selangor	Sg. Bernam	Sg. Bernam	8	81	B/C	II	83	B/C	II
		Sg. Dusun	1	85	B/C	II	91	B/C	II
		Sg. Gelinting	1	87	B/C	II	92	B/C	II
		Sg. Inki	1	93	B/C	I	94	B/C	I
		Sg. Slim	3	84	B/C	II	88	B/C	II
		Sg. Trolak	3	91	B/C	II	92	B/C	II
Selangor	Sg. Selangor	Sg. Batang Kali	1	87	B/C	II	90	B/C	II
		Sg. Kanching	1	84	B/C	II	90	B/C	II
		Sg. Kerling	1	93	B/C	I	94	B/C	I
		Sg. Rangkap	1	92	B/C	II	95	B/C	I
		Sg. Selangor	10	81	B/C	II	85	B/C	II
		Sg. Serendah	1	87	B/C	II	90	B/C	II
	Sg. Tengi	Sg. Tengi	4	84	B/C	II	87	B/C	II
Selangor / W.P. KL	Sg. Klang	Sg. Anak Air Batu	1	72	ST/SP	III	81	B/C	II
		Sg. Rasau	1	74	ST/SP	III	83	B/C	II
		Sg. Rumput	1	91	B/C	II	92	B/C	II
		Sg. Semelah	1	80	ST/SP	II	83	B/C	II

Jadual 2.1 : Status Kualiti Air bagi Sungai Bersih, 2020
Table 2.1 : Water Quality Status of Clean Rivers, 2020

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	2019			2020		
				IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS	IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS
Selangor/ Putrajaya/ N.Sembilan	Sg. Langat	Sg. Anak Chuau	1	83	B/C	II	89	B/C	II
		Sg. Beranang	1	76	ST/SP	III	82	B/C	II
		Sg. Chuau	2	87	B/C	II	91	B/C	II
		Sg. Jijan	1	78	ST/SP	II	85	B/C	II
		Sg. Rinching	2	85	B/C	II	88	B/C	II
		Sg. Semenyih	3	77	ST/SP	II	83	B/C	II
Melaka / N. Sembilan	Sg. Melaka	Sg. Batang Melaka	3	80	ST/SP	II	88	B/C	II
		Sg. Dusun	1	86	B/C	II	93	B/C	I
		Sg. Kemunting	1	87	B/C	II	92	B/C	II
		Sg. Tampin	3	86	B/C	II	92	B/C	II
N. Sembilan / Melaka	Sg. Linggi	Sg. Batang Penar	6	82	B/C	II	89	B/C	II
		Sg. Batu Hampar	1	88	B/C	II	93	B/C	I
		Sg. Chembong	1	83	B/C	II	93	B/C	I
		Sg. Jelai	1	84	B/C	II	89	B/C	II
		Sg. Kenaboi	1	80	ST/SP	II	83	B/C	II
		Sg. Kepayong	2	83	B/C	II	88	B/C	II
		Sg. Kundur Besar	1	86	B/C	II	91	B/C	II
		Sg. Muar	1	90	B/C	II	88	B/C	II
		Sg. Pedas	1	83	B/C	II	90	B/C	II
		Sg. Rembau	1	82	B/C	II	91	B/C	II
		Sg. Simin	1	77	ST/SP	II	82	B/C	II
		Sg. Simpang Ampat	1	79	ST/SP	II	83	B/C	II
		Sg. Siput	2	85	B/C	II	87	B/C	II
Melaka	Sg. Duyong	Sg. Gapam	1	87	B/C	II	88	B/C	II
	Sg. Kesang	Sg. Chohong	2	82	B/C	II	88	B/C	II
	Sg. Seri Melaka	Sg. Sg.Udang	1	81	B/C	II	87	B/C	II
Johor	Sg. Batu Pahat	Sg. Bantang	1	91	B/C	II	96	B/C	I
		Sg. Bekok	6	71	ST/SP	III	81	B/C	II
		Sg. Chaah	1	83	B/C	II	88	B/C	II
		Sg. Kahang	1	86	B/C	II	90	B/C	II
		Sg. Lenik	1	82	B/C	II	82	B/C	II
		Sg. Merek	1	81	B/C	II	88	B/C	II
		Sg. Merpo	1	81	B/C	II	91	B/C	II
		Sg. Semberong Dam	1	85	B/C	II	89	B/C	II
	Sg. Benut	Sg. Machap Dam	1	91	B/C	II	92	B/C	II
		Sg. Parit Hj. Yassin	1	77	ST/SP	II	85	B/C	II
		Sg. Ulu Benut	1	79	ST/SP	II	89	B/C	II

Jadual 2.1 : Status Kualiti Air bagi Sungai Bersih, 2020
Table 2.1 : Water Quality Status of Clean Rivers, 2020

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	2019			2020		
				IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS	IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS
Johor	Sg. Endau	Sg. Anak Sg. Semberong	1	84	B/C	II	84	B/C	II
		Sg. Dengar	1	80	ST/SP	II	84	B/C	II
		Sg. Empangan Labong	1	92	B/C	II	89	B/C	II
		Sg. Endau	3	89	B/C	II	87	B/C	II
		Sg. Jasin	1	94	B/C	I	94	B/C	I
		Sg. Kahang	3	86	B/C	II	90	B/C	II
		Sg. Lenggor	2	86	B/C	II	81	B/C	II
		Sg. Mamai	1	86	B/C	II	87	B/C	II
		Sg. Paloh	1	81	B/C	II	82	B/C	II
		Sg. Selai	1	92	B/C	II	92	B/C	II
		Sg. Semberong	5	83	B/C	II	84	B/C	II
		Sg. Tamok	1	91	B/C	II	91	B/C	II
	Sg. Jemaluang	Sg. Jemaluang	2	86	B/C	II	81	B/C	II
	Sg. Johor	Sg. Belitong	1	86	B/C	II	83	B/C	II
		Sg. Johor	6	83	B/C	II	84	B/C	II
		Sg. Layang	1	89	B/C	II	93	B/C	I
		Sg. Layau Kiri	1	84	B/C	II	87	B/C	II
		Sg. Linggiu	1	88	B/C	II	84	B/C	II
		Sg. Papan	1	83	B/C	II	81	B/C	II
		Sg. Pelepah	4	91	B/C	II	88	B/C	II
		Sg. Penggeli	2	87	B/C	II	89	B/C	II
		Sg. Remis	1	86	B/C	II	86	B/C	II
		Sg. Santi	1	85	B/C	II	89	B/C	II
		Sg. Sayong	4	85	B/C	II	82	B/C	II
		Sg. Seluyut	1	77	ST/SP	II	83	B/C	II
		Sg. Semangar	1	82	B/C	II	81	B/C	II
		Sg. Sening	1	83	B/C	II	89	B/C	II
		Sg. Telor	1	84	B/C	II	88	B/C	II
	Sg. Mersing	Sg. Empangan Congok	1	84	B/C	II	85	B/C	II
		Sg. Mersing	3	87	B/C	II	86	B/C	II
	Sg. Paloi	Sg. Paloi	1	80	ST/SP	II	89	B/C	II
	Sg. Pontian Kecil	Sg. Pontian Kecil	2	79	ST/SP	II	82	B/C	II
	Sg. Pulai	Sg. Pulai Dam	1	93	B/C	I	95	B/C	I
	Sg. Sedili Besar	Sg. Ambat	1	88	B/C	II	86	B/C	II
		Sg. Dohol	1	88	B/C	II	89	B/C	II
		Sg. Pasir Panjang	1	87	B/C	II	88	B/C	II
		Sg. Sedili Besar	6	82	B/C	II	86	B/C	II
		Sg. Temubor Kanan	1	90	B/C	II	93	B/C	I

Jadual 2.1 : Status Kualiti Air bagi Sungai Bersih, 2020
Table 2.1 : Water Quality Status of Clean Rivers, 2020

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	2019			2020		
				IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS	IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS
Johor	Sg. Sedili Kecil	Sg. Sedili Kecil	2	81	B/C	II	82	B/C	II
Johor / N. Sembilan / Pahang	Sg. Muar	Sg. Air Panas	1	92	B/C	II	94	B/C	I
		Sg. Belemang	1	90	B/C	II	94	B/C	I
		Sg. Gemencheh	2	83	B/C	II	82	B/C	II
		Sg. Jelai	1	83	B/C	II	88	B/C	II
		Sg. Jementah	1	91	B/C	II	93	B/C	I
		Sg. Juasseh	3	88	B/C	II	94	B/C	I
		Sg. Labis	3	79	ST/SP	II	88	B/C	II
		Sg. Meda	1	82	B/C	II	82	B/C	II
		Sg. Muar	25	82	B/C	II	83	B/C	II
		Sg. P.Mengkuang	1	67	ST/SP	III	89	B/C	II
		Sg. Palong	2	82	B/C	II	85	B/C	II
		Sg. Pendol	1	89	B/C	II	90	B/C	II
		Sg. Segamat	3	87	B/C	II	90	B/C	II
Pahang / N. Sembilan	Sg. Pahang	Sg. Anak Sg. Lepar	1	84	B/C	II	85	B/C	II
		Sg. Batu	1	79	ST/SP	II	84	B/C	II
		Sg. Belayar	1	89	B/C	II	94	B/C	I
		Sg. Bentong	6	83	B/C	II	89	B/C	II
		Sg. Benus	3	83	B/C	II	93	B/C	I
		Sg. Bera	5	84	B/C	II	84	B/C	II
		Sg. Berkelah	1	92	B/C	II	93	B/C	I
		Sg. Bertam	4	89	B/C	II	94	B/C	I
		Sg. Bilut	2	84	B/C	II	83	B/C	II
		Sg. Burung	1	92	B/C	II	96	B/C	I
		Sg. Chini	1	86	B/C	II	82	B/C	II
		Sg. Gapoi	1	94	B/C	I	94	B/C	I
		Sg. Habu	1	88	B/C	II	90	B/C	II
		Sg. Jelai	3	87	B/C	II	88	B/C	II
		Sg. Jempol	5	88	B/C	II	87	B/C	II
		Sg. Jengka	2	87	B/C	II	88	B/C	II
		Sg. Kecau	3	80	ST/SP	II	86	B/C	II
		Sg. Kelau	4	83	B/C	II	88	B/C	II
		Sg. Kertam	1	90	B/C	II	91	B/C	II
		Sg. Koyan	1	88	B/C	II	89	B/C	II
		Sg. Krau	1	90	B/C	II	92	B/C	II
		Sg. Lenggok	1	91	B/C	II	93	B/C	I
		Sg. Lepar	1	91	B/C	II	92	B/C	II

Jadual 2.1 : Status Kualiti Air bagi Sungai Bersih, 2020
Table 2.1 : Water Quality Status of Clean Rivers, 2020

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	2019			2020		
				IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS	IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS
Pahang / N. Sembilan	Sg. Pahang	Sg. Lipis	3	86	B/C	II	89	B/C	II
		Sg. Luit	1	89	B/C	II	91	B/C	II
		Sg. Maran	1	90	B/C	II	93	B/C	I
		Sg. Mentiga	3	85	B/C	II	84	B/C	II
		Sg. Pahang	27	85	B/C	II	87	B/C	II
		Sg. Penjuring	1	87	B/C	II	94	B/C	I
		Sg. Pertang	2	83	B/C	II	90	B/C	II
		Sg. Perting	1	91	B/C	II	94	B/C	I
		Sg. Raub	1	89	B/C	II	93	B/C	I
		Sg. Retang	1	87	B/C	II	92	B/C	II
		Sg. Ringlet	1	82	B/C	II	83	B/C	II
		Sg. Salak	1	89	B/C	II	87	B/C	II
		Sg. Semantan	4	85	B/C	II	88	B/C	II
		Sg. Serting	5	76	ST/SP	III	81	B/C	II
		Sg. T. Paya Bungor	1	85	B/C	II	91	B/C	II
		Sg. Tahan	1	88	B/C	II	91	B/C	II
		Sg. Tanglir	5	86	B/C	II	88	B/C	II
		Sg. Tasik Bera	1	86	B/C	II	91	B/C	II
		Sg. Tasik Chini	10	90	B/C	II	92	B/C	II
		Sg. Teh	1	90	B/C	II	93	B/C	I
		Sg. Tekal	1	81	B/C	II	85	B/C	II
		Sg. Telang	1	90	B/C	II	91	B/C	II
		Sg. Telemong	3	88	B/C	II	93	B/C	I
		Sg. Telom	2	85	B/C	II	86	B/C	II
		Sg. Tembeling	1	88	B/C	II	91	B/C	II
		Sg. Teranum	1	87	B/C	II	95	B/C	I
		Sg. Teras	2	88	B/C	II	92	B/C	II
		Sg. Teris	3	87	B/C	II	91	B/C	II
		Sg. Terla	2	91	B/C	II	94	B/C	I
		Sg. Triang	3	86	B/C	II	88	B/C	II
		Sg. Tringkap	1	82	B/C	II	89	B/C	II
		Sg. Ulong	1	94	B/C	I	96	B/C	I
Pahang	Sg. Anak Endau	Sg. Anak Endau	2	92	B/C	II	87	B/C	II
	Sg. Bebar	Sg. Bebar	2	83	B/C	II	82	B/C	II
		Sg. Merba	1	86	B/C	II	85	B/C	II
	Sg. Cherating	Sg. Cherating	1	79	ST/SP	II	81	B/C	II

Jadual 2.1 : Status Kualiti Air bagi Sungai Bersih, 2020
Table 2.1 : Water Quality Status of Clean Rivers, 2020

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	2019			2020		
				IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS	IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS
Pahang	Sg. Kuantan	Sg. Charu	1	92	B/C	II	93	B/C	I
		Sg. Kenau	1	90	B/C	II	94	B/C	I
		Sg. Kuantan	8	87	B/C	II	88	B/C	II
		Sg. Pandan	1	83	B/C	II	87	B/C	II
		Sg. Reman	1	86	B/C	II	87	B/C	II
		Sg. Riau	1	84	B/C	II	84	B/C	II
	Sg. Merchong	Sg. Merchong	2	86	B/C	II	87	B/C	II
	Sg. Rompin	Sg. Aur	1	86	B/C	II	86	B/C	II
		Sg. Jekatih	2	85	B/C	II	87	B/C	II
		Sg. Jeram	1	88	B/C	II	88	B/C	II
		Sg. Kepasing	1	81	B/C	II	88	B/C	II
		Sg. Keratong	4	85	B/C	II	85	B/C	II
		Sg. Pontian	1	87	B/C	II	85	B/C	II
		Sg. Pukin	3	83	B/C	II	86	B/C	II
		Sg. Rompin	5	87	B/C	II	83	B/C	II
Terengganu	Sg. Besut	Sg. Besut	5	90	B/C	II	92	B/C	II
		Sg. Jertih	1	84	B/C	II	88	B/C	II
	Sg. Chukai	Sg. Ibok	2	84	B/C	II	85	B/C	II
	Sg. Dungun	Sg. Dungun	5	88	B/C	II	90	B/C	II
		Sg. Telemboh	1	86	B/C	II	86	B/C	II
	Sg. Ibai	Sg. Ibai	3	78	ST/SP	II	83	B/C	II
	Sg. Kemaman	Sg. Cherul	3	85	B/C	II	90	B/C	II
		Sg. Kemaman	3	84	B/C	II	88	B/C	II
		Sg. Perasing	1	82	B/C	II	82	B/C	II
		Sg. Ransan	2	73	ST/SP	III	81	B/C	II
	Sg. Kertih	Sg. Kertih	2	83	B/C	II	85	B/C	II
	Sg. Kluang	Sg. Kluang	1	83	B/C	II	88	B/C	II
	Sg. Marang	Sg. Marang	1	83	B/C	II	88	B/C	II
		Sg. Temala	1	87	B/C	II	91	B/C	II
	Sg. Merang	Sg. Merang	1	77	ST/SP	II	82	B/C	II
	Sg. Paka	Sg. Besul	1	86	B/C	II	92	B/C	II
		Sg. Paka	3	85	B/C	II	87	B/C	II
		Sg. Rasau	2	79	ST/SP	II	82	B/C	II
		Sg. Rengat	1	85	B/C	II	84	B/C	II
	Sg. Setiu	Sg. Bari	1	91	B/C	II	92	B/C	II
		Sg. Chalok	3	87	B/C	II	86	B/C	II
		Sg. Setiu	2	86	B/C	II	89	B/C	II
		Sg. Tarom	1	88	B/C	II	89	B/C	II

Jadual 2.1 : Status Kualiti Air bagi Sungai Bersih, 2020
Table 2.1 : Water Quality Status of Clean Rivers, 2020

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	2019			2020		
				IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS	IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS
Terengganu	Sg. Terengganu	Sg. Berang	2	91	B/C	II	91	B/C	II
		Sg. Nerus	6	88	B/C	II	89	B/C	II
		Sg. Telemong	1	89	B/C	II	88	B/C	II
		Sg. Terengganu	4	88	B/C	II	87	B/C	II
Kelantan	Sg. Golok	Sg. Golok	5	85	B/C	II	88	B/C	II
		Sg. Jedok	1	88	B/C	II	90	B/C	II
		Sg. Lanas	1	86	B/C	II	84	B/C	II
	Sg. Kelantan	Sg. Belatop	3	83	B/C	II	82	B/C	II
		Sg. Ber	1	84	B/C	II	87	B/C	II
		Sg. Berok	3	81	B/C	II	82	B/C	II
		Sg. Betis	1	84	B/C	II	86	B/C	II
		Sg. Chiku	2	85	B/C	II	88	B/C	II
		Sg. Galas	5	84	B/C	II	86	B/C	II
		Sg. Kelantan	7	82	B/C	II	82	B/C	II
		Sg. Kelesa	1	84	B/C	II	87	B/C	II
		Sg. Kenkren	1	88	B/C	II	92	B/C	II
		Sg. Kerilla	2	88	B/C	II	91	B/C	II
		Sg. Ketil	2	86	B/C	II	90	B/C	II
		Sg. Lebir	5	85	B/C	II	87	B/C	II
		Sg. Muring	1	84	B/C	II	85	B/C	II
		Sg. Nal	3	86	B/C	II	88	B/C	II
		Sg. Nenggiri	3	81	B/C	II	81	B/C	II
		Sg. Pehi	2	87	B/C	II	86	B/C	II
		Sg. Pelaur	1	88	B/C	II	90	B/C	II
		Sg. Pergau	8	92	B/C	II	92	B/C	II
		Sg. Relai	2	84	B/C	II	90	B/C	II
		Sg. Sokor	1	83	B/C	II	86	B/C	II
		Sg. Tuang	1	87	B/C	II	90	B/C	II
	Sg. Kemasin	Sg. Kemasin	2	81	B/C	II	83	B/C	II
		Sg. Semerak	3	84	B/C	II	85	B/C	II
	Sg. Pengkalan Datu	Sg. Pengkalan Datu	3	76	ST/SP	III	85	B/C	II
Sabah	Sg. Apas	Sg. Apas	1	91	B/C	II	89	B/C	II
	Sg. Balung	Sg. Balung	1	93	B/C	I	87	B/C	II
	Sg. Bengkoka	Sg. Bengkoka	2	85	B/C	II	88	B/C	II
	Sg. Bingkongan	Sg. Bandau	1	90	B/C	II	91	B/C	II
		Sg. Bingkongan	2	92	B/C	II	91	B/C	II
		Sg. Menggaris	2	91	B/C	II	93	B/C	I
		Sg. Tandek	1	90	B/C	II	91	B/C	II

Jadual 2.1 : Status Kualiti Air bagi Sungai Bersih, 2020
Table 2.1 : Water Quality Status of Clean Rivers, 2020

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	2019			2020		
				IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS	IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS
Sabah	Sg. Bongawan	Sg. Bongawan	1	88	B/C	II	87	B/C	II
	Sg. Brantian	Sg. Brantian	1	91	B/C	II	86	B/C	II
	Sg. Kalabakan	Sg. Kalabakan	3	86	B/C	II	84	B/C	II
	Sg. Kalumpang	Sg. Kalumpang	3	89	B/C	II	86	B/C	II
		Sg. Pang Burong 1	1	89	B/C	II	83	B/C	II
	Sg. Kedamaian	Sg. Kedamaian	1	93	B/C	I	90	B/C	II
		Sg. Tempasuk	2	92	B/C	II	91	B/C	II
		Sg. Wariu	1	91	B/C	II	91	B/C	II
	Sg. Kimanis	Sg. Kimanis	1	89	B/C	II	87	B/C	II
	Sg. Kinabatangan	Sg. Karamuak	1	92	B/C	II	91	B/C	II
		Sg. Kinabatangan	4	87	B/C	II	84	B/C	II
		Sg. Koyah	1	88	B/C	II	87	B/C	II
		Sg. Leepang	1	88	B/C	II	84	B/C	II
		Sg. Menanggul	1	87	B/C	II	81	B/C	II
		Sg. Pin	1	85	B/C	II	86	B/C	II
		Sg. Takala	1	88	B/C	II	85	B/C	II
	Sg. Labok	Sg. Kinipir	2	91	B/C	II	90	B/C	II
		Sg. Labok	1	89	B/C	II	87	B/C	II
		Sg. Liwagu	2	91	B/C	II	88	B/C	II
		Sg. Maliau	1	93	B/C	I	92	B/C	II
		Sg. Tungud	1	90	B/C	II	88	B/C	II
	Sg. Lakutan	Sg. Lakutan	1	90	B/C	II	89	B/C	II
	Sg. Likas	Sg. Inanam	3	84	B/C	II	84	B/C	II
		Sg. Menggatal	2	90	B/C	II	85	B/C	II
	Sg. Lingkungan	Sg. Bukau	1	90	B/C	II	88	B/C	II
		Sg. Lingkungan	1	89	B/C	II	91	B/C	II
	Sg. Membakut	Sg. Membakut	1	87	B/C	II	85	B/C	II
	Sg. Menggalong	Sg. Menggalong	2	91	B/C	II	89	B/C	II
	Sg. Merotai	Sg. Merotai	3	87	B/C	II	89	B/C	II
	Sg. Mounad	Sg. Mounad	2	87	B/C	II	86	B/C	II
	Sg. Moyog	Sg. Moyog	4	92	B/C	II	89	B/C	II
	Sg. Padas	Sg. Bunsit	1	92	B/C	II	91	B/C	II
		Sg. Liawan	1	91	B/C	II	91	B/C	II
		Sg. Padas	4	87	B/C	II	86	B/C	II
		Sg. Pangatan	1	86	B/C	II	87	B/C	II
		Sg. Pegalan	3	89	B/C	II	88	B/C	II
		Sg. Tandulu	1	90	B/C	II	91	B/C	II

Jadual 2.1 : Status Kualiti Air bagi Sungai Bersih, 2020
Table 2.1 : Water Quality Status of Clean Rivers, 2020

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	2019			2020		
				IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS	IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS
Sabah	Sg. Paitan	Sg. Paitan	1	88	B/C	II	85	B/C	II
	Sg. Papar	Sg. Papar	5	92	B/C	II	90	B/C	II
	Sg. Sapi	Sg. Sapi	3	87	B/C	II	85	B/C	II
		Sg. Sualong	1	91	B/C	II	92	B/C	II
	Sg. Segaliud	Sg. Segaliud	2	87	B/C	II	87	B/C	II
	Sg. Segama	Sg. Segama	3	91	B/C	II	85	B/C	II
	Sg. Silabukan	Sg. Silabukan	2	90	B/C	II	89	B/C	II
	Sg. Sugut	Sg. Bongkud	1	92	B/C	II	91	B/C	II
		Sg. Lohan	1	92	B/C	II	91	B/C	II
		Sg. Merali	1	92	B/C	II	88	B/C	II
		Sg. Sugut	3	91	B/C	II	88	B/C	II
	Sg. Tawau	Sg. Tawau	4	88	B/C	II	85	B/C	II
	Sg. Telipok	Sg. Telipok	2	77	ST/SP	II	86	B/C	II
	Sg. Tenghilan	Sg. Tenghilan	1	91	B/C	II	92	B/C	II
	Sg. Tingkayu	Sg. Tingkayu	2	89	B/C	II	85	B/C	II
	Sg. Tuaran	Sg. Damit	2	88	B/C	II	89	B/C	II
		Sg. Song Sai	1	91	B/C	II	90	B/C	II
		Sg. Tuaran	2	92	B/C	II	92	B/C	II
	Sg. Tungku	Sg. Tungku	2	88	B/C	II	89	B/C	II
	Sg. Umas-Umas	Sg. Umas Umas	1	90	B/C	II	83	B/C	II
Sarawak	Sg. Balingian	Sg. Balingian	2	86	B/C	II	90	B/C	II
	Sg. Baram	Sg. Baram	4	88	B/C	II	84	B/C	II
		Sg. Tutuh	1	92	B/C	II	90	B/C	II
	Sg. Kayan	Sg. Kayan	3	81	B/C	II	82	B/C	II
	Sg. Kemena	Sg. Kemena	4	85	B/C	II	82	B/C	II
		Sg. Sibiu	1	83	B/C	II	81	B/C	II
	Sg. Kerian	Sg. Kerian	2	82	B/C	II	86	B/C	II
		Sg. Seblak	1	82	B/C	II	84	B/C	II
		Sg. Selalang	1	91	B/C	II	92	B/C	II
	Sg. Lawas	Sg. Lawas	3	91	B/C	II	89	B/C	II
	Sg. Limbang	Sg. Limbang	5	91	B/C	II	88	B/C	II
	Sg. Lupar	Sg. Ai	2	92	B/C	II	90	B/C	II
		Sg. Lupar	3	88	B/C	II	85	B/C	II
		Sg. Sekerang	1	91	B/C	II	92	B/C	II
		Sg. Seterap	1	86	B/C	II	82	B/C	II
		Sg. Undup	1	88	B/C	II	91	B/C	II

Jadual 2.1 : Status Kualiti Air bagi Sungai Bersih, 2020
Table 2.1 : Water Quality Status of Clean Rivers, 2020

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	2019			2020		
				IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS	IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS
Sarawak	Sg. Miri	Sg. Adong	1	70	ST/SP	III	83	B/C	II
		Sg. Dalam	1	74	ST/SP	III	84	B/C	II
		Sg. Miri	2	75	ST/SP	III	87	B/C	II
		Sg. Padang Liku	1	90	B/C	II	89	B/C	II
	Sg. Mukah	Sg. Mukah	5	83	B/C	II	88	B/C	II
	Sg. Niah	Sg. Niah	2	90	B/C	II	86	B/C	II
	Sg. Oya	Sg. Oya	3	84	B/C	II	86	B/C	II
	Sg. Rajang	Sg. Baloi	1	89	B/C	II	89	B/C	II
		Sg. Binatang	1	89	B/C	II	89	B/C	II
		Sg. Julau	1	90	B/C	II	88	B/C	II
		Sg. Kanowit	1	88	B/C	II	89	B/C	II
		Sg. Pakan	1	89	B/C	II	88	B/C	II
		Sg. Rajang	11	85	B/C	II	85	B/C	II
		Sg. Salim	1	80	ST/SP	II	83	B/C	II
		Sg. Sarikei	2	87	B/C	II	85	B/C	II
	Sg. Sadong	Sg. Sadong	4	84	B/C	II	83	B/C	II
		Sg. Tarat	1	90	B/C	II	91	B/C	II
	Sg. Sarawak	Sg. Kuap	2	85	B/C	II	87	B/C	II
		Sg. Sarawak	6	85	B/C	II	87	B/C	II
		Sg. Sarawak Kanan	1	85	B/C	II	82	B/C	II
		Sg. Sarawak Kiri	1	87	B/C	II	88	B/C	II
		Sg. Semadang	1	90	B/C	II	89	B/C	II
		Sg. Tapah	1	89	B/C	II	89	B/C	II
	Sg. Saribas	Sg. Layar	2	87	B/C	II	86	B/C	II
	Sg. Semunsam	Sg. Semunsam	1	85	B/C	II	87	B/C	II
	Sg. Sibuti	Sg. Kejapil	1	90	B/C	II	88	B/C	II
		Sg. Satap	1	86	B/C	II	88	B/C	II
		Sg. Sibuti	2	86	B/C	II	85	B/C	II
	Sg. Similajau	Sg. Similajau	2	89	B/C	II	90	B/C	II
	Sg. Suai	Sg. Suai	1	89	B/C	II	88	B/C	II
	Sg. Tatau	Sg. Tatau	1	87	B/C	II	88	B/C	II
	Sg. Trusan	Sg. Trusan	1	92	B/C	II	88	B/C	II

Nota / Note :
B/C : Bersih / Clean
ST/SP : Sederhana tercemar / Slightly polluted
T/P : Tercemar / Polluted

Jadual 2.2 : Status Kualiti Air bagi Sungai Sederhana Tercemar, 2020
Table 2.2 : Water Quality Status of Slightly Polluted Rivers, 2020

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	2019			2020		
				IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS	IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS
Perlis	Sg. Perlis	Sg. Korok	1	71	ST/SP	III	75	ST/SP	III
		Sg. Perlis	1	72	ST/SP	III	76	ST/SP	III
Kedah	Sg. Kedah	Sg. Kedah	1	64	ST/SP	III	70	ST/SP	III
	Sg. Merbok	Sg. Batu	1	66	ST/SP	III	70	ST/SP	III
		Sg. Bongkok	1	63	ST/SP	III	71	ST/SP	III
		Sg. Korok	1	69	ST/SP	III	65	ST/SP	III
		Sg. Merbok	1	77	ST/SP	II	79	ST/SP	II
		Sg. Petani	1	54	T/P	III	63	ST/SP	III
	Sg. Muda	Sg. Jerong	2	67	ST/SP	III	68	ST/SP	III
	Sg. Ulu Melaka	Sg. Chenang	1	69	ST/SP	III	78	ST/SP	II
P. Pinang	Sg. Bayan Lepas	Sg. Bayan Lepas	1	76	ST/SP	III	64	ST/SP	III
		Sg. Tiram	2	71	ST/SP	III	73	ST/SP	III
	Sg. Jawi	Sg. Junjong	3	62	ST/SP	III	66	ST/SP	III
		Sg. Machang Bubok	1	70	ST/SP	III	76	ST/SP	III
	Sg. Juru	Sg. Juru	2	56	T/P	III	68	ST/SP	III
		Sg. Kilang Ubi	5	68	ST/SP	III	70	ST/SP	III
		Sg. Pasir	1	61	ST/SP	III	65	ST/SP	III
	Sg. Kluang	Sg. Ara	2	85	B/C	II	67	ST/SP	III
		Sg. Dua Besar	1	57	T/P	III	64	ST/SP	III
		Sg. Kluang	1	63	ST/SP	III	65	ST/SP	III
		Sg. Relau	1	66	ST/SP	III	66	ST/SP	III
	Sg. Pinang	Sg. Air Itam	3	76	ST/SP	III	77	ST/SP	II
		Sg. Dondang	6	74	ST/SP	III	73	ST/SP	III
		Sg. Jelutong	1	64	ST/SP	III	63	ST/SP	III
		Sg. Pinang	3	68	ST/SP	III	69	ST/SP	III
		Sg. Titi Kerawang	1	63	ST/SP	III	68	ST/SP	III
P. Pinang / Kedah	Sg. Perai	Sg. Jarak	6	72	ST/SP	III	73	ST/SP	III
		Sg. Keladi	1	74	ST/SP	III	78	ST/SP	II
		Sg. Kubang Semang	1	64	ST/SP	III	64	ST/SP	III
		Sg. Perai	2	63	ST/SP	III	66	ST/SP	III
		Sg. Pertama	1	59	T/P	III	65	ST/SP	III
		Sg. Seluang	1	64	ST/SP	III	64	ST/SP	III
		Sg. Seluang Bawah	2	65	ST/SP	III	61	ST/SP	III
P. Pinang / Kedah / Perak	Sg. Kerian	Sg. Serdang	1	73	ST/SP	III	71	ST/SP	III
Perak	Sg. Perak	Sg. Kepayang	2	70	ST/SP	III	79	ST/SP	II
		Sg. Kerdah	2	72	ST/SP	III	80	ST/SP	II
		Sg. Nyamok	1	68	ST/SP	III	76	ST/SP	III

Jadual 2.2 : Status Kualiti Air bagi Sungai Sederhana Tercemar, 2020
Table 2.2 : Water Quality Status of Slightly Polluted Rivers, 2020

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	2019			2020		
				IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS	IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS
Perak	Sg. Perak	Sg. Pari	2	72	ST/SP	III	80	ST/SP	II
		Sg. Pinji	2	67	ST/SP	III	73	ST/SP	III
		Sg. Seluang	1	58	T/P	III	72	ST/SP	III
		Sg. Serokai	2	69	ST/SP	III	73	ST/SP	III
		Sg. Sintang	1	65	ST/SP	III	72	ST/SP	III
		Sg. Tumboh	1	71	ST/SP	III	73	ST/SP	III
	Sg. Raja Hitam	Sg. Derhaka	2	68	ST/SP	III	77	ST/SP	II
		Sg. Raja Hitam	3	68	ST/SP	III	72	ST/SP	III
	Sg. Sepetang	Sg. Malai	2	76	ST/SP	III	76	ST/SP	III
		Sg. Sepetang	2	78	ST/SP	II	79	ST/SP	II
	Sg. Wangi	Sg. Deralik	2	73	ST/SP	III	73	ST/SP	III
Selangor	Sg. Buloh	Sg. Buloh	6	52	T/P	III	60	ST/SP	III
	Sg. Selangor	Sg. Air Hitam	1	92	B/C	II	75	ST/SP	III
		Sg. Guntong	1	73	ST/SP	III	80	ST/SP	II
		Sg. Kundang	1	66	ST/SP	III	70	ST/SP	III
		Sg. Rawang	1	70	ST/SP	III	77	ST/SP	II
		Sg. Sembah	2	74	ST/SP	III	75	ST/SP	III
	Sg. Sepang	Sg. Sepang	3	75	ST/SP	III	78	ST/SP	II
Selangor/ Putrajaya/ N.Sembilan	Sg. Langat	Sg. Balak	1	56	T/P	III	71	ST/SP	III
		Sg. Batang Benar	1	67	ST/SP	III	74	ST/SP	III
		Sg. Batang Labu	8	72	ST/SP	III	79	ST/SP	II
		Sg. Batang Nilai	2	72	ST/SP	III	78	ST/SP	II
		Sg. Buan	1	76	ST/SP	III	80	ST/SP	II
		Sg. Langat	9	72	ST/SP	III	77	ST/SP	II
		Sg. Limau Manis	1	74	ST/SP	III	71	ST/SP	III
		Sg. Pajam	2	63	ST/SP	III	73	ST/SP	III
		Sg. Sering	1	60	ST/SP	III	69	ST/SP	III
Selangor/ W.P. KL	Sg. Klang	Sg. Ampang	2	60	ST/SP	III	64	ST/SP	III
		Sg. Batu	5	70	ST/SP	III	68	ST/SP	III
		Sg. Belongkong	1	67	ST/SP	III	69	ST/SP	III
		Sg. Bunos	3	67	ST/SP	III	70	ST/SP	III
		Sg. Damansara	5	62	ST/SP	III	65	ST/SP	III
		Sg. Gombak	5	63	ST/SP	III	73	ST/SP	III
		Sg. Jinjang	4	66	ST/SP	III	64	ST/SP	III
		Sg. Keroh	3	60	ST/SP	III	64	ST/SP	III
		Sg. Klang	13	58	T/P	III	61	ST/SP	III
		Sg. Kuyoh	2	51	T/P	IV	62	ST/SP	III
		Sg. Penchala	3	64	ST/SP	III	60	ST/SP	III

Jadual 2.2 : Status Kualiti Air bagi Sungai Sederhana Tercemar, 2020
Table 2.2 : Water Quality Status of Slightly Polluted Rivers, 2020

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	2019			2020		
				IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS	IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS
Selangor / W.P. KL	Sg. Klang	Sg. Pusu	1	67	ST/SP	III	71	ST/SP	III
		Sg. Toba	1	59	T/P	III	61	ST/SP	III
		Sg. Untut	1	54	T/P	III	64	ST/SP	III
Melaka	Sg. Duyong	Sg. Duyong	3	71	ST/SP	III	65	ST/SP	III
	Sg. Kesang	Sg. Chin-Chin	3	73	ST/SP	III	78	ST/SP	II
		Sg. Kesang	3	72	ST/SP	III	77	ST/SP	II
		Sg. Tangkak	1	64	ST/SP	III	67	ST/SP	III
	Sg. Seri Melaka	Sg. Air Salak	1	65	ST/SP	III	62	ST/SP	III
		Sg. Seri Melaka	1	65	ST/SP	III	65	ST/SP	III
Melaka / N. Sembilan	Sg. Melaka	Sg. Durian Tunggal	1	73	ST/SP	III	79	ST/SP	II
		Sg. Malim	2	58	T/P	III	67	ST/SP	III
		Sg. Melaka	14	71	ST/SP	III	78	ST/SP	II
		Sg. Putat	2	58	T/P	III	60	ST/SP	III
		Sg. Rembia	2	66	ST/SP	III	73	ST/SP	III
N. Sembilan	Sg. Lukut	Sg. Lukut	1	69	ST/SP	III	74	ST/SP	III
N. Sembilan / Melaka	Sg. Baru	Sg. Baru	1	68	ST/SP	III	74	ST/SP	III
	Sg. Linggi	Sg. Empangan Terip	1	72	ST/SP	III	80	ST/SP	II
		Sg. Kayu Ara	1	62	ST/SP	III	77	ST/SP	II
		Sg. Linggi	6	77	ST/SP	II	79	ST/SP	II
		Sg. Ngoi Ngoi	1	73	ST/SP	III	76	ST/SP	III
		Sg. Paroi	1	76	ST/SP	III	78	ST/SP	II
		Sg. Senawang	1	74	ST/SP	III	73	ST/SP	III
		Sg. Temiang	2	68	ST/SP	III	78	ST/SP	II
Johor	Sg. Air Baloi	Sg. Air Baloi	3	49	T/P	IV	60	ST/SP	III
	Sg. Batu Pahat	Sg. Amran	1	74	ST/SP	III	75	ST/SP	III
		Sg. Batu Pahat	1	56	T/P	III	66	ST/SP	III
		Sg. Berlian	1	79	ST/SP	II	78	ST/SP	II
		Sg. Simpang Kiri	3	61	ST/SP	III	67	ST/SP	III
	Sg. Benut	Sg. Benut	4	65	ST/SP	III	75	ST/SP	III
		Sg. Pinggan	1	61	ST/SP	III	60	ST/SP	III
	Sg. Endau	Sg. Jebong	1	61	ST/SP	III	74	ST/SP	III
		Sg. Lenga	1	60	ST/SP	III	68	ST/SP	III
		Sg. Melatai	1	63	ST/SP	III	70	ST/SP	III
		Sg. Mengkibol	3	74	ST/SP	III	77	ST/SP	II
		Sg. Pamol	1	65	ST/SP	III	72	ST/SP	III
		Sg. Singol	1	55	T/P	III	79	ST/SP	II
	Sg. Johor	Sg. Anak Sg. Sayong	2	77	ST/SP	II	80	ST/SP	II
		Sg. Berangan	1	67	ST/SP	III	71	ST/SP	III

Jadual 2.2 : Status Kualiti Air bagi Sungai Sederhana Tercemar, 2020
Table 2.2 : Water Quality Status of Slightly Polluted Rivers, 2020

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	2019			2020		
				IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS	IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS
Johor	Sg. Johor	Sg. Bukit Besar	2	76	ST/SP	III	75	ST/SP	III
		Sg. Chemangar	1	72	ST/SP	III	70	ST/SP	III
		Sg. Lebam	1	85	B/C	II	79	ST/SP	II
		Sg. Panti	1	72	ST/SP	III	79	ST/SP	II
		Sg. Sebol	1	69	ST/SP	III	73	ST/SP	III
		Sg. Semenchu	1	35	T/P	IV	66	ST/SP	III
		Sg. Serai	1	57	T/P	III	67	ST/SP	III
		Sg. Temoh	1	64	ST/SP	III	74	ST/SP	III
		Sg. Tiram	4	79	ST/SP	II	76	ST/SP	III
	Sg. Kaw. Pasir Gudang	Sg. Latoh	1	58	T/P	III	62	ST/SP	III
		Sg. Masai	1	50	T/P	IV	63	ST/SP	III
	Sg. Kim-Kim	Sg. Kim-Kim	2	67	ST/SP	III	74	ST/SP	III
	Sg. Pontian Besar	Sg. Air Hitam	2	80	ST/SP	II	71	ST/SP	III
		Sg. Pontian Besar	5	67	ST/SP	III	73	ST/SP	III
	Sg. Pulai	Sg. Pulai	2	72	ST/SP	III	80	ST/SP	II
		Sg. Ulu Choh	1	67	ST/SP	III	72	ST/SP	III
	Sg. Rambah	Sg. Rambah	2	62	ST/SP	III	68	ST/SP	III
	Sg. Sedili Besar	Sg. Mupur	1	47	T/P	IV	67	ST/SP	III
	Sg. Sedili Kecil	Sg. Anak Sedili Kecil	2	56	T/P	III	64	ST/SP	III
		Sg. Bahan	2	76	ST/SP	III	74	ST/SP	III
	Sg. Segget	Sg. Segget	5	52	T/P	III	65	ST/SP	III
	Sg. Skudai	Sg. Melana	2	68	ST/SP	III	78	ST/SP	II
		Sg. Skudai	9	57	T/P	III	66	ST/SP	III
Johor / N. Sembilan / Pahang	Sg. Muar	Sg. Gemas	2	67	ST/SP	III	72	ST/SP	III
		Sg. Kelamah	1	79	ST/SP	II	71	ST/SP	III
		Sg. Merbudu	1	65	ST/SP	III	63	ST/SP	III
		Sg. Merlimau	1	59	T/P	III	70	ST/SP	III
		Sg. Pagoh	1	67	ST/SP	III	66	ST/SP	III
		Sg. Senarut	1	66	ST/SP	III	75	ST/SP	III
		Sg. Serom	1	55	T/P	III	63	ST/SP	III
		Sg. Simpang Loi	1	78	ST/SP	II	77	ST/SP	II
		Sg. Tenang	1	68	ST/SP	III	79	ST/SP	II
Pahang / N. Sembilan	Sg. Pahang	Sg. Kundang	1	86	B/C	II	79	ST/SP	II
Pahang	Sg. Balok	Sg. Balok	2	68	ST/SP	III	69	ST/SP	III
		Sg. Panjang	1	86	B/C	II	76	ST/SP	III
		Sg. Yior	1	64	ST/SP	III	62	ST/SP	III
	Sg. Bebar	Sg. Serai	2	81	B/C	II	79	ST/SP	II

Jadual 2.2 : Status Kualiti Air bagi Sungai Sederhana Tercemar, 2020
Table 2.2 : Water Quality Status of Slightly Polluted Rivers, 2020

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	2019			2020		
				IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS	IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS
Pahang	Sg. Kuantan	Sg. Belat	1	79	ST/SP	II	80	ST/SP	II
		Sg. Galing Besar	2	61	ST/SP	III	64	ST/SP	III
		Sg. Pinang	1	89	B/C	II	80	ST/SP	II
		Sg. Talam	1	69	ST/SP	III	72	ST/SP	III
	Sg. Rompin	Sg. Bakar	1	71	ST/SP	III	75	ST/SP	III
		Sg. Sepayang	1	84	B/C	II	77	ST/SP	II
	Sg. Tonggok	Sg. Tonggok	2	70	ST/SP	III	76	ST/SP	III
Terengganu	Sg. Chukai	Sg. Bungkus	1	82	B/C	II	80	ST/SP	II
		Sg. Chukai	1	80	ST/SP	II	80	ST/SP	II
		Sg. Ruang	2	73	ST/SP	III	67	ST/SP	III
	Sg. Kemaman	Sg. Neram	1	31	T/P	IV	75	ST/SP	III
	Sg. Marang	Sg. Kerak	1	81	B/C	II	79	ST/SP	II
	Sg. Merchang	Sg. Landas	1	65	ST/SP	III	71	ST/SP	III
		Sg. Merchang	1	72	ST/SP	III	71	ST/SP	III
	Sg. Terengganu	Sg. Pueh	2	69	ST/SP	III	73	ST/SP	III
Kelantan	Sg. Golok	Sg. Tasik Garu	1	76	ST/SP	III	80	ST/SP	II
	Sg. Kelantan	Sg. Aring	1	76	ST/SP	III	79	ST/SP	II
		Sg. Isos	1	73	ST/SP	III	73	ST/SP	III
		Sg. Penangau	1	82	B/C	II	78	ST/SP	II
		Sg. Rasau	1	81	B/C	II	80	ST/SP	II
	Sg. Kemasin	Sg. Gali	1	76	ST/SP	III	79	ST/SP	II
	Sg. Pengkalan Chepa	Sg. Alor B	1	48	T/P	IV	65	ST/SP	III
		Sg. Alor Lintah	1	61	ST/SP	III	76	ST/SP	III
		Sg. Keladi	1	78	ST/SP	II	76	ST/SP	III
		Sg. Pengkalan Chepa	2	59	T/P	III	73	ST/SP	III
		Sg. Raja Gali	1	73	ST/SP	III	79	ST/SP	II
	Sg. Pengkalan Datu	Sg. Pasir Hor	1	67	ST/SP	III	73	ST/SP	III
Sabah	Sg. Kalumpang	Sg. Pang Burong 2	1	76	ST/SP	III	69	ST/SP	III
	Sg. Likas	Sg. Darau	1	76	ST/SP	III	80	ST/SP	II
		Sg. Likas	2	78	ST/SP	II	78	ST/SP	II
	Sg. Sembulan	Sg. Sembulan	2	77	ST/SP	II	79	ST/SP	II
Sarawak	Sg. Miri	Sg. Lutong	2	86	B/C	II	78	ST/SP	II
	Sg. Niah	Sg. Sekaloh	2	81	B/C	II	75	ST/SP	III
	Sg. Rajang	Sg. Daro	1	76	ST/SP	III	80	ST/SP	II
		Sg. Jemoreng	1	78	ST/SP	II	80	ST/SP	II
		Sg. Meradong	1	86	B/C	II	80	ST/SP	II
		Sg. Pila Parit	1	81	B/C	II	62	ST/SP	III

Jadual 2.2 : Status Kualiti Air bagi Sungai Sederhana Tercemar, 2020
Table 2.2 : Water Quality Status of Slightly Polluted Rivers, 2020

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	2019			2020		
				IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS	IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS
Sarawak	Sg. Sadong	Sg. Karangan	2	78	ST/SP	II	74	ST/SP	III
	Sg. Sarawak	Sg. Kelantan	1	84	B/C	II	74	ST/SP	III
		Sg. Maong Kiri	1	76	ST/SP	III	72	ST/SP	III
		Sg. Samarahan	2	70	ST/SP	III	74	ST/SP	III
		Sg. Semenggoh	1	77	ST/SP	II	71	ST/SP	III
		Sg. Tabuan	1	73	ST/SP	III	77	ST/SP	II
	Sg. Saribas	Sg. Saribas	1	80	ST/SP	II	74	ST/SP	III
	Sg. Sibuti	Sg. Kabuloh	2	68	ST/SP	III	71	ST/SP	III

Nota / Note :
B/C : Bersih / Clean
ST/SP : Sederhana tercemar / Slightly polluted
T/P : Tercemar / Polluted

Sungai Linggi, Melaka / Linggi River, Melaka

Jadual 2.3 : Status Kualiti Air bagi Sungai Tercemar 2020
Table 2.3 : Water Quality Status of Polluted Rivers 2020

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	2019			2020		
				IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS	IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS
P. Pinang	Sg. Jawi	Sg. Chempedak	1	54	T/P	III	47	T/P	IV
		Sg. Jawi	1	49	T/P	IV	55	T/P	III
		Sg. Tengah	1	61	ST/SP	III	49	T/P	IV
	Sg. Juru	Sg. Permatang Rawa	2	64	ST/SP	III	59	T/P	III
		Sg. Rambai	2	51	T/P	IV	57	T/P	III
P. Pinang / Kedah	Sg. Perai	Sg. Air Melintas	1	54	T/P	III	58	T/P	III
		Sg. Kereh	3	57	T/P	III	55	T/P	III
Kedah	Sg. Merbok	Sg. Bakar Arang	1	59	T/P	III	56	T/P	III
Selangor / W.P. KL	Sg. Klang	Sg. Air Busuk	1	59	T/P	III	41	T/P	IV
		Sg. Kerayong	4	54	T/P	III	58	T/P	III
Selangor	Sg. Sepang	Sg. Rambai	1	21	T/P	V	25	T/P	V
N. Sembilan / Melaka	Sg. Linggi	Sg. Tuang	1	57	T/P	III	57	T/P	III
	Sg. Tuang	Sg. Tuang	1	58	T/P	III	59	T/P	III
Melaka	Sg. Duyong	Sg. Punggur	2	51	T/P	IV	51	T/P	IV
	Sg. Merlimau	Sg. Merlimau	5	49	T/P	IV	56	T/P	III
Johor	Sg. Batu Pahat	Sg. Panchor	1	58	T/P	III	59	T/P	III
		Sg. Semberong	2	55	T/P	III	58	T/P	III
		Sg. Simpang Kanan	2	56	T/P	III	59	T/P	III
		Sg. Temehel	1	48	T/P	IV	57	T/P	III
	Sg. Danga	Sg. Danga	2	46	T/P	IV	57	T/P	III
	Sg. Kaw. Pasir Gudang	Sg. Buluh	1	41	T/P	IV	41	T/P	IV
		Sg. Perembi	1	42	T/P	IV	57	T/P	III
		Sg. Tukang Batu	1	37	T/P	IV	42	T/P	IV
	Sg. Kempas	Sg. Kempas	2	40	T/P	IV	32	T/P	IV
	Sg. Pontian Besar	Sg. Ayer Merah	1	46	T/P	IV	43	T/P	IV
	Sg. Sanglang	Sg. Sanglang	1	60	ST/SP	III	59	T/P	III
	Sg. Tebrau	Sg. Bala	1	42	T/P	IV	55	T/P	III
		Sg. Pandan	1	43	T/P	IV	46	T/P	IV
		Sg. Plentong	1	52	T/P	III	56	T/P	III
		Sg. Sebulung	1	38	T/P	IV	53	T/P	III
		Sg. Sengkuang	1	35	T/P	IV	52	T/P	III
		Sg. Tampoi	1	44	T/P	IV	52	T/P	III
		Sg. Tebrau	5	56	T/P	III	58	T/P	III
Johor / N. Sembilan / Pahang	Sg. Muar	Sg. Sarang Buaya	1	70	ST/SP	III	58	T/P	III

Nota / Note :
B/C : Bersih / Clean
ST/SP : Sederhana tercemar / Slightly polluted
T/P : Tercemar / Polluted

Jadual 2.4 menunjukkan IKA sebanyak 24 daripada 34 sungai tercemar tergolong dalam Kelas III, sembilan (9) sungai adalah dalam Kelas IV, manakala satu (1) sungai adalah Kelas V. Berdasarkan sub-indeks BOD, dua (2) sungai diklasifikasikan sebagai kelas II, empat (4) sungai Kelas III, 18 sungai Kelas IV, manakala 10 sungai Kelas V. Dari segi sub-indeks AN, pula, dua (2) sungai tergolong dalam Kelas II, dua (2) sungai juga Kelas III, empat (4) sungai Kelas IV manakala 26 sungai adalah Kelas V. Dari segi sub-indeks SS, 10 sungai yang diklasifikasikan kelas I, 15 sungai Kelas II, tujuh (7) sungai Kelas III dan dua (2) sungai Kelas IV.

Table 2.4 shows the WQI and that out of the 34 polluted rivers, 24 rivers were classified as Class III, while nine (9) rivers were Class IV, and one (1) river Class V. In terms of BOD sub-index, one (1) river was classified as Class II, four (4) rivers as Class III, 18 rivers as Class IV and 10 rivers as Class V. In terms of AN sub-index, two (2) rivers were classified as Class II, also two (2) rivers as Class III, four (4) rivers as Class IV and 26 rivers as Class V. In terms of SS sub-index, 10 rivers were classified as Class I, 15 rivers as Class II, seven (7) rivers as Class III and two (2) rivers as Class IV.

Jadual 2.4 : Sungai Tercemar dan Kelas Kualiti Air Berdasarkan Sub-Indeks BOD, AN dan SS, 2020
Table 2.4 : The Polluted Rivers and Classes Based on BOD, AN and SS Sub-Indexes, 2020

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	2020			KELAS BERDASARKAN / CLASS BASED ON		
			IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS	BOD	AN	SS
P. Pinang	Sg. Jawi	Sg. Chempedak	47	T/P	IV	IV	V	IV
		Sg. Jawi	55	T/P	III	IV	V	III
		Sg. Tengah	49	T/P	IV	IV	V	III
	Sg. Juru	Sg. Permatang Rawa	59	T/P	III	IV	V	I
		Sg. Rambai	57	T/P	III	IV	V	I
P. Pinang / Kedah	Sg. Perai	Sg. Air Melintas	58	T/P	III	IV	V	III
		Sg. Kereh	55	T/P	III	IV	V	III
Kedah	Sg. Merbok	Sg. Bakar Arang	56	T/P	III	V	IV	I
Selangor / W.P. KL	Sg. Klang	Sg. Air Busuk	41	T/P	IV	V	V	II
		Sg. Kerayong	58	T/P	III	IV	V	II
Selangor	Sg. Sepang	Sg. Rambai	25	T/P	V	V	V	III
N. Sembilan / Melaka	Sg. Linggi	Sg. Tuang	57	T/P	III	IV	V	II
	Sg. Tuang	Sg. Tuang	59	T/P	III	IV	V	III
Melaka	Sg. Duyong	Sg. Punggur	51	T/P	IV	IV	V	II
	Sg. Merlimau	Sg. Merlimau	56	T/P	III	III	IV	I
Johor	Sg. Batu Pahat	Sg. Panchor	59	T/P	III	III	IV	I
		Sg. Semberong	58	T/P	III	II	III	II
		Sg. Simpang Kanan	59	T/P	III	II	IV	I
		Sg. Temehel	57	T/P	III	IV	V	II
	Sg. Danga	Sg. Danga	57	T/P	III	III	V	II
	Sg. Kaw. Pasir Gudang	Sg. Buluh	41	T/P	IV	V	III	II
		Sg. Perembi	57	T/P	III	IV	V	II
		Sg. Tukang Batu	42	T/P	IV	V	V	II
	Sg. Kempas	Sg. Kempas	32	T/P	IV	V	V	III

Jadual 2.4 : Sungai Tercemar dan Kelas Kualiti Air Berdasarkan Sub-Indeks BOD, AN dan SS, 2020
Table 2.4 : The Polluted Rivers and Classes Based on BOD, AN and SS Sub-Indexes, 2020

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	2020			KELAS BERDASARKAN / CLASS BASED ON		
			IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS	BOD	AN	SS
Johor	Sg. Pontian Besar	Sg. Ayer Merah	43	T/P	IV	V	V	I
	Sg. Sanglang	Sg. Sanglang	59	T/P	III	IV	II	IV
	Sg. Tebrau	Sg. Bala	55	T/P	III	IV	V	II
		Sg. Pandan	46	T/P	IV	V	V	II
		Sg. Plentong	56	T/P	III	IV	V	II
		Sg. Sebulung	53	T/P	III	V	V	I
		Sg. Sengkuang	52	T/P	III	V	V	I
		Sg. Tampoi	52	T/P	III	IV	V	I
		Sg. Tebrau	58	T/P	III	IV	V	II
Johor / N. Sembilan / Pahang	Sg. Muar	Sg. Sarang Buaya	58	T/P	III	III	II	II

TREN PENCEMARAN AIR SUNGAI

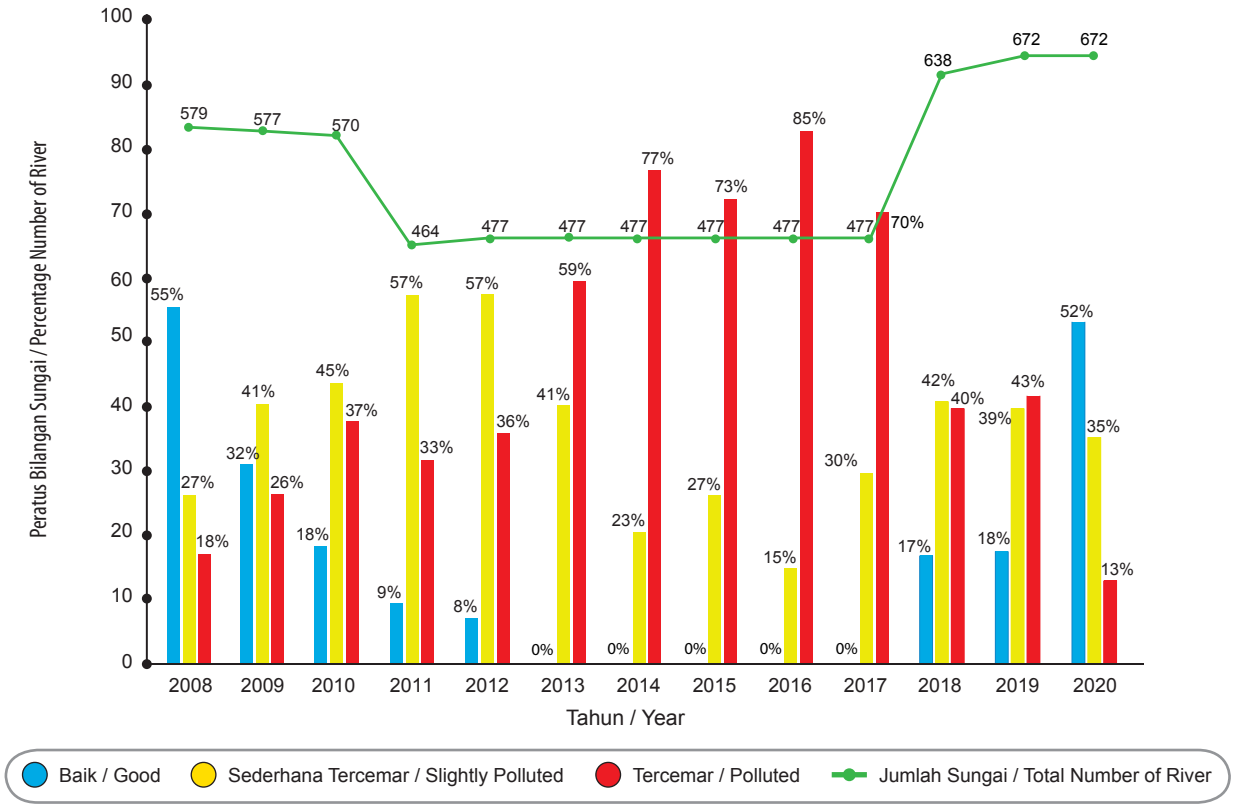
Kualiti air sungai yang ditentukan dari segi IKA telah menunjukkan peningkatan pada tahun 2020. Peratus bilangan sungai yang dikategorikan sebagai bersih telah sedikit meningkat kepada 66% pada tahun 2020 berbanding 61% pada tahun sebelumnya. Peratus bilangan sungai yang dikategorikan sebagai tercemar telah menurun daripada 9% pada tahun 2019 kepada 5% pada tahun 2020. Trend ini adalah ditunjukkan oleh **Rajah 2.1**.

Berdasarkan sub-indeks BOD, 352 sungai yang dikategori sebagai bersih pada tahun 2020 (**Rajah 2.2**). Bilangan sungai yang tercemar dari segi sub-indeks BOD telah menurun daripada 289 pada tahun 2019 kepada 84 sungai pada tahun 2020. Peningkatan kualiti air sungai dari segi sub-indeks BOD ini adalah disebabkan oleh pengurangan pelepasan bahan buangan yang bersifat organik daripada pelbagai punca seperti air sisa industri, serta aktiviti komersil dan domestik.

TRENDS IN RIVER WATER POLLUTION

The river water quality in terms of WQI shows an increase in 2020. The percentage of clean rivers has increased slightly from 61% in 2019 to 66% in 2020. The percentage of polluted rivers has decreased from 9% in 2019 to 5% in 2020. These trends are shown in **Figure 2.1**.

In terms of BOD sub-index, 352 of the monitored rivers have been categorised as clean in 2020 (**Figure 2.2**). The number of polluted rivers in terms of BOD sub-index has decreased from 289 in 2019 to 84 rivers in 2020. The improvement of river water quality in terms of BOD sub-index is due to the reduction of organic waste from various sources including wastewater from industrial, domestic and commercial activities.



Rajah 2.2 : Tren Kualiti Air Sungai Berdasarkan Sub-Indeks BOD (2008-2020)
Figure 2.2 : River Water Quality Trend Based on BOD Sub-Index (2008-2020)

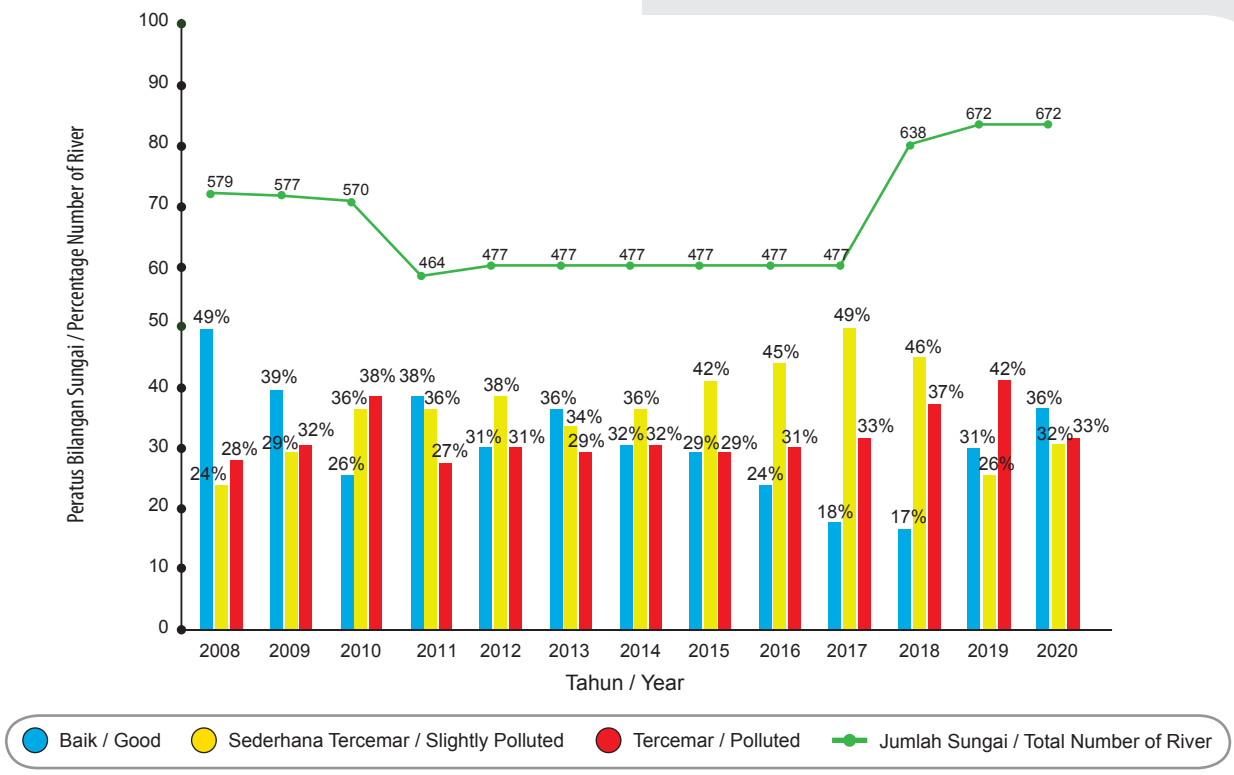
Lata Lembik, Raub, Pahang

Dari segi sub-indeks AN pula, bilangan sungai bersih telah meningkat daripada 211 pada tahun 2019 kepada 239 pada tahun 2020 (**Rajah 2.3**). Bilangan sungai yang tercemar dari segi sub-indeks AN telah bertambah baik daripada 283 pada tahun 2019 kepada 220 sungai pada tahun 2020. Peningkatan kualiti air sungai yang bagi sub-indeks AN boleh dikaitkan dengan pengurangan pelepasan air sisa kumbahan manusia dan haiwan yang ke dalam air sungai.

