



Site Remediation and Reclamation Manual

VERSION 1.7: Nov. 2023

About the Regulator

The BC Energy Regulator (Regulator) is the single-window regulatory agency with responsibilities for regulating oil and gas activities in British Columbia, including exploration, development, pipeline transportation and reclamation.



The Regulator's core roles include reviewing and assessing applications for industry activity, consulting with First Nations, ensuring industry complies with provincial legislation and cooperating with partner agencies. The public interest is protected by ensuring public safety, protecting the environment, conserving petroleum resources and ensuring equitable participation in production.

Vision, Mission and Values

Vision

A resilient energy future where B.C.'s energy resource activities are safe, environmentally leading and socially responsible.

Mission

We regulate the life cycle of energy resource activities in B.C., from site planning to restoration, ensuring activities are undertaken in a manner that:



Protects public safety and the environment



Supports reconciliation with Indigenous peoples and the transition to low-carbon energy



Conserves energy resources



Fosters a sound economy and social well-being



Values

Respect is our commitment to listen, accept and value diverse perspectives.

Integrity is our commitment to the principles of fairness, trust and accountability.

Transparency is our commitment to be open and provide clear information on decisions, operations and actions.

Innovation is our commitment to learn, adapt, act and grow.

Responsiveness is our commitment to listening and timely and meaningful action.

Additional Guidance

As with all Regulator documents, this document does not take the place of applicable legislation. Readers are encouraged to become familiar with the acts and regulations and seek direction from Regulator staff for clarification.

The Regulator publishes both application and operations manuals and guides. The application manual provides guidance to applicants in preparing and applying for permits and the regulatory requirements in the planning and application stages. The operation manual details the reporting, compliance and regulatory obligations of the permit holder. Regulator manuals focus on requirements and processes associated with the Regulator's legislative authorities. Some activities may require additional requirements and approvals from other regulators or create obligations under other statutes. It is the applicant and permit holder's responsibility to know and uphold all legal obligations and responsibilities. For example, Federal Fisheries Act, Transportation Act, Highway Act, Workers Compensation Act and Wildlife Act.

Throughout the document there are references to guides, forms, tables and definitions to assist in creating and submitting all required information. Additional resources include:

- [Glossary and acronym listing](#) on the Regulator website.
- [Documentation and guidelines](#) on the Regulator website.
- [Frequently asked questions](#) on the Regulator website.
- [Advisories, bulletins, reports and directives](#) on the Regulator website.
- [Regulations and Acts](#) listed on the Regulator website.

In addition, this document may reference some application types and forms to be submitted outside of the Application Management System but made available on the Regulator's website. Application types and forms include:

- Heritage Conservation Act, Section 12
- Road use permits
- Water licences
- Master licence to cut
- Certificate of restoration
- Waste discharge permit
- Experimental scheme application
- Permit extension application

Table of Revisions

The Regulator is committed to the continuous improvement of its documentation. The table below summarizes revisions to the Site Remediation and Reclamation Manual. Revisions are posted to [the documentation](#) section of the Regulator’s website at the beginning of every month and are effective one month after posting, unless otherwise noted. For more information about the Regulator’s monthly revisions, and for details of this month’s revisions, please visit the [documentation section](#) of the Regulator’s website.

Stakeholders who would like to provide input or feedback on BCER documentation may send comments to ServiceDesk@bc-er.ca.

Posted Date	Effective Date	Chapter	Summary of Revision(s)
April 9, 2018	May 1, 2018	Various	Various updates have been made to reflect Stage 10 and Stage 11 Amendments to the Contaminated Sites Regulation. Users are encouraged to review the document in its entirety.
June 7, 2019	June 7, 2019	Various	The document name has been changed from the “Certificate of Restoration Application Manual” to “Site Remediation and Reclamation Manual”. Other changes made reflect the release of the new Dormancy and Shutdown Regulation. For more information refer to News Release 2019-02 on the Regulator’s website.
January 10, 2020	February 1, 2020	Various	Updated references to the Dormancy and Shutdown Regulation.
June 6, 2022	June 6, 2022	Various	Updated to align with INDB 2022-08: Removal of Access to Crown land for Offsite Investigation Application Form.
Nov 23, 2023	Nov 23, 2023	Various	Replace BCOGC with BCER; OGAA with ERAA; new logos, references and associations

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Preface

About

The Site Remediation and Reclamation Manual is intended to provide a reference document for oil and gas permit holders detailing the requirements and expectations for Certificate of Restoration applications made to the Regulator. For permit holders, the manual provides an overview of their obligations under the Energy Resource Activities Act ([ERAA](#)), and the Environmental Management Act ([EMA](#)) and the Contaminated Sites Regulation ([CSR](#)). For environmental consultants, the manual provides an overview of the Regulator's expectations and key regulatory requirements during site screening, site investigation, remediation, confirmation of remediation and reclamation.

The manual has been prepared to be as comprehensive as possible; however it is not all encompassing and may not cover all site-specific situations. Where circumstances or scenarios arise and are not covered by the manual, contact the Regulator's Director, Environmental Management and Reclamation, for assistance.

Manual Structure

Beginning with a site certification overview, this manual provides references to the legislation that provides the basis for the oil and gas site restoration processes.

Also captured are the requirements for site screening, site investigation, site remediation, Certificate of Restoration Part 1 and 2 applications, as well the Regulator's Restoration Verification Audit Program process and requirements. The manual is limited in scope to the Regulator's application processes and the authorities and requirements established within ERAA or specified enactments established thereunder. Carrying out oil and gas and related activities may require additional approvals from other regulators or create obligations under other statutes.

Manual Scope

This manual is limited in scope to the regulatory provisions applicable to the Certification of Restoration processes for BCER Classified – Not Priority Sites found in ERAA. Pursuant to the 2008 Memorandum of Understanding (MOU) signed between (as they then were) the Oil and Gas Commission (now BC Energy Regulator), Ministry of Environment (MoE, now Ministry of Environment and Climate Change Strategy), Ministry of Agriculture and Lands (now Ministry of Agriculture and Food), and Ministry of Energy, Mines and Petroleum Resources (now Ministry of Energy, Mines, and Low Carbon Innovation), any site identified as OGC (BCER) Classified - Priority Site is referred to the MoE and the operator is required to complete a Site Risk Classification Report (SRCR) under MoE [Protocol 12](#). The MoE will follow-up with the operator if a completed SRCR is not received within 30 days of the BCER's referral. SRCRs received by the MoE will be reviewed in accordance with procedures outlined in Protocol 12. Upon

completion of remediation, the sites declassified as MoE Not-High Risk will be referred back to the Regulator as OGC (BCER) Classified – Not Priority Site for regulatory oversight by the Regulator. It is the permit holder’s responsibility to know and uphold all of their legal obligations. For a detailed list of the applicable regulatory provisions, see Appendix E of this document.

Compliance and Enforcement

This document does not replace legislation or affect legislative requirements. All permit holders are ultimately responsible for ensuring they understand and meet all requirements of ERAA and their permits. Should a person not comply with ERAA, the Regulator may take compliance and enforcement actions. For more information regarding the Regulator’s Compliance and Enforcement processes, please refer to the [Compliance and Enforcement Manual](#).

Chapter 1: Site Certification

Regulatory Framework

Regulatory provisions related to permit holder obligations for site restoration, site screening, site investigation, remediation and surface reclamation are established in the Energy Resource Activities Act ([ERAA](#)), Environmental Management Act ([EMA](#)), Petroleum and Natural Gas Act ([PNGA](#)), [Land Act](#), [Water Act](#), Contaminated Sites Regulation ([CSR](#)), Oil and Gas Waste Regulation ([OGWR](#)), Hazardous Wastes Regulation ([HWR](#)) and Environmental Protection and Management Regulation ([EPMR](#)).

This chapter provides references to the legislation and regulations that form the legal framework for Certificate of Restoration, investigations, remediation and reclamation of contaminated sites in British Columbia. This chapter provides references related to:

- Site restoration
- Site screening
- Site investigation
- Investigation quality standards
- Site remediation
- Remediation quality standards
- Site reclamation
- Certificate of Restoration

1.1 Site Restoration

Regulatory requirements related to site restoration are found in Sections 40 to 43 of ERAA. If a permit, a permission specified in a permit or an authorization is cancelled, declared spent, or expires, the permit holder or former permit holder must carry out actions for the purpose of site restoration or the protection of public safety.

1.2 Site Screening

Regulatory requirements related to site screening are found in EMA. The requirement for screening a site is triggered through a site profile or independently as part of a due diligence program. The site profile, as a legal requirement under Section 40(3) of EMA, provides information to identify the potential to cause contamination.

1.2.1 Site Profiles

Regulatory requirements related to site profile are found in EMA. Section 40(3) of [EMA](#) requires that a permit holder must provide a site profile to the Regulator at the time the

permit holder applies for a Certificate of Restoration with respect to an oil and gas activity in accordance with Section 41 of ERAA.

Section 4(1) of the CSR detailed regarding exemptions from providing a site profile. Section 7(3) and 7(4) of the CSR provides Regulator's responsibility after receiving a site profile.

1.2.2 CSR Schedule 2 Activities

Commercial and industrial activities are listed in [Schedule 2](#) of the CSR, as per [Administrative Guidance 13](#) on Contaminated Sites [Guidance on Schedule 2 Purposes and Activities]. Schedule 2 lists different purposes or activities which have been determined to have the potential to cause contamination.

1.2.3 Drilling Waste Management

Regulatory requirements for management of wastes from natural gas and oil drilling operations are provided in the [Oil and Gas Handbook Drilling Waste Management Chapter](#), OGWR and the HWR.

1.3 Site Investigation

Regulatory requirements related to site investigation are found in EMA and the CSR. If potential sources of contamination are identified through a site profile on oil and gas site, the Regulator will not approve a CoR application until all requirements of EMA are met.

Requirements for first and second stages of preliminary site investigations are found in Section [58](#) of the CSR. Requirements for detailed site investigations as required by the Ministry of Environment are found in Section [59](#) of the CSR.

