



# Technical guidance for adaptive management – Protocol 13

September 2019



# **Technical guidance for use of Protocol 13 of the Contaminated Sites Regulations of the Environment Act at solid waste disposal facilities**

This guidance document provides additional information to operators of solid waste facilities, in support of the requirements identified in [Protocol 13](#). This guidance document does not supersede the *Environment Act*, its regulations or its protocols. It does not list all provisions relating to contaminated sites. If there are any differences or omissions in this guidance document, the Act and regulations apply.

In accordance with Section 21(1) of the *Contaminated Sites Regulation*, O.I.C. 2002/171 (CSR), Protocol 13 was designed to ensure consistency in approaches to identifying and responding to impacts from activities that may adversely affect water quality, including the operation of a solid waste disposal facility.

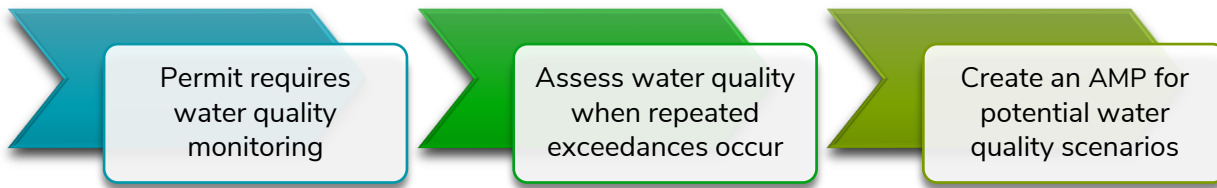
This guidance document can assist in the development of an Adaptive Management Plan (AMP) in the event that one is required under Protocol 13

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## **What is Adaptive Management?**

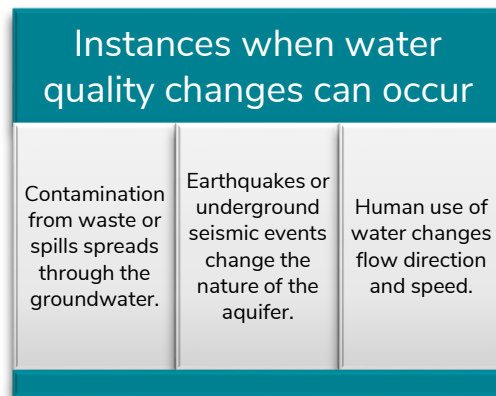
Adaptive Management is the process of planning a response to circumstances or events that may not be fully predictable or expected. Adaptive Management identifies, in advance, actions that must be taken in order to gather information and respond appropriately.

## How does Adaptive Management relate to permitted facilities?



Solid waste disposal facility permittees must develop an AMP if there is evidence of any contamination at a concentration equal to or greater than the applicable water quality standards specified in the CSR for a sustained period of time.

All solid waste disposal facilities, some modified transfer stations and all land treatment facilities that accept highly contaminated material or have a capacity to hold 3,000 m<sup>3</sup> of contaminated material or greater are required to complete a hydrogeological assessment and conduct ongoing groundwater monitoring as per the conditions of their permits issued under the *Environment Act*. Ongoing monitoring of groundwater is required to identify potential impacts to water quality that may pose a potential risk to human health and/or to the environment.



Despite frequent monitoring, water quality has the potential to change based on a number of factors (see box to the left). By creating an AMP, proper responses to these potential changes can be planned in advance. Whether water quality stays the same, improves, or degrades, pre-planned responses to potential water quality scenarios prepare permittees for unforeseen circumstances that may arise in the future.

## Why is it important to monitor water quality?

The monitoring of surface and groundwater quality at solid waste disposal sites is an important component of managing potential human health and environmental risks. Water quality monitoring is conducted to confirm that the receiving environment is not being negatively impacted by facility operations.

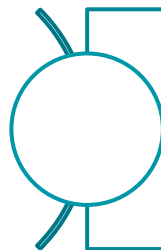
Schedule 3 of the CSR contains numerical water quality standards that indicate whether water has been contaminated. When the concentration of regulated contaminants **repeatedly** exceeds CSR water quality standards, solid waste management permits direct permittees to develop an AMP. This

**What is the receiving environment?** Wells, streams and other sources of water that are meant to be protected from contaminants so they do not pose risks to human health and/or to the environment

plan acts as a follow-up on water quality monitoring and prepares for potential circumstances in which water degrades to the point that it poses a risk to the receiving environment.