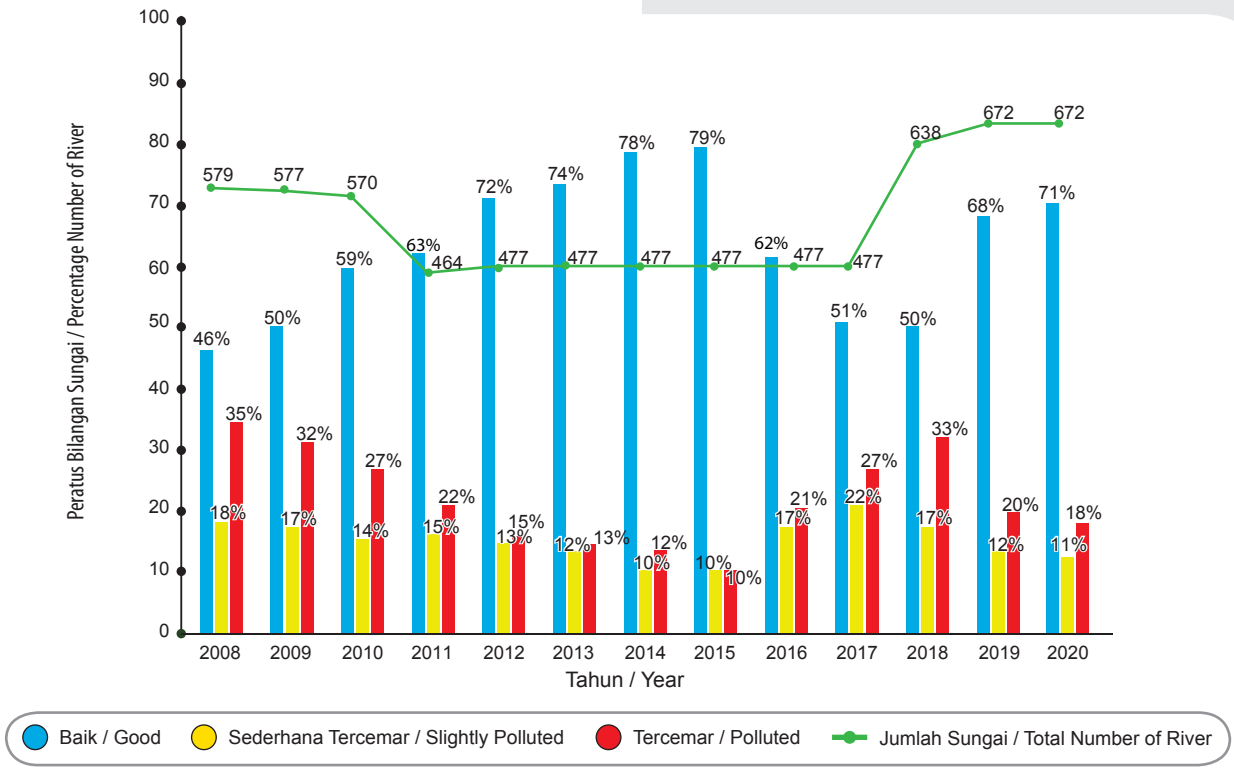
Dari segi sub-indeks SS pula, bilangan sungai yang dikategorikan bersih telah meningkat daripada 456 pada tahun 2019 kepada 480 pada tahun 2020 (**Rajah 2.4**). Bilangan sungai yang dikategorikan sebagai tercemar dari segi sub-indeks SS pula bertambah baik daripada 133 pada 2019 kepada 119 sungai pada tahun 2020. Peningkatan kualiti air sungai dari segi pepejal terampai tersebut disebabkan oleh kecekapan kawalan ke atas aktiviti kerja tanah dan pembukaan tanah di kawasan-kawasan tertentu di samping kerencatan terhadap kepesatan sektor pembinaan negara akibat pandemik COVID-19.

In terms of AN sub-index, the number of clean rivers has increased from 211 in 2019 to 239 rivers in 2020 (**Figure 2.3**). The number of polluted rivers in terms of AN sub-index parameter has reduced from 283 in 2019 to 220 rivers in 2020. The improvement of river water quality by AN sub-index can be related to the reduction of discharge from treated and untreated sewage into the rivers.

In terms of SS sub-index, the number of clean rivers has increased from 456 in 2019 to 480 in 2020 (**Figure 2.4**). The number of polluted rivers in terms of SS sub-index has reduced from 133 in 2019 to 119 rivers in 2020. This can be attributed to the efficient control over earthworks and land clearing activities in certain areas as well as to the COVID-19 pandemic that has hampered the growth of the construction sector in our country.



Rajah 2.3 : Tren Kualiti Air Sungai Berdasarkan Sub-Indeks AN (2008-2020)
Figure 2.3 : River Water Quality Trend Based on AN Sub-Index (2008-2020)



Rajah 2.4 : Tren Kualiti Air Sungai Berdasarkan Sub-Indeks SS (2008-2020)
Figure 2.4 : River Water Quality Trend Based on SS Sub-Index (2008-2020)

Sungai Tembeling, Taman Negara / Tembeling River, National Park

LOGAM BERAT DALAM SUNGAI

Analisis kandungan beberapa jenis logam berat dalam air sungai telah dilakukan ke atas Raksa (Hg), Arsenik (As), Kadmium (Cd), Kromium (Cr), Plumbum (Pb), dan Zink (Zn). Pada tahun 2020, kesemua sampel air sungai telah menunjukkan kandungan logam Hg, Cd dan Zn pada tahap Kelas II. Sampel air sungai yang diuji telah menunjukkan kandungan As (99.2%) dalam Kelas II, dikuti dengan Cr (99.8%), dan Pb (99.9%).

KUALITI AIR SUNGAI DI HULU MUKA SAUK

Pada tahun 2020, 49 (89.1%) daripada 55 stesen pengawasan kualiti air di hulu muka sauk telah menunjukkan indeks kualiti air bersih, sementara enam (6) (10.9%) stesen dikategorikan sebagai sederhana tercemar. Berdasarkan IKA juga, 17 (30.9%) stesen telah dikategorikan sebagai kelas I dan 37 (67.3%) adalah Kelas II, manakala satu (1) (1.8%) adalah Kelas III. **Jadual 2.5** menunjukkan status kualiti air di stesen hulu muka sauk terpilih berdasarkan IKA.

HEAVY METALS IN RIVERS

The heavy metals content that were analysed in river water were Mercury (Hg), Arsenic (As), Cadmium (Cd), Chromium (Cr), Plumbum (Pb), and Zinc (Zn). In 2020, all of the water samples showed that the concentration of Hg, Cd and Zn was within Class II limits. Water samples showed that the concentrations of As (99.2%) were within Class II limits followed by Cr (99.8%) and Pb (99.9%).

QUALITY OF RIVER WATER AT UPSTREAM INTAKES

In 2020, 49 (89.1%) of the 55 monitoring stations located at upstream water intakes showed clean water quality while six (6) (10.9%) stations were categorised as slightly polluted. Based on the overall WQI, 17 (30.9%) stations were categorised as Class I, 37 (67.3%) were Class II, while one (1) (1.8%) was Class III. **Table 2.5** shows the water quality of the selected water intake stations based on WQI.

Jadual 2.5 : Status Kualiti Air di Hulu Muka Sauk, 2020
Table 2.5 : Water Quality Status of Upstream Water Intake, 2020

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	STESEN ID LAMA / OLD ID STATION	STATION ID BARU / NEW ID STATION	MUKA SAUK / WATER INTAKE	2019			2020		
						IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS	IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS
Perlis	Sg. Perlis	Sg. Terusan Mada	2PS 13	1RPLS010	Loji Rawatan Air Arau Fasa IV	84	B/C	II	88	B/C	II
			2PS 14	1RPLS011	Loji Rawatan Air TTPC, Sg. Baru	87	B/C	II	89	B/C	II
Kedah	Sg. Ulu Melaka	Sg. Melaka	2LG05	1KMLK003	Ulu Melaka	81	B/C	II	87	B/C	II
		Sg. Saga	2LG06	1KMLK004	Padang Saga	76	ST/SP	III	81	B/C	II
	Sg. Kedah	Sg. Ahning	2KD11	1KKDH011	Padang Sanai	88	B/C	II	92	B/C	II
		Sg. Padang Terap	2KD12	1KKDH012	Kuala Nerang	91	B/C	II	92	B/C	II
		Sg. Temin	2KD10	1KKDH010	Changloon	77	ST/SP	II	84	B/C	II
	Sg. Muda	Sg. Muda	2MD16	1KMUD014	Jeneri	89	B/C	II	90	B/C	II
			2MD17	1KMUD015	Jeniang	87	B/C	II	88	B/C	II
			2MD18	1KMUD016	Bukit Selambau	86	B/C	II	85	B/C	II
			2MD20	1KMUD018	Pinang Tunggal	86	B/C	II	86	B/C	II
			2MD21	1KMUD019	Nami	88	B/C	II	90	B/C	II
		Sg. Sedim	2MD19	1KMUD017	Bikan	87	B/C	II	89	B/C	II
P. Pinang	Sg. Pinang	Sg. Satu	2PG12	1PPNG020	Batu Feringgi	93	B/C	I	96	B/C	I
Perak	Sg. Bernam	Sg. Gelinting	1BM15	1ABNM015	Loji Rawatan Air Ulu Slim	87	B/C	II	92	B/C	II
		Sg. Trolak	1BM14	1ABNM014	Loji Rawatan Air Trolak Timur	91	B/C	II	93	B/C	I
	Sg. Kurau	Sg. Air Hitam	2KU07	1AKRU007	Loji Rawatan Air Jelai	92	B/C	II	95	B/C	I

Jadual 2.5 : Status Kualiti Air di Hulu Muka Sauk, 2020
Table 2.5 : Water Quality Status of Upstream Water Intake, 2020

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	STESEN ID LAMA / OLD ID STATION	STATION ID BARU / NEW ID STATION	MUKA SAUK / WATER INTAKE	2019			2020		
						IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS	IKA / WQI	KATEGORI / CATEGORY	KELAS / CLASS
Perak	Sg. Perak	Sg. Manong	2PK62	1APRK060	Loji Rawatan Air Manong	95	B/C	I	95	B/C	I
		Sg. Perak	2PK61	1APRK059	Loji Rawatan Air Sauk	92	B/C	II	95	B/C	I
		Sg. Tesong	2PK64	1APRK062	Loji Rawatan Air Sg. Klah	94	B/C	I	96	B/C	I
		Sg. Woh	2PK63	1APRK061	Loji Rawatan Air Kuala Woh	94	B/C	I	96	B/C	I
	Sg. Sepetang	Sg. Batu Tegoh	2SP18	1ASPT016	Loji Rawatan Air Bukit Larut	95	B/C	I	95	B/C	I
Selangor	Sg. Klang	Sg. Gombak	1K53	2BKLG020	Loji Rawatan Air Gombak	90	B/C	II	93	B/C	I
	Sg. Langat	Sg. Batang Labu	1L26	2BLGT028	Loji Rawatan Air Salak Tinggi	72	ST/SP	III	79	ST/SP	II
		Sg. Semenyih	1L09	2BLGT010	Loji Rawatan Air Semenyih	77	ST/SP	II	83	B/C	II
Johor	Sg. Batu Pahat	Sg. Semberong Dam	3BP27	3JBPT021	Semberong Dam	85	B/C	II	89	B/C	II
	Sg. Benut	Sg. Machap Dam	3BN10	3JBNT008	Machap Dam	91	B/C	II	92	B/C	II
	Sg. Endau	Sg. Kahang	3ED38	3JEND026	Jalan Felda Kahang Timur, Kluang	86	B/C	II	90	B/C	II
	Sg. Muar	Sg. Jelai	1MN23	3NMUA054	Loji Rawatan Air Dangi	83	B/C	II	88	B/C	II
		Sg. Jementah	3MR39	3JMUA040	Loji Rawatan Air Jementah	91	B/C	II	93	B/C	I
		Sg. Muar	3MR38	3JMUA039	Loji Rawatan Air Gombang	81	B/C	II	82	B/C	II
	Sg. Pulai	Sg. Pulai Dam	3PU04	3JPLI004	Pulai Dam	93	B/C	I	95	B/C	I
Melaka	Sg. Kesang	Sg. Chin-Chin	1KA08	3MKSG008	Muka sauk Loji Rawatan Air Chin-chin	80	ST/SP	II	79	ST/SP	II
Pahang	Sg. Pahang	Sg. Bertam	2CH15	4CBTM013	Loji Rawatan Air Habu	94	B/C	I	97	B/C	I
		Sg. Gapoi	4PH95	4CPHG086	Muka sauk Loji Rawatan Air Gapoi	94	B/C	I	94	B/C	I
		Sg. Jempol	4PH96	4CPHG087	Loji Air Sg Jerik	89	B/C	II	93	B/C	I
			4PH97	4CPHG088	Loji Air Jengka 3	89	B/C	II	90	B/C	II
		Sg. Mentiga	4PH98	4CPHG089	Loji Air Chini	82	B/C	II	85	B/C	II
		Sg. Terla	2CH14	4CBTM012	Loji Rawatan Air Kuala Terla	88	B/C	II	95	B/C	I
		Sg. Triang	4PH93	4CPHG074	Loji Rawatan Air Sg. Triang	86	B/C	II	88	B/C	II
		Sg. Ulong	2CH16	4CBTM014	Brinchang Dam	94	B/C	I	96	B/C	I
Terengganu	Sg. Terengganu	Sg. Terengganu	4TE14	4TTGG013	Loji Air Serada	89	B/C	II	89	B/C	II
Kelantan	Sg. Golok	Sg. Golok	4GL10	4DGLK003	Syarikat Air Kelantan	90	B/C	II	94	B/C	I
	Sg. Kelantan	Sg. Chiku	4KE66	4DKLT043	Felda Ciku 2	87	B/C	II	89	B/C	II
		Sg. Kelantan	4KE68	4DKLT045	Loji Air Kelar, Pasir Mas	78	ST/SP	II	80	ST/SP	II
		Sg. Pehi	4KE67	4DKLT044	Loji Air Pahi	88	B/C	II	86	B/C	II
Sabah	Sg. Padas	Sg. Padas	72PD04	5SPDS011	Water Intake Jabatan Air Beaufort	86	B/C	II	85	B/C	II
	Sg. Papar	Sg. Papar	75PP04	5SPPR004	Sekolah Kebangsaan Mandalipau	92	B/C	II	90	B/C	II
			75PP05	5SPPR005	Water Intake Kogopon	93	B/C	I	92	B/C	II
Sarawak	Sg. Kerian	Sg. Selalang	55SG01	6QKRN017	Selalang Water Intake	91	B/C	II	92	B/C	II
	Sg. Mukah	Sg. Mukah	58MH05	6QMKH005	Mukah Water Intake	83	B/C	II	89	B/C	II
	Sg. Rajang	Sg. Daro	56DR01	6QRJG021	Daro Water Intake	76	ST/SP	III	80	ST/SP	II
		Sg. Jemoreng	56JG01	6QRJG022	Jemoreng Water Intake	78	ST/SP	II	80	ST/SP	II
		Sg. Pakan	56PN01	6QRJG020	Pakan Water Intake	89	B/C	II	88	B/C	II
		Sg. Pila Parit	56PL01	6QRJG023	Igan Water Intake	81	B/C	II	62	ST/SP	III

Dari segi sub-indeks BOD, 53 (96.4%) stesen telah menunjukkan kualiti air pada Kelas II dan dua (2) (3.6%) stesen Kelas III. Berdasarkan sub-indeks AN, sebanyak 38 (69.1%) stesen menunjukkan kualiti air pada Kelas I, 15 (27.3%) Kelas II, dan dua (2) (3.6%) stesen Kelas III. Dari segi sub-indeks SS, 32 (58.2%) stesen telah dikategorikan sebagai Kelas I, 14 (25.5%) stesen Kelas II, tujuh (7) (12.7%) stesen Kelas III, satu (1) (1.8%) stesen Kelas IV manakala satu (1) (1.8%) stesen Kelas V.

Jadual 2.6, Jadual 2.7 dan **Jadual 2.8** menunjukkan kualiti air sungai di stesen di hulu muka sauk masing-masing berdasarkan sub-indeks BOD, AN dan SS. **Rajah 2.5** menunjukkan peratusan stesen hulu muka sauk berdasarkan kelas kualiti air dan parameter utama.

In terms of BOD sub-index, 53 (96.4%) stations showed Class II water quality and two (2) (3.6%) stations as Class III. In terms of AN sub-index, 38 (69.1%) stations showed water quality of Class I, 15 (27.3%) as Class II, and two (2) (3.6%) as Class III. Meanwhile in terms of SS, 32 (58.2%) stations were categorised as Class I, 14 (25.5%) as Class II, seven (7) (12.7%) as Class III, one (1) (1.8%) as Class IV, and one (1) (1.8%) station as Class V.

Tables 2.6, 2.7 and **2.8** show the water quality at upstream stations of water intake points based on BOD, AN and SS sub-indexes respectively. **Figure 2.5** shows the percentage of water quality of upstream water intake stations in terms of classes based on main parameters.

Jadual 2.6 : Status Kualiti Air di Hulu Muka Sauk Berdasarkan Sub-Indeks BOD, 2020
Table 2.6 : Water Quality Status of Upstream Water Intakes Based on BOD Sub-Index, 2020

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	STESEN ID LAMA / OLD ID STATION	STATION ID BARU / NEW ID STATION	MUKA SAUK / WATER INTAKE	2019			2020		
						SUB-INDEKS BOD / BOD SUB-INDEX	KATEGORI / CATEGORY	KELAS / CLASS	SUB-INDEKS BOD / BOD SUB-INDEX	KATEGORI / CATEGORY	KELAS / CLASS
Perlis	Sg. Perlis	Sg. Terusan Mada	2PS 13	1RPLS010	Loji Rawatan Air Arau Fasa IV	81	ST/SP	III	90	ST/SP	II
			2PS 14	1RPLS011	Loji Rawatan Air TTPC, Sg. Baru	83	ST/SP	III	88	ST/SP	II
Kedah	Sg. Ulu Melaka	Sg. Melaka	2LG05	1KMLK003	Ulu Melaka	76	T/P	IV	92	B/C	II
		Sg. Saga	2LG06	1KMLK004	Padang Saga	75	T/P	IV	92	B/C	II
	Sg. Kedah	Sg. Ahning	2KD11	1KKDH011	Padang Sanai	83	ST/SP	III	92	B/C	II
		Sg. Padang Terap	2KD12	1KKDH012	Kuala Nerang	81	ST/SP	III	92	B/C	II
		Sg. Temin	2KD10	1KKDH010	Changloon	79	T/P	III	88	ST/SP	II
	Sg. Muda	Sg. Muda	2MD16	1KMUD014	Jeneri	86	ST/SP	III	94	B/C	II
			2MD17	1KMUD015	Jeniang	83	ST/SP	III	90	ST/SP	II
			2MD18	1KMUD016	Bukit Selambau	83	ST/SP	III	88	ST/SP	II
			2MD20	1KMUD018	Pinang Tunggal	83	ST/SP	III	90	ST/SP	II
			2MD21	1KMUD019	Nami	78	T/P	III	88	ST/SP	II
		Sg. Sedim	2MD19	1KMUD017	Bikan	86	ST/SP	III	88	ST/SP	II
P. Pinang	Sg. Pinang	Sg. Satu	2PG12	1PPNG020	Batu Feringgi	88	ST/SP	II	94	B/C	II
Perak	Sg. Bernam	Sg. Gelinting	1BM15	1ABNM015	Loji Rawatan Air Ulu Slim	83	ST/SP	III	92	B/C	II
		Sg. Trolak	1BM14	1ABNM014	Loji Rawatan Air Trolak Timur	83	ST/SP	III	90	ST/SP	II
	Sg. Kurau	Sg. Air Hitam	2KU07	1AKRU007	Loji Rawatan Air Jelai	81	ST/SP	III	90	ST/SP	II
	Sg. Perak	Sg. Manong	2PK62	1APRK060	Loji Rawatan Air Manong	90	ST/SP	II	96	B/C	II
		Sg. Perak	2PK61	1APRK059	Loji Rawatan Air Sauk	83	ST/SP	III	96	B/C	II
		Sg. Tesong	2PK64	1APRK062	Loji Rawatan Air Sg. Klah	90	ST/SP	II	96	B/C	II
		Sg. I	2PK63	1APRK061	Loji Rawatan Air Kuala I	88	ST/SP	II	96	B/C	II
	Sg. Sepetang	Sg. Batu Tegoh	2SP18	1ASPT016	Loji Rawatan Air Bukit Larut	90	ST/SP	II	92	B/C	II

Jadual 2.6 : Status Kualiti Air di Hulu Muka Sauk Berdasarkan Sub-Indeks BOD, 2020
Table 2.6 : Water Quality Status of Upstream Water Intakes Based on BOD Sub-Index, 2020

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	STESEN ID LAMA / OLD ID STATION	STATION ID BARU / NEW ID STATION	MUKA SAUK / WATER INTAKE	2019			2020		
						SUB-INDEKS BOD / BOD SUB-INDEX	KATEGORI / CATEGORY	KELAS / CLASS	SUB-INDEKS BOD / BOD SUB-INDEX	KATEGORI / CATEGORY	KELAS / CLASS
Selangor	Sg. Klang	Sg. Gombak	1K53	2BKLG020	Loji Rawatan Air Gombak	83	ST/SP	III	92	B/C	II
	Sg. Langat	Sg. Batang Labu	1L26	2BLGT028	Loji Rawatan Air Salak Tinggi	79	T/P	III	90	ST/SP	II
		Sg. Semenyih	1L09	2BLGT010	Loji Rawatan Air Semenyih	79	T/P	III	92	B/C	II
Johor	Sg. Batu Pahat	Sg. Semberong Dam	3BP27	3JBPT021	Semberong Dam	81	ST/SP	III	83	ST/SP	III
	Sg. Benut	Sg. Machap Dam	3BN10	3JBNT008	Machap Dam	83	ST/SP	III	88	ST/SP	II
	Sg. Endau	Sg. Kahang	3ED38	3JEND026	Jalan Felda Kahang Timur, Kluang	78	T/P	III	92	B/C	II
	Sg. Muar	Sg. Jelai	1MN23	3NMUA054	Loji Rawatan Air Dangi	79	T/P	III	86	ST/SP	III
		Sg. Jementah	3MR39	3JMUA040	Loji Rawatan Air Jementah	88	ST/SP	II	92	B/C	II
		Sg. Muar	3MR38	3JMUA039	Loji Rawatan Air Gombang	88	ST/SP	II	88	ST/SP	II
	Sg. Pulai	Sg. Pulai Dam	3PU04	3JPLI004	Pulai Dam	81	ST/SP	III	92	B/C	II
Melaka	Sg. Kesang	Sg. Chin-Chin	1KA08	3MKSG008	Muka sauk Loji Rawatan Air Chin-chin	75	T/P	IV	90	ST/SP	II
Pahang	Sg. Pahang	Sg. Bertam	2CH15	4CBTM013	Loji Rawatan Air Habu	88	ST/SP	II	96	B/C	II
		Sg. Gapoi	4PH95	4CPHG086	Muka sauk Loji Rawatan Air Gapoi	88	ST/SP	II	94	B/C	II
		Sg. Jempol	4PH96	4CPHG087	Loji Air Sg Jerik	81	ST/SP	III	92	B/C	II
			4PH97	4CPHG088	Loji Air Jengka 3	88	ST/SP	II	94	B/C	II
		Sg. Mentiga	4PH98	4CPHG089	Loji Air Chini	86	ST/SP	III	92	B/C	II
		Sg. Terla	2CH14	4CBTM012	Loji Rawatan Air Kuala Terla	86	ST/SP	III	96	B/C	II
		Sg. Triang	4PH93	4CPHG074	Loji Rawatan Air Sg. Triang	86	ST/SP	III	96	B/C	II
		Sg. Ulong	2CH16	4CBTM014	Brinchang Dam	88	ST/SP	II	96	B/C	II
Terengganu	Sg. Terengganu	Sg. Terengganu	4TE14	4TTGG013	Loji Air Serada	88	ST/SP	II	92	B/C	II
Kelantan	Sg. Golok	Sg. Golok	4GL10	4DGLK003	Syarikat Air Kelantan	79	T/P	III	96	B/C	II
	Sg. Kelantan	Sg. Chiku	4KE66	4DKLT043	Felda Ciku 2	76	T/P	IV	92	B/C	II
		Sg. Kelantan	4KE68	4DKLT045	Loji Air Kelar, Pasir Mas	81	ST/SP	III	96	B/C	II
		Sg. Pehi	4KE67	4DKLT044	Loji Air Pahi	83	ST/SP	III	94	B/C	II
Sabah	Sg. Padas	Sg. Padas	72PD04	5SPDS011	Water Intake Jabatan Air Beaufort	96	B/C	II	94	B/C	II
	Sg. Papar	Sg. Papar	75PP04	5SPPR004	Sekolah Kebangsaan Mandalipau	96	B/C	II	96	B/C	II
			75PP05	5SPPR005	Water Intake Kogopon	96	B/C	II	96	B/C	II
Sarawak	Sg. Kerian	Sg. Selalang	55SG01	6QKRN017	Selalang Water Intake	96	B/C	II	96	B/C	II
	Sg. Mukah	Sg. Mukah	58MH05	6QMKH005	Mukah Water Intake	96	B/C	II	96	B/C	II
	Sg. Rajang	Sg. Daro	56DR01	6QRJG021	Daro Water Intake	94	B/C	II	96	B/C	II
		Sg. Jemoreng	56JG01	6QRJG022	Jemoreng Water Intake	94	B/C	II	96	B/C	II
		Sg. Pakan	56PN01	6QRJG020	Pakan Water Intake	96	B/C	II	96	B/C	II
		Sg. Pila Parit	56PL01	6QRJG023	Igan Water Intake	92	B/C	II	92	B/C	II

Jadual 2.7 : Status Kualiti Air di Hulu Muka Sauk Berdasarkan Sub-Indeks AN, 2020
Table 2.7 : Water Quality Status of Upstream Water Intakes Based on AN Sub-Index, 2020

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	STESEN ID LAMA / OLD ID STATION	STATION ID BARU / NEW ID STATION	MUKA SAUK / WATER INTAKE	2019			2020		
						SUB-INDEKS AN / AN SUB-INDEX	KATEGORI / CATEGORY	KELAS / CLASS	SUB-INDEKS AN / AN SUB-INDEX	KATEGORI / CATEGORY	KELAS / CLASS
Perlis	Sg. Perlis	Sg. Terusan Mada	2PS 13	1RPLS010	Loji Rawatan Air Arau Fasa IV	95	B/C	I	93	B/C	I
			2PS 14	1RPLS011	Loji Rawatan Air TTPC, Sg. Baru	91	ST/SP	I	94	B/C	I
Kedah	Sg. Ulu Melaka	Sg. Melaka	2LG05	1KMLK003	Ulu Melaka	93	B/C	I	94	B/C	I
		Sg. Saga	2LG06	1KMLK004	Padang Saga	82	ST/SP	II	80	ST/SP	II
	Sg. Kedah	Sg. Ahning	2KD11	1KKDH011	Padang Sanai	99	B/C	I	96	B/C	I
		Sg. Padang Terap	2KD12	1KKDH012	Kuala Nerang	96	B/C	I	80	ST/SP	II
		Sg. Temin	2KD10	1KKDH010	Changloon	80	ST/SP	II	74	ST/SP	II
	Sg. Muda	Sg. Muda	2MD16	1KMUD014	Jeneri	94	B/C	I	99	B/C	I
			2MD17	1KMUD015	Jeniang	93	B/C	I	95	B/C	I
			2MD18	1KMUD016	Bukit Selambau	92	B/C	I	97	B/C	I
			2MD20	1KMUD018	Pinang Tunggal	87	ST/SP	II	86	ST/SP	II
			2MD21	1KMUD019	Nami	96	B/C	I	99	B/C	I
		Sg. Sedim	2MD19	1KMUD017	Bikan	95	B/C	I	93	B/C	I
P. Pinang	Sg. Pinang	Sg. Satu	2PG12	1PPNG020	Batu Feringgi	99	B/C	I	99	B/C	I
Perak	Sg. Bernam	Sg. Gelinting	1BM15	1ABNM015	Loji Rawatan Air Ulu Slim	96	B/C	I	99	B/C	I
		Sg. Trolak	1BM14	1ABNM014	Loji Rawatan Air Trolak Timur	99	B/C	I	97	B/C	I
	Sg. Kurau	Sg. Air Hitam	2KU07	1AKRU007	Loji Rawatan Air Jelai	99	B/C	I	99	B/C	I
	Sg. Perak	Sg. Manong	2PK62	1APRK060	Loji Rawatan Air Manong	97	B/C	I	99	B/C	I
		Sg. Perak	2PK61	1APRK059	Loji Rawatan Air Sauk	98	B/C	I	99	B/C	I
		Sg. Tesong	2PK64	1APRK062	Loji Rawatan Air Sg. Klah	98	B/C	I	99	B/C	I
		Sg. I	2PK63	1APRK061	Loji Rawatan Air Kuala I	99	B/C	I	99	B/C	I
	Sg. Sepetang	Sg. Batu Tegoh	2SP18	1ASPT016	Loji Rawatan Air Bukit Larut	98	B/C	I	99	B/C	I
Selangor	Sg. Klang	Sg. Gombak	1K53	2BKLG020	Loji Rawatan Air Gombak	97	B/C	I	99	B/C	I
	Sg. Langat	Sg. Batang Labu	1L26	2BLGT028	Loji Rawatan Air Salak Tinggi	38	T/P	IV	58	T/P	III
		Sg. Semenyih	1L09	2BLGT010	Loji Rawatan Air Semenyih	60	T/P	III	66	T/P	III
Johor	Sg. Batu Pahat	Sg. Semberong Dam	3BP27	3JBPT021	Semberong Dam	96	B/C	I	98	B/C	I
	Sg. Benut	Sg. Machap Dam	3BN10	3JBNT008	Machap Dam	72	ST/SP	II	96	B/C	I
	Sg. Endau	Sg. Kahang	3ED38	3JEND026	Jalan Felda Kahang Timur, Kluang	87	ST/SP	II	77	ST/SP	II
	Sg. Muar	Sg. Jelai	1MN23	3NMUA054	Loji Rawatan Air Dangi	97	B/C	I	95	B/C	I
		Sg. Jementah	3MR39	3JMUA040	Loji Rawatan Air Jementah	93	B/C	I	99	B/C	I
		Sg. Muar	3MR38	3JMUA039	Loji Rawatan Air Gombang	91	ST/SP	I	82	ST/SP	II
	Sg. Pulai	Sg. Pulai Dam	3PU04	3JPLI004	Pulai Dam	79	ST/SP	II	98	B/C	I
Melaka	Sg. Kesang	Sg. Chin-Chin	1KA08	3MKSG008	Muka sauk Loji Rawatan Air Chin-chin	97	B/C	I	80	ST/SP	II
Pahang	Sg. Pahang	Sg. Bertam	2CH15	4CBTM013	Loji Rawatan Air Habu	99	B/C	I	99	B/C	I
		Sg. Gapoi	4PH95	4CPHG086	Muka sauk Loji Rawatan Air Gapoi	98	B/C	I	99	B/C	I

Jadual 2.7 : Status Kualiti Air di Hulu Muka Sauk Berdasarkan Sub-Indeks AN, 2020
Table 2.7 : Water Quality Status of Upstream Water Intakes Based on AN Sub-Index, 2020

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	STESEN ID LAMA / OLD ID STATION	STATION ID BARU / NEW ID STATION	MUKA SAUK / WATER INTAKE	2019			2020		
						SUB-INDEKS AN / AN SUB-INDEX	KATEGORI / CATEGORY	KELAS / CLASS	SUB-INDEKS AN / AN SUB-INDEX	KATEGORI / CATEGORY	KELAS / CLASS
Pahang	Sg. Pahang	Sg. Jempol	4PH96	4CPHG087	Loji Air Sg Jerik	93	B/C	I	97	B/C	I
			4PH97	4CPHG088	Loji Air Jengka 3	92	B/C	I	90	ST/SP	II
		Sg. Mentiga	4PH98	4CPHG089	Loji Air Chini	91	ST/SP	I	92	B/C	I
		Sg. Terla	2CH14	4CBTM012	Loji Rawatan Air Kuala Terla	94	B/C	I	99	B/C	I
		Sg. Triang	4PH93	4CPHG074	Loji Rawatan Air Sg. Triang	96	B/C	I	98	B/C	I
		Sg. Ulong	2CH16	4CBTM014	Brinchang Dam	99	B/C	I	99	B/C	I
Terengganu	Sg. Terengganu	Sg. Terengganu	4TE14	4TTGG013	Loji Air Serada	89	ST/SP	II	90	ST/SP	II
Kelantan	Sg. Golok	Sg. Golok	4GL10	4DGLK003	Syarikat Air Kelantan	93	B/C	I	97	B/C	I
	Sg. Kelantan	Sg. Chiku	4KE66	4DKLT043	Felda Ciku 2	93	B/C	I	98	B/C	I
		Sg. Kelantan	4KE68	4DKLT045	Loji Air Kelar, Pasir Mas	91	ST/SP	I	92	B/C	I
		Sg. Pehi	4KE67	4DKLT044	Loji Air Pahi	97	B/C	I	96	B/C	I
Sabah	Sg. Padas	Sg. Padas	72PD04	5SPDS011	Water Intake Jabatan Air Beaufort	86	ST/SP	II	93	B/C	I
	Sg. Papar	Sg. Papar	75PP04	5SPPR004	Sekolah Kebangsaan Mandalipau	88	ST/SP	II	94	B/C	I
			75PP05	5SPPR005	Water Intake Kogopon	92	B/C	I	95	B/C	I
Sarawak	Sg. Kerian	Sg. Selalang	55SG01	6QKRN017	Selalang Water Intake	67	T/P	III	79	ST/SP	II
	Sg. Mukah	Sg. Mukah	58MH05	6QMKH005	Mukah Water Intake	74	ST/SP	II	83	ST/SP	II
	Sg. Rajang	Sg. Daro	56DR01	6QRJG021	Daro Water Intake	66	T/P	III	85	ST/SP	II
		Sg. Jemoreng	56JG01	6QRJG022	Jemoreng Water Intake	69	T/P	II	84	ST/SP	II
		Sg. Pakan	56PN01	6QRJG020	Pakan Water Intake	74	ST/SP	II	84	ST/SP	II
		Sg. Pila Parit	56PL01	6QRJG023	Igan Water Intake	77	ST/SP	II	72	ST/SP	II

Jadual 2.8 : Status Kualiti Air di Hulu Muka Sauk Berdasarkan Sub-Indeks SS, 2020
Table 2.8 : Water Quality Status of Upstream Water Intakes Based on SS Sub-Index, 2020

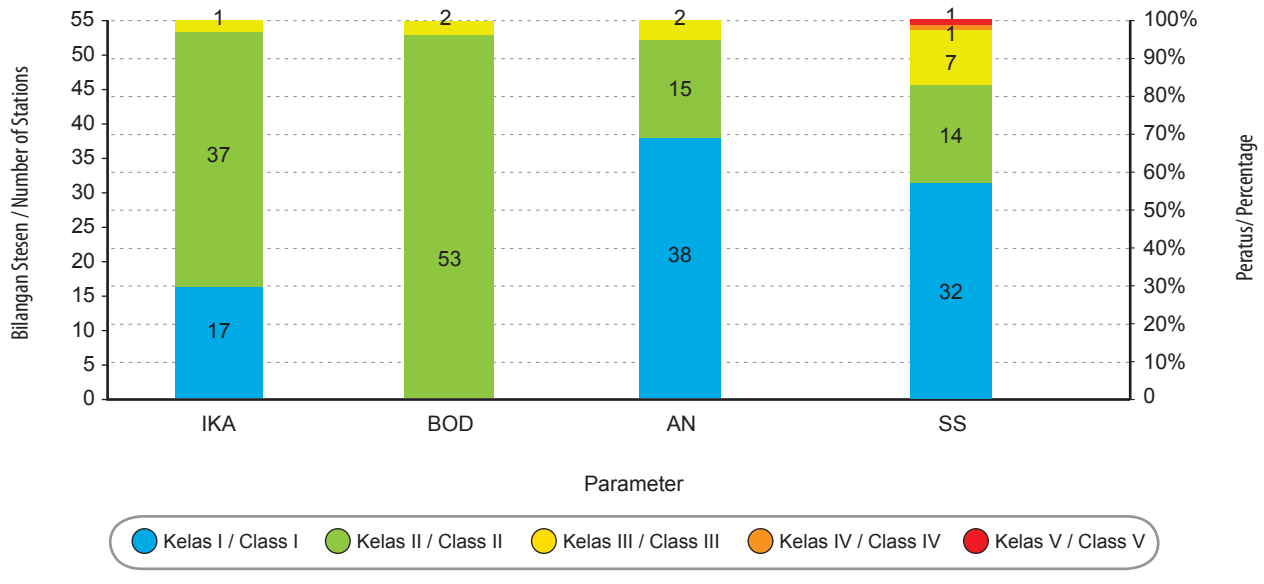
NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	STESEN ID LAMA / OLD ID STATION	STATION ID BARU / NEW ID STATION	MUKA SAUK / WATER INTAKE	2019			2020		
						SUB-INDEKS SS / SS SUB-INDEX	KATEGORI / CATEGORY	KELAS / CLASS	SUB-INDEKS SS / SS SUB-INDEX	KATEGORI / CATEGORY	KELAS / CLASS
Perlis	Sg. Perlis	Sg. Terusan Mada	2PS 13	1RPLS010	Loji Rawatan Air Arau Fasa IV	70	ST/SP	III	83	B/C	II
			2PS 14	1RPLS011	Loji Rawatan Air TTPC, Sg. Baru	78	B/C	II	82	B/C	II
Kedah	Sg. Ulu Melaka	Sg. Melaka	2LG05	1KMLK003	Ulu Melaka	71	ST/SP	III	75	ST/SP	II
		Sg. Saga	2LG06	1KMLK004	Padang Saga	79	B/C	II	87	B/C	I
	Sg. Kedah	Sg. Ahning	2KD11	1KKDH011	Padang Sanai	75	ST/SP	II	80	B/C	II
		Sg. Padang Terap	2KD12	1KKDH012	Kuala Nerang	93	B/C	I	93	B/C	I
		Sg. Temin	2KD10	1KKDH010	Changloon	68	T/P	III	78	B/C	II

Jadual 2.8 : Status Kualiti Air di Hulu Muka Sauk Berdasarkan Sub-Indeks SS, 2020
Table 2.8 : Water Quality Status of Upstream Water Intakes Based on SS Sub-Index, 2020

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	STESEN ID LAMA / OLD ID STATION	STATION ID BARU / NEW ID STATION	MUKA SAUK / WATER INTAKE	2019			2020		
						SUB-INDEKS SS / SS SUB-INDEX	KATEGORI / CATEGORY	KELAS / CLASS	SUB-INDEKS SS / SS SUB-INDEX	KATEGORI / CATEGORY	KELAS / CLASS
Kedah	Sg. Muda	Sg. Muda	2MD16	1KMUD014	Jeneri	72	ST/SP	II	77	B/C	II
			2MD17	1KMUD015	Jeniang	68	T/P	III	76	B/C	II
			2MD18	1KMUD016	Bukit Selambau	63	T/P	III	56	T/P	III
			2MD20	1KMUD018	Pinang Tunggal	78	B/C	II	75	ST/SP	II
			2MD21	1KMUD019	Nami	75	ST/SP	II	78	B/C	II
		Sg. Sedim	2MD19	1KMUD017	Bikan	60	T/P	III	76	B/C	II
P. Pinang	Sg. Pinang	Sg. Satu	2PG12	1PPNG020	Batu Feringgi	94	B/C	I	97	B/C	I
Perak	Sg. Bernam	Sg. Gelinting	1BM15	1ABNM015	Loji Rawatan Air Ulu Slim	77	B/C	II	80	B/C	II
		Sg. Trolak	1BM14	1ABNM014	Loji Rawatan Air Trolak Timur	89	B/C	I	89	B/C	I
	Sg. Kurau	Sg. Air Hitam	2KU07	1AKRU007	Loji Rawatan Air Jelai	90	B/C	I	95	B/C	I
	Sg. Perak	Sg. Manong	2PK62	1APRK060	Loji Rawatan Air Manong	95	B/C	I	95	B/C	I
		Sg. Perak	2PK61	1APRK059	Loji Rawatan Air Sauk	93	B/C	I	96	B/C	I
		Sg. Tesong	2PK64	1APRK062	Loji Rawatan Air Sg. Klah	94	B/C	I	96	B/C	I
		Sg. I	2PK63	1APRK061	Loji Rawatan Air Kuala I	95	B/C	I	96	B/C	I
	Sg. Sepetang	Sg. Batu Tegoh	2SP18	1ASPT016	Loji Rawatan Air Bukit Larut	95	B/C	I	96	B/C	I
Selangor	Sg. Klang	Sg. Gombak	1K53	2BKLG020	Loji Rawatan Air Gombak	93	B/C	I	92	B/C	I
	Sg. Langat	Sg. Batang Labu	1L26	2BLGT028	Loji Rawatan Air Salak Tinggi	64	T/P	III	65	T/P	III
		Sg. Semenyih	1L09	2BLGT010	Loji Rawatan Air Semenyih	53	T/P	IV	66	T/P	III
Johor	Sg. Batu Pahat	Sg. Semberong Dam	3BP27	3JBPT021	Semberong Dam	84	B/C	II	92	B/C	I
	Sg. Benut	Sg. Machap Dam	3BN10	3JBNT008	Machap Dam	90	B/C	I	92	B/C	I
	Sg. Endau	Sg. Kahang	3ED38	3JEND026	Jalan Felda Kahang Timur, Kluang	91	B/C	I	91	B/C	I
	Sg. Muar	Sg. Jelai	1MN23	3NMUA054	Loji Rawatan Air Dangi	80	B/C	II	72	ST/SP	II
		Sg. Jementah	3MR39	3JMUA040	Loji Rawatan Air Jementah	93	B/C	I	92	B/C	I
		Sg. Muar	3MR38	3JMUA039	Loji Rawatan Air Gombang	79	B/C	II	88	B/C	I
	Sg. Pulai	Sg. Pulai Dam	3PU04	3JPLI004	Pulai Dam	93	B/C	I	96	B/C	I
Melaka	Sg. Kesang	Sg. Chin-Chin	1KA08	3MKSG008	Muka sauk Loji Rawatan Air Chin-chin	57	T/P	III	59	T/P	III
Pahang	Sg. Pahang	Sg. Bertam	2CH15	4CBTM013	Loji Rawatan Air Habu	95	B/C	I	95	B/C	I
		Sg. Gapoi	4PH95	4CPHG086	Muka sauk Loji Rawatan Air Gapoi	93	B/C	I	91	B/C	I
		Sg. Jempol	4PH96	4CPHG087	Loji Air Sg Jerik	87	B/C	I	93	B/C	I
			4PH97	4CPHG088	Loji Air Jengka 3	80	B/C	II	82	B/C	II
		Sg. Mentiga	4PH98	4CPHG089	Loji Air Chini	84	B/C	II	67	T/P	III
		Sg. Terla	2CH14	4CBTM012	Loji Rawatan Air Kuala Terla	94	B/C	I	92	B/C	I
		Sg. Triang	4PH93	4CPHG074	Loji Rawatan Air Sg. Triang	57	T/P	III	55	T/P	III
		Sg. Ulong	2CH16	4CBTM014	Brinchang Dam	95	B/C	I	96	B/C	I
Terengganu	Sg. Terengganu	Sg. Terengganu	4TE14	4TTGG013	Loji Air Serada	87	B/C	I	93	B/C	I

Jadual 2.8 : Status Kualiti Air di Hulu Muka Sauk Berdasarkan Sub-Indeks SS, 2020
Table 2.8 : Water Quality Status of Upstream Water Intakes Based on SS Sub-Index, 2020

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	STESEN ID LAMA / OLD ID STATION	STATION ID BARU / NEW ID STATION	MUKA SAUK / WATER INTAKE	2019			2020		
						SUB-INDEKS SS / SS SUB-INDEX	KATEGORI / CATEGORY	KELAS / CLASS	SUB-INDEKS SS / SS SUB-INDEX	KATEGORI / CATEGORY	KELAS / CLASS
Kelantan	Sg. Golok	Sg. Golok	4GL10	4DGLK003	Syarikat Air Kelantan	96	B/C	I	93	B/C	I
	Sg. Kelantan	Sg. Chiku	4KE66	4DKLT043	Felda Ciku 2	90	B/C	I	86	B/C	I
		Sg. Kelantan	4KE68	4DKLT045	Loji Air Kelar, Pasir Mas	38	T/P	V	33	T/P	V
		Sg. Pehi	4KE67	4DKLT044	Loji Air Pahi	71	ST/SP	III	61	T/P	III
Sabah	Sg. Padas	Sg. Padas	72PD04	5SPDS011	Water Intake Jabatan Air Beaufort	52	T/P	IV	44	T/P	IV
	Sg. Papar	Sg. Papar	75PP04	5SPPR004	Sekolah Kebangsaan Mandalipau	91	B/C	I	92	B/C	I
			75PP05	5SPPR005	Water Intake Kogopon	91	B/C	I	94	B/C	I
Sarawak	Sg. Kerian	Sg. Selalang	55SG01	6QKRN017	Selalang Water Intake	94	B/C	I	95	B/C	I
	Sg. Mukah	Sg. Mukah	58MH05	6QMKH005	Mukah Water Intake	78	B/C	II	82	B/C	II
	Sg. Rajang	Sg. Daro	56DR01	6QRJG021	Daro Water Intake	92	B/C	I	93	B/C	I
		Sg. Jemoreng	56JG01	6QRJG022	Jemoreng Water Intake	91	B/C	I	89	B/C	I
		Sg. Pakan	56PN01	6QRJG020	Pakan Water Intake	85	B/C	I	86	B/C	I
		Sg. Pila Parit	56PL01	6QRJG023	Igan Water Intake	91	B/C	I	87	B/C	I



Rajah 2.5 : Kualiti Air Sungai di Stesen Hulu Muka Sauk, 2020
Figure 2.5 : River Water Quality at Upstream Water Intake Stations, 2020

STATUS PENGAWASAN KUALITI AIR SUNGAI AUTOMATIK

Rajah 2.6 menunjukkan lokasi 29 stesen pengawasan sungai automatik serta takat pengambilan air yang disenaraikan seperti dalam **Jadual 2.9.**

Pada tahun 2020, 29 stesen pengawasan sungai automatik telah diukur menggunakan peratusan pematuhan kepada kelas II. Parameter yang diukur adalah pH, oksigen terlarut, keperluan oksigen biokimia dan kimia, ammoniakal nitrogen dan jumlah pepejal terampai, Pematuhan ini ditunjukkan seperti pada **Rajah 2.7**.

Oksigen terlarut (DO) adalah salah satu penunjuk kepada kehadiran BOD yang disebabkan oleh bahan pencemar organik. Julat pematuhan DO yang rendah didapati bagi stesen CR01K, CR04P, CR08B, CR12W, CR13N, CR19J dan CR21J.

Ammonium adalah satu bentuk ammonia yang telah terion. Pengukuran ammonium memberi petunjuk kepada potensi kehadiran pencemar ammonia atau ammonia nitrogen dalam air sungai apabila pH dan suhu air berubah. Julat pematuhan yang rendah bagi ammonia nitrogen yang rendah didapati di stesen CR04P, CR08B, CR09B, CR10B, CR11B, CR12W, CR13N, CR16M dan CR21J.

pH adalah ukuran bagi keasidan dan kealkalian mengikut skala pH. Julat pematuhan yang rendah bagi pH diperhatikan di CR24T.

Kekeruhan digunakan sebagai penunjuk kehadiran pepejal terampai di dalam sungai. Bagi julat pematuhan TSS yang direkodkan adalah rendah adalah stesen CR01K, CR03K, CR04P, CR06A, CR08B, CR09B, CR10B, CR11B, CR13N, CR14N, CR15N, CR16M, CR17M, CR19J, CR20J, CR21J, CR22C dan CR26D.

STATUS OF CONTINUOUS / AUTOMATIC RIVER WATER QUALITY MONITORING (CRWQM)

Figure 2.6 shows the location of the 29 continuous river monitoring stations and subsequent water intakes as listed in **Table 2.9**.

In 2020, 29 continuous river monitoring stations were measured using percentage of compliance to Class II. The measured parameter is pH, dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, ammoniacal nitrogen and total suspended solids. This compliance is shown in **Figure 2.7**.

Dissolved oxygen (DO) is one of the indicators of BOD presence caused by organic pollutants. Low range compliance of DO were observed at stations CR01K, CR04P, CR08B, CR12W, CR13N, CR19J and CR21J.

Ammonium is an ionized form of ammonia. The measurement of ammonium indicates the potential presence of ammonia or ammoniacal nitrogen pollutants in rivers with the occurrence of pH level and temperature changes in these waters. Low range compliance of ammoniacal nitrogen were observed at stations CR04P, CR08B, CR09B, CR10B, CR11B, CR12W, CR13N, CR16M and CR21J.

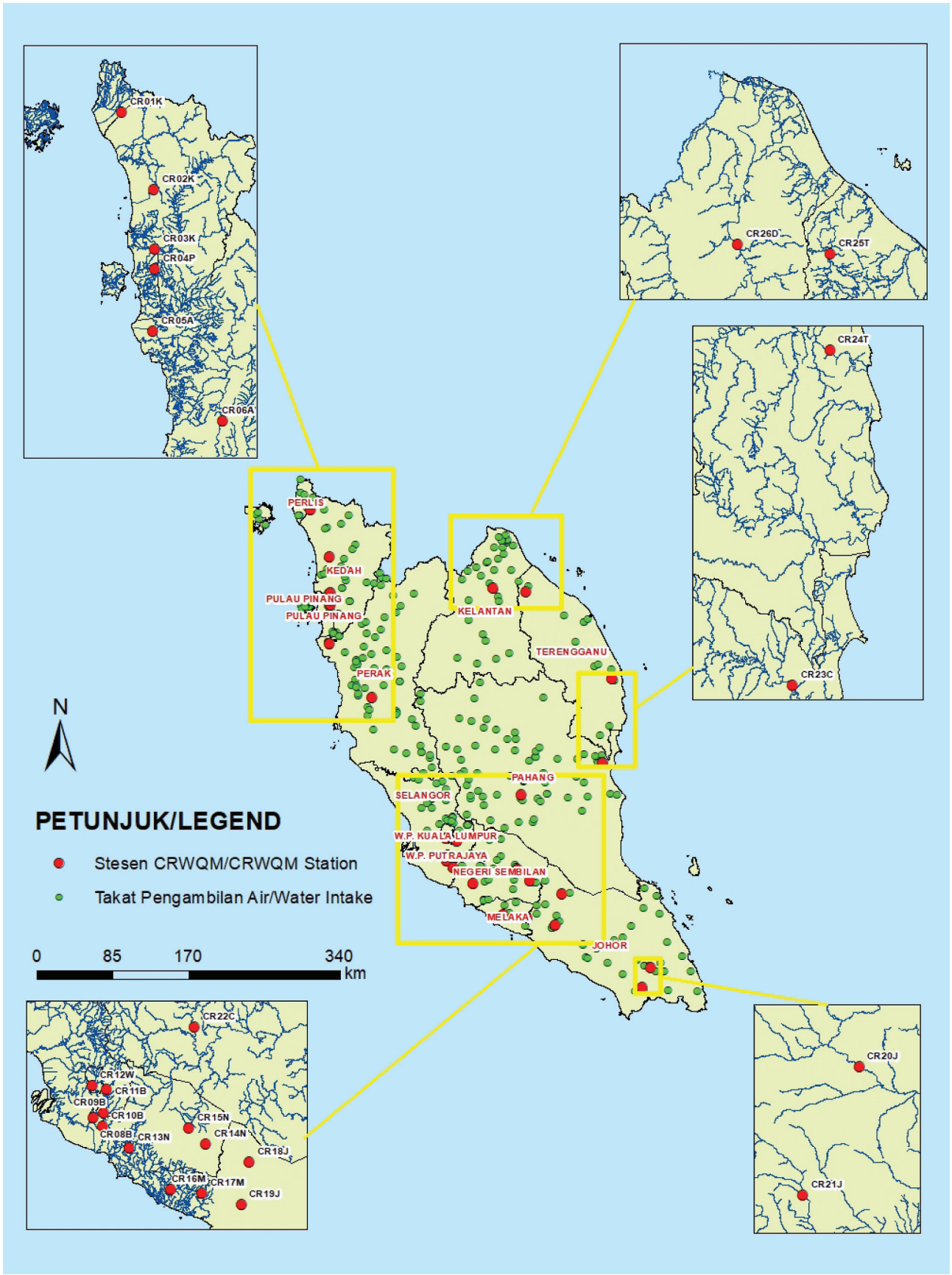
pH is a measurement of acidity and alkalinity based on the pH scale. Relatively low compliance of pH ranges were observed at CR24T.

Turbidity is used as an indicator of the presence of suspended solids in a river. Low range compliance of TSS were recorded at stations CR01K, CR03K, CR04P, CR06A, CR08B, CR09B, CR10B, CR11B, CR13N, CR14N, CR15N, CR16M, CR17M, CR19J, CR20J, CR21J, CR22C and CR26D.