Sections [11](#)(1) to 11(4) of the CSR, define whether or not a site is considered contaminated. Sections [15](#)(1) to 15(7) of the CSR, describe the procedures for determination of a contaminated site. Numerical standards must be applied in determining whether or not a site is contaminated.

1.3.1 Notification of Offsite Migration

Regulatory requirements related to offsite migration notification are found in Section 60.1 of the CSR. The Notification of Likely or Actual Migration Form is provided in [Protocol 17](#) [Forms for Notifications of Independent Remediation and Migration].

1.3.2 Offsite Investigation Permission

Where entry onto Crown land cannot be adhered to as per s.8.3 of the [Crown Land Permissions Policy](#), an authorization under the [Land Act](#) or under s.138 of the [PNG Act](#) is required, subject to any terms or conditions the Regulator considers appropriate.

Applications for Investigative Use are submitted through the Application Management System.

Access to private land will be authorized under a surface lease agreement with the landowner or an order of the Surface Rights Board under Section [142](#) of the PNGA.

1.4 Investigation Quality Standards

Provisions for contaminated site determination are presented in [Part 5](#) of the CSR. Pursuant to Section [15\(1\)](#) of the CSR, numerical standards will be applied to determine whether a site is contaminated.

[Protocol 4](#) [Determining Background Soil Quality] and [Protocol 9](#) [Determining Background Groundwater Quality] will be used to determine local background concentrations of a substance. Risk-based standards cannot be used to determine whether a site is contaminated.

1.4.1 Soil Investigation Standards

Numerical standards for each land use are presented in the CSR as matrix numerical soil standards ([Schedule 3.1](#)- Part 1), generic numerical soil standards to protect human health ([Schedule 3.1](#)- Part 2) and generic numerical soil standards to protect ecological health ([Schedule 3.1](#)- Part 3). Site-specific numerical standards can be developed for substances with Schedule 3.1 – Part 1 matrix numerical standards provided sufficient site specific data is available in accordance with [Protocol 2](#) [Site Specific Numerical Soil Standards]. Land use for a site will be designated under [Section 12\(3\)](#) of the CSR. A definition of each land use is provided in [Part 1](#) [Definitions] of the CSR.

1.4.2 Groundwater Investigation Standards

Groundwater standards for each water use are presented as generic numerical water standards in [Schedule 3.2](#) and it presents generic numerical standards for all water uses listed under [Section 12\(4\)](#) of the CSR. A definition of each water use is provided in Part 1 [Definitions] of the CSR. [Section 11\(b\)](#) of the CSR, detailed when a site is considered contaminated.

1.4.3 Surface Water Investigation Standards

Surface water standards for aquatic life, wildlife, livestock and irrigation water use are presented in the Water Quality Guidelines Summary ([WQG](#)) that have been approved by the province of British Columbia.

The WQG presents water standards for all water uses, except drinking water use, listed under Section 12(4) of the CSR. A definition of each water use is provided in Part 1 [Definitions] of the CSR. Section 11(b) of the CSR, detailed when a site is considered contaminated.

1.4.4 Sediment Investigation Standards

Generic numerical sediment standards for both sensitive and typical aquatic sediment uses are found in [Schedule 3.4](#) of the CSR. Sediment use for a site will be designated under [Section 12](#)(4.1) of the CSR. A definition of each sediment use is provided in Part 1 [Definitions] of the CSR. Section 11(c) of the CSR, details when a site is considered contaminated.

1.4.5 Vapour Investigation Standards

Generic numerical vapour standards for each land uses are presented in [Schedule 3.3](#) of the CSR. A definition of each land use is provided in Part 1 [Definitions] of the CSR.

1.5 Site Remediation

As per Section [1](#) [Definitions] of the EMA, “remediation” means action to eliminate, limit, correct, counteract, mitigate, or remove any contaminant or the adverse effects on the environment or human health of any contaminant. Section 8 of the Dormancy and Shutdown Regulation (DASR) requires that remediation be completed to the satisfaction of the Regulator in order for a dormant site to be remediated for the purposes of that regulation.

1.5.1 Remediation Options

Section [16](#) of the CSR states that either numerical standards, or the risk based standards prescribed under Section [18](#) [Application of Risk-based Standards for Remediation] or [18.1](#) [Application of Risk-based Standards for Remediation at Wide Area Sites] of the CSR, will be used in relation to the remediation of a contaminated site.

1.5.2 Selection of Remediation Options

Section 56(1) of EMA requires that a person conducting or otherwise providing for remediation of a site must give preference to remediation alternatives that provide permanent solutions to the maximum extent practicable, taking into account factors (a) to (d) in Section 56(1).

As per Section 56(2) of EMA, when issuing an instrument, an MoE Director must consider whether permanent solutions have been given preference to the maximum extent practicable as determined in accordance with any guidelines set out in the regulations.

Similarly, Section 8(1)(c) of the DASR requires that the site and any neighboring lands to which contamination has migrated from the site be remediated to an extent that provides a permanent solution to the maximum extent practicable taking into account factors (a) to (d) in Section 8(1)(c)(i).

1.5.3 Offsite Remediation Permissions

In order to occupy Crown land to carry out offsite remediation, a permit holder must submit an application for Associated Oil and Gas Activity with a land use type of Site Remediation. The Oil and Gas Activity Application Manual should be followed when applying for the right to occupy to Crown land.

1.5.4 Permission for Working Near a Stream

In order to carry out changes in and about a stream during offsite remediation, a permit holder must submit an application for Changes In and About a Stream under [Section 11](#) of the Water Sustainability Act and secure approvals before proceeding.

1.5.5 Independent Remediation and Notification

Regulatory requirements related to independent remediation and notification are found in Section 54 of EMA and Section 57 of the CSR. The Notification of Independent Remediation Form is provided in [Protocol 17](#) [Forms for Notifications of Independent Remediation and Migration].

1.5.6 Remediation of Hazardous Waste

Regulatory provisions related to remediation of hazardous wastes are provided in Section [7](#) of EMA and the HWR.

1.5.7 Remediation of Sites Contaminated by Spill

Remediation of oil and gas sites contaminated by spill must be managed and be in compliance with the requirements in Section [37](#) of ERAA and with the Spill Reporting Regulation (SRR).

1.5.8 Certification of Compliance

Under Section 53(3) of EMA, an MoE Director may issue a Certificate of Compliance with respect to remediation of a contaminated site if the contaminated site has been remediated in accordance with the numerical or risk based standards.

1.6 Remediation Quality Standards

Part 6 [Remediation Standards] of the CSR contains requirements for the remediation of contaminated sites. Under Section 16 of the CSR, either numerical standards or risk-based standards may be used in relation to the remediation of a contaminated site.

1.6.1 Soil Remediation Standards

Numerical Standards

Numerical Standards are acceptable concentrations of substances in soil, surface water, groundwater, vapour and sediments. Matrix numerical soil standards are found in Schedule 3.1-Part 1 of the CSR, generic numerical soil standards to protect human health are in Schedule 3.1-Part 2 and generic numerical soil standards to protect ecological human health are in Schedule 3.1-Part 3. Site-specific numerical standards may be developed in accordance with Protocol 2 [Site Specific Numerical Soil Standards].

Under Section 17(3) of the CSR, soil at a depth greater than 3.0 m must be remediated to commercial land use (CL) numerical soil standards for all land uses.

Risk-Based Standards

Risk-based standards are acceptable risk level from exposure to substances at sites. A Screening Level Risk Assessment (SLRA) will be conducted in accordance with [Protocol 13](#) [Screening Level Risk Assessment] to determine whether contamination at a specific site poses acceptable or unacceptable risk to the environment. SLRA cannot be applied without pre-authorization by the MoE Director to screen sites where precluding conditions of Protocol 13 are applicable.

Where SLRA failed due to potential for unacceptable risk, a detailed risk assessment is required.

1.6.2 Groundwater Remediation Standards

Numerical Standards

The applicable numerical remediation standards are the same as the numerical standards applied during the determination of site contamination. Generic numerical water standards are presented in Schedule 3.2 of the CSR.

Risk-Based Standards

Under Section 16 of the CSR, risk-based standards may be used in relation to the remediation of a contaminated site. The groundwater concentrations at receiving environments are used in accordance with Protocol 13 [Screening Level Risk Assessment] to determine whether groundwater contamination presents an unacceptable risk to the environment and whether remedial action is required.

1.6.3 Surface Water Remediation Standards

Numerical Standards

The applicable numerical remediation standards are the same as the numerical standards applied during the determination of site contamination. Approved surface water guidelines are presented in WQGs.

Risk-Based Standards

Under Section 16 of the CSR, risk-based standards may be used in relation to the remediation of a contaminated site. Protocol 13 shall not be used to screen sites that contain surface water except where the contamination is related to a beneficial use.

If a site exceeds WQGs and is to be remediated to risk-based standards, a Detailed Ecological Risk Assessment (DERA) must be completed in accordance with [Protocol 20](#).

1.6.4 Sediment Remediation Standards

Numerical Standards

The applicable numerical remediation standards are the same as the numerical standards applied during the determination of site contamination. Generic numerical sediment standards are presented in Schedule 3.4 of the CSR.

Risk-Based Standards

Under Section 16 of the CSR, risk-based standards may be used in relation to the remediation of a contaminated site. Protocol 13 shall not be used to screen sites that contain contaminated sediments except where the contamination is related to a beneficial use.

1.6.5 Vapour Remediation Standards

Numerical Standards

The applicable numerical remediation standards are the same as the numerical standards applied during the determination of site contamination. Generic numerical vapour standards are presented in Schedule 3.3 of the CSR.

Risk-Based Standards

Under Section 16 of the CSR, risk-based standards may be used in relation to the remediation of a contaminated site. Protocol 13 shall not be used to screen sites that contain soil vapours for all land uses except Wild Lands land use.

