

National Lake Water Quality Criteria and Standards



**NATIONAL HYDRAULIC RESEARCH INSTITUTE OF MALAYSIA (NAHRIM)
MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT (NRE)**

NATIONAL LAKE WATER QUALITY CRITERIA AND STANDARDS

**National Hydraulic Research Institute of Malaysia (NAHRIM)
Ministry of Natural Resources and Environment (NRE)
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1.0 INTRODUCTION

1.1 Scope and purpose

The National Lake Water Quality Criteria and Standards (NLWQS) for Malaysian lake water use is essentially a user needs specification of the quality of water required for different protection uses. The criteria is intended to provide the required information in making judgments as to the fitness of lake water for human protection of recreational purposes and ecosystem health for the diversity or aquatic life protection.

The NLWQS are applicable to any lake or reservoir, dams, ponds and other impoundments water of any usage or purposes. This standard is also to be used by the owner of the water body as a primary source of information and decision-support to judge the fitness of the said water body and for other water quality management purposes.

The information contained in this NLWQS is similar to what is available in the international literature of lake water quality standards. On top of that, the information provided in NLWQS is relevant to the Malaysian condition. NLWQS also provides background information to help users make informed judgments about the fitness of the lakes that they are using as well as providing information on the ideal water quality for lake water uses.

1.2 The role of standards

The NLWQS has been developed to be used as the basis for future research on lakes in Malaysia. The standard will be used to either improve the environmental quality of a lake or to prevent it from further deteriorating.

Action to protect or improve water quality in lakes may take at least two forms:

- By setting local controls, in order to meet a standard in a particular lake.

or

- By applying uniform controls across all operators of a certain type or size of lakes.

This constitutes a step, where the NLWQS will benefits lakes in Malaysia that can be reduced or extended once its impact is demonstrated.

1.3 Users of the standards

The NLWQS is being developed as an information resource, primarily for lake managers, operators and owners. Nevertheless, researchers and other stakeholders as well as members of the general public are likely to find them a valuable source of information for many aspects of water quality and its management.

1.4 Continuous improvement

The NLWQS 2015 will be reviewed within 3 to 5 years. The time frame is based on the possible amount of new information and data that has been collected and could be used for this standard. The review is part of the continuous improvement approach that has been planned for this standard and two main activities can be done:

- i. Add additional information and instruction into the documents;
- ii. Update the parameters' figures which will more suitable with the Malaysian condition as new information from international and local sources becomes available.

2.0 MONITORING GUIDE

2.1 The parameters

A number of parameters were discussed frequently during the stakeholder's consultative sessions. During the process of selecting the most appropriate parameters for representing different categories of lakes, the following factors were noted:

- i. ease of measurement
- ii. the cost of sampling and analysis
- iii. availability of equipment and related measurement technologies
- iv. relevance to the purpose of the lakes

The parameters were then chosen to be highlighted according to the different categories of lakes.

- **Physical** measurements such as water clarity, dissolved oxygen (DO), and temperature;
- **Nutrients** measurements such as phosphorus and nitrogen which will indicate the trophic state of a lake;
- **Biological/Microbiological** measurements such as the biochemical oxygen demand (BOD), chemical oxygen demand (COD) and bacterial content in the water for human protection purposes; and
- **Other measurement such as heavy metal**

The monitoring parameters based on different uses are given in Chapter 4 to Chapter 7. A long list of organics, pesticide, toxicants and the radioactivity parameters and the appropriate acceptable values are listed in Chapter 8. These values are not compulsory for categorising the lakes and can be measured if sufficient budget is available.

2.2 Use of Carlson Index for Trophic Status

One of the important aspects in lake and reservoir management is the use of Carlson Index as an indication for trophic state status.

It is recommended that the Carlson Index to be used as an indicator of the eutrophication level of lakes in Malaysia. Research effort on lakes should then be focused on finding suitable values of the Carlson Index that would suit Malaysian climate and conditions.