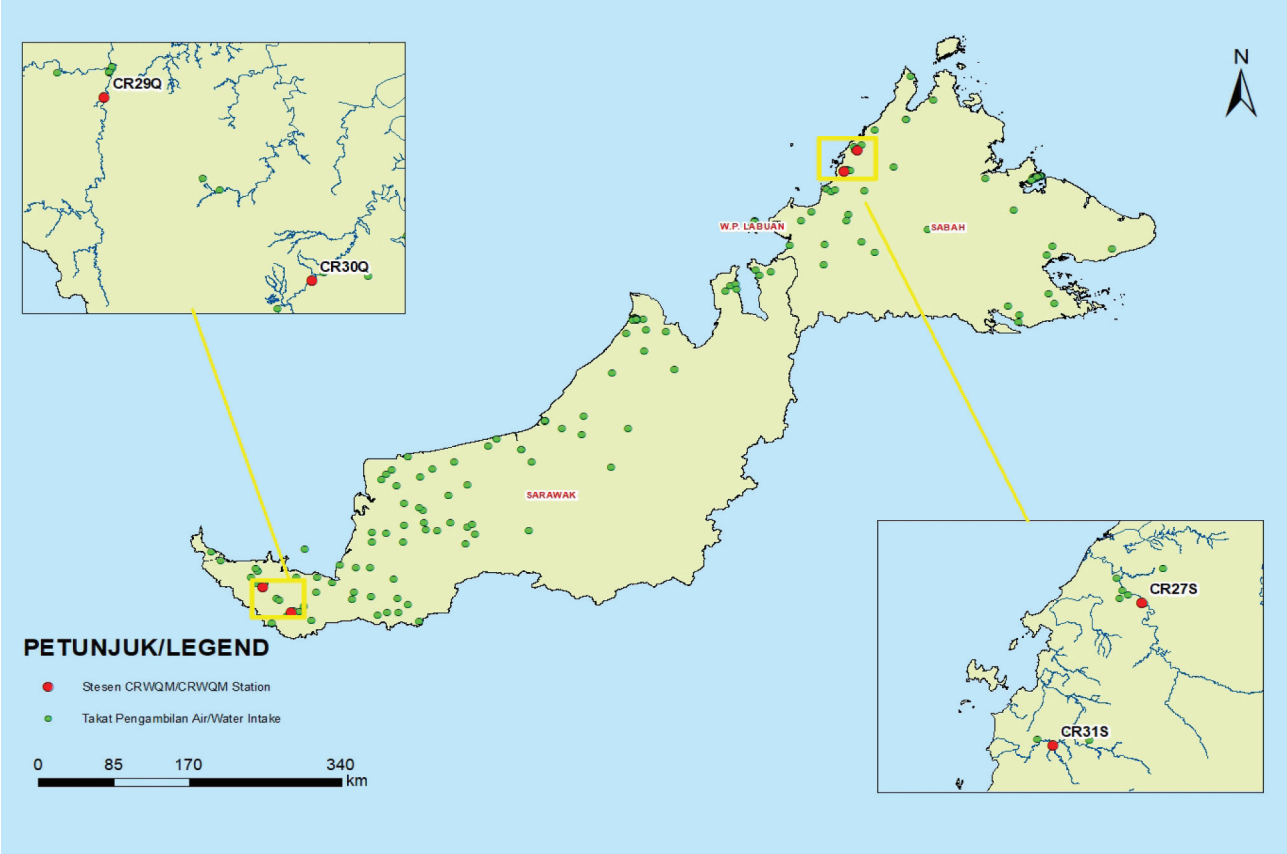
Jadual 2.9 : CRWQMS Lokasi: ID Stesen, Sungai bagi Stesen dan Takat Pengambilan Air
Table 2.9 : CRWQMS Location: Station ID, River of the Station and Water Intake

NEGERI / STATE	STESEN ID / ID STATION	SUNGAI / RIVER	TAKAT PENGAMBILAN AIR / WATER INTAKE
Kedah	CR01K CR02K CR03K	Terusan MADA Terusan MADA Sungai Muda	Arau Fasa IV Bukit Jenun Kulim Hi-Tech
P. Pinang	CR04P	Sungai Kulim	Toh Along
Perak	CR05A CR 06A	Sungai Bogak Sungai Perak	Parit Buntar Sultan Idris
Selangor	CR08B CR09B CR10B CR11B	Sungai Langat Sungai Semenyih Sungai Labu Sungai Langat	Bukit Tampoi Jenderam Labu Lanjut Cheras Batu 11
Wilayah Kuala Lumpur	CR12W	Sungai Klang	NA
N. Sembilan	CR13N CR15N	Sungai Linggi Sungai Muar Sungai Muar	Linggi Pasir Besar Jelai Jempol
Melaka	CR16M CR17M	Sungai Melaka Sungai Kesang	Durian Tunggal Chin Chin
Johor	CR18J CR19J CR20J CR21J	Sungai Segamat Sungai Muar Sungai Johor Sungai Sekudai	Segamat Panchor Semanggar Skudai
Pahang	CR22C CR23C	Sungai Pahang Sungai Kuantan	Lubuk Kawah Semambu
Terengganu	CR24T CR25T	Sungai Paka Sungai Besut	Bulit Bauk Nukit Bunga
Kelantan	CR26D	Sungai Kelantan	Sokor
Sabah	CR27S CR28S* CR31S*	Sungai Tuaran Sungai Padas Sungai Moyog	Telibong Beufort Kasigui
Sarawak	CR29Q CR30Q	Sungai Sarawak Sungai Batang Sadong	Sarawak Kiri Tebekang

*CR28S telah dipindahkan ke CR31S
*CR28S was relocated to CR31S



Rajah 2.6 : Stesen Pengawasan Kualiti Air Sungai Automatik dan Takat Pengambilan Air
Figure 2.6 : Continuous River Water Quality Stations and Water Intakes



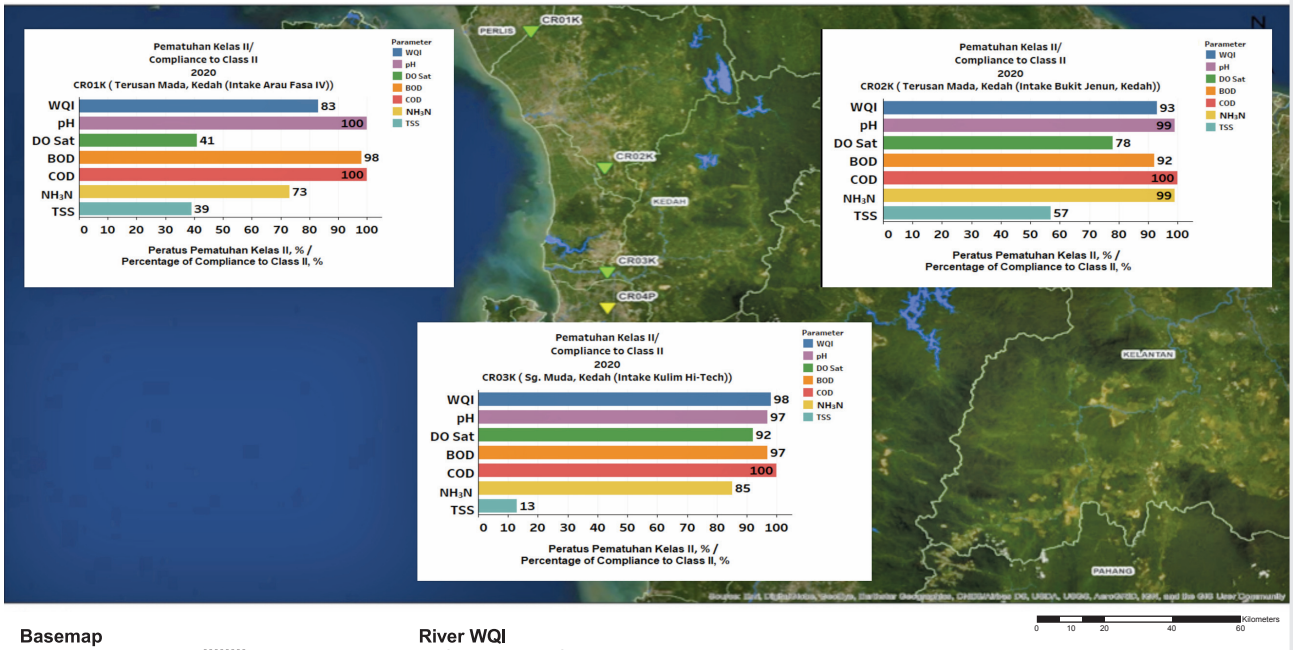
Rajah 2.6 : Stesen Pengawasan Kualiti Air Sungai Automatik Dan Takat Pengambilan Air
Figure 2.6 : Continuous River Water Quality Stations and Water Intakes

Temerloh, Pahang

Sungai Benus, Janda Baik / Benus River, Janda Baik

Rajah 2.7 : Peratus Pematuhan Kelas II (Utara)
Figure 2.7 : Percentage of Compliance to Class II (Northern)

CRWQM - WILAYAH UTARA / NORTHERN REGION

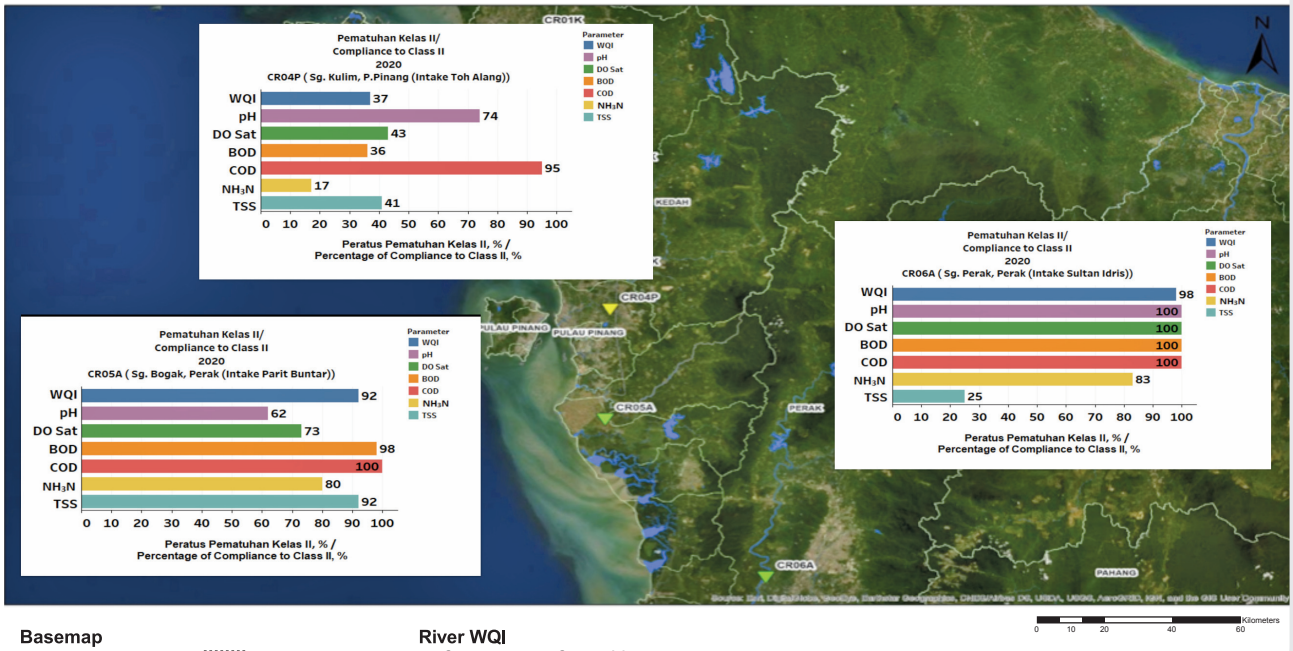


Basemap
Water Body
State Boundary
Basin

River WQI
Class I
Class II
Class III
Class IV
Class V
WQI Not Avilable

Rajah 2.8 : Peratus Pematuhan Kelas II (Utara)
Figure 2.8 : Percentage of Compliance to Class II (Northern)

CRWQM - WILAYAH UTARA / NORTHERN REGION

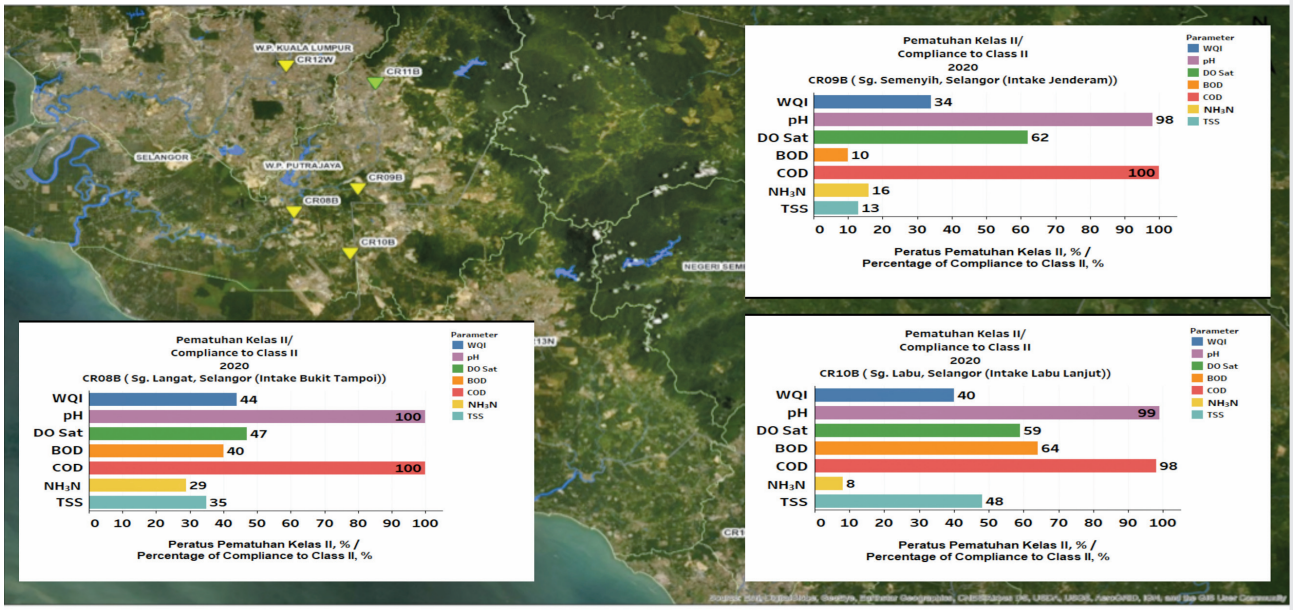


Basemap
Water Body
State Boundary
Basin

River WQI
Class I
Class II
Class III
Class IV
Class V
WQI Not Avilable

Rajah 2.9 : Peratus Pematuhan Kelas II (Tengah)
Figure 2.9 : Percentage of Compliance to Class II (Central)

CRWQM - WILAYAH TENGAH / CENTRAL REGION

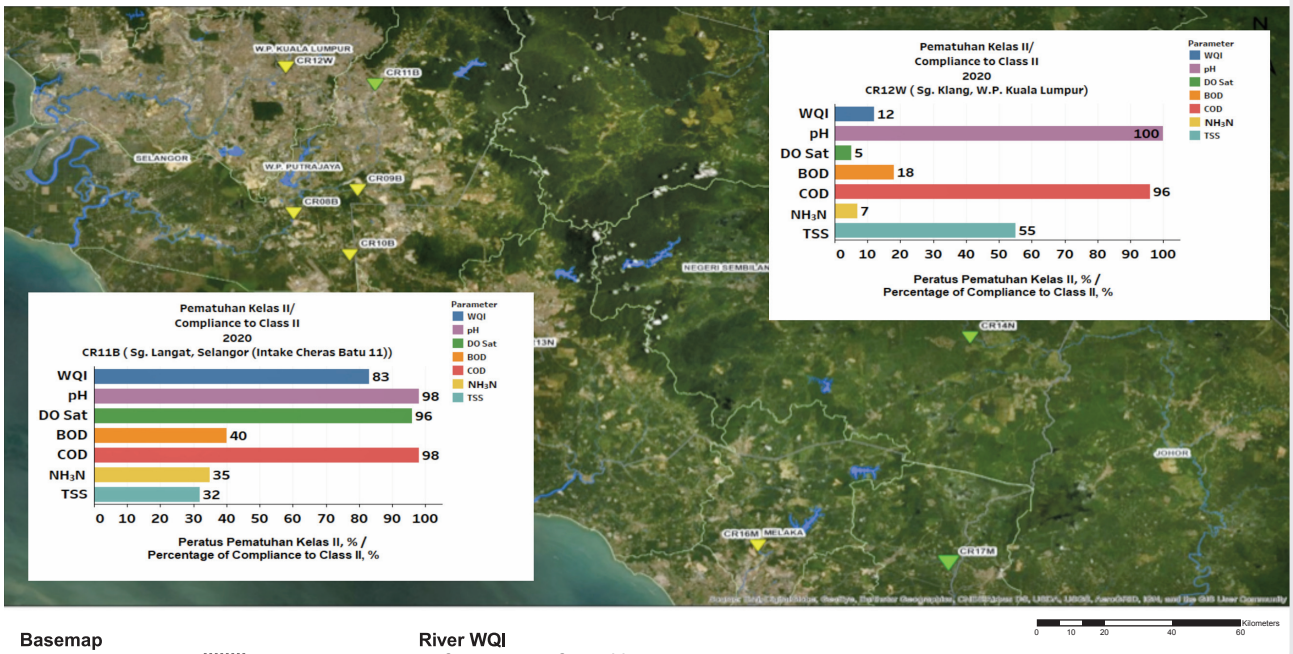


Basemap
Water Body
State Boundary
Basin

River WQI
Class I
Class II
Class III
Class IV
Class V
WQI Not Avilable

Rajah 2.10 : Peratus Pematuhan Kelas II (Tengah)
Figure 2.10 : Percentage of Compliance to Class II (Central)

CRWQM - WILAYAH TENGAH / CENTRAL REGION

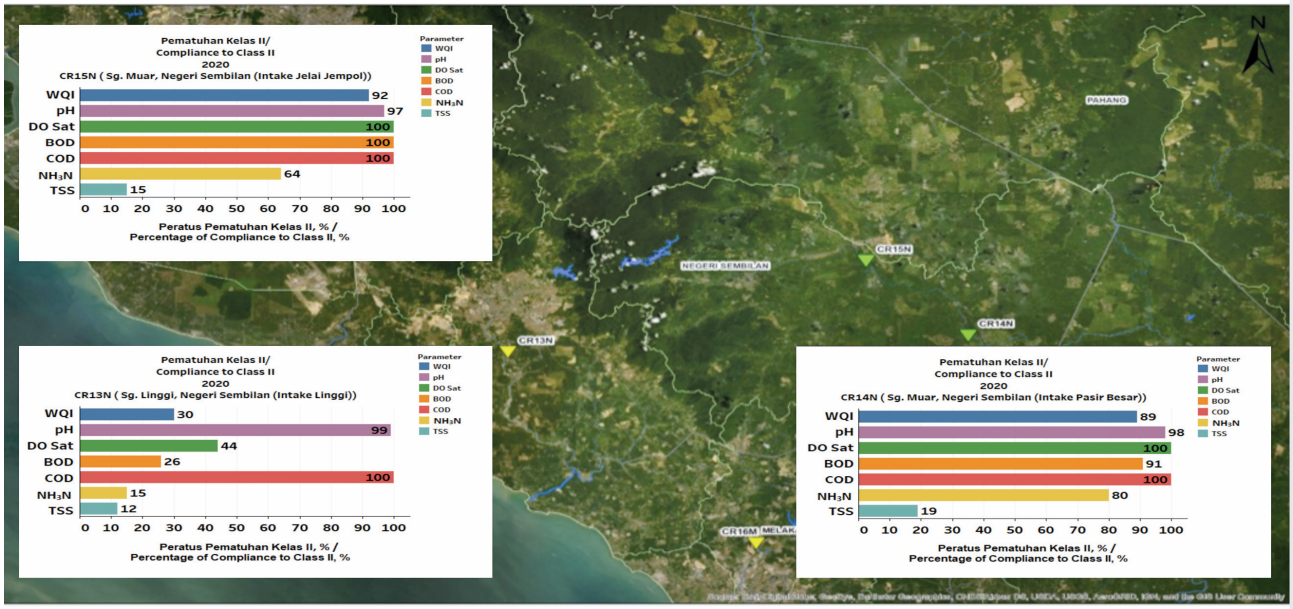


Basemap
Water Body
State Boundary
Basin

River WQI
Class I
Class II
Class III
Class IV
Class V
WQI Not Avilable

Rajah 2.11 : Peratus Pematuhan Kelas II (Tengah)
Figure 2.11 : Percentage of Compliance to Class II (Central)

CRWQM - WILAYAH TENGAH / CENTRAL REGION

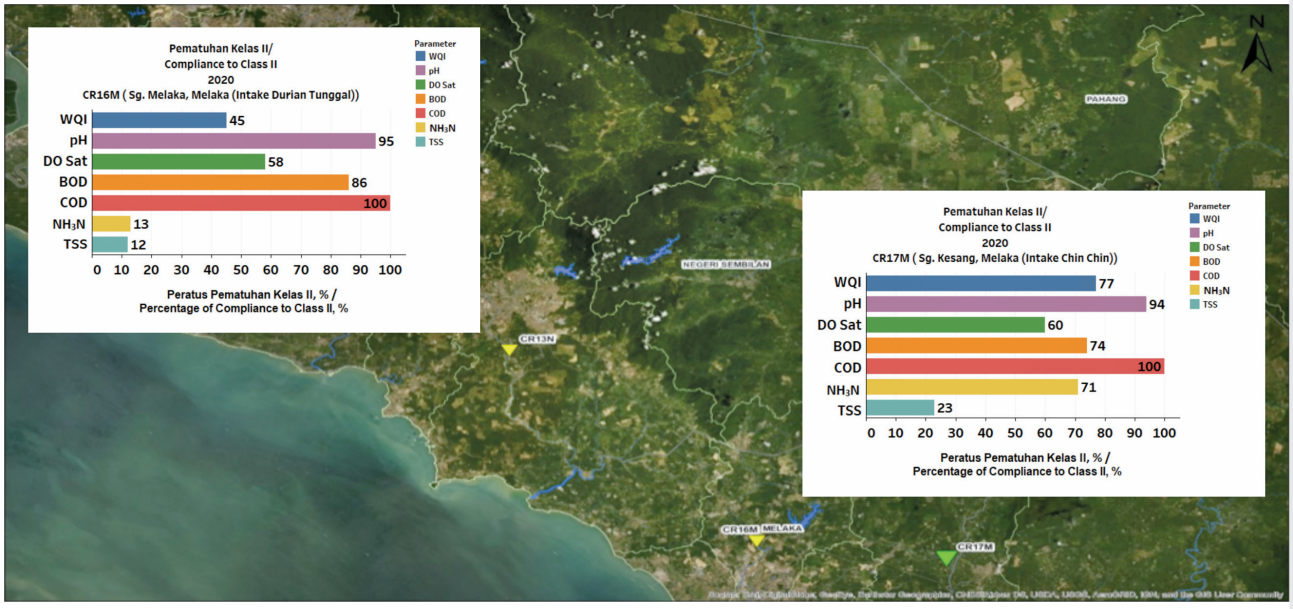


Basemap
Water Body
State Boundary
Basin

River WQI
Class I
Class II
Class III
Class IV
Class V
WQI Not Avilable

Rajah 2.12 : Peratus Pematuhan Kelas II (Tengah)
Figure 2.12 : Percentage of Compliance to Class II (Central)

CRWQM - WILAYAH TENGAH / CENTRAL REGION

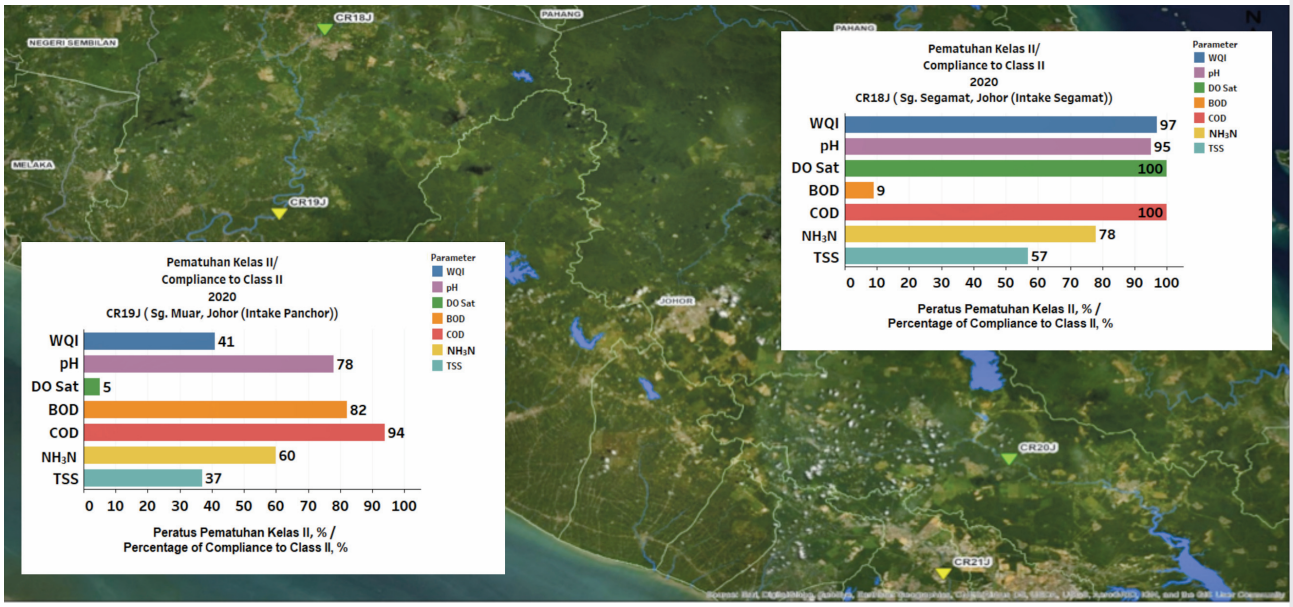


Basemap
Water Body
State Boundary
Basin

River WQI
Class I
Class II
Class III
Class IV
Class V
WQI Not Avilable

Rajah 2.13 : Peratus Pematuhan Kelas II (Selatan)
Figure 2.13 : Percentage of Compliance to Class II (Southern)

CRWQM - WILAYAH SELATAN / SOUTHERN REGION

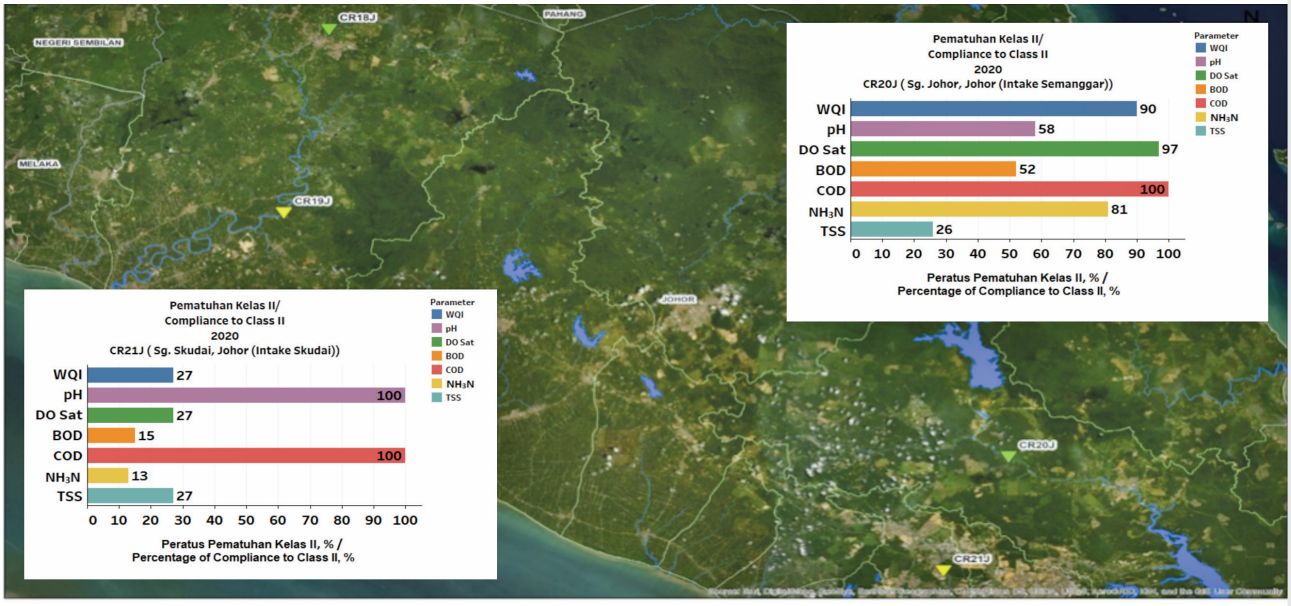


Basemap
Water Body
State Boundary
Basin

River WQI
Class I
Class II
Class III
Class IV
Class V
WQI Not Avilable

Rajah 2.14 : Peratus Pematuhan Kelas II (Selatan)
Figure 2.14 : Percentage of Compliance to Class II (Southern)

CRWQM - WILAYAH SELATAN / SOUTHERN REGION

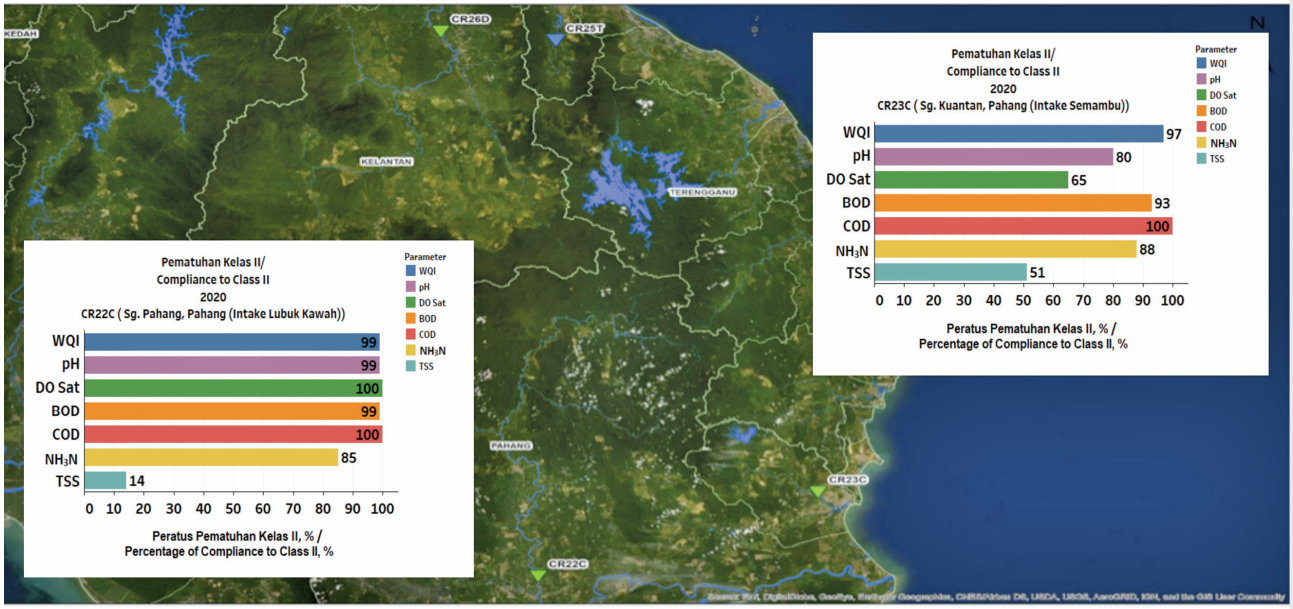


Basemap
Water Body
State Boundary
Basin

River WQI
Class I
Class II
Class III
Class IV
Class V
WQI Not Avilable

Rajah 2.15 : Peratus Pematuhan Kelas II (Timur)
Figure 2.15 : Percentage of Compliance to Class II (Eastern)

CRWQM - WILAYAH TIMUR / EASTERN REGION

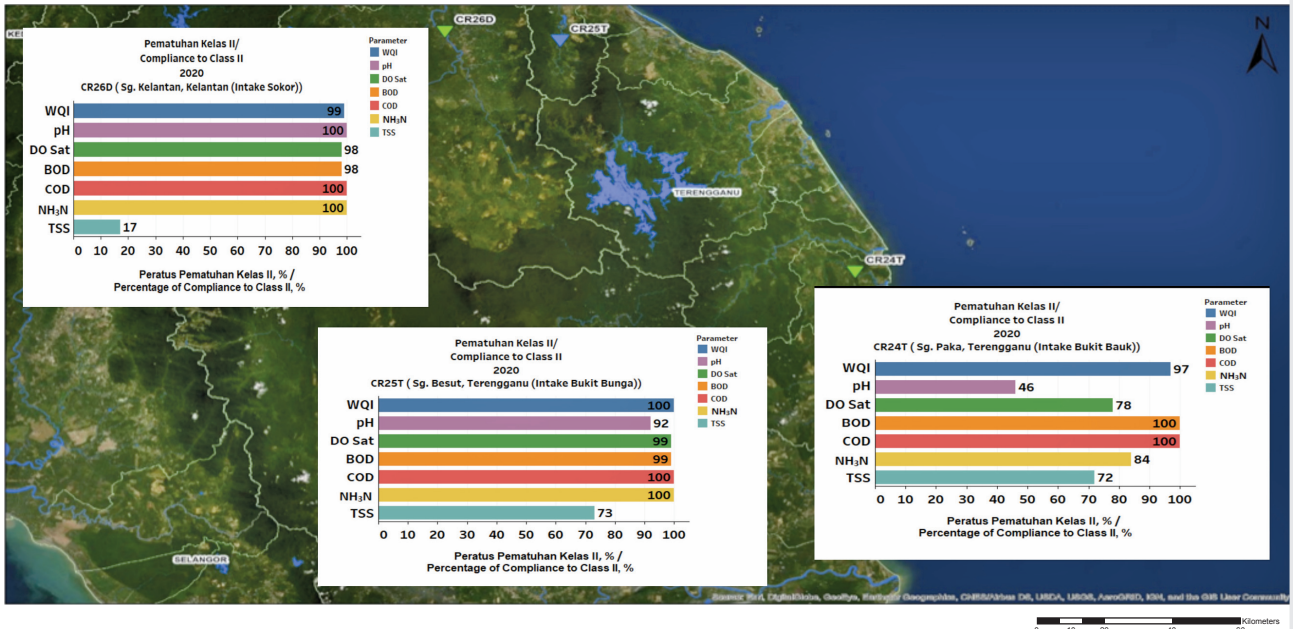


Basemap
Water Body
State Boundary
Basin

River WQI
Class I
Class II
Class III
Class IV
Class V
WQI Not Avilable

Rajah 2.16 : Peratus Pematuhan Kelas II (Timur)
Figure 2.16 : Percentage of Compliance to Class II (Eastern)

CRWQM - WILAYAH TIMUR / EASTERN REGION

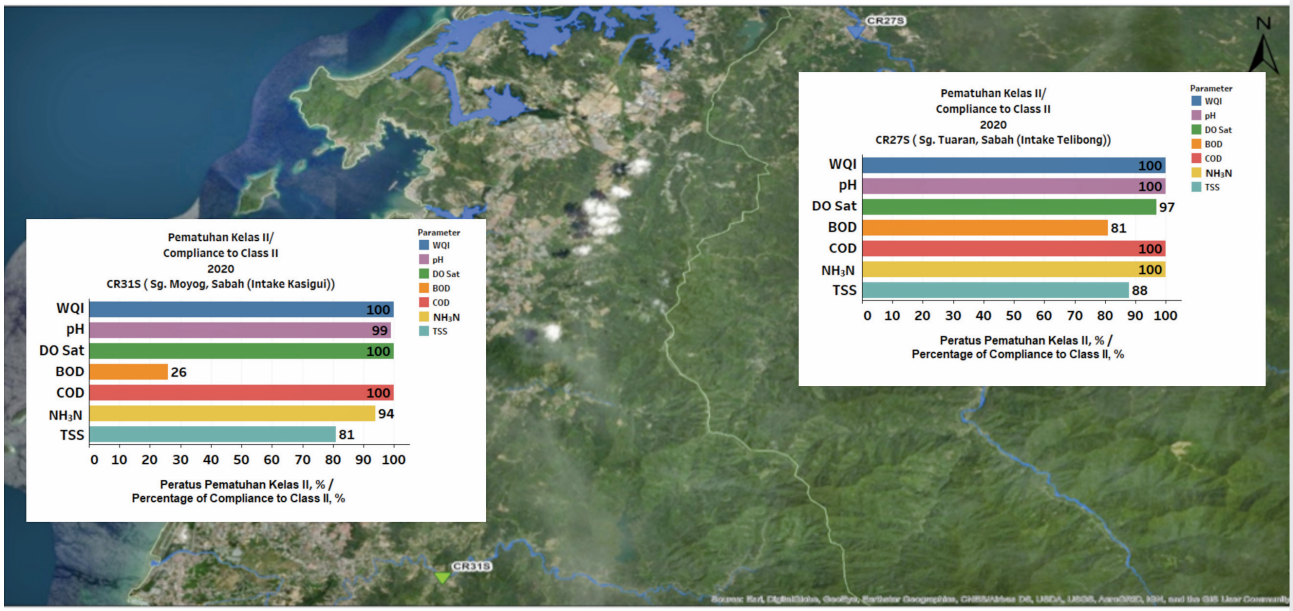


Basemap
Water Body
State Boundary
Basin

River WQI
Class I
Class II
Class III
Class IV
Class V
WQI Not Avilable

Rajah 2.17 : Peratus Pematuhan Kelas II (Sabah)
Figure 2.17: Percentage of Compliance to Class II (Sabah)

CRWQM - WILAYAH SABAH / SABAH REGION

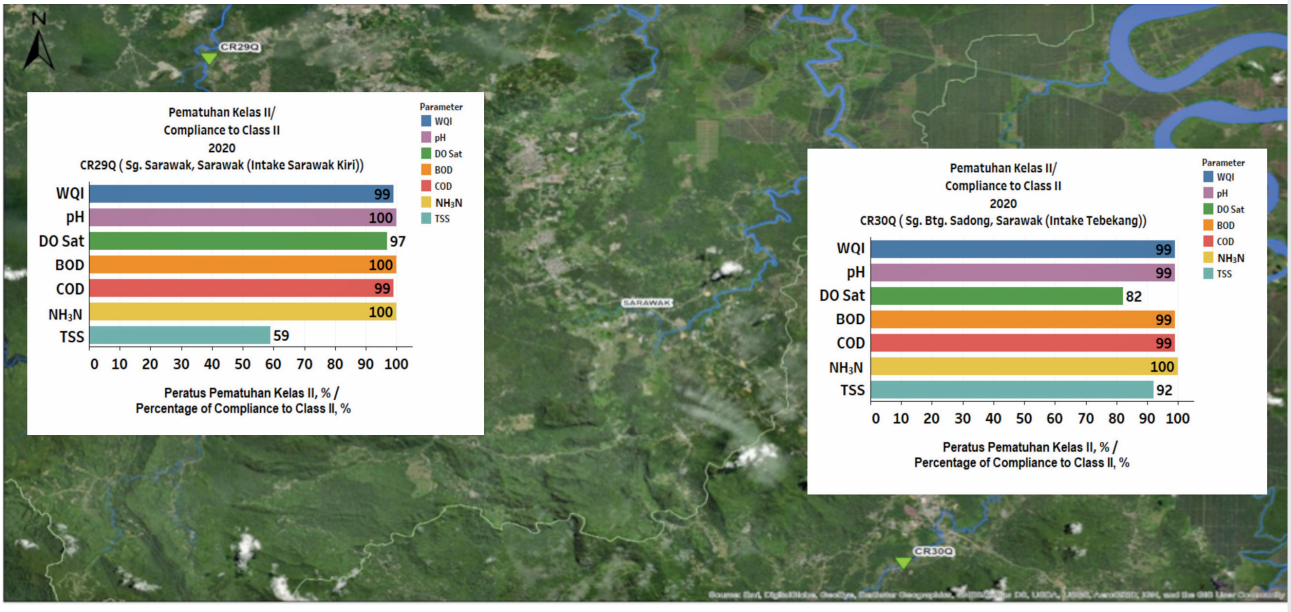


Basemap
Water Body
State Boundary
Basin

River WQI
Class I
Class II
Class III
Class IV
Class V
WQI Not Avilable

Rajah 2.18 : Peratus Pematuhan Kelas II (Sarawak)
Figure 2.18 : Percentage of Compliance to Class II (Sarawak)

CRWQM - WILAYAH SARAWAK / SARAWAK REGION



Basemap
Water Body
State Boundary
Basin

River WQI
Class I
Class II
Class III
Class IV
Class V
WQI Not Avilable

BAB 3
CHAPTER 3

KUALITI AIR TANAH
GROUNDWATER QUALITY

KUALITI AIR TANAH / GROUNDWATER QUALITY

PENGAWASAN KUALITI AIR TANAH

Program Pengawasan Kualiti Air Tanah Kebangsaan telah dimulakan semenjak tahun 1997. Tapak stesen pengawasan yang telah dipilih adalah mewakili jenis guna tanah spesifik. Program pengawasan telah dijalankan terhadap 120 buah stesen pengawasan kualiti air tanah (telaga) di seluruh negara. Walau bagaimanapun hanya 114 stesen telah dijalankan persampelan air tanah. Ini memandangkan terdapat stesen pengawasan kualiti air tanah yang tiada luahan air akibat faktor pembangunan dan rekahan batuan di dalam stesen tersebut **Jadual 3.1** menunjukkan taburan stesen pengawasan kualiti air tanah (telaga) seluruh Malaysia mengikut jenis kategori guna tanah.

Pada tahun 2020, sebanyak 363 sampel telah dianalisa untuk bahan kimia organik meruap (VOCs), racun perosak, logam berat, anion, bakteria (kolifom), sebatian berfenol, jumlah keliatan, jumlah pepejal terlarut, pH, suhu, konduktiviti dan oksigen terlarut (DO).

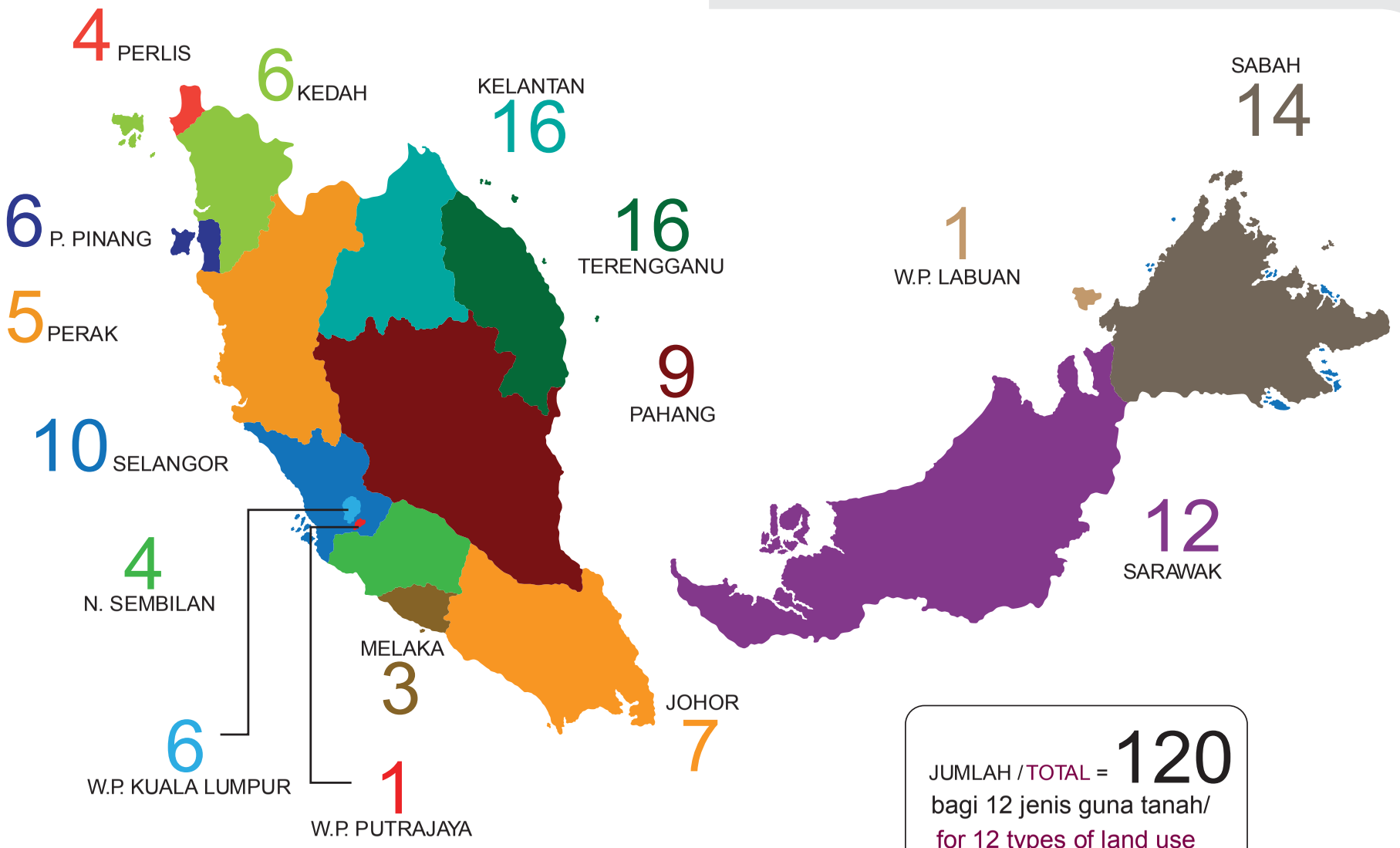
Indeks Kualiti Air Tanah (IKAT) digunakan sebagai satu kaedah menentukan kategori dan status kualiti air tanah. IKAT dibangunkan berdasarkan tujuh (7) parameter utama iaitu pH, besi, jumlah pepejal terlarut, nitrat, E-Coli, fenol dan sulfat. IKAT yang berskala 0 hingga 100 akan menentukan kategori kualiti air tanah dari sangat baik hingga sangat tercemar (**Jadual 3.2**).

GROUNDWATER QUALITY MONITORING

The National Groundwater Water Quality Monitoring Programme was established in 1997. The sites were selected based on specific land use. The groundwater monitoring was carried out on 120 groundwater quality monitoring stations (wells) throughout the country. However, monitoring for only 114 stations were conducted for groundwater sampling. This is because there was no discharge of groundwater due to development factors and rock fractures in the groundwater quality monitoring stations. **Table 3.1** shows the distribution of groundwater quality monitoring stations (wells) in all the states by land use category.

In 2020, 363 samples were analysed for volatile organic compounds (VOCs), pesticides, heavy metals, anions, bacteria (coliform), phenolic compounds, total hardness, total dissolved solids (TDS), pH, temperature, conductivity and dissolved oxygen (DO).

The Malaysia Groundwater Quality Index (GWQI) is used to determine the groundwater quality status and its category. GWQI was developed based on seven (7) parameters which are pH, iron, total dissolved solids, nitrate, E-Coli, phenol and sulphate. GWQI with a scale quality ranging from 0 to 100 will identify the quality of the groundwater from excellent to very poor (**Table 3.2**).



Jumlah Telaga Pengawasan bagi Setiap Negeri Seluruh Malaysia, 2020
Total Number of Monitoring Wells for Each State in Malaysia, 2020

Jadual 3.1 : Taburan Stesen Pengawasan Kualiti Air Tanah di Seluruh Negeri di Malaysia mengikut Jenis Kategori Guna Tanah, 2020

Table 3.1 : Distribution of Groundwater Quality Monitoring Stations Throughout the States in Malaysia by Land Use Category, 2020

KATEGORI / CATEGORY	BILANGAN TELAGA / NUMBER OF WELLS	NEGERI / STATE	BILANGAN TELAGA / NUMBER OF WELLS
Kawasan Pertanian / Agriculture	14	Sabah	2
		Terengganu	5
		Pahang	1
		Kedah	2
		Perlis	1
		Kelantan	2
		Selangor	1
Bandar & Pinggir Bandar / Urban & Suburban Area	14	Sabah	1
		Terengganu	2
		Pahang	2
		Kedah	1
		Perlis	2
		Kelantan	2
		Selangor	3
		W.P. Putrajaya	1
Tapak Perindustrian / Industrial Sites	22	W.P. Labuan	1
		Terengganu	5
		Johor	2
		Kedah	1
		Kelantan	2
		Melaka	1
		Selangor	3
		Pulau Pinang	3
		N. Sembilan	1
		Perak	1
		Pahang	1
		Perlis	1
Bekas Tapak Pelupusan Sampah / Used Solid Waste Landfills	26	Sabah	7
		Sarawak	2
		Terengganu	2
		Johor	2
		Kelantan	3
		Perak	1
		Kuala Lumpur	5
		N. Sembilan	3
		Melaka	1
Padang Golf / Golf Course	7	Sabah	2
		Kelantan	4
		Kuala Lumpur	1
Luar Bandar / Rural	5	Terengganu	1
		Kelantan	3
		Melaka	1

Jadual 3.1 : Taburan Stesen Pengawasan Kualiti Air Tanah di Seluruh Negeri di Malaysia mengikut jenis Kategori Guna Tanah, 2020
Table 3.1: Distribution of Groundwater Quality Monitoring Stations (Wells) Throughout the States in Malaysia by Land Use Category, 2020

KATEGORI / CATEGORY	BILANGAN TELAGA / NUMBER OF WELLS	NEGERI / STATE	BILANGAN TELAGA / NUMBER OF WELLS
Bekas Lombong Emas / Used Mining (Gold Mines)	3	Sarawak	3
Bekalan Air / Water Supply	5	Sabah	1
		Sarawak	4
Bekas Tapak Pelupusan Bangkai Haiwan / Used Animal Burial Sites	14	Sarawak	2
		Johor	3
		Perak	3
		Selangor	3
		Pulau Pinang	3
Akuakultur / Aquaculture	7	Pahang	6
		Terengganu	1
Tapak Pelupusan Radioaktif / Radioactive Landfills	1	Perak	1
Peranginan / Resorts	2	Sabah	1
		Kedah	1

Jadual 3.2 : Klasifikasi Indek Kualiti Air Tanah
Table 3.2 : Groundwater Quality Index Classification

STATUS KUALITI AIR TANAH BAGI KAWASAN PERTANIAN

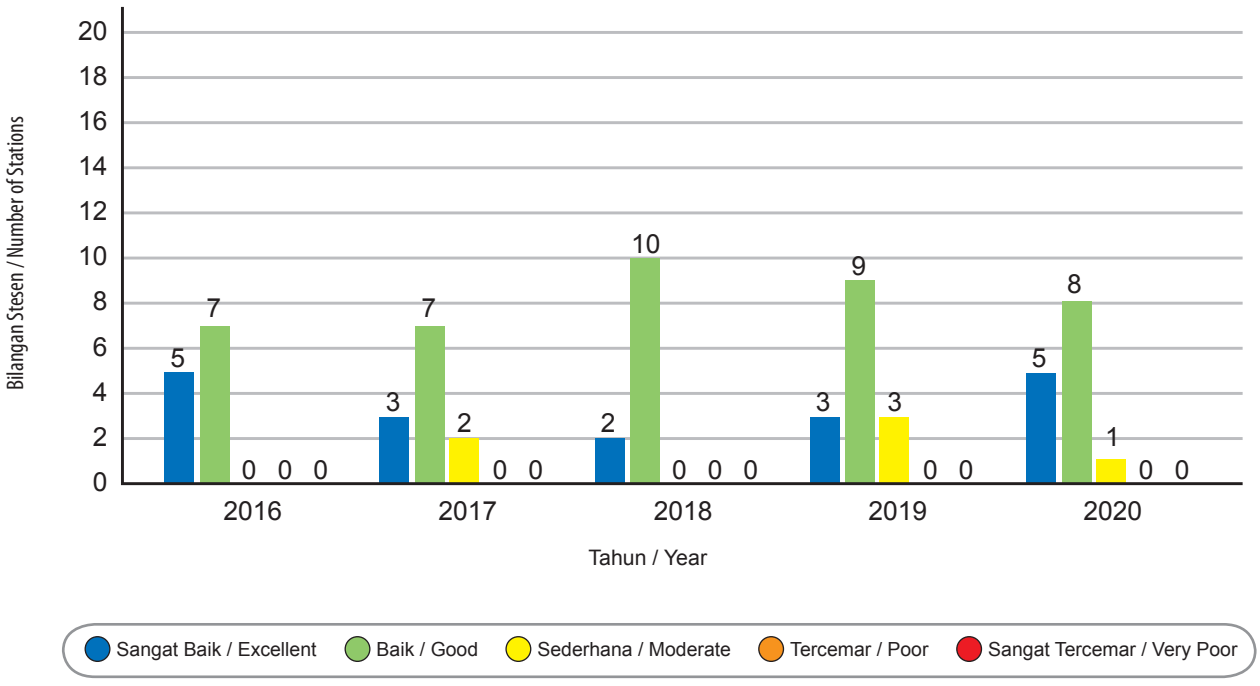
Tren IKAT mulai tahun 2016 hingga 2020 bagi kawasan pertanian adalah seperti yang ditunjukkan dalam **Rajah 3.1**. Berdasarkan **Rajah 3.1**, didapati bilangan stesen sangat baik telah meningkat berbanding tahun sebelumnya. Bilangan stesen baik pula telah menurun, bilangan stesen dalam kategori sederhana telah menurun dibandingkan tahun sebelumnya dan tiada stesen tercemar dan sangat tercemar pada tahun 2020.

Pada tahun 2020, sebanyak 14 stesen kawasan pertanian telah dipantau berbanding 15 pada tahun 2019. Hasil program pengawasan yang telah dijalankan menunjukan lima (5) stesen (36.0%) sangat baik, lapan (8) stesen (57.0%) baik dan tiga (3) stesen (7.0%) sederhana (**Jadual 3.3**).

STATUS OF GROUNDWATER QUALITY INDEX FOR AGRICULTURE

The GWQI trend for agriculture from 2016 to 2020 is shown in **Figure 3.1**. Based on **Figure 3.1**, the number of excellent stations has increased compared to the previous year. The number of good categories has decreased, and the number of moderate stations has decreased. There are no stations under poor and very poor category for the year 2020.

In 2020, a total of 14 stations under agriculture were monitored compared to the previous year of 15 monitoring wells. The monitoring result indicates that five (5) stations were excellent (36.0%), eight (8) stations were good (57.0%) and three (3) stations were moderate (7.0%) (**Table 3.3**).



Rajah 3.1 : Tren Indeks Kualiti Air Tanah Kawasan Pertanian
Figure 3.1 : Trends of Groundwater Quality Index for Agriculture

Jadual 3.3 : Status Indeks Kualiti Air Tanah bagi Kawasan Pertanian
Table 3.3 : Status of Groundwater Quality Index for Agriculture

NEGERI / STATE	KLASSIFIKASI STESEN/ STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAT / GWQI VALUE					KATEGORI (2020) / CATEGORY (2020)
				2016	2017	2018	2019	2020	
Perlis	Urban & Suburban	Arau, Perlis	MW(7)-R4-1-5.41	80	80	77	76	75	Baik / Good
		Arau, Perlis	MW(7)-R4-1-19.80	96	95	93	87	93	Sangat Baik / Excellent
Kedah	Urban & Suburban	SK Darul Uloom Kepala Batas	MW(7)-K2-1-6.22	59	59	55	75	74	Baik / Good
Selangor	Urban & Suburban	Saujana Golf Resort, Subang	MW(7)-S13-1-5.45	93	82	69	79	78	Baik / Good
		Saujana Golf Resort, Subang	MW(7)-S13-1-12.67	96	88	78	97	97	Sangat Baik / Excellent
W. P. Putrajaya	Urban & Suburban	*Taman Wetland	MW(7)-W210103-1-10.0	–	–	–	72	80	Baik / Good
Pahang	Urban & Suburban	Nenasi	MW(7)-C13-1-45.97	88	85	90	88	93	Sangat Baik / Excellent
Kelantan	Urban & Suburban	Sek. Men. Keb. Rantau Panjang	MW(7)-D7-1-5.50	95	91	82	96	97	Sangat Baik / Excellent
		Sek. Men. Keb. Rantau Panjang	MW(7)-D7-1-20.23	90	92	81	86	82	Baik / Good
		*Sek. Men. Keb. Cherang Ruku, Pasir Puteh	MW(7)-D510202-1-7.96	–	–	–	67	88	Baik / Good
Terengganu	Urban & Suburban	Suburban Kg. Raja, Besut	MW(7)-T1-1-7.25	82	83	84	79	88	Baik / Good
		Kg. Raja, Besut	MW(7)-T1-1-31.79	82	67	85	64	73	Baik / Good
Sabah	Urban & Suburban	SK Inanam	MW(7)-H511601-9-7.50	74	78	80	93	91	Sangat Baik / Excellent

Nota / Note :
* Stesen Baru / New Station
– Tiada Data / No Data :
i. Tiada Air / No Water
ii. Stesen Rosak / Damaged Station

STATUS KUALITI AIR TANAH BAGI BANDAR DAN PINGGIR BANDAR

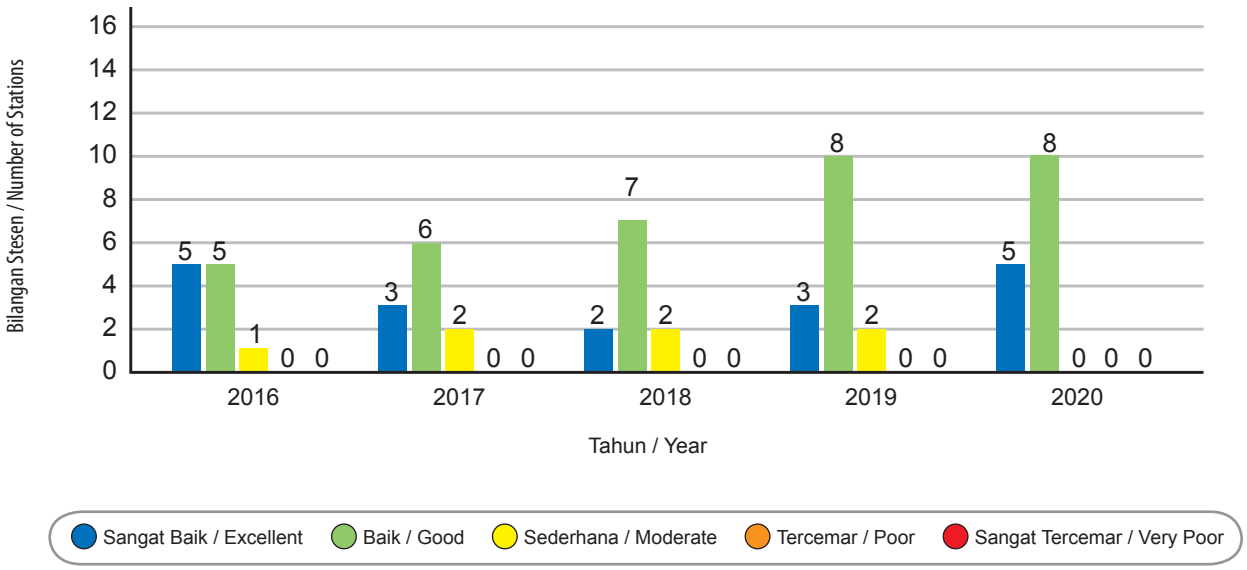
Tren IKAT mulai tahun 2016 hingga 2020 bagi bandar dan pinggir bandar adalah seperti yang ditunjukkan dalam **Rajah 3.2**. Berdasarkan **Rajah 3.2** didapati bilangan stesen sangat baik telah meningkat berbanding tahun sebelumnya. Tiada stesen tercemar dan sangat tercemar pada tahun 2020.

Pada tahun 2020, sebanyak 13 stesen bandar dan pinggir bandar telah dipantau sama seperti pada tahun 2019. Hasil program pengawasan yang telah dijalankan menunjukan lima (5) stesen (38.0%) sangat baik, dan lapan (8) stesen (62.0%) baik **(Jadual 3.4)**.

STATUS OF GROUNDWATER QUALITY INDEX FOR URBAN AND SUBURBAN

GWQI trend for urban and suburban from year 2016 to 2020 is shown in **Figure 3.2**. Based on **Figure 3.2**, the number of excellent stations has increased compared to the previous year. There are no stations under poor and very poor in 2020.

In 2020, a total of 13 stations under urban and suburban were monitored, the same as in the previous year. The monitoring results indicate that five (5) stations (38.0%) were excellent, and eight (8) stations (62.0%) were good (**Table 3.4**).



Rajah 3.2 : Tren Indeks Kualiti Air Tanah bagi Bandar dan Pinggir Bandar (2016-2020)
Figure 3.2 : Trends of Groundwater Quality Index for Urban and Suburban (2016-2020)

Jadual 3.4 : Status Indeks Kualiti Air Tanah bagi Bandar dan Pinggir Bandar
Table 3.4 : Status of Groundwater Quality Index for Urban and Suburban

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAT / GWQI VALUE					KATEGORI (2020) / CATEGORY (2020)
				2016	2017	2018	2019	2020	
Perlis	Urban & Suburban	Arau , Perlis	MW(7)-R4-1-5.41	80	80	77	76	75	Baik / Good
		Arau , Perlis	MW(7)-R4-1-19.80	96	95	93	87	93	Sangat Baik / Excellent
Kedah	Urban & Suburban	SK Darul Uloom Kepala Batas	MW(7)-K2-1-6.22	59	59	55	75	74	Baik / Good
Selangor	Urban & Suburban	Saujana Golf Resort, Subang	MW(7)-S13-1-5.45	93	82	69	79	78	Baik / Good
		Saujana Golf Resort, Subang	MW(7)-S13-1-12.67	96	88	78	97	97	Sangat Baik / Excellent
W.P. Putrajaya	Urban & Suburban	*Taman Wetland	MW(7)-W210103-1-10.0	–	–	–	72	80	Baik / Good
Pahang	Urban & Suburban	Nenasi	MW(7)-C13-1-45.97	88	85	90	88	93	Sangat Baik / Excellent
Kelantan	Urban & Suburban	Sek. Men. Keb. Rantau Panjang	MW(7)-D7-1-5.50	95	91	82	96	97	Sangat Baik / Excellent
		Sek. Men. Keb. Rantau Panjang	MW(7)-D7-1-20.23	90	92	81	86	82	Baik / Good
		*Sek. Men. Keb. Cherang Ruku, Pasir Puteh	MW(7)-D510202-1-7.96	–	–	–	67	88	Baik / Good
Terengganu	Urban & Suburban	Kg. Raja, Besut	MW(7)-T1-1-7.25	82	83	84	79	88	Baik / Good
		Kg. Raja, Besut	MW(7)-T1-1-31.79	82	67	85	64	73	Baik / Good
Sabah	Urban & Suburban	SK Inanam	MW(7)-H511601-9-7.50	74	78	80	93	91	Sangat Baik / Excellent

Nota / Note :
* Stesen Baru / New Station
– Tiada Data / No Data :
i. Tiada Air / No Water
ii. Stesen Rosak / Damaged Station

STATUS KUALITI AIR TANAH BAGI TAPAK PERINDUSTRIAN

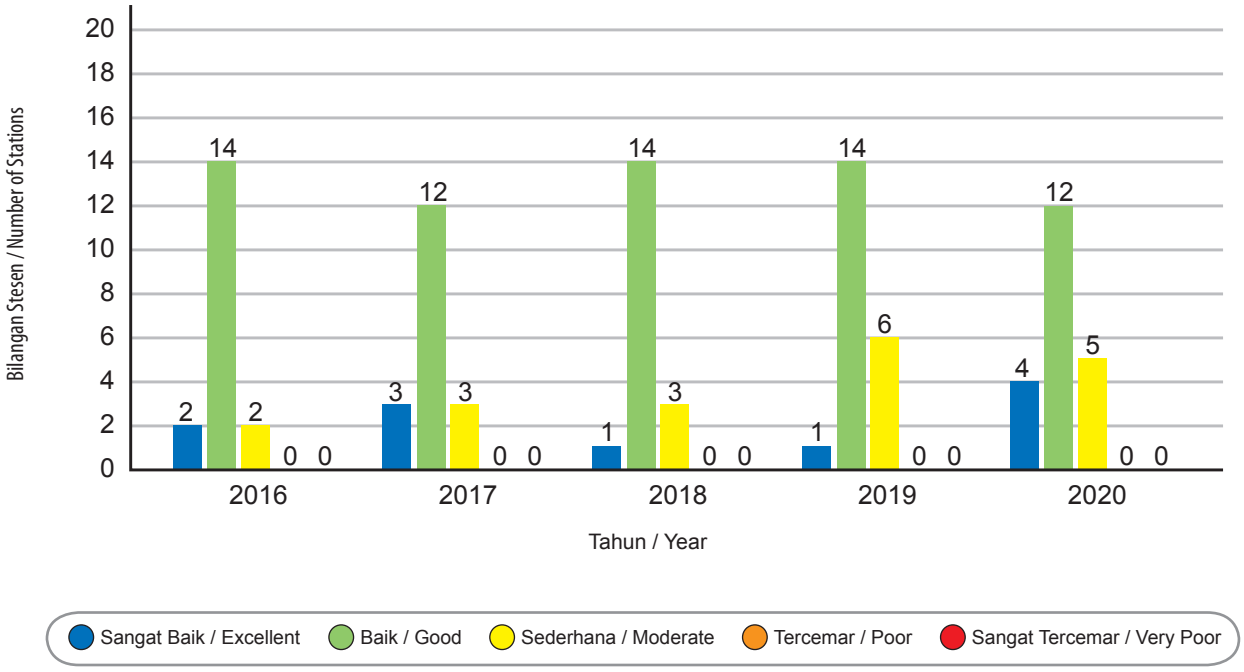
Tren IKAT mulai tahun 2016 hingga 2020 bagi tapak perindustrian adalah seperti yang ditunjukkan dalam **Rajah 3.3**. Berdasarkan **Rajah 3.3** didapati bilangan stesen sangat baik meningkat. Bilangan stesen baik dan sederhana telah berkurang. Tiada stesen dalam kategori tercemar dan sangat tercemar pada tahun 2020.

Pada tahun 2020, sebanyak 21 stesen tapak perindustrian telah dipantau sama seperti tahun 2019. Hasil program pengawasan yang telah dijalankan menunjukan empat (4) stesen (19.1%) sangat baik, 12 stesen (57.1%) baik dan lima (5) stesen (23.5%) sederhana (**Jadual 3.5**).

STATUS OF GROUNDWATER QUALITY INDEX FOR INDUSTRIAL SITES

GWQI trend for industrial sites from year 2016 to 2020 is shown in **Figure 3.3**. Based on **Figure 3.3**, the number of excellent stations has increased. The number of stations categorised as good and moderate has decreased. No station was categorised as poor and very poor in 2020.

In 2020, a total of 21 stations for industrial sites were monitored, the same as the previous year. The monitoring results indicate that four 4 stations (19.1%) were excellent, 12 stations (57.1%) were good and 5 stations (23.5%) were moderate (**Table 3.5**).



Rajah 3.3 : Tren Indeks Kualiti Air Tanah bagi Tapak Perindustrian (2016-2020)
Figure 3.3 : Trends of Groundwater Quality Index for Industrial Sites (2016-2020)

Jadual 3.5 : Status Indeks Kualiti Air Tanah bagi Tapak Perindustrian
Table 3.5 : Status of Groundwater Quality Index for Industrial Sites

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAT / GWQI VALUE					KATEGORI (2020) / CATEGORY (2020)
				2016	2017	2018	2019	2020	
Perlis	Tapak Perindustrian / Industrial Sites	*Felda Chuping	MW(7)-R610006-2-6.55	–	–	–	71	90	Sangat Baik / Excellent
Kedah	Tapak Perindustrian / Industrial Sites	Kulim Hi-Tech	MW(7)-K3-1-8.45	65	68	70	82	72	Baik / Good
Pulau Pinang	Tapak Perindustrian / Industrial Sites	Mak Mandin (MAGRI)	MW(7)-P1-2-4.50	76	86	76	69	78	Baik / Good
		Mak Mandin (KASTAM)	MW(7)-P1-1-6.50	76	91	77	74	79	Baik / Good
		Bayan Lepas	MW(7)-P2-1-4.34	91	89	87	78	98	Sangat Baik / Excellent
Selangor	Tapak Perindustrian / Industrial Sites	SK Seksy. 20, Shah Alam	MW(7)-S9A-1-8.20	82	74	67	82	73	Baik / Good
		CIAST, Seksy. 19, Shah Alam	MW(7)-S9-1-20.21	81	77	67	81	81	Baik / Good
		CIAST, Seksy. 19, Shah Alam	MW(7)-S9-1-5.97	77	72	66	54	78	Baik / Good
N. Sembilan	Tapak Perindustrian / Industrial Sites	Senawang Edible Oil	MW(7)-N4-1-6.44	72	71	71	81	65	Sederhana / Moderate
Melaka	Tapak Perindustrian / Industrial Sites	Petronas Oil Refinery, Melaka	MW(7)-M1-1-8.10	73	75	71	64	64	Sederhana / Moderate
Johor	Tapak Perindustrian / Industrial Sites	Tg. Puteri, Pasir Gudang	MW(7)-J5-1-7.34	88	92	99	73	85	Baik / Good
		Tg. Puteri, Pasir Gudang	MW(7)-J5-2-7.49	77	74	72	70	60	Sederhana / Moderate
Pahang	Tapak Perindustrian / Industrial Sites	*LYNAS, Gebeng	MW(7)-C310302-1-6.50	–	–	–	66	62	Sederhana / Moderate
Kelantan	Tapak Perindustrian / Industrial Sites	Eastern Garment MFG. Pkln.Chepa	MW(7)-D6-2-51.38	82	81	70	87	71	Baik / Good
		Eastern Garment MFG. Pkln.Chepa	MW(7)-D6-2-4.24	87	90	80	79	71	Baik / Good
Terengganu	Tapak Perindustrian / Industrial Sites	TCOT Kerteh, Kemaman	MW(7)-T15-1-5.68	99	81	82	88	97	Sangat Baik / Excellent
		TCOT Kerteh, Kemaman	MW(7)-T15-1-24.89	65	68	85	82	82	Baik / Good
		KSB Telok Kalong, Kemaman	MW(7)-T16-1-5.57	81	70	87	64	82	Baik / Good
		KSB Telok Kalong, Kemaman	MW(7)-T16-1-18.76	81	66	83	61	69	Sederhana / Moderate
		*Sk. Bari, Setiu	MW(7)-T510208-1-7.97	–	–	–	74	78	Baik / Good
Labuan	Tapak Perindustrian / Industrial Sites	Asian Supply Base W. P. Labuan	MW(7)-H511509-1-6.80	83	83	81	91	94	Sangat Baik / Excellent

Nota / Note :
* Stesen Baru / New Station
– Tiada Data / No Data :
i. Tiada Air / No Water
ii. Stesen Rosak / Damaged Station

STATUS KUALITI AIR TANAH BAGI BEKAS TAPAK PELUPUSAN SAMPAH

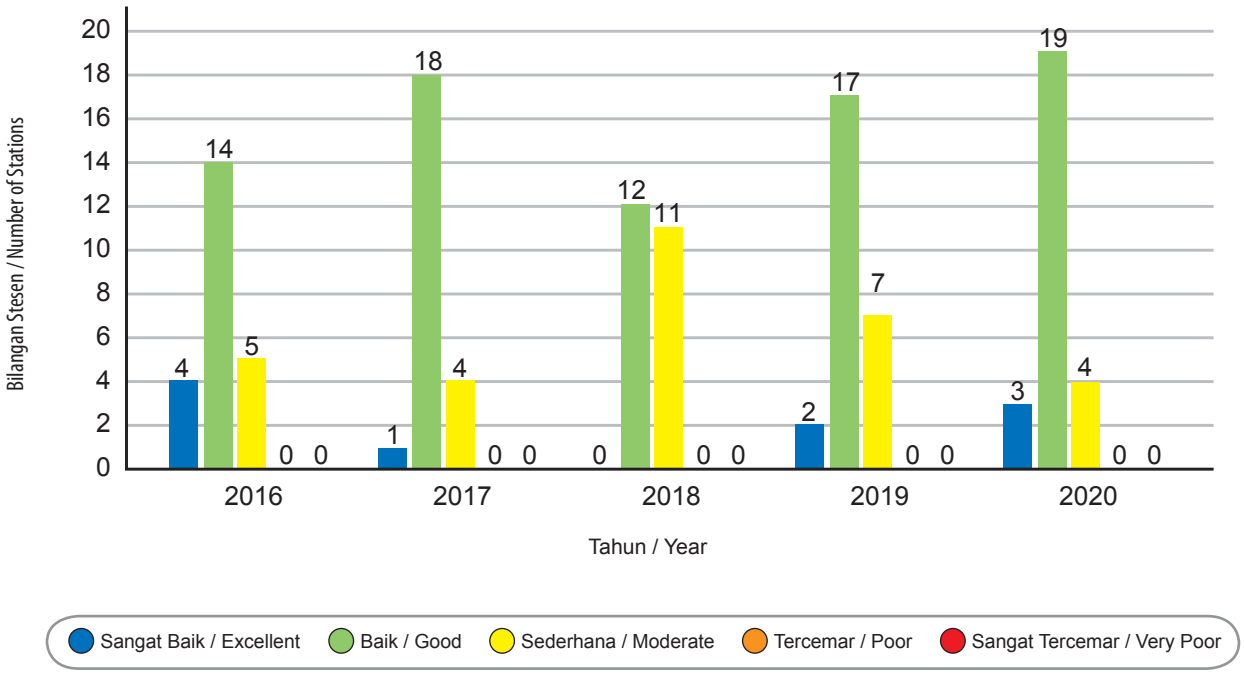
Tren IKAT mulai tahun 2016 hingga 2020 bagi bekas tapak pelupusan sampah adalah seperti yang ditunjukkan dalam **Rajah 3.4**. Berdasarkan **Rajah 3.4** didapati bilangan stesen sangat baik telah meningkat berbanding tahun sebelumnya. Bilangan stesen baik juga telah meningkat manakala bilangan stesen sederhana telah menurun berbanding tahun sebelumnya. Manakala, tiada stesen dalam kategori tercemar dan sangat tercemar pada tahun 2020.