Before an AMP can be created, an assessment needs to be completed by a qualified, experienced person such as an environmental consultant. The goal of an assessment is to

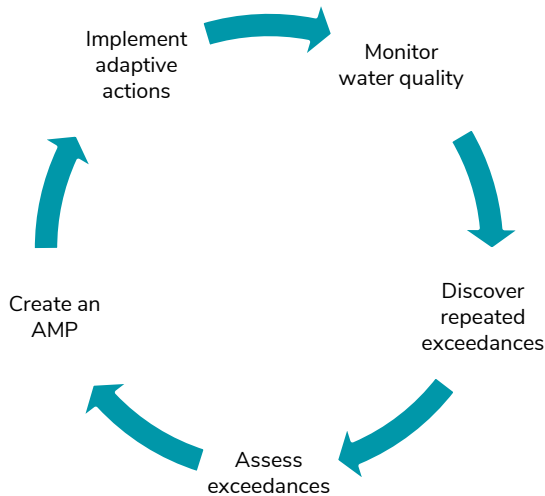
describe the trends in data as they relate to the site's hydrogeology. This assessment will help the facility operator to understand the



**A site's hydrogeology** is the particular aspects of the groundwater, such as the direction the groundwater is flowing, whether or not it will reach sensitive receptors like streams or wells, and if so, how much time it will take to reach them.

nature of the exceedance(s) to evaluate whether or not the exceedance(s) pose(s) a risk to human health and/or to the environment. Once an assessment is conducted, it will then be used to determine what actions (if any) are needed to mitigate potential risks to nearby receptors.

## When is an Adaptive Management Plan required?



An AMP is required if one of the following triggers occurs within any groundwater monitoring well or surface water body affected by the facility:

- exceedances of a contaminant in four consecutive bi-annual sampling events;
- exceedances of a contaminant in five out of six bi-annual sampling events; or
- three seasonally-consecutive exceedances (e.g. three spring exceedances in a three-year period or three fall exceedances in a three-year period).

## When is an Adaptive Management Plan not required?

An AMP is not required if:

- the contamination observed is caused by a source other than the permitted activity; or
- the contamination observed is consistent with local, natural background water quality (based on analysis of upgradient or local area water quality).

For example, some areas of Yukon are naturally high in metals concentrations. Common metals include cadmium, manganese, iron, zinc and arsenic. If concentrations of these metals are from naturally occurring sources, they will be elevated in the upgradient and downgradient wells and likely in other wells from other nearby facilities. In another example, if there is a facility such as a mine or contaminated site near the facility, it is possible that contaminants would migrate onto the site.

In both these cases, the permittee may not be required to submit an AMP. However, the rationale for these exemptions must be submitted to an environmental protection analyst for review. The analyst will then determine whether or not an AMP is required.

## What goes into an Adaptive Management Plan?

If an AMP is required, then the plan must describe the current water quality conditions at the site and predict a number of possible future scenarios. Each scenario in an AMP shall be associated with a series of specific actions that will be taken if that scenario occurs.


Scenarios need to be created for both short-term (5 to 10 years from the current date) and longer-term (20 to 50 years from the current date) water quality outcomes.

The short-term analysis should include any planned expansion, changes and closures to the facility as outlined in the approved Solid Waste Management Plan. This plan outlines new cells, planned closure of cells, monitoring, and other operational changes. These changes may be relevant when predicting short-term water quality scenarios.


Initial actions associated with any scenario may be simple, such as increasing the frequency of water quality monitoring or establishing additional water quality monitoring locations.

Subsequent actions may be more complex, such as delineating, containing or assessing the risk of the observed contamination.


Advanced actions associated with adaptive management fall under the following categories:




**Source Control** – Reducing or eliminating the observed source of contamination in groundwater  
**e.g.** banning certain types of material from the facility, or repairing or installing liners




**Monitored Natural Attenuation** – The natural process of decreasing the concentration of contaminants in groundwater. This can be a biological, physical or chemical process and occurs without human intervention  
**e.g.** some microbes can degrade contaminants and remediate groundwater



**Plume Containment** – A method of containment aiming to prevent contaminants in groundwater from migrating and subsequently spreading to and impacting the environment outside the site  
**e.g.** inserting a Waterloo barrier to isolate/contain contamination within the site



**In-situ Restoration** – The process of isolating and subsequently reducing and cleaning the contaminated groundwater located on-site  
**e.g.** injecting hydrogen peroxide into groundwater to treat hydrocarbon contamination

