檢討與制定海水水質指標
第一階段公眾諮詢文件

First Stage Public Engagement Document for the Review And Development Of Marine Water Quality Objectives



環境保護署
Environmental Protection Department

1. 公眾諮詢

環境保護署正檢討和修訂海水水質指標，目的是根據最新的科學發展加強保護本港的水環境，及為公眾利益而促進這些水域的保育及最佳用途。在檢討過程中，我們將考慮本港海洋環境的狀況及結合外國的最佳做法。根據檢討結果，我們會考慮修訂目前的指標及／或制定新的指標。我們也會就有關修訂或新建議的指標，評估其技術可行性及潛在的社會經濟影響。

為收集社會人士對檢討事宜及修訂水質指標的意見，我們將分兩個階段諮詢公眾。本諮詢文件旨在介紹本地的海水水質狀況，和外國在制定水質指標的趨勢。我們也同時諮詢公眾對修訂海水水質指標的主要檢討事宜及檢討方法的意見。更重要的是，為了在未來加強保護我們的海洋環境，我們鼓勵公眾就制定水質指標的最佳方法發表意見。

1. Public Engagement

The Environmental Protection Department (EPD) has embarked on a review of our marine water quality objectives (WQOs) so as to enhance the protection of the water environment in an evolving scientific setting, and to promote the conservation and the best use of the waters of Hong Kong in the public interest. Our review examines the existing WQOs in light of the local conditions and overseas best practices; and subject to the findings, we may consider refining the existing WQOs and/or developing new WQOs. The review will also examine the technical attainability and potential socio-economic implications associated with any proposed changes to the WQOs.

We shall conduct the public engagement in two stages to seek views from the public on the issues to be addressed, and any proposed changes to the WQOs. This document is intended for informing the public of the local conditions and overseas trends, and seeking your views on the issues to be addressed and the review approaches. More importantly, we encourage the public to express views on the best ways to develop the WQOs so as to enhance the protection of our marine environment in the coming decades.

2. 我們的基準：海水水質指標

海洋水域是我們寶貴的天然資產。它為多種野生生物，包括微小的浮游生物、海草、珊瑚以及綠海龜、馬蹄蟹、海豚和江豚等，提供了棲息地。對於我們日常生活，它也提供了多種實益用途[1]，包括康樂設施、海產養殖、漁業、冷卻、沖廁、航海、污水排放、採沙和污泥棄置。圖1顯示了各種海洋生物在本港海洋水域的分布狀況。

2. Our Yardstick: Water Quality Objectives (WQOs)

Our marine waters are a valuable natural asset. They support a huge variety of wildlife, from microscopic plankton, seagrasses and corals, to green turtles, horseshoe crabs, dolphins and finless porpoises. For our daily life, they also support a variety of 'beneficial uses'[1] (BUs), including amenities, mariculture, fisheries, cooling, toilet flushing, navigation, effluent discharge, sand borrowing and mud disposal. Figure 1 illustrates the abundance of different marine life supported by our marine waters.

Figure 1 Our marine waters support different habitats for marine life
圖1 我們的海洋水域為生物提供各種的棲息地

我們應保護四周的海洋環境，確保海洋生物持續繁衍和維持人類的各種用途。很多國家均以水質指標作為量度水體「環境健康」的基準[2]。一般而言，具有較敏感用途的水域，包括重要物種（如中華白海豚）的保護區、海產養殖區和泳灘，均需要較高程度的保護（即較嚴格的水質指標），而用作低敏感用途（如航海）的水體，其需要的保護程度相對較低（即較寬鬆的水質指標）。具有敏感用途的水體大多集中在本港東部和南部的水域。

We need to protect our marine waters to ensure they are fit for marine life growth and different human uses in a sustainable manner. Many overseas jurisdictions establish WQOs as the benchmark[2] to measure the "environmental health" of a water body. In general, waters with more sensitive uses, including sanctuaries for important species such as the Chinese White Dolphin, mariculture areas and bathing beaches, require higher level of protection (i.e. with more stringent WQOs), while water bodies with less sensitive uses such as navigation require relatively lower level of protection (i.e. with less stringent WQOs). Sensitive water bodies are mostly found in the eastern and southern waters.

[1] **Beneficial use (BU) refers to the planned use of a water body. A water body is fit for a specific BU, if it meets the relevant WQOs set for the BU.**
實益用途指水體的規劃用途。如水體質素達到為某一實益用途所訂立的水質指標，則該水體便適合作該指定實益用途。

[2] **These benchmarks, can be numerical or narrative, and include various parameters to describe the physical, chemical and biological properties of the marine environment.**
這些基準是由描述海洋環境的物理、化學和生物特性的一系列參數所組成。它們可以是數值，也可以是陳述性的參照基準。

Different beneficial uses in the marine waters of Hong Kong
本港海域的各類實益用途

環繞我們的海域是多種野生動物的棲息地，亦為人類提供各類的實益用途。良好的海洋環境讓野生動物健康生長及持續繁衍。而海水水質指標乃界定海洋環境質素的基準。

Our marine waters support a variety of wildlife and beneficial uses. A marine environment of appropriate quality, which is defined by the WQOs, favours their healthy and sustained growth.

水質指標提供客觀及科學的基礎，協助我們制定和實施污染管制策略，以及規劃和發展合適的和可持續的基礎設施，達致防止不必要的污染、減少污染對水質影響的目的。

The WQOs provide an objective and scientific basis for us to formulate and implement pollution control strategies, and to plan and develop infrastructure in a suitable and sustainable way, with a view to preventing unnecessary pollution and minimising impacts on the water quality.