Pada tahun 2020, sebanyak 26 stesen bekas tapak pelupusan sampah telah dipantau sama seperti tahun lepas. Hasil program pengawasan yang telah dijalankan menunjukan tiga (3) stesen (11.5%) sangat baik, 19 stesen (73.1%) baik dan empat (4) stesen (15.4%) sederhana (**Jadual 3.6**).

STATUS OF GROUNDWATER QUALITY INDEX FOR USED SOLID WASTE LANDFILLS

The GWQI trend for used solid waste landfills from year 2016 to 2020 is shown in **Figure 3.4**. Based on **Figure 3.4**, the number of excellent stations for 2020 has increased compared to the previous year. The number of stations under good category has increased as well, while stations in the moderate category has decreased compared to the previous year. No station was categorised under poor and very poor in 2020.

In 2020, a total of 26 stations for used solid waste landfills were monitored, the same number as last year. The monitoring result indicates that three (3) stations (11.5%) were excellent, 19 stations (73.1%) were good and four (4) stations (15.4%) were moderate (**Table 3.6**).



Rajah 3.4 : Tren Indeks Kualiti Air Tanah bagi Bekas Tapak Pelupusan Sampah (2016-2020)
Figure 3.4 : Trends of Groundwater Quality Index for Used Solid Waste Landfills (2016-2020)

Jadual 3.6 : Status Indeks Kualiti Air Tanah bagi Bekas Tapak Pelupusan Sampah

Table 3.6 : Status of Groundwater Quality Index for Used Solid Waste Landfills

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAT / GWQI VALUE					KATEGORI (2020) / CATEGORY (2020)
				2016	2017	2018	2019	2020	
Perak	Bekas Tapak Pelupusan Sampah / Used Solid Waste Landfills	Pusing, Batu Gajah	MW(7)-A11-1-6.05	70	70	70	59	73	Baik / Good
Kuala Lumpur	Bekas Tapak Pelupusan Sampah / Used Solid Waste Landfills	Jln Sg. Besi	MW(7)-S11-1-5.50	82	70	51	86	79	Baik / Good
		Jln Sg. Besi	MW(7)-S11-1-5.54	81	68	59	82	74	Baik / Good
		Jln Sg. Besi	MW(7)-S11-1-5.57	98	72	65	93	74	Baik / Good
		Tmn Beringin, Kepong	MW(7)-S13-1-7.26	96	72	58	95	84	Baik / Good
		Tmn Beringin, Kepong	MW(7)-S13-2-6.10	75	64	56	87	75	Baik / Good
N. Sembilan	Bekas Tapak Pelupusan Sampah / Used Solid Waste Landfills	Kualiti Alam	MW(7)-N5-1-8.00	95	82	64	84	79	Baik / Good
		Kualiti Alam	MW(7)-N5-1-7.55	79	70	64	64	64	Sederhana / Moderate
		*TPS Tanah Merah (CYPARK), Port Dickson	MW(7)-N210108-2-10.03	–	–	–	69	70	Baik / Good
Melaka	Bekas Tapak Pelupusan Sampah / Used Solid Waste Landfills	*Tapak Pelupusan Sampah, Sungai Udang	MW(7)-M210209-1-7.68	–	–	–	62	75	Baik / Good
Johor	Bekas Tapak Pelupusan Sampah / Used Solid Waste Landfills	Kg. Batu 4, Kota Tinggi	MW(7)-J4-1-6.94	73	76	82	65	89	Baik / Good
		*Tapak Pelupusan Sisa Pepejal, Ladang CEP, Simpang Renggam	MW(7)-J110302-1-7.02	–	–	–	64	63	Sederhana / Moderate
Kelantan	Bekas Tapak Pelupusan Sampah / Used Solid Waste Landfills	Panji Landfill, Panji Kota Bharu	MW(7)-D6-3-13.43	90	88	83	89	82	Baik / Good
		Panji Landfill, Panji Kota Bharu	MW(7)-D6-3-5.34	89	88	80	89	82	Baik / Good
		P. Mas Landfill, Kg. Pusu 40, P. Mas	MW(7)-D8-1-5.22	87	90	76	89	94	Sangat Baik / Excellent
Terengganu	Bekas Tapak Pelupusan Sampah / Used Solid Waste Landfills	Kg. Kubang Badak, K. Terengganu	MW(7)-T10-1-5.45	80	80	67	78	98	Sangat Baik / Excellent
		Kg. Kubang Badak, K. Terengganu	MW(7)-T10-1-22.89	76	81	81	78	97	Sangat Baik / Excellent
Sabah	Bekas Tapak Pelupusan Sampah / Used Solid Waste Landfills	ITAC, Kg. Duvanson, Penampang	MW(7)-H511601-1-8.80	68	70	70	82	82	Baik / Good
		ITAC, Kg. Duvanson, Penampang	MW(7)-H511601-2-14.0	68	74	82	82	82	Baik / Good
		ITAC, Kg. Duvanson, Penampang	MW(7)-H511601-3-8.00	69	78	85	86	85	Baik / Good
		ITAC, Kg. Duvanson, Penampang	MW(7)-H511601-4-17.3	71	78	84	85	85	Baik / Good
		ITAC, Kg. Duvanson, Penampang	MW(7)-H511601-5-19.0	70	74	76	73	80	Baik / Good
		ITAC, Kg. Duvanson, Penampang	MW(7)-H511601-6-10.2	81	72	69	80	80	Baik / Good
		ITAC, Kg. Duvanson, Penampang	MW(7)-H511601-7-10.3	82	80	73	82	82	Baik / Good
Sarawak	Bekas Tapak Pelupusan Sampah / Used Solid Waste Landfills	Kemuyang, No. 1	MW(7)-QS-K1-11.10	48	56	58	53	53	Sederhana / Moderate
		Kemuyang, No. 2	MW(7)-QS-K2-10.78	68	62	51	72	69	Sederhana / Moderate

Nota / Note :
* Stesen Baru / New Station
– Tiada Data / No Data :
  i. Tiada Air / No Water
  ii. Stesen Rosak / Damaged Station

STATUS KUALITI AIR TANAH BAGI PADANG GOLF

Tren IKAT mulai tahun 2016 hingga 2020 bagi padang golf adalah seperti yang ditunjukkan dalam **Rajah 3.5**. Berdasarkan **Rajah 3.5**, didapati bilangan stesen sangat baik meningkat berbanding tahun sebelumnya. Bilangan stesen dalam kategori baik menurun berbanding tahun sebelumnya. Tiada stesen yang berada dalam kategori sederhana, tercemar dan sangat tercemar pada tahun 2020.

Pada tahun 2015 sebanyak tujuh (7) stesen yang dipantau, walau bagaimanapun bermula pada tahun 2016 hanya enam (6) stesen yang dipantau memandangkan satu (1) stesen di Kuala Lumpur telah kering (**Jadual 3.7**).

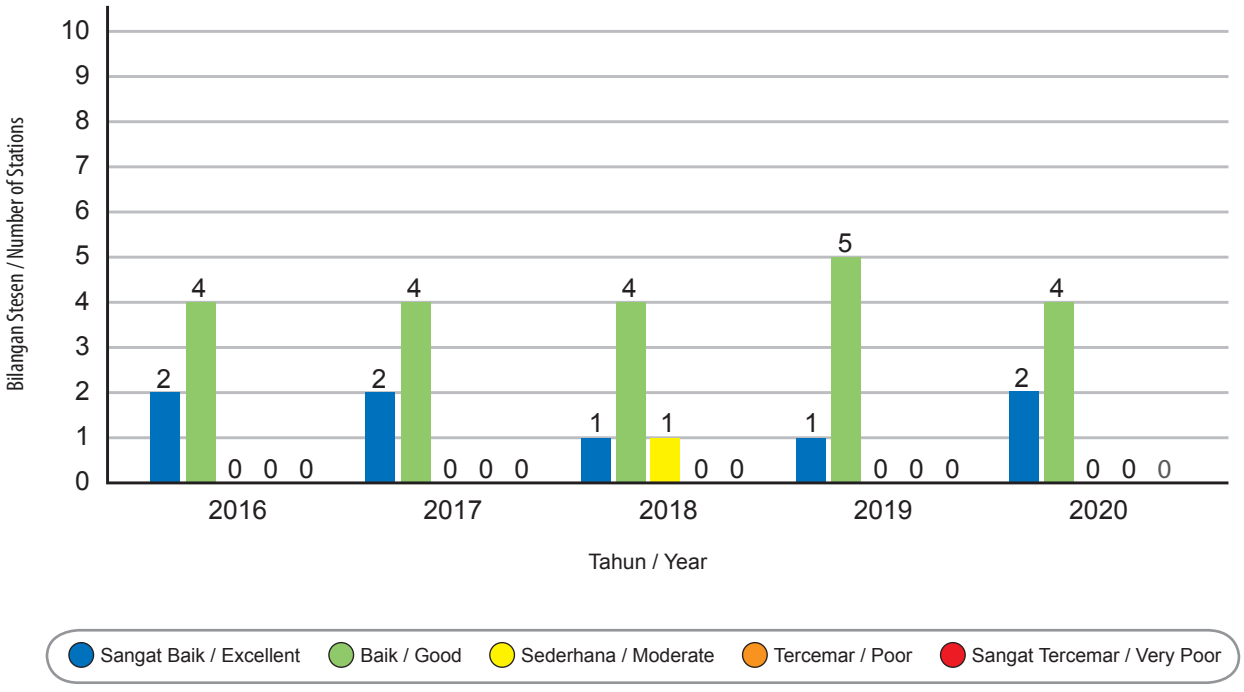
Hasil program pengawasan yang telah dijalankan menunjukan dua (2) stesen (33.3%) sangat baik dan empat (4) stesen (66.7%) baik (**Jadual 3.7**).

STATUS OF GROUNDWATER QUALITY INDEX FOR GOLF COURSES

The GWQI trend for golf course from year 2016 until 2020 is shown in **Figure 3.5**. Based on **Figure 3.5**, the number of excellent stations has increased compared to the previous year. The number of stations under good category has decreased compared to the previous year. No station was categorised under moderate, poor and very poor in 2020.

In 2015 seven (7) stations were monitored, however beginning 2016 only six (6) stations were monitored as one (1) station in Kuala Lumpur had dried up (**Table 3.7**).

The monitoring results indicate that two (2) stations (33.3%) were excellent and four (4) stations (66.7%) were good (**Table 3.7**).



Rajah 3.5 : Tren Indeks Kualiti Air Tanah bagi Padang Golf (2016-2020)
Figure 3.5 : Trends of Groundwater Quality Index for Golf Courses (2016-2020)

Jadual 3.7 : Status Indeks Kualiti Air Tanah Bagi Padang Golf
Table 3.7 : Status of Groundwater Quality Index for Golf Courses

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAT / GWQI VALUE					KATEGORI (2020) / CATEGORY (2020)
				2016	2017	2018	2019	2020	
Kuala Lumpur	Padang Golf / Golf Courses	Royal Selangor Golf Club	MW(7)-S12-1-5.37	–	–	–	–	–	Tiada Data / No Data
Kelantan	Padang Golf / Golf Courses	Kelab Golf & Desa Pkln. Chepa	MW(7)-D3-1-6.90	83	84	82	89	82	Baik / Good
		Kelab Golf & Desa Pkln. Chepa	MW(7)-D3-1-6.37	88	90	71	84	71	Baik / Good
		Kelab Golf D'Raja Kubang Kerian	MW(7)-D6-4-31.29	82	82	65	82	82	Baik / Good
		Kelab Golf D'Raja Kubang Kerian	MW(7)-D6-4-9.05	78	89	75	85	81	Baik / Good
Sabah	Padang Golf / Golf Courses	Sandakan Golf Club, Sandakan	MW(7)-H511801-1-8.82	93	86	79	81	96	Sangat Baik / Excellent
		Sandakan Golf Club, Sandakan	MW(7)-H511801-2-8.60	93	96	96	96	95	Sangat Baik / Excellent

Nota / Note :
* Stesen Baru / New Station
– Tiada Data / No Data :
i. Tiada Air / No Water
ii. Stesen Rosak / Damaged Station

STATUS KUALITI AIR TANAH BAGI LUAR BANDAR

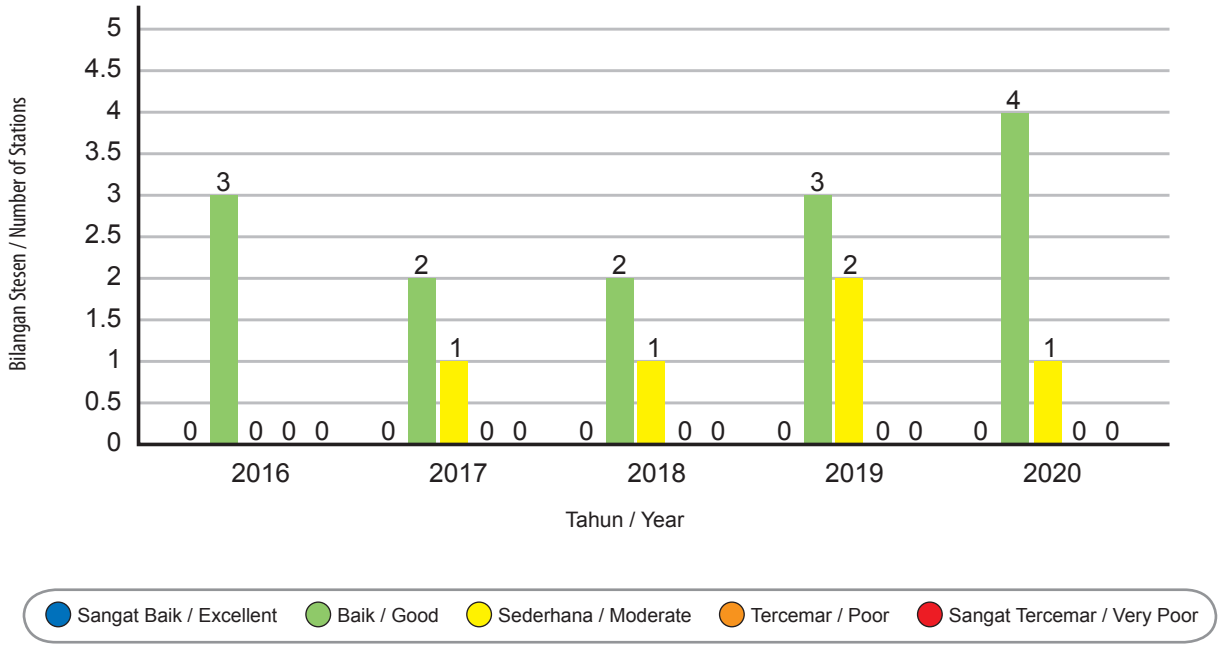
Tren IKAT mulai tahun 2016 hingga 2020 bagi kawasan luar bandar adalah seperti yang ditunjukkan dalam **Rajah 3.6**. Berdasarkan **Rajah 3.6** didapati tiada stesen sangat baik sejak tahun 2015 manakala bilangan stesen baik telah menunjukkan peningkatan berbanding tahun sebelumnya. Tiada stesen dalam kategori tercemar dan sangat tercemar pada tahun 2020.

Pada tahun 2020, sebanyak lima (5) stesen kawasan luar bandar telah dipantau berbanding tiga (3) pada tahun 2018. Hasil program pengawasan yang telah dijalankan menunjukan empat (4) stesen (80.0%) baik dan satu (1) stesen (20.0%) sederhana (**Jadual 3.8**).

STATUS OF GROUNDWATER QUALITY INDEX FOR RURAL

GWQI trends for rural area from year 2016 to 2020 is shown in **Figure 3.6**. Based on **Figure 3.6**. No station has been categorised as excellent since year 2015 while the number of stations categorised under good has increased compared to the previous year. There were no stations under poor and very poor in 2020.

In 2020, a total of five (5) stations under rural area were monitored compared to only three (3) monitoring wells in 2018. The monitoring results indicate that four (4) stations (80.0%) were good and one (1) station (20.0%) was moderate (**Table 3.8**).



Rajah 3.6 : Tren Indeks Kualiti Air Tanah bagi Luar Bandar (2016-2020)
Figure 3.6 : Trends of Groundwater Quality Index for Rural (2016-2020)

Jadual 3.8 : Status Indeks Kualiti Air Tanah bagi Luar Bandar
Table 3.8 : Status of Groundwater Quality Index for Rural

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAT / GWQI VALUE					KATEGORI (2020) / CATEGORY (2020)
				2016	2017	2018	2019	2020	
Kelantan	Luar Bandar / Rural	Sek. Keb. Jelawat Bachok	MW(7)-D11-1-6.10	88	81	81	80	79	Baik / Good
		Sek. Men. Keb. Jelawat Bachok	MW(7)-D11-2-5.09	82	74	65	65	81	Baik / Good
Selangor	Luar Bandar / Rural	*Institut Alam Sekitar, EIMAS, UKM Bangi	MW(7)-S210104-1-20.30	–	–	–	72	85	Baik / Good
Melaka	Luar Bandar / Rural	*Pusat Kecemerlangan Buangan Terjadual, JAS Tabuh Naning	MW(7)-M210209-2-21.10	–	–	–	49	42	Sederhana / Moderate
Terengganu	Luar Bandar / Rural	Kg. Padang Pak Wan, Bkt. Payung, Marang	MW(7)-T14-1-6.99	81	80	81	80	88	Baik / Good

Nota / Note :
* Stesen Baru / New Station
– Tiada Data / No Data :
i. Tiada Air / No Water
ii. Stesen Rosak / Damaged Station

STATUS KUALITI AIR TANAH BAGI BEKAS LOMBONG EMAS

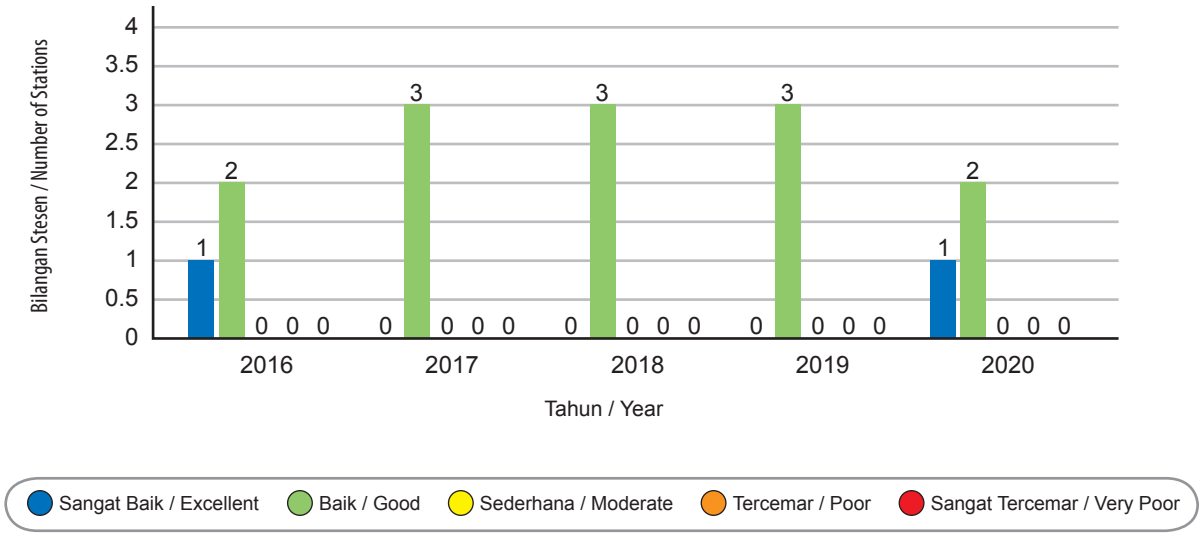
Tren IKAT mulai tahun 2016 hingga 2020 bagi bekas lombong emas adalah seperti yang ditunjukkan dalam **Rajah 3.7**. Berdasarkan **Rajah 3.7** didapati satu (1) stesen berada dalam kategori sangat baik. Dua (2) stesen berada dalam kategori baik. Tiada stesen dalam kategori sederhana, tercemar dan sangat tercemar pada tahun 2020.

Pada tahun 2020, sebanyak tiga (3) stesen bekas lombong emas telah dipantau. Hasil program pengawasan yang telah dijalankan menunjukan satu (1) stesen (33.3%) sangat baik dan dua (2) stesen (66.7%) baik (**Jadual 3.9**).

STATUS OF GROUNDWATER QUALITY INDEX FOR USED MINING (GOLD MINE)

GWQI trend for used mining (gold mine) from year 2016 to 2020 is shown in **Figure 3.7**. Based on **Figure 3.7**, the year 2020 had one (1) station categorised as excellent and two (2) stations as good. No station was categorised as moderate, poor and very poor in 2020.

In 2020, a total of three (3) stations for used mining (gold mine) were monitored. The monitoring results indicate that one (1) station (33.3%) was excellent and two (2) stations (66.7%) were good (**Table 3.9**).



Rajah 3.7 : Tren Indeks Kualiti Air Tanah bagi Bekas Lombong Emas (2016-2020)
Figure 3.7 : Trends of Groundwater Quality Index for Used Mining (Gold Mine) (2016-2020)

Jadual 3.9 : Status Indeks Kualiti Air Tanah bagi Bekas Lombong Emas
Table 3.9 : Status of Groundwater Quality Index for Used Mining (Gold Mine)

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAT / GWQI VALUE					KATEGORI (2020) / CATEGORY (2020)
				2016	2017	2018	2019	2020	
Sarawak	Bekas Lombong Emas / Used Mining (Gold Mine)	Bau, No. 1	MW(7)-QK-B1-27.27	85	82	82	85	88	Baik / Good
		Bau, No. 2	MW(7)-QK-B2-29.50	85	85	82	84	93	Sangat Baik / Excellent
		Bau	MW(7)-QK-B3-29.00	97	82	73	82	82	Baik / Good

STATUS KUALITI AIR TANAH BAGI BEKALAN AIR

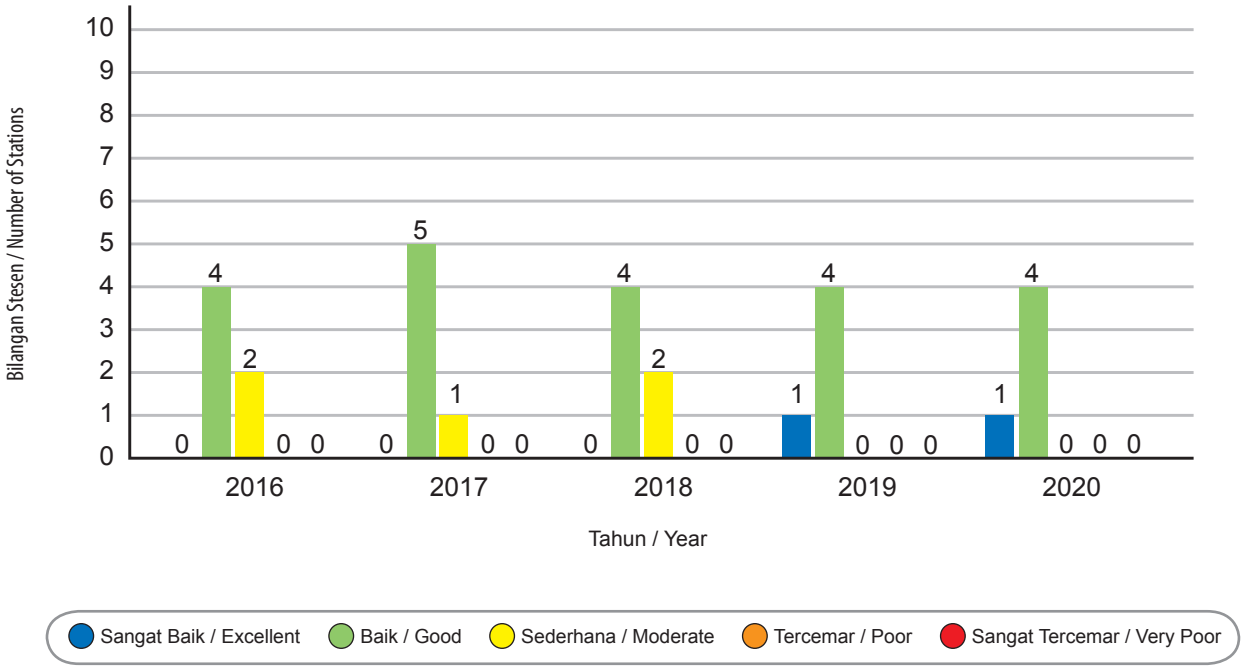
Tren IKAT mulai tahun 2016 hingga 2020 bagi bekalan air adalah seperti yang ditunjukkan dalam **Rajah 3.8**. Berdasarkan **Rajah 3.8** didapati stesen bagi kategori sangat baik sama seperti tahun sebelumnya manakala stesen bagi kategori baik kekal sejak tahun 2018. Tiada stesen dalam kategori sederhana, tercemar dan sangat tercemar pada tahun 2020.

Pada tahun 2020, sebanyak lima (5) stesen bekalan air telah dipantau sama seperti pada tahun 2019. Hasil program pengawasan yang telah dijalankan menunjukan satu (1) stesen (20.0%) sangat baik dan empat (4) stesen (80.0%) baik (**Jadual 3.10**).

STATUS OF GROUNDWATER QUALITY INDEX FOR WATER SUPPLY

The GWQI trend for water supply from year 2016 to 2020 is shown in **Figure 3.8**. Based on **Figure 3.8**, the number of stations categorised as excellent same as in the previous year. Stations categorised as good remain unchanged since 2018. No station was categorised under moderate, poor and very poor in 2020.

In 2020, a total of five (5) stations for water supply were monitored compared to the previous year. The monitoring results indicate that one (1) station (20.0%) was excellent while four (4) stations (80.0%) were good (**Table 3.10**).



Rajah 3.8 : Tren Indeks Kualiti Air Tanah bagi Bekalan Air (2016-2020)
Figure 3.8 : Trends of Groundwater Quality Index for Water Supply (2016-2020)

Jadual 3.10 : Status Indeks Kualiti Air Tanah bagi Bekalan Air
Table 3.10 : Status of Groundwater Quality Index for Water Supply

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAT / GWQI VALUE					KATEGORI (2020) / CATEGORY (2020)
				2016	2017	2018	2019	2020	
Sabah	Bekalan Air / Water Supply	Kg. Tajau Laut, Kudat	MW(7)-H511604-1-4.5	84	80	75	87	88	Baik / Good
Sarawak	Bekalan Air / Water Supply	Kabong, No. 1	MW(7)-QB-K1-6.70	81	81	79	84	70	Baik / Good
		Pusat Rawatan Air. JKR, No. 1, Miri	MW(7)-QL-L1-7.53	81	72	56	92	99	Sangat Baik / Excellent
		Pusat Rawatan Air. JKR, No. 2, Miri	MW(7)-QL-L2-7.90	70	72	70	–	–	Tiada Data / No Data
		LAKU (Lambir), No. 1, Miri	MW(7)-QM-L1-30.50	68	62	59	75	83	Baik / Good
		Kg. Lusut Kiri, No. 3, Miri	MW(7)-QM-L3-28.30	62	72	82	77	87	Baik / Good

Nota / Note :
* Stesen Baru / New Station
– Tiada Data / No Data :
i. Tiada Air / No Water
ii. Stesen Rosak / Damaged Station

STATUS KUALITI AIR TANAH BAGI BEKAS TAPAK PELUPUSAN BANGKAI HAIWAN

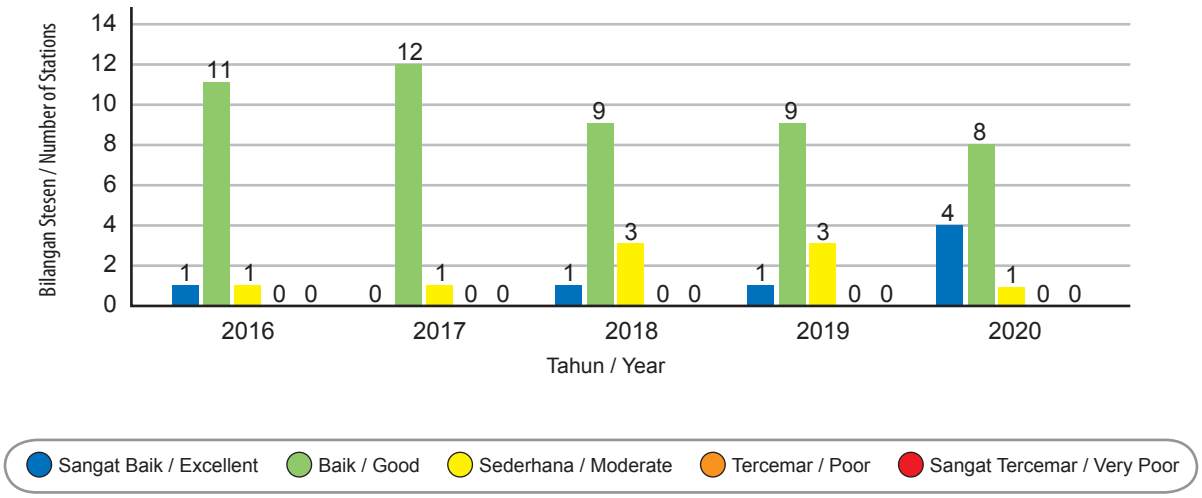
Tren IKAT mulai tahun 2016 hingga 2020 bagi bekas tapak pelupusan bangkai haiwan adalah seperti yang ditunjukkan dalam **Rajah 3.9**. Berdasarkan **Rajah 3.9** didapati jumlah stesen dalam kategori sangat baik meningkat dari tahun sebelumnya. Bilangan stesen baik dan sederhana menurun pada tahun ini. Tiada stesen dalam kategori tercemar dan sangat tercemar pada tahun 2020.

Pada tahun 2020 sebanyak 13 stesen yang dipantau, (**Jadual 3.11**). Hasil program pengawasan yang telah dijalankan menunjukan empat (4) stesen (30.8%) sangat baik, lapan (8) stesen (61.5%) baik dan satu (1) stesen (7.7%) sederhana (**Jadual 3.11**).

STATUS OF GROUNDWATER QUALITY INDEX FOR USED ANIMAL BURIAL SITES

The GWQI trend for used animal burial sites from year 2016 to 2020 is shown in **Figure 3.9**. Based on **Figure 3.9**, the number of stations in the excellent category, increased from the previous year. The number of good and moderate stations decreased in this year. There were no stations under the poor and very poor category in 2020.

In 2020, 13 stations were monitored (**Table 3.11**). The monitoring results indicate that four (4) stations (30.8%) were excellent, eight (8) stations (61.5 %) were good and one (1) station (7.7%) was moderate (**Table 3.11**)



Rajah 3.9 : Tren Indeks Kualiti Air Tanah bagi Bekas Tapak Pelupusan Bangkai Haiwan (2016-2020)
Figure 3.9 : Trends of Groundwater Quality Index for Used Animal Burial Sites (2016-2020)

Jadual 3.11 : Status Indeks Kualiti Air Tanah bagi Bekas Tapak Pelupusan Bangkai Haiwan
Table 3.11 : Status of Groundwater Quality Index for Used Animal Burial Sites

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAT / GWQI VALUE					KATEGORI (2020) / CATEGORY (2020)
				2016	2017	2018	2019	2020	
Perak	Bekas Tapak Pelupusan Bangkai Haiwan / Used Animal Burial Sites	Tapak Bazar Seramik Tambun	MW(7)-A(IP)-1-5.92	73	70	69	69	78	Baik / Good
		Tapak Bekas Wabak JE Jalong	MW(7)-A(SS)-2-3.14	–	–	–	–	–	Tiada Data / No Data
		Tapak Bekas Wabak JE Jalong	MW(7)-A(SS)-1-7.65	84	85	85	83	87	Baik / Good
Pulau Pinang	Bekas Tapak Pelupusan Bangkai Haiwan / Used Animal Burial Sites	Perkampungan Ldg Valdor (Kelapa)	MW(7)-P(LV)-1-7.45	78	73	89	96	96	Sangat Baik / Excellent
		Perkampungan Ldg Valdor (Tengah)	MW(7)-P(LV)-2-6.78	85	73	88	74	90	Sangat Baik / Excellent
		Perkampungan Ldg Valdor (Jalan)	MW(7)-P(LV)-3-7.30	76	80	91	72	90	Sangat Baik / Excellent
Johor	Bekas Tapak Pelupusan Bangkai Haiwan / Used Animal Burial Sites	Ulu Choh (Pintu)	MW(7)-JPN-1-6.90	73	74	82	62	73	Baik / Good
		Ulu Choh (kolam)	MW(7)-JPN-2-6.10	70	74	81	70	70	Baik / Good
		Ulu Choh (sungai)	MW(7)-JPN-3-6.71	77	78	82	78	83	Baik / Good
Selangor	Bekas Tapak Pelupusan Bangkai Haiwan / Used Animal Burial Sites	stesen kg. sg. keroh, sepang	MW(7)-S(SE)-1-5.67	82	72	63	59	52	Sederhana / Moderate
		TNB Sepang	MW(7)-S(SE)-2-6.95	94	87	71	79	96	Sangat Baik / Excellent
		Ladang Sepang	MW(7)-S(SE)-3-5.60	84	82	78	78	87	Baik / Good
Sarawak	Bekas Tapak Pelupusan Bangkai Haiwan / Used Animal Burial Sites	Oya Road, No. 1, Sibu	MW(7)-QS-Y1-10.00	69	64	55	79	79	Baik / Good
		Oya Road, No. 2, Sibu	MW(7)-QS-Y2-9.17	74	72	71	78	83	Baik / Good

Nota / Note :
* Stesen Baru / New Station
– Tiada Data / No Data :
i. Tiada Air / No Water
ii. Stesen Rosak / Damaged Station

STATUS KUALITI AIR TANAH BAGI AKUAKULTUR

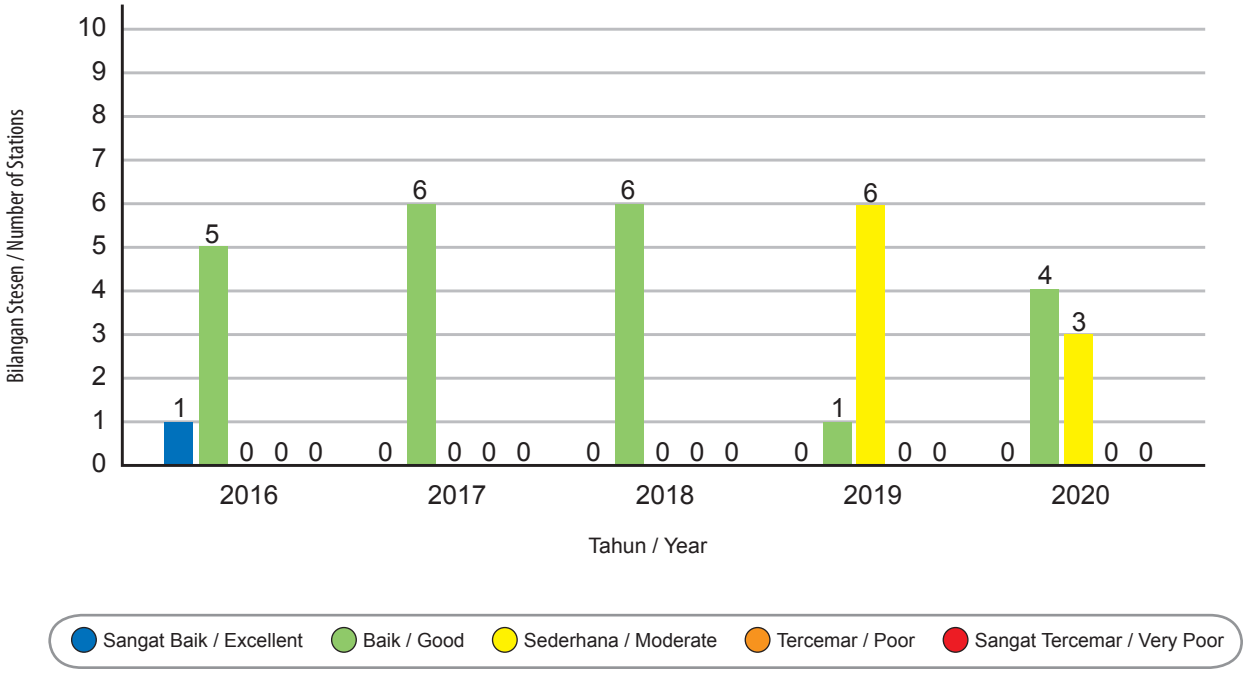
Tren IKAT mulai tahun 2016 hingga 2020 bagi akuakultur adalah seperti yang ditunjukkan dalam **Rajah 3.10**. Berdasarkan **Rajah 3.10** didapati tiada stesen sangat baik pada tahun 2020. Bilangan stesen baik meningkat berbanding tahun sebelumnya manakala bilangan stesen bagi kategori sederhana menurun berbanding tahun 2019. Tiada stesen dalam kategori tercemar dan sangat tercemar pada tahun 2020.

Pada tahun 2020, sebanyak tujuh (7) stesen bagi akuakultur telah dipantau. Hasil program pengawasan yang telah dijalankan, empat (4) stesen (57.1%) baik, manakala tiga (3) stesen (42.9%) sederhana (**Jadual 3.12**).

STATUS OF GROUNDWATER QUALITY INDEX FOR AQUACULTURE

The GWQI trend for aquaculture from year 2016 to 2020 is shown in **Figure 3.10**. Based on **Figure 3.10**, no station was categorised as excellent in the year 2020. The number of stations categorised as good increased compared to the previous year while the number of stations categorised as moderate decreased compared to the year 2019. No station was categorised under poor and very poor in 2020.

In 2020, a total of seven (7) stations for aquaculture were monitored. The monitoring results indicate that four (4) stations (57.1%) were good while three (3) stations (42.9%) were moderate (**Table 3.12**).



Rajah 3.10 : Tren Indeks Kualiti Air Tanah bagi Akuakultur (2016-2020)
Figure 3.10 : Trends of Groundwater Quality Index for Aquaculture (2016-2020)

Jadual 3.12 : Status Indeks Kualiti Air Tanah bagi Akuakultur
Table 3.12 : Status of Groundwater Quality Index for Aquaculture

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAT / GWQI VALUE					KATEGORI (2020) / CATEGORY (2020)
				2016	2017	2018	2019	2020	
Pahang	Akuakultur / Aquaculture	Nenasi (Agrobest)	MW(7)-C16-2-10.5	81	80	81	62	61	Sederhana/ Moderate
		Nenasi (Agrobest)	MW(7)-C16-3-43	79	79	80	68	74	Baik/Good
		Nenasi (Agrobest)	MW(7)-C16-4-38	83	82	83	72	76	Baik/Good
		Nenasi (Agrobest)	MW(7)-C16-5-10	92	84	79	60	58	Sederhana/ Moderate
		Nenasi (Agrobest)	MW(7)-C16-6-10	82	73	82	64	82	Baik/Good
		Nenasi (Agrobest)	MW(7)-C16-7-29	87	87	88	69	80	Baik/Good
Terengganu	Akuakultur / Aquaculture	*Blue Archipelago	MW(7)-T510208-2-14.00	–	–	–	66	68	Sederhana/ Moderate

Nota / Note :
* Stesen Baru / New Station
– Tiada Data / No Data :
  i. Tiada Air / No Water
  ii. Stesen Rosak / Damaged Station

STATUS KUALITI AIR TANAH BAGI PERANGINAN

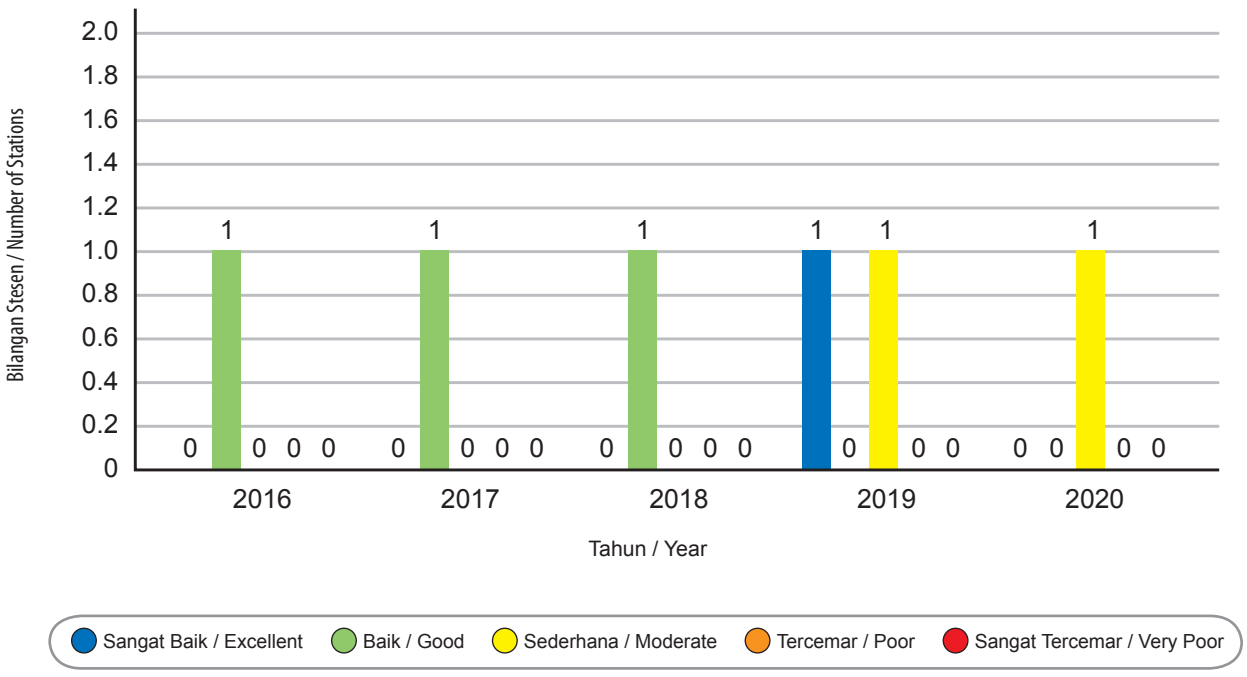
Tren IKAT mulai tahun 2016 hingga 2020 bagi peranginan adalah seperti yang ditunjukkan dalam **Rajah 3.11**. Berdasarkan **Rajah 3.11** didapati tiada stesen dikategorikan sebagai sangat baik berbanding tahun 2019. Tiada stesen baik yang ditunjukkan pada tahun 2020, manakala satu (1) stesen yang dikategorikan sebagai sederhana. Tiada stesen dalam kategori tercemar dan sangat tercemar sejak tahun 2015.

Pada tahun 2020, sebanyak satu (1) stesen bagi peranginan telah dipantau berbanding dua (2) pada tahun 2019. Hasil program pengawasan yang telah dijalankan, satu (1) stesen adalah sederhana manakala satu (1) stesen tidak dapat dijalankan persampelan kerana Perintah Kawalan Pergerakan (PKP) yang dikeluarkan oleh Kerajaan Malaysia (**Jadual 3.13**).

STATUS OF GROUNDWATER QUALITY INDEX FOR RESORTS

The GWQI trend for resorts from year 2016 to 2020 is shown in **Figure 3.11**. Based on **Figure 3.11**, no station was categorised as excellent when compared to the year 2019. No station was categorised under good in 2020, while one (1) station was categorised as moderate in 2020. There were no stations under poor and very poor since 2015.

In 2020, one (1) station of the two (2) for resorts was monitored compared to two (2) for 2019. This was because of the Movement Control Order imposed by the Government at that time. The monitoring result indicates one (1) station (50.0%) categorised as moderate while one (1) station could not be sampled. (**Table 3.13**).



Rajah 3.11 : Tren Indeks Kualiti Air Tanah bagi Peranginan (2016-2020)
Figure 3.11 : Trend of Groundwater Quality Index for Resorts (2016-2020)

Rajah 3.13 : Status Indeks Kualiti Air Tanah bagi Peranginan
Table 3.13 : Status of Groundwater Quality Index for Resorts

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAT / GWQI VALUE					KATEGORI (2020) / CATEGORY (2020)
				2016	2017	2018	2019	2020	
Sabah	Peranginan / Resort	Pulau Manukan	MW(7)-H511601-8-6.50	82	83	85	93	–	Tiada Data / No Data
Kedah	Peranginan / Resort	*Kuarters Imigresen Tanjung Rhu, Langkawi	MW(7)-KV 69912-1-10.10	–	–	–	68	57	Sederhana / Moderate

Jadual 3.14 : Standard Kualiti Air Tanah bagi Rawatan Air Mentah Secara Konvensional (Air Minuman) Merujuk kepada Parameter Utama dalam Penilaian Status Kualiti Air Tanah
Table 3.14 : Groundwater Quality Standards for Conventional Treatment of Raw Water (Drinking Water) with Reference to Significant Parameters in Assessment of Groundwater Quality Status

PARAMETER	SIMBOL / SYMBOL	STANDARD	UNIT
Kolifom / Total coliform	–	5000	MPN/100 ml
Pepejal Terlarut / TDS	–	1500	mg/l
Klorida / Chloride	Cl	250	mg/l
Besi / Iron	Fe	1.0	mg/l
Keliatan / Hardness	$CaCO_3$	500	mg/l
Mangan / Manganese	Mn	0.2	mg/l
Nitrit / Nitrite	NO_2	0.4#	mg/l
Raksa / Mercury	Hg	0.001	mg/l
Kadmium / Cadmium	Cd	0.003	mg/l
Arsenik / Arsenic	As	0.01	mg/l
Plumbum / Lead	Pb	0,05	mg/l
Kromium / Chromium	Cr	0.05	mg/l
Kuprum / Copper	Cu	1.0	mg/l
Zink / Zinc	Zn	3.0	mg/l
Sulfat / Sulphate	SO_4^-	250	mg/l
Selenium / Selenium	Se	0.01	mg/l
Sebatian Fenol / Phenolics	–	0.002	mg/l

Diambil dari Class IIA, National Water Quality Standards

STATUS KUALITI AIR TANAH

Penilaian terhadap kualiti air tanah adalah berdasarkan kepada nilai peratusan yang melebihi had penerimaan dalam Standard Kebangsaan Bagi Standard Kualiti Air Tanah Bagi Rawatan Air Mentah Secara Konvensional (Air Minuman).

Nilai peratusan tersebut adalah sebagaimana di dalam **Jadual 3.15**.

GROUNDWATER QUALITY STATUS

The assessment of groundwater quality was based on the percentage value exceeding the acceptance level of the National Standards of Groundwater Quality Standards for Conventional Raw Water Treatment (Drinking Water).

The percentage value is as shown in **Table 3.15.**

Jadual 3.15 : Peratusan Julat Nilai Pematuhan, 2020 / Table 3.15 : Percentage Range of Compliance, 2020

PERATUSAN JULAT NILAI PEMATUHAN (%) / PERCENTAGE RANGE OF COMPLIANCE (%)	KATEGORI / CATEGORY
0% - 49%	Rendah / Low
50% - 79%	Sederhana / Moderate
80% - 100%	Tinggi / High

Pada tahun 2020, keputusan yang diperoleh daripada pengawasan kualiti air tanah yang dijalankan menunjukkan bahawa semua stesen berada dalam julat nilai pematuhan Standard Kualiti Air Tanah Bagi Rawatan Air Mentah Secara Konvensional (Air Minuman) kecuali bagi mangan (Mn), jumlah kolifom, besi (Fe) dan sebatian fenol mempunyai peratusan julat nilai pematuhan Standard Kualiti Air Tanah Bagi Rawatan Air Mentah Secara Konvensional (Air Minuman) yang rendah bagi guna tanah tertentu seperti **Rajah 3.12** dan **Jadual 3.16.**

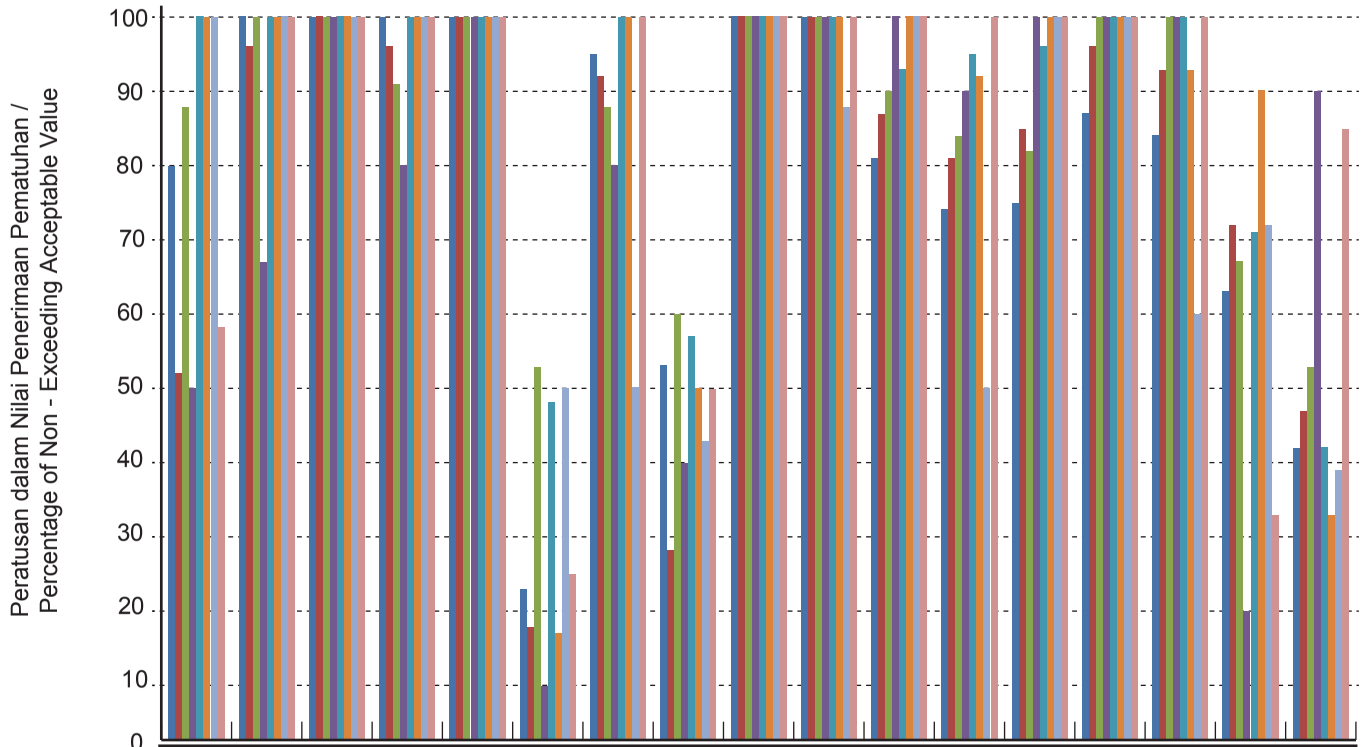
Jadual 3.17 menunjukkan nilai peratusan yang melebihi Standard Kualiti Air Tanah mengikut negeri.

In 2020, the results derived from monitoring showed that all stations were within the Groundwater Quality Standards for Conventional Raw Water Treatment (Drinking Water) values except for iron (Fe), manganese (Mn), total coliform and phenolics which had a low range of Groundwater Quality Standards for Conventional Raw Water Treatment (Drinking Water) value as shown in **Figure 3.12** and **Table 3.16**.

Table 3.17 shows the percentage of Groundwater Quality Standards exceedance by state.