For Carlson's Index, the following parameters are used:

- Chlorophyll a (Chl)
- Phosphorus (P)
- Secchi Depth (SD)

The relationships between Trophic Index (TI), chlorophyll (Chl), phosphorus (P, both micrograms per liter), Secchi depth (SD, meters), and Trophic Class (Carlson and Simpson 1996) is summarized in Table 1.

Table 1: Trophic state classification

TI	Chl	P	SD	Trophic Class
<30—40	0—2.6	0—12	>8—4	Oligotrophic
40—50	2.6—20	12—24	4—2	Mesotrophic
50—70	20—56	24—96	2—0.5	Eutrophic
70—100+	56—155+	96—384+	0.5—<0.25	Hypereutrophic

Even though the Carlson Index was developed based on the condition of lakes in temperate countries, it will be useful for scientists and researchers to validate the values of the Carlson Index using data from Malaysian lakes.

2.3 Sampling strategy

- The sampling method for data collection must be based on the need to capture the ambient conditions of the lakes. Therefore, the number and location of sampling stations should represent the ambient condition of the lakes.
- Three commonly used sampling strategies are random, stratified random and sequential sampling. A random sampling procedure where the sampling team is

required to generate a sampling scheme using a random selection of the sample is proposed for initial exercise before upgrading into stratified and sequential sampling whenever time and logistics permitted.

- The sampling must be done according to APHA Standards.
- All laboratories performing the analysis for lake monitoring should be accredited to the standard of SAMM 17025.

2.4 Sampling frequency

- Typically, lakes are not sampled as often as streams because the large volume of water buffers against the short-term changes in quality. Water quality sampling for lakes is to be carried out at least twice in a year to cover both the dry and wet season, consisting of three replicates per sampling exercise.

2.5 Sampling location

- Representative of the lake

In the past, many limnologists would sample lakes at a single site over the deepest part of the lake. Sampling at the deepest part of the lake would also allow the sampling of every possible depth. However, using this point as the single site to characterize a lake assumes that there are no horizontal gradients in the lake and each depth at that single sampling site represents the conditions at that depth throughout the whole lake.

- Considering the size & shape

Many lakes are long and narrow, with a majority of the water flowing into the outflow at a single point. Some are highly dendritic with many inlets and often with their own contributing stream. Spatial differences in lake water quality do exist and assumptions about homogeneity at a given depth stratum sometimes simply cannot be made. However, more emphasis should be placed in sampling the areas of a lake where most of the volume can be found because methods of sampling should reflect the need to characterize the entire surface area of the lake.

2.6 Sample percentile

It is suggested that 90% percentile of sampling results is to be considered as acceptable to be included in any category of the NLWQS. This means that 10 percent or less of the data for a given site is greater than the standard.

3.0 DESCRIPTION OF CATEGORIES

Table 2: Description of categories

NO	CATEGORIES	DESCRIPTION
1	CATEGORY A	<ul style="list-style-type: none">• Lakes that are managed in which the water to be used for recreational purposes - primary body contact such as swimming, diving and kayaking.
2	CATEGORY B	<ul style="list-style-type: none">• Lakes used for recreational purposes - secondary body contact such as boating and cruising.• Swimming is not allowed in this category of lakes
3	CATEGORY C	<ul style="list-style-type: none">• The lakes are meant for the preservation of aquatic life and biodiversity
4	CATEGORY D	<ul style="list-style-type: none">• Lakes managed for the minimum preservation of good aquatic life in the lakes.• It applies good management practices of lakes.

4.0 CATEGORY A

Category A is for lakes that are managed in which the water will be used for primary body contact recreation. The lakes are managed in the manner where people will be allowed to swim in these lakes. The lake water quality is free from water borne diseases. The additional microbiological and water borne disease parameters are the added list to be measured for this purpose. The minimum required parameters and their respective values in determining the Category A status for primary contact lakes are as listed in Table 3.

