

Concentration Limits for the Protection of Aquatic Receiving Environments

This guidance establishes concentration limits for the protection of aquatic receiving environments in British Columbia. Where these concentration limits are satisfied, no further action is required to address risks to aquatic life as long as site conditions do not change.

This guidance is intended for use at sites where contamination occurs in proximity of aquatic receiving environments. It is to be used once preliminary and detailed site investigations have been completed and soil, sediment, groundwater, and surface water contamination has been satisfactorily characterized and delineated in accordance with regulatory requirements, procedures, and guidance. Terms used in this guidance are defined in the ministry's [Procedure 8, "Definitions and Acronyms for Contaminated Sites."](#)

This guidance has been provided to support compliance with the contaminated sites provisions of the *Environmental Management Act* (the Act) and the Contaminated Sites Regulation (the Regulation). Other provincial and Federal statutes and regulations may impose additional requirements.

Standards, guidelines and criteria for the protection of aquatic life

Water

The British Columbia ([Approved](#) and [Working](#)) Water Quality Guidelines (WQGs) are substance concentrations considered protective of aquatic life in receiving environments.

The Regulation's Schedule 3.2 aquatic life standards (AW standards) are generic numerical water standards for the protection of groundwater and surface water that may discharge into an aquatic receiving environment. The AW standards are, for the majority of substances, 10 times the respective WQGs based on the assumption that 10-fold dilution will occur before discharge.

Sediment

The Regulation's Schedule 3.4 Sediment Standards (SedS) are generic numerical criteria that have been developed for the protection of aquatic life in sediments of aquatic receiving environments.

SedS are separated into those for sensitive (SedS_{SS}) and typical (SedS_{TS}) sediments based on the level of protection needed to support the designated uses of the ecosystem and ministry sediment management objectives.

In addition to the SedS, WQGs for ambient sediment quality have been developed for some substances. These WQGs for sediment are not commonly used in the assessment of sediment quality under the Regulation. However, the WQGs for sediment are often considered in establishing ministry authorizations for effluent discharges into uncontaminated areas or areas not impacted by human activity.

Salinity

WQGs, AW standards, and SedS may be specific to either freshwater (i.e., salinity less than 1.5

practical salinity units; Regulation Schedule 3.2) or marine/estuarine receiving environments. To differentiate freshwater from marine/estuarine water, the salinity of the water should be determined either by a sampling program, or by reference to a credible scientific authority (e.g., the Fraser River Estuary Management Program, the ministry, Environment Canada, etc.).

The ministry considers the Fraser River to be freshwater above the Pattullo Bridge, and marine or estuarine below the George Massey tunnel on the Main Arm and below the western tip of Mitchell Island on the North Arm of the river.

Where the water is considered to be transitional between freshwater and marine/estuarine water, or if a proponent elects not to characterize the salinity *per se*, the more stringent of the freshwater or marine/estuarine standards or guidelines should be used.

Concentration limits for water

In this guidance, protection of aquatic receiving environments is achieved by meeting specified concentration limits at two fixed locations along the groundwater to surface water flow pathway as described below and in Table 1 and shown in Figure 1. Briefly:

- 1) substance concentrations below the CSR AW standards at a location ≥ 10 metres inland from the high water mark of an aquatic receiving environment are deemed protective of the aquatic receiving environment
- 2) where substance concentrations as specified above are not met, concentrations of substances below the WQGs at the location of the high water mark are also deemed protective of the aquatic receiving environment.

Table 1. Water concentration limits in proximity of aquatic receiving environments

| | Assessment Zone | Zone Description | Concentration Limit |
|----|----------------------|---------------------------------------|---------------------|
| 1. | Upland (groundwater) | Beyond ten metres inland from the HWM | AW standards |

| | | | |
|----|--|--|------------------------------------|
| | | of an ARE | |
| 2. | Aquatic receiving environment (surface water, porewater) | Water below the HWM of an ARE that is not a maintained watercourse | WQGs |
| 3. | Dilution zone (groundwater) | Area between the HWM of an ARE and 10 metres inland | Concentration limits not specified |

Abbreviations: ARE = aquatic receiving environment; AW standards = Contaminated Sites Regulation Schedule 3.2 aquatic life standards; HWM = high water mark; WQG = BC water quality guidelines.

Concentration limits at the two fixed locations apply to all depths of investigation. However, water samples should be obtained from a depth that intersects the contamination and is representative of worst case concentrations of contaminants for the purpose of this guidance.

Contaminant plumes should also be demonstrated to be stable or shrinking, and seasonal and temporal effects should be taken into account.

Concentration limits for inorganic substances apply to dissolved substance concentrations in groundwater and porewater, but to total substance concentrations in surface water and porewater obtained from the ecologically active zone.