The site will be eligible for risk-based standards when it is demonstrated that the risks associated with exposure to vapour contaminants do not exceed the risk-based standards under Section 18 of the Regulation.

1.7 Site Reclamation

Regulatory requirements related to site reclamation are found in Section 19 of the [EPMR](#) and Sections [5\(2\)](#) and [11](#) of the [Pipeline Regulation, and Sections 8 and 9 of the DASR](#).

1.8 Certification of Restoration

Under Section 41(1) of [ERAA](#), a permit holder may apply to the Regulator for a Certificate of Restoration. Under Section 41(2) of [ERAA](#), the Regulator, subject to section 43 of [ERAA](#), may issue a Certificate of Restoration.

Chapter 2: Site Screening

The purpose of screening oil and gas sites is to identify those sites that may require investigation. It also helps identify the presence of areas of potential environmental concern (APECs) and potential contaminants of concern (PCOCs) due to oil and gas activities.

This chapter describes the screening mechanism for oil and gas sites and is divided into following sections:

- Site profile system
- Electromagnetic survey
- Screening results

2.1 Site Profile System

The site profile system is a legally defined process that provides a mechanism to screen potentially contaminated sites in British Columbia and it is mandatory under the EMA. The Site Profile Form is provided in [Schedule 1](#) of the CSR.

2.1.1 Site Profile

Site screening requirements in the Environmental Management Act (EMA) and Contaminated Sites Regulation (CSR) are in place to ensure potentially contaminated sites are identified.

Pursuant to Section 3(4) of the CSR, subject to Section 4 of the CSR, a permit holder under the ERAA as described in Section 40(3) of EMA, must provide a site profile to the Regulator at the time the permit holder applies for a CoR in accordance with Section 41 of ERAA.

There are three steps to determine when a site profile must be submitted for an oil and gas site:

- Step 1: establish if applying for a CoR under Section 41 of ERAA.
- Step 2: determine if Schedule 2 use or activity applies and/or one or more of the listed triggers on the site profile pertains to the site; and □ Step 3: verify that no exemptions apply.

For more information on these steps and the site profile system, please see [Administrative Guidance 1](#)

[Completing and Submitting Site Profile] and [Facts 19](#): The Site Profile System, which are available on the Ministry of Environment's website.

2.1.2 Applicable Exemptions for Site Profile

Pursuant to Section 4(1) of the CSR, subject to Subsection (3) of the CSR, a person is exempt from the duty to provide a site profile under Section 40 of EMA if the site is the subject of a certificate of restoration issued under ERAA, but only if the person has no reason to believe that there is contamination at the site that is not otherwise addressed in the Certificate of Restoration.

2.1.3 Information Sources for Completing a Site Profile

The Regulator requires that the Site Profile Form be completed by a professional to the best of their knowledge by completing historical searches to determine the site's uses. The Regulator recommends collecting information for completing the site profile through the following procedures:

- Review of the site's historical records held by the Regulator and the Ministry of Environment and any other air photos or databases (such as those available through GeoBC) that may provide information to identify current and past activities relating to potential contamination at the oil and gas site.
- Site reconnaissance visits for visual inspection of the site for indicators or presence of contamination.
- Interviews with people familiar with the site who might be able to provide information related to activities that may have caused contamination.

The information collected for completing the site profile can also be used to complete the Certificate of Restoration Application Form – [Part 1](#).

2.1.4 Completing a Site Profile

A site profile must be completed by a qualified professional. Pursuant to Section 40(3) of EMA, a site profile submission to the Regulator is required at the time the permit holder applies for a CoR. The Regulator recommends completing a site profile prior to conducting a site investigation and remediation as it helps screen potentially contaminated oil and gas sites. Upon completion of a site investigation and remediation, the completed site profile can be submitted to the Regulator with the CoR Part 1 Application Form, pursuant to Section 40(3) of EMA.

Schedule 2 Activities and other Triggers for Investigation

Section III of the site profile helps identify the Schedule 2 uses or activities. The Schedule 2 lists different purposes or activities which have been determined to have the potential to cause contamination. The Schedule 2 lists the industrial and commercial activities triggering potential contamination and requires a site profile submission to the Ministry's designated recipient.

Pursuant to Section 2(1) of the CSR, a person is exempt from the duty to provide a site profile under Section 40(3) of EMA for an oil and gas site with respect to industrial or commercial purposes and industrial or commercial activities which are not described in the [Schedule 2](#).

When referencing a Schedule 2 activity on a [Site Profile](#) Form or on a list of due diligence screening, it must indicate both column I and column II information from the Schedule 2. For example, an oil and gas site with natural gas drilling, production and processing activities will be indicated on a Site Profile Form Section III as follows:

- F1 “petroleum or natural gas drilling”
- F2 “petroleum or natural gas production facilities”
- F3 “natural gas processing”

Spill Areas of Potential Concern

Section IV of the site profile helps identify APECs due to spills to the environment. The relevant site information is collected by reviewing historical records, site reconnaissance visits and interviews with persons familiar with the site.

Any land or water body affected by spillage must be managed according to the provisions in Section 37 of ERAA. Where the permit holder can provide records from a qualified professional to demonstrate that spillage was adequately managed to meet the applicable CSR standards, then the area affected by the spillage will not be considered an APEC for investigation purposes. In the absence of such records, areas of spillage are considered to be an APEC that requires investigation.

Identified APECs related to petroleum, solvent or other polluting substance spills to the environment greater than 100 liters must be reported as “YES” on Section IV-A of the site profile.

Drilling Waste Storage and Disposal Areas of Potential Concern

Section VI of the site profile helps identify APECs related to oil and gas drilling waste storage and disposal. Relevant site information is collected by reviewing historical records, site reconnaissance visits and interviews with persons familiar with the site.

If wastes from natural gas or oil drilling operations were not managed according to the applicable provisions of the OGWR, HWR, and the Drilling Waste Management Chapter of the Oil and Gas Handbook, then during the site screening process, drilling waste disposal from an oil and gas site must be reported as “YES” on Section VI-Waste Disposal D: Waste products from natural gas and oil well drilling activities, such as drilling fluids and muds. In this case, drilling waste storage and/or disposal areas may be considered as APECs with associated PCOCs.

For an example, if the drilling waste disposal checklist passes the criteria, then it may not require investigation. If the drilling waste disposal checklist failed the criteria, then it is considered an APEC that requires investigation.

2.2 Electromagnetic Survey

Oil and gas sites may be lacking information on the location of APECs. In such cases, it may be necessary to screen the entire site to determine the presence of APECs and PCOCs. The Regulator requires the permit holder to undertake reasonable efforts to identify the risks associated with oil and gas activities. The use of applied geophysical techniques such as electromagnetic (EM) surveys may be used to identify the location of unknown APECs such as drilling waste storage and disposal areas, flare pits, spill areas or other unknown areas of potential environmental concern.

An applied geophysical technique like an EM survey investigates the ground's physical properties to provide information on subsurface conditions. Geophysical surveys are non-intrusive, non-invasive tools that optimize the targeting of intrusive investigations. These techniques are typically less expensive and less time consuming than other methods of locating APECs such as grid sampling.

The EM survey uses a frequency domain electromagnetic technique to measure and map ground conductivity. It provides the capability of mapping subsurface features or contaminants that are associated with or cause changes in ground conductivity. The EM survey technique has many uses where ground conductivity changes are measured and may indicate subsurface contamination in sumps and flare pits, changes in stratigraphy, soil moisture, buried pipelines, drums and underground storage tanks.

Overall, the EM survey results can provide valuable information at the site screening level to help in identifying APECs to target intrusive investigation locations. EM-38 exploration depth is about 0-1.5 meters and for EM-31 the exploration depth is about 0-8 m, depending on surface conditions and snow cover which may reduce the effective depths.

The Regulator's Restoration Verification Assessment Audit Program includes conducting an EM survey, where not previously conducted as part of site restoration process. Intrusive sampling will be completed where the EM survey mapping indicates an anomaly.

In order to demonstrate that reasonable effort has been undertaken to identify APECs and PCOCs, an EM survey should be conducted if:

1. The site produced prior to 1996;
2. The site produced more than 5 years after 1996;
3. Landspray While Drilling (LWD) occurred on the lease but failed the drilling waste checklist;
4. there is no information on the DWDA;
5. a flare pit was present at a producing site; 6. The site had a history of produced water spills.

2.3 Screening Results

The site screening process must identify the oil and gas sites that require investigation and a list of APECs and PCOCs must be provided by the professional who completed the site screening process. All reasonable efforts must be undertaken to identify APECs with associated PCOCs. A list of the oil and gas sites that may require investigation are presented in Appendix A Table 1 and a list of common APECs and PCOCs are presented in Appendix A Table 2 of this manual. The Regulator recommends presenting the identified APECs spatially depicted on a site map and in tabular form.

Chapter 3: Site Investigation and Assessment

In order to meet the requirements of the DASR or to apply for a Certificate of Restoration each site must be assessed for potential contamination and a report of the assessment is submitted to the Regulator. A site investigation involves the sampling of relevant environmental media and is intended to assess the presence or absence of potential contaminants of concern within the areas of potential environmental concern that have been identified through site screening. The investigation may expand to further characterize, delineate and identify any migration resulting from a contaminated site. The information gathered through a site investigation must be sufficient to develop an effective remediation plan or a human health or environmental risk assessment.

This chapter contains an overview of the requirements, standards, guidelines and the process related to the investigation of environmental conditions at oil and gas sites, presented in the following sections:

- Investigation requirements
- Applicable investigation standards
- Investigations
- Investigation findings
- Conceptual site model

3.1 Site Assessment and Investigation Requirements

The Regulator requires that an oil and gas site be investigated to determine if the site is contaminated. Investigations must be completed by a qualified environmental professional or by a person working under direct supervision of a qualified environmental professional. The qualifications of an acceptable environmental professional are described in Appendix C, of this manual.