Jadual 3.16 : Peratusan Pematuhan oleh Pencemar Terpilih mengikut Guna Tanah dalam Peratusan Julat 0% - 49%, 2020
Table 3.16 : Percentage of Compliance of Selected Contaminants by Land Use in Percentage of 0% - 49%, 2020

KATEGORI GUNA TANAH / CATEGORY OF LAND USE	PARAMETER	PERATUSAN PEMATUHAN KEPADA STANDARD / PERCENTAGE OF STANDARD COMPLIANCE
Tiada / Nil	Tiada / Nil	0% -10%
Tapak Perindustrian / Industrial Sites	Fe Phenol Mn T-Coliform	11% - 30%
Bekas Tapak Pelupusan Sampah / Used Solid Waste Landfill		
Bekalan Air / Water Supply		
Padang Golf / Golf Course		
Bekas Lombong / Used Mining		
Tapak Perindustrian / Industrial Sites	Fe Phenol Mn T-Coliform	31% - 49%
Bekas Tapak Pelupusan Sampah / Used Solid Waste Landfill		
Luar Bandar / Rural		
Bekalan Air / Water Supply		
Padang Golf / Golf Course		
Bekas Lombong / Used Mining		



	As	Hg	Cd	Cr	Cu	Fe	Pb	Mn	Zn	Se	$CaCO_3$	TDS	Cl	NO_3	SO_4	T - Coliform	Phenol
Industri / Industrial	80	100	100	100	100	23	95	53	100	100	81	74	75	87	84	63	42
Tapak Pelupusan Sampah / Used Solid Waste Landfills	52	96	100	96	100	18	92	28	100	100	87	81	85	96	93	72	47
Pertanian / Agriculture	88	100	100	91	100	53	88	60	100	100	90	84	82	100	100	67	53
Bekalan Air / Water Supply	50	67	100	80	100	10	80	40	100	100	100	90	100	100	100	20	90
Bandar / Pinggir Bandar / Urban / Suburban	100	100	100	100	100	48	100	57	100	100	93	95	96	100	100	71	42
Padang Golf / Golf Course	100	100	100	100	100	17	100	50	100	100	100	92	100	100	93	90	33
Luar Bandar / Rural	100	100	100	100	100	50	50	43	100	88	100	50	100	100	60	72	39
Bekas Lombong / Used Mining	58	100	100	100	100	25	100	50	100	100	100	100	100	100	100	33	85

Rajah 3.12 : Peratusan Pematuhan oleh Pencemar Terpilih mengikut Guna Tanah, 2020
Figure 3.12 : Percentage of Compliance of Selected Contaminants by Land Use, 2020

Jadual 3.17 : Nilai Peratusan yang Melebihi Standards Kualiti Air Tanah mengikut Negeri, 2020

Table 3.17 : Percentage Value Exceeding Groundwater Quality Standards by State, 2020

NEGERI/ STATE	BILANGAN STESEN / NO. OF STATION	MAKLUMAT STESEN / STATION DESCRIPTION	NILAI PERATUSAN YANG MELEBIHI GWQI(%) / THE PERCENTAGE OF EXCEEDANCE GWQI (%)				
			As	Fe	Mn	T-COLIFORM	PHENOL
Sabah	14	1) ITAC, Penampang 1	75	50	50	0	75
		2) ITAC, Penampang 2	25	25	75	100	100
		3) ITAC, Penampang 3	0	0	50	50	100
		4) ITAC, Penampang 4	0	0	50	50	50
		5) ITAC, Penampang 5	50	50	50	50	50
		6) ITAC, Penampang 6	0	0	50	100	100
		7) ITAC, Penampang 7	0	25	50	100	100
		8) Limbawang	25	75	100	100	100
		9) Tawau	25	25	50	100	100
		10 Kg. Tajau Laut	0	75	75	100	100
		11) Sandakan Golf Club No.1	25	0	0	50	75
		12) Sandakan Golf Club No.2	25	25	25	100	75
		13) Inanam	0	75	75	75	75
		14) Pulau Manukan	-	-	-	-	-
W.P. Labuan	1	1) Asian Supply Base	0	25	75	100	100
Sarawak	12	1) Kemuyang no.1	0	75	100	75	75
		2) Kemuyang no.2	0	75	100	100	100
		3) Kabong	75	100	100	100	100
		4) Kuala Lawas no.1	100	0	0	50	100
		5) Kuala Lawas no.2	-	-	-	-	-
		6) Laku	0	75	0	75	75
		7) Kg. Lusut Kir	50	100	100	100	100
		8) Bau no.1	100	100	100	100	100
		9) Bau no.2	75	75	100	100	100
		10) Bau	25	75	25	75	75
		11) Oya no.1	100	100	75	75	100
		12) Oya no.2	100	100	75	75	100
Terengganu	16	1) Kerteh no.1	0	0	0	75	75
		2) Kerteh no.2	0	25	0	100	100
		3) Telok Kalong no.1	0	100	0	75	75
		4) Telok Kalong no.2	25	25	100	75	75
		5) Kg. Kubang Badak no.1, K.Treg	0	0	0	75	75
		6) Kg. Kubang Badak no.2, K.Treg	0	100	0	75	100
		7) Kg. Merang,Setiu	0	0	0	75	75
		8) Kg. Raja no.1, Besut	0	0	0	0	75
		9) Kg. Raja no.2, Besut	0	100	100	75	75
		10) Bukit Payung, Marang	0	0	50	100	75
		11) Kg. Alor Peroi no.1	50	50	100	100	100
		12) Kg. Alor Peroi no.2	25	100	100	100	100
		13) Kg. Alor Peroi no.3	25	100	100	100	100
		14) SK Bari, Setiu	0	0	0	75	75
		15) Blue Archipelago	75	50	75	100	100
		16) SK Telaga, Hulu Terengganu	0	0	0	75	100

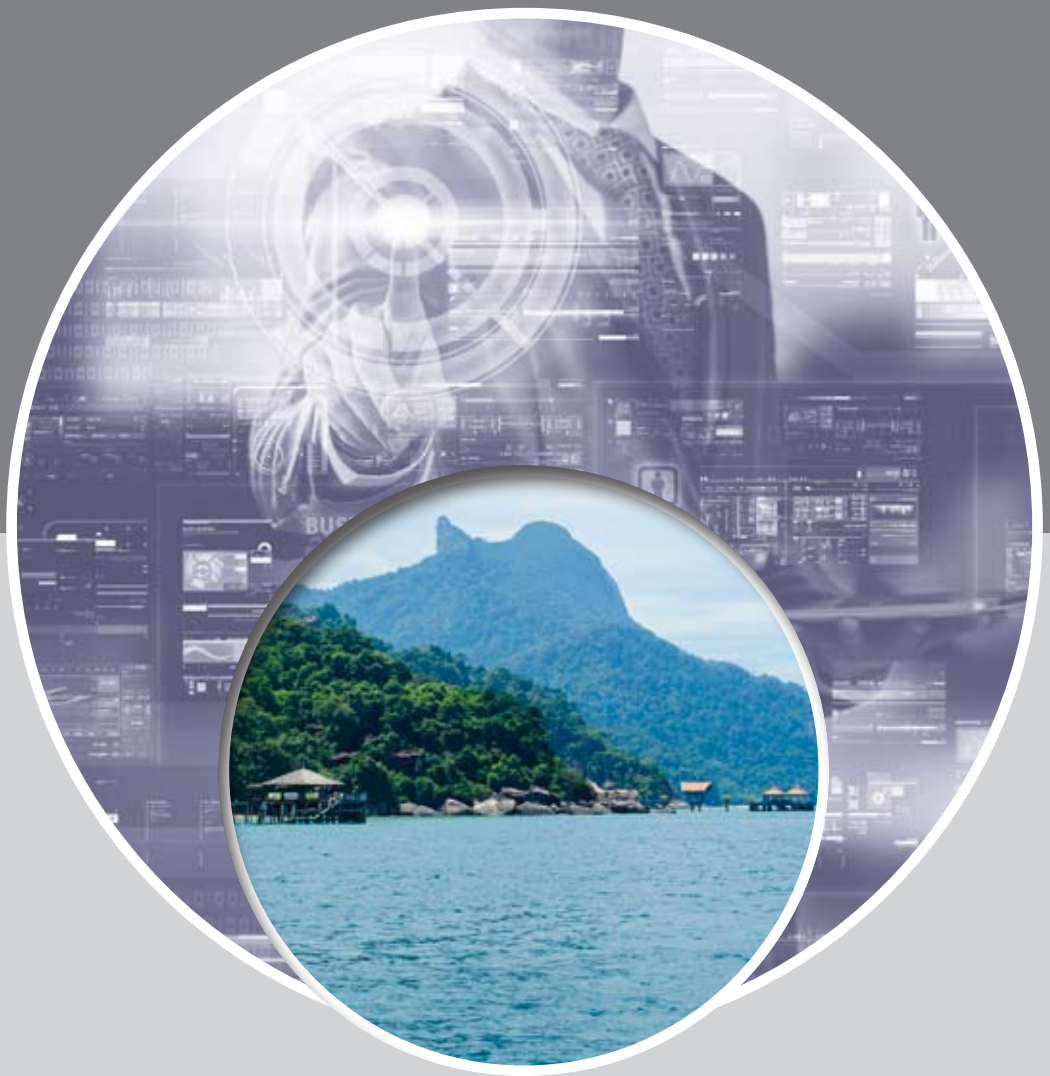
Jadual 3.17 : Nilai Peratusan yang Melebihi Standards Kualiti Air Tanah mengikut Negeri, 2020
Table 3.17 : Percentage Value Exceeding Groundwater Quality Standards by State, 2020

NEGERI/ STATE	BILANGAN STESEN / NO. OF STATION	MAKLUMAT STESEN / STATION DESCRIPTION	NILAI PERATUSAN YANG MELEBIHI GWQI(%) / THE PERCENTAGE OF EXCEEDANCE GWQI (%)				
			As	Fe	Mn	T-COLIFORM	PHENOL
Pahang	9	1) Nenasi	0	50	75	100	100
		2) Lepar	0	75	0	75	100
		3) Agrobest no.2, Nenasi	25	0	0	100	100
		4) Agrobest no.3, Nenasi	25	100	100	100	100
		5) Agrobest no.4, Nenasi	0	75	75	100	100
		6) Agrobest no.5, Nenasi	25	0	25	75	75
		7) Agrobest no.6, Nenasi	25	100	100	100	100
		8) Agrobest no.7, Nenasi	0	0	75	100	100
		9) Lynas	25	25	100	100	100
Johor	7	1) Tg. Puteri, Pasir Gudang (MUCC)	0	50	0	75	100
		2) Tg. Puteri, Pasir Gudang	100	100	100	100	100
		3) Kota Tinggi	25	75	100	100	100
		4) Ulu Choh (Pintu)	75	75	100	100	75
		5) Ulu Choh (Kolam)	75	75	100	100	100
		6) Ulu Choh (Sungai)	100	100	100	100	100
		7) Tapak Pelupusan Sisa Pepejal, Ladang CEP, Lot 2075, Mukim Renggam	75	100	100	100	100
Kedah	6	1) Kulim Hi-tech	0	0	0	75	100
		2) Pulau Langkawi no.1	0	50	0	25	100
		3) Pulau Langkawi no.2	100	0	0	25	100
		4) SK Darul Uloom Kepala Batas	75	100	100	100	100
		5) SK Kepala Batas	0	0	0	75	100
		6) Kuarters Imigresen, Tg. Rhu, Langkawi	0	0	0	75	100
Perlis	4	1) Arau no.1	0	100	0	50	50
		2) Arau no.2	0	0	50	50	50
		3) Rimba Mas	0	0	0	0	100
		4) Felda Chuping	0	0	0	75	50
Kelantan	16	1) Eastern Garment MFG no.1	0	75	75	75	75
		2) Eastern Garment MFG no.2	75	0	0	75	75
		3) Panji no.1	0	50	0	75	75
		4) Panji no.2	0	75	75	100	100
		5) Pasir Mas	0	100	100	100	100
		6) Kampong Jembal	0	50	75	75	100
		7) Beris Lalang	-	-	-	-	-
		8) Rantau Panjang no.1	0	75	0	50	50
		9) Rantau Panjang no.2	0	0	0	75	50
		12) Kelab Golf & Desa no.1	0	100	25	75	75
		13) Kelab Golf & Desa no.2	0	50	25	75	75
		10) Kelab Golf DiRaja Kubang Kerian no.1	50	100	75	100	100
		11) Kelab Golf DiRaja Kubang Kerian no.2	25	100	0	100	100
		14) Bachok no.1	25	25	50	75	75
		15) Bachok no.2	25	50	75	75	100
		16) SMK Cherang Ruku, Pasir Puteh	0	0	0	100	100

Jadual 3.17 : Nilai Peratusan yang Melebihi Standards Kualiti Air Tanah mengikut Negeri, 2020
Table 3.17 : Percentage Value Exceeding Groundwater Quality Standards by State, 2020

NEGERI/ STATE	BILANGAN STESEN / NO. OF STATION	MAKLUMAT STESEN / STATION DESCRIPTION	NILAI PERATUSAN YANG MELEBIHI GWQI(%) / THE PERCENTAGE OF EXCEEDANCE GWQI (%)				
			As	Fe	Mn	T-COLIFORM	PHENOL
Melaka	3	1) Petronas Sungai Udang	100	100	100	100	100
		2) Pusat Kecemerlangan Buangan Terjadual, Jabatan Alam Sekitar	0	75	0	100	100
		3) Tapak Pelupusan Sampah, Sungai Udang	75	75	100	100	100
Perak	5	1) Tambun	100	100	100	75	100
		2) Jalong no.2	-	-	-	-	-
		3) Batu Gajah	100	100	100	75	75
		4) Pusat Kecermelangan Kenderaan Bermotor, JAS Gopeng, Perak	-	-	-	-	-
		5) Jalong no.1	0	75	75	75	75
Kuala Lumpur	7	1) Jln. Sungai Besi no.1	100	67	100	100	100
		2) Jln. Sungai Besi no.2	0	0	0	75	75
		3) Jln. Sungai Besi no.3	0	0	0	75	75
		4) Taman Beringin no.1	50	75	33	33	50
		5) Taman Beringin no.2	75	75	33	100	100
		6) Royal Selangor Golf Club	-	-	-	-	-
		7) Taman Wetland, W.P. Putrajaya	50	50	0	75	75
Selangor	10	1) Sek Keb Seksyen 20, Shah Alam	0	25	0	75	75
		2) CIAST no. 1, Shah Alam	0	75	67	75	75
		3) CIAST no. 2, Shah Alam	0	75	75	75	75
		4) Saujana Golf Resort no. 1, Subang	50	75	75	75	75
		5) Saujana Golf Resort no. 2, Subang	75	75	50	75	75
		6) Stesen Kampung Sungai Keroh, Sepang	75	50	75	100	100
		7) TNB Sepang	25	100	100	100	100
		8) Ladang Sepang	0	75	75	100	100
		9) Masjid Jameul Huda, Parit 7, Sekinchan	50	0	0	25	50
		10) Institut Alam Sekitar (EIMAS)	0	0	0	50	50
Pulau Pinang	6	1) Mak Mandin no. 1	75	0	75	75	75
		2) Mak Mandin no. 2	100	50	50	50	75
		3) Bayan Lepas	0	0	0	75	75
		4) Valdor (Kelapa)	0	75	75	50	75
		5) Valdor (Tengah)	0	0	0	50	50
		6) Valdor (Jalan)	0	0	75	75	75
N. Sembilan	4	1) Senawang	75	50	0	75	75
		2) Kualiti Alam Sdn. Bhd no. 1	75	100	100	100	100
		3) Kualiti Alam Sdn. Bhd no. 2	100	100	75	100	100
		4) TPS Tanah Merah (Cypark) Port Dickson	100	100	100	100	100

BAB 4
CHAPTER 4



KUALITI AIR MARIN DAN PULAU-PULAU
MARINE AND ISLAND MARINE WATER QUALITY

KUALITI AIR MARIN DAN PULAU-PULAU / MARINE AND ISLAND MARINE WATER QUALITY

PENGAWASAN KUALITI AIR MARIN

Jabatan Alam Sekitar (JAS) telah menjalankan pengawasan kualiti air marin semenjak tahun 1978 di Semenanjung Malaysia dan 1985 di Sabah dan Sarawak. Objektif utama program pengawasan kualiti air marin ini adalah untuk menilai status kualiti air marin dan seterusnya untuk menentukan tahap pencemaran daripada punca-punca di daratan dan juga laut. Punca-punca pencemaran ini boleh menimbulkan ancaman pada kemampanan ekosistem dari segi kesihatan dan biodiversiti persekitaran marin.

Stesen-stesen pengawasan yang dibangunkan di bawah Program Pengawasan Kualiti Air Marin diklasifikasikan kepada tiga (3) kategori seperti berikut:-

MARINE WATER QUALITY MONITORING

The Department of Environment (DOE) has been monitoring the marine water quality since 1978 in Peninsular Malaysia and since 1985 in Sabah and Sarawak. The primary objective of the monitoring programme is to assess the marine water quality status and subsequently to determine the degree of pollution from both land-based as well as sea-based sources. The pollution sources are threatening both the sustainability of the ecosystem health and the biodiversity of the marine environment.

Monitoring stations established under the Marine Water Quality Monitoring Program are classified into three (3) groups as follows:

1 **Stesen Pantai**
Coastal Stations

2 **Stesen Muara Sungai**
Estuary Stations

3 **Stesen Pulau**
Island Stations

Stesen pantai terletak di sepanjang pantai kira-kira 100 meter dari gigi air laut dan ia mestilah sekurang-kurangnya 500 meter dari punca yang berpotensi sebagai punca pencemaran.

Coastal stations are located along the coastline; approximately 100 meter from the water edge and it must be at least 500 meters away from potential point source(s).

Stesen muara sungai terletak di persekitaran muara sungai di mana terdapat interaksi antara air tawar dan air laut. Stesen muara sungai banyak menerima kesan daripada ekosistem sungai.

Stesen pulau pula dibahagikan kepada empat (4) kategori termasuk Pulau (Kawasan Dilindungi), Pulau (Taman Laut), Pulau (Pembangunan) dan Pulau (Resort).

- Stesen Pulau (Kawasan Dilindungi) adalah stesen yang dibangunkan di dalam Kawasan Perlindungan Perikanan di bawah Peraturan-Peraturan Perikanan (Kawasan Larangan) 1994.
- Stesen Pulau (Taman Laut) adalah stesen pengawasan yang dibangunkan di kawasan Taman Laut yang ditetapkan di bawah Perintah Penubuhan Taman Laut Malaysia 1994.
- Stesen Pulau (Pembangunan) adalah stesen pengawasan yang dibangunkan di sekitar pulau yang sekurang-kurangnya 90 km^2 dengan jumlah penduduk lebih daripada 20,000 orang; atau/ dan pulau-pulau yang ada kepentingan ekonomi.
- Stesen Pulau (Resort) adalah stesen pengawasan di sekitar pulau yang dibangunkan untuk pelancongan, yang mempunyai resort dan chalet sebagai pemacu ekonomi setempat bagi pulau tersebut.

Standard Kualiti Air Marin Malaysia (SKAMM) merupakan standard ambien, memberi fokus pada perlindungan dan kelestarian ekosistem akuatik serta perkhidmatan ekosistem tersebut kepada masyarakat dan mengambilkira faktor ekonomi, praktikal dan sosial.

Pemakaian SKAMM adalah berdasarkan pra penentuan pengkelasan air marin mengikut kegunaan di persekitaran tersebut. Terdapat lima (5) kelas dikategorikan dalam SKAMM iaitu:-

1. Kelas 1 merangkumi air di perairan yang diwartakan atau ada perlindungan berkanun dan perairan yang tidak diwartakan tetapi ada ekosistem marin yang sensitif seperti terumbu karang, rumpai laut, tapak pendaratan penyu dan perairan yang terdapat habitat tertentu seperti habitat sensitif kawasan sumber makanan organisma marin.

Estuary stations are located within an estuarine environment where the freshwater and seawater interact. The estuarine stations have been impacted by the riverine ecosystem.

Island Stations are further divided into four (4) categories : Island (Protected Area), Island (Marine Park), Island (Development) and Island (Resorts).

- Island Stations (Protected Area) are those stations established within the Fisheries Protected Area under the Fisheries (Prohibited Area) Regulation, 1994.
- Island Stations (Marine Park) are those established within the designated Marine Park area under the Marine Parks Malaysia Order 1994.
- Island Stations (Development) are monitoring stations established around islands that are at least 90 km^2 with a total population of more than 20,000 people and/or islands of economic importance.
- Island Stations (Resort) are those that have been established surrounding islands developed for tourism; with resorts and chalets developed on the islands as the key economy driver for the islands.

The Malaysian Marine Water Quality Standards (MMWQS) are ambient standards, with a focus on the protection and sustainability of the aquatic ecosystem; the importance of the ecosystems for society; and to accomplish it in an economical, practical and socially relevant manner.

The application of MMWQS is based on the pre-determination of marine water classification according to its uses in the environment. Five (5) classes are categorized in MMWQS:-

1. Class 1 water comprises the gazetted and statutory protected waters; and un-gazetted areas but with the presence of sensitive ecosystem including coral reefs, seagrass, turtle landing sites and water specific to habitats and feeding grounds of sensitive marine organisms.

2. Kelas 2 merangkumi air yang ada aktiviti perikanan dan marikultur yang berdasarkan pada zon penangkapan ikan yang diterbitkan oleh Jabatan Perikanan sebagai panduan. Perairan dalam Kelas 2 terdiri daripada sebahagian zon pemuliharaan (termasuk `Kawasan Larangan Perikanan') sehingga ke Zon Ekonomi Eksklusif (ZEE). Aktiviti marikultur yang ditakrifkan sebagai Kelas 2 adalah aktiviti dalam badan air marin tersebut (seperti penternakan sangkar dan penternakan kerang) dan tidak termasuk aktiviti akuakultur perikanan darat.

3. Kelas 3 ialah standard untuk kualiti air marin yang terdedah kepada pelepasan efluen secara langsung daripada aktiviti antropogenik. Oleh itu, ekosistem di perairan ini akan mengalami banyak pencemaran. Tahap perlindungan adalah bertujuan untuk mengekalkan kesihatan ekosistem yang masih ada dan memulihara kualiti air marin di kawasan yang terjejas.

4. Kelas E (Interim) adalah standard yang banyak dipengaruhi oleh musim dan variasi diurnal. Selain itu, ciri-ciri geologi dan corak pergerakan air turut menyumbang pada sifat dinamik di perairan ini. Berdasarkan pada kepelbagaian semulajadi ini, Standard Kelas E terhasil adalah daripada ciri-ciri kualiti air muara sungai yang boleh mewakili persekitaran yang belum terganggu. Kawasan muara sungai sebegini akan dijadikan tapak rujukan untuk mewakili tiga jenis muara utama di Malaysia. Kelas E1 dipilih untuk mewakili muara jenis dataran pantai, Kelas E2 mewakili muara jenis lagun manakala Kelas E3 akan mewakili muara sungai yang besar dan ada rangkaian kompleks.

5. Kelas R adalah standard untuk kegunaan air marin bagi tujuan rekreasi. Ia merujuk pada Standard Kebangsaan Kualiti Air Rekreasi Semulajadi dan Garispanduan bagi Pemantauan Kualiti Air Rekreasi Semulajadi (Air Marin & Air Tawar) yang diterbitkan oleh Kementerian Kesihatan Malaysia.

2. Class 2 water encompasses both fisheries and mariculture activities, based on fishing zones established by the Department of Fisheries as a guide. Its water comprises the conservation zone (including 'Fisheries Prohibited Area') right up to the Economic Exclusive Zone (EEZ). Mariculture activities are defined within the marine water bodies such as marine cage and cockle culture; but excluding land aquaculture activities.

3. Class 3 is the standard for marine water which is exposed to direct effluence from anthropogenic activities. Hence, ecosystems in these areas are subject to some degree of degradation. The corresponding level of protection is therefore aimed at sustaining the health of the remaining ecosystem and to improve water quality of the affected area.

4. Class E (Interim) is the standard for estuarine water subject to both seasonal and diurnal variation. In addition, the geological characteristics and water circulation patterns also contribute to the dynamic nature of these waters. Based on these natural variations, the standards derived from the water quality characteristic of estuarine waters is deemed to represent a relatively undisturbed environment. These sites, which are referred to as Reference Sites, are selected to represent the three major estuary types in Malaysia. Hence, Class E1 is taken to be representative of coastal plain, Class E2 represents the lagoon type estuary while Class E3 is to be referred to when assessing estuaries with large and complex distributary network.

5. Class R is the standard for recreational use of marine waters. It is based on the National Standard for Water Quality for Nature-based Recreation, and Guidelines for Monitoring for Nature-based Recreation (Marine and Freshwater) by the Ministry of Health, Malaysia.

IKAMM adalah pengagregatan parameter kualiti air marin yang paling relevan bertujuan untuk menyediakan maklumat yang berkaitan dengan status kualiti air marin bagi badan air. Indeks ini berdasarkan pada enam (6) parameter kualiti air iaitu oksigen terlarut, faecal coliform, ammonia, nitrat, fosfat dan jumlah pepejal terampai.

Pengagregatan IKAMM adalah dalam julat daripada 0 hingga 100, dengan 0 menunjukkan kualiti air sebagai tercemar manakala 100 menunjukkan kualiti air sebagai terbaik (**Jadual 4.1**).

Sebanyak 188 stesen pantai, 85 stesen muara sungai dan 95 stesen pulau telah dipantau pada tahun 2020. Terdapat enam (6) frekuensi persampelan bagi setiap stesen dengan jumlah sampel sebanyak 1127 sampel untuk stesen pantai, 509 sampel untuk stesen muara sungai dan 565 sampel untuk stesen pulau. Sampel-sampel tersebut dianalisa dan hasil analisa dirumuskan berdasarkan IKAMM bagi enam (6) frekuensi.

MMWQI is an aggregation of the most relevant marine water quality parameters aimed at providing information pertinent to the marine water quality status of a water body. The index is derived based on six (6) water quality parameters, which are dissolved oxygen, faecal coliform, unionized ammonia, nitrate, phosphate and total suspended solid.

The MMWQI aggregation is scaled from 0 to 100 where 0 indicates poor water quality while 100 indicates excellent water quality (**Table 4.1**).

A total of 188 coastal stations, 85 estuary stations and 95 island stations were monitored in the year of 2020. There were six (6) sampling frequencies in total for each monitoring station amounting to 1127 samples for coastal stations, 509 samples for estuary stations and 565 samples for island stations. The samples were analysed and results were summarised based on the MMWQI of the six (6) frequencies.

Jadual 4.1 : Klasifikasi Indeks Kualiti Air Marin Malaysia (IKAMM)
Table 4.1 : Malaysian Marine Water Quality Index (MMWQI) Classification

KATEGORI / CATEGORY	NILAI INDEKS / INDEX VALUE
Terbaik / Excellent	90 -100
Baik / Good	80 - <90
Sederhana / Moderate	50 - <80
Tercemar / Poor	0 - <50

Jadual 4.2 : Standard Kualiti Air Marin Malaysia
Table 4.2 : Malaysian Marine Water Quality Standards

PARAMETER (µg/l) MELAINKAN DINYATAKAN SEBALIKNYA / PARAMETER (µg/l) UNLESS OTHERWISE STATED	KLASIFIKASI / CLASSIFICATION					
	KELAS 1 / CLASS 1	KELAS 2 / CLASS 2	KELAS 3 / CLASS 3	INTERIM KELAS E1 / INTERIM CLASS E1	INTERIM KELAS E2 / INTERIM CLASS E2	INTERIM KELAS E3 / INTERIM CLASS E3
	HABITAT MARIN SENSITIF / SENSITIVE MARINE HABITATS	PERIKANAN (TERMASUK MARIKULTUR) / FISHERIES (INCLUDING MARICULTURE)	INDUSTRI, AKTIVITI KOMERSIAL & KAWASAN KEDIAMAN PESISIR PANTAI / INDUSTRY, COMMERCIAL ACTIVITIES & COASTAL SETTLEMENTS	MUARA SUNGAI / ESTUARIES		
				DATARAN PANTAI / COASTAL PLAIN	LAGUN / LAGOON	RANGKAIAN KOMPLEKS / COMPLEX DISTRIBUTARY NETWORK
Oksigen Terlarut / Dissolved Oxygen (mg/l)	>6.0	>5.0	>3.0	>5.0	>5.0	>5.0
Jumlah Pepejal Terampai / Total Suspended Solids (mg/l)	25.0	50.0	100.0	30.0	30.0	30.0
Fosfat / Phosphate	5.0	75.0	670.0	100.0	180.0	180.0
Nitrat / Nitrate	10.0	60.0	700.0	200.0	570.0	430.0
Ammonia	35.0	50.0	320.0	5.0	10.0	10.0
Merkuri / Mercury	0.04	0.04	0.04	0.04	0.04	0.04
Kadmium / Cadmium	0.50	2.00	3.00	1.00	1.00	1.00
Kromium (VI) / Chromium (VI)	0.14	10.00	20.00	10.00	10.00	10.00
Kuprum / Copper	1.30	2.90	8.00	1.00	1.00	1.00
Sianida / Cyanide	2.00	7.00	14.00	5.00	5.00	5.00
Plumbum / Lead	2.20	8.50	12.00	1.30	2.00	2.00
Zink / Zinc	7.00	50.00	100.00	16.00	5.00	5.00
Arsenik (III) / Arsenic (III)	1.00	3.00	3.00	3.00	1.00	1.00
Aluminium	27.0	27.0	55.0	27.0	27.0	27.0
Tributyltin (TBT)	0.001	0.010	0.050	0.002	0.002	0.002
Polycyclic Aromatic Hydrocarbon (PAH)	100.0	200.0	1000.0	5.0	5.0	5.0
Jumlah Fenol / Total Phenol	1.0	10.0	100.0	10.0	10.0	10.0
Minyak & Gris / Oil & Grease (mg/l)	0.01	0.14	5.00	1.00	1.00	1.00
Faecal Coliform (Cfu/100ml)	70	70	70	70	70	70
Suhu / Temperature (°C)	≤ 2 °C bertambah melebihi ambien maksimum / ≤ 2 °C increase over maximum ambient					
pH	6.5 - 9.0					
Marine Litter	Bebas dari marine litter / Free from marine litter					

STATUS STESEN-STESEN PENGAWASAN KUALITI AIR MARIN

Dalam tahun 2020, daripada 368 stesen pengawasan kualiti air marin bagi pantai, muara sungai dan pulau di negara ini, sebanyak 104 stesen adalah terbaik, 56 stesen baik, sementara 190 stesen sederhana manakala 18 stesen tercemar.

13 daripada stesen tercemar berada di kawasan muara sungai, empat (4) di kawasan pantai dan satu (1) di kawasan pulau.

Selangor mempunyai bilangan stesen tercemar yang paling tinggi, diikuti oleh Pulau Pinang, Johor, Sarawak, Perak dan Melaka. Hanya Terengganu dan Wilayah Persekutuan Labuan yang tidak mempunyai rekod stesen tercemar pada tahun ini. Faecal coliforms, nutrien dan jumlah pepejal terampai adalah parameter utama yang menyebabkan kualiti air marin merosot secara konsistensi dalam rangkaian Pengawasan Kualiti Air Marin Manual.

Jumlah faecal coliform, *E. coli* dan enterococci yang tinggi terdapat di stesen yang kategori tercemar yang terletak berdekatan muara sungai menunjukkan kemungkinan terdapat pencemaran kumbahan di persekitaran marin.

Fenomena La Nina dan Perintah Kawalan Pergerakan (PKP) yang ditetapkan oleh Kerajaan untuk mencegah penularan secara meluas wabak COVID-19 adalah antara faktor yang mempengaruhi status kualiti air marin di negara ini pada tahun 2020.

Jadual 4.3, **Jadual 4.4** dan **Jadual 4.5** menunjukkan senarai stesen pantai, muara sungai dan pulau yang mencapai kategori terbaik berdasarkan IKAMM bagi tahun 2020.

Rajah 4.1-4.6 menunjukkan status kualiti air marin berdasarkan IKAMM mengikut lokasi stesen pengawasan bagi pantai, muara sungai dan pulau-pulau tahun 2020

STATUS OF MARINE WATER QUALITY MONITORING STATIONS

In 2020, out of the 368 marine water quality monitoring stations at coastal, estuary and islands in the country, 104 stations were categorised as excellent, 56 stations are good, while 190 stations were categorised as moderate. The remaining 18 stations were categorised as poor.

13 of the poor water quality stations were located at the estuary, four (4) were located at coastal while the remaining one (1) was located at the island.

Selangor had the largest number of poor stations, followed by Penang, Johor, Sarawak, Perak and Melaka. Only Terengganu and Labuan Federal Territory did not register any poor stations in 2020 . Faecal coliforms, nutrients and total suspended solids (TSS) are key parameters that have degraded the consistency of the water quality in the Manual Marine Water Quality Monitoring (MMWQM) network.

High faecal coliform, *E. coli* and enterococci levels found in stations under the poor category were situated near river estuaries suggesting the possibility of sewage contamination in the marine environment.

The La Nina phenomena and the Government Movement Control Order (MCO) to curb the spread of COVID-19 pandemic are among the prevailing factors which affected the status of the marine water quality in the country in year 2020.

Table 4.3, Table 4.4 and **Table 4.5** show the list of coastal, estuary and island stations that achieved the excellent category based on MMWQI in 2020.

Figures 4.1-4.6 shows the marine water quality status based on MMWQI according to coastal, estuary and island monitoring stations, 2020.

Jadual 4.3 : Senarai Stesen Pengawasan Kualiti Air Marin bagi Pantai dengan Status Kategori Terbaik, 2020
Table 4.3: List of Marine Water Quality Monitoring Stations for Coastal with Status of Excellent, 2020

BIL. / NO.	NEGERI / STATE	LOKASI / LOCATION
1	Pahang	Pantai Legenda A
2	Pahang	Pantai Cherating (Legend A)
3	Terengganu	Pantai Tok Jembal
4	Kedah	Pantai Tengah
5	Pahang	Pantai Cherating (Legend B)
6	Pahang	Pantai Legenda B
7	Johor	Pantai Desaru
8	Pahang	Pantai Teluk Cempedak B
9	Terengganu	Pantai Rhu 10
10	Kedah	Pantai Kok

Nota / Notes:
Senarai menunjukkan sepuluh (10) stesen teratas dengan status kategori terbaik / The list shows the top ten (10) stations with the Excellent Category

Jadual 4.4 : Senarai Stesen Pengawasan Kualiti Air Marin bagi Muara Sungai dengan Status Kategori Terbaik, 2020
Table 4.4: List of Marine Water Quality Monitoring Stations for Estuary with Status of Excellent, 2020

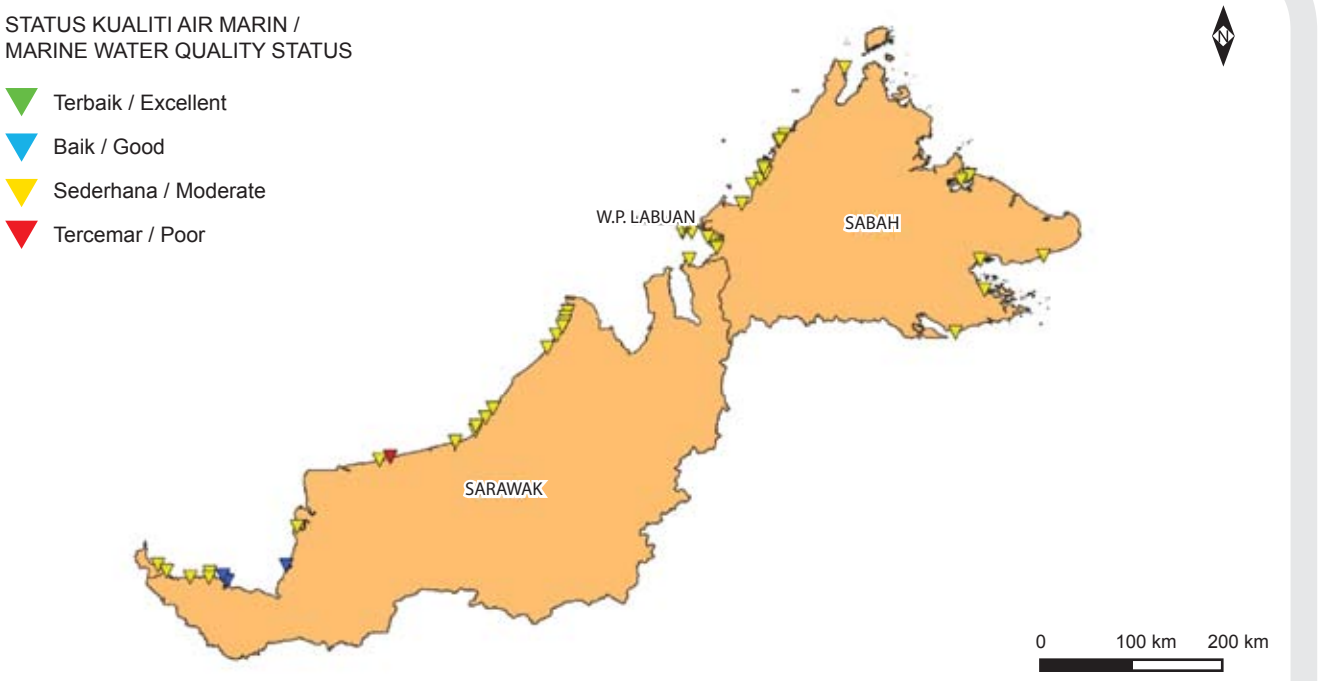
BIL. / NO.	NEGERI / STATE	LOKASI / LOCATION
1	Terengganu	Tioxide Utara (Kg. Bukit Kuang, Kijal)
2	Terengganu	Tioxide Selatan (KSB, T. Kalong)
3	Pahang	Kuala Nenasi*

Jadual 4.5 : Senarai Stesen Pengawasan Kualiti Air Marin bagi Pulau dengan Status Kategori Terbaik, 2020
Table 4.5: List of Marine Island Water Quality Monitoring Stations for Island with Status of Excellent, 2020

BIL. / NO.	NEGERI / STATE	LOKASI / LOCATION
1	Terengganu	Ekor Tebu
2	Kedah	Payar
3	Kedah	Pasir
4	Pahang	Sepui
5	Terengganu	Perhentian Besar (West)
6	Terengganu	Perhentian Kecil
7	Terengganu	Lang Tengah
8	Melaka	Undan (Point A)
9	Melaka	Undan (Point B)
10	Pahang	Cebeh

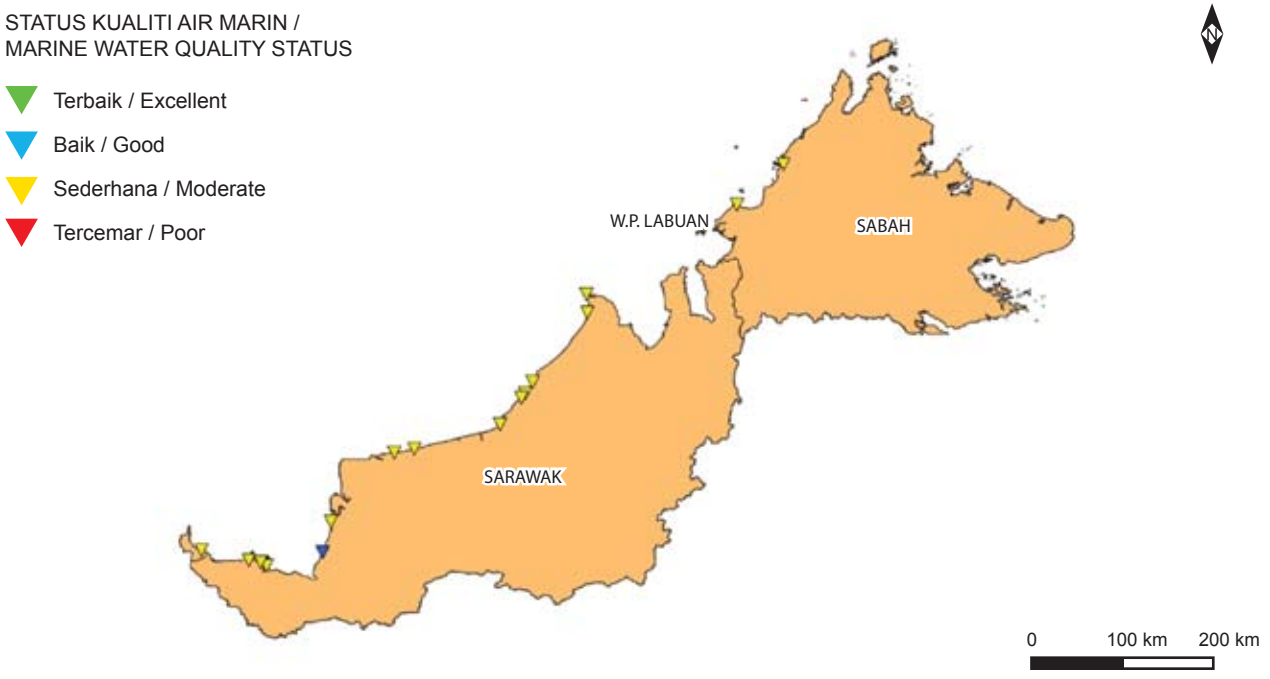
Nota / Notes:
Senarai menunjukkan sepuluh (10) stesen teratas dengan status kategori terbaik / The list shows the top ten (10) stations with Excellent Category

Rajah 4.1 : Status Kualiti Air Marine mengikut Lokasi Stesen Pengawasan bagi Pantai di Semenanjung Malaysia
Figure 4.1 : Marine Water Quality Status based on the Location Monitoring Stations for Coastal at Peninsular Malaysia

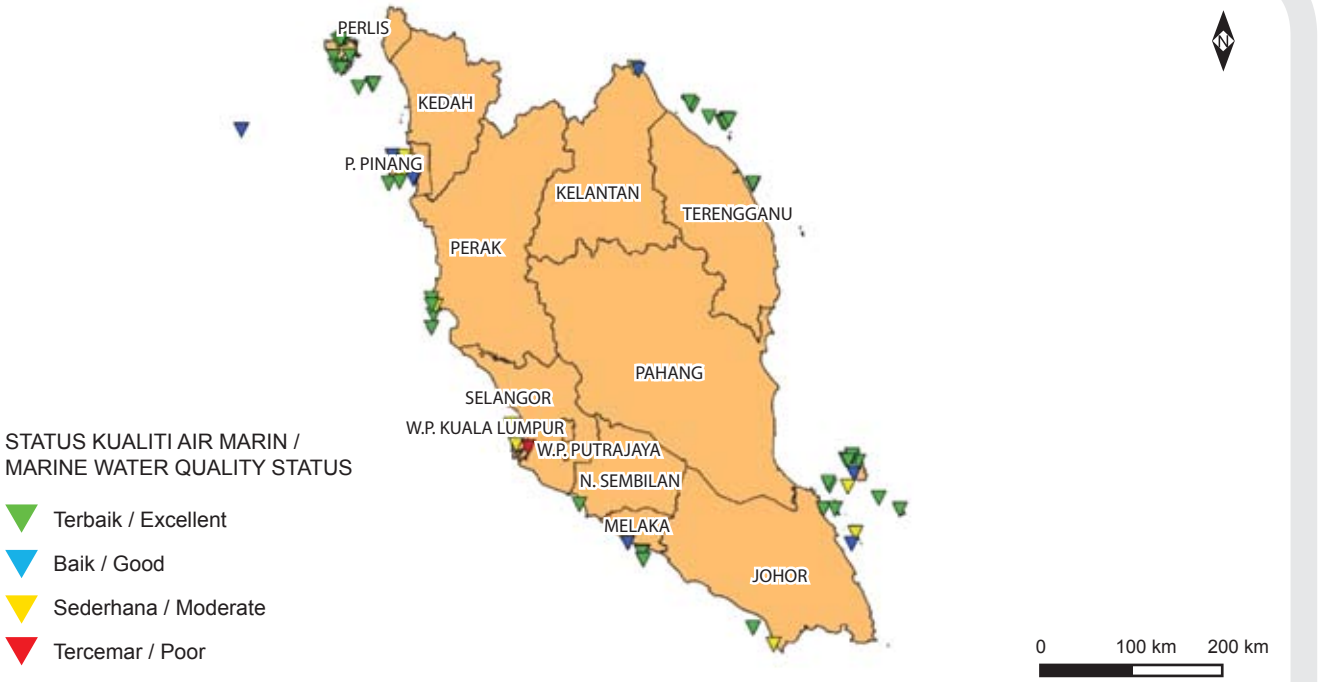


Rajah 4.2 : Status Kualiti Air Marine mengikut Lokasi Stesen Pengawasan bagi Pantai di Sabah, Sarawak dan W.P. Labuan
Figure 4.2 : Marine Water Quality Status based on the Location Monitoring Stations for Coastal at Sabah, Sarawak and Labuan

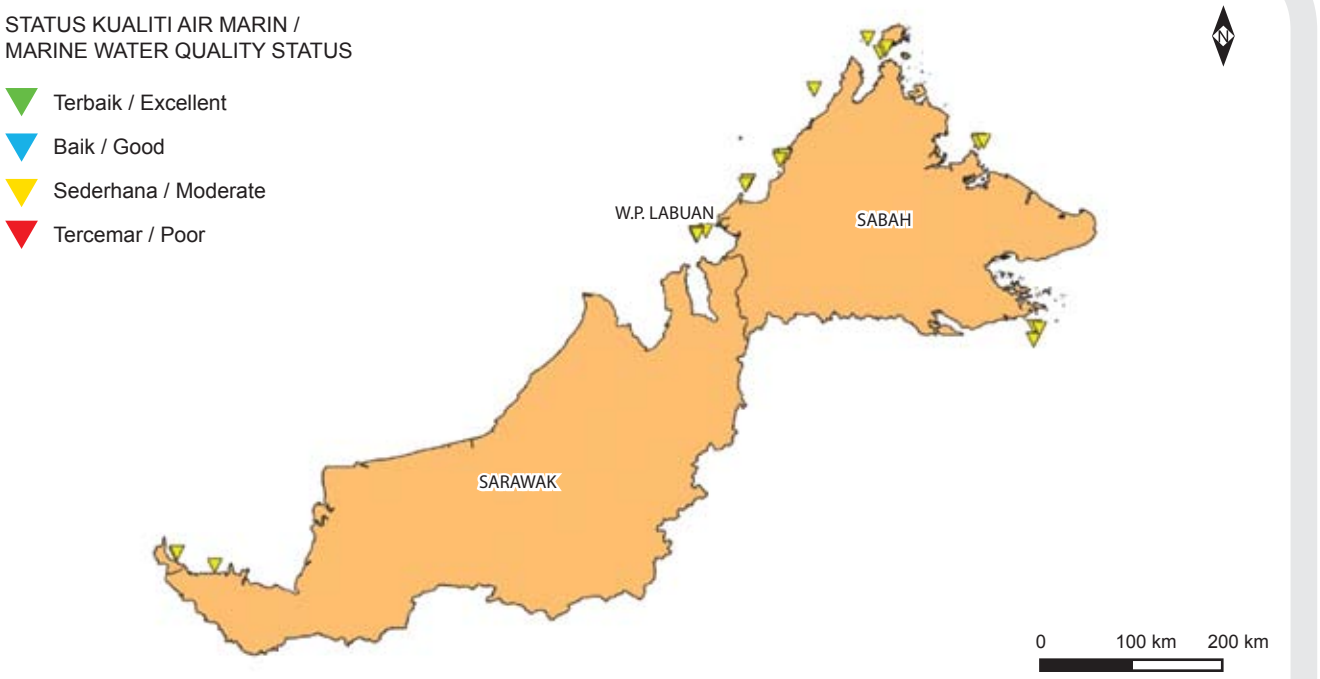
Rajah 4.3 : Status Kualiti Air Marine mengikut Lokasi Stesen Pengawasan bagi Muara Sungai di Semenanjung Malaysia
Figure 4.3 : Marine Water Quality Status based on the Location Monitoring Stations for Estuary at Peninsular Malaysia



Rajah 4.4 : Status Kualiti Air Marine mengikut Lokasi Stesen Pengawasan bagi Muara Sungai di Sabah dan Sarawak
Figure 4.4 : Marine Water Quality Status based on the Location Monitoring Stations for Estuary at Sabah and Sarawak



Rajah 4.5 : Status Kualiti Air Marine mengikut Lokasi Stesen Pengawasan bagi Pulau di Semenanjung Malaysia
Figure 4.5 : Marine Water Quality Status based on the Location Monitoring Stations for Island at Peninsular Malaysia



Rajah 4.6 : Status Kualiti Air Marine mengikut Lokasi Stesen Pengawasan bagi Pulau di Sabah, Sarawak dan W.P. Labuan
Figure 4.6 : Marine Water Quality Status based on the Location Monitoring Stations for Island at Sabah, Sarawak and Labuan

STATUS KUALITI AIR MARIN PANTAI

Sebanyak 188 stesen pantai dipantau pada tahun 2020. Daripada 188 stesen pantai, 55 stesen (29.26%) terbaik, 41 stesen (21.81%) baik, 88 stesen (46.81%) sederhana manakala empat (4) stesen (2.13%) tercemar **(Jadual 4.6).**

COASTAL WATER QUALITY STATUS

A total of 188 coastal stations were monitored for water quality in 2020. Of this number, 55 stations (29.26%) were ranked excellent, 41 (21.81%) ranked good, 88 stations (46.81%) ranked moderate while four (4) stations (2.13%) were ranked poor (**Table 4.6**).

Jadual 4.6 : Status Kualiti Air Marin bagi Pantai, 2020
Table 4.6 : Marine Water Quality Status for Coastal Areas, 2020

NEGERI / STATE	KLASIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN LAMA / OLD STATION NUMBER	NOMBOR STESEN BARU / NEW STATION NUMBER	NILAI IKAMM / MMWQI VALUE					KATEGORI STATUS KUALITI AIR MARIN (2020) / MARINE WATER QUALITY STATUS CATEGORY (2020)
					2016	2017	2018	2019	2020	
Kedah	Pantai / Coastal	Pantai Merdeka	5603905	MMKC001	76	79	91	79	71	Sederhana / Moderate
		Langkawi Island Resort	6399914	MMKC002	66	90	94	90	93	Terbaik / Excellent
		Pantai Kok	6397922	MMKC003	66	83	94	92	95	Terbaik / Excellent
		Pantai Kuah	6398925	MMKC004	71	91	94	84	89	Baik / Good
		Pantai Pasir Tengkorak	6499701	MMKC005	68	93	94	68	93	Terbaik / Excellent
		Pantai Teluk Burau	6396923	MMKC006	64	85	94	83	89	Baik / Good
		Pantai Teluk Nibong	6497915	MMKC007	63	91	84	91	94	Terbaik / Excellent
		Pantai Tengah	6297903	MMKC008	60	87	94	92	96	Terbaik / Excellent
		Pantai Beras Basah*	NA	MMKC009	-	93	94	92	95	Terbaik / Excellent
Pulau Pinang	Pantai / Coastal	Gertak Sanggul	5201919	MMPC001	53	71	81	58	84	Baik / Good
		Kawasan Perindustrian Bayan Lepas 1	5303932	MMPC002	-	67	59	56	56	Sederhana / Moderate
		Kawasan Perindustrian Bayan Lepas 2**	5303933	NA	-	-	-	-	-	Stesen tutup / Close station
		Kawasan Perindustrian Bayan Lepas 3**	5302939	NA	50	-	-	-	-	Stesen tutup/ Close station
		Pantai Bersih	5403906	MMPC003	76	50	66	58	58	Sederhana / Moderate
		Pantai Miami	5502901	MMPC004	61	68	93	69	81	Baik / Good
		Pantai Pasir Panjang	5201938	MMPC005	63	86	93	81	81	Baik / Good
		Batu Feringgi (Casuarina)	5402904	MMPC006	79	67	67	60	58	Sederhana / Moderate
		Luar Pantai Teluk Bahang	5402930	MMPC007	88	85	93	57	83	Baik / Good
		Persiaran Gurney	5403902	MMPC008	83	62	66	58	59	Sederhana / Moderate
		Rumah Pam Baru Perai	5304927	MMPC009	66	59	64	56	61	Sederhana / Moderate
		Rumah Pam Lama Perai	5303926	MMPC010	61	64	65	57	60	Sederhana / Moderate
		Selat PP Selatan (Jelutong)	5303911	MMPC011	60	49	59	57	55	Sederhana / Moderate
		Tanjung Bungah	5402937	MMPC012	83	84	67	57	70	Sederhana / Moderate
		Teluk Tempoyak	5202923	MMPC013	51	61	75	57	69	Sederhana / Moderate
		Batu Maung	5202901	MMPC014	46	59	62	57	56	Sederhana / Moderate

Jadual 4.6 : Status Kualiti Air Marin bagi Pantai, 2020
Table 4.6 : Marine Water Quality Status for Coastal Areas, 2020

NEGERI / STATE	KLASIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN LAMA / OLD STATION NUMBER	NOMBOR STESEN BARU / NEW STATION NUMBER	NILAI IKAMM / MMWQI VALUE					KATEGORI STATUS KUALITI AIR MARIN (2020) / MARINE WATER QUALITY STATUS CATEGORY (2020)
					2016	2017	2018	2019	2020	
Pulau Pinang	Pantai / Coastal	Pantai Sungai Batu Ferringhi 3*	NA	MMPC015	-	62	93	83	84	Baik / Good
		Pantai Sungai Batu Ferringhi 2*	NA	MMPC016	-	61	93	70	74	Sederhana / Moderate
		Pantai Sungai Batu Ferringhi 1*	NA	MMPC017	-	51	85	71	85	Baik / Good
Perak	Pantai / Coastal	Pantai Pasir Bogak	4205908	MMAC001	58	91	92	80	93	Terbaik / Excellent
		Pantai Teluk Dalam	4205928	MMAC002	75	91	93	88	89	Baik / Good
		Pantai Teluk Batik	4205932	MMAC003	51	89	92	62	84	Baik / Good
		Pantai Tanjung Batu	4406927	MMAC004	53	92	94	61	83	Baik / Good
		Pantai Teluk Rubiah*	NA	MMAC005	-	93	92	62	92	Terbaik / Excellent
		Pantai Damai Laut*	NA	MMAC006	-	91	92	70	93	Terbaik / Excellent
		Pantai Teluk Senangin*	NA	MMAC007	-	92	93	67	90	Terbaik / Excellent
		Pantai Pasir Panjang	4205924	MMAC008	52	93	93	70	94	Terbaik / Excellent
Selangor	Pantai / Coastal	Pantai Bagan Lalang	2616927	MMBC001	90	92	88	81	91	Terbaik / Excellent
		Pantai Morib	2712902	MMBC002	62	89	87	61	68	Sederhana / Moderate
		Selat Pulau Babi	3012929	MMBC003	75	72	90	73	73	Sederhana / Moderate
		Selat Klang Utara	3013908	MMBC004	78	64	62	56	55	Sederhana / Moderate
		Pantai Remis*	NA	MMBC005	-	67	90	58	63	Sederhana / Moderate
		Pantai Klanang*	NA	MMBC006	-	91	82	58	71	Sederhana / Moderate
N. Sembilan	Pantai / Coastal	Bagan Pinang	2518915	MMNC001	97	68	91	82	85	Baik / Good
		Telok Sinting	2419908	MMNC002	97	87	88	71	86	Baik / Good
		Port Dickson Bandar	2517907	MMNC003	97	68	68	60	74	Sederhana / Moderate
		Port Dickson Batu 4	2518937	MMNC004	97	67	90	81	86	Baik / Good
		Port Dickson Batu 5	2418906	MMNC005	97	79	68	63	67	Sederhana / Moderate
		Port Dickson Batu 6	2418916	MMNC006	97	68	92	77	90	Terbaik / Excellent
		Port Dickson Batu 7	2418905	MMNC007	97	67	88	86	92	Terbaik / Excellent
		Port Dickson Batu 8	2418912	MMNC008	97	75	87	86	85	Baik / Good
		Port Dickson Batu 10	2418914	MMNC009	97	68	89	84	92	Terbaik / Excellent
		Port Dickson Janakuasa TNB	2517909	MMNC010	97	68	68	59	89	Baik / Good
		Telok Pelanduk	2419917	MMNC011	97	81	90	87	83	Baik / Good
		Pantai Cermin	2416918	MMNC012	97	68	92	70	83	Baik / Good
		Pantai Teluk Kemang*	NA	MMNC013	-	68	67	83	94	Terbaik / Excellent
		Pantai Seri Purnama*	NA	MMNC014	-	85	93	80	90	Terbaik / Excellent
Melaka	Pantai / Coastal	Pantai Rombang	2221916	MMMC001	68	85	85	68	89	Baik / Good
		Pantai Kundur	2221908	MMMC002	57	84	82	77	90	Terbaik / Excellent
		Pantai Tanjung Bidara	2320909	MMMC003	57	82	93	78	90	Terbaik / Excellent

Jadual 4.6 : Status Kualiti Air Marin bagi Pantai, 2020
Table 4.6 : Marine Water Quality Status for Coastal Areas, 2020

NEGERI / STATE	KLASIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN LAMA / OLD STATION NUMBER	NOMBOR STESEN BARU / NEW STATION NUMBER	NILAI IKAMM / MMWQI VALUE					KATEGORI STATUS KUALITI AIR MARIN (2020) / MARINE WATER QUALITY STATUS CATEGORY (2020)
					2016	2017	2018	2019	2020	
Melaka	Pantai / Coastal	Teluk Gong	2320902	MMMC004	57	88	93	76	83	Baik / Good
		Pulau Melaka Point A1	2121915	MMMC005	72	64	67	60	91	Terbaik / Excellent
		Pulau Melaka Point A2	2121915	MMMC006	-	72	81	60	79	Sederhana / Moderate
		Pulau Melaka Point B1	2121916	MMMC007	63	63	62	57	58	Sederhana / Moderate
		Pulau Melaka Point B2	2121916	MMMC008	-	66	58	57	57	Sederhana / Moderate
		Pantai Klebang*	NA	MMMC009	-	67	81	58	78	Sederhana / Moderate
Johor	Pantai / Coastal	Tanjung Bin	1336975	MMJC001	84	92	92	81	90	Terbaik / Excellent
		Pelabuhan Tanjung Pelepas	1438943	MMJC002	85	90	92	67	92	Terbaik / Excellent
		Hadapan Jabatan Laut	1438918	MMJC003	84	80	88	77	87	Baik / Good
		Pantai Stulang Laut	1437951	MMJC004	76	61	63	49	48	Tercemar / Poor
		Jeti Teluk Jawa	1438918	MMJC005	53	62	62	52	62	Sederhana / Moderate
		Pelabuhan Pasir Gudang	1428939	MMJC006	75	64	65	54	57	Sederhana / Moderate
		Hadapan HSAJB	1437920	MMJC007	44	59	59	36	49	Tercemar / Poor
		Pantai Lido	1437921	MMJC008	66	55	52	37	44	Tercemar / Poor
		Pantai Teluk Mahkota	1841911	MMJC009	89	92	94	72	90	Terbaik / Excellent
		Pantai Tanjung Leman	2140694	MMJC010	88	94	93	87	83	Baik / Good
		Pantai Sri Pantai	2339960	MMJC011	88	94	94	87	87	Baik / Good
		Tanjung Merak	1441968	MMJC012	89	93	73	60	89	Baik / Good
		Tanjung Pengelih	1441967	MMJC013	88	93	93	77	90	Terbaik / Excellent
		Pantai Tanjong Stapa	1341961	MMJC014	89	93	93	86	91	Terbaik / Excellent
		Pantai Teluk Gorek	2538958	MMJC015	88	93	94	92	83	Baik / Good
		Pantai Air Papan	2538959	MMJC016	89	93	94	92	95	Terbaik / Excellent
		Jeti Kukup	1334925	MMJC017	87	88	89	58	59	Sederhana / Moderate
		Pasir Gogok	1441966	MMJC018	90	94	93	74	92	Terbaik / Excellent
		Tanjung Buai	1340973	MMJC019	80	92	92	63	75	Sederhana / Moderate
		Pantai Desaru	1542914	MMJC020	89	94	94	81	95	Terbaik / Excellent
		Tanjung Sepang	1443969	MMJC021	87	94	93	87	92	Terbaik / Excellent
		Tanjung Penyusup	1444920	MMJC022	86	92	93	62	83	Baik / Good
		Pantai Sungai Lurus	1730962	MMJC023	89	90	91	59	74	Sederhana / Moderate
		Punggur	1531974	MMJC024	88	84	87	59	69	Sederhana / Moderate
		Pantai Penyabung*	NA	MMJC025	-	93	93	80	82	Baik / Good
		Tanjung Resang*	NA	MMJC026	-	94	94	93	90	Terbaik / Excellent
		Tanjung Balau*	NA	MMJC027	-	93	93	84	93	Terbaik / Excellent
		Batu Layar*	NA	MMJC028	-	93	94	62	90	Terbaik / Excellent
		Tanjung Sengat*	NA	MMJC029	-	92	91	60	72	Sederhana / Moderate

Jadual 4.6 : Status Kualiti Air Marin bagi Pantai, 2020
Table 4.6 : Marine Water Quality Status for Coastal Areas, 2020

NEGERI / STATE	KLASIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN LAMA / OLD STATION NUMBER	NOMBOR STESEN BARU / NEW STATION NUMBER	NILAI IKAMM / MMWQI VALUE					KATEGORI STATUS KUALITI AIR MARIN (2020) / MARINE WATER QUALITY STATUS CATEGORY (2020)
					2016	2017	2018	2019	2020	
Pahang	Pantai / Coastal	Pantai Cherating (Club Med A)	4133903 (A)	MMCC001	60	92	94	88	91	Terbaik / Excellent
		Pantai Cherating (Club Med B)	4133903 (B)	MMCC002	61	93	94	85	94	Terbaik / Excellent
		Pantai Cherating (Legend A)	4133942 (A)	MMCC003	81	92	94	88	96	Terbaik / Excellent
		Pantai Cherating (Legend B)	4133942 (B)	MMCC004	61	89	94	94	96	Terbaik / Excellent
		Pantai Muhibbah Balok A	3933901 (A)	MMCC005	58	68	89	59	73	Sederhana / Moderate
		Pantai Muhibbah Balok B	3933901 (B)	MMCC006	59	65	83	59	67	Sederhana / Moderate
		Pantai Batu Hitam A	3833915 (A)	MMCC007	62	68	87	75	76	Sederhana / Moderate
		Pantai Batu Hitam B	3833915 (B)	MMCC008	56	81	91	62	73	Sederhana / Moderate
		Pantai Berserah A	3933941 (A)	MMCC009	65	80	90	74	76	Sederhana / Moderate
		Pantai Berserah B	3933941 (B)	MMCC010	63	67	90	80	60	Sederhana / Moderate
		Pantai Teluk Cempedak A	3833910 (A)	MMCC011	59	67	88	83	84	Baik / Good
		Pantai Teluk Cempedak B	3833910 (B)	MMCC012	59	88	91	90	95	Terbaik / Excellent
		Pantai Teluk Gelora A	3833909 (A)	MMCC013	64	67	77	75	60	Sederhana / Moderate
		Pantai Teluk Gelora B	3833909 (B)	MMCC014	59	66	76	62	59	Sederhana / Moderate
		Pantai Sepat A	3737915	MMCC015	88	91	93	81	92	Terbaik / Excellent
		Pantai Sepat B	3633916	MMCC016	80	91	93	88	92	Terbaik / Excellent
		Pantai Legenda A	3534943 (A)	MMCC017	85	93	94	93	97	Terbaik / Excellent
		Pantai Legenda B	3534943 (B)	MMCC018	79	93	94	92	96	Terbaik / Excellent
		Pantai Kuala Api-Api	3235917	MMCC019	79	90	93	58	85	Baik / Good
		Pantai Tanjung Batu	3334915	MMCC020	79	90	94	72	85	Baik / Good
		Pantai Chendor*	NA	MMCC021	–	86	94	84	87	Baik / Good
		Pantai Lanjut*	NA	MMCC022	–	93	92	86	85	Baik / Good
Terengganu	Pantai / Coastal	Pantai Batu Buruk	5331935	MMTC001	78	94	93	59	93	Terbaik / Excellent
		Pantai Bukit Keluang	5825903	MMTC002	64	94	94	86	95	Terbaik / Excellent
		Pantai Chendering	5231934	MMTC003	61	89	94	69	93	Terbaik / Excellent
		Pantai Rantau Abang	4833917	MMTC004	61	90	94	85	95	Terbaik / Excellent
		KIPC Utara	4634954	MMTC005	74	91	94	92	78	Sederhana / Moderate
		KIPC Tengah	4534955	MMTC006	77	89	94	90	88	Baik / Good
		KIPC Selatan	4534956	MMTC007	74	89	94	94	88	Baik / Good
		Pantai Rhu 10*	NA	MMTC008	-	94	94	89	95	Terbaik / Excellent
		Pantai Tok Jembal*	NA	MMTC009	-	94	94	95	96	Terbaik / Excellent
		Pantai Kelulut*	NA	MMTC010	-	94	94	95	93	Terbaik / Excellent
		Pantai Teluk Ketapang*	NA	MMTC011	-	94	94	80	95	Terbaik / Excellent

Jadual 4.6 : Status Kualiti Air Marin bagi Pantai, 2020
Table 4.6 : Marine Water Quality Status for Coastal Areas, 2020

NEGERI / STATE	KLASIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN LAMA / OLD STATION NUMBER	NOMBOR STESEN BARU / NEW STATION NUMBER	NILAI IKAMM / MMWQI VALUE					KATEGORI STATUS KUALITI AIR MARIN (2020) / MARINE WATER QUALITY STATUS CATEGORY (2020)
					2016	2017	2018	2019	2020	
Terengganu	Pantai / Coastal	Pantai Kuala Abang*	NA	MMTC012	-	94	94	88	94	Terbaik / Excellent
		Pantai Teluk Kalong*	NA	MMTC013	-	94	94	94	94	Terbaik / Excellent
		Pantai Sura*	NA	MMTC014	-	94	94	89	94	Terbaik / Excellent
		Pantai Tanjung Bidara*	NA	MMTC015	-	94	94	93	93	Terbaik / Excellent
		Pantai Kemasik*	NA	MMTC016	-	93	88	86	90	Terbaik / Excellent
Kelantan	Pantai / Coastal	Pantai Seri Tujuh	6221910	MMDC001	66	88	93	88	84	Baik / Good
		Pantai Cahaya Bulan	6122903	MMDC002	78	87	93	87	92	Terbaik / Excellent
		Pantai Sabak	6123909	MMDC003	66	81	93	88	89	Baik / Good
		Pantai Irama Bachok	6024908	MMDC004	66	86	93	89	66	Sederhana / Moderate
		Pantai Bisikan Bayu	5825905	MMDC005	66	89	94	95	83	Baik / Good
		Pantai Melawi*	NA	MMDC006	-	93	94	85	83	Baik / Good
Sarawak	Pantai / Coastal	Pantai Sematan	1898902	MMQC001	74	88	90	91	72	Sederhana / Moderate
		Pantai Pandan	1824918	MMQC002	75	87	91	91	75	Sederhana / Moderate
		Pantai Pasir Putih	1604910	MMQC003	88	80	87	91	80	Baik / Good
		Pantai Bako	1704906	MMQC004	74	88	89	91	85	Baik / Good
		Pantai Damai	1702904	MMQC005	89	86	91	91	68	Sederhana / Moderate
		Pantai Tanjung Kembang	1810923	MMQC006	85	69	85	88	86	Baik / Good
		Pantai Harmoni Mukah	2920921	MMQC007	85	72	86	89	60	Sederhana / Moderate
		Pantai Tanjung Batu	3132602	MMQC008	82	84	89	88	56	Sederhana / Moderate
		Pantai Likau	3230915	MMQC009	78	85	89	87	62	Sederhana / Moderate
		Pantai Emas	3331903	MMQC010	90	87	90	90	62	Sederhana / Moderate
		Pantai Piasau	4539918	MMQC011	68	86	89	87	70	Sederhana / Moderate
		Pantai Brighton	4449917	MMQC012	68	81	88	80	79	Sederhana / Moderate
		Pantai Esplaned	4339920	MMQC013	68	86	82	88	70	Sederhana / Moderate
		Pantai Beraya	4238921	MMQC014	68	87	88	90	65	Sederhana / Moderate
		Pantai Bungai	4137922	MMQC015	94	88	87	88	68	Sederhana / Moderate
		Pantai Belawai	2212913	MMQC016	73	84	88	90	66	Sederhana / Moderate
		Pantai Mukah*	NA	MMQC017	-	84	88	87	49	Tercemar / Poor
		Tanjung Kidurong*	NA	MMQC018	-	85	90	87	63	Sederhana / Moderate
		Pasir Pandak*	NA	MMQC019	-	86	90	90	74	Sederhana / Moderate
		Rambungan*	NA	MMQC020	-	89	90	89	69	Sederhana / Moderate
		Sri Tanjung Lawas*	NA	MMQC021	-	92	86	78	71	Sederhana / Moderate
		Pantai Luak*	NA	MMQC022	-	88	78	88	77	Sederhana / Moderate
		Pasir Panjang*	NA	MMQC023	-	87	88	91	55	Sederhana / Moderate

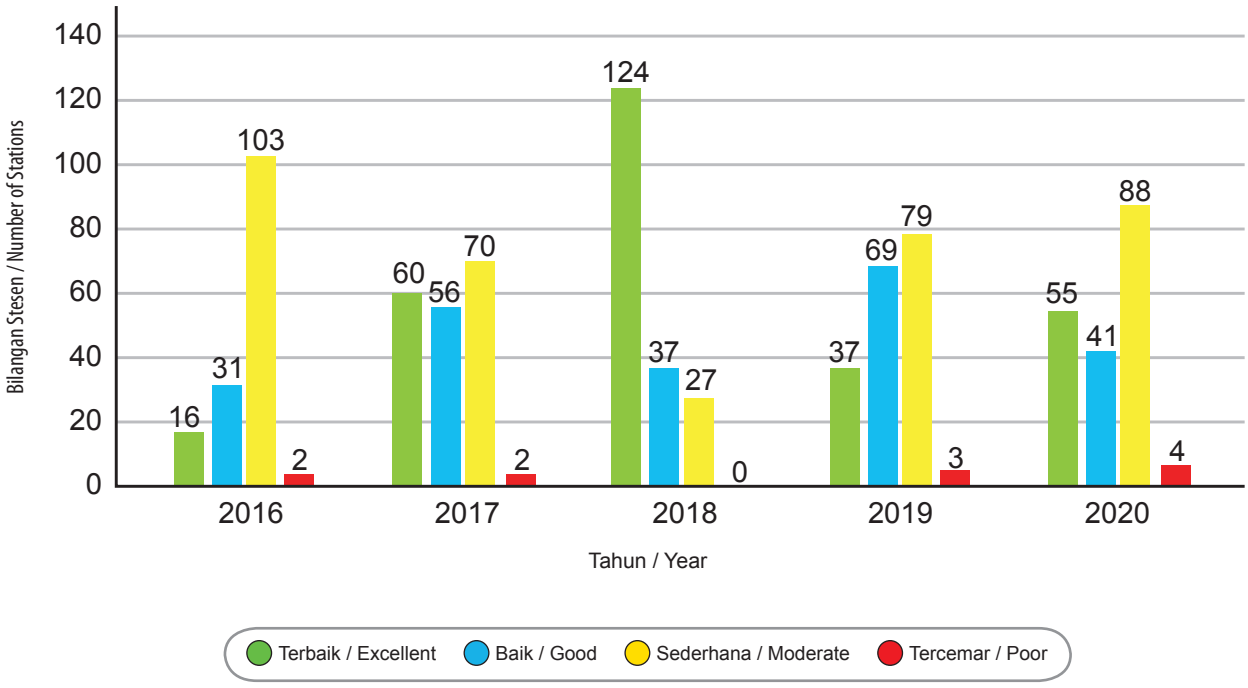
Jadual 4.6 : Status Kualiti Air Marin bagi Pantai, 2020
Table 4.6 : Marine Water Quality Status for Coastal Areas, 2020

NEGERI / STATE	KLASIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN LAMA / OLD STATION NUMBER	NOMBOR STESEN BARU / NEW STATION NUMBER	NILAI IKAMM / MMWQI VALUE					KATEGORI STATUS KUALITI AIR MARIN (2020) / MARINE WATER QUALITY STATUS CATEGORY (2020)
					2016	2017	2018	2019	2020	
Sabah	Pantai / Coastal	Pantai Teluk Brunei 1	5053901	MMSC001	66	70	92	85	67	Sederhana / Moderate
		Pantai Teluk Brunei 2	5053902	MMSC002	59	65	93	94	69	Sederhana / Moderate
		Pantai Teluk Brunei 3	5053903	MMSC003	67	65	92	81	62	Sederhana / Moderate
		Pantai Teluk Brunei 4	5053904	MMSC004	66	69	93	78	72	Sederhana / Moderate
		Pantai Teluk Brunei 5	5053905	MMSC005	65	69	93	88	64	Sederhana / Moderate
		Pantai Teluk Brunei 6	5053906	MMSC006	67	70	93	94	67	Sederhana / Moderate
		Borneo Golf Seawater	5355901	MMSC007	68	68	92	88	72	Sederhana / Moderate
		Pantai Manis Papar	5555901	MMSC008	66	69	91	92	60	Sederhana / Moderate
		Pantai Melinsung	5565902	MMSC009	67	73	93	90	67	Sederhana / Moderate
		Pantai Tanjung Aru (Roll Skating)	5656902	MMSC010	63	86	93	92	67	Sederhana / Moderate
		Pantai Tanjung Aru (No. 3)	5656903	MMSC011	67	82	93	88	64	Sederhana / Moderate
		Pantai Lok Kawi	5656904	MMSC012	62	85	93	87	72	Sederhana / Moderate
		Pantai Dalit Tuaran	6161901	MMSC013	64	74	93	88	78	Sederhana / Moderate
		Mangrove Paradise	6161902	MMSC014	68	86	93	87	73	Sederhana / Moderate
		Pantai Sabandar	6161903	MMSC015	67	71	93	95	75	Sederhana / Moderate
		Pantai Bak-Bak Kudat	6665901	MMSC016	63	70	93	85	62	Sederhana / Moderate
		Pasir Putih Sandakan	5580901	MMSC017	67	66	92	84	63	Sederhana / Moderate
		Pantai TLDM	5580902	MMSC018	69	69	92	67	72	Sederhana / Moderate
		Pantai Batu Sapi	5580903	MMSC019	67	51	93	93	61	Sederhana / Moderate
		Pantai Ulu Tungku	5085901	MMSC020	68	69	92	70	66	Sederhana / Moderate
		Pantai Sarina Kunak	4481901	MMSC021	69	68	93	84	74	Sederhana / Moderate
		Pantai Kg. Lamak	4581902	MMSC022	67	49	91	79	64	Sederhana / Moderate
		Pantai Tinagat	4473901	MMSC023	69	70	93	78	58	Sederhana / Moderate
		Pantai Tanjung Aru (Rest Lido)	5656901	MMSC024	68	86	93	79	63	Sederhana / Moderate
Labuan	Pantai / Coastal	Pulau Papan	5151905	MMLC001	75	73	92	68	62	Sederhana / Moderate
		Kiamsam	5151906	MMLC002	76	73	93	64	68	Sederhana / Moderate
		Sungai Pagar	5151907	MMLC003	78	71	92	83	61	Sederhana / Moderate
		Layang-Layangan	5251902	MMLC004	77	73	92	82	69	Sederhana / Moderate
		Tanjung Aru	5251903	MMLC005	72	73	91	59	58	Sederhana / Moderate

Nota / Note:
* (Stesen baru / New station)
** (Stesen tutup / Station closed)
– (Tiada data / No data)
NA (Tidak berkenaan / Not available)

Rajah 4.7 menunjukkan status kualiti air marin bagi pantai berdasarkan IKAMM. Bilangan stesen terbaik meningkat daripada 37 stesen pada tahun 2019 kepada 55 stesen pada tahun 2020; Walau bagaimanapun stesen dengan status kualiti air baik menurun daripada 69 stesen pada tahun 2019 kepada 41 stesen pada tahun 2020.