Upland

The AW standards apply to groundwater located at distances less than 500 metres away from an aquatic receiving environment. Refer to [Protocol 21, “Water Use Determination”](#) for details.

Under this guidance, the AW standards apply to groundwater located up to 10 metres inland from the high water mark of aquatic receiving environments, based on the assumption that groundwater will be diluted at least 10-fold from its initial concentration in the remaining 10

metres before entering the aquatic receiving environment.

It is not necessary to include substances for which there are no corresponding CSR AW standards in the assessment of groundwater for the protection of aquatic life when seeking a contaminated sites legal instrument such as a Certificate of Compliance. However, other provisions related to pollution prevention (Act section 6(4)), or the mitigation of environmental risk (Regulation section 18(7b)) may apply to unregulated substances.

Aquatic receiving environment

Surface water and porewater in aquatic receiving environments other than maintained watercourses should be evaluated against the WQGs.

Water is to be collected at the location of, or in the immediate vicinity of, the high water mark of an aquatic receiving environment.

There may be circumstances where site conditions limit the ability to collect water samples at the location of the high water mark. Examples include sites where shorelines are lined with riprap or other porous materials, or sites where steep banks prevent access to the high water mark. At these sites, sampling at a representative location inland of the high water mark may be used for demonstrating compliance with the WQGs, or detailed risk assessment may be required to demonstrate protection of the aquatic receiving environment.

Dilution zone

This guidance does not specify concentration limits within the zone located between the high water mark and a point 10 metres inland from the high water mark of an aquatic receiving environment (i.e., the dilution zone). Therefore, if the concentration limits at the two fixed locations (i.e., AW standards at 10 metres inland from the high water mark and WQGs at the high water mark) cannot be met, use of an alternative risk-based approach is recommended.

Reliance on dilution of substance concentrations *within* the aquatic receiving environment is not authorized under this guidance.

Alternative risk-based approaches

Following the completion of detailed site investigation, an alternative risk-based approach can be used to demonstrate that:

- the dilution of substance concentrations along the groundwater to surface water flow pathway results in concentrations less than 1/10th of the AW standards before the groundwater enters the aquatic receiving environment; or
- groundwater quality meets a site-specific risk-based standard with a protection level appropriate for aquatic receiving environments (i.e., EC₂₀); or
- substance concentrations in groundwater do not represent an unacceptable risk to aquatic life as revealed by a detailed ecological risk assessment (See also [Detailed Ecological Risk Assessment in British Columbia Technical Guidance](#), [Science Advisory Board, September, 2008](#) and [Protocol 20, “Detailed Ecological Risk Assessment”](#)).

Contaminated groundwater within 10 metres of the high watermark of an aquatic receiving environment is excluded from evaluation under [Protocol 13, “Screening Level Risk Assessment”](#).

Concentration limits for sediment

The SedS apply to the sediments in aquatic receiving environments below the high water mark as shown in Table 2 and Figure 2.

Table 2. Sediment concentration limits in proximity of aquatic receiving environments

| | Assessment Zone | Zone Description | Concentration Limit |
|----|---|---|--|
| 1. | Sediment in the ecologically active zone | The top one metre of stable sediment of an ARE | SedS _{SS} or SedS _{TS} |
| 2. | Sediment below the ecologically active zone | Sediment below the top one metre of stable sediment of an ARE | SedS _{TS} |

| | | | |
|----|---------------------|----------------------------------|--|
| 3. | Intertidal sediment | Sediment between the HWM and LWM | Sed _{SS} or Sed _{TS} (environmental protection) and Schedule 3.1 Part and 2 (human health) |
| 4. | Soil | Beyond the HWM of an ARE | Schedule 3.1 Part 1 to 3 (environmental & human health protection) |

Abbreviations: ARE = aquatic receiving environment; HWM = high water mark; LWM = low water mark; Sed_{SS} = Contaminated Sites Regulation sediment standards for sensitive sediments; Sed_{TS} = Contaminated Sites Regulation sediment standards for typical sediments.

The uppermost 1 metre of stable sediment comprises the ecologically active zone, i.e., that depth of sediment which is important for a variety of ecological and physicochemical processes that support aquatic life.

Stable sediment is sediment which is not subject to erosion, dredging or re-entrainment of contaminants. If sediment is unstable, a depth comprising the sum of the depth of unstable sediment and an additional 1 metre of stable sediment underlying the unstable sediment should be considered as the ecologically active zone.

In the ecologically active zone, either the Sed_{SS} or Sed_{TS} apply depending on whether the zone supports sensitive habitat and/or whether sensitive sediment management objectives apply. Sed_{TS} are applicable to all depths at typical sediment sites and to any depth greater than 1 metre of stable sediment at sensitive sediment sites.