If potential sources of contamination are identified on an oil and gas site through the site screening and an investigation is required, then the permit holder must demonstrate that the site either meets numerical standards or risk based standards of the CSR or has been adequately remediated in accordance with the requirements detailed in Section 8 of the DASR. Identified sites that may require investigation to determine if the site is contaminated are listed in Appendix A Table 1 of this manual.

Section 39 of EMA defines a contaminated site and Section 11 of the CSR, specifies when a site is considered contaminated. A site is considered contaminated if substances in the soil, surface water and groundwater, sediment or vapour at the site exceed the applicable numerical standards. Section 15 of the CSR requires that numerical standards must be applied to determine whether or not a site is contaminated and also describes the procedures for determination of a contaminated site.

3.2 Applicable Investigation Quality Standards

Environmental quality standards for investigation are used to determine whether contamination is present. Provisions for contaminated site determination are presented in Part 5 of the CSR. Under Section 15(1) of the CSR, numerical standards must be applied to determine whether a site is contaminated. The applicable numerical standards selected based on land, water and sediment use for a site are compared with the site investigation results. As per Section 11(3) of the CSR, a site may not be considered contaminated if the concentrations of all substances present at the site are not greater than local background concentrations. [Protocol 4](#) [Determining Background Soil Quality] and [Protocol 9](#) [Determining Background Groundwater Quality] may be used to determine the local background concentrations of a substance.

Risk-based standards cannot be applied to determine whether a site is contaminated.

3.2.1 Soil Investigation Standards

Numerical standards are presented as matrix numerical soil standards and generic numerical soil standards. Site-specific numerical standards may also be developed for substances with [Schedule 3.1](#)-Part 1 matrix numerical standards provided sufficient site-specific data is available.

A substance will not have both generic and matrix numerical soil standards.

Generic Numerical Standards

Generic numerical soil standards to protect human health and to protect ecological health for each land use are presented in [Schedules 3.1](#)-Part 2 and [3.1](#)-Part 3, respectively. Land use for a site may be designated as following under Section 12(3) of the CSR:

- Natural Wildlands land use (WL_N)
- Reverted Wildlands land use (WL_R)
- Agricultural land use (AL)
- Urban park land use (PL)
- Low Density Residential land use (RL_{LD})

- High Density Residential land use (RL_{HD})
- Commercial land use (CL)
- Industrial land use (IL)

A definition of each land use is provided in [Part 1](#) [Definitions] of the CSR.

Matrix Numerical Standards

Matrix numerical soil standards are presented in Schedule 3.1-Part 1 of the CSR. Site specific factors must be considered when applying matrix numerical standards. As specified in Section [12](#)(8) of the CSR, the following two site-specific factors must be considered for all sites regardless of land use:

- Human intake of contaminated soil, and
- Toxicity to soil invertebrates and plants

For agricultural sites, the following site specific factors must also be considered:

- Livestock ingesting soil and fodder, and
- Major microbial functional impairment

Under the applicable land use the matrix value for each applicable site specific factor must be considered. As per Section [11](#)(1)(a)(ii) of the CSR, the concentration of a substance must be compared to the lowest of these applicable matrix numerical values. Additional guidance on the selection of applicable matrix numerical soil standards is presented in the [Technical Guidance 3](#) [Environmental Quality Standards].

Applicable Exemptions of Site-specific Factors

The applicability of site-specific factors related to groundwater is based on the determination of water use at the site. Whether a specific water use applies or does not apply to the site under investigation can be determined following the [Technical Guidance 6](#) [Water Use Determination].

Where information is unavailable or inadequate to demonstrate an absence of drinking water aquifers below a site, drinking water aquifers are considered to exist and drinking water use standards are applicable.

Due to the prevalence of bedrock fracturing, natural confining barriers greater than or equal to 5 meters in bedrock may not be considered a natural confining unit unless the bedrock investigations confirm that the bedrock serves as a natural confining barrier.

Site Specific Numerical Soil Standards

Site-specific numerical soil standards (SSSs) allow for limited modification of matrix numerical soil standards where sufficient site-specific data is available. SSSs may only be calculated for substances with Schedule 5 matrix numerical soil standards. Site-specific numerical standards must be developed in accordance with [Protocol 2](#) [Site Specific Numerical Soil Standards].

3.2.2 Groundwater Investigation Standards

Groundwater standards for each water use are presented as generic numerical water [Schedule 3.2](#). Schedule 3.2 presents generic numerical standards for all water uses listed under Section [12\(4\)](#) of the CSR. Water use for a site may be designated as follows under Section [12\(4\)](#):

- Aquatic life water use (AW)
- Livestock watering water use (LW)
- Irrigation water use (IW)
- Drinking water use (DW)

A definition of each water use is provided in [Part 1](#) [Definitions] of the CSR.

As per Section [11](#) (b) of the CSR, a site is considered contaminated if the concentration of any substance in the groundwater is greater than the applicable generic numerical water standard. The applicability of groundwater standard is based on the determination of the water use at the site. Specific water use apply or does not apply to the site under investigation can be determined following the [Technical Guidance 6](#).

3.2.3 Surface Water Investigation Standards

Surface water standards for aquatic life, wildlife, livestock and irrigation water use are presented in the Water Quality Guidelines Summary ([WQG](#)) that have been approved by the province of British Columbia.

The WQG presents water standards for all water uses, except drinking water use, listed under Section [12\(4\)](#) of the CSR. A definition of each water use is provided in Part 1 [Definitions] of the CSR. Section [11\(b\)](#) of the CSR, detailed when a site is considered contaminated.

3.2.4 Sediment Investigation Standards

The generic numerical sediment criteria for both sensitive and typical aquatic sediment uses are presented in Schedule 3.4 of the CSR. Sediment use for a site may be designated as the following under Section [12](#) (4.1):

- Sensitive habitat sediment use
- Typical habitat sediment use

A definition of each sediment use is provided in [Part 1](#) [Definitions] of the CSR.

As per Section [11](#) (c) of the CSR, a site is considered contaminated if the concentration of any substance in sediment is greater than the applicable generic numerical sediment criteria.

3.2.5 Vapour Investigation Standards

Numerical standards for each land use are presented in the [CSR](#) as generic numerical vapour standards (Schedule 3.3). A definition of each land use is provided in Part 1 [Definitions] of the CSR.

3.2.6 Selection of Applicable Standards

The selection of the applicable numerical standards is based on the land, water or sediment use at a site. Provisions for the selection of applicable land, water and sediment uses and site-specific factors are presented in Section 12 of the CSR. Site-specific applicable land use, water use and sediment use will be considered applicable unless any exemptions apply to a site. A qualified professional must provide a rationale for the selection of the applicable standards used to determine if a site is contaminated.

3.2.7 Selection of Standards in Muskeg Environment

Muskeg environments present challenges when selecting soil and water standards. The selection of standards in a muskeg environment may be based on the duration of saturation, which is indicated by the presence of surface water on muskeg soils. The following suggestions should be applied when selecting standards in a muskeg environment:

- Where surface water is present for more than half of the frost-free season the Regulator suggests that this should be considered an aquatic receiving environment and that the BC WQG be applicable to surface water and the CSR sediment criteria be applicable to the organic soils.
- Where surface water is present for less than half of the frost-free season the environment could be considered incapable of supporting aquatic life and the CSR Aquatic Life water use standards may be applied to the surface water and the land use standards may be applied to the organic soils.

The Regulator suggests seeking the opinion of a team of qualified professional biologists and professional hydrologists to evaluate whether the muskeg is permanent and capable of supporting aquatic life. On a sitespecific basis, sound professional judgement with scientific support may be acceptable in determining the applicable standards in the muskeg environment.

3.2.8 Barite Sites

Barium sulphate (barite) may have been used at a wellsite under investigation. The toxicity of a particular barium compound is related to the compound's solubility. Barite is a virtually insoluble barium compound and is non-toxic under most environmental conditions.

Section 3 of [Protocol 14](#) [Requirements for Determining Barite Sites] should be used to find the sole anthropogenic source of barium at the site. Where barite is the sole source of anthropogenic barium, a site may be considered a barite site for investigation purposes.

3.3 Investigations

Investigations confirm or refute suspected contamination. If the site is contaminated, then the investigations can define the lateral and vertical extent, magnitude, and potential of offsite migration.

Identified areas of potential environmental concern (APECs) with associated potential contaminants of concern (PCOCs) on an oil and gas site require investigation to identify if the

APEC is an area of environmental concern (AEC). Common APECs at oil and gas sites include, but are not limited to the following:

- Well head and surrounding area
- Drilling waste storage and disposal areas
- Flare pits
- Storage tanks
- Spill areas
- Metering stations
- Pipelines
- Stained surface areas
- Stressed vegetation, and
- Camp sites
- Land Treatment Area

The intensity of a site investigation can be determined by a site's uses and environmental conditions. Appendix A Table 3 in this manual provides a list of APECs and the required minimum number of investigative locations for each APEC. The APECs list is not exhaustive and additional APECs and associated PCOCs may be present. The Regulator requires investigation of site-specific APECs and PCOCs be completed by a qualified professional, and a sampling rationale be provided for each location of investigations. PCOCs may degrade over time and may create additional by-product contaminants that require special attention during investigations. By-product contaminants are not listed in the Appendix A Table 2 of this manual. The number of investigative locations for each APEC described in Appendix A Table 3 of this manual are the minimum required to determine if the individual APEC is considered an AEC with associated contaminants of concern (COCs) and support the determination of whether the site is contaminated or not. If a site is identified as a contaminated site then the investigation may expand to further characterize and delineate contamination and also to identify the degree of offsite migration, if applicable. Investigations may also serve to quantify contamination and identify potential pathways and receptors to plan remedial measures. The expanded investigation plan may be site-specific based on professional judgement or Sections [58](#) and [59](#) of the CSR may be followed to set an expanded investigation plan.

The Regulator requires that the information gathered during a site investigation be sufficient to develop an effective remediation plan or a human health or environmental risk assessment.