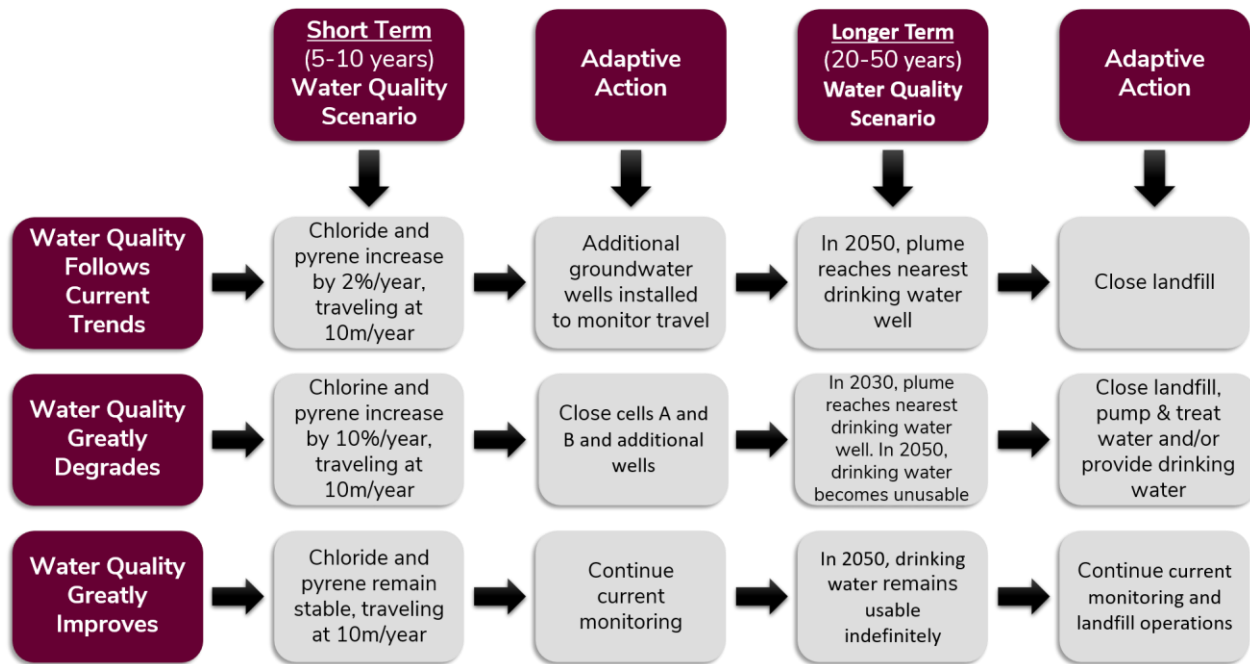


**Ex-situ Restoration** – Reducing contamination in groundwater by removing the impacted water off the site and treating it  
**e.g.** pumping groundwater and processing it through a treatment system

See Protocol 13, pgs.4-5 for more details on each of these categories

## What does a sample Adaptive Management Plan look like?

Below is a graphic of short-term and long-term scenarios and actions for a hypothetical solid waste facility. This facility is finding exceedances of pyrene and chlorine in groundwater wells downgradient of the facility and, in response, developed an AMP using information about groundwater speed and direction from their hydrogeological assessment. The plan considers whether the current contamination will improve, worsen, or stay stable.



This example sets out adaptive actions to the potential scenarios in which water quality at the site stays the same, improves or degrades. In each of these cases, the AMP considers and describes how contaminants of concern are expected to respond to each proposed adaptive action. A plan may identify multiple actions associated with each scenario.

In addition, an AMP must also describe how progress will be measured, including water quality monitoring locations and sampling frequency, as well as the statistical methods used to analyze the data gathered. This may mean more sampling than is currently required in a solid waste facility permit.

Another valid form of an AMP can take is of a quantitative human health and ecological risk assessment. This type of AMP would look quite different from the example shown above. For more information on risk assessments, please see [Protocol 12](#), issued pursuant to the CSR.

## What happens once an Adaptive Management Plan has been submitted?

Implement adaptive management activities **only** when the AMP has been approved, except when actions are needed to respond to an emergency

The permittee must not undertake any of the actions described in the AMP before the plan is approved unless there is an emergency. This enables an analyst to determine the extent to which actions will be effective to manage human health and environmental risks prior to making any major capital, operational or

infrastructural decisions. Once approved, the permittee must incorporate any changes to the AMP as requested by an environmental protection analyst and implement the AMP on the approval date, with the exception of additional water quality monitoring. If some actions in the proposed AMP should be undertaken immediately, then the permittee must first obtain permission from an environmental protection analyst for that portion of the plan prior to the entire plan being approved.