If the SedS cannot be met, the sediment quality assessment should default to detailed ecological risk assessment.

In addition to the SedS, the Regulation's Schedules 3.1 Part 1 and 2 soil standards for the

protection of human health apply to sediments located in the intertidal zone of a site. Land use in intertidal zones is typically considered to default to residential/parkland use, unless site-specific circumstances determine the actual land use to be otherwise (e.g., water lots leased for industrial land use).

If an operable human health exposure pathway is identified for sediment containing substance concentrations greater than the applicable standards, detailed human health risk assessment is recommended.

Unless a beneficial use exemption applies, contaminated sediments are excluded from evaluation under [Protocol 13, "Screening Level Risk Assessment"](#).

Concentration limits for maintained watercourses

For maintained watercourses, the AW standards apply to surface water, porewater, and groundwater and the Regulation's Schedules 3.1 Part 1, 2 and 3 soil standards apply to sediment (see Table 3).

The ministry encourages that, wherever possible, the WQGs be met in all watercourses (including maintained watercourses) at the point where surface water enters an aquatic receiving environment.

Furthermore, in the case that a maintained watercourse:

- ceases to be maintained in accordance with a regular maintenance schedule,
- is abandoned, or allowed to ecologically succeed, or
- otherwise ceases to serve as a maintained watercourse, then

the ministry considers the function of the watercourse to have reverted to an aquatic receiving environment to which the WQGs and SedS apply.

For more information, please direct inquiries to site@gov.bc.ca.

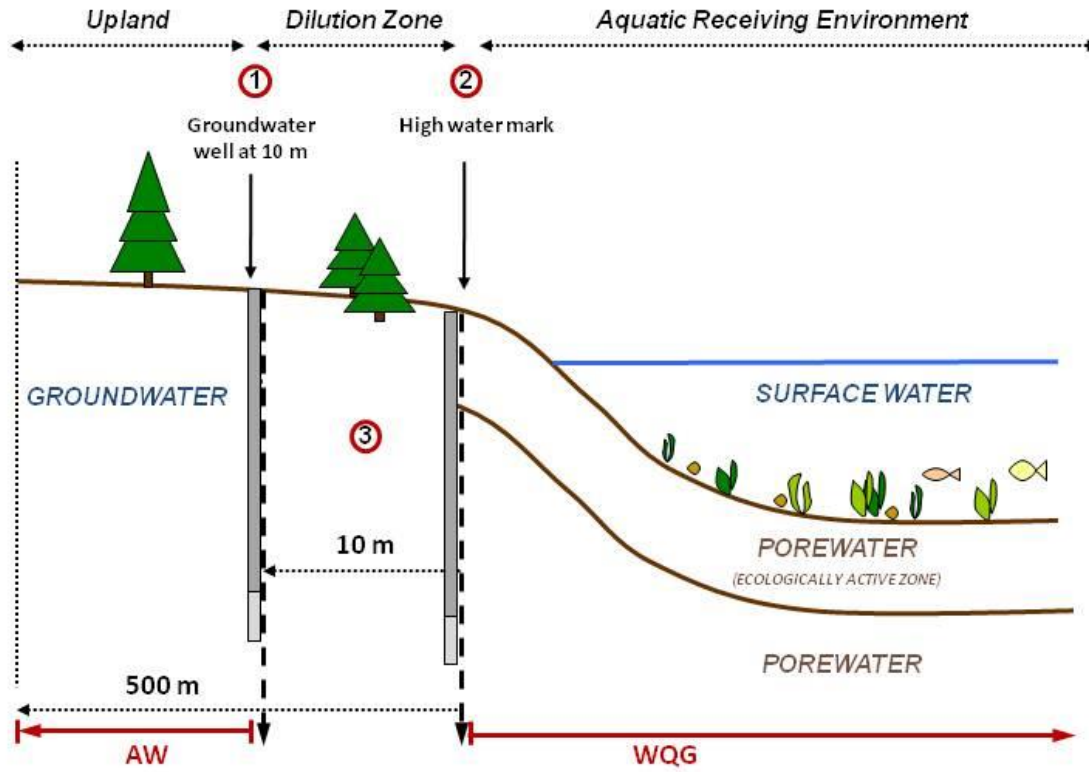


Figure 1. Illustration of the concentration limits for water in an aquatic receiving environment.

Note. Numbering refers to the assessment locations/zones as listed in Table 1. Red lettering indicates the applicable standards and guidelines. Illustration is not drawn to scale.