3.3.1 Investigation Exemption for an Individual APEC

An APEC on a site may be exempted from further investigation where a previously completed investigation documented by a qualified environmental professional regarding an APEC demonstrates that the APEC was not considered an AEC with associated COCs, unless there is reason to suspect further contamination subsequent to that investigation. The following scenarios are examples of APECs that may be exempted from further investigation if they were not considered AECs upon completion of the investigation.

- a. An investigation in the proximity of the wellhead may occur at the time of well abandonment by a qualified environmental professional. If the investigation at the wellhead was completed and documented by a qualified environmental professional at the time of well abandonment and the investigated area was not considered an AEC with associated COCs, then it may be exempted from further investigation provided that the investigation report is submitted as supporting documentation with the CoR Part 1 Application.
- b. If wastes from natural gas or oil drilling operations were not managed according to the applicable provisions of the [OGWR](#), [HWR](#) or the Drilling Waste Management Chapter of the Oil and Gas Handbook , then during site screening the storage and disposal areas may be considered as areas of potential environmental concerns (APECs) with associated Potential Contaminants of Concerns (PCOCs). The Assessing Drilling Waste Disposal Areas document provides Drilling Waste Disposal Checklists to determine if the drilling waste disposal was in compliance with the applicable criteria at the time of disposal. If compliance can be demonstrated by passing the checklist, then intrusive sampling of the waste material and the sump is not required and is exempted from further investigation unless there is another reason to suspect contamination.
- c. A Flaring facility requires investigation as an APEC. If there is no evidence of a temporary flaring facility for drilling being used, then it may be exempted from further investigation unless there is another reason to suspect contamination. The permit holder must demonstrate with drilling information that there is no record of production for flaring to support the exemption.
- d. Leaks or spills from pipelines are considered APECs. Pipelines located onsite that have been decommissioned following the regulatory criteria may be exempted from further investigation provided that an investigation report is submitted as supporting documentation with the CoR Part 1 Application.

3.3.2 Data Quality Management

The conclusions of an investigation may be uncertain due to insufficient analytical data or poor data quality which may compromise the ability to determine if a site is contaminated. A quality assurance and quality control (QA/QC) program should be part of an investigation plan as it helps to enhance reliability of the data by achieving three goals:

- Quantify the errors to be considered when interpreting data for making conclusions.
- Monitor the errors to recognize biased or spurious data and if possible, make a correction.
- Minimize errors by improving sampling and analytical procedures.

The Regulator requires a sound QA/QC program for all sample collection, handling and analysis that produces information which may be used to determine if a site is contaminated.

3.3.3 Soil Investigation

Soil sampling should be fair and unbiased in that every member of the population has the same chance of being sampled and selected to be tested. A soil investigation must include in-situ representative and discrete soil sampling at all APECs and laboratory analysis for all associated PCOCs. A rationale must be provided if any identified APECs or PCOCs were omitted from the investigation. Soil results must be compared with the numerical CSR standards in order to determine whether a site is contaminated as per Section [15\(1\)](#) of the CSR.

Soil samples should be collected by a qualified environmental professional or by a person working under direct supervision of a qualified environmental professional in accordance with Technical Guidance 1 [Site Characterization and Confirmation Testing]. Background samples should be collected in accordance with Protocol 4 [Determining Background Soil Quality].

Appendix A Table 3 of this manual presents a list of APECs and the required number of investigative locations for each APEC. The Regulator requires that a qualified professional identify and investigate site-specific APECs and PCOCs and provide a rationale for each location selected for sampling. A minimum of two soil samples collected at appropriate depths per borehole should be selected for laboratory analysis for the PCOCs, except where field screening indicates the need to select more than two per location. Field indicators may include discoloration, odor or staining. If EM survey has been conducted, then the intrusive sampling should be completed where the EM survey mapping indicates an anomaly. Further, sampling guidance for the investigation and characterization of the fill and soil is provided in Technical Guidance 1 [Site Characterization and Confirmation Testing].

Soil Stratigraphy and Physical Properties

Preliminary information on soil stratigraphy and physical properties can be obtained from published sources or findings of the professional's subsurface investigations conducted in the area. The Regulator requires that site-specific soil stratigraphy and physical properties be obtained by means of an intrusive subsurface investigation by qualified professionals.

Required information on subsurface conditions includes, but is not limited to, a description of soil uniformity and preferential pathways that could influence the fate and transport of the contaminants. This is important to determine during the investigation for remediation planning and risk assessment purposes.

3.3.4 Groundwater Investigation

As part of the site investigation, groundwater that is already being used or has the possibility of being used for aquatic life, irrigation, livestock or drinking water, must be investigated in order to determine if the groundwater at the site is contaminated.

Groundwater investigations and characterization procedures are provided in the [Technical Guidance 8](#) [Groundwater Investigation and Characterization]. Recommended groundwater sampling and monitoring procedures are provided in the British Columbia Field Sampling Manual.

Whether a specific water use applies or does not apply to the site under investigation can be determined by following the Ministry of Environment guidelines and protocols including the Technical Guidance 6. Where information is unavailable or is inadequate to demonstrate an absence of drinking water aquifers below a site, drinking water aquifers are considered to exist and drinking water use standards are applicable.

Exemption of groundwater investigations may be determined based on past and present site uses and evidence of absence of the potential mechanisms of contaminant transport, if any.

Hydrogeological Conditions

The Regulator requires that hydrogeological investigations be part of any subsurface investigation when the potential of groundwater contamination exists. If sufficient time has elapsed since contamination was introduced to the site, then there may be potential for mobile substances to have leached or moved out of the vadose zone into groundwater.

Boreholes drilled for soil investigation may be completed with groundwater monitoring wells for characterizing groundwater and measuring hydrogeological parameters. Hydrogeological investigations may include, but are not limited to, measuring depth to the groundwater table, hydraulic gradient, groundwater flow direction and field tests to determine hydraulic conductivity. Hydrogeological information assists in planning remediation and in supporting risk assessments.

3.3.5 Sediment Investigations

Under Section [11](#) (1)(c) of the CSR, a site will be classified as contaminated if any substance in sediment at the site is greater than the applicable generic numerical sediment standards. Sediment is only considered during a site investigation if a lake, river, or stream is located within lease boundaries or within the plume of offsite contaminant migration. Sediment investigation guidance is provided in [Technical Guidance 19](#) [Assessing and Managing Contaminated Sediment]. Sediment sampling methods are provided in the British Columbia [Field Sampling Manual](#).

3.3.6 Soil Vapour Investigation

Under Section [11](#)(1)(d) of the CSR, a site can be classified as contaminated if any substance in the soil vapour at the site is greater than the applicable generic numerical soil vapour standards. These standards are only applicable in the breathing zone, where there is a risk of direct human contact with soil vapour. However, the majority of oil and gas sites in Northeastern British Columbia are located in remote areas, where human inhabitation is unlikely after abandonment. Therefore, a soil vapour investigation may not

be required due to the absence of a breathing zone. Soil vapour investigation guidance is provided in Technical Guidance 4 [Vapour Investigation and Remediation].

Consistent with Protocol 13, the exposure threshold of 2hours/day, 1 day/week for soil vapour exposure, may be considered comparable to short term exposures such as hunting camps that might occur on remote former oil and gas sites. The Regulator requires that soil vapour assessment be completed at sites where volatile substances in Schedule 11 have been detected in soil or groundwater either:

- on a parcel of land currently zoned or designated for future use as parkland, residential, or commercial within an official community plan; or
- within 30 metres of an existing building that is not part of the onsite infrastructure.

3.3.7 Offsite Migration and Investigation

If during the site investigation it is determined that contamination has migrated to a neighboring site, then the CSR notification requirements apply. Section [60.1](#) of the CSR, requires that if at any time during the site investigation it is found that contamination has migrated or is likely to have migrated to a neighbouring site and is, or is likely, causing contamination at the neighbouring site, a written notification must be provided to the owner(s) of the neighbouring site and a copy of the notification to the MoE Director, within 15 days after the responsible person becomes aware of the migration or likely migration. In case of offsite migration to a neighbouring Crown land, a copy of Notice of Offsite Migration is required to be sent to the Regulator. In case of offsite migration to a neighbouring private land, a copy of Notice of Offsite Migration is not required to be sent to the Regulator.

Notifications of Likely or Actual Migration Forms are provided in [Protocol 17](#) [Forms for Notifications of Independent Remediation and Migration].

Site Classification Report

A Site Classification Report is required after notification of offsite migration. The Site Classification Report is used to determine if a site classified as a potential high risk site, which would require MoE oversight until the site is classified as not high risk by the MoE. Conditions for the classification of potential high risk sites are provided in the Upstream Oil and Gas [Site Classification Tool](#). The Upstream Oil and Gas Site Classification Tool provides criteria for characterizing environmental and human health risk as not priority sites administered by the Regulator. The Upstream Oil and Gas Site Classification Tool must be used in order to complete the Site Classification Report. Given that some sites may not have been investigated in sufficient detail to complete accurate characterization at the time the Site Classification Report is required the Regulator allows for the inclusion of professional judgement into the data set used to evaluate the risk associated with a site. A responsible person may need to resubmit the Site Classification Report if they originally determine the site was not high risk and then the investigation determines later that it is a potential high risk site.

3.3.8 Offsite Investigation

If the site investigation finds that on-site contamination has potentially migrated past the surveyed boundaries of the site to adjacent land, the permit holder is responsible for investigating and, if present, remediating any contamination under the DASR and before a Certificate of Restoration (CoR) is granted. However, investigation and/or remediation can be carried out independent of the CoR process when contamination is identified.

To legally access off-site land for the purposes of investigating potential migration, the permit holder must first determine if the land bordering the contaminated site is Crown land or private land and arrange access accordingly.

Entry on Unoccupied Crown Land

Where entry onto Crown land cannot be adhered to as per s.8.3 of the [Crown Land Permissions Policy](#), an authorization under the [Land Act](#) or under s.138 of the [PNG Act](#) is required, subject to any terms or conditions the Regulator considers appropriate.