3. 為何要檢討水質指標？

目前的水質指標是依據《水污染管制條例》（第358章）[3]制定的，並於1982年首先應用於吐露港及赤門水質管制區（WCZ）[4]，然後在1987年至1996年期間擴展至其他水質管制區。

經過多年，水科學知識和技術已顯著進步。我們的水域也加入了新用途，例如作保育和教育用途的海岸公園和海岸保護區。隨著社會的環保意識日增，公眾也期望更高質素的海洋環境作康樂用途，以達到更良好的生活質素。

作為國際社會一員，我們亦需要通過國際合作為保護海洋環境及其持續發展作出貢獻。我們在政府間的協作方面已扮演更積極的角色，舉例說，我們實施了防止海洋污染[5]和促進保護海洋資源的國際協議及條約，並參與亞太區經濟合作組織論壇等國際論壇。

因此，為跟上全球發展和科技進步，我們檢討水質指標是適時的，並可確保指標適合長遠保護我們的海洋環境。

3. Why WQO Review ?

Our existing WQOs were introduced under the Water Pollution Control Ordinance (Chapter 358)[3], and first applied to the Tolo Harbour and Channel Water Control Zone (WCZ)[4] in 1982, and then extended to other WCZs from 1987 to 1996.

Over the years, there has been significant advancement in water science and technology. New uses of our waters, such as marine parks and reserves for conservation and education purposes, have also emerged. The community is more aware of the need to protect our environment, and the public expects a higher quality marine environment for recreational purposes, to secure a higher quality of life.

As a member of the global community, we also need to contribute to the sustainability of the marine environment through international cooperation. We have been taking a more active role in intergovernmental collaboration, for instance, implementing international agreements and treaties which aim at preventing pollution[5] and conserving marine resources, and participating in international fora such as the Asia-Pacific Economic Cooperation Forum.

In order to keep pace with global developments and scientific advances, this review is timely and it enables us to ensure that our water quality objectives are suitable for the long-term protection of our marine environment.

在規劃排污基礎設施時，水質指標可以幫助我們確定：（i）可排放的污染負荷量，及（ii）恰當的排放地點，以免對受納水體造成顯著影響。一般而言，作航行、排污和抽取沖廁水用途的水域，只需要較寬鬆的水質指標來保護。但那些為高生態價值的生物提供棲息地的水域，就需要較嚴格的水質指標。

In planning sewage infrastructures, the WQOs provide guidance as to (i) how much pollution can be discharged, and (ii) at what location the discharge be made without causing significant impact to the receiving water bodies. Usually, some uses of the water bodies such as abstraction of water for toilet flushing, navigation, and sewage disposal require lower water quality standards than those waters supporting habitats for marine life with high ecological value.

[3] Details can be found at http://www.legislation.gov.hk/eng/index.htm
詳情可參閱http://www.legislation.gov.hk/chi/index.htm

[4] Under the WPCO, if a specific water body is declared as a Water Control Zone (WCZ), all discharges and deposits within the WCZ are subject to licensing control, There are ten WCZs declared, covering all the marine waters of Hong Kong.
根據《水污染管制條例》，如果宣布某一水體為水質管制區，所有在水質管制區內的排放及沉積，均須受發牌管制。本港共有十個水質管制區，覆蓋所有海洋水域。

[5] For example, the Stockholm Convention on Persistent Organic Pollutants.
例如關於持久性有機污染物的斯德哥爾摩公約。

4. 主要的檢討事宜

要更新海水水質指標，第一步是檢討現有指標，分析本地海洋環境狀況，及研究外國制定水質指標的做法。下一步是定出需改進的內容、優先保護的領域、以及制定適當的新海水水質指標的方法。我們將對修訂指標的各個環節作出深入的檢討，並且在過程中參考最新的科學知識和外國的最佳做法。然後，我們會為水體的各類實益用途分配經修訂或新制定的水質指標。在採用那些指標之前，我們也會研究實施時的技術問題、效益和對社會經濟的影響。

我們已研究了本地的海洋環境和外國制定水質指標的最佳做法，並定出主要的檢討事宜。我們將在下文談到其要點。詳細的技術資料可於『檢討海水水質指標』網站[6]的「技術摘要」裏找到。

本港海洋水域的特點

本港海洋水域由西面的海灣河流環境漸變為東面開闊的海洋環境，而中部則為過渡區。從珠江口流出的淡水水流主要影響西部和南部水域，而其影響程度向東則逐漸減弱。如圖2所示，夏季期間，中國南部降雨量最大，珠江流量此時處於高峰期，因此珠江水流在夏季期間影響本港最大。

4. Key Issues of the Review

The logical first step in updating our WQOs is a review of existing WQOs, the local marine environment and overseas practices, in order to identify areas for improvements, the main protection priorities, and ways to develop suitable new WQOs. An in-depth review on each aspect will then be conducted to reflect the latest scientific knowledge and overseas best practices. Changes to the WQOs, or new WQOs, will then be assigned to the BUs identified for each water body. We will also examine the technical issues, benefits and socio-economic impacts associated with the implementation of the proposed changes before they are adopted.

We have already identified a number of key issues related to the existing WQOs, after a review of our marine environment and overseas best practices. The findings are shown in the paragraphs below. More technical details can be found in the "Technical Note" downloadable at the WQO Review Project Website[6].

Characteristics of our marine waters

Our marine waters change gradually from a sheltered, estuarine environment in the west, to an exposed, ocean environment in the east, with a transition zone in the middle. The freshwater flow of Pearl River affects the western and southern areas of the territory, and the influence is progressively reduced towards the east. The influence of the Pearl River flow, as shown in Figure 2, is greater during summer, when the flow is at its peak and rainfall is at its highest in the southern part of the mainland.