Table 3: List of parameter and criteria for Category A

PARAMETER	UNIT	CATEGORY A
PHYSICALS		
Colour	TCU	100 - 200
Conductivity	μS/cm	1000
Salinity	ppt	nvd
Floatables	-	NV
Dissolved Oxygen	mg/L	6.3 - 7.8
DO percentage saturation	%	80 -100
Odour	-	NOO
pH	-	6.5 - 8.5
Taste	-	NOT
Temperature	°C	28
Total Suspended Solid	mg/L	<100
Turbidity	NTU	40
Transparency (Secchi)	m	0.6
Oil & Grease	mg/L	1.5
NUTRIENTS		
Ammoniacal Nitrogen (NH ₃ -N)	mg/L	0.1 ^a
Nitrate-N (NO ₃ -N)	mg/L	7 ^h
Total Phosphorus	mg/L	0.01 ^d

HEAVY METALS		
Arsenic (As)	mg/L	0.05 ^a
Cadmium (Cd)	mg/L	0.002 ^g
Lead (Pb)	mg/L	0.05 ^a
Mercury (Hg)	mg/L	<0.001 ^a
Nickel (Ni)	mg/L	0.02 ^a
BIOLOGICAL/MICROBIOLOGICAL		
Chlorophyll-a	µg/L	10 ^b
Biochemical Oxygen Demand (BOD ₅)	mg/L	3
Chemical Oxygen Demand (COD)	mg/L	10
<i>Clostridium perfringens</i> (including spores)	-	nd ^g
Total Coliform	Counts/ 100ml	5000 ^a
<i>E. coli</i>	Counts/ 100ml	100 ^f
Giardia sp	-	nd ^g
<i>Leptospira</i> sp.	-	nd ^h
Cryptosporidium sp	-	nd ^g
Enterococci	Counts/ 100ml	33 ^h
Cyanobacteria	Cells/ ml	15 000 ^h

Note: ^aDOE 2006, ^bCarlson 1996, ^cANZECC 2000, ^dHealth Canada 2012,

^eUSEPA2012, ^fDonna et al 1993, ^gPerbadanan Putrajaya 2000, ^hMOH 2012,

ⁱMEEA 2013

5.0 CATEGORY B

Category B is for lakes that are managed in which the water to be used for the secondary body contact recreation. This category of lakes is used mainly for recreational purposes such as cruising. The lake will be kept clean for the purpose but people will not be allowed to swim in it. Thus, it is not compulsory for the lake manager to measure the microbiological and water borne disease parameters. The minimum required parameters and their respective values in determining the status Category B for secondary contact are physical, nutrients and heavy metals as listed in Table 4a.

Table 4a: List of parameter and criteria for Category B

PARAMETER	UNIT	CATEGORY B
Colour	TCU	150 - 300
Conductivity	µS/cm	1000
Salinity	ppt	nvd
Floatables	-	NV
Dissolved oxygen	mg/L	5.5 - 8.7
DO percentage saturation	%	70 -110
Odour	-	NOO
pH	-	6.5 - 8.5
Taste	-	NOT
Temperature	°C	28
Total Suspended Solid	mg/L	100 - 500
Turbidity	NTU	40 - 170
Transparency (Secchi)	m	0.6
Oil & Grease	mg/L	1.5
BIOLOGICAL/MICROBIOLOGICAL		
Chlorophyll-a	µg/L	15 ^b
CHEMICALS		
Ammoniacal Nitrogen (NH ₃ -N)	mg/L	0.3 ^a
Nitrate (NO ₃ -N)	mg/L	7 ^h
Total Phosphorus	mg/L	0.035 ^d

Table 4a: List of parameter and criteria for Category B (Cont')

PARAMETER	UNIT	CATEGORY B
Arsenic (As)	mg/L	0.1 ^a
Cadmium (Cd)	mg/L	0.002 ^a
Lead (Pb)	mg/L	0.05 ^a
Mercury (Hg)	mg/L	<0.001 ^a
Nickel (Ni)	mg/L	0.02 ^a

The following parameters are optional for determining Category B.