This includes temporary access to Crown land for investigation of ancillary sites (such as a remote sump) that cannot adhere to s.8.3 of the Crown Land Permissions Policy.

Applications for Investigative Use are submitted through the Application Management System.

Authority to Enter Private Land

Under Section [142](#) of the PNG Act, a person may not enter, occupy or use a private land to carry out oil and gas activity or a related activity, or to comply with an order of the Regulator, unless authorized under a surface lease with the landowner or an order of the Surface Rights Board. Therefore, the permit holder must arrange an access agreement with the landowner or be in receipt of a valid order to enter the property.

3.3.9 Completion of Offsite Investigations

Offsite investigations must characterize, identify the degree of migration and delineate contamination. The information gathered in the offsite investigation should be sufficient to develop an effective remediation plan or a human health or environmental risk assessment.

3.3.10 Sample Management

Sample handling, preparation, and storage procedures should follow the methods described in the [British Columbia Field Sampling Manual](#). Samples must be submitted, extracted and analyzed in accordance with the [Current Ministry Preservation and Holding Time Requirements](#). All laboratory analyses should be carried out in accordance with the procedures described in the latest version of the [British Columbia Environmental Laboratory Manual](#). The laboratory must provide with its analytical report a copy of the chain of custody with sample integrity receipt form.

Naturally Occurring Organics

Organic soils exhibit high organic content and may reveal interference from naturally occurring organics in the soil that are not derived from petroleum sources. Naturally occurring organics tend to mask analytical results of petroleum hydrocarbons. For such cases, the Regulator recommends two acceptable practices:

- 1) Science supports silica gel cleanup on samples with high organic contents to minimize interference of naturally occurring polar organics those are not derived from petroleum. But the silica gel approach may be unable to cleanup all naturally occurring polar organics.
- 2) Collection of background soil samples from unaffected areas in the vicinity of the site and analysis for hydrocarbon. The naturally occurring organics in the background soil would then be subtracted to obtain a more accurate estimate of petroleum hydrocarbon concentrations in the samples.

3.4 Investigation Findings

Site investigations must confirm the presence or absence of potential contaminants of concern within the areas of potential environmental concern. If a site is contaminated, then a qualified professional must establish all areas of environmental concern (AECs) and associated contaminants of concern (COCs).

The Regulator recommends presenting the identified AECs in tabular form and spatially depicting the areas on a site map. The information gathered for a contaminated site in the site investigation should be sufficient to develop an effective remediation plan or a human health or environmental risk assessment.

Overall, care should be taken to ensure that the site investigation findings are supported by appropriate, sufficient, and accurate site information obtained in accordance with relevant BCER and MoE procedures, protocols, guidance and standard professional practice.

3.4.1 Reporting

Site investigation and assessment reports submitted as required per Section 7 of the DASR or submitted in support of a CoR application must satisfy the Regulator's minimum reporting requirements. The site investigation reporting requirements are presented in Appendix B of this manual.

3.4.2 Professional Statements

The Regulator requires that a qualified environmental professional must attest to the following statements:

- The investigation and remediation referred to in this report have been conducted in accordance with all requirements of EMA and the CSR.

- The reported information is true based on the signatory current knowledge as of the date completed. Where data gaps exist in this report, I have used my professional judgement.
- The signatory has demonstrable experience with remediation of the type of contamination at the site for which the statement applies and is familiar with the remediation carried out on the site.

The Regulator expects all site investigations to be conducted by or under the direct supervision of a qualified professional and requires the professional statement to be signed and dated by a qualified professional.

3.5 Conceptual Site Model

A Conceptual Site Model (CSM) of a contaminated site is used to organize and communicate information regarding contamination, pathways and receptors and also helps focus resources on contamination that may present unacceptable risk to human health or the environment. Information sources for the CSM may include, but are not limited to, record reviews, interviews, site visits and analytical results from the initial site investigations. Further investigation may expand on this information and can be added to the CSM until it is sufficient to develop an effective remediation plan or a human health or environmental risk assessment.

CSM Significance

The CSM serves many purposes, some of which include:

- Establishing whether there is a likelihood of imminent and substantial endangerment; justifying characterization approaches; and prioritizing investigation and remedial resources.
- Understanding the processes that determine contaminant releases, contaminant migration, and environmental receptor exposure to contaminants.
- Determining potential exposure routes and suggesting possible effects of the contaminants on human health and the environment.
- Identifying uncertainties associated with the CSM so that efforts can be directed to reduce these uncertainties to acceptable levels. Early versions of the model, which may have limited or incomplete information, will identify and emphasize the uncertainties that should be addressed in the revised versions.
- Facilitating the selection of remedial alternatives and evaluating the effectiveness of remedial actions in reducing the exposure of environmental receptors to contaminants.

The information gathered for a contaminated site during the site investigation process may be used to formulate a CSM. For those sites where contamination is identified and present, the Regulator recommends developing and providing a CSM with the investigation and remediation report with the CoR Part 1 Application.

Chapter 4: Site Remediation

The intent of remediating an oil and gas site is to eliminate, limit, correct, counteract, mitigate, or remove any contaminants or the adverse effects on the environment or human health of any contaminants. Remediation is required if potential contaminants are present with concentration exceeding the applicable standards within the areas of environmental concern on oil and gas sites. The areas of environmental concern (AECs) with associated contaminants of concern (COCs) are established and the information gathered in the site investigation is used to develop an effective remediation plan or a human health or environmental risk assessment.

This chapter relates to a common view of remediation as the removal or treatment of contaminants to clean up a site or to otherwise contain and manage risks associated with contamination at a site. This chapter divides into following sections:

- Remediation requirements
- Applicable remediation standards
- Remediation plan
- Remediation
- Confirmation of remediation

4.1 Remediation Requirements

If substances encountered during the site investigations have concentrations exceeding the applicable standards, then remediation will be required in order to prevent risks to the environment and human health. The [EMA](#) requires a responsible person conducting or otherwise providing remediation at a contaminated site to give preference to remedial alternatives that provide permanent solutions.

As per Section [16](#) of the [CSR](#), contaminated soil, groundwater, surface water, sediment and vapour must be remediated to either numerical or risk-based standards. Risk-based assessments can be used to demonstrate that there is no unacceptable risk to human health or the environment and that remediation is not required.

A site may be considered successfully remediated in accordance with the numerical standards if the concentrations of all substances in the soil, groundwater, surface water, sediment and vapour are not greater than or equal to the applicable remediation standards as per Section [17\(1\)](#) of the CSR; or not greater than or equal to the applicable site specific numerical standards or the local background concentrations as per Sections [17\(2\)](#) of the CSR. Local background concentrations should be determined following [Protocol 4](#) [Determining Background Soil Quality] and [Protocol 9](#) [Determining Background Groundwater Quality].

4.2 Applicable Remediation Quality Standards

The goal of remediation is to restore the quality of environmental media to a level that does not present an unacceptable risk to human health or the environment. Environmental quality standards determine when a site has been adequately cleaned up.

Part 6 [Remediation Standards] of the CSR contains provisions for the remediation of contaminated sites. Under Section 16 of the CSR, either numerical standards or risk-based standards may be used in relation to the remediation of a contaminated site.

4.2.1 Soil Remediation Standards

Numerical Standards

If a site is to be remediated to numerical standards, post-remediation confirmation sampling results are compared with the applicable numerical standards. The applicable numerical remediation standards are the same as the numerical standards applied during the determination of site contamination.

Generic numerical soil standards to protect human health and to protect ecological health are presented in [Schedule 3.1](#)-Part 2 and [Schedule 3.1](#)-Part 3 of the CSR, respectively. Matrix numerical soil standards are presented in [Schedule 3.1](#)-Part 1 and site-specific numerical standards may be developed in accordance with Protocol 2 [Site Specific Numerical Soil Standards].

Under Section 17(3) of the CSR, soil at a depth greater than 3.0 meters must be remediated to commercial land use (CL) numerical soil standards for all land uses.

Risk-Based Standards

Risk-based standards cannot be used to determine whether a site is contaminated, however, where numerical standards are exceeded, established MoE protocols should be used to demonstrate that there is no unacceptable risk to human health or the environment and that remediation is not required. The risk assessment is based on contaminant concentrations, potential exposure pathways, and the presence of receptors. Sections 18 and 18.1 of the CSR, states that contaminated site can be remediated to risk based standards.

A Screening Level Risk Assessment (SLRA) should be conducted in accordance with [Protocol 13](#) [Screening Level Risk Assessment] to determine whether contamination at a specific site poses acceptable or unacceptable risk to the environment. A comprehensive site investigation must be completed prior to conducting a SLRA. A SLRA may not be used to evaluate high risk sites or sites designated for agricultural land use without Ministry of Environment approval. If a SLRA finds there is no unacceptable risk to the environment then the site has met the CSR risk-based standards and may not require remediation.

Risk-based standards at depth for remediation purposes may be used specifically for the human health soil exposure and environmental health terrestrial soil exposure pathways. These pathways are considered not to be operable for soils 1.0 meters or greater below

the ground surface and the contamination may not present a significant risk to the environment below this depth, as per Protocol 13.

Where SLRA failed due to potential for unacceptable risk, a detailed risk assessment is required.

4.2.2 Groundwater Remediation Standards

Numerical Standards

The applicable numerical remediation standards are the same as the numerical standards applied during the determination of site contamination. Generic numerical water standards are presented in [Schedule 3.2](#) of the CSR.

Risk-Based Standards

Under Section [16](#) of the CSR, risk-based standards may be used in relation to the remediation of a contaminated site. The groundwater concentrations at receiving environments are used in accordance with Protocol 13 [Screening Level Risk Assessment] to determine whether the groundwater contamination presents an unacceptable risk to the environment and whether remedial action is required. Where SLRA failed due to potential for unacceptable risk, a detailed risk assessment is required.

4.2.3 Surface Water Remediation Standards

Numerical Standards

The applicable numerical remediation standards are the same as the numerical standards applied during the determination of site contamination. Surface water standards are presented in the WQG.