[6] Link: http://www.epd.gov.hk/epd/wqo_review
網址：http://www.epd.gov.hk/epd/wqo_review

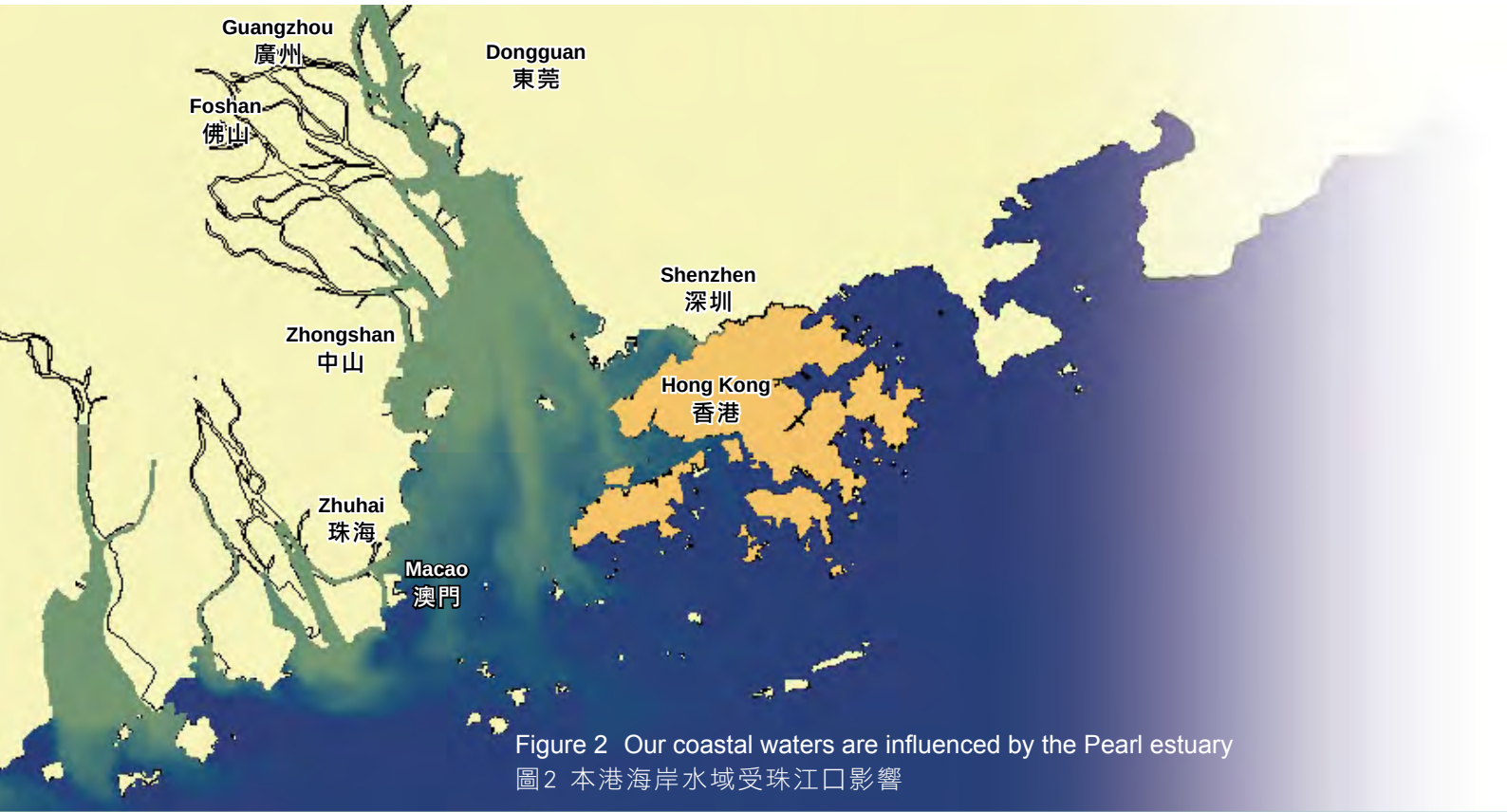


Figure 2 Our coastal waters are influenced by the Pearl estuary
圖2 本港海岸水域受珠江口影響

本港海水水質

多年來，我們定期監測本港海域的水質，為檢查海水水質達標率、評估政府的排污基礎設施及污染控制措施是否有效提供了數據。

在2008年，本港海水水質指標整體達標率[7]為80%。就個別水體而言，本港東部水域（如大鵬灣和牛尾海）整體水質良好，能完全達到指標。其他水域的水質則較差，如后海灣，達標率只有40%。

環境保護署也監測分布在本港不同地點的44個泳灘。以大腸桿菌含量計算，2008年的泳灘水質達標率為83%，大致上與過去數年相同。水質最佳的泳灘主要位於港島南區、西貢和離島。

整體而言，海水中的有毒物質、沉積物含量和生物水平符合為保護海洋生物和人類健康而定立的本地及海外地區的指標。

關於海水水質監測及其他監測計劃（例如「泳灘水質監測計劃」和「有毒物質監測計劃」）的詳情，及監測數據，請瀏覽環境保護署的網頁[8]。

Quality of our marine waters

Over the years, our routine monitoring of the marine waters has provided useful data for checking the compliance rates of the WQOs, and assessing the effectiveness of the sewage infrastructure programmes and pollution control measures put into place by the Government.

In 2008, the marine water quality in Hong Kong achieved 80% overall compliance[7] with the WQOs. For individual water bodies, the water quality in the eastern parts of Hong Kong, such as Mirs Bay and Port Shelter, is good overall, with a 100% rate of success in meeting our existing WQOs. Other parts of Hong Kong waters are not so good, such as Deep Bay, which only achieved a 40% rate of success.