Figure 4.7 depicts the trend of marine water quality status for islands based on MMWQI. The number of excellent stations increased from 37 stations in 2019 to 55 stations in 2020; Nevertheless, the number of good water quality stations decreased from 69 stations in 2019 to 41 stations in 2020.



Rajah 4.7 : Tren Status Kualiti Air Marin bagi Kawasan Pantai, 2016-2020
Figure 4.7 : The Trend of Marine Water Quality Status for Coastal Area, 2016-2020

STATUS KUALITI AIR MUARA SUNGAI

Sebanyak 85 stesen muara sungai dipantau pada tahun 2020. Daripada 85 stesen pengawasan bagi muara sungai, tiga (3) stesen (3.53%) terbaik, enam (6) stesen (7.06%) baik, 63 stesen (74.12%) sederhana manakala 13 stesen (15.29%) tercemar (**Jadual 4.7**).

ESTUARY WATER QUALITY STATUS

A total of 85 estuary stations were monitored in the year 2020 and of this number, three (3) stations (3.53%) were ranked excellent, six (6) stations (7.06%) were ranked good, 63 stations (74.12%) were moderate, while the remaining 13 stations (15.29%) were ranked poor (**Table 4.7**).

Jadual 4.7 : Status Kualiti Air Marin bagi Muara Sungai
Table 4.7 : Marine Water Quality Status for Estuaries

NEGERI / STATE	KLASIFIKASI STESEN/ STATION CLASSIFICATION	KAWASAN/ AREA	NOMBOR STESEN LAMA/ OLD STATION NUMBER	NOMBOR STESEN BARU / NEW STATION NUMBER	NILAI IKAMM / MMWQI VALUE					KATEGORI STATUS KUALITI AIR MARIN (2020) / MARINE WATER QUALITY STATUS CATEGORY (2020)
					2016	2017	2018	2019	2020	
Perlis	Muara Sungai / Estuary	Kuala Sungai Baru	6201902	MMRE001	60	64	70	50	56	Sederhana / Moderate
		Kuala Sungai Perlis	6401901	MMRE002	61	64	66	58	54	Sederhana / Moderate
Kedah	Muara Sungai / Estuary	Kuala Kedah	6102908	MMKE001	77	62	61	53	53	Sederhana / Moderate
		Kuala Jerlun	6302925	MMKE002	75	62	82	50	57	Sederhana / Moderate
		Kuala Segantang Garam*	NA	MMKE003	-	83	88	57	70	Sederhana / Moderate
		Kuala Sungai Muda*	NA	MMKE004	-	64	62	62	58	Sederhana / Moderate
Pulau Pinang	Muara Sungai / Estuary	Kuala Sungai Jawi	5204901	MMPE001	45	49	54	46	38	Tercemar / Poor
		Kuala Sungai Juru	5303904	MMPE002	70	49	47	51	30	Tercemar / Poor
		Kuala Sungai Kerian	5104901	MMPE003	34	56	60	52	54	Sederhana / Moderate
		Kuala Sungai Pinang	5403934	MMPE004	58	52	61	52	53	Sederhana / Moderate
		Kuala Sungai Perai	5303908	MMPE005	64	52	59	53	43	Tercemar / Poor
		Kuala Sungai Tengah	5204935	MMPE006	65	58	37	52	52	Sederhana / Moderate
		Kuala Sungai Pinang (Balik Pulau)	5202929	MMPE007	60	55	64	50	48	Tercemar / Poor
Perak	Muara Sungai / Estuary	Kuala Sungai Manjung	4205930	MMAE001	78	88	91	71	75	Sederhana / Moderate
		Kuala Sungai Gula	4906926	MMAE002	67	82	84	55	53	Sederhana / Moderate
		Kuala Sungai Kurau	4994919	MMAE003	59	61	64	54	53	Sederhana / Moderate
		Kuala Sungai Tanjung Piandang	5003921	MMAE004	57	59	61	51	38	Tercemar / Poor
		Kuala Sungai Sepetang	4806925	MMAE005	56	60	58	46	48	Tercemar / Poor
		Kuala Sungai Perak	4007901	MMAE006	64	61	81	53	58	Sederhana / Moderate
Selangor	Muara Sungai / Estuary	Kuala Sungai Sepang	2517922	MMBE001	85	92	89	60	57	Sederhana / Moderate
		Kuala Sungai Sepang (Kecil)	2612928	MMBE002	86	93	89	61	88	Baik / Good
		Kuala Sungai Sepang (Kawalan)	2616926	MMBE003	92	93	92	70	88	Baik / Good
		Kuala Sungai Langat (Jugra)	2814925	MMBE004	72	82	62	50	44	Tercemar / Poor
		Kuala Sungai Klang	3013909	MMBE005	77	60	37	38	35	Tercemar / Poor
		Kuala Sungai Langat (Lumut)	2913903	MMBE006	81	60	39	49	45	Tercemar / Poor
		Kuala Sungai Buloh	3212930	MMBE007	67	64	62	44	58	Sederhana / Moderate
		Kuala Sungai Selangor	3312915	MMBE008	74	85	69	45	45	Tercemar / Poor
		Kuala Sungai Tengi	3311931	MMBE009	72	74	64	49	43	Tercemar / Poor
		Kuala Sungai Bernam	3808924	MMBE010	72	56	86	52	55	Sederhana / Moderate

Jadual 4.7 : Status Kualiti Air Marin bagi Muara Sungai
Table 4.7 : Marine Water Quality Status for Estuaries

NEGERI / STATE	KLASIFIKASI STESEN/ STATION CLASSIFICATION	KAWASAN/ AREA	NOMBOR STESEN LAMA/ OLD STATION NUMBER	NOMBOR STESEN BARU / NEW STATION NUMBER	NILAI IKAMM / MMWQI VALUE					KATEGORI STATUS KUALITI AIR MARIN (2020) / MARINE WATER QUALITY STATUS CATEGORY (2020)
					2016	2017	2018	2019	2020	
N. Sembilan	Muara Sungai / Estuary	Kuala Sungai Linggi	2319901	MMNE001	97	75	65	52	64	Sederhana / Moderate
		Kuala Sungai Lukut	2517910	MMNE002	97	66	66	52	52	Sederhana / Moderate
Melaka	Muara Sungai / Estuary	Kuala Sungai Melaka	2123903	MMME001	56	63	65	55	56	Sederhana / Moderate
		Kuala Sungai Sri Melaka	2121914	MMME002	53	57	59	45	53	Sederhana / Moderate
		Kuala Sungai Merlimau	2124912	MMME003	71	81	75	52	55	Sederhana / Moderate
		Kuala Sungai Kesang	2186905	MMME004	70	83	82	54	85	Baik / Good
		Kuala Sungai Sebatu	2186904	MMME005	69	86	87	56	63	Sederhana / Moderate
		Kuala Sungai Melaka 2*	NA	MMME006	-	64	64	52	54	Sederhana / Moderate
		Kuala Sungai Baru*	NA	MMME007	-	84	83	55	56	Sederhana / Moderate
		Kuala Sungai Lereh	2221922	MMME008	69	63	64	55	57	Sederhana / Moderate
Johor	Muara Sungai / Estuary	Kuala Sungai Melayu	1437946	-	58	63	-	-	-	Stesen tutup/ Close station
		Kuala Sungai Skudai	1437922	-	65	40	-	-	-	Stesen tutup/ Close station
		Kuala Sungai Tebrau	1438943	-	56	62	-	-	-	Stesen tutup/ Close station
		Kuala Sungai Segget	1437919	MMJE001	47	53	32	33	41	Tercemar / Poor
		Kuala Sungai Laloh	1439965	MMJE002	82	61	61	39	42	Tercemar / Poor
		Kuala Sungai Johor	1440916	MMJE003	85	92	92	72	88	Baik / Good
		Kuala Sungai Batu Pahat	1729930	MMJE004	87	90	80	57	67	Sederhana / Moderate
		Kuala Sungai Muar	2024932	MMJE005	88	92	66	55	57	Sederhana / Moderate
		Kuala Sungai Mersing	2438905	MMJE006	85	67	67	59	62	Sederhana / Moderate
Pahang	Muara Sungai / Estuary	Kuala Kuantan*	NA	MMCE001	-	66	67	56	59	Sederhana / Moderate
		Kuala Rompin Kecil*	NA	MMCE002	-	89	93	69	79	Sederhana / Moderate
		Kuala Pahang*	NA	MMCE003	-	92	73	59	59	Sederhana / Moderate
		Kuala Nenasi*	NA	MMCE004	-	93	94	63	93	Terbaik / Excellent
		Kuala Sungai Balok*	NA	MMCE005	-	65	66	57	59	Sederhana / Moderate
Terengganu	Muara Sungai / Estuary	Kuala Sungai Besut	5825902	MMTE001	63	73	67	58	59	Sederhana / Moderate
		Kuala Sungai Dungun	4734918	MMTE002	53	65	86	59	60	Sederhana / Moderate
		Kuala Sungai Ibai	5231949	MMTE003	61	90	93	85	77	Sederhana / Moderate
		Kuala Sungai Kerteh	4534922	MMTE004	56	91	92	59	73	Sederhana / Moderate
		Kuala Sungai Marang	5232911	MMTE005	72	90	91	67	71	Sederhana / Moderate
		Kuala Sungai Paka	4634920	MMTE006	72	80	94	58	73	Sederhana / Moderate
		Kuala Sungai Setiu	5627953	MMTE007	75	92	93	86	64	Sederhana / Moderate

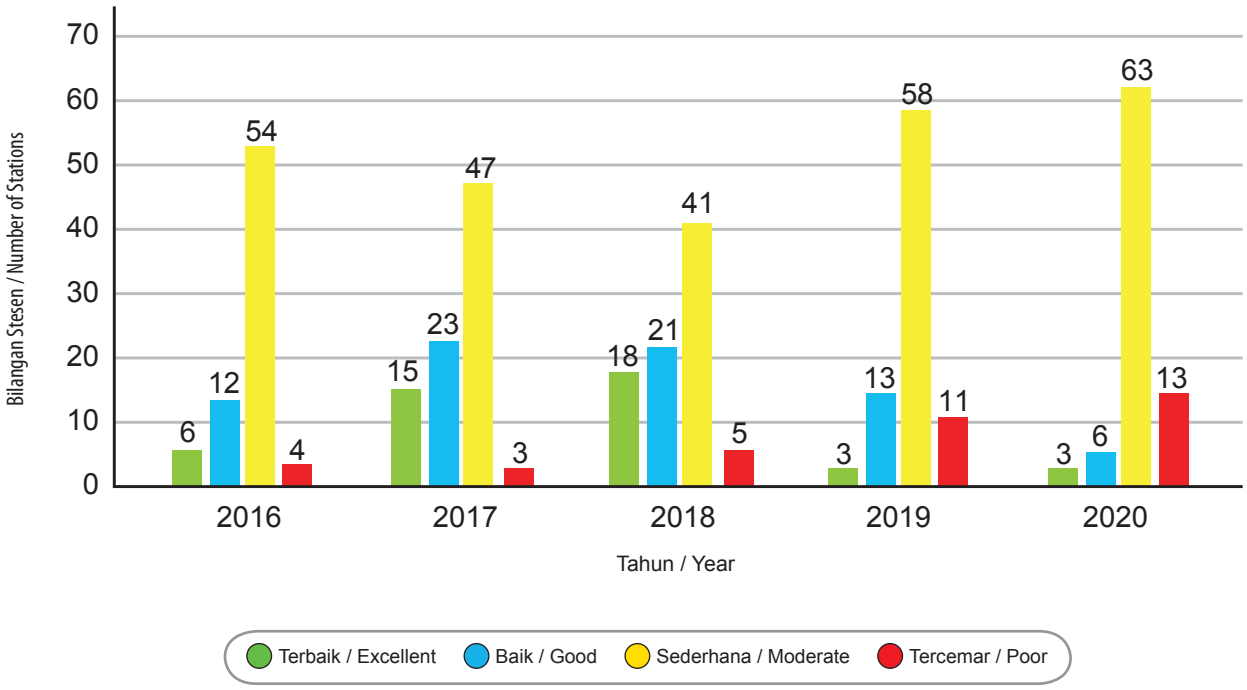
Jadual 4.7 : Status Kualiti Air Marin bagi Muara Sungai
Table 4.7 : Marine Water Quality Status for Estuaries

NEGERI / STATE	KLASIFIKASI STESEN/ STATION CLASSIFICATION	KAWASAN/ AREA	NOMBOR STESEN LAMA/ OLD STATION NUMBER	NOMBOR STESEN BARU / NEW STATION NUMBER	NILAI IKAMM / MMWQI VALUE					KATEGORI STATUS KUALITI AIR MARIN (2020) / MARINE WATER QUALITY STATUS CATEGORY (2020)
					2016	2017	2018	2019	2020	
Terengganu	Muara Sungai / Estuary	Kuala Sungai Terengganu	5331907	MMTE008	55	66	67	59	59	Sederhana / Moderate
		Kuala Sungai Kemaman / Chukai	4234929	MMTE009	56	90	94	59	60	Sederhana / Moderate
		Tioxide Utara (Kg. Bukit Kuang, Kijal)	4234950	MMTE010	63	89	94	95	94	Terbaik / Excellent
		Tioxide Tengah (Pupuk Semangat, Kijal)	4234951	MMTE011	61	90	94	94	87	Baik / Good
		Tioxide Selatan (KSB, T. Kalong)	4234952	MMTE012	-	94	94	85	94	Terbaik / Excellent
		Pulau Duyung	5231908	MMTE013	57	66	66	58	59	Sederhana / Moderate
Kelantan	Muara Sungai / Estuary	Kuala Sungai Golok	6220911	MMDE001	76	75	67	58	59	Sederhana / Moderate
		Kuala Sungai Kelantan	6222901	MMDE002	74	79	65	55	58	Sederhana / Moderate
		Kuala Sungai Pengkalan Chepa	6223912	MMDE003	72	89	67	53	56	Sederhana / Moderate
		Kuala Sungai Pengkalan Datu	6123913	MMDE004	61	86	81	68	59	Sederhana / Moderate
		Kuala Sungai Kemasin	5824914	MMDE005	57	63	67	39	56	Sederhana / Moderate
		Kuala Sungai Semerak*	NA	MMDE006	-	87	67	69	59	Sederhana / Moderate
Sarawak	Muara Sungai / Estuary	Kuala Sungai Semantan	1898901	MMQE001	90	86	90	91	65	Sederhana / Moderate
		Kuala Sungai Sarawak	1604907	MMQE002	70	85	86	86	64	Sederhana / Moderate
		Kuala Sungai Bako	1704905	MMQE003	66	55	90	63	56	Sederhana / Moderate
		Kuala Sungai Santubong	1702903	MMQE004	89	87	88	87	76	Sederhana / Moderate
		Kuala Batang Krian (Kabong)	1710922	MMQE005	73	64	76	80	83	Baik / Good
		Kuala Batang Rejang	2111909	MMQE006	87	83	85	89	66	Sederhana / Moderate
		Kuala Mukah	2920920	MMQE007	89	72	83	76	50	Sederhana / Moderate
		Kuala Batang Kemena	3130911	MMQE008	69	68	87	83	53	Sederhana / Moderate
		Kuala Tanjung Similajau	3431903	MMQE009	92	84	89	84	55	Sederhana / Moderate
		Kuala Sungai Panipah	3332904	MMQE010	92	86	89	87	55	Sederhana / Moderate
		Kuala Pantai Nyalau	3431903	MMQE011	86	84	79	83	58	Sederhana / Moderate
		Kuala Sungai Baram	4539919	MMQE012	66	72	76	74	57	Sederhana / Moderate
		Kuala Sungai Miri	4349915	MMQE013	68	61	78	74	68	Sederhana / Moderate
		Kuala Sungai Trusan*	NA	MMQE014	-	70	87	80	54	Sederhana / Moderate
Sabah	Muara Sungai / Estuary	Kuala Penyu	5453901	MMSE001	66	71	92	83	63	Sederhana / Moderate
		Muara Sungai Inanam	5050905	MMSE002	45	86	91	75	57	Sederhana / Moderate

Nota / Note:
* (Stesen baru / New station)
** (Stesen tutup / Station closed)
– (Tiada data / No data)
NA (Tidak berkenaan / Not available)

Rajah 4.8 menunjukkan tren status kualiti air marin bagi muara sungai berdasarkan IKAMM. Bilangan stesen terbaik adalah sama iaitu tiga (3) stesen pada tahun 2019 dan tahun 2020 manakala bilangan stesen baik berkurang daripada 13 stesen pada tahun 2019 kepada enam (6) stesen pada tahun 2020.

Figure 4.8 shows the trend of marine water quality status for estuaries based on MMWQI. The number of stations ranked excellent remain the same number, three (3) as in 2019 and 2020, whereas the number of stations ranked good decreased from 13 stations in 2019 to six (6) stations in 2020.



Rajah 4.8 : Tren Status Kualiti Air Marin bagi Muara Sungai, 2016-2020
Figure 4.8 : The Trend of Marine Water Quality Status for Estuaries, 2016-2020

KUALITI AIR MARIN PULAU

Sebanyak 95 stesen pengawasan kualiti air marin bagi pulau dibangunkan yang meliputi 80 pulau yang telah dipantau pada tahun 2020. **Jadual 4.8** menunjukkan senarai stesen pengawasan kualiti air marin bagi pulau. Daripada 95 stesen pengawasan, 46 stesen (48.42%) terbaik, sembilan (9) stesen (9.47%) baik, manakala 39 stesen (41.05%) sederhana dan satu (1) stesen (1.05%) tercemar pada tahun 2020 (**Jadual 4.9**).

ISLAND MARINE WATER QUALITY

A total of 95 island water quality monitoring stations were established surrounding 80 islands and were monitored in the year 2020. **Table 4.8** shows the list of island water quality monitoring stations. Out of the 95 island monitoring stations, 46 (48.42%) ranked excellent, nine (9) stations (9.47%) ranked good, while the remaining 39 stations (41.05%) ranked moderate and one (1) station (1.05%) was ranked poor in 2020 (**Table 4.9**).

Jadual 4.8 : Stesen-Stesen Pengawasan Kualiti Air Marin bagi Pulau, 2020

Table 4.8 : Marine Water Quality Monitoring Stations for Island, 2020

NEGERI / STATE	BILANGAN PULAU / NUMBER OF ISLAND	BILANGAN STESEN / NUMBER OF STATION	PULAU / ISLAND	ID STESEN LAMA / OLD STATION ID	ID STESEN BARU / NEW STATION ID	KATEGORI / CATEGORY
Kedah	11	1	Singa Besar	7KR01	MMKR001	Peranginan / Resort
		2	Dayang Bunting	7KR02	MMKR002	Peranginan / Resort
			Dayang Bunting 2*	NA	MMKR003	Peranginan / Resort
		1	Pulau Perak	7KP01	MMRP001	Dilindungi / Protected
		1	Payar	7KM03	MMKM001	Taman Laut / Marine Park
		1	Kaca	7KM04	MMKM002	Taman Laut / Marine Park
		1	Segantang	7KM06	MMKM003	Taman Laut / Marine Park
		4	Pantai Kuah	7KD07	MMKD001	Pembangunan / Development
			Pantai Chenang	7KD09	MMKD002	Pembangunan / Development
			Tanjung Rhu	7KD010	MMKD003	Pembangunan / Development
			Teluk Ewa	7KD08	MMKD004	Pembangunan / Development
		1	Pasir*	NA	MMKP001	Dilindungi / Protected
		1	Gasing*	NA	MMKP002	Dilindungi / Protected
		1	Dangli*	NA	MMKP003	Dilindungi / Protected
Pulau Pinang	7	1	Tanjung Tokong*	NA	MMPP001	Dilindungi / Protected
		3	Batu Maung	7PD01	MMPD001	Pembangunan / Development
			Padang Kota	7PD04	MMPD002	Pembangunan / Development
			Teluk Bahang	7PD03	MMPD003	Pembangunan / Development
		1	Aman	7PR05	MMPR001	Peranginan / Resort
		1	Jerejak	7PR06	MMPR002	Peranginan / Resort
		1	Kendi	7PR07	MMPR003	Peranginan / Resort
		1	Rimau	7PR08	MMPR004	Peranginan / Resort
		1	Gedong	7PR09	MMPR005	Peranginan / Resort
Perak	4	2	Pantai Teluk Gedong	7AR01	MMAR001	Peranginan / Resort
			Pantai Puteri Dewi	7AR02	MMAR002	Peranginan / Resort
		1	Pangkor Laut	7AR03	MMAR003	Peranginan / Resort
		1	Sembilan	7AR04	MMAR004	Peranginan / Resort
		1	Tukun Perak	7AP05	MMAP001	Dilindungi / Protected
Selangor	3	1	Ketam	7BR01	MMBR001	Peranginan / Resort
		1	Angsa	7BR02	MMBR002	Peranginan / Resort
		1	Lumut	7BR03	MMBR003	Peranginan / Resort
N. Sembilan	1	1	Arang	7NP01	MMNP001	Dilindungi / Protected
Melaka	3	2	Upeh (Point A)	7MR02	MMMR001	Peranginan / Resort
			Upeh (Point B)	7MR02	MMMR002	Peranginan / Resort

Jadual 4.8 : Stesen-Stesen Pengawasan Kualiti Air Marin bagi Pulau, 2020
Table 4.8 : Island Water Quality Monitoring Stations, 2020

NEGERI / STATE	BILANGAN PULAU / NUMBER OF ISLAND	BILANGAN STESEN / NUMBER OF STATION	PULAU / ISLAND	ID STESEN LAMA / OLD STATION ID	ID STESEN BARU / NEW STATION ID	KATEGORI / CATEGORY
Melaka	3	2	Besar (Point A)	7MR01	MMMR003	Peranginan / Resort
			Besar (Point B)	7MR01	MMMR004	Peranginan / Resort
		2	Undan (Point A)	7MR03	MMMR005	Peranginan / Resort
			Undan (Point B)	7MR03	MMMR006	Peranginan / Resort
Johor	8	1	Setindan	7JR01	MMJR001	Peranginan / Resort
		1	Babi Tengah	7JR02	MMJR002	Peranginan / Resort
		1	Dayang	7JM03	MMJM001	Taman Laut / Marine Park
		1	Nanga Besar	7JM08	MMJM002	Taman Laut / Marine Park
		1	Sibu Tengah	7JM11	MMJM003	Taman Laut / Marine Park
		1	Pemanggil	7JM15	MMJM004	Taman Laut / Marine Park
		1	Kukup	7JP17	MMJP001	Dilindungi / Protected
		1	Pisang	7JP18	MMJP002	Dilindungi / Protected
Pahang	9	1	Tioman (Teluk Salang)	7CM02	MMCM001	Taman Laut / Marine Park
		1	Tioman (Kg. Nipah)	7CM01	MMCM002	Taman Laut / Marine Park
		1	Tulai	7CM05	MMCM003	Taman Laut / Marine Park
		1	Labas	7CM07	MMCM004	Taman Laut / Marine Park
		1	Cebeh	7CM04	MMCM005	Taman Laut / Marine Park
		1	Sepui	7CM06	MMCM006	Taman Laut / Marine Park
		1	Sembilang	7CM08	MMCM007	Taman Laut / Marine Park
		1	Seri Buat	7CM03	MMCM008	Taman Laut / Marine Park
		1	Tokong Bahara	7CM09	MMCM009	Taman Laut / Marine Park
Terengganu	9	1	Gemia	7TR01	MMTR001	Peranginan / Resort
		1	Perhentian Besar (South)	7TM04	MMTM001	Taman Laut / Marine Park
		2	Perhentian Besar (West)	7TM05	MMTM002	Taman Laut / Marine Park
			Perhentian Kecil	7TM06	MMTM003	Taman Laut / Marine Park
		2	Redang (North)	7TM07	MMTM004	Taman Laut / Marine Park
			Redang (South)	7TM08	MMTM005	Taman Laut / Marine Park
		1	Lang Tengah	7TM11	MMTM006	Taman Laut / Marine Park
		1	Pinang	7TM12	MMTM007	Taman Laut / Marine Park
		1	Ekor Tebu	7TM13	MMTM008	Taman Laut / Marine Park
		1	Lima	7TM14	MMTM009	Taman Laut / Marine Park
		1	Kapas	7TM09	MMTM010	Taman Laut / Marine Park
Kelantan	2	1	Panjang	7DP01	MMDP001	Dilindungi / Protected
		1	Kundur	7DP02	MMDP002	Dilindungi / Protected

Jadual 4.8 : Stesen-Stesen Pengawasan Kualiti Air Marin bagi Pulau, 2020
Table 4.8 : Island Water Quality Monitoring Stations, 2020

NEGERI / STATE	BILANGAN PULAU / NUMBER OF ISLAND	BILANGAN STESEN / NUMBER OF STATION	PULAU / ISLAND	ID STESEN LAMA / OLD STATION ID	ID STESEN BARU / NEW STATION ID	KATEGORI / CATEGORY
Sarawak	3	1	Satang	7QP01	MMQP001	Dilindungi / Protected
		1	Talang-Talang Kecil	7QP02	MMQP002	Dilindungi / Protected
		1	Talang-Talang Besar	7QP03	MMQP003	Dilindungi / Protected
Sabah	16	1	Gaya	7SR01	MMSR001	Peranginan / Resort
		1	Mabul	7SR03	MMSR002	Peranginan / Resort
		2	Sipadan (N)	7SR04	MMSR003	Peranginan / Resort
			Sipadan (W)	7SR05	MMSR004	Peranginan / Resort
		1	Manukan	7SM09	MMSR005	Peranginan / Resort
		1	Tiga	7SR10	MMSR006	Peranginan / Resort
		1	Kapalai	7SR12	MMSR007	Peranginan / Resort
		1	Molleangan Besar	7SR14	MMSR008	Peranginan / Resort
		1	Banggi (South)	7SR15	MMSR009	Peranginan / Resort
		1	Banggi (East)	7SR20	MMSR010	Peranginan / Resort
		1	Balambangan	7SR16	MMSR011	Peranginan / Resort
		1	Mantanani Besar	7SR21	MMSR012	Peranginan / Resort
		1	Sapi	7SM08	MMSM001	Taman Laut / Marine Park
		1	Kalampunian Besar	7SM11	MMSM002	Taman Laut / Marine Park
		1	Selingan	7SP17	MMSP001	Dilindungi / Protected
		1	Gulisan	7SP18	MMSP002	Dilindungi / Protected
		1	Bakungan Kecil	7SP19	MMSP003	Dilindungi / Protected
Labuan	4	1	Kuraman	7LM05	MMLM001	Taman Laut / Marine Park
		1	Rusukan Besar	7LM07	MMLM002	Taman Laut / Marine Park
		1	Rusukan Kecil	7LM06	MMLM003	Taman Laut / Marine Park
		4	Pohon Batu	7LD01	MMLD001	Pembangunan / Development
			Water Front	7LD02	MMLD002	Pembangunan / Development
			Lubuk Temiang	7LD03	MMLD003	Pembangunan / Development
			Ranca-Ranca	7LD04	MMLD004	Pembangunan / Development

Nota / Note:
* (Stesen baru / New station)
** (Stesen tutup / Station closed)
– (Tiada data / No data)
NA (Tidak berkenaan / Not available)

Jadual 4.9 : Status Kualiti Air Marin bagi Pulau, 2020

Table 4.9 : Marine Water Quality Status for Islands, 2020

NEGERI / STATE	KLASIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN LAMA / OLD STATION NUMBER	NOMBOR STESEN BARU / NEW STATION NUMBER	NILAI IKAMM / MMWQI VALUE					KATEGORI STATUS KUALITI AIR MARIN (2020) / MARINE WATER QUALITY STATUS CATEGORY (2020)
					2016	2017	2018	2019	2020	
Kedah	Pulau / Island	Singa Besar	7KR01	MMKR001	61	90	93	84	92	Terbaik / Excellent
		Dayang Bunting	7KR02	MMKR002	60	91	93	90	87	Baik / Good
		Dayang Bunting 2*	NA	MMKR003	-	93	93	84	94	Terbaik / Excellent
		Pulau Perak	7KP01	MMRP001	56	94	94	93	89	Baik / Good
		Payar	7KM03	MMKM001	75	91	94	92	96	Terbaik / Excellent
		Kaca	7KM04	MMKM002	74	93	94	86	95	Terbaik / Excellent
		Segantang	7KM06	MMKM003	70	91	94	83	95	Terbaik / Excellent
		Pantai Kuah	7KD07	MMKD001	51	92	94	85	92	Terbaik / Excellent
		Pantai Chenang	7KD09	MMKD002	63	74	82	73	93	Terbaik / Excellent
		Tanjung Rhu	7KD010	MMKD003	67	92	94	91	93	Terbaik / Excellent
		Teluk Ewa	7KD08	MMKD004	74	92	94	95	94	Terbaik / Excellent
		Lembu**	7KM05	NA	71	-	-	-	-	Stesen tutup/ Close station
		Pasir*	NA	MMKP001	-	93	94	94	96	Terbaik / Excellent
		Gasing*	NA	MMKP002	-	94	94	94	95	Terbaik / Excellent
		Dangli*	NA	MMKP003	-	92	94	95	95	Terbaik / Excellent
Pulau Pinang	Pulau / Island	Tanjung Tokong*	NA	MMPP001	46	64	62	55	57	Sederhana / Moderate
		Batu Maung	7PD01	MMPD001	82	52	65	58	67	Sederhana / Moderate
		Padang Kota	7PD04	MMPD002	-	61	82	59	85	Baik / Good
		Teluk Bahang*	7PD03	MMPD003	-	63	66	57	71	Sederhana / Moderate
		Aman	7PR05	MMPR001	72	72	88	60	72	Sederhana / Moderate
		Jerejak	7PR06	MMPR002	46	57	65	57	58	Sederhana / Moderate
		Kendi	7PR07	MMPR003	76	83	93	77	93	Terbaik / Excellent
		Rimau	7PR08	MMPR004	51	85	93	85	90	Terbaik / Excellent
		Gedong	7PR09	MMPR005	71	63	86	56	84	Baik / Good
Perak	Pulau / Island	Pantai Teluk Gedong	7AR01	MMAR001	69	93	93	88	93	Terbaik / Excellent
		Pantai Puteri Dewi	7AR02	MMAR002	56	85	92	69	79	Sederhana / Moderate
		Pangkor Laut	7AR03	MMAR003	79	92	94	90	95	Terbaik / Excellent
		Sembilan	7AR04	MMAR004	52	89	92	86	93	Terbaik / Excellent
		Tukun Perak	7AP05	MMAP001	58	93	94	82	91	Terbaik / Excellent
Selangor	Pulau / Island	Ketam	7BR01	MMBR001	93	88	89	57	68	Sederhana / Moderate
		Angsa	7BR02	MMBR002	88	85	92	71	59	Sederhana / Moderate
		Lumut	7BR03	MMBR003	87	61	54	47	46	Tercemar / Poor
N. Sembilan	Pulau / Island	Arang	7NP01	MMNP001	97	68	92	81	92	Terbaik / Excellent
Melaka	Pulau / Island	Upeh (Point A)	7MR02	MMMR001	58	65	85	59	87	Baik / Good
		Upeh (Point B)	7MR02	MMMR002	67	82	84	70	80	Baik / Good

Jadual 4.9 : Status Kualiti Air Marin bagi Pulau, 2020
Table 4.9 : Marine Water Quality Status for Islands, 2020

NEGERI / STATE	KLASIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN LAMA / OLD STATION NUMBER	NOMBOR STESEN BARU / NEW STATION NUMBER	NILAI IKAMM / MMWQI VALUE					KATEGORI STATUS KUALITI AIR MARIN (2020) / MARINE WATER QUALITY STATUS CATEGORY (2020)
					2016	2017	2018	2019	2020	
Melaka	Pulau / Island	Besar (Point A)	7MR01	MMMR003	70	89	94	84	95	Terbaik / Excellent
		Besar (Point B)	7MR01	MMMR004	70	90	93	71	95	Terbaik / Excellent
		Undan (Point A)	7MR03	MMMR005	77	90	94	83	96	Terbaik / Excellent
		Undan (Point B)	7MR03	MMMR006	61	90	94	91	96	Terbaik / Excellent
Johor	Pulau / Island	Setindan	7JR01	MMJR001	88	94	94	88	94	Terbaik / Excellent
		Babi Tengah	7JR02	MMJR002	90	94	94	70	78	Sederhana / Moderate
		Dayang	7JM03	MMJM001	88	94	94	86	86	Baik / Good
		Nanga Besar	7JM08	MMJM002	90	94	94	91	95	Terbaik / Excellent
		Sibu Tengah	7JM11	MMJM003	83	91	87	58	62	Sederhana / Moderate
		Pemanggil	7JM15	MMJM004	86	93	93	58	94	Terbaik / Excellent
		Kukup	7JP17	MMJP001	89	94	94	91	95	Terbaik / Excellent
		Pisang	7JP18	MMJP002	89	94	94	94	94	Terbaik / Excellent
Pahang	Pulau / Island	Tioman (Teluk Salang)	7CM02	MMCM001	78	92	94	94	89	Baik / Good
		Tioman (Kg. Nipah)	7CM01	MMCM002	85	93	94	83	95	Terbaik / Excellent
		Tulai	7CM05	MMCM003	85	93	94	94	95	Terbaik / Excellent
		Labas	7CM07	MMCM004	86	93	94	91	95	Terbaik / Excellent
		Cebeh	7CM04	MMCM005	85	94	94	95	96	Terbaik / Excellent
		Sepui	7CM06	MMCM006	83	93	94	95	96	Terbaik / Excellent
		Sembilang	7CM08	MMCM007	75	93	94	96	94	Terbaik / Excellent
		Seri Buat	7CM03	MMCM008	84	94	94	94	93	Terbaik / Excellent
		Tokong Bahara	7CM09	MMCM009	86	93	94	69	69	Sederhana / Moderate
Terengganu	Pulau / Island	Gemia	7TR01	MMTR001	63	89	94	86	95	Terbaik / Excellent
		Perhentian Besar (South)	7TM04	MMTM001	62	90	94	92	96	Terbaik / Excellent
		Perhentian Besar (West)	7TM05	MMTM002	61	90	94	91	96	Terbaik / Excellent
		Perhentian Kecil	7TM06	MMTM003	78	90	94	88	96	Terbaik / Excellent
		Redang (North)	7TM07	MMTM004	64	89	94	85	95	Terbaik / Excellent
		Redang (South)	7TM08	MMTM005	64	90	94	75	96	Terbaik / Excellent
		Lang Tengah	7TM11	MMTM006	63	90	94	94	95	Terbaik / Excellent
		Pinang	7TM12	MMTM007	63	90	94	87	97	Terbaik / Excellent
		Ekor Tebu	7TM13	MMTM008	64	90	94	97	96	Terbaik / Excellent
		Lima	7TM14	MMTM009	76	90	93	90	94	Terbaik / Excellent
		Kapas	7TP16	MMTM010	64	89	94	96	90	Terbaik / Excellent
Kelantan	Pulau / Island	Panjang	7DP01	MMDP001	66	88	93	82	77	Sederhana / Moderate
		Kundur	7DP02	MMDP002	65	89	93	84	84	Baik / Good

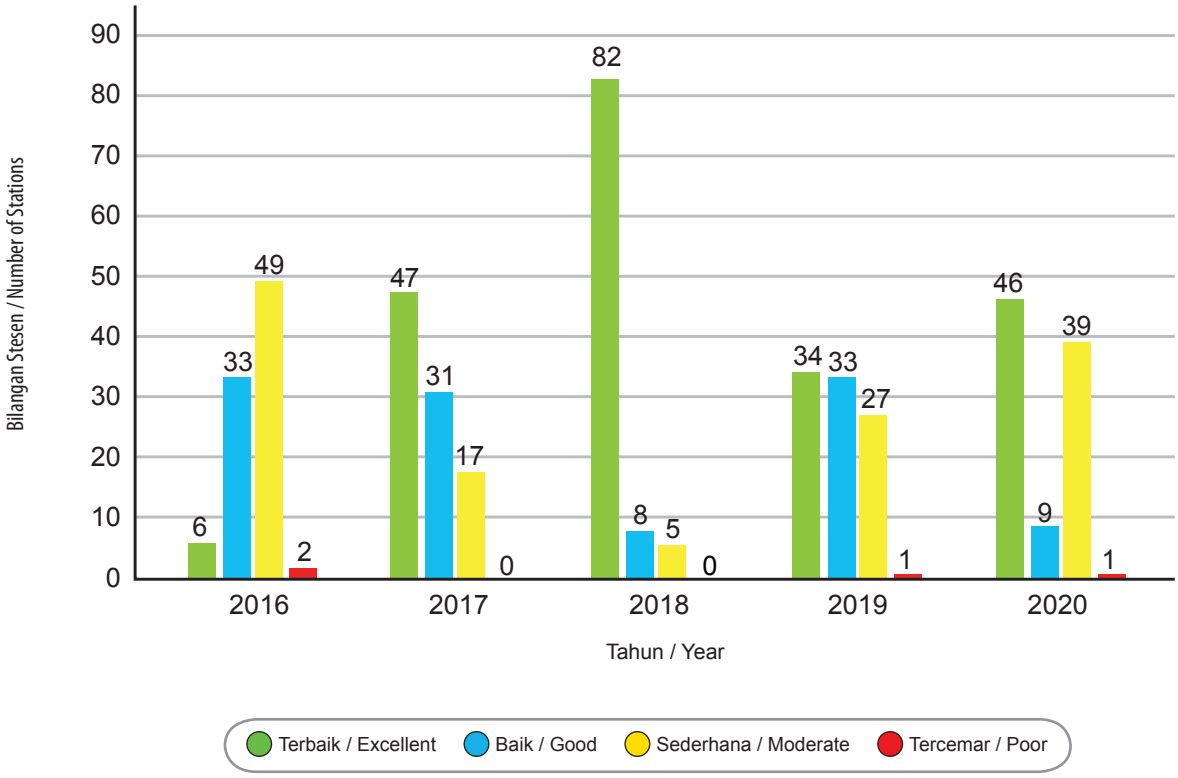
Jadual 4.9 : Status Kualiti Air Marin bagi Pulau, 2020
Table 4.9 : Marine Water Quality Status for Islands, 2020

NEGERI / STATE	KLASIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN LAMA / OLD STATION NUMBER	NOMBOR STESEN BARU / NEW STATION NUMBER	NILAI IKAMM / MMWQI VALUE					KATEGORI STATUS KUALITI AIR MARIN (2020) / MARINE WATER QUALITY STATUS CATEGORY (2020)
					2016	2017	2018	2019	2020	
Sarawak	Pulau / Island	Satang	7QP01	MMQP001	90	87	90	91	76	Sederhana / Moderate
		Talang-Talang Kecil	7QP02	MMQP002	77	87	91	92	69	Sederhana / Moderate
		Talang-Talang Besar	7QP03	MMQP003	91	87	90	90	79	Sederhana / Moderate
Sabah	Pulau / Island	Gaya	7SR01	MMSR001	84	72	93	85	65	Sederhana / Moderate
		Mabul	7SR03	MMSR002	81	86	93	89	67	Sederhana / Moderate
		Sipadan (N)	7SR04	MMSR003	84	89	93	85	60	Sederhana / Moderate
		Sipadan (W)	7SR05	MMSR004	85	89	93	80	65	Sederhana / Moderate
		Manukan	7SM09	MMSR005	83	87	93	83	59	Sederhana / Moderate
		Tiga	7SR10	MMSR006	85	73	93	86	68	Sederhana / Moderate
		Kapalai	7SR12	MMSR007	82	87	93	60	58	Sederhana / Moderate
		Molleangan Besar	7SR14	MMSR008	84	88	93	63	59	Sederhana / Moderate
		Banggi (South)	7SR15	MMSR009	80	85	93	77	58	Sederhana / Moderate
		Banggi (East)	7SR20	MMSR010	82	70	93	85	75	Sederhana / Moderate
		Balambangan	7SR16	MMSR011	84	85	92	87	72	Sederhana / Moderate
		Mantanani Besar	7SR21	MMSR012	85	85	93	77	58	Sederhana / Moderate
		Sapi	7SM08	MMSM001	83	88	93	91	61	Sederhana / Moderate
		Kalampunian Besar	7SM11	MMSM002	84	87	93	79	65	Sederhana / Moderate
		Selingan	7SP17	MMSP001	83	88	93	93	75	Sederhana / Moderate
		Gulisan	7SP18	MMSP002	83	88	93	88	69	Sederhana / Moderate
		Bakungan Kecil	7SP19	MMSP003	83	85	93	95	72	Sederhana / Moderate
Labuan	Pulau / Island	Kuraman	7LM05	MMLM001	67	63	92	86	67	Sederhana / Moderate
		Rusukan Besar	7LM07	MMLM002	76	66	92	61	59	Sederhana / Moderate
		Rusukan Kecil	7LM06	MMLM003	74	72	92	67	69	Sederhana / Moderate
		Pohon Batu	7LD01	MMLD001	52	91	92	90	59	Sederhana / Moderate
		Water Front	7LD02	MMLD002	73	89	93	88	67	Sederhana / Moderate
		LubukTemiang	7LD03	MMLD003	50	91	93	88	59	Sederhana / Moderate
		Ranca-Ranca	7LD04	MMLD004	50	90	92	90	64	Sederhana / Moderate

Nota / Note:
* (Stesen baru / New station)
** (Stesen tutup / Station closed)
– (Tiada data / No data)
NA (Tidak berkenaan / Not available)

Rajah 4.9 menunjukkan tren status kualiti air marin bagi pulau berdasarkan IKAMM. Bilangan stesen sebagai terbaik meningkat daripada 34 stesen pada tahun 2019 kepada 46 stesen pada tahun 2020 manakala stesen sebagai baik berkurang daripada 33 stesen pada tahun 2019 kepada sembilan (9) stesen pada tahun 2020.

Figure 4.9 displays the trend of marine water quality status for islands based on MMWQI. The number of stations ranked excellent increased from 34 in 2019 to 46 stations in 2020. The number of stations considered good, though, decreased from 33 in 2019 to nine (9) stations in 2020.



Rajah 4.9 : Tren Status Kualiti Air Marin bagi Pulau, 2016-2020
Figure 4.9 : The Trend of Marine Water Quality Status for Islands, 2016-2020

Pulau Tioman

Stesen Marin dalam Kategori Tercemar

Jadual 4.10 menunjukkan terdapat 18 stesen marin tercemar iaitu empat (4) stesen pantai, 13 stesen muara sungai dan satu (1) stesen pulau. Unjuran peratusan sub-indeks adalah dengan menggunakan skala 0 hingga 100%. Sub-indeks yang memberikan nilai 49% dan ke bawah dijadikan sebagai tanda aras yang ditandakan warna merah bermaksud kemerosotan pada IKAMM.

Jadual ini juga menunjukkan semua stesen marin yang mengalami kemerosotan adalah disebabkan oleh parameter faecal coliform (FC). Selain itu, oksigen terlarut (DO), jumlah pepejal terampai, fosfat (PO_4) dan nitrat (NO_3) juga turut mempengaruhi nilai IKAMM.

Stesen muara sungai di Kuala Sungai Juru, Pulau Pinang adalah stesen yang menerima kesan terbanyak daripada tiga (3) parameter, manakala stesen yang lain kebanyakannya terkesan daripada satu (1) atau dua (2) parameter sahaja.

Marine Stations in Poor Category

Table 4.10 shows the list of 18 marine stations that were ranked poor. Of these, four (4) were coastal stations, 13 estuary stations and one (1) island station. Sub-index projection percentages are used on a scale of 0 to 100%. A sub-index of 49% and below is a benchmark and marked in red and indicates a decline in MMWQI.

The table also shows that this degradation is primarily due to faecal coliform (FC) parameters. In addition, dissolved oxygen (DO), total suspended solids (TSS), phosphate (PO_4) and nitrate (NO_3) also have had a slight impact on the value of MMWQI.

The estuary station of Kuala Sungai Juru, Pulau Pinang was most impacted by all three (3) parameters, while the other stations were mostly impacted by one (1) or two (2) parameters only.

Pulau kecil berhampiran Kampung Paya, Pulau Tioman / A small island near Kampung Payar, Tioman Island

Jadual 4.10 : Senarai Stesen Pengawasan Kualiti Air Marin dengan Status Kategori Tercemar dan Peratusan Sub-Indeks mengikut Parameter, 2020

Table 4.10 : List of Marine Water Quality Monitoring Stations under the Category of Poor Status and their Sub-Index Percentages by Parameter, 2020

NEGERI / STATE	KLASIFIKASI STESEN / STATION CLASSIFICATION	LOKASI / LOCATION	ID STESEN / STATION ID	IKAMM / MMWQI	KATEGORI IKAMM / MMWQI CATEGORY	PERATUSAN SUB INDEKS (%) / SUB INDEX PERCENTAGES (%)					
						OKSIGEN TERLARUT / DISSOLVED OXYGEN	AMONIA TIDAK TERION / UNIONIZED AMMONIA	FAECAL COLIFORM	JUMLAH PEPEJAL TERAMPAI / TOTAL SUSPENDED SOLID	NITRAT / NITRATE	FOSFAT / PHOSPHATE
Johor	Pantai / Coastal	Pantai Stulang Laut	MMJC004	48	Tercemar / Poor	81	93	8	94	68	60
Johor	Pantai / Coastal	Hadapan HSAJB	MMJC007	49	Tercemar / Poor	72	93	8	94	68	63
Johor	Pantai / Coastal	Pantai Lido	MMJC008	44	Tercemar / Poor	75	94	8	94	71	55
Sarawak	Pantai / Coastal	Pantai Mukah	MMQC017	49	Tercemar / Poor	99	95	8	88	46	68
Pulau Pinang	Muara Sungai / Estuary	Kuala Sungai Jawi	MMPE001	38	Tercemar / Poor	52	78	8	84	90	40
Pulau Pinang	Muara Sungai / Estuary	Kuala Sungai Juru	MMPE002	30	Tercemar / Poor	10	82	8	87	73	10
Pulau Pinang	Muara Sungai / Estuary	Kuala Sungai Perai	MMPE005	43	Tercemar / Poor	30	92	8	92	74	89
Pulau Pinang	Muara Sungai/ Estuary	Kuala Sungai Pinang (Balik Pulau)	MMPE007	48	Tercemar / Poor	92	99	8	43	91	93
Perak	Muara Sungai / Estuary	Kuala Sungai Tanjung Piandang	MMAE004	38	Tercemar / Poor	10	95	8	79	88	61
Perak	Muara Sungai / Estuary	Kuala Sungai Sepetang	MMAE005	48	Tercemar / Poor	74	99	8	78	63	82
Selangor	Muara Sungai / Estuary	Kuala Sungai Langat (Jugra)	MMBE004	44	Tercemar / Poor	83	93	8	86	41	88
Selangor	Muara Sungai / Estuary	Kuala Sungai Klang	MMBE005	35	Tercemar / Poor	10	88	8	90	83	66
Selangor	Muara Sungai / Estuary	Kuala Sungai Langat (Lumut)	MMBE006	45	Tercemar / Poor	46	96	8	90	66	77
Selangor	Muara Sungai / Estuary	Kuala Sungai Selangor	MMBE008	45	Tercemar / Poor	65	98	8	42	56	88
Selangor	Muara Sungai / Estuary	Kuala Sungai Tengi	MMBE009	43	Tercemar / Poor	78	98	8	47	74	91
Johor	Muara Sungai / Estuary	Kuala Sungai Segget	MMJE001	41	Tercemar / Poor	81	88	8	94	41	53
Johor	Muara Sungai / Estuary	Kuala Sungai Laloh	MMJE002	42	Tercemar / Poor	10	95	8	94	90	81
Selangor	Pulau / Island	Lumut	MMBR003	46	Tercemar / Poor	63	94	8	94	80	74

PENGAWASAN KUALITI AIR MARIN AUTOMATIK

Rangkaian Pengawasan Kualiti Air Marin Automatik (CMWQM) bertujuan untuk menyediakan data kualiti air marin hampir pada waktu sebenar bagi sepuluh (10) lokasi stesen yang ditetapkan.

Jadual 4.11 menyenaraikan lokasi stesen-stesen pengawasan kualiti air marin automatik dan kategori kelas kegunaan air marin berdasarkan SKAMM manakala **Rajah 4.10** menunjukkan lokasi Stesen Pengawasan Kualiti Air Marin Automatik (CMWQM).

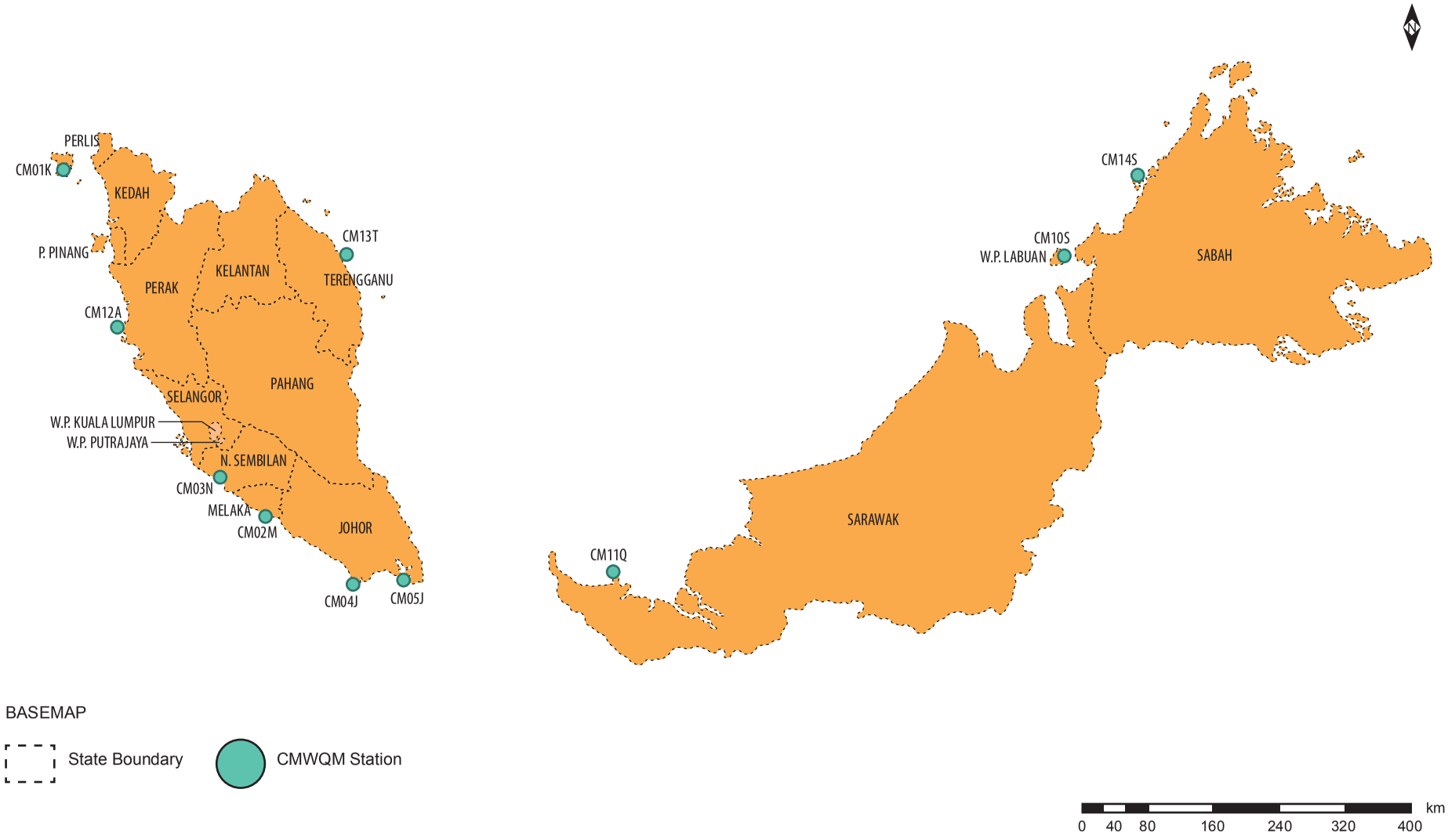
CONTINUOUS MARINE WATER QUALITY MONITORING

The Continuous Marine Water Quality Monitoring (CMWQM) network aims to provide near real-time marine water quality data in ten (10) designated locations.

Table 4.11 lists the location of the continuous marine water quality monitoring stations and its respective class categories based on MMWQS while **Figure 4.10** shows the location of the Continuous Marine Water Quality Monitoring (CMWQM) stations.

Jadual 4.11: Stesen Pengawasan Kualiti Air Marin Automatik
Table 4.11: Continuous Marine Water Quality Monitoring Stations

BIL. / NO.	LOKASI STESEN / STATION LOCATION	ID STESEN / STATION ID	STRUKTUR / STRUCTURE	KELAS STESEN / STATION CLASS
1	Pulau Langkawi, Kedah	CM01K	Jeti / Jetty	Kelas 2 / Class 2
2	Pulau Undan, Melaka	CM02M	Jeti / Jetty	Kelas 2 / Class 2
3	Port Dickson, N. Sembilan	CM03N	Beacon	Kelas 2 / Class 2
4	Tanjung Piai, Johor	CM04J	Beacon	Kelas E / Class E
5	Tanjung Pengelih, Johor	CM05J	Jeti / Jetty	Kelas 3 / Class 3
6	W.P. Labuan	CM10S	Jeti / Jetty	Kelas 3 / Class 3
7	Santubong, Sarawak	CM11Q	Jeti / Jetty	Kelas E / Class E
8	Pulau Mentagor, Perak	CM12A	Jeti / Jetty	Kelas 2 / Class 2
9	Pulau Kapas, Terengganu	CM13T	Jeti / Jetty	Kelas 1 / Class 1
10	Teluk Sepanggar, Sabah	CM14S	Jeti / Jetty	Kelas 3 / Class 3



Rajah 4.10 : Lokasi Stesen Pengawasan Kualiti Air Marin Automatik

Figure 4.10 : Location of Continuous Marine Water Quality Monitoring Stations

Pada tahun 2020, kualiti air marin menerima kesan dari fenomena La Nina dan Perintah Kawalan Pergerakan (PKP) yang ditetapkan oleh Kerajaan untuk mencegah penularan wabak COVID-19. Fenomena La Nina telah mempengaruhi corak hujan yang akhirnya mempengaruhi tahap input sungai ke persekitaran marin dalam taburan temporal dan spatial.

Kepekatan median dan purata bagi rata-rata parameter yang dipantau dalam rangkaian CMWQM menunjukkan pematuhan tinggi bagi setiap kelas kualiti air marin sepertimana yang ditetapkan dalam SKAMM.

Stesen CMWQM iaitu CM11Q Santubong, CM05J Tanjung Pengelih dan CM12A Pulau Mentagor yang terletak berdekatan muara sungai dipengaruhi oleh pasang surut air ketika terdapat pengaliran air sungai yang mempengaruhi parameter kualiti air. Kualiti air marin di stesen CMWQM juga dipengaruhi oleh kadar presipitasi di kawasan tersebut terutamanya ketika musim Monsun Timur Laut.

Pada tahun 2020, paras oksigen terlarut yang direkodkan di kesemua stesen CMWQM menunjukkan peratusan pematuhan yang tinggi (>90%) terhadap SKAMM kecuali CM13T Pulau Kapas, CM12A Pulau Mentagor dan CM11Q Santubong. Tahap oksigen terlarut yang rendah berkemungkinan disebabkan oleh akumulasi bahan-bahan organik di dasar laut yang mengurangkan oksigen terlarut apabila pengaliran air laut adalah terhad atau arus hidrologi minimum. CM11Q menunjukkan peratusan pematuhan oksigen terlarut yang rendah pada tahun 2020. CM11Q terletak di muara sungai Santubong dan dipengaruhi oleh air pasang surut. Ketika air surut, pengaliran air di muara sungai adalah rendah dan oksigen terlarut berkurangan dengan cepat yang memberi kesan kepada kepekatan oksigen terlarut yang rendah.

Pada tahun 2020, tidak terdapat sebarang pencemaran yang disebabkan oleh jumlah pepejal terampai (TSS). Kebanyakan stesen CMWQM menunjukkan pematuhan yang tinggi terhadap SKAMM. Secara purata, kepekatan TSS lebih tinggi di CM04J Tanjung Piai dan CM05J Tanjung Pengelih berbanding dengan stesen CMWQM yang lain pada tahun ini.

In 2020, the marine water quality received impacts from the La Nina phenomena and the Movement Control Order (MCO) by Government to curb the spread of COVID-19 pandemic. The La Nina phenomena affected the rainfall pattern which eventually influenced the degree of riverine inputs to the marine environment in both temporal and spatial distribution.

The average and median concentration of all water quality parameters monitored in the CMWQM network showed high conformance to their respective marine water quality classes as stipulated in the MMWQS.

CMWQM Stations, CM11Q Santubong, CM05J Tanjung Pengelih and CM12A Pulau Mentagor that are located nearby river mouths are affected by tide. During low tide, influent of riverine discharge affects the water quality parameters. In addition, the marine water quality of CMWQM stations also subject to the rate of precipitation in the area especially during the North East Monsoon.

In 2020, the level of dissolved oxygen (DO) recorded in all the CMWQM stations showed high degree of conformance (>90%) to their respective MMWQS except for CM13T Pulau Kapas, Terengganu, CM12A Pulau Mentagor, Perak and CM11Q at Santubong. The low dissolved oxygen maybe related to the accumulation of the organic matters in the sea bottom which depleted the dissolved oxygen when the sea current movement is subtle and limited or when the hydrological flow is minimum. CM11Q reported the lowest percentage of DO compliance in 2020. CM11Q which is located within the Santubong river estuary is affected by tide. During low tide, when the water flow within the estuary is low, the dissolved oxygen in the water could be depleted rapidly resulting in low concentration of dissolved oxygen.