Table 4b: optional parameters for Category B

PARAMETER	UNIT	CATEGORY B
BIOLOGICAL/MICROBIOLOGICAL		
Biochemical Oxygen Demand (BOD ₅)	mg/L	6
Chemical Oxygen Demand (COD)	mg/L	25
<i>Clostridium perfringens</i> (including spores)	-	nd ^g
Total Coliform	Counts/ 100ml	5000 ^a
<i>E. coli</i>	Counts/ 100ml	600 ^f
<i>Giardia sp</i>	-	nd ^g
<i>Leptospira sp.</i>	-	nd ^h
<i>Cryptosporidium sp.</i>	-	nd ^g
Enterococci	Counts/ 100ml	230 ^h
Cyanobacteria	Cells/ ml	15 000 ^h

6.0 CATEGORY C

Category C is for lakes that are managed for the purpose of preserving aquatic life and biodiversity. The status of the aquatic living things in this lake must be of the best condition. It is the main intention of the lake management of these lakes. The diversity of living organisms in this type of lakes is also considered as a good measure of healthy lakes and of paramount importance. The minimum required parameters and their respective values in determining the status of Category C lakes for the diversity and healthy aquatic life are the physical parameters, nutrients and heavy metals are as listed in Table 5a.

Table 5a: List of parameter and criteria for Category C

PARAMETER	UNIT	CATEGORY C
PHYSICAL		
Colour	TCU	300
Conductivity	μS/cm	2000
Salinity	ppt	<1
Floatables	-	NV
Dissolved Oxygen	mg/L	4.5 – 10.3
DO percentage saturation	%	55 – 130
Odour	-	NOO
pH	-	6.0 - 9.0
Taste	-	NOT
Temperature	°C	28
Total Suspended Solid	mg/L	200
Turbidity	NTU	70
Transparency (Secchi disk)	m	0.3
Oil & Grease	mg/L	1.5
BIOLOGICAL/MICROBIOLOGICAL		
Chlorophyll-a	μg/L	15 ^b
CHEMICALS		
Ammoniacal Nitrogen (NH ₃ -N)	mg/L	1 ^a
Nitrate (NO ₃ -N)	mg/L	10 ^c
Total Phosphorus	mg/L	0.035 ^d

Table 5a: List of parameter and criteria for Category C (Cont')

PARAMETER	UNIT	CATEGORY C
Arsenic (As)	mg/L	0.15 ^e
Cadmium (Cd)	mg/L	0.01 ^a
Lead (Pb)	mg/L	0.05 ^a
Mercury (Hg)	mg/L	<0.001 ^e
Nickel (Ni)	mg/L	0.05 ^a

The following parameters are optional for determining Category C.

Table 5b: optional parameters for Category C

PARAMETER	UNIT	CATEGORY C
BIOLOGICAL/MICROBIOLOGICAL		
Biochemical Oxygen Demand (BOD ₅)	mg/L	6
Chemical Oxygen Demand (COD)	mg/L	25
<i>Clostridium perfringens</i> (including spores)	-	nvd
Total Coliform	Counts/ 100ml	5000 ^a
<i>E. coli</i>	Counts/ 100ml	3000 ^f
<i>Giardia sp</i>	-	nvd
<i>Leptospira sp.</i>	-	nvd
<i>Cryptosporidium sp.</i>	-	nvd
Enterococci	Counts/ 100ml	nvd
Cyanobacteria	Cells/ ml	15 000 ^h

7.0 CATEGORY D

Category D is for lakes that are managed for the minimum preservation of good aquatic life in the lakes. This category of lakes must be kept in good condition, thus will prevent it to be a nuisance to its surrounding. All the possible pollutant must be kept out of the lake, even if it is not meant to be used for any particular purpose. The lake must always be good to be photographed. The minimum required parameters and their respective values in determining the status of Category D are the physical parameters, nutrients and heavy metals are as listed in Table 6a.