EPD monitors 44 beaches located in different parts of the territory. The compliance with bathing WQO laid down for the beaches in 2008, based on the *E.coli* reading, was 83%, which is largely in line with that of the past couple of years. Beaches with the best quality are mainly located in the southern district of Hong Kong Island, Sai Kung, and Outlying Islands.

The levels of toxic substances in marine water, sediment and biological organisms generally met local and overseas standards for the protection of marine life and human health.

More details about the marine water quality monitoring, other monitoring programmes such as the “Beach Water Monitoring Programme” and the “Toxic Substances Monitoring Programme”, and the monitoring data can be found on the EPD’s website[8].

[7] The overall compliance rate is based on the combined individual compliance rates of all monitoring stations for the four important marine WQOs, namely dissolved oxygen, total inorganic nitrogen, unionized ammonia, and *E.coli*.
整體達標率是根據所有水質監測站所錄得的四個重要的海水水質指標（即溶解氧，總無機氮，非離子氨氮和大腸桿菌）的達標率所得出。

[8] Link: http://www.epd.gov.hk/epd/english/environmentinhk/water/water_maincontent.html
網址：http://www.epd.gov.hk/epd/tc_chi/environmentinhk/water/water_maincontent.html

現有水質指標之概況

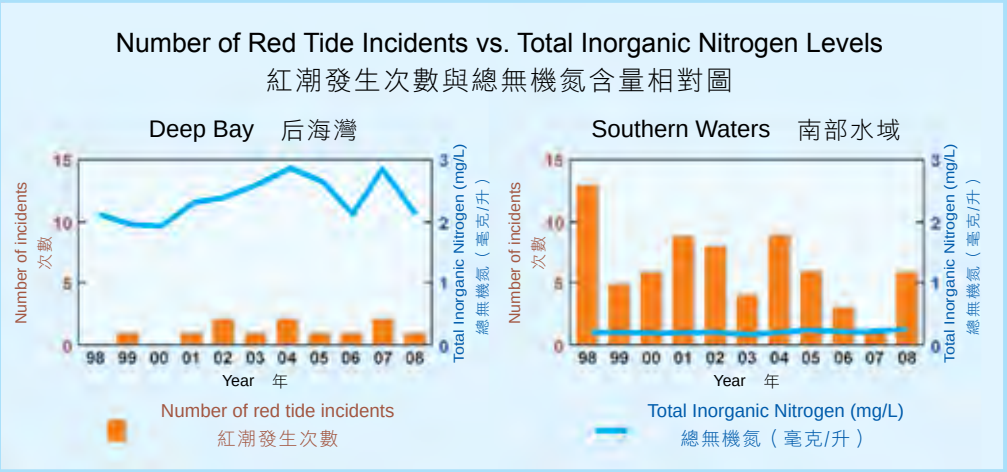
現時的水質指標主要是以80年代的科學水平、水質狀況和社會需求，參考其他國家當時採用的水質指標而制定的。對比其他國家目前的最佳做法，這些指標有以下情況：

- 某些指標可能不再適合現今的環境保護要求。例如，本港的有毒物質水質指標只是個陳述性指標，而其他國家多已採用定量性的指標，並為個別有毒物質制定指標數值。
- 某些化學品的背景濃度頗高，且超出水質指標。例如，后海灣水域總無機氮的背景濃度高，且多年來有關水質指標的達標率都是偏低的，但藻類的生長（通常與某些營養物的高水平有關）卻處於意想不到的低水平。

Observations on the existing WQOs

Our current WQOs were largely developed on the basis of our scientific knowledge, water quality conditions and social needs in the 1980s, with reference to the WQOs adopted by other countries. With reference to overseas best practices, we have a number of observations on the existing WQOs:

- Some WQOs may no longer be appropriate for today's conditions - for example, there is a single word-based or 'narrative' WQO for toxic substances, while other countries have now introduced numerical WQOs for individual toxic substances.
- High background levels of some chemicals leads to non-compliance – for example, non-compliance with the WQO for total inorganic nitrogen (TIN) has been observed in Deep Bay for some years due to the high background level, although algal growth (which is very often linked to high levels of certain nutrients) in the water body, is at a surprisingly low level.



總無機氮是海洋生態系統營養物的重要來源。營養物本身無毒，但過量就可能導致藻類大量繁殖或出現紅潮。藻類死亡後沉入海底，然後腐化。腐化過程會消耗氧氣，導致周邊水環境缺氧。藻類的生長受很多因素影響，如溫度、透光度、鹽度、海水流動程度和營養物的相對成份等。海外的慣例是採用一系列水質指標參數，以反映水體藻類是否易於繁殖。

Total inorganic nitrogen (TIN) is an essential nutrient source in a marine ecosystem. Nutrients are not toxic themselves but if present in large amount will help promote excessive algal growth or red tides. When the algae die, they sink to the sea bottom. The decaying process of these dead bodies will consume oxygen, thus causing an impact of oxygen depletion in the surrounding environment. Algal formation is a complex issue which is due to a number of factors such as temperature, light penetration, salinity, water stagnancy, and relative composition of the nutrients. Overseas jurisdictions usually employ a suite of criteria to reflect how likely the water bodies would have algal blooms.

- 某些水體要同時維持兩個或以上的實益用途。例如后海灣是養蠔區和較敏感的海域，同時又甚接近人口聚居的市鎮。
- 對某些實益用途（如：海產養殖），現有的水質指標所提供的保護可能不足夠。對一些新增的實益用途（如：海岸公園和海岸保護區），則缺乏相關的水質指標。
- 在水質管理方面，我們需要採用符合外國最新做法，如：
  - ♦ 使用生物性水質指標；
  - ♦ 在建立營養物水質指標時，充分考慮水體的背景環境狀況；
  - ♦ 盡量使用定量性的水質指標；
  - ♦ 對於泳灘水域，採用其他細菌指標。

- Two or more BUs co-exist in some water bodies – for example, Deep Bay is used for oyster culture and other sensitive marine uses, but is also close to urban developments.
- The existing WQOs may not be able to provide full protection for some BUs (e.g. mariculture), and are not available for new BUs (e.g. marine parks and reserves).
- We need to keep pace with the latest overseas trends in water quality management, such as:
  - ♦ Use of biological objectives;
  - ♦ Establishing nutrient WQOs with reference to background conditions;
  - ♦ More common use of numerical WQOs;
  - ♦ Other bacterial indicators for bathing waters.