Throughout 2020, there was no pollution alert triggered by total suspended solids (TSS). Most of the CMWQM stations showed high conformance to the MMWQS in relation to their water quality objective. On average, TSS concentration at CM04J Tanjung Piai and CM05J Tanjung Pengelih were reported to be higher than other CMWQM stations in this year.

Terdapat insiden tumpahan minyak yang dilaporkan kira-kira 15 km dari stesen CM03N Port Dickson, Negeri Sembilan iaitu di Pantai Cermin pada Oktober 2020. Parameter Polycyclic Aromatic Hydrocarbons (PAHs) yang dilaporkan di stesen tersebut semasa tumpahan minyak bertindak balas terhadap kejadian itu, namun tahap PAH yang dikesan masih di bawah standard yang ditetapkan. Oleh itu, tidak ada amaran pencemaran yang dilaporkan daripada stesen tersebut.

Tiada amaran pencemaran yang dijana oleh rangkaian CMWQM pada tahun 2020. Secara keseluruhan, tahap kualiti air marin yang dipantau di bawah rangkaian CMWQM adalah dianggap baik.

Jadual 4.12 menunjukkan tahap pematuhan stesen CMWQM terhadap kelas masing-masing pada tahun 2020. Pematuhan parameter kualiti air marin berdasarkan SKAMM bagi kesemua stesen CMWQM untuk jumlah pepejal terampai dan PAH adalah tinggi (> 90%) pada tahun 2020.

An oil spill incident was reported near CM03N at Pantai Cermin in October 2020, about 15km away from the CM03N Port Dickson. The Polycyclic Aromatic Hydrocarbons (PAHs) parameter reported at the station during the oil spill was a response to the incident; however the level of PAHs detected was still below the stipulated standards. Hence no pollution alert was triggered from the station.

There were no pollution warnings generated under the CMWQM network in 2020. Overall, the status of marine water quality monitored under the CMWQM network received was good.

Table 4.12 shows the status of CMWQM stations were in compliance with their respective classes in 2020. Compliance to the marine water quality parameters in relation to the MMWQS for all CMWQM stations for TSS and PAHs were high (>90%) in 2020.

Jadual 4.12 : Peratusan Pematuhan Parameter Oksigen Terlarut, Jumlah Pepejal Terampai dan PAH mengikut Kelas Stesen
Table 4.12 : Percentage of Dissolved Oxygen, Total Suspended Solid and PAH's Parameters Compliance according to Their Station Classes

NEGERI / STATE	LOKASI STESEN / STATION LOCATION	ID STESEN / STATION ID	KELAS / CLASS	PERATUSAN PEMATUHAN (%)/ PERCENTAGE OF COMPLIANCE (%)		
				KEPEKATAN OKSIGEN TERLARUT / DISSOLVED OXYGEN (DO) CONCENTRATION	JUMLAH PEPEJAL TERAMPAI / TOTAL SUSPENDED SOLID (TSS)	POLYCYCLIC AROMATIC HYDROCARBONS (PAHS)
Kedah	Pulau Langkawi	CM01K	Kelas 2 / Class 2	98.93%	99.69%	100%
Melaka	Jeti Pulau Undan	CM02M	Kelas 2 / Class 2	100%	99.95%	100%[1**]
N. Sembilan	Port Dickson	CM03N	Kelas 2 / Class 2	100%	99.82%	98.94%
Johor	Tanjung Piai	CM04J	Kelas E1 / Class E1	99.80%	96.83%	97.61%[4**]
	Tanjung Pengelih	CM05J	Kelas 3 / Class 3	100%	99.92%	100%[3**]
W.P. Labuan	W.P. Labuan	CM10S	Kelas 3 / Class 3	99.99%	100%	100%[2**]
Sarawak	Santubong	CM11Q	Kelas E3 / Class E3	43.91%	97.59%	97.55%[3**]
Perak	Pulau Mentagor	CM12A	Kelas 2 / Class 2	78.01%	98.78%	100%
Terengganu	Pulau Kapas	CM13T	Kelas 1 / Class 1	74.24%	99.47%	99.99%
Sabah	Teluk Sepanggar	CM14S	Kelas 3 / Class 3	99.98%	98.93%	100%

NOTA:
[1] Berdasarkan data 11 bulan
[2] Berdasarkan data 10 bulan
[3] Berdasarkan data 7 bulan
[4] Berdasarkan data 4 bulan
**Data PAHs dipengaruhi oleh peratusan (%) kepatuhan berdasarkan tempoh di mana data tersedia.

Sebuah pulau di luar pantai Melaka / An island off the coast of Melaka

BAB 5
CHAPTER 5

INVENTORI PUNCA PENCEMARAN
POLLUTION SOURCES INVENTORY

INVENTORI PUNCA PENCEMARAN / POLLUTION SOURCES INVENTORY

PENGIRAAN BEBAN PENCEMARAN

Sungai merupakan antara ekosistem utama yang mempunyai keupayaan asimilasi untuk mengurangkan kesan pencemaran melalui proses daripada penguraian, penyebaran dan pelarutan. Namun begitu, keupayaan ini ada batas dan sekiranya ia melebihi, kemerosotan kualiti air sungai akan terjadi.

Keupayaan asimilasi sungai ini amat berkait rapat dengan beban pencemaran yang ditakrifkan sebagai kepekatan bahan cemar yang dibawa oleh jasad air pada sesuatu masa yang diberikan. Beban pencemaran ini dipengaruhi oleh faktor kadar alir jasad air tersebut dan juga kepekatan bahan cemar yang dibawa.

Beban pencemaran air adalah kriteria penting bertujuan untuk mengatur strategi dan merancang tindakan pencegahan dan mengawal pencemaran. Pelaksanaan kawalan beban pencemaran air adalah usaha untuk meningkatkan kualiti air sungai demi mengekalkan pelbagai kegunaan berfaedah sungai seperti sumber bekalan air, rekreasi, ternakair (akuakultur), pertanian serta menampung keperluan sistem ekologi.

Punca beban pencemaran air terbahagi kepada dua (2) kategori utama, iaitu punca tetap dan punca tidak tetap. Punca tetap beban pencemaran air adalah punca-punca yang mempunyai takat pelepasan yang boleh dikenalpasti dan tidak berubah dalam masa yang singkat seperti sektor industri, ternakan, sistem rawatan kumbahan dan sebagainya.

POLLUTION LOAD CALCULATION

Rivers are one of the ecosystems that have the assimilative capacity to reduce the impacts from pollution through the processes of degradation, dispersion and dilution. However, this capacity has its limitations and once exceeded, it will cause the quality of the river to deteriorate.

This assimilative capacity is co-related to the water pollution load which is defined as concentration of pollutants carried by a body of water at a given time. Pollution load is influenced by the water body flow rate and the concentration of pollutants carried by the water body.

Water pollution load is one of the important criteria in prioritizing strategies and planning the mode of action for pollution prevention and control. The implementation of the pollution load control is one of the efforts to enhance the river water quality in order to maintain the beneficial uses of a river as a source of water supply, recreation, aquaculture, agriculture as well as to sustain the needs of the ecological system.

Sources of water pollution load can be divided into two (2) main categories which are point sources and non-point sources. Point sources can be described as pollution sources that have specific identifiable discharge points which are unchanged over time. Sectors such as industry, livestock and sewage treatment system fall under this category.

Manakala punca tidak tetap seperti aktiviti pertanian, kerja tanah, perlombongan dan kumbahan bukan najis (air cucian dapur dan bilik air selain kumbahan) tidak mempunyai takat pelepasan yang tetap dan sering berubah-ubah yang menyukarkan anggaran pelepasan beban pencemaran dibuat. Kajian berkaitan beban pencemaran di bawah kategori ini bagi Malaysia tidak banyak dibuat dan tersedia untuk rujukan buat masa ini.

BEBAN PENCEMARAN AIR

Untuk tahun 2020, sebanyak lima (5) jenis punca pencemaran air ditumpukan dalam pelaporan status beban pencemaran air, iaitu industri pembuatan, industri berasaskan pertanian, loji rawatan kumbahan, ternakan babi dan pasar basah.

Sumber data industri pembuatan dan industri berasaskan pertanian diperolehi daripada Jabatan Alam Sekitar (JAS) Negeri manakala bagi loji rawatan kumbahan adalah daripada pihak operator loji seperti Indah Water Konsortium Sdn. Bhd. dan pihak berkuasa tempatan. Data-data berkaitan aktiviti ternakan babi diperolehi daripada Jabatan Perkhidmatan Veterinar dan Kementerian Perumahan dan Kerajaan Tempatan pula membekalkan data bilangan pasar basah.

Pengiraan beban pencemaran ditumpukan kepada tiga (3) parameter utama yang memberikan kesan ketara kepada kualiti air sungai iaitu Keperluan Oksigen Biokimia (BOD), Pepejal Terampai (SS) dan Ammoniakal Nitrogen (AN).

Meanwhile the non-point sources such agricultural activities, earthworks, mining, and sullage (domestic wastewater other than sewage such as kitchen and bathroom wastewater) do not have specific identifiable discharge points and the locations are varied over time. This makes it difficult to estimate the amount of released pollution loads. Studies on this particular category for Malaysia are currently not widely available for reference.

WATER POLLUTION LOAD

For the year of 2020, this report focusses on five (5) types of water pollution load sources which are the manufacturing industries, agricultural-based industries, sewage treatment plants, pig farming and wet markets.

The source of data for manufacturing industries and agricultural-based industries were provided by the Department of Environment (DOE) State offices while data for sewage treatment plants were obtained from Indah Water Konsortium Sdn. Bhd. and the local authority. All data regarding pig farming were provided by the Department of Veterinary Services and data on wet markets were acquired from the Ministry of Housing and Local Government.

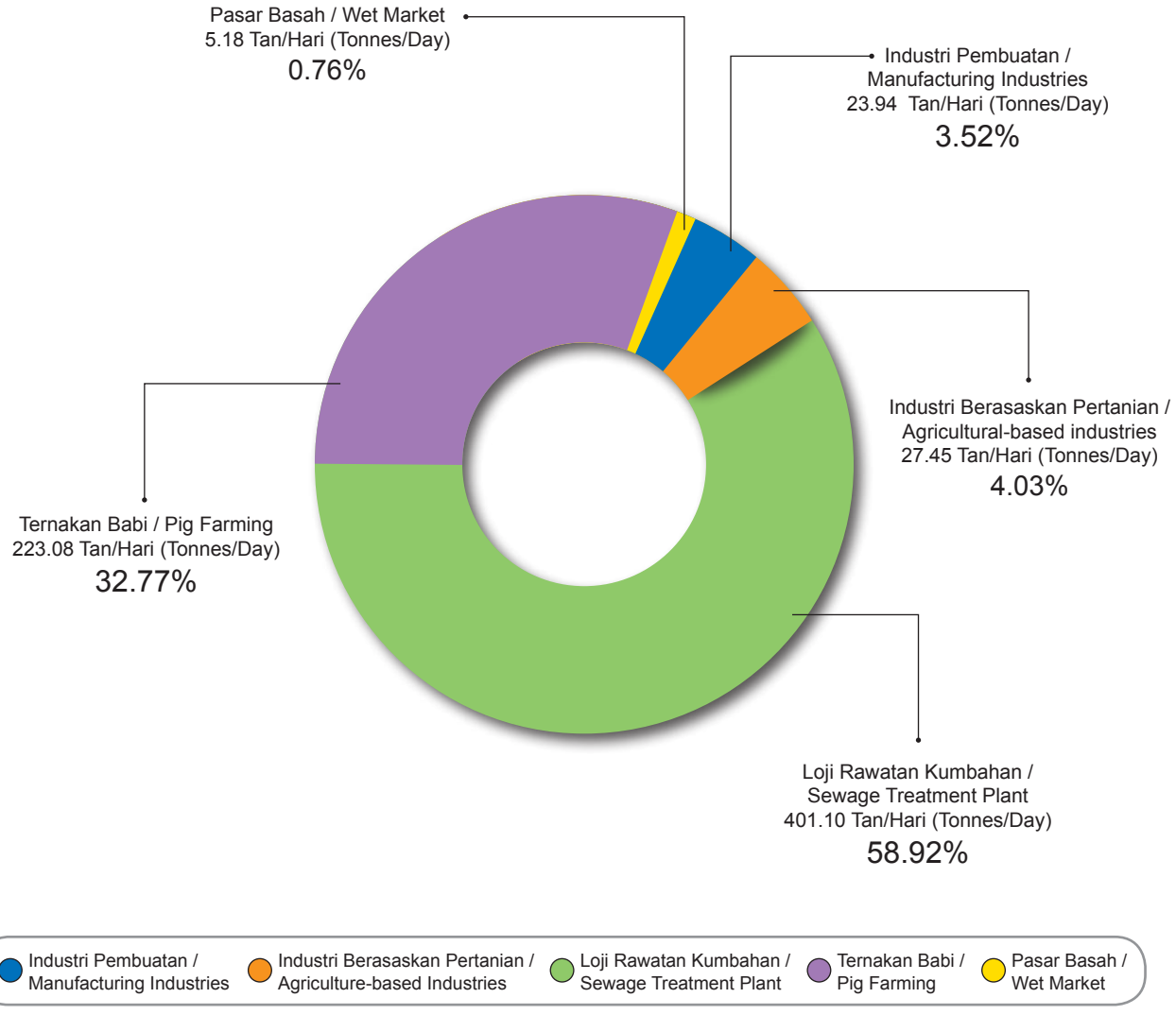
Calculations on pollution load are mainly focused on three (3) main parameters that show significant impact on the river water quality, which are Biochemical Oxygen Demand (BOD), Suspended Solids (SS) and Ammoniacal Nitrogen (AN).

Keperluan Oksigen Biokimia

Pada tahun 2020, anggaran jumlah beban pencemaran BOD terhasil adalah sebanyak 680.75 tan/hari. Pelepasan daripada loji rawatan kumbahan adalah penyumbang beban pencemaran BOD tertinggi iaitu sebanyak 401.10 tan/hari (58.92%), diikuti dengan aktiviti ternakan babi 223.08 tan/hari (32.77%), industri berasaskan pertanian 27.45 tan/hari (4.03%), industri pembuatan 23.94 tan/hari (3.52%) dan pasar basah 5.18 tan/hari (0.76%) (**Rajah 5.1**).

Biochemical Oxygen Demand

In the year 2020, an estimated BOD pollution load of 680.75 tonnes/day was generated. Sewage treatment plants remain the largest BOD load contributor with a total load of 401.10 tonnes/day (58.92%), followed by pig farming activities which contributed 223.08 tonnes/day (32.77%), agriculture-based industries 27.45 tonnes/day (4.03%), manufacturing industries 23.94 tonnes/day (3.52%) and wet markets 5.18 tonnes/ day (0.76%) (**Figure 5.1**).



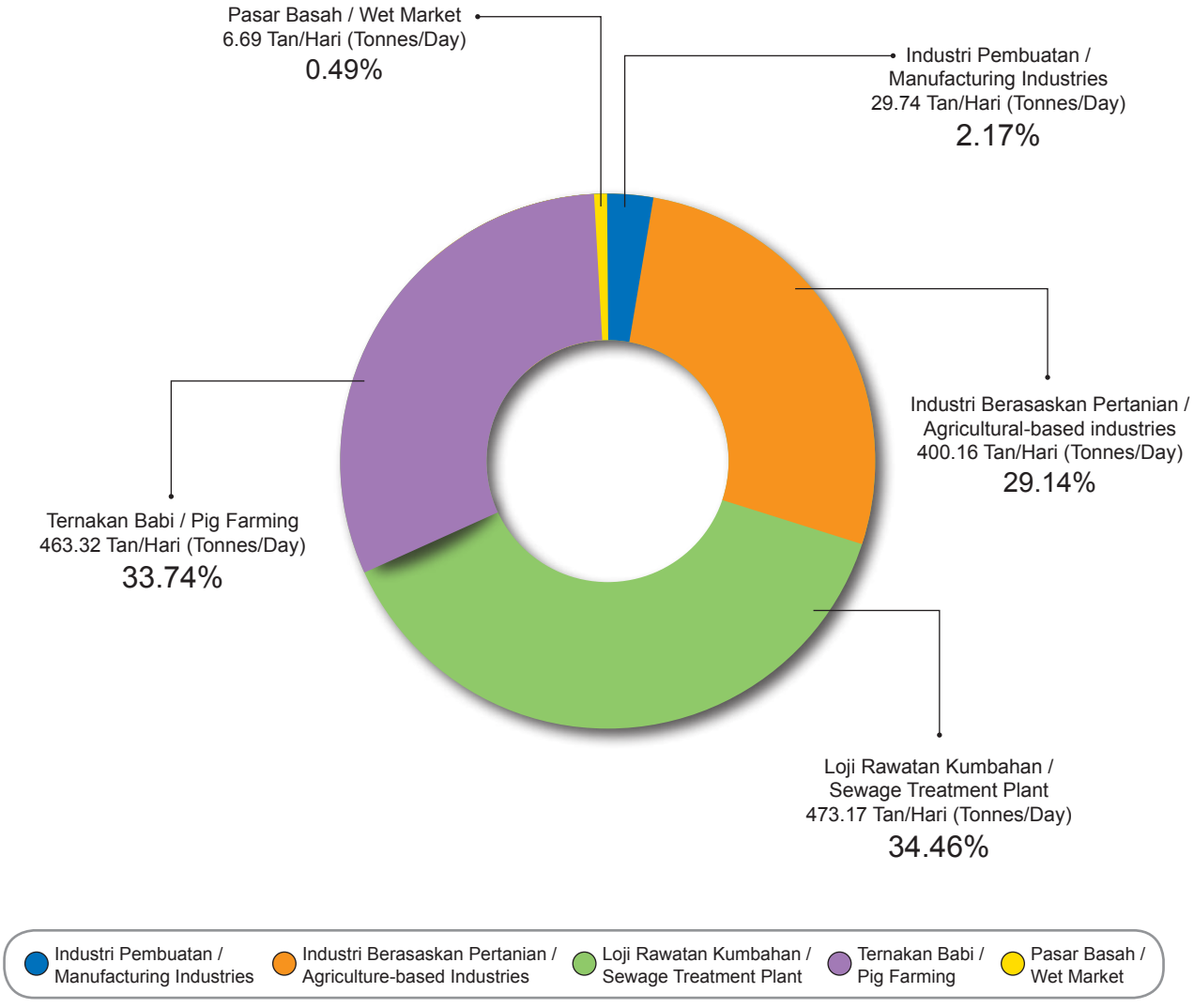
Rajah 5.1 : Anggaran Beban BOD (Tan/Hari) mengikut Punca Pencemaran Air, 2020
Figure 5.1 : Estimation of BOD Load (Tonnes/Day) by Sources of Water Pollution, 2020

Beban Pepejal Terampai

Pada tahun 2020, anggaran jumlah beban pencemaran bagi SS adalah sebanyak 1373.08 tan/hari. Jumlah beban pencemaran daripada loji rawatan kumbahan berada di tangga teratas sebanyak 473.17 tan/hari (34.46%) diikuti dengan ternakan babi 463.32 tan/hari (33.74%). Industri berasaskan pertanian pula adalah sebanyak 400.16 tan/hari (29.14%), industri pembuatan 29.74 tan/hari (2.17%) dan pasar basah 6.69 tan/hari (0.49%) (**Rajah 5.2**).

Suspended Solids Load

The overall estimation in the year 2020 for SS load was 1373.08 tonnes/day. Total pollution load from sewage treatment plant shows the highest load 473.17 tonnes/day (34.46%) followed by pig farming activities with 463.32 tonnes/day (33.74%). Agriculture-based industries contributed 400.16 tonnes/day (29.14%), followed by manufacturing industries 29.74 tonnes/day (2.17%), and wet markets 6.69 tonnes/day (0.49%) (**Figure 5.2**).



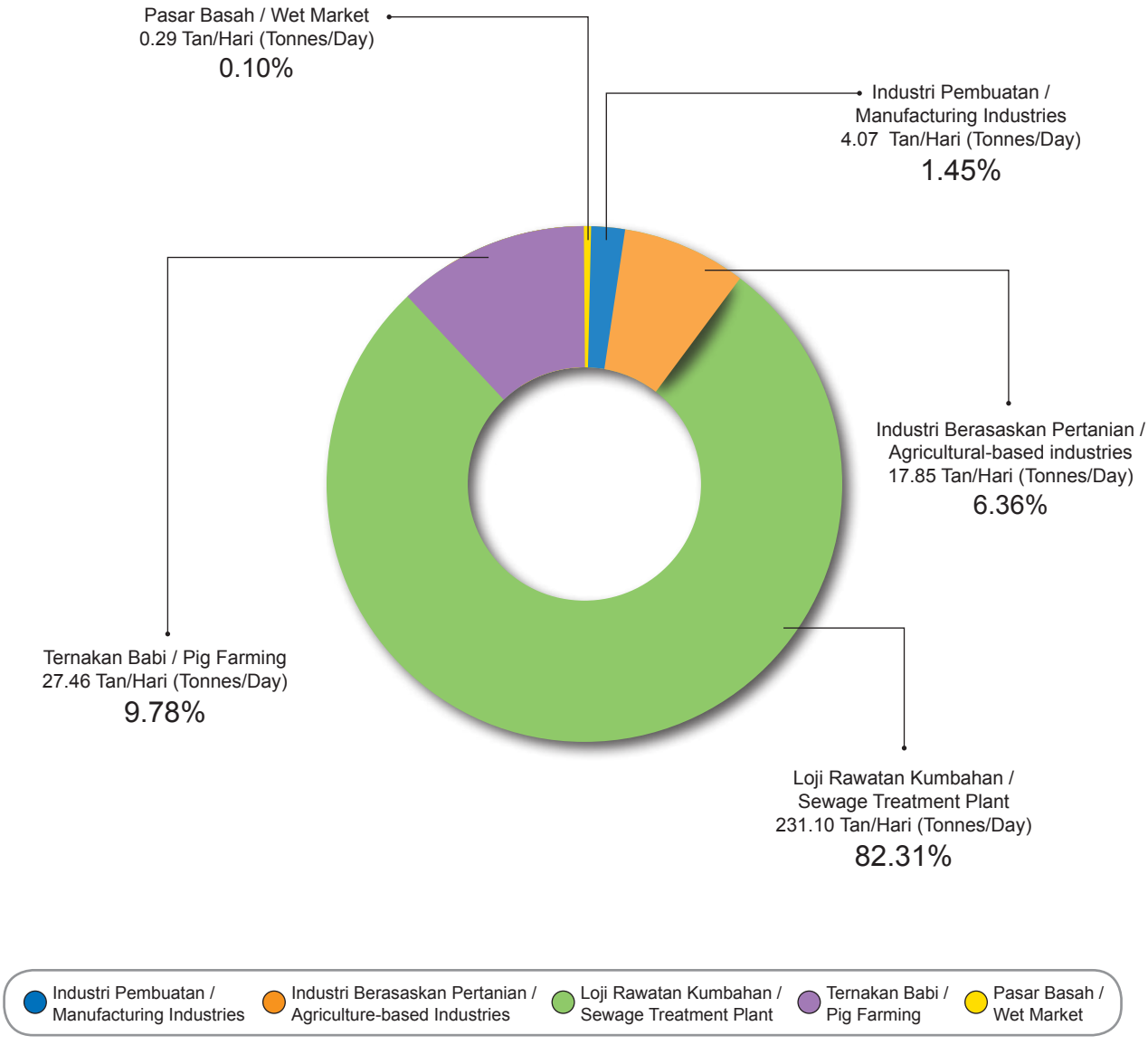
Rajah 5.2 : Anggaran Beban SS (Tan/Hari) mengikut Punca Pencemaran Air, 2020
Figure 5.2 : Estimation of SS Load (Tonnes/Day) by Sources of Water Pollution, 2020

Beban Ammoniakal Nitrogen

Pada tahun 2020, anggaran beban pencemar AN adalah sebanyak 280.77 tan/hari di mana pelepasan loji rawatan kumbahan adalah penyumbang terbesar beban AN dengan jumlah sebanyak 231.10 tan/hari (82.31%), diikuti aktiviti ternakan babi iaitu 27.46 tan/hari (9.78%), industri berasaskan pertanian 17.85 tan/hari (6.36%), industri pembuatan 4.07 tan/hari (1.45%) dan pasar basah 0.29 tan/hari (0.10%) (**Rajah 5.3**).

Ammoniacal Nitrogen Load

In year 2020, the AN load was estimated to be 280.77 tonnes/day in which sewage treatment plant remained the largest contributor with a total load of 231.10 tonnes/day (82.31%), followed by pig farming activities with 27.46 tonnes/day (9.78%), agriculture-based industries 17.85 tonnes/day (6.36%), manufacturing industries 4.07 tonnes/day (1.45%) and wet markets 0.29 tonnes/day (0.10%) (**Figure 5.3**).



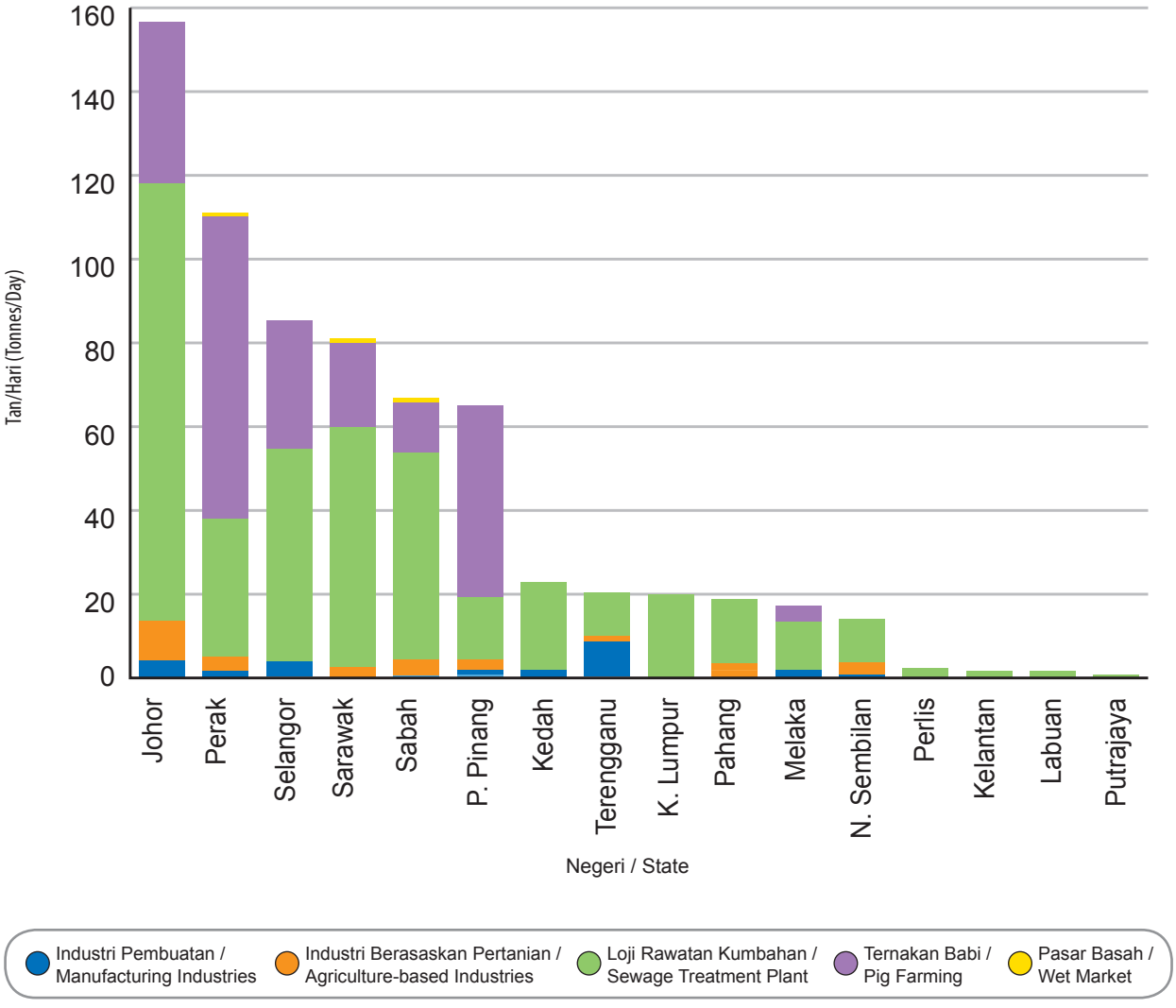
Rajah 5.3 : Anggaran Beban AN (Tan/Hari) mengikut Punca Pencemaran Air, 2020
Figure 5.3 : Assessment of AN Load (Tonnes/Day) by Sources of Water Pollution, 2020

Beban Pencemaran Keperluan Oksigen Biokimia mengikut Negeri

Pada tahun 2020, anggaran penghasilan beban BOD di Johor adalah tertinggi iaitu sebanyak 155.00 tan/hari, Perak 110.72 tan/hari, Selangor 85.52 tan/hari, Sarawak 80.82 tan/hari, Sabah 65.65 tan/hari dan Pulau Pinang 64.36 tan/hari. Beban BOD untuk lain-lain negeri termasuk Wilayah Persekutuan Labuan dan Putrajaya adalah kurang daripada 22.54 tan/hari. Beban pencemar BOD mengikut negeri ditunjukkan pada **Rajah 5.4.**

Biochemical Oxygen Demand Load by States

In the year 2020, the estimation of BOD loads generated in Johor was recorded to be the highest with a value of 155.00 tonnes/day, followed by Perak 110.72 tonnes/day, Selangor 85.52 tonnes/day, Sarawak 80.82 tonnes/day, Sabah 65.65 tonnes/day and Pulau Pinang 64.36 tonnes/day. BOD load for the rest of the states including Federal Territory of Labuan and Putrajaya generated less than 22.54 tonnes/day. BOD pollution load based on states is shown in **Figure 5.4.**



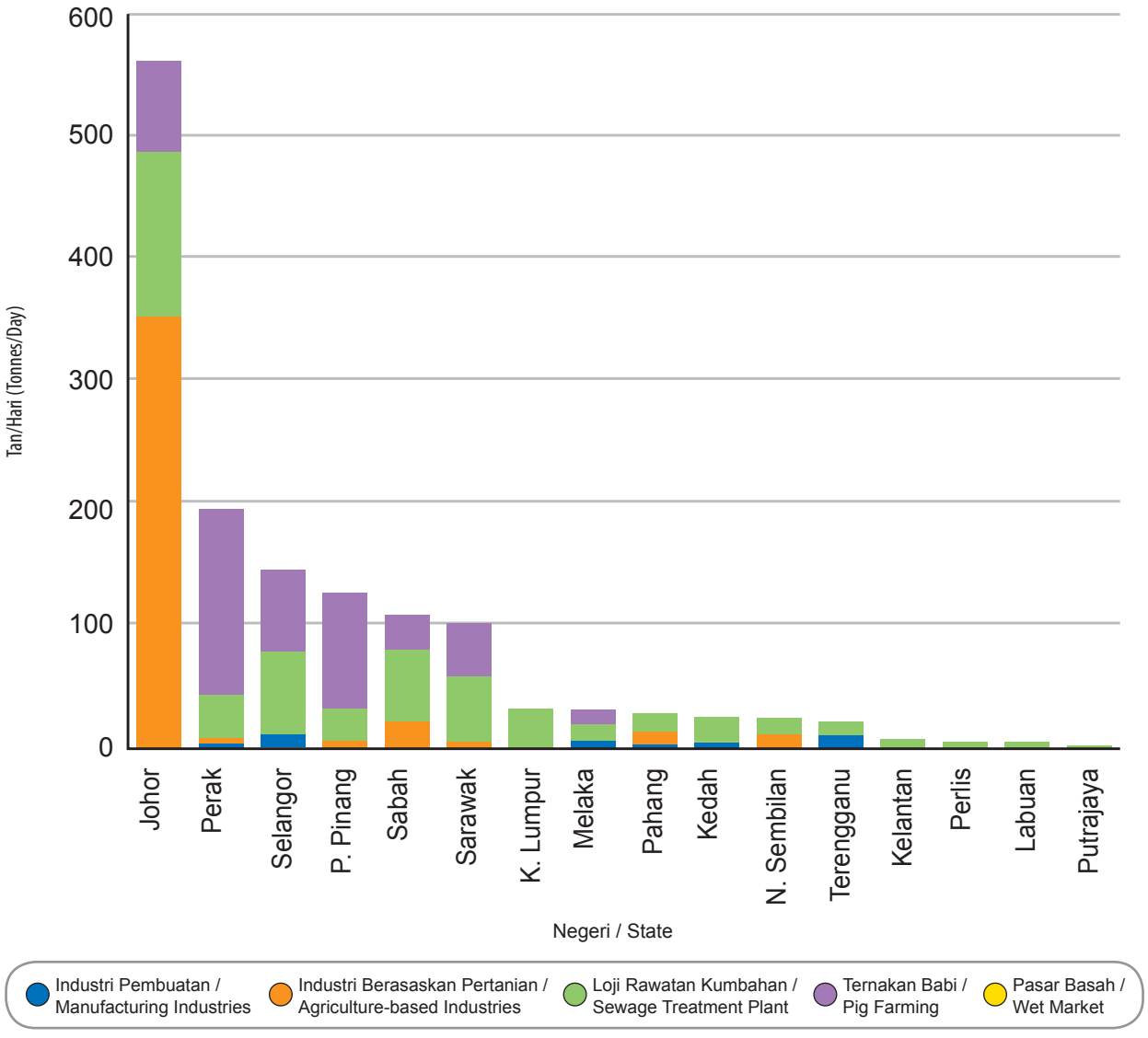
Rajah 5.4 : Taburan Anggaran Beban BOD (Tan/Hari) dan Punca Pencemaran Air mengikut Negeri, 2020
Figure 5.4 : Dispersions of BOD Load (Tonnes/Day) Assessment and Sources of Water Pollution by States, 2020

Beban Pencemaran Pepejal Terampai mengikut Negeri

Anggaran penghasilan beban SS di Johor adalah tertinggi iaitu sebanyak 558.99 tan/hari, diikuti Perak 192.61 tan/hari, Selangor 142.57 tan/hari, Pulau Pinang 122.59 tan/hari dan Sabah 105.49 tan/hari. Beban SS untuk lain-lain negeri termasuk Wilayah Persekutuan Labuan dan Putrajaya adalah kurang daripada 99.55 tan/hari. Beban pencemar SS mengikut negeri ditunjukkan pada **Rajah 5.5**.

Suspended Solids Load by States

The estimated SS load generated in Johor was recorded to be the highest with a value of 558.99 tonnes/day, followed by Perak 192.61 tonnes/day, Selangor 142.57 tonnes/day, Pulau Pinang 122.59, and Sabah 105.49. The SS load for the rest of the states including Federal Territory of Labuan and Putrajaya generated less than 99.55 tonnes/day. SS pollution loads at the state level is shown in **Figure 5.5**.



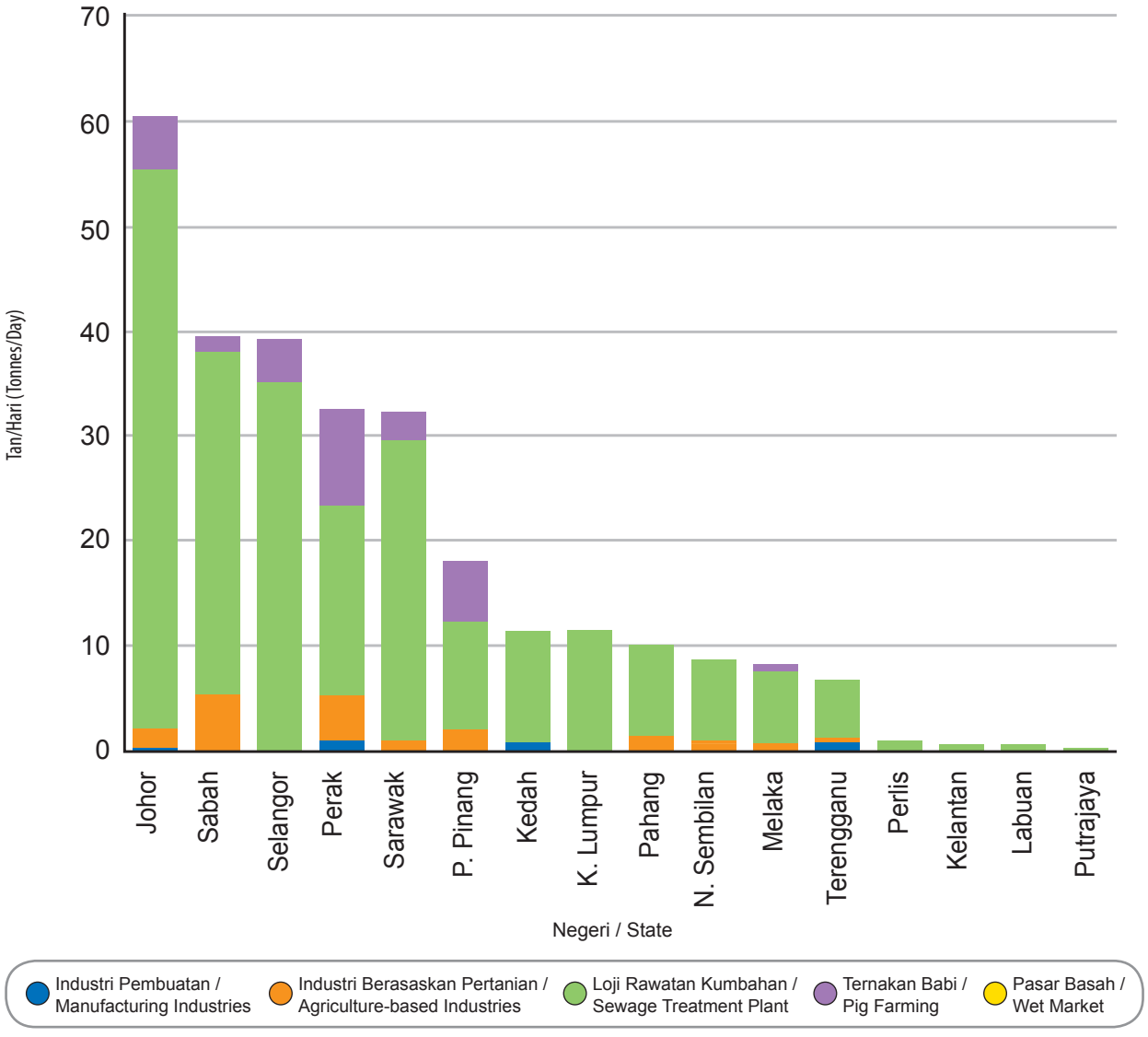
Rajah 5.5 : Taburan Anggaran Beban SS (Tan/Hari) dan Punca Pencemaran Air mengikut Negeri, 2020
Figure 5.5 : Dispersions of SS Load (Tonnes/Day) Assessment and Sources of Water Pollution by States, 2020

Beban Pencemaran Ammoniakal Nitrogen mengikut Negeri

Anggaran penghasilan beban AN di Johor adalah tertinggi iaitu sebanyak 60.06 tan/hari, diikuti Sabah 39.41 tan/hari, Selangor 39.09 tan/hari, Perak 32.46 tan/hari, dan Sarawak 32.23 tan/hari. Beban AN untuk lain-lain negeri termasuk Wilayah Persekutuan Labuan dan Putrajaya adalah kurang daripada 18.10 tan/hari. Beban pencemar AN mengikut negeri ditunjukkan pada **Rajah 5.6**.

Ammoniacal Nitrogen Load by States

The estimated AN loads generated in Johor was recorded to be the highest with a value of 60.06 tonnes/day, followed by Sabah at 39.41 tonnes/day, Selangor 39.09 tonnes/day, Perak 32.46 tonnes/day and Sarawak 32.23 tonnes/day. The AN load for the rest of the states including Federal Territory of Labuan and Putrajaya generated less than 18.10 tonnes/day. AN pollution load based on states is shown in **Figure 5.6.**



Rajah 5.6 : Taburan Anggaran Beban AN (Tan/Hari) dan Punca Pencemaran Air mengikut Negeri, 2020
Figure 5.6 : Dispersions of AN Load (Tonnes/Day) Assessment and Sources of Water Pollution by States, 2020

PUNCA-PUNCA PENCEMARAN UDARA

Peningkatan punca industri dan bilangan kenderaan bermotor boleh menyebabkan pencemaran udara yang teruk jika pelepasan pencemar termasuk pelepasan asap daripada kedua-dua aktiviti ini tidak dikawal dengan berkesan.

Sehingga Disember 2020, jumlah punca industri yang melepaskan bahan pencemar ke udara adalah sebanyak 13,776. Bilangan punca pencemar yang tertinggi adalah di Selangor (2,867:21) diikuti Johor (2,434:18) dan Perak (1,557:11) seperti ditunjukkan dalam **Rajah 5.7**.

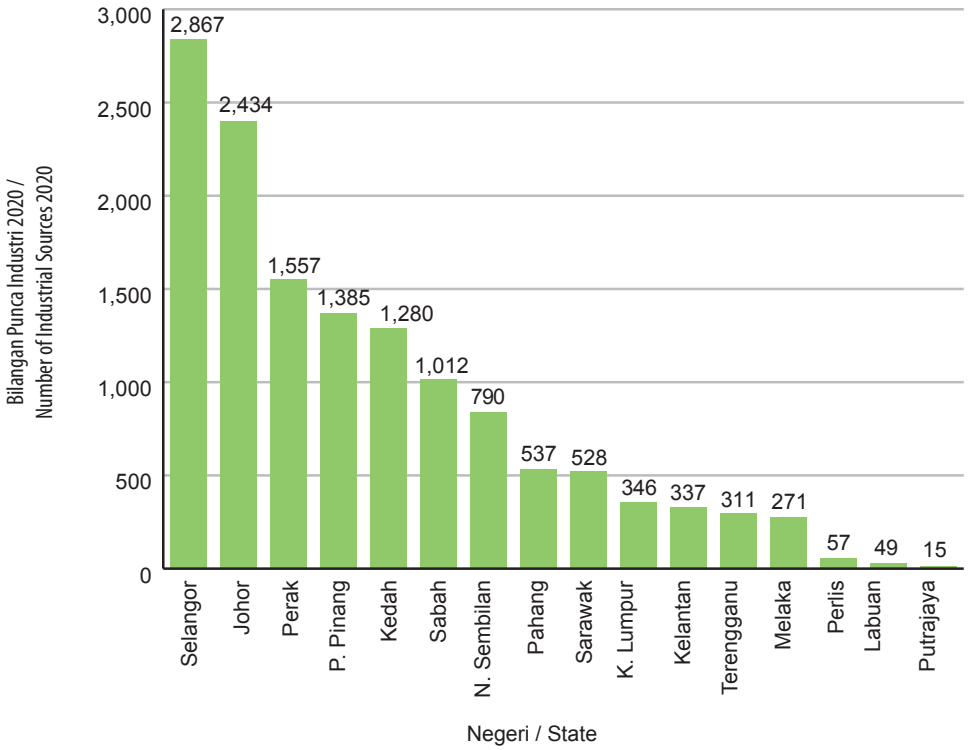
Pada tahun 2020, terdapat peningkatan bagi jumlah keseluruhan kenderaan bermotor yang berdaftar. Bilangan teksi dan kenderaan sewa pandu sendiri yang berdaftar meningkat sebanyak 4.36%, diikuti dengan kenderaan penumpang meningkat sebanyak 3.51%, motosikal sebanyak 3.82%, kenderaan barangan sebanyak 2.31%, dan bas sebanyak 0.70% berbanding dengan tahun 2019. Bilangan kenderaan bermotor yang berdaftar yang direkodkan oleh Jabatan Pengangkutan Jalan pada tahun 2019 dan 2020 adalah seperti yang ditunjukkan dalam **Rajah 5.8**. Jumlah kenderaan berdaftar yang sedang digunakan (aktif) meningkat sebanyak 2.52% berbanding dengan tahun 2019. Bilangan kenderaan penumpang meningkat sebanyak 2.57%, teksi menurun sebanyak 5.11% dan motosikal meningkat sebanyak 2.25%, manakala kenderaan barang meningkat 4.35% dan bas menurun 8.09% berbanding dengan bilangan tahun 2019. Bilangan kenderaan berdaftar yang sedang digunakan (aktif) adalah seperti ditunjukkan dalam **Rajah 5.9**.

SOURCES OF AIR POLLUTION

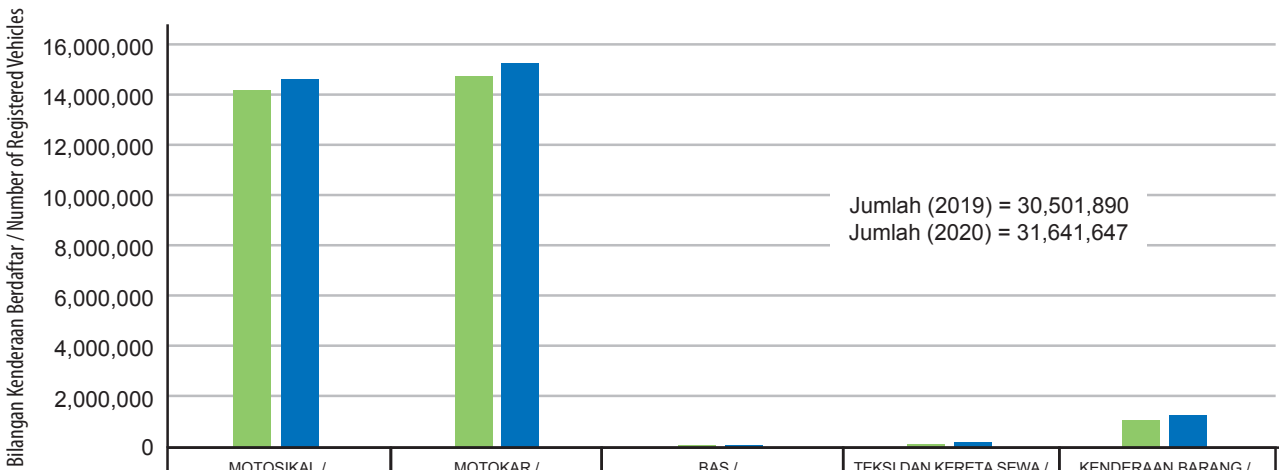
The increase in industrial sources and numbers of motor vehicles could cause severe air pollution if the emissions of pollutants, including smoke emission, from both sources are not effectively controlled.

As at December 2020, a total of 13,776 industrial sources were emitting air pollutants. The highest pollution sources were in Selangor (2,867:21) followed by Johor (2434:18) and Perak (1,557:11) as indicated in **Figure 5.7.**

In 2020, there was an increase in the overall number of registered motor vehicles. The number of registered taxis and self-driven rental vehicles increased by 4.36%, followed by an increase of 3.51% in passenger cars, 3.82% in motorcycles, 2.31% in freight vehicles, and 0.70% in buses compared to 2019. The number of registered vehicles in Malaysia as reported by the Road Transport Department for 2019 and 2020 is shown in **Figure 5.8**. The number of registered in-use (active) vehicles increased by 2.52% compared to 2019. The number of passenger vehicles increased by 2.57%, taxis decreased by 5.11% and motorcycles increased by 2.25%, while freight vehicles increased by 4.35% and buses decreased by 8.09% compared to the respective numbers of 2019. The number of registered in-use vehicles (active) is shown in **Figure 5.9**.



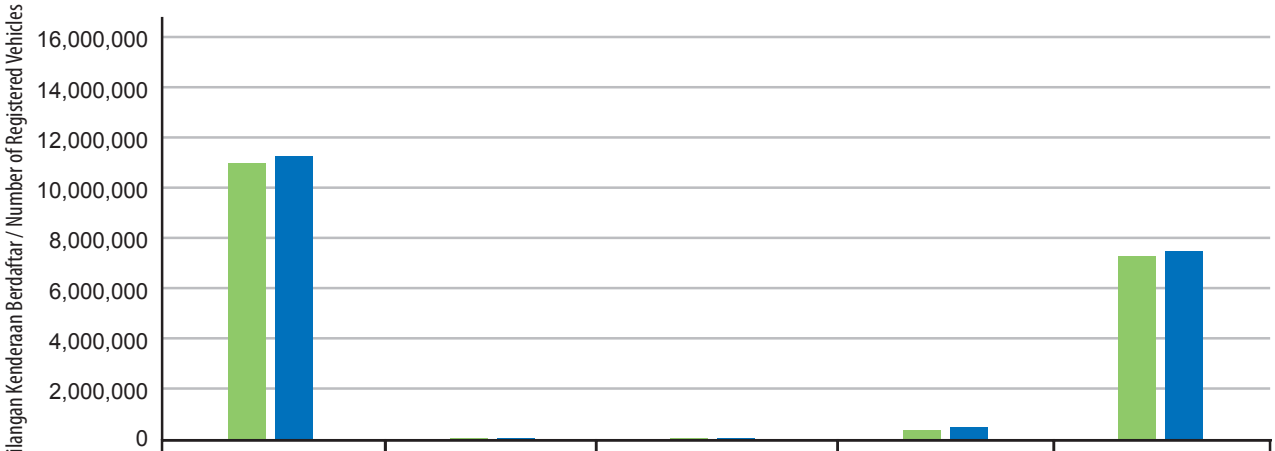
Rajah 5.7 : Punca Pencemaran Udara Industri mengikut Negeri Tahun 2020
Figure 5.7 : Industrial Air Pollution Sources by State in Year 2020



	MOTOSIKAL / MOTORCYCLE	MOTOKAR / MOTORCAR	BAS / BUS	TEKSI DAN KERETA SEWA / TAXI AND RENTAL CAR	KENDERAAN BARANG / GOODS VEHICLE
2019	14,322,379	14,706,008	62,944	115,487	1,295,072
2020	14,891,568	15,240,296	63,390	120,754	1,325,639

(Sumber: Jabatan Pengangkutan Jalan, Malaysia 2020)
(Source: Road Transport Department, Malaysia, 2020)

Rajah 5.8 : Bilangan Kenderaan Berdaftar pada Tahun 2019-2020
Figure 5.8 : Number of Registered Vehicles in 2019-2020



	MOTOKAR / MOTORCAR	TEKSI / TAXI	BAS / BUS	KENDERAAN BARANG / GOODS VEHICLE	MOTOSIKAL / MOTORCYCLE
2019	11,166,702	19,696	10,886	764,358	7,356,468
2020	11,461,510	18,738	10,071	799,097	7,525,840

(Sumber: Jabatan Pengangkutan Jalan, Malaysia 2020)
(Source: Road Transport Department, Malaysia, 2020)

Rajah 5.9 : Bilangan Kenderaan Berdaftar yang Sedang Digunakan (Aktif) pada Tahun 2019-2020
Figure 5.9 : Number of Registered In-Use Vehicles (Active) in 2019-2020

BEBAN PENCEMARAN PENCEMAR UDARA

Beban Pencemaran Secara Menyeluruh

Dianggarkan pada tahun 2020, keseluruhan beban pencemaran yang terkumpul bagi pencemar karbon monoksida (CO) adalah 2,307,440 tan metrik, 935,747 tan metrik bagi nitrogen dioksida (NO_2), 292,651 tan metrik bagi sulfur dioksida (SO_2) dan 29,266 tan metrik bagi jirim zarahan (PM). Perbandingan keseluruhan beban pencemaran bagi tahun 2018, 2019 dan 2020 seperti ditunjukkan dalam **Rajah 5.10**.

Beban pencemaran bagi CO meningkat pada tahun 2020 berbanding dengan 2019. Pada tahun 2020, peningkatan adalah sebanyak 3.2% bagi beban pencemar CO dan peningkatan 1.1% bagi beban pencemar NO_2. Peningkatan sebanyak 8.3% bagi pencemar SO_2 dan pencemar PM juga menunjukkan peningkatan sebanyak 7.7% berbanding dengan tahun 2019.

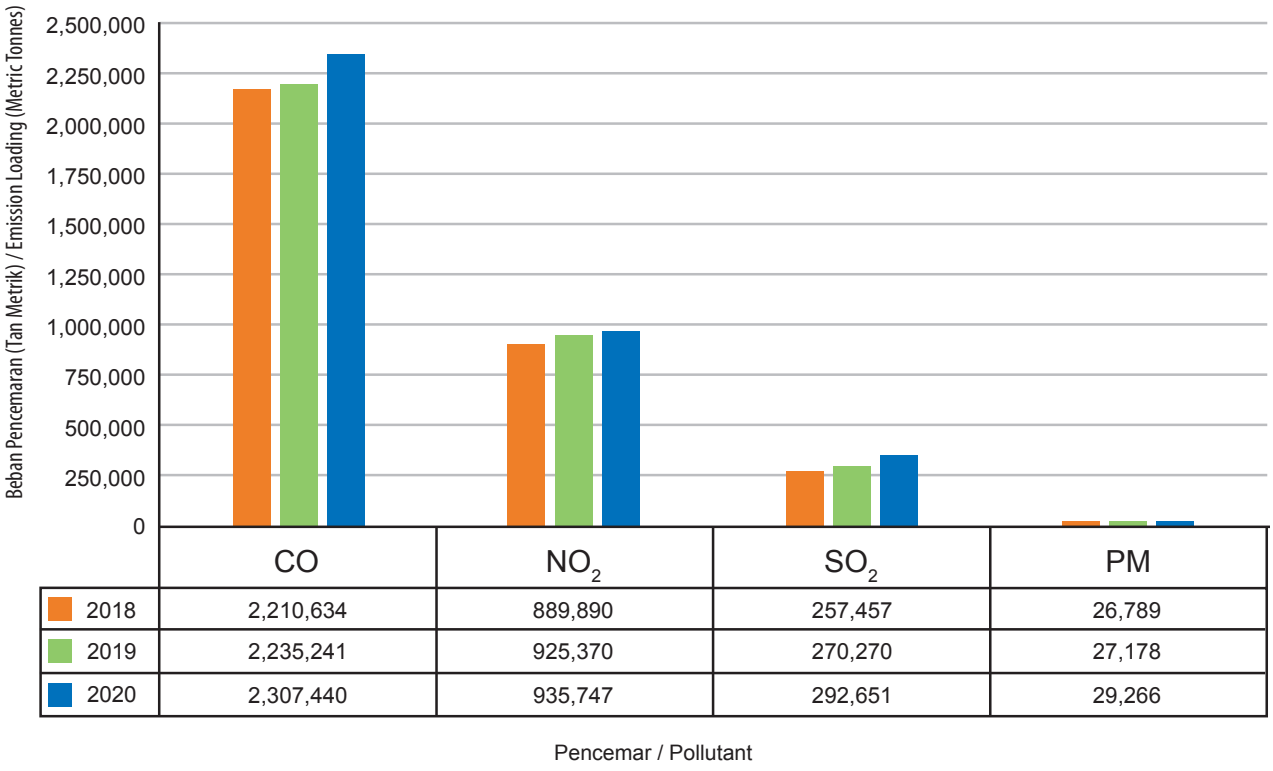
AIR POLLUTION EMISSION LOAD

Overall Emission Load

It was estimated that in 2020 the overall cumulative air pollutant emission load was 2,307,440 metric tonnes of carbon monoxide (CO), 935,747 metric tonnes of nitrogen dioxide (NO_2), 292,651 metric tonnes of sulphur dioxide (SO_2) and 29,266 metric tonnes of particulate matter (PM). A comparison of the combined air pollutants emission load in 2018, 2019 and 2020 is shown in **Figure 5.10.**

Emission load for CO had increased in 2020 compared to 2019. In 2020 the increment in CO emission load was 3.2% and 1.1% for NO_2. There was an increase of 8.3% for SO_2 and for pollutant PM, the rise was 7.7% compared to 2019.

Kuala Lumpur



	CO	NO_2	SO_2	PM
2018	2,210,634	889,890	257,457	26,789
2019	2,235,241	925,370	270,270	27,178
2020	2,307,440	935,747	292,651	29,266

(Sumber: National Energy Balance, 2018)
(Source: National Energy Balance, 2018)

Rajah 5.10 : Beban Pencemaran Bahan Pencemar Udara dari Semua Punca, 2018-2020
Figure 5.10 : Air Pollutant Emission Load from All Sources, 2018-2020

Punca Beban Pencemaran

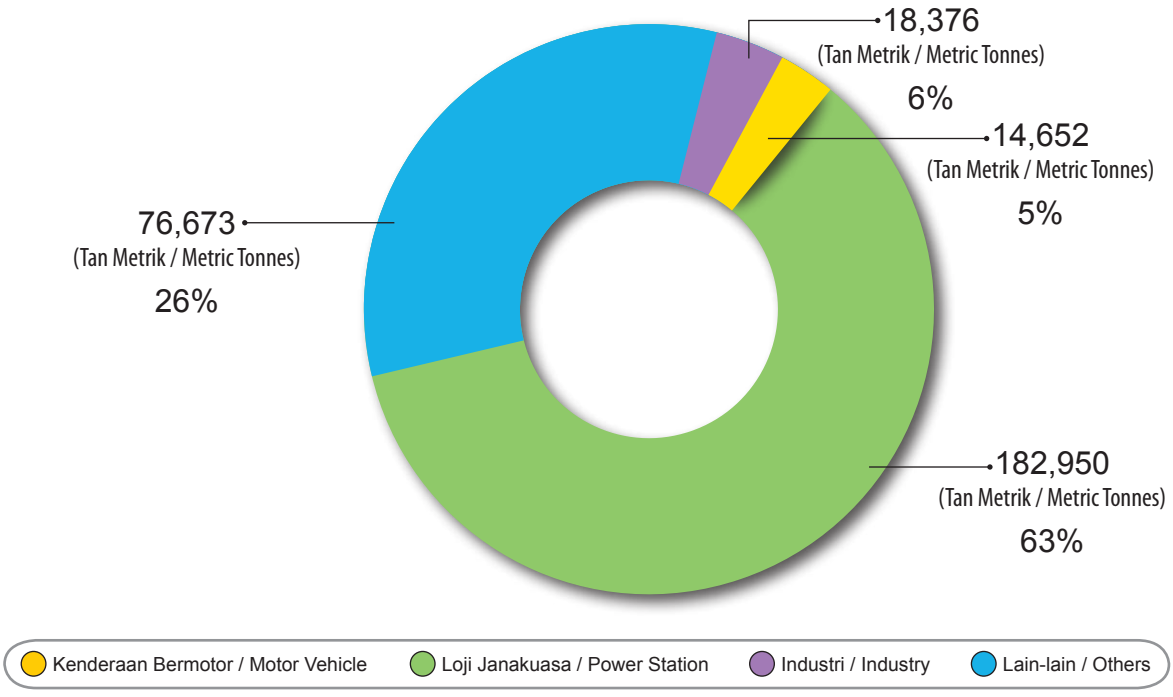
Loji janakuasa merupakan penyumbang utama kepada beban pencemar SO_2 (63%), diikuti dengan lain-lain kategori (26%), industri (6%) dan kenderaan bermotor (5%) (**Rajah 5.11**). Bagi beban pencemar PM pula, penyumbang terbesar adalah daripada loji janakuasa (39%), industri (29%), diikuti kenderaan bermotor (12%) dan lain-lain kategori (20%) (**Rajah 5.12**).

Penyumbang terbesar bagi NO_2 adalah daripada loji janakuasa (62%) diikuti kenderaan bermotor (24%), industri (9%) dan lain-lain kategori (5%) (**Rajah 5.13**). Walau bagaimanapun, kenderaan bermotor masih merupakan penyumbang terbesar kepada CO (95.7%) (**Rajah 5.14**). Punca-punca bagi kategori 'Lain-lain' yang dinyatakan di dalam rajah-rajah adalah merupakan pelepasan bahan pencemar udara dari kawasan perumahan, komersial dan penggunaan bukan tenaga. Anggaran pencemaran yang dihasilkan oleh beban pencemar udara daripada kenderaan bermotor iaitu HC, CO, PM, NO_2 dan SO_2 pada tahun 2019 dan 2020 ditunjukkan dalam **Rajah 5.15**.