Table 6a: List of parameter and criteria for Category D

PARAMETER	UNIT	CATEGORY D
PHYSICAL		
Colour	TCU	300
Conductivity	µS/cm	5000
Salinity	ppt	>1
Floatables	-	NV
Dissolved Oxygen	mg/L	3.3 – 10.3
DO percentage saturation	%	40 - 130
Odour	-	NOO
pH	-	5.5 - 9.0
Taste	-	NOT
Temperature	°C	28
Total Suspended Solid	mg/L	>200
Turbidity	NTU	250
Transparency (Secchi disk)	m	0.3
Oil & Grease	mg/L	1.5
BIOLOGICAL/MICROBIOLOGICAL		
Chlorophyll-a	µg/L	25 ^b
CHEMICALS		
Ammoniacal Nitrogen (NH ₃ -N)	mg/L	2.7 ^a
Nitrate (NO ₃ -N)	mg/L	10 ^c
Total Phosphorus	mg/L	0.05 ^d

Table 6a: List of parameter and criteria for Category D (Cont')

PARAMETER	UNIT	CATEGORY D
Arsenic (As)	mg/L	0.4 ^a
Cadmium (Cd)	mg/L	0.01 ^c
Lead (Pb)	mg/L	0.05 ^a
Mercury (Hg)	mg/L	<0.001 ^a
Nickel (Ni)	mg/L	0.05 ^a

The following parameters are optional.

Table 6b: Optional parameters for Category D

PARAMETER	UNIT	CATEGORY D
BIOLOGICAL/MICROBIOLOGICAL		
Biochemical Oxygen Demand (BOD ₅)	mg/L	8
Chemical Oxygen Demand (COD)	mg/L	50
<i>Clostridium perfringens</i> (including spores)	-	nvd
Total Coliform	Counts/ 100ml	5000 ^a
<i>E. coli</i>	Counts/ 100ml	3000 ^f
<i>Giardia sp</i>	-	nvd
<i>Leptospira sp.</i>	-	nvd
<i>Cryptosporidium sp.</i>	-	nvd
Enterococci	Counts/ 100ml	nvd
Cyanobacteria	Cells/ ml	15 000 ^h

8.0 THE OTHER PARAMETERS

This chapter presents the criteria for the list of parameters that are not mandatory to be measured. The criteria of the parameters necessary for different categories are provided as a reference or guideline values.

Table 7: The criteria for other parameters in NLWQS 2015

A. NLWQS – other parameters

PARAMETER	UNIT	CATEGORY	CATEGORY	CATEGORY	CATEGORY
		A	B	C	D
Calcium ion (Ca ²⁺)	mg/L	200	200	**	**
Chloride	mg/L	250	250	250	250
Combined Chlorine	mg/L	1.0	1.0	1.0	1.0
Free Residual Chlorine	mg/L	1.5	1.5	1.5	1.5
Fluorine	mg/L	1	1	1.5	1.5
Nitrite (NO ₂ ⁻ -N)	mg/L	0.04 ^g	0.4 ^h	0.4 ^h	0.4 ^h
Sulphate	mg/L	250	250	250	250
Total Dissolved Solid	mg/L	1,000 ^h	1,000 ^h	1,000 ^h	1,000 ^h
Total Nitrogen	mg/L	0.35 ^h	0.35 ^h	0.35 ^h	0.35 ^h
Potassium Ion (K ⁺)	mg/L	200	200	200	200
Hydrogen carbonate (HCO ₃ ⁻)	mg/L	200	200	**	**

PARAMETER	UNIT	CATEGORY A	CATEGORY B	CATEGORY C	CATEGORY D
Faecal Coliform	Counts/ 100ml	150 ^h	1000 ^h	1000 ⁱ	2000 ⁱ
Microcystin - LR	µg/L	0	0	0	0
Enteroviruses	PFU/L	nvd	nvd	nvd	nvd