表1和表2詳列本港與外國採用的水質指標特性之比較。

We have made comparisons between our practice and overseas best practices, as shown in Tables 1 and 2.

Table 1 – Comparison between local and overseas best practices

表1 – 本港與外國的水質指標特性之比較

WQO PARAMETERS 水質指標參數	LOCAL PRACTICE 本港	OVERSEAS PRACTICE 外國
Natural (e.g. pH, dissolved oxygen) 物理性參數（如：酸鹼值，溶解氧）	Narrative and numerical level 陳述性與定量性參數並用	Narrative and numerical level 陳述性與定量性參數並用
Nutrients (e.g. total inorganic nitrogen (TIN), phosphate, silicate, etc.) 營養物參數（如：總無機氮、磷酸鹽、矽酸鹽等）	Narrative, and a TIN WQO with numerical level 除總無機氮的水質指標為定量性外，其他指標均為陳述性	A range of nutrient parameters, each with numerical level 由一系列營養物參數指標所組成，每個參數均設有定量性指標
Chemical (including toxicants) 化學性參數（包括有毒物質）	Narrative 陳述性參數	Numerical level 定量性參數
Biological 生物性參數	None 無	Numerical level 定量性參數

Table 2 – Comparison between WQO parameters for specific uses

表2 – 本港與外國為特定功能用途而定立的水質指標之比較

WQO PARAMETERS FOR SPECIFIC USE 為特定功能用途而定立的水質指標	LOCAL PRACTICE 本港	OVERSEAS PRACTICE 外國
Bathing Waters 泳灘水域	Numerical level using *E. coli* 以大腸桿菌為細菌指標的定量性參數	Numerical level using Enterococci alone, or both *E.coli* and Enterococci 單獨使用腸道鏈球菌數目的定量性指標或並用腸道鏈球菌和大腸桿菌兩個定量性參數
Mariculture 海產養殖區		
• for proliferation of cultured products 海產養殖	A WQO for *E.coli* with numerical level 以大腸桿菌為細菌指標的定量性參數	Numerical level 定量性水質參數
• for meeting with food standards 符合食品安全標準	None 無	Some with numerical level 有些國家採用定量性水質參數

外國慣用的水質管理模式

其他國家慣用的水質管理模式有以下：

- 「技術為本模式」為德國、日本和馬來西亞等國家採用。此模式主要採用最佳的污水處理技術，使排入水體的出水符合排放標準。因此，在執行上，要預先為經處理的污水制定排污管制標準。但實際上，受納水體的水質要求卻較難從排放標準反映出來。

- 「功能保護模式」為加拿大、美國、歐洲和澳洲等國家採用，以提供某程度的保護和符合個別水體實益用途的需要。此模式是為具有不同實益用途的水體，制定不同的水質指標。若同一水體具有多種實益用途，則以對水質要求最嚴格的實益用途為制定指標的基礎。這模式通常用於輕微至中度污染的水體。香港在上世紀80年代制定海水水質指標時，就是採用此模式。

- 「無損害功能模式」實際上是最嚴格的「功能保護模式」。這模式的目的是防止海洋生物受到任何形式的污染。它通常應用於具有高生態價值的水域。「無損害功能模式」還包括其他嚴格的污染控制政策，如嚴禁向水體排放污染物，及採用最嚴格的水質指標。

Overseas approaches for water quality management

The approaches commonly adopted by some other countries for managing their water bodies are as follows:

- The “Technology-Based Approach”, commonly adopted by countries such as Germany, Japan, and Malaysia, is mainly intended to apply the best available technology to meet the required standards for discharges into marine waters. There are usually predetermined pollutant control standards for wastewater discharge after treatment. However, it is sometimes difficult to relate the discharge standards to the quality needs of the receiving water body.

- The “Use-Protection Approach”, commonly adopted by countries such as Canada, the US, Europe, and Australia, is intended to offer a level of protection which suits the BU of the water body. A suite of quality standards will usually be developed for a water body with defined BU. If there is more than one BU in close proximity to the water body, the water quality standards for the most sensitive BU will be adopted. The approach is usually applied to water bodies in which marine life is only slightly to moderately disturbed. This approach was largely adopted in Hong Kong when the local WQOs were established in the 1980s.

- The “Non-Degradation Approach” is in fact the strictest form of the “Use-Protection Approach”, in which no disturbance to marine life is allowed. It is generally applied to waters of high ecological value, and comprises other strict policies such as a complete ban on the discharge to the water body. The strictest WQOs may be adopted in parallel.