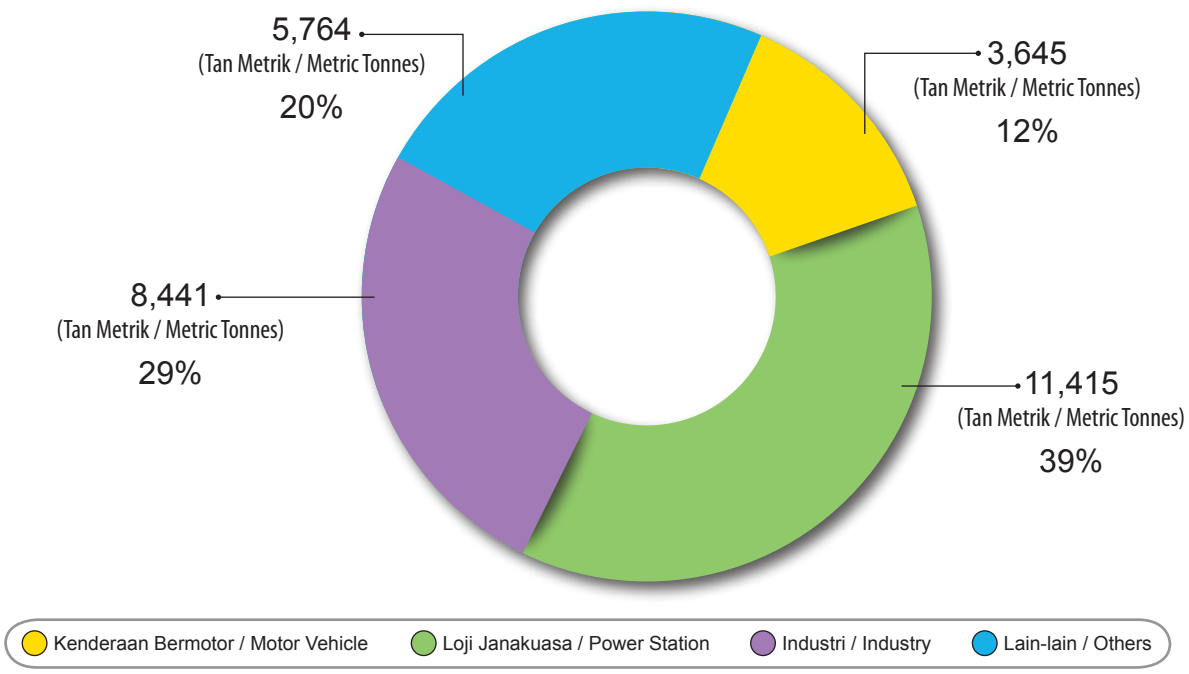
Emission Load by Sources

Power plants contributed the highest SO_2 emission load (63%), followed by other categories (26%), industries (6%) and motor vehicles (5%) (**Figure 5.11**). As for PM, the highest contributors were power plants (39%) followed by industries (29%), motor vehicles (12%) and others (20%) (**Figure5.12**)

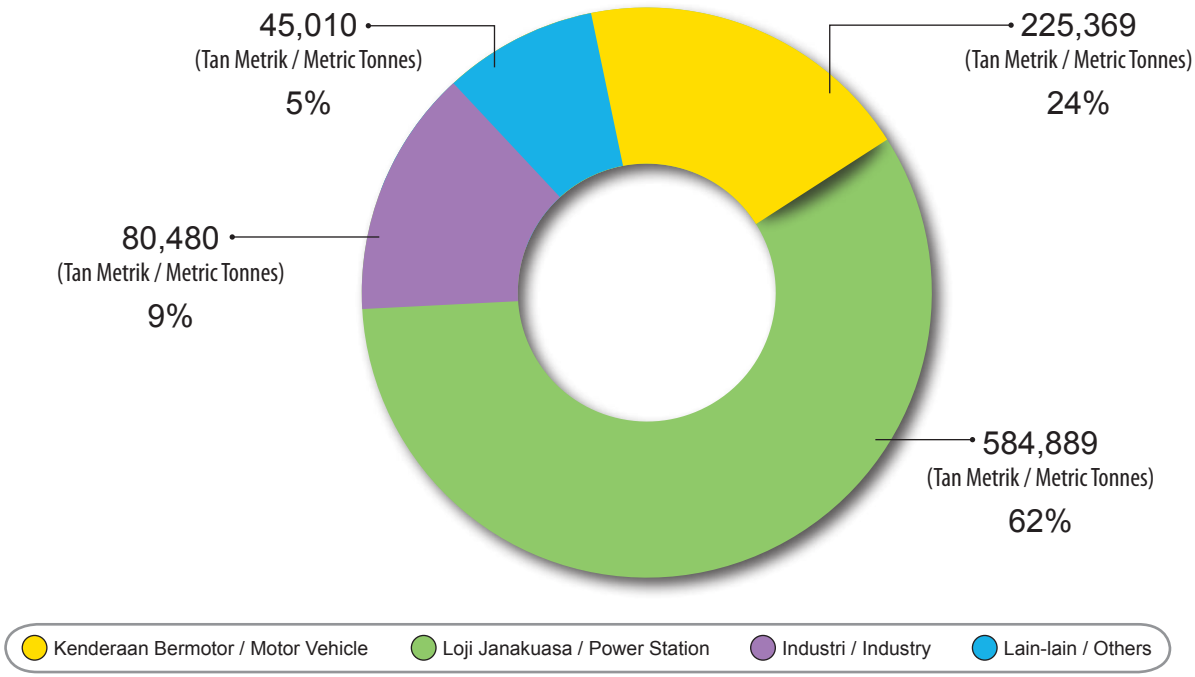
The highest contributors of NO_2 were power plants (62%) followed by motor vehicles (24%), industries (9%), and others (5%) (**Figure 5.13**). However, motor vehicles remained the highest contributor of CO (95.7%) (**Figure 5.14**). 'Others' in the figures represent air pollutant emission from residential, commercial and non-energy use sources. The estimated annual air pollutant emission loads of HC, CO, PM, NO_2 and SO_2 from motor vehicles for 2019 and 2020 are shown in **Figure 5.15.**



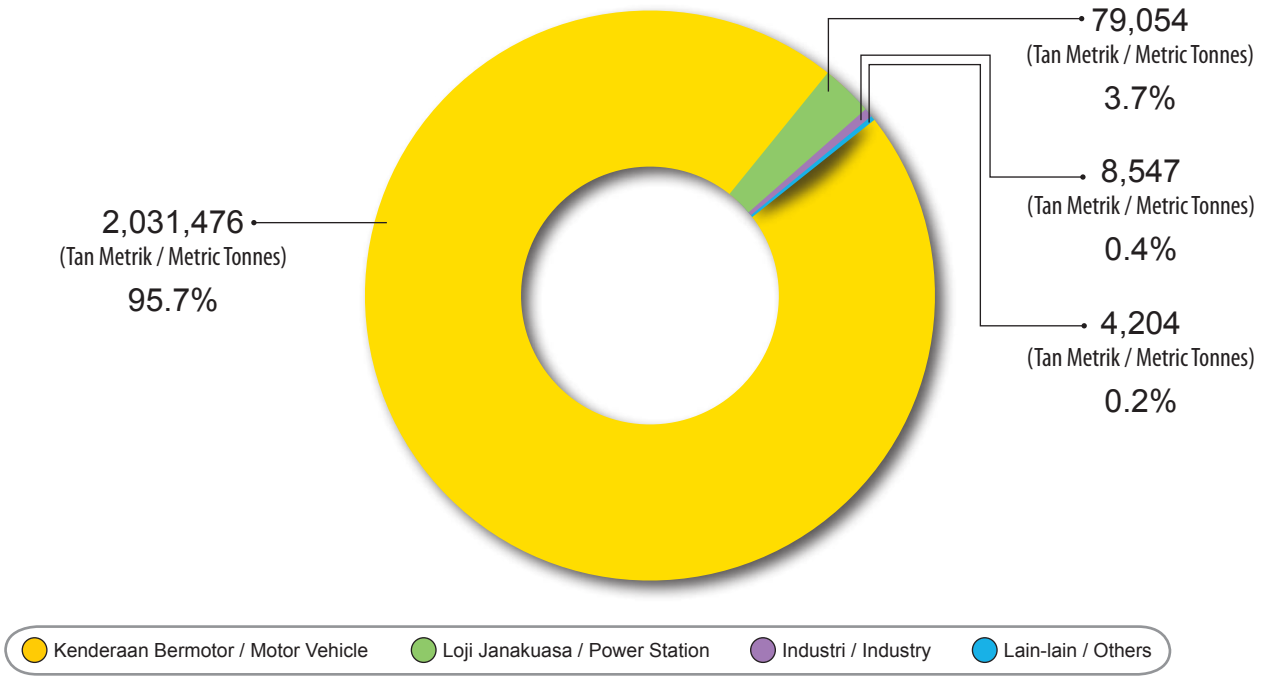
Rajah 5.11 : Punca Beban Pencemaran SO_2 (Tan Metrik), 2020
Figure 5.11 : SO_2 Emission Load by Sources (Metric Tonnes), 2020



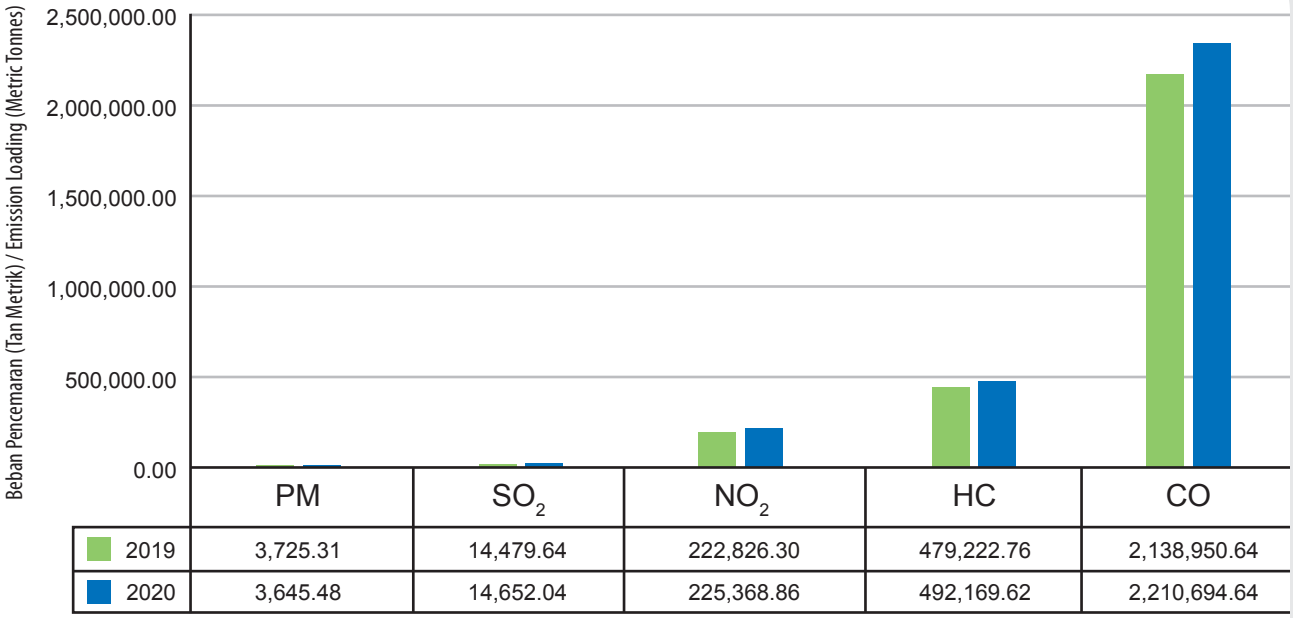
Rajah 5.12 : Punca Beban Pencemaran PM (Tan Metrik), 2020
Figure 5.12 : PM Emission Load by Sources (Metric Tonnes), 2020



Rajah 5.13 : Punca Beban Pencemaran NO_2 (Tan Metrik), 2020
Figure 5.13 : NO_2 Emission Load by Sources (Metric Tonnes), 2020



Rajah 5.14 : Punca Beban Pencemaran CO (Tan Metrik), 2020
Figure 5.14 : CO Emission Load by Sources (Metric Tonnes), 2020



	PM	SO_2	NO_2	HC	CO
2019	3,725.31	14,479.64	222,826.30	479,222.76	2,138,950.64
2020	3,645.48	14,652.04	225,368.86	492,169.62	2,210,694.64

Rajah 5.15 : Beban Pencemar Udara dari Kenderaan Bermotor, 2019-2020
Figure 5.15 : Air Pollutant Emission Load from Motor Vehicles, 2019-2020

INVENTORI BUANGAN TERJADUAL

Pada tahun 2020, sebanyak 7,185,227.76 tan metrik buangan terjadual telah dihasilkan. Ini merupakan peningkatan sebanyak 79.04% berbanding 4,013,189.03 tan metrik yang dilaporkan pada 2019. Kategori utama buangan yang dihasilkan adalah dros/ sanga/ klinker/ abu, enapcemar logam berat dan buangan gipsum (**Jadual 5.1**). Selangor menghasilkan jumlah terbesar buangan terjadual (28.51%), diikuti oleh Johor (16.83%), Negeri Sembilan (16.18%), Sarawak (6.95%), Sabah (6.45%), Perak (6.11%) manakala sepuluh (10) negeri-negeri yang lain menghasilkan sebanyak 18.97% (**Rajah 5.16**). Berdasarkan jumlah buangan terjadual yang dihasilkan mengikut jenis industri (**Jadual 5.2**), loji janakuasa didapati menghasilkan kuantiti buangan terjadual yang tertinggi sebanyak 2,491,477.65 tan metrik diikuti loji rawatan air (1,148,834.33 tan metrik) dan industri kimia (739,280.91 tan metrik).

Tren pengurusan buangan terjadual dalam negara adalah seperti di **Rajah 5.17**.

Sebanyak 714,292.11 tan metrik (9.94%) daripada jumlah buangan yang dihasilkan diperoleh kembali di dalam dan luar negara. Ini menunjukkan peningkatan sebanyak 38.27% berbanding 516,585.65 tan metrik pada tahun 2019. Daripada jumlah itu, 546,290.52 tan metrik (7.60%) buangan terjadual diperoleh kembali di kemudahan pemerolehan kembali luar tapak tempatan manakala 168,001.59 tan metrik (2.34%) telah diberi kebenaran eksport untuk pemerolehan kembali di kemudahan di luar negara.

Sebanyak 214,351.09 tan metrik (2.98%) daripada jumlah buangan terjadual yang dihasilkan, dirawat dan dilupuskan di Kualiti Alam Sdn. Bhd (142,479.00 tan metrik), Trienekens (Sarawak) Sdn. Bhd (31,988.77 tan metrik) dan 39,883.32 tan metrik daripada buangan klinikal telah dibakar dan dilupuskan di kemudahan luar tapak yang dilesenkan. Jumlah ini menunjukkan peningkatan sebanyak 17.63% berbanding 182,220.01 tan metrik buangan berjadual dilupuskan pada tahun 2019. Sebanyak 1,104,481.06 tan metrik (15.37%) daripada buangan terjadual terhasil telah diolah di tapak; manakala 2,983,676.57 tan metrik (41.53%) distor di premis pengeluar buangan (**Jadual 5.3**).

SCHEDULED WASTE INVENTORY

A total of 7,185,227.76 metric tonnes of scheduled waste were generated in the year 2020. This represents an overall increase of 79.04% as compared to 4,013,189.03 metric tonnes reported in 2019. The main categories of scheduled waste generated were dross/ slag/ clinker/ ash, heavy metal sludge and gypsum (**Table 5.1**). Selangor generated the largest amount of scheduled wastes (28.51%), followed by Johor (16.83%), Negeri Sembilan (16.18%), Sarawak (6.95%), Sabah (6.45%), Perak (6.11%) while the other ten (10) states generated a total of 18.97% (**Figure 5.16**).Based on the scheduled waste generated by the industries (**Table 5.2**), power plants generated the largest quantity with a total of 2,491,477.65 metric tonnes followed by water treatment plants (1,148,834.33 metric tonnnes) and chemical industries (739,280.91 metric tonnnes).

The scheduled waste management trend in the country is as shown in **Figure 5.17**.

A total of 714,292.11 metric tonnes (9.94%) of scheduled waste had gone through recovery process both locally and abroad. This showed an increase of 38.27% as compared to 516,585.65 metric tonnes in 2019, where 546,290.52 metric tonnes (7.60%) of scheduled waste was processed at local off-site facilities while 168,001.59 metric tonnes (2.34%) were exported for recovery process.

A total of 214,351.09 metric tonnes (2.98%) of scheduled wastes were treated for final disposal at Kualiti Alam Sdn. Bhd. (142,479.00 metric tonnes), at Trienekens (Sarawak) Sdn. Bhd. (31,988.77 metric tonnes) and 39,883.32 metric tonnes of clinical wastes were incinerated and disposed off at licensed off-site facilities. This was an increase of 17.63% compared to 182,220.01 metric tonnes of scheduled waste disposed in 2019. About 1,104,481.06 metric tonnes (15.37%) of scheduled waste were treated on-site; while 2,983,676.57 metric tonnes (41.53%) were stored on-site at waste generators' premises (**Table 5.3**).

Daripada jumlah buangan terjadual yang dihasilkan pada tahun 2020, 2,168,426.92 tan metrik (30.18%) telah diberi kelulusan bersyarat di bawah pengurusan khas seperti yang ditetapkan di bawah Peraturan 7, Peraturan-Peraturan Kualiti Alam Sekeliling (Buangan Terjadual) 2005 (**Jadual 5.4**). Jumlah ini merupakan peningkatan sebanyak 44.10% berbanding 1,504,833.23 tan metrik pada tahun 2019. Buangan yang terlibat adalah kebanyakannya enap cemar logam berat daripada kemudahan rawatan air minuman (49.22%), abu dari loji jana kuasa arang batu (41.33%) dan lain-lain (9.45%) .

Of the total wastes produced in 2020, 2,168,426.92 metric tonnes (40.19%) were granted conditional approval to be managed under special management as stipulated under Regulation 7, Environmental Quality (Scheduled Wastes) Regulations 2005 (**Table 5.4**). This amount is an increase of 44.10% as compared to 1,504,833.23 metric tonnes in 2019. These waste streams are mostly sludge from drinking water treatment facilities (49.22%), ashes from coal-fired power plant (41.33%) and others (9.45%).

Jadual 5.1 : Jumlah Buangan Terjadual yang Dihasilkan mengikut Kod Buangan Terjadual, 2020
Table 5.1 : Quantity of Scheduled Wastes Generated by Scheduled Waste Code, 2020

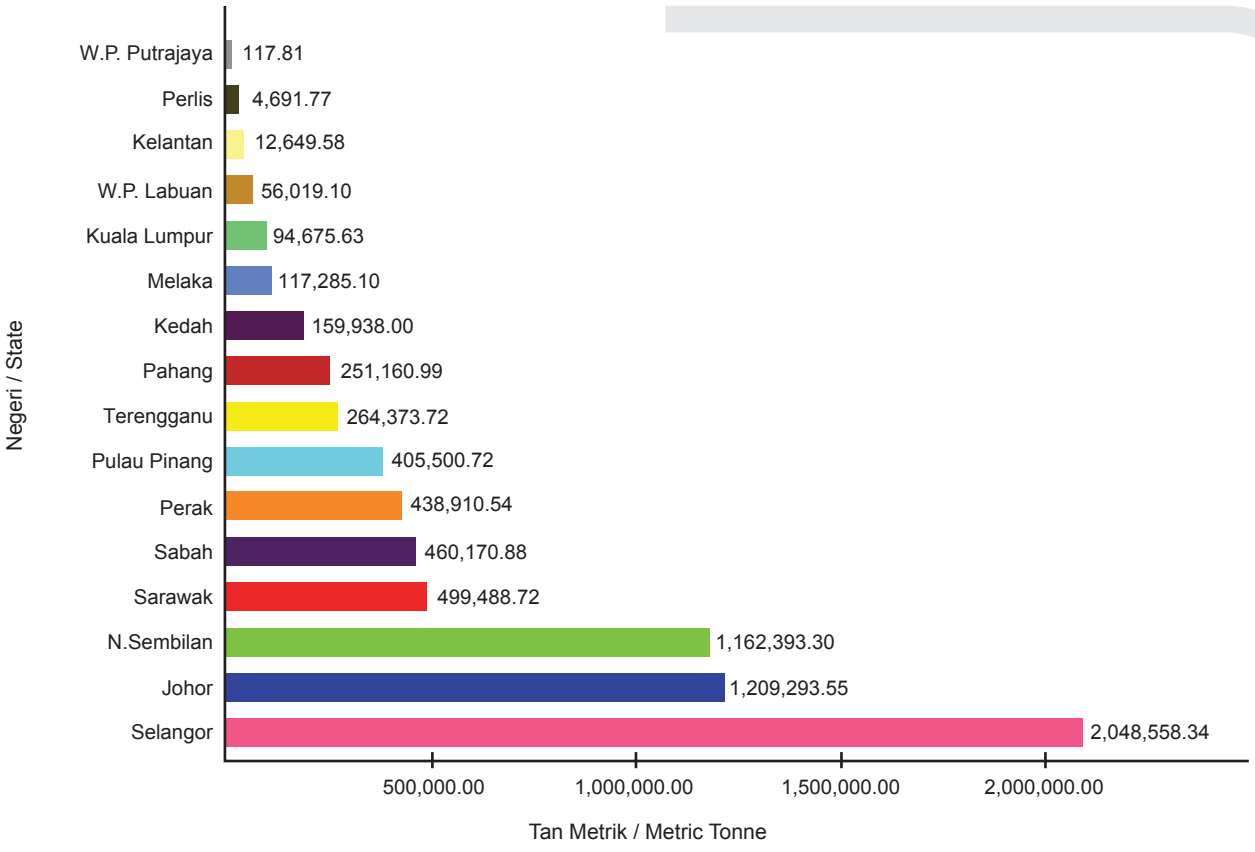
BIL / NO	NAMA BUANGAN / NAME OF WASTE	KOD BUANGAN / WASTE CODE	KUANTITI BUANGAN / QUANTITY OF WASTE	
			(MT/TAHUN / MT/YEAR)	PERATUSAN (%) / PERCENTAGE (%)
1	Dros/Sanga/Klinker/Abu / Dross/Slag/Clinker/Ash	SW104	3,078,454.72	42.84
2	Enap Cemar Logam Berat / Heavy Metal Sludges	SW204	1,389,730.52	19.34
3	Gipsum / Gypsum	SW205	403,713.80	5.62
4	Buangan Pelarut Organic Bukan Terhalogen / Waste of Non-Halogenated Solvent	SW322	310,522.69	4.32
5	Campuran Buangan Terjadual dan Buangan Tidak Terjadual / Mixture of Scheduled Waste & Non-Scheduled Waste	SW422	230,147.36	3.20
6	Minyak Pelincir Terpakai / Spent Lubricating Oil	SW305	229,887.16	3.20
7	Buangan Getah atau Lateks yang Mengandungi Logam Berat / Rubber/Latex Waste Containing Heavy Metal	SW321	200,855.67	2.80
8	Emulsi Minyak Mineral-Air Terpakai / Spent Mineral Oil-Water Emulsion	SW307	125,285.22	1.74
9	Bekas Tercemar / Used Container	SW409	116,872.80	1.63
10	Buangan Kimia / Lab Waste	SW429	112,634.25	1.57
11	Enap Cemar yang Mengandungi Fluoride / Sludge Containing Fluoride	SW207	111,260.04	1.55
12	Tanah/Puing Tercemar / Contaminated Land/Debris	SW408	104,534.64	1.45
13	Dadah Terbuang / Expired Drug	SW403	100,767.14	1.40
14	Buangan Elektronik / E-Waste	SW110	94,008.90	1.31
15	Asid Terpakai / Spent Acids	SW206	84,566.54	1.18
16	Sisa dari Pengolahan atau Pemerolehan Kembali Buangan Terjadual / Residue from Recovery	SW501	73,401.98	1.02
17	Kain Buruk, Plastik, Kertas atau Turas Tercemar / Rags/Plastics/Papers Contaminated with Scheduled Waste	SW410	58,930.87	0.82
18	Buangan Patogenik/Klinikal / Pathogenic/Clinical Waste	SW404	39,883.32	0.56
19	Enap Cemar Mineral / Mineral Sludges	SW427	32,401.76	0.45
20	Campuran Minyak-Air / Oil-Water Mixture	SW309	28,617.42	0.40
21	Buangan Minyak atau Enap Cemar Berminyak / Waste Oil/Oily Sludges	SW311	28,386.55	0.40
22	Buangan Dakwat dan Cat / Waste of Inks & Paints	SW417	27,934.18	0.39
23	Buangan Kimia / Waste of Batteries Containing Cadmium/Mercury/Lithium	SW103	25,561.98	0.36
24	Buangan Resin yang Mengandungi Pelarut Organik / Waste of Resin Containing Organic	SW325	22,312.72	0.31
25	Buangan Fotografi / Photographic Waste	SW423	20,514.12	0.29
26	Buangan Mangkin / Waste Catalyst	SW202	19,085.41	0.27
27	Enap Cemar Dakwat dan Cat / Ink & Paints Sludges	SW416	14,294.93	0.20

Jadual 5.1 : Jumlah Buangan Terjadual yang Dihasilkan mengikut Kod Buangan Terjadual, 2020
Table 5.1 : Quantity of Scheduled Wastes Generated by Scheduled Waste Code, 2020

BIL / NO	NAMA BUANGAN / NAME OF WASTE	KOD BUANGAN / WASTE CODE	KUANTITI BUANGAN / QUANTITY OF WASTE	
			(MT/TAHUN / MT/YEAR)	PERATUSAN (%) / PERCENTAGE (%)
28	Minyak/Enapcemar daripada Loji Penapisan Minyak / Oil/Sludges from Oil Refinery	SW314	12,146.77	0.17
29	Alkali Terpakai / Spent Alkalis	SW401	9,966.60	0.14
30	Alkali Terpakai dengan pH ≥ 11.5 / Spent Alkalis with pH > 11.5	SW402	9,355.61	0.13
31	Produk Dakwat, Cat, Pigmen atau Lakuer yang Tidak Mengikut Spesifikasi / Discarded of Ink/Paint/Pigment/Lacquer Containing Organic Solvent	SW418	8,823.77	0.12
32	Minyak Hidraulik Terpakai / Spent Hydraulic Oil	SW306	8,189.39	0.11
33	Buangan Pelarut Organik Terhalogen / Waste of Halogenated Solvents	SW323	6,333.12	0.09
34	Klinker, Sanga dan Abu dari Penunu Buangan Terjadual / Clinker/Slag/Ashes from Incinerator	SW406	6,279.55	0.09
35	Karbon Teraktif Terpakai / Contaminated Activated Carbon	SW411	6,036.75	0.08
36	Larutan Alkali Berair Terpakai yang Mengandungi Sianida / Spent Aqueous Alkaline Containing Cyanide	SW414	6,009.62	0.08
37	Buangan Cecair Terma / Waste of Thermal Fluids	SW327	3,981.38	0.06
38	Buangan Bateri Asid Plumbum / Waste of Acid Lead Batteries	SW102	3,558.96	0.05
39	Asid Organik Terpakai / Spent Organic Acids	SW301	3,124.69	0.04
40	Buangan Pelekat/Glu yang Mengandungi Pelarut Organik / Adhesive/Glue Containing Organic Solvent	SW303	2,985.57	0.04
41	Campuran Buangan Terjadual / Mixture of Scheduled Wastes	SW421	2,934.31	0.04
42	Sisa Berminyak dari Bengkel Automotive / Oily Residue from Workshop	SW312	2,841.05	0.04
43	Buangan Mengandungi Merkuri / Waste containing Mercury/Compound	SW109	1,639.51	0.02
44	Enap Cemar dari Tangki Penyimpanan Minyak Mineral / Sludges from Mineral Oil Storage Tank	SW310	1,276.99	0.02
45	Buangan Mengandungi Formaldehid / Waste Containing Formaldehyde	SW320	753.48	0.01
46	Buangan Asbestos / Asbestos	SW201	749.12	0.01
47	Tar atau Sisa Bertar dari Loji Penapisan Minyak / Tar Residue from Oil Refinery/Petrochemical Plant	SW315	569.30	0.01
48	Buangan Farmaseutikal / Discarded Drug	SW405	550.89	0.01
49	Buangan Sisa Penyulingan Tidak Berair Terhalogen atau Bukan / Waste of Halogenated or Unhalogenated Non-Aqueous Distillation Arising from Organic Solvents Recovery Process	SW324	535.49	0.01
50	Tanah yang Dicemari dengan Minyak daripada Penapisan / Contaminated Oil from Re-Refining/Used lubricating Oil	SW313	528.30	0.01
51	Buangan Makmal / Chemical Waste	SW430	392.96	0.01
52	Enap Cemar yang Distabilkan / Stabilized Sludges	SW203	246.40	0.00
53	Buangan Fluks / Flux Waste	SW302	227.76	0.00
54	Sisa dari Pemerolehan Kembali Likuor Penjerukan Asid / Residue from Recovery of Acid Pickling Liquor	SW106	154.83	0.00
55	Buangan Racun Perosak / Pesticide	SW425	125.95	0.00
56	Enap Cemar dari Tangki Minyak / Oil Tankers Sludges	SW308	104.20	0.00
57	Diisosianat Terpakai / Spent Di-Isocyanates	SW419	63.19	0.00
58	Produk Racun Perosak yang Tidak Mengikut Spesifikasi / Off Spec Pesticide/Herbicides/Biocides	SW426	36.26	0.00
59	Buangan Fenol / Waste of Phenols/Its Compound	SW319	30.63	0.00
60	Buangan yang Mengandungi Peroksida / Waste Containing Peroxides	SW432	25.88	0.00
61	Agen Pengoksidaan Terpakai / Spent Oxidizing Agent	SW424	22.81	0.00
62	Buangan daripada Operasi Pengawetan Kayu / Waste from Wood Containing Heavy Metals	SW428	15.83	0.00
63	Buangan yang Mengandungi Arsenik / Waste containing arsenic	SW101	13.53	0.00
64	Enap Cemar Asid / Acid Sludges	SW316	12.63	0.00

Jadual 5.1 : Jumlah Buangan Terjadual yang Dihasilkan mengikut Kod Buangan Terjadual, 2020
Table 5.1 : Quantity of Scheduled Wastes Generated by Scheduled Waste Code, 2020

BIL / NO	NAMA BUANGAN / NAME OF WASTE	KOD BUANGAN / WASTE CODE	KUANTITI BUANGAN / QUANTITY OF WASTE	
			(MT/TAHUN / MT/YEAR)	PERATUSAN (%) / PERCENTAGE (%)
65	Buangan dari Pengilangan Bahan Letupan / Waste from Manufacturing/Processing or Use of Explosive	SW431	7.32	0.00
66	Buangan yang Mengandungi BFT dan TFT / Waste Containing PCB or PCT	SW318	4.56	0.00
67	Enap Cemar yang Mengandungi Sianida / Sludges Containing Cyanide	SW412	1.74	0.00
68	Buangan Sebatian Fosforus Organik / Waste of Organic Phosphorus Compound	SW326	1.29	0.00
69	Sanga Kuprum / Slag Copper	SW107	1.24	0.00
70	Garam Terpakai yang Mengandungi Sianida / Spent Salt Containing Cyanide	SW413	0.92	0.00
71	Sisa dari Pemprosesan Zink / Zink Residue	SW108	0.47	0.00
72	Minyak Pelindapan Terpakai yang Mengandungi Sianida / Spent Quenching Oil Containing Cyanide	SW415	0.19	0.00
73	Buangan yang Mengandungii Dioksin atau Furan / Waste Containing Dioxins or Furans	SW407	0.11	0.00
74	Sebatian Organologam Terpakai / Spent of Organometallic Compound	SW317	0.10	0.00
75	Kek Tekan daripada Prapengolahan Lai Sabun Gliserol / Cake from Glycerol Soap Iye	SW304	0.07	0.00
76	Enap Cemar Galvani / Galvanic Sludges	SW105	-	0.00
77	Larutan Resap dari Tapak Pelupusan Buangan Terjadual / Leachate from Scheduled Waste Landfill	SW420	-	0.00
	JUMLAH / TOTAL		**7,185,227.76**	**100.00**



Rajah 5.16 : Penghasilan Buangan Terjadual mengikut Negeri 2020
Figure 5.16 : Distribution of Scheduled Waste Generated by States 2020

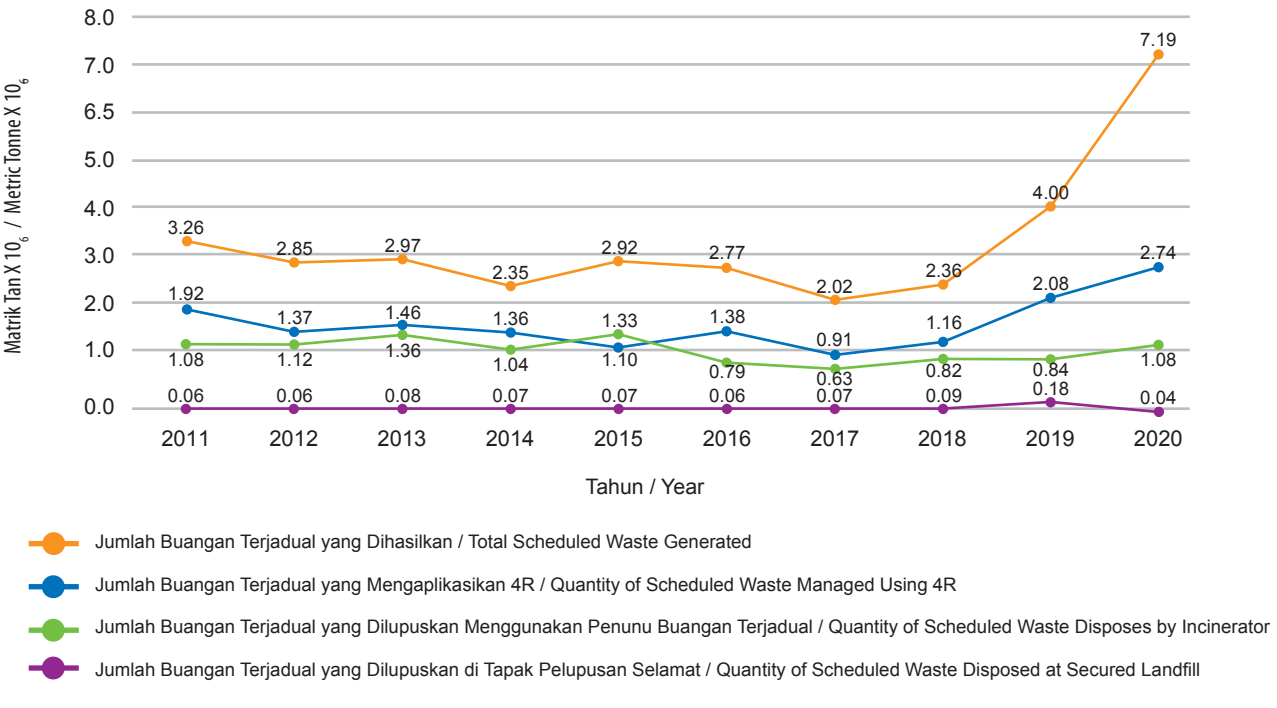
Jadual 5.2 : Jumlah Buangan Terjadual yang Dihasilkan mengikut Jenis Industri, 2020

Table 5.2 : Quantity of Scheduled Wastes Generated by Industry, 2020

BIL / NO	JENIS INDUSTRI / TYPE OF INDUSTRY	JUMLAH BUANGAN / QUANTITY OF WASTE	
		(MT/TAHUN) / (MT/YEAR)	PERATUS (%) / PERCENTAGE (%)
1	Loji Janakuasa / Power Plant	2,491,477.65	34.67
2	Loji Rawatan Air / Water Treatment Plant	1,149,834.33	16.00
3	Industri Kimia / Chemical Industry	739,280.91	10.29
4	Pengilangan Logam / Metal Refinery	571,217.58	7.95
5	Elektrik dan Elektronik / Electric and Electronic	548,348.38	7.63
6	Premis Buangan Terjadual (PYDT) / Scheduled Waste Treatment and Disposal Facilities	313,670.52	4.37
7	Berasaskan Getah / Rubber Base	205,709.12	2.86
8	Lain-lain / Others	195,781.66	2.72
9	Kenderaan / Vehicle	166,743.13	2.32
10	Penyudahan Logam dan Sadur Elektrik / Metal Finishing and Coating	144,852.87	2.02
11	Gudang / Warehouse	137,354.75	1.91
12	Bengkel / Workshop	107,379.46	1.49
13	Penapisan Petroleum / Petroleum Refinery	86,048.74	1.20
14	Jentera / Machinery	72,656.44	1.01
15	Fabrikasi Logam / Metal Fabrication	38,978.81	0.54
16	Kertas / Paper	37,256.60	0.52
17	Percetakan / Printing	37,198.31	0.52
18	Perubatan / Health Care Services	34,267.64	0.48
19	Plastik / Plastic	26,098.47	0.36
20	Galian Bukan Logam / Excavation Non Metal	15,932.06	0.22
21	Penapisan Minyak Makan / Edible Oil Refinery	14,802.70	0.21
22	Makanan & Minuman / Food & Drink	10,177.54	0.14
23	Kilang Kelapa Sawit (PYDT) / Palm Oil Mill	7,427.96	0.10
24	Tekstil / Textiles	7,249.40	0.10
25	Kuari / Quarry	4,436.36	0.06
26	Pembuatan Payung dan Lain-lain Industri Pembuatan / Others Manufacturing	3,647.09	0.05
27	Perlombongan / Mining	3,588.25	0.05
28	Pertanian / Agriculture	3,438.44	0.05
29	Berasaskan Kayu / Wood Based	3,382.81	0.05
30	Simen / Cement	2,747.94	0.04
31	Kilang Getah (PYDT) / Rubber Factory	1,474.18	0.02
32	Peralatan Sukan dan Permainan / Sports Equipment and Games	920.36	0.01

Jadual 5.2 : Jumlah Buangan Terjadual yang Dihasilkan mengikut Jenis Industri, 2020
Table 5.2 : Quantity of Scheduled Wastes Generated by Industry, 2020

BIL / NO	JENIS INDUSTRI / TYPE OF INDUSTRY	JUMLAH BUANGAN / QUANTITY OF WASTE	
		(MT/TAHUN) / (MT/YEAR)	PERATUS (%) / PERCENTAGE (%)
33	Perkhidmatan / Services	497.67	0.01
34	Makanan Ternakan / Livestock Food	428.38	0.01
35	Peralatan Pejabat dan Alat Tulis / Office Supplies and Stationery	270.87	0.00
36	Kulit / Leather	265.92	0.00
37	Rokok dan Tembakau / Cigarettes and Tobacco	146.23	0.00
38	Loji Pengolahan Kumbahan (IWK, Majari, PBT) / Sewage Treatment Plant (IWK, Majari, PBT)	94.62	0.00
39	Loji Pengolahan Kumbahan Persendirian / Private Sewage Treatment Plant	70.19	0.00
40	Tapak Pelupusan Sanitary / Sanitary Landfill	40.19	0.00
41	Hotel / Hotel	18.88	0.00
42	Perhutanan / Forestry	7.81	0.00
43	Kilang Padi / Rice Mill	4.20	0.00
44	Perikanan / Fishery	2.00	0.00
45	Restoran / Restaurant	0.21	0.00
46	Penternakan / Husbandry	0.13	0.00
	JUMLAH / TOTAL	**7,185,227.76**	**100.00**



Rajah 5.17 : Trend Pengurusan Buangan Terjadual, 2011-2020
Figure 5.17 : Scheduled Waste Management Trend, 2011-2020

Jadual 5.3 : Kemudahan yang Mengendalikan Buangan Terjadual, 2020

Table 5.3 : Facilities Handling Scheduled Wastes, 2020

BIL / NO	KEMUDAHAN / FACILITIES	(MT/TAHUN) / (MT/YEAR)	PERATUSAN (%) / PERCENTAGE (%)
1	Pengurusan Khas / Special Waste Management	2,168,426.92	30.18
2	Pengolahan Dalam Tapak / On-Site Treatment	1,104,481.07	15.37
3	Kemudahan Pemerolehan Kembali Luar Tapak Tempatan / Local Off-Site Recovery Facilities	546,290.52	7.60
4	Penstoran Dalam Tapak / On-Site Storage	2,983,676.57	41.53
5	Kualiti Alam Sdn Bhd	142,479.00	1.98
6	Kemudahan Buangan Klinikal (Penunu Buangan Klinikal, Gelombang Mikro dan Tapak Pelupusan Selamat) / Off-Site Clinical Waste Facilities (Incinerator, Microwave and Secured Landfill)	39,883.32	0.56
7	Kemudahan Luar Negara (Ekspot) / Foreign Facilities (Export)	168,001.594	2.34
8	Trienekens (Sarawak) Sdn Bhd	31,988.77	0.45
	JUMLAH / TOTAL	**7,185,227.76**	**100.00**

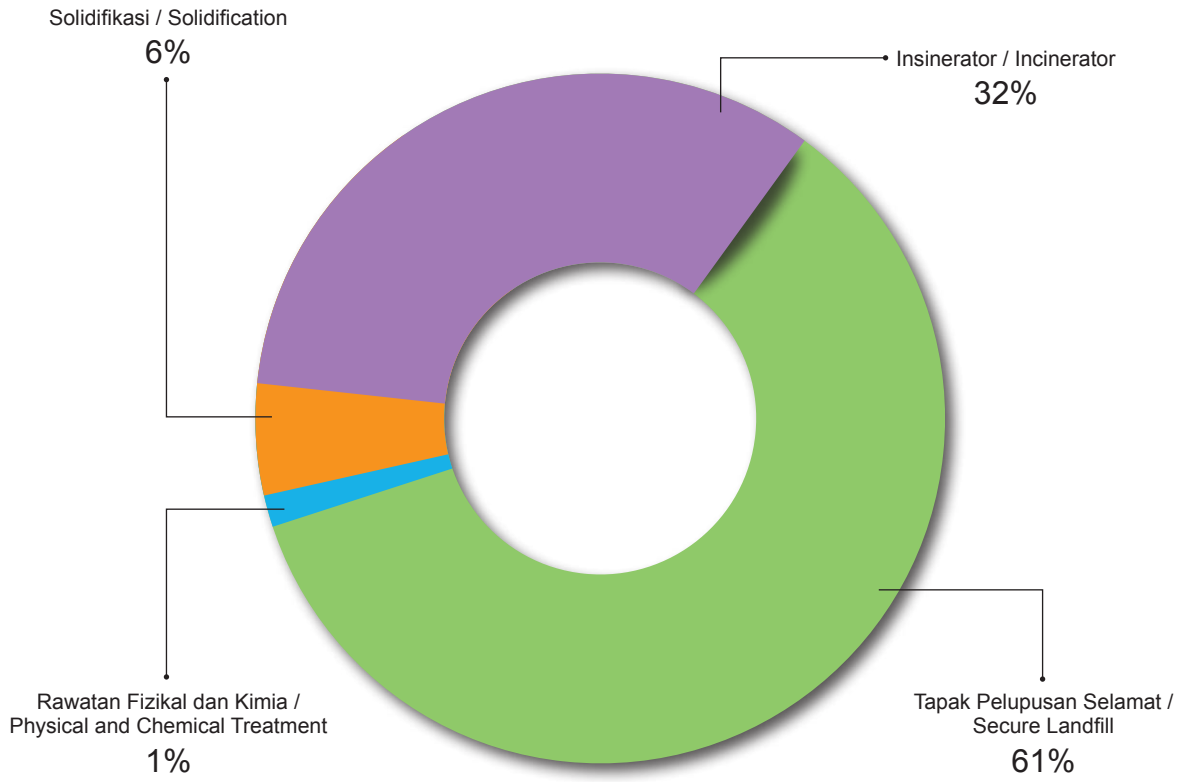
Jadual 5.4 : Buangan Terjadual yang Diuruskan Di Bawah Pengurusan Khas, 2020

Table 5.4 : Scheduled Waste Managed Under Special Management, 2020

BIL / NO.	KATEGORI BUANGAN / WASTE CATEGORY	KOD BUANGAN / WASTE CODE	SUMBER / SOURCE	METRIK TAN / METRIC TONNES	PERATUS (%) / PERCENTAGE (%)	KAEDAH PELUPUSAN / METHOD OF DISPOSAL)
1.	Enap Cemar Logam Berat / Heavy Metal Sludge	SW 204	Loji Rawatan Air Minuman / Drinking Water Treatment Plant	1,067,377.38	49.22	Tapak Pelupusan Sanitari / Reuse as Raw Material for Product
			Industri / Industry	6,348.70	0.29	
				48,734.45	2.25	
2.	Fly Ash & Bottom Ash	SW 104	Coal-Fired Power Plant	896,270.09	41.33	Guna Semula sebagai Bahan Mentah Pembuatan Produk / Sanitary Landfill
			Industri / Industry	140,443.27	6.48	
3.	Enap Cemar Mengandungi *Flouride* / Sludge Containing Flouride	SW 207	Industri / Industry	866.68	0.04	Guna Semula sebagai Bahan Mentah Pembuatan Produk / Reuse as Raw Material for Product
4.	Buangan yang Mengandungi Formaldehid, Resin, Serbuk Epoksi Terbuang / Waste Containing Formaldehyde, Resin, Discarded Epoxy Powder	SW 320, 325, 418	Industri / Industry	663.58	0.03	Tapak Pelupusan Sanitari / Sanitary Landfill
5.	Abu dari Enapcemar Kertas / Ash of Paper Sludge	SW 406	Industri / Industry	3,531.45	0.16	Tapak Pelupusan Sanitari / Sanitary Landfill
6.	*Activated Carbon* Terpakai / Spent Activated Carbon	SW411	Industri / Industry	3,728.00	0.17	Guna Semula sebagai Bahan Mentah Pembuatan Produk / Reuse as Raw Material for Product
7.	Enap Cemar Mineral / Mineral Sludge	SW 427	Industri / Industry	456.00	0.02	Guna Semula sebagai Bahan Agen Peneutralan / Reuse as Neutralizing Agent
8.	Buangan daripada Bahan Letupan Terpakai / Waste from the Use of Explosives	SW431	Industri / Industry	7.32	0.00	Kaedah Pembakaran / Slow Burning Method
			JUMLAH / TOTAL	**2,168,426.92**	**100.00**	

Kategori buangan terjadual yang dihantar ke premis yang dilesenkan (Kualiti Alam Sdn. Bhd. dan Trienekens (Sarawak) Sdn. Bhd.) untuk pelupusan akhir adalah seperti enapcemar yang mengandungi satu atau beberapa logam berat, campuran buangan terjadual, debu/ sanga/ dros atau abu yang mengandungi arsenik/ merkuri dan asid bukan organik terpakai. Bergantung kepada ciri-ciri tertentu, buangan tersebut samada dibakar, dirawat secara fizikal dan kimia, distabilkan atau dilupuskan di tapak pelupusan selamat. Seperti yang ditunjukkan dalam **Rajah 5.18**, kebanyakan sisa yang dihantar ke Kualiti Alam Sdn. Bhd. dan Trienekens Sdn. Bhd. adalah ke tapak pelupusan (61%), diikuti dibakar (32%), solidifikasi (6%) dan rawatan secara fizikal dan kimia (1.0%).

The categories of scheduled wastes sent to the licensed premises (Kualiti Alam Sdn. Bhd. and Trienekens (Sarawak) Sdn. Bhd.) for final disposal were sludge containing one or several heavy metals, mixed wastes, dust/ slag/ dross or ash containing arsenic/ mercury and spent inorganic acid. Depending on their characteristics, the wastes were either incinerated, treated physically and chemically, solidified or disposed of in a secured landfill. As shown in **Figure 5.18**, most wastes sent to Kualiti Alam Sdn. Bhd. and Trienekens Sdn. Bhd. were landfilled (61%), followed by incineration (32%), solidification (6%) and physical and chemical treatment (1.0%).



Rajah 5.18 : Kualiti Alam dan Trienekens : Jenis Rawatan dan Pelupusan Buangan Terjadual, 2020
Figure 5.18 : Kualiti Alam and Trienekens : Types of Scheduled Waste Treatment and Disposal, 2020

ANNEX

NATIONAL WATER QUALITY STANDARDS FOR MALAYSIA

PARAMETER	UNIT	CLASS				
		I	IIA/IIB	III#	IV	V
A l	mg/l	NATURAL LEVEL OR ABSENT	-	(0.06)	0.5	LEVEL ABOVE IV
As	mg/l		0.05	0.4 (0.05)	0.1	
Ba	mg/l		1	-	-	
Cd	mg/l		0.01	0.01* (0.001)	0.01	
Cr (VI)	mg/l		0.05	1.4 (0.05)	0.1	
Cr (III)	mg/l		-	2.5	-	
Cu	mg/l		0.02	-	0.2	
Hardness	mg/l		250	-	-	
Ca	mg/l		-	-	-	
Mg	mg/l		-	-	-	
Na	mg/l		-	-	3 SAR	
K	mg/l		-	-	-	
Fe	mg/l		1	1	1 (Leaf) 5 (Others)	
Pb	mg/l		0.05	0.02* (0.01)	5	
Mn	mg/l		0.1	0.1	0.2	
Hg	mg/l		0.001	0.004 (0.0001)	0.002	
Ni	mg/l		0.05	0.9*	0.2	
Se	mg/l		0.01	0.25 (0.04)	0.02	
Ag	mg/l		0.05	0.0002	-	
Sn	mg/l		-	0.004	-	
U	mg/l		-	-	-	
Zn	mg/l		5	0.4*	2	
B	mg/l		1	(3.4)	0.8	
Cl	mg/l		200	-	80	
Cl_2	mg/l		-	(0.02)	-	
CN	mg/l		0.02	0.06 (0.02)	-	
F	mg/l		1.5	10	1	
NO_2	mg/l		0.4	0.4 (0.03)	-	
NO_3	mg/l		7	-	5	
P	mg/l		0.2	0.1	-	
Silica	mg/l		50	-	-	
SO_4	mg/l		250	-	-	
S	mg/l		0.05	(0.001)	-	
CO_2	mg/l		-	-	-	
Gross- α	Bq/l		0.1	-	-	
Gross- β	Bq/l		1	-	-	
Ra-226	Bq/l		< 0.1	-	-	
Sr-90	Bq/l		< 1	-	-	
CCE	mg/l		500	-	-	-
MBAS/BAS	mg/l		500	5000 (200)	-	-
O & G (Mineral)	mg/l		40; N	N	-	-
O & G (Emulsified Edible)	mg/l		7000; N	N	-	-
PCB	mg/l		0.1	6 (0.05)	-	-
Phenol	mg/l		10	-	-	-
Aldrin/Dieldrin	mg/l		0.02	0.2 (0.01)	-	-
BHC	mg/l		2	9 (0.1)	-	-
Chlordane	mg/l		0.08	2 (0.02)	-	-
t-DDT	mg/l		0.1	(1)	-	-
Endosulfan	mg/l		10	-	-	-
Heptachlor/Epoxide	mg/l		0.05	0.9 (0.06)	-	-
Lindane	mg/l		2	3 (0.4)	-	-
2,4-D	mg/l		70	450	-	-
2,4,5-T	mg/l		10	160	-	-
2,4,5-TP	mg/l		4	850	-	-
Paraquat	mg/l		10	1800	-	-

Notes :
* = At hardness 50 mg/l CaCO
# = Maximum (unbracketed) and 24-hour average (bracketed) concentrations
N = Free from visible film sheen, discolouration and deposits

NATIONAL WATER QUALITY STANDARDS FOR MALAYSIA

PARAMETER	UNIT	CLASS					
		I	IIA	IIB	III	IV	V
Ammoniacal Nitrogen	mg/l	0.1	0.3	0.3	0.9	2.7	> 2.7
Biochemical Oxygen Demand	mg/l	1	3	3	6	12	> 12
Chemical Oxygen Demand	mg/l	10	25	25	50	100	> 100
Dissolved Oxygen	mg/l	7	5 - 7	5 - 7	3 - 5	< 3	< 1
pH	-	6.5 - 8.5	6 - 9	6 - 9	5 - 9	5 - 9	-
Colour	TCU	15	150	150	-	-	-
Electrical Conductivity*	µS/cm	1000	1000	-	-	6000	-
Floatables	-	N	N	N	-	-	-
Odour	-	N	N	N	-	-	-
Salinity	%	0.5	1	-	-	2	-
Taste	-	N	N	N	-	-	-
Total Dissolved Solid	mg/l	500	1000	-	-	4000	-
Total Suspended Solid	mg/l	25	50	50	150	300	300
Temperature	°C	-	Normal + 2°C	-	Normal + 2°C	-	-
Turbidity	NTU	5	50	50	-	-	-
Faecal Coliform**	count/100 ml	10	100	400	5000 (20000)[a]	5000 (20000)[a]	-
Total Coliform	count/100 ml	100	5000	5000	50000	50000	> 50000

Notes :

N : No visible floatable materials or debris, no objectional odour or no objectional taste

* : Related parameters, only one recommended for use

** : Geometric mean

a : Maximum not to be exceeded

WATER CLASSES AND USES

CLASS	USES
Class I	Conservation of natural environment. Water Supply I – Practically no treatment necessary. Fishery I – Very sensitive aquatic species.
Class IIA	Water Supply II – Conventional treatment required. Fishery II – Sensitive aquatic species.
Class IIB	Recreational use with body contact.
Class III	Water Supply III – Extensive treatment required. Fishery III – Common, of economic value and tolerant species; livestock drinking.
Class IV	Irrigation
Class V	None of the above.

DOE WATER QUALITY CLASSIFICATION BASED ON WATER QUALITY INDEX

SUB INDEX & WATER QUALITY INDEX	INDEX RANGE		
	CLEAN	SLIGHTLY POLLUTED	POLLUTED
Biochemical Oxygen Demand (BOD)	91 - 100	80 - 90	0 - 79
Ammoniacal Nitrogen (NH_3-N)	92 - 100	71 - 91	0 - 70
Suspended Solids (SS)	76 - 100	70 - 75	0 - 69
Water Quality Index (WQI)	81 - 100	60 - 80	0 - 59

DOE WATER QUALITY INDEX CLASSIFICATION

PARAMETER	UNIT	CLASS				
		I	II	III	IV	V
Ammoniacal Nitrogen	mg/l	< 0.1	0.1 – 0.3	0.3 – 0.9	0.9 – 2.7	> 2.7
Biochemical Oxygen Demand	mg/l	< 1	1 – 3	3 – 6	6 – 12	> 12
Chemical Oxygen Demand	mg/l	< 10	10 – 25	25 – 50	50 – 100	> 100
Dissolved Oxygen	mg/l	> 7	5 – 7	3 – 5	1 – 3	< 1
pH	-	> 7.0	6.0 – 7.0	5.0 – 6.0	< 5.0	> 5.0
Total Suspended Solid	mg/l	< 25	25 – 50	50 – 150	150 – 300	> 300
Water Quality Index (WQI)		> 92.7	76.5 – 92.7	51.9 – 76.5	31.0 – 51.9	< 31.0

WQI FORMULA AND CALCULATION

FORMULA

WQI = (0.22 * SIDO) + (0.19 * SIBOD) + (0.16 * SICOD) + (0.15 * SIAN) + (0.16 * SISS) + (0.12 * SIpH)
where;

SIDO = Subindex DO (% saturation)
SIBOD = Subindex BOD
SICOD = Subindex COD
SIAN = Subindex NH_3-N
SISS = Subindex SS
SIpH = Subindex pH
$0 \leq WQI \leq 100$

Best Fit Equations for the Estimation of Various Subindex Values

Subindex for DO (in % saturation)

SIDO = 0 for $x \leq 8$
SIDO = 100 for $x \geq 92$
SIDO = $-0.395 + 0.030x^2 - 0.00020x^3$ for $8 < x < 92$

Subindex for BOD

SIBOD = 100.4 - 4.23x for $x \leq 5$
SIBOD = 108 * exp(-0.055x) - 0.1x for $x > 5$

Subindex for COD

SICOD = -1.33x + 99.1 for $x \leq 20$
SICOD = 103 * exp(-0.0157x) - 0.04x for $x > 20$

Subindex for NH_3-N

SIAN = 100.5 - 105x for $x \leq 0.3$
SIAN = 94 * exp(-0.573x) - 5 * | x – 2 | for $0.3 < x < 4$
SIAN = 0 for $x \geq 4$

Subindex for SS

SISS = 97.5 * exp(-0.00676x) + 0.05x for $x \leq 100$
SISS = 71 * exp(-0.0016x) - 0.015x for $100 < x < 1000$
SISS = 0 for $x \geq 1000$

Subindex for pH

SIpH = 17.2 - 17.2x + 5.0^2x for $x < 5.5$
SIpH = -242 + 95.5x - 6.67^2x for $5.5 \leq x < 7$
SIpH = -181 + 82.4x - 6.05^2x for $7 \leq x < 8.75$
SIpH = 536 - 77.0x + 2.76^2x for $x \geq 8.75$

Note:
* means multiply with

MALAYSIAN MARINE WATER QUALITY STANDARDS

PARAMETER (µG/L) UNLESS OTHERWISE STATED	CLASSIFICATION					
	CLASS 1	CLASS 2	CLASS 3	INTERIM CLASS E1	INTERIM CLASS E2	INTERIM CLASS E3
	SENSITIVE MARINE HABITATS	FISHERIES (INCLUDING MARICULTURE)	INDUSTRY, COMMERCIAL ACTIVITIES & COASTAL SETTLEMENTS	ESTUARIES		
				COASTAL PLAIN	LAGOON	COMPLEX DISTRIBUTARY NETWORK
Dissolved Oxygen (mg/l)	>6.0	>5.0	>3.0	>5.0	>5.0	>5.0
Suspended Solids (mg/l)	25.0	50.0	100.0	30.0	30.0	30.0
Phosphate	5.0	75.0	670.0	100.0	180.0	180.0
Nitrate	10.0	60.0	700.0	200.0	570.0	430.0
Ammonia	35.0	50.0	320.0	5.0	10.0	10.0
Mercury	0.04	0.04	0.04	0.04	0.04	0.04
Cadmium	0.50	2.00	3.00	1.00	1.00	1.00
Chromium (VI)	0.14	10.00	20.00	10.00	10.00	10.00
Copper	1.30	2.90	8.00	1.00	1.00	1.00
Cyniade	2.00	7.00	14.00	5.00	5.00	5.00
Lead	2.20	8.50	12.00	1.30	2.00	2.00
Zinc	7.00	50.00	100.00	16.00	5.00	5.00
Arsenic (III)	1.00	3.00	3.00	3.00	1.00	1.00
Aluminium	27.0	27.0	55.0	27.0	27.0	27.0
TBT	0.001	0.010	0.050	0.002	0.002	0.002
PAH	100.0	200.0	1000.0	5.0	5.0	5.0
Total Phenol	1.0	10.0	100.0	10.0	10.0	10.0
Oil & Grease (mg/l)	0.01	0.14	5.00	1.00	1.00	1.00
Faecal Coliform (cfu/100ml)	70	70	70	70	70	70
Temperature (°C)	≤ 2 °C increase over maximum ambient					
pH	6.5 - 9.0					
Marine Litter	Free from marine litter					

MALAYSIAN MARINE WATER QUALITY INDEX (MMWQI) FORMULA AND CALCULATION

MMWQI = $qi\,DO^{0.18}$ x $qi\,FC^{0.19}$ x $qi\,NH_3^{0.15}$ x $qi\,NO_3^{0.16}$ x $qi\,PO_4^{0.17}$ x $qi\,TSS^{0.15}$

whereby;

qi DO = Subindex Dissolved Oxygen
qi FC = Subindex Faecal Coliform
qi NH_3 = Subindex Unionized Ammonia
qi NO_3 = Subindex Nitrate
qi PO_4 = Subindex Phosphate
qi TSS = Subindex Total Suspended Solids

*Salinity of the marine water quality data shall be higher than 10 ppt

BEST FIT EQUATIONS FOR THE ESTIMATION OF VARIOUS SUBINDEX VALUES

Dissolved Oxygen (DO) in mg/l

qi DO = -85.816 + 55.4768(DO) – 4.142$(DO)^2$
If DO is less than (<) 3 mg/l, or more than (>) 10 mg/l, qiDO= 10

Faecal Coliform (FC) in cfu/100ml

qi FC = 100*$EXP^{(-0.005(\text{Faecal Coliform}))}$
If FC is more than (>) 500 cfu/100ml, qi FC = 8

Unionized Ammonia (NH_3) in µg/l

qi NH_3 = 100*$EXP^{(-0.0046(\text{Unionized Ammonia}))}$
If Ammoniacal Nitrogen (NH3-N) is measured, convert the value into unionized ammonia.

Nitrate (NO_3) in µg/l

qi NO3 = 94.8*$EXP^{(-0.00035(\text{Nitrate}))}$

Phosphate (PO_4) in µg/l

qi PO4 = 95.2*$EXP^{(-0.002(\text{Phosphate}))}$
If PO_4 is more than (>) 900 µg/l, qi PO_4 = 10

Total Suspended Solids (TSS) in mg/l

qi TSS = 95.8*$EXP^{(-0.0043(\text{Total Suspended Solid}))}$
If TSS is more than (>) 100 mg/l, qiTSS = 20

UNIONIZED AMMONIA CALCULATION

In order to convert the concentration of total ammoniacal nitrogen into unionized ammonia, calculate (a), (b), (c) and (d). Substitute the results into equation 1.

a. Calculation of Ionic Strength (IS)

$$IS = \frac{19.9273 * Salinity}{(1000 - 1.005109 * Salinity)}$$

Salinity in part per thousand (ppt)

b. Calculation of PKa

$$PKa = (0.0901821 + \frac{2729.92}{(Temp + 273.15)} + IS(0.1552 - 0.000314 * Temp)$$

Temperature in °C

c. Calculation of working pH

pHsw = pH – (0.0007 x IS) – 0.131

d. Calculation of mole fraction for unionized ammonia

Mole Fraction =
equation 1:

Ammoniacal nitrogen (NH_3-N) x mole fraction x 17/14

Ammoniacal nitrogen should be measured in µg/l

GROUNDWATER QUALITY STANDARDS FOR CONVENTIONAL RAW WATER TREATMENT (DRINKING WATER)

PARAMETER	STANDARD (mg/L)
Total coliform	5000 MPN/100 ml
E coli	5000 MPN/100 ml
Kekeruhan	1000 NTU
Warna	300 TCU
pH	5.5-9.0
Suhu	Normal ± 2°C
Konduktiviti	1000 µS/cm#
Jumlah Pepejal Terlarut	1500
Klorida	250
Ammonia	1.5
Nitrat	10
Besi	1.0
Fluorida	1.5
Kekerasan	500
Mangan	0.2
COD	10
MBAS	1.0
BOD	6
Nitrit	0.4#
Raksa	0.001
Kadmium	0.003
Arsenik	0.01
Sianida	0.07
Plumbum	0.05
Kromium	0.05
Kuprum	1.0
Zink	3.0
Natrium	200
Sulfat	250
Selenium	0.01
Perak	0.05
Magnesium	150
Minyak	0.3
Racun Perosak (Pesticides)	0.00003-0.03*
Fenol	0.002
Nikel	0.05
Gross alpha	0.1 Bq/l
Gross beta	1.0 Bq/l

*Aldrin/ Dieldrin, DDT, Heptachlor, Methoxychlor, Lindane, Chlordane, Endosulfan, Hexachlorobenzene, 2,4,5–T, 2,4-D, 2,4-DB, Alachlor, Aldicarb, Carbofuran, MCPA, Permethrin

#Diambil dari *Class IIA, National Water Quality Standards*

GROUNDWATER QUALITY INDEX (GWQI) FORMULA AND CALCULATION

To calculate the GWQI, the additive equation is used as follows:

$$GWQI=\sum W_i q_i$$

or

GWQI = 0.13Si(pH) + 0.17Si(Fe) + 0.17Si(*E. coli*)+ 0.04Si(TDS) + 0.09Si(SO_4^{2-}) + 0.22Si(NO_3) + 0.17 Si (Phenol)

The sub-indices of all the parameters used for generating the GWQI are as follows

pH Sub Index

pH	*Si(pH)*	
<3.0	0	Acidic
3 – 4	10	
4 – 5.5	30	
5.5 – 9	100	
9 – 10	30	Alkaline
10 – 11	10	
>11.0	0	

Iron Sub Index

Si (Fe) = (1-$_i$C/5.0) x 100

Si (Fe) = 0, if Ci exceeds 5.0 mg/L; Ci is the concentration of iron determined in the groundwater sample.

Nitrate Sub Index

Si (NO_3^-) = (1 - C_i/100) x 100

Si (NO_3^-) = 0, if C_i exceeds 100 mg/L; C_i is the concentration of nitrate determined in the groundwater sample.

Phenol Sub Index

Si (Phenol) = (1- C_i/0.015) x 100

Si (Phenol) = 0, if Ci exceeds 0.015 mg/L; Ci is the concentration of phenol determined in the groundwater sample.

Total Dissolved Solid Sub Index

Si (TDS) = (1- C_i/3000) x 100

Si (TDS) = 0, if Ci exceeds 3000 mg/L; Ci is the concentration of total dissolved solid determined in the groundwater sample.

Sulfate Sub Index

Si (SO_4^{2-}) = (1- C_i/1000) x 100

Si (SO_4^{2-}) = 0, if Ci exceeds 1000 mg/L; C_i is the concentration of sulfate determined in the groundwater sample.

***E. coli* Sub Index**

Si (E. coli) = (1- C $_i$/5000) x 100

Si (*E. coli*) = 0, if Ci exceeds 5000 MPN/100ml; Ci is the MPN E. coli measured in the groundwater sample.

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