Risk-Based Standards

Under Section 16 of the CSR, risk-based standards may be used in relation to the remediation of a contaminated site. Protocol 13 shall not be used to screen sites that contain surface water except where the contamination is related to a beneficial use.

If a site exceeds the WQG and is to be remediated to risk-based standards, a detailed risk assessment must be completed.

4.2.4 Sediment Remediation Standards

Numerical Standards

The applicable numerical remediation standards are the same as the numerical standards applied during the determination of site contamination. Generic numerical sediment standards are presented in [Schedule 3.4](#) of the CSR. Technical Guidance 15

[Concentration Limits for the Protection of Aquatic Receiving Environments] distinguishes between typical and sensitive sediment standards.

Risk-Based Standards

Under Section [16](#) of the CSR, risk-based standards may be used in relation to the remediation of a contaminated site. Protocol 13 shall not be used to screen sites that contain contaminated sediments except where the contamination is related to a beneficial use. If a site exceeds Schedule 3.4 and is to be remediated to risk-based standards, a detailed risk assessment must be completed.

4.2.5 Vapour Remediation Standards

Numerical Standards

The applicable numerical remediation standards are the same as the numerical standards applied during the determination of site contamination. Generic numerical vapour standards are presented in [Schedule 3.3](#) of the CSR.

Risk-Based Standards

Under Section 16 of the CSR, risk-based standards may be used in relation to the remediation of a contaminated site. Protocol 13 shall not be used to screen sites that contain soil vapour for all land uses except Wild Lands land use.

The site will be eligible for risk-based standards when it is demonstrated that the risks associated with exposure to vapour contaminants do not exceed the risk-based standards under Section 18 of the CSR.

4.2.6 Selection of Applicable Remediation Standards

The selection of applicable numerical standards for remediation is based on the land, water or sediment used at a site. Definitions of uses are provided in Part [1](#) of the CSR. Under Section [12\(5\)](#) of the CSR, both current and potential future land, water and sediment uses must be considered when determining the primary land, water and sediment uses for a site. Provisions for the selection of applicable land, water and sediment uses and site-specific factors are presented in Section [12](#) of the CSR.

4.3 Remediation Plan

Remediation plans may include, but are not limited to, the following actions:

- Graphic representation of identified zone of contamination (i.e. in maps and cross-sections).
- Selecting and rationalizing remediation approach.
- Quantification of soil, groundwater, surface water, sediment and vapour to be removed.

- Identification and classification of the substances in soil, surface water, groundwater, sediment or vapour to remain in place, where risk-based standards are used □ Remediation schedule.
- Identification of the regulatory requirements for remediation including required notifications and authorizations.
- Confirmatory sampling plan during and after treatment, management or removal of contamination to ensure compliance with the numerical standards, or the risk-based standards upon completion of the remediation.

A definition and components of “remediation plan” is provided in [Part 1](#) [Definitions] of the CSR and that may be followed when preparing a remediation plan.

The Regulator also recommends that the permit holder schedule a pre-remediation meeting with the Regulator’s Supervisor, Environmental Stewardship when planning a risk-based remediation approach.

4.3.1 Selection of Remediation Options

Pursuant to Section 56(1) of EMA, a person conducting or otherwise providing for remediation of a site must give preference to remediation alternatives that provide permanent solutions to the maximum extent practicable, taking into account the following factors:

- Any potential for adverse effects on human health or for pollution of the environment.
- The technical feasibility and risks associated with alternative remediation options.
- Remediation costs associated with alternative remediation options and the potential economic benefits, costs and effects of the remediation options; and □ Other prescribed factors.

4.3.2 Independent Remediation and Notifications

Independent remediation is carried out without direct Ministry involvement. Independent remediation may be conducted in B.C. on private land and provincial Crown land. The independent remediation provisions of [EMA](#), [CSR](#) and [HWR](#) apply to both private land and provincial Crown land, but do not apply to lands under Federal jurisdiction, including First Nations lands, unless a First Nation has signed a treaty with the Provincial government making it subject to provincial laws.

Section 54(1) of EMA provides that a responsible person may carry out independent remediation in accordance with the applicable regulations.

As per Section 54(2) of [EMA](#), any person undertaking independent remediation of a contaminated site must notify an MoE Director in writing promptly on initiating remediation within 3 days after commencement of remediation as per Section 57(1.2) of the [CSR](#) and notify the MoE Director in writing within 90 days of completing remediation.

The form for Notification of Independent Remediation (NIR) is provided in Protocol 17 [Forms for Notifications of Independent Remediation and Migration].

The Ministry of Environment's compliance staff can verify that independent remediation requirements are being met and can follow up on incidents and complaints of potential noncompliance. Penalties for noncompliance with the contaminated site requirements of [EMA](#), CSR and [HWR](#) are provided in Section 120(17) of [EMA](#).

Site Classification Report

A Site Classification Report is required after notification of independent remediation or notification of off-site migration. The Site Classification Report is used to determine if a site classified as a potential high risk site, requiring MoE oversight. Conditions for the classification of potential high risk sites are provided in the Upstream Oil and Gas Site Classification Tool. The Upstream Oil and Gas Site Classification Tool provides criteria for characterizing environmental and human health risks as not priority sites administered by the Regulator. The Upstream Oil and Gas Site Classification Tool must be used in order to complete the Site Classification Report. Some complex sites cannot be characterized using this tool, for such sites the inclusion of professional judgement from a qualified professional into the data set to evaluate the risk associated with a site is an acceptable practice.

4.3.3 Offsite Migration and Notification

If during site remediation it is determined that contamination has migrated to a neighboring site, then the CSR requirements for offsite notification apply. Section [60.1](#) of the CSR, requires that if at any time during site investigation it is found that contamination has migrated or is likely to have migrated to a neighbouring site and is, or is likely causing contamination at the neighbouring site, a written notification must be provided to the owner(s) of the neighbouring site and a copy of the notification to the MoE Director, within 15 days after the responsible person becomes aware of the migration or likely migration. Notifications of Likely or Actual Migration Forms are provided in Protocol 17 [Forms for Notifications of Independent Remediation and Migration].

In case of offsite migration to a neighbouring Crown land, a copy of Notice of Offsite Migration is required to be sent to the Regulator. In case of offsite migration to a neighbouring private land, a copy of Notice of Offsite Migration is not required to be sent to the Regulator.

4.3.4 Offsite Remediation on Crown Land

If contamination has migrated into neighboring Crown land and concentrations exceed the applicable standards, then it needs remediation. In order to access Crown land to carry out offsite remediation, a permit holder must submit an application for Associated Oil and Gas Activity with a land use type of Site Remediation. The Oil and Gas Activity Application Manual should be followed when applying for the right to occupy Crown land.

In order to carry out changes in and about a stream during offsite remediation, a permit holder must submit an application for Changes In and About a Stream under Section 11 of the Water Sustainability Act and secure approvals before proceeding.

4.4 Remediation

Contaminated sites must be cleaned up in accordance with Section [16](#) of the CSR. The CSR states that either numerical standards or the risk based standards prescribed under Section [18](#) [Application of Risk-based Standards for Remediation] or [18.1](#) [Application of Risk-based Standards for Remediation at Wide Area Sites] of the CSR may be used in relation to the remediation of a contaminated site.

4.4.1 Soil Remediation

The selection of soil remediation methods should be based on professional judgement. A few common soil remediation options are provided in Protocol [15](#): [Soil Treatment Facility Design and Operation for Bioremediation of Hydrocarbon Contaminated Soil], Technical Guidance [14](#) [Operation of Soil Treatment Facilities for the Bioremediation of Hydrocarbon Contaminated Soil] and Protocol [3](#) [Blending, Mixing, or Dilution as a Remediation Approach]. The excavation of soil and disposal of the soil at a secure landfill is the most common practice which involves hauling the contaminated soil to a landfill permitted under EMA to accept such material. Notification of independent remediation (NIR) is required under EMA for soil remediation.

Soil Disposal or Relocation

The responsible person to cleanup a contaminated site must ensure that the contaminated soil removed from a site during remedial activities has been disposed of in accordance with EMA. Contaminated soil can be sent to a facility preauthorized to accept soil up to maximum concentrations of contaminants.

If the receiving site is not authorized to accept contaminated soil, a Contaminated Soil Relocation Agreement is required. Section [55](#) of EMA and Sections [40–46](#) of the CSR specify requirements for such soil relocation.

Bioremediation

Concentrations of hydrocarbon constituents in excavated soils can be reduced through biodegradation which is a controlled process that involves constructing cells, piles or rows of contaminated soils and stimulating microbial activity within the soils through aeration and the addition of nutrients and moisture. Bioremediation techniques can be used to treat non-hazardous waste hydrocarbon contaminated soils as part of a remediation strategy. Bioremediation is a regulated activity under [EMA](#) and the requirements must be met throughout the process.

Design, operation and maintenance requirements for bioremediation facilities are detailed in Protocol 15 [Soil

Treatment Facility Design and Operation for Bioremediation of Hydrocarbon Contaminated Soil]. Technical Guidance 14 augments Protocol 15 by providing recommendations relating to the operation of bioremediation facilities and describing when a discharge authorization may be required during their operation.

Soil must be managed appropriately in accordance with EMA and its regulations. Bioremediation activities trigger the notification of independent remediation (NIR) requirements of EMA as per Section 54. Contaminated site management is a prescribed activity and is defined under Schedule 1 of the Waste Discharge Regulation (WDR). Any discharge of waste from a soil treatment facility requires authorization under EMA.

Blending Contaminated Soils

Blending soils containing different contaminant concentrations to obtain a uniform material of a desired quality without reducing the contamination mass can be used as a remediation strategy. Blending non-hazardous waste is not specifically prohibited under the CSR and can be considered as a possible remediation technique where risk-based standards are used, as per Protocol 3 [Blending, Mixing, or Dilution as a Remediation Approach]. Blending non-hazardous waste is not considered an acceptable remediation approach where numerical remediation standards are used for the sole purpose of circumventing regulatory restrictions, as per Protocol 3. Blending of hazardous waste is prohibited under Section 36 of the Hazardous Waste Regulation (HWR).