我們將在下文討論不同國家制定各類水質指標，和泳灘和海產養殖場的水質指標時所用的方法。由於各國所採取的水質管理模式有異，所以她們制定指標的方法也有差異。

- 物理性水質指標—澳洲、歐盟和美國等均採用「參照區方法」來制定物理性的定量性指標。有關參數包括酸鹼值、溫度、鹽度、溶解氧等。該方法根據參照區[9]兩年以上的水質監測資料，為目標水域制定各個物理性參數的指標。參照區的生物特性須與目標水域的相同或類似。

- 營養物水質指標—制定營養物水質指標是為了控制藻類過度生長。相關的水質參數包括氮、矽酸鹽和磷酸鹽。與制定物理性指標相似，澳洲、歐盟和美國也是採用「參照區方法」來制定營養物指標。在制定有關指標時，也要按個別水體的情況，考慮影響藻類過度生長的其他因素，包括水流，透光度等。

- 化學性水質指標（和有毒物質水質指標）—澳洲和美國等均採用「風險評估方法」及「完全保護法」來制定這類指標。按「風險評估方法」而制定的指標旨在保護99%、95%、90%或80%的海洋物種。而以「完全保護法」制定的指標則在任何時間均保護所有物種。如果制定指標所需的毒性資料不足夠，外國的做法是以「評估系數法」輔助，將由毒性資料得出的定量性指標，再乘上一個「安全系數」，以彌補因數據不足而帶來的不確定性。

The general methods adopted by different countries in coming up with (i) different types of WQOs, and (ii) WQOs for bathing water and mariculture, are discussed as follows. The derivation of WQOs is normally driven by the different water quality management approaches adopted by the various overseas jurisdictions as described above.

- WQOs for natural parameters – These parameters include pH, temperature, salinity, dissolved oxygen, etc., and the "Reference Site Approach" is commonly adopted for developing the numerical values concerned. The approach is to generate required values at measurement sites for each natural parameter, based on at least two years' data at a corresponding reference site[9], which has similar or the same biological make-up as the water body for which the WQO is to be established. This approach is commonly adopted by jurisdictions such as Australia, the EU, and the US.

- WQOs for nutrients – The primary purpose of setting nutrient-related WQOs is to control excessive growth of algae. The parameters concerned include nitrogen, silicate, and phosphate. Similar to the WQOs for natural parameters, the "Reference Site Approach" is in general adopted, by jurisdictions such as Australia, the EU, and the US in the derivation of nutrient-related WQOs. Other site-specific factors such as water current and light intensity, which contribute to excessive algal growth, will also be considered.

- WQOs for chemical parameters (and toxicants) – The "Risk Assessment Approach" aims at protecting 99%, 95%, 90%, or 80% of the marine species, while the "Full Protection Approach" is to protect 100% of the species for 100% of the time. These approaches are commonly adopted by countries such as Australia and the US. If toxicity data needed for setting the WQOs is not enough, the usual overseas practice is to adopt the "Assessment Factor Approach", which is to apply a "factor of safety" to the value derived from the toxicity data to cater for any uncertainty.

[9] Any site selected for reference purpose should be unimpaired or minimally impaired.
任何被選為參照區的水域應為未受損害或受損程度為最低的水域

- 生物性水質指標—生物性指標能直接量度固有的水生物種在環境受污染時的反應。這類指標與物理性和化學性指標是相輔相成的。制定生物性指標需首先收集水中生物的物種、豐富度、分布、構成和多樣性的基線資料（或「典型狀況」），然後再制定一個可以反映生物群相對於「典型狀況」的變化指數或分級體系。

- Biological WQOs – These WQOs measure directly how resident species "behave" when their environment is exposed to pollution, and they complement other physical and chemical WQOs. The approach is to first collect baseline or 'normal' data of biological conditions concerning the types, abundance, distribution, composition and diversity of marine life in a certain water body. The next step is to develop a system such as an index or grading scale which can reflect changes in biological conditions with respect to the 'normal' conditions.

要制定生物性水質指標，必須先收集特定生物群在污染程度轉變的情況下如何反應的資料。環境保護署已開展生物指標監測計劃，為制定合適的生物性水質指標收集資料。

生物性指標的目的是直接反映生態系統的健康狀況，它與物理性和化學性水質指標是相輔相成的。使用生物性指標有明顯好處，例如它能反映各種水污染的累積效應，並就重要生態系統的完整性提供資料。

The development of biological WQOs needs data on the responses of selected organisms to changes in the pollution levels. We have introduced a biological indicator monitoring programme to collect the data for the development of suitable WQOs.

Biological objective is to reflect directly the health of ecosystem, and to supplement physical and chemical criteria. The benefits of using biological objective are notable, including that it reflects the cumulative impacts in relation to a combination of water quality issues, and provides information on the integrity of the important ecosystems.

- 泳灘水質指標—2003年世界衛生組織頒布的《世界衛生組織指引 — 安全使用休憩水域環境》指出腸道鏈球菌是反映泳灘水質污染與常見泳灘疾病（如腸胃疾病和急性發熱呼吸道疾病）之間關係的最佳細菌指標。該指引也提供參考資料，讓不同國家按本身的具體情況，包括可承受的風險水平、公共衛生數據、環境及社會經濟條件等，來制定泳灘水質指標。

- WQOs for bathing waters – The "WHO Guidelines for Safe Recreational Water Environments" issued by the World Health Organisation (WHO) in 2003 suggests that intestinal enterococci is the best bacterial indicator of the relationship between bathing water pollution and common bathing illnesses, such as gastrointestinal illnesses, and acute febrile respiratory illnesses. The WHO Guidelines provide reference for countries to develop their own bathing water standards, taking into account local conditions such as acceptable risk level, public health data, environmental and socio-economic conditions.

本港的沿海水域常有各式各樣的水上活動，如游泳和滑浪風帆。從公共衛生角度而言，水域應保持清潔，以減少人類接觸病菌的機會。以細菌水平作為水質指標有助反映水域受生活污水污染的情況和相關的健康風險。

公共衛生法例的目的是減少泳客在游泳時接觸病菌的機會。由於要將泳灘海水中所有病菌測試是不可行的，外國的做法是使用與一種或多種污染源相關的微生物作為指標，以反映使用泳灘的健康風險。

The coastal waters of Hong Kong are famous for various kinds of waterborne activities such as bathing and windsurfing. From public health perspective, the waters should be clean enough to limit human exposure to pathogens. A bacteriological WQO helps to reflect the waters' likely health risks associated with sewage pollution.