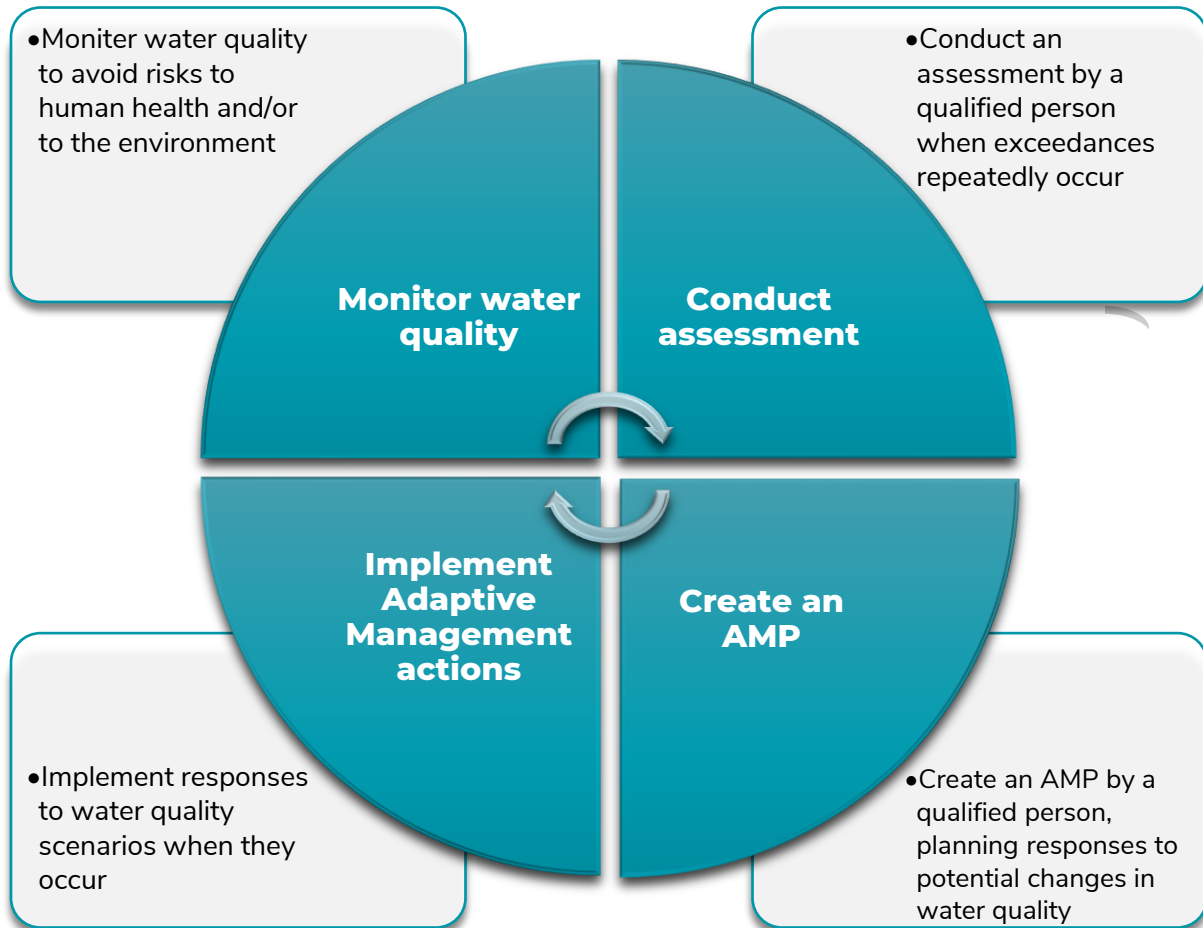
Additionally, if an environmental protection analyst requests, in writing and with reasons, that an approved AMP be amended, then the permittee must prepare the required amendment and submit the revised AMP for approval to an environmental protection analyst within the period specified in the analyst's request.

## Why does a permittee need to be familiar with an Adaptive Management Plan?

While an assessment and an AMP must be completed by a qualified professional, it is still important for the permittee to be familiar with both processes. An AMP helps the permittee (and potentially, local citizens and local decision-makers) to evaluate the short-term and long-term impacts on water quality, and what actions can be taken to manage and reduce any risks from contamination to humans and the environment. It also allows the permittee to identify



whether or not operational changes at the site (e.g., opening or closing certain cells, or changing the type of waste that is disposed of) would help reduce the movement of contamination.



\* Note that some activities under an AMP may trigger an assessment under the Yukon Environmental and Socio-economic Assessment Act.

## For further information:

[Yukon.ca/en/doing-business/managing-contaminated-site](http://Yukon.ca/en/doing-business/managing-contaminated-site)

[Yukon.ca/en/protocol-no-13-adaptive-management](http://Yukon.ca/en/protocol-no-13-adaptive-management)