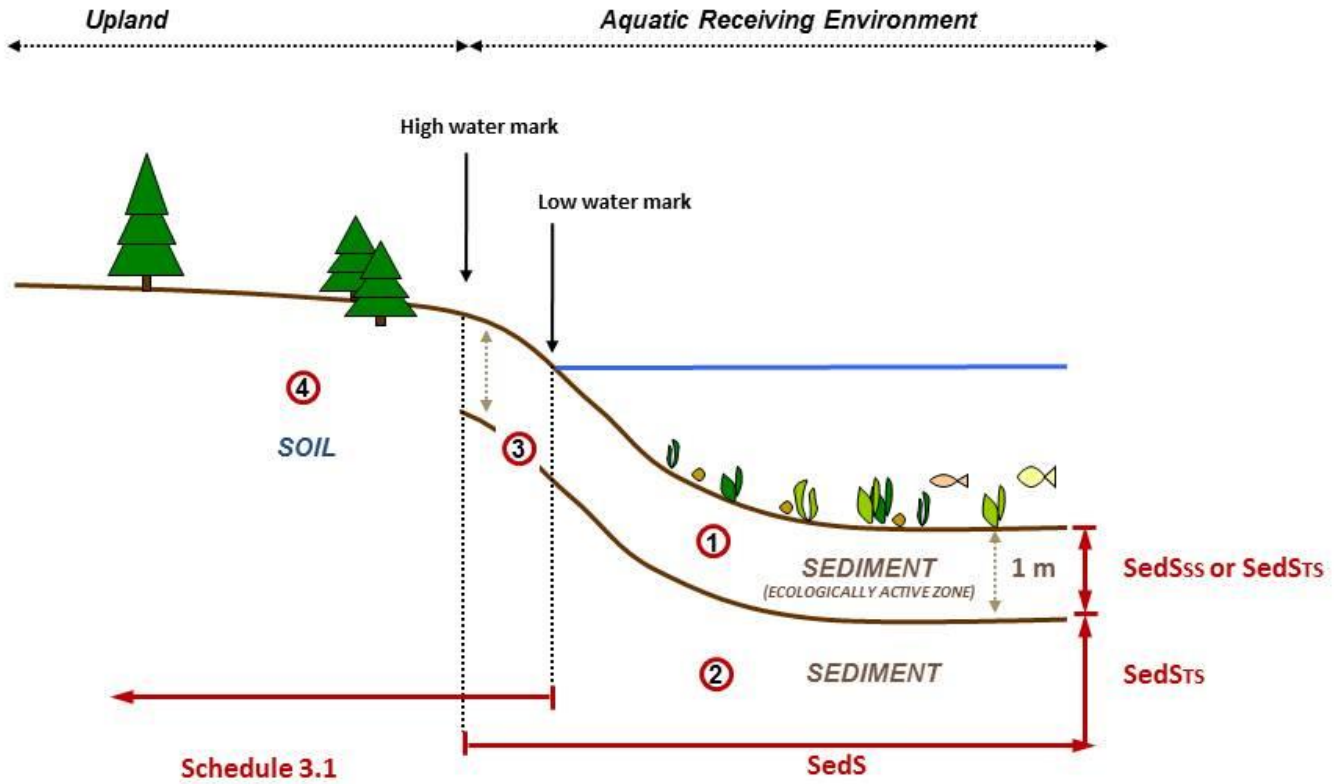


Figure 2. Illustration of the concentration limits for sediment in an aquatic receiving environment.

Note. Numbering refers to the assessment zones as listed in Table 2. Red lettering indicates the applicable standards and criteria. Illustration is not drawn to scale.

Table 3. Summary of concentration limits in aquatic receiving environments and maintained watercourses

| | Groundwater | Surface water | Sediment |
|---|--|--|---|
| Aquatic receiving environments that are not maintained watercourses | WQG | WQG | Schedule 3.4 |
| Constructed ponds - Less than 500 metres from an aquatic receiving environment | Schedule 3.2 AW ¹ | If operational and permitted, standards and guidelines do not apply. | If operational and permitted, standards do not apply. Upon remediation, Schedule 3.1 applies. |
| Constructed ponds - More than 500 metres from an aquatic receiving environment | If operational and permitted, standards and guidelines do not apply. | | If operational and permitted, standards do not apply. Upon remediation, Schedule 3.1 applies. |
| Constructed ditches | Schedule 3.2 AW | Schedule 3.2 AW | Schedule 3.1 |

¹ If the pond is hydraulically connected to an aquatic receiving environment, Schedule 3.2 AW standards apply to the down-gradient groundwater, between the constructed pond and the aquatic receiving environment, based on an assumed operative pathway for groundwater flow to surface water containing aquatic life.