The objective of public health regulation is to limit human exposure to pathogens in bathing waters. However, due to practical reasons, indicator organisms having good correlation with the health risks associated with one or several types of pollution sources, are widely used in overseas jurisdictions to indicate the health risk of using the waters for swimming.

- 海產養殖區的水質指標—韓國、澳洲和美國等依據水質指標來確保所飼養的魚類或貝殼類能健康繁殖。而澳洲和美國更藉水質指標明確規定水體中特定污染物的最高濃度，以保證有關漁獲能符合既定的食物標準。另外，有些國家引入另一層的規管，就是制定個別物質在魚類和貝殼類體內組織的標準。

- WQOs for mariculture – A number of countries such as Korea, Australia and the US rely on WQOs for protecting the growth and reproduction of cultured fish or shellfish. Some jurisdictions such as Australia and the US have produced WQOs for specific pollutants in the water, so that products harvested from these areas can meet established food standards. In conjunction with the WQOs, some jurisdictions adopt a further tier of control by setting standards for body tissues of the fish and shellfish.

貝殼類海產容易將飼養海水中的有毒物質和病菌累積在身體內。因此，個別國家制定養殖區的有毒物和細菌水質標準，以保證貝殼類海產的質素。美國食品及藥品管理局管理的《國家貝殼類衛生計劃》將養殖貝殼類的海洋水域根據其水質狀況分為不同類別。在最高類別的水域養殖的貝殼類海產可以生吃，而在較低類別水域養殖的貝殼類海產要受發牌規管，且要在市場出售前進行濾清處理。

Shellfish are very good at accumulating toxic substances, and pathogens from marine waters in which they are cultured. Some overseas countries adopt appropriate toxic substances and bacteria standards for the culture water so as to control the quality of shellfish. In overseas practice, such as the National Shellfish Sanitation Programme (NSSP) administered by the U.S. Food and Drug Administration, marine waters used for shellfish culturing are classified into different categories according to their qualities. Shellfish harvested from waters of the highest category can be eaten raw, while those from lower categories would be subject to licensing control, and cleansing requirements before distribution or sale.

5. 檢討水質指標的方法

經初步檢討，我們在附錄A列出了擬重點檢討的水質參數清單。我們擬採用以下的基本原則和方法，詳細檢討那些參數：

(a) 制定水質指標的基本原則包括：

- 在考慮水體現有的實益用途下，採用「功能保護模式」 制定相關水域的水質指標；
- 對具有高生態價值的水域，採用「無損害功能模式」制定相關的水質指標；
- 使用「風險評估方法」以保護有關水域內80%以上物種。

(b) 就制定個別水質指標，我們建議採用下表所示的最佳方法：

5. Review Approaches

Based on our initial review, a list of parameters proposed for closer attention is shown in Appendix A. In addition, we propose to adopt the general principles, and approaches set out below for in-depth review of the parameters:

(a) General principles for WQO development include the following:

- Application of the Use-Protection Approach taking into account existing BUs;
- Application of Non-Degradation Approach to waters of high ecological value;
- Application of Risk Assessment Approach to protect at least 80% of species.

(b) The best practice approach(es) for setting individual WQOs are set out below:

WQO PARAMETERS 水質參數	PROPOSED METHODS 建議的水質指標制定方法
Natural 物理性參數	Site-specific approach setting certain values for background data. 以背景數據為基礎，為個別水域制定適當的水質指標。
Nutrients 營養物	Site-specific approach, with trigger values for algal blooms, and taking into account background conditions. 以背景數據為基礎，及考慮藻類大量繁殖的觸發值，為個別水域制定適當的水質指標。
Chemical (including toxicants) 化學性（包括有毒物質）參數	• Full Protection Approach for sensitive organisms. 採用「無損害功能模式」以保護敏感的水生物。 • Risk Assessment Approach for chemicals with sufficient toxicity data. 對具有足夠毒性資料的化學品，採用風險評估方法。 • Assessment Factor Approach for chemicals with insufficient toxicity data as an interim method. 對毒性資料不足的化學品，採用「評估系數法」作為暫時措施。
Biological 生物性參數	Baseline 'normal' biological conditions will be assessed through monitoring programme, before identifying suitable indicators and parameters. 在找出合適的指標和參數前，從監測數據去評估水體生物的基線狀況。
Bacterial indicator for Bathing Waters 泳灘水域的細菌指標	By reference to the WHO's guidelines, the use of enterococci as a bacterial indicator will be explored. 參考《世界衛生組織指引—安全使用休憩水域環境》，探索使用腸道鏈球菌作為細菌指標的可行性。
For Mariculture (fish farming, shellfish cultivation, etc.) 海產養殖區（魚類養殖、貝殼類養殖等）	Risk-based approach, and drawing on overseas and local references as appropriate. 運用風險評估方法，借鑒外國和本地的相關資料。

6. 徵求你的意見

從包括本港海洋水域的實益用途、海洋水質管理、海洋生態保護、海岸開發、環境影響評估及污染控制等方面而言，檢討海水水質指標是很重要的。在研究的初期，我們希望聽取你的意見，以建立一套在未來數十年都適合本港海域的水質指標。具體來說，我們希望聽取你對以下問題的意見：