B. NLWQS – (other parameters) heavy metals

PARAMETER	UNIT	CATEGORY	CATEGORY	CATEGORY	CATEGORY
		A	B	C	D
Aluminium (Al)	mg/L	0.1	0.1	0.05	0.05
Antimony (Sb)	mg/L	0.03	0.03	0.03	0.03
Barium (Ba)	mg/L	0.1	0.1	1	1
Beryllium (Be)	mg/L	0.004	0.004	0.004	0.004
Boron (B)	mg/L	1	1	1	1
Chromium (Cr)	mg/L	0.05 ^c	0.05 ^c	0.05 ^c	0.05 ^c
Cobalt (Co)	mg/L	0.05 ^c	0.05 ^c	0.05 ^c	0.05 ^c
Cuprum/ Copper (Cu)	mg/L	0.02	0.02	0.02	0.02
Iron/Ferum (Fe)	mg/L	1	1	1	1
Magnesium (Mg)	mg/L	150	150	150	150
Manganese (Mn)	mg/L	0.1	0.1	0.1	0.1
Silver (Ag)	mg/L	0.05	0.05	0.05	0.05
Sodium (Na)	mg/L	200	200	200	200
Sulphur (S)	mg/L	0.05	0.05	0.05	0.05
Zinc (Zn)	mg/L	3	3	5	5

C. NLWQS - (other parameters) organics/pesticides/contaminants

PARAMETER	UNIT	CATEGORY	CATEGORY	CATEGORY	CATEGORY
		A	B	C	D
1,2-dichloroethane	µg/l	30	30	30	30
2,4-D	µg/L	30	30	70	70
2,4-DB	µg/L	90	90	90	90
2,4-dichlorophenol	µg/L	90	90	90	90
2,4,5-T	µg/L	9	9	10	10
2,4,5-TP	µg/L	4	4	4	4
2,4,6-trichlorophenol	µg/L	200	200	200	200
Alachlor	µg/L	20	20	20	20
Aldicarb	µg/L	10	10	10	10
Aldrin / Dieldrin	µg/L	0.02	0.02	0.02	0.02
Anionic Detergent MBAS	µg/L	1000	1000	1000	1000
Atrazine	µg/L	nvd	nvd	nvd	nvd
BHC	µg/L	2	2	2	2
Carbofuran	µg/L	7	7	7	7
Carbon Chloroform Extract	µg/L	500	500	500	500
Chlordane	µg/L	0.08	0.08	0.08	0.08
Chloroform	µg/L	200	200	200	200

PARAMETER	UNIT	CATEGORY	CATEGORY	CATEGORY	CATEGORY
		A	B	C	D
Cyanide	mg/L	0.05	0.05	0.05	0.05
DDT	µg/L	2	2	2	2
Heptachlor	µg/L	0.05	0.05	0.05	0.05
Glyphosate	µg/L	200	200	200	200
Hexachloro benzene	µg/L	1	1	1	1
Lindane	µg/L	2	2	2	2
MBAS/BAS (Methylene Blue)	µg/L	200	200	200	200
MCPA	µg/L	2	2	2	2
Methoxychlor	µg/L	20	20	20	20
Mineral Oil	µg/L	300	300	300	300
Oil & Grease (Emulsified Edible)	mg/L	7:N	7:N	7:N	7:N
Oil & Grease (Mineral)	mg/L	0.04:N	0.04:N	0.04:N	0.04:N
Paraquat	µg/L	10	10	10	10
Parathion	µg/L	30	30	30	30
PCB	µg/L	0.1	0.1	0.0001	0.0001
Pendimethalin	µg/L	20	20	20	20

PARAMETER	UNIT	CATEGORY A	CATEGORY B	CATEGORY C	CATEGORY D
Pentachlorophenol	µg/L	9	9	9	9
Permethrin	µg/L	20	20	20	20
Pesticides	µg/L	nvd	nvd	nvd	nvd
Phenol	µg/L	5	5	5	5
t-DDT	µg/L	0.1	0.1	0.1	0.1
Tetrachloroethene and Trichloroethene	µg/L	10	10	10	10
Total indicative dose	µg/L	nvd	nvd	nvd	nvd
Total organic carbon (TOC)	µg/L	nvd	nvd	nvd	nvd
Trichloroacetic acid	µg/L	100	100	100	100
Trichloroaceto nitrile	µg/L	1	1	1	1
Trihalomethanes - Total	µg/L	1000	1000	1000	1000
Tritium	µg/L	nvd	nvd	nvd	nvd
Vinyl chloride	µg/L	5	5	5	5