(a) 你對上述第4節列出的主要的檢討事宜有何意見？

(b) 你對上述第2節列出的實益用途和敏感受體有何意見？你認為在檢討中，還需要考慮其他實益用途嗎？

(c) 就保護水域的各種實益用途、敏感受體和敏感生物群而言，你認為保護的優先次序和程度應如何？

(d) 除附錄A所列的資料外，下階段的研究還應考慮什麼類型的水質指標或參數？

(e) 你對上述第5節提議的水質指標檢討方法有何意見？

(f) 在下階段的研究中，還應考慮那些水質管理概念和水質指標的制定方法？

請通過下列其中一項方式，在二零零九年十二月三十一日前向我們表達你的意見：

地址：海水水質指標檢討
環境保護署
水質政策及科學組
香港灣仔告士打道5號
稅務大樓33樓

電郵：wqo_review@epd.gov.hk

傳真：2838 2155

政府希望在日後的公開或非公開討論或其後的報告中，可以引述各界回應本諮詢文件時所發表的意見。若發表意見者要求把全部或部分意見保密，政府定會尊重有關意願。若無提出此等要求，則假定收到的意見無須保密。

環境保護署
二零零九年九月

6. Your Views are Welcome

This WQO review is important in a number of aspects such as beneficial uses of marine waters, marine water quality management, marine conservation, coastal development, environmental impact assessment, and pollution control in Hong Kong. We would like to hear your views at this early stage, so as to develop a set of WQOs appropriate for Hong Kong in the decades to come. Specifically, we are keen to hear your views on the following questions:

(a) what are your views on the key issues set out in section 4 above?

(b) what are your views on the beneficial uses and sensitive receivers set out in section 2? Are you aware of any other beneficial uses of waters that should be considered in this review?

(c) what are your views on the priority and level of protection for various beneficial uses, sensitive receivers and sensitive organisms that should be protected through the WQOs?

(d) in respect of Appendix A, what other types of WQOs or parameters should be considered in the next stage?

(e) what are your views on the review approaches as set out in section 5 above?

(f) what broad water quality management principles and WQO approaches should be considered in the next stage?

Please send your comments to us before 31 December 2009 by one of the following means:

Address: WQO Review
Environmental Protection Department
Water Policy and Science Group
33/F, Revenue Tower
5 Gloucester Road
Wan Chai, Hong Kong

E-mail: wqo_review@epd.gov.hk

Facsimile: 2838 2155

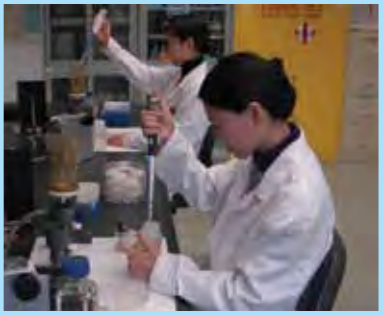
Please note that the Government would wish, either in discussion with others or in any subsequent report, whether privately or publicly, to be able to refer to and attribute views submitted in response to this public engagement document. Any request to treat all or part of a response in confidence will be respected, but if no such request is made, it will be assumed that the response is not intended to be confidential.

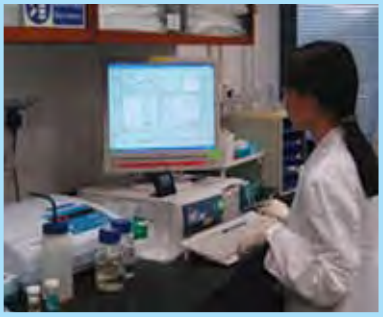
Environmental Protection Department
September 2009

附錄A：水質指標參數

Appendix A: WQO Parameters or Indicators

營養物指標	Nutrients-related
1 陳述性的營養物水質指標	The narrative nutrient WQO
2 總無機氮	Total inorganic nitrogen
3 一個與氮相關的參數（例如：總氮）	One nitrogen-related parameter (e.g. Total nitrogen)
4 一個與磷相關的參數（例如：總磷）	One phosphorus-related parameter (e.g. Total phosphorus)
5 葉綠素-*a*	Chlorophyll-*a*
6 硅	Silica
7 混濁度	Turbidity
8 溶解氧	Dissolved Oxygen
物理性與化學性指標	**Physical and Chemical**
9 美觀程度（陳述性）	Aesthetic Appearance (narrative)
10 危險物質（陳述性）	Dangerous Substances (narrative)
11 可沉降物質(陳述性)	Settleable Material (narrative)
12 顏色	Colour
13 透光度	Light penetration
14 酸鹼值	pH
15 鹽度	Salinity
16 懸浮固體	Suspended Solids
17 溫度	Temperature
18 混濁度	Turbidity
19 溶解氧	Dissolved Oxygen
20 砷	Arsenic
21 鎘	Cadmium
22 鉻	Chromium
23 銅	Copper
24 鉛	Lead
25 汞	Mercury
26 鎳	Nickel
27 銀	Silver
28 鋅	Zinc
29 苯酚	Phenol
30 聚芳烴（PAHs）	Polycyclic Aromatic Hydrocarbons (PAHs)
31 三丁基錫（TBT）	Tributyl-tin (TBT)
32 多氯聯苯（PCBs）	Polychlorinated Biphenyls (PCBs)
33 滴滴涕（DDT）	Dichlorodiphenyltrichloroethane (DDT)
34 二噁英	Dioxins
35 六氯苯	Hexachlorobenzene
36 非離子氨氮	Unionised Ammonia
37 氰化物	Cyanide
38 硫化物	Sulphide
39 表面活性劑	Surfactants
40 油脂	Oil and Grease
41 總石油碳氫化合物	Total Petroleum Hydrocarbons
42 總殘餘氯	Total Residual Chlorine
43 氯化消毒副產物	Chlorination by-products
微生物指標	**Microbiological**
44 大腸桿菌	*E. coli*
45 腸道鏈球菌	Enterococci
46 糞便鏈球菌	Faecal streptococci
47 產氣莢膜梭狀芽孢桿菌	*Clostridium perfringens*
48 糞大腸菌群	Faecal coliforms





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