PARAMETER	UNIT	CATEGORY	CATEGORY	CATEGORY	CATEGORY
		A	B	C	D
Acrylamide	µg/L	0.1	0.1	0.1	0.1
Benzene	µg/L	10	10	10	10
Benzo(a) pyrene	µg/L	0.01	0.01	0.01	0.01
Bromate	µg/L	10	10	10	10
Bromodikloro methane	µg/L	60	60	60	60
Bromoform	µg/L	100	100	100	100
Dibromoaceto nitrile	µg/L	100	100	100	100
Dibromochloro methane	µg/L	100	100	100	100
Dichloroacetic acid	µg/L	50	50	50	50
Dichloroaceto nitrile	µg/L	90	90	90	90
Endosulfan	µg/L	10	10	10	10
Epichlorohydrin	µg/L	4	4	4	4
Polycyclic Aromatic Hydrocarbons (PAH)	µg/L	nvd	nvd	nvd	nvd
Propanil	µg/L	20	20	20	20

PARAMETER	UNIT	CATEGORY A	CATEGORY B	CATEGORY C	CATEGORY D
Simazine	µg/L	20	20	20	20
Selenium	mg/L	0.01	0.01	0.01	0.01
Toxicants (heavy metal, organics)	µg/L	nvd	nvd	nvd	nvd

D. NLWQS - (other parameters) radionuclides

PARAMETER	UNIT	CATEGORY A	CATEGORY B	CATEGORY C	CATEGORY D
Gross-alpha	Bq/L	0.1	0.1	0.1	0.1
Gross-Beta	Bq/L	1	1	1	1
Radium-226	Bq/L	<0.1	<0.1	<0.1	<0.1
Strontium-90	Bq/L	<1	<1	<1	<1

Abbreviation

- Note** : All value stated is upper value for each range of categories
- #** : The parameter not fully established
- a** : National Water Quality Standards for Malaysia (DOE 2006)
- b** : Carlson Trophic Index with considering tropical condition (Carlson & Simpson 1996)
- c** : Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000)
- d** : Guidelines for Canadian Recreational Water Quality (Health Canada 2012)
- e** : USEPA 2012, USEPA 2014
- f** : Conversion using USEPA ratio (126 E.coli = 200 faecal) (USEPA 2012)
- g** : Putrajaya Lake Water Quality Standards (Perbadanan Putrajaya 2000)
- h** : “Deraf Penetapan Standard Kualiti Air Rekreasi Semulajadi” (MOH 2012)
- i** : Massachusetts Surface Water Quality Standards (MEEA 2013)
- As alkalinity (CaCO₃ in mg/L)
- <10 mg/L Waterbody is highly sensitive to acid inputs (<4 mg/L dissolved calcium)
- **** 10-20 mg/L Waterbody is moderately sensitive to acid inputs (4-8 mg/L dissolved calcium)
- >20 mg/L Waterbody has low sensitivity to acid inputs (>8 mg/L dissolved calcium)
- BHC** : Benzene hexachloride
- DDT** : Dichloro-diphenyl-trichloroethane
- E. Coli** : Pathogenic *Escherichia coli*.

Hardness	:	Water hardness at 50 mg/L
MCPA	:	4-(2-methyl-4-chlorophenoxy) acetic acid
nd	:	Not detected
NOO	:	No obvious odour
NOT	:	No obvious taste
NTU	:	Nephelometric turbidity unit
NV	:	Not visible
nvd	:	No value determined (Parameter that is not necessary to be measured for certain category)
PCB	:	Polychlorinated biphenyls
pH	:	Is defined as the decimal logarithm of the reciprocal of the hydrogen ion activity, H ⁺ , in a solution. Potential of hydrogen,
TCU	:	True Colour Unit

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