Blending soils can be a possible remediation option where risk-based standards are used on a site-specific basis to demonstrate that the proposal to blend contaminated material will result in a net benefit to the environment and no unacceptable risk to human health or the environment.

Other Remediation Methods

Phytoremediation or other methods may be used to remediate soil as appropriate based on professional judgement. These methods may be carried out independently or in combination with other techniques.

Remediation of Hazardous Wastes

Under Section 7 of EMA, a person who produces, stores, transports, handles, treats, recycles, deals with, processes, or owns a hazardous waste must keep the hazardous waste confined in accordance with the Hazardous Waste Regulation (HWR). A list of hazardous wastes is provided in Schedule 7 of the HWR. As per Section 43 [Registration of Hazardous Waste] of the HWR, a person who treats, recycles or disposes of a quantity of a category of hazardous waste greater than the quantity set out in Column II of Schedule 6 must register the hazardous waste and apply for a registered site number. The registration form is provided as Form 1 in Schedule 5 of the HWR. Samples of hazardous waste must be analyzed in accordance with Section 49 [Analytical Methods] of the HWR. The application for land treatment sites to remediate hazardous wastes and closure requirements for such sites is regulated under Part 3 and Part 4 of the HWR.

Remediation of Sites Contaminated by a Spill

A spill is a release or discharge into the environment of a substance not authorized under EMA. Requirements for managing spillage from oil and gas activities are detailed in Section 37 of [ERAA](#). Spills of an amount equal to or greater than the amount listed within the Spill Reporting Regulation (SRR) must be reported to Emergency Management BC (EMBC) in accordance with the SRR. If spillage occurs, a permit holder or person carrying out the oil and gas activity must comply with Section 37 of [ERAA](#).

If the cleanup of a spill is sufficient to be in compliance with Section 37 of [ERAA](#), then no further investigation and/or remediation is required. If cleanup is not sufficient to fulfill requirements of the Section 37 of [ERAA](#) and continued monitoring, risk management, or extensive remediation is needed, then the site may be considered contaminated and further actions may be required in accordance with [EMA](#) and CSR.

Independent remediation of spill sites is often undertaken by a responsible party to improve the environmental quality of a site affected by a spill. Anyone undertaking independent remediation must provide written notification of independent remediation to the MoE Director of Waste Management. If a spill was reported during the initial emergency response under the SRR, the duty to provide notification of initiation of independent remediation is deemed to have been met but notification of completion is still required.

If it is determined during an investigation or the independent remediation of a spill site that one or more substances has migrated or could likely migrate from the spill site to a neighboring property and cause contamination or could likely cause contamination, the responsible person must notify the owner of that property in writing. A copy of this notification must also be sent to the MoE Director of Waste Management. Regulatory requirements related to off-site migration notification are found in Section 60.1 of the CSR. In case of offsite migration to a neighbouring Crown land, a copy of Notice of Offsite Migration is required to be sent to the Regulator. In case of offsite migration to a neighbouring private land, a copy of Notice of Offsite Migration is not required to be sent to the Regulator.

Notification of Likely or Actual Migration Form is provided in Protocol 17 [Forms for Notifications of Independent Remediation and Migration].

Soil Remediation to Numerical Standards

Soil contamination at an oil and gas site must be remediated to numerical standards where numerical remediation standards are used. Generic numerical soil standards are presented in Schedule 3.1-Part 1 and Schedule 3.1-Part 2 of the CSR, respectively. Matrix numerical soil standards are presented in Schedule 3.1Part 1 and site-specific numerical standards may be developed in accordance with Protocol 2 for comparison purposes and to determine when a site has been adequately cleaned up.

Soil Remediation to Risk-Based Standards

Soil may be remediated to risk-based standards where risk-based remediation standards are used. Under Section [16](#) of the CSR, risk-based standards prescribed in section [18](#) or [18.1](#) may be used in relation to the soil remediation of a contaminated site.

4.4.2 Groundwater Remediation

Remediation to Numerical Standards

Groundwater contamination originating or resulting from an oil and gas site must be remediated to numerical standards where numerical remediation standards are used. Generic numerical water standards are presented in Schedule 3.2 of the CSR for comparison purposes and to determine when a site has been adequately cleaned up. The selection of groundwater remediation methods should be based on professional judgement.

Remediation to Risk-Based Standards

Groundwater may be remediated to risk-based standards where risk-based remediation standards are used. Under Section [16](#) of the CSR, risk-based standards may be used in relation to the groundwater remediation of a contaminated site. The groundwater concentrations at receiving environments should be used in accordance with Protocol 13 to determine whether groundwater contamination presents an unacceptable risk to the environment and whether remedial action is required.

Surface Water Remediation

Remediation to Numerical Standards

Surface water contamination originating or resulting from an oil and gas site must be remediated to numerical standards where numerical remediation standards are used. Surface water standards for aquatic life, wildlife, livestock and irrigation water use are presented in the WQG for comparison purposes and to determine when a site has been adequately cleaned up. The selection of surface water remediation methods should be based on professional judgement.

Remediation to Risk-Based Standards

Surface water may be remediated to risk-based standards where risk-based remediation standards are used. Under Section [16](#) of the CSR, risk-based standards may be used in relation to the surface water remediation of a contaminated site.

Protocol 13 shall not be used to screen sites that contain contaminated surface water except where the contamination is related to a beneficial use. If a site exceeds the WQG and is to be remediated to risk-based standards, a detailed risk assessment must be completed.

4.4.3 Sediment Remediation

Remediation to Numerical Standards

Contaminated sediments must be remediated to applicable numerical remediation standards. Generic numerical sediment standards are presented in Schedule 3.4 of the [CSR](#) for comparison purposes and to determine when a site has been adequately cleaned up.

Remediation to Risk-Based Standards

Under Section [16](#) of the CSR, risk-based standards may be used in relation to the remediation sediments on a contaminated site. Protocol 13 shall not be used to screen sites that contain contaminated sediments except where the contamination is related to a beneficial use. If a site exceeds Schedule 3.4 and is to be remediated to risk-based standards, a detailed risk assessment must be completed.

Vapour Remediation

Remediation to Numerical Standards

Vapour contamination must be remediated by source reduction or removal to applicable numerical remediation standards. Generic numerical vapour standards are presented in Schedule 3.3 of the CSR for comparison purposes and to determine when a site has been adequately cleaned up.

Remediation to Risk-Based Standards

Under Section [16](#) of the CSR, risk-based standards may be used in relation to the remediation of vapour on a contaminated site. Protocol 13 shall not be used to screen sites that contain soil vapour for all land uses except Wild Lands land use.

4.5 Confirmation of Remediation

Post-cleanup sampling and analyses are required to ensure that the contaminants have been removed and that the residual soil, groundwater, surface water, sediment and vapour meet the applicable numerical remediation standards for soil, groundwater, surface water, sediments and vapour. Sites cleaned up to meet risk-based standards will require post-cleanup inspections and environmental monitoring to ensure that any exposure of receptors to substances remaining in place has been mitigated and satisfies the applicable remediation standards.

4.5.1 Soil Confirmation

After soil remediation is complete, confirmation sampling is required to ensure soil concentrations do not exceed applicable numerical or risk-based CSR standards. If samples collected along the boundary of the remediated area exceed applicable

remediation standards, then remediation efforts should be extended to those locations which exceed applicable standards as per [Technical Guidance 1](#) [Site Characterization and Confirmation Testing]. Additional remediation will be required if remediated soil exceeds numerical or risk based CSR standards. A site is considered remediated if all soil, groundwater, surface water, sediment, and vapour samples do not exceed either the background concentrations or numerical or risk-based CSR standards as per Sections [17\(1\)](#) and [17\(2\)](#) of the CSR.

4.5.2 Groundwater Confirmation

If groundwater contamination is present at the site, groundwater confirmation samples must be collected after remediation in order to verify that the groundwater substances do not exceed numerical or risk-based remediation standards as per [Technical Guidance 8](#) [Groundwater Investigation and Characterization].

If soil remediation occurred near aquatic receiving environments, groundwater confirmation samples should not exceed the standards provided in [Technical Guidance 15](#) [Concentration Limits for the Protection of Aquatic Receiving Environments].

If soil remediation occurred where potential preferential pathways are present between the zone of soil contamination and the aquifer then post-cleanup groundwater confirmation must be completed.

If soil remediation occurred where potential mechanisms of contaminant transport are not present between the zone of soil contamination and the aquifer then post-cleanup groundwater confirmation may be exempted.

4.5.3 Surface Water Confirmation

If surface water contamination is present at the site, surface water confirmation samples must be collected after remediation in order to verify that the surface water substances do not exceed numerical or risk-based remediation standards.

4.5.4 Sediment Confirmation

After sediment remediation is complete, confirmation sampling is required to ensure the substance concentrations do not exceed the applicable numerical or risk-based [CSR](#) standards. If remediation occurred near aquatic receiving environments, sediment confirmation samples should not exceed the standards provided in [Technical Guidance 15](#) [Concentration Limits for the Protection of Aquatic Receiving Environments].

4.5.5 Vapour Confirmation

If vapour contamination is present at the site, vapour confirmation samples must be collected after remediation in order to verify that the vapour contaminant is either less than the applicable [Schedule 3.3](#) standard in the breathing zone or, for the gasoline and diesel components listed in Table 1 in [Technical Guidance 4](#) [Vapour Investigation and Remediation], less than their detection limits in soil, sediment, and water. Where vapour

remediation includes risk assessment, it must be demonstrated that the risk associated with exposure to vapour contaminants do not exceed the risk based standards under Section [18](#) of the CSR.

4.5.6 Completion of Remediation

If soil, groundwater, surface water, sediment and vapour confirmation samples do not exceed the applicable numerical (or in case of risk-based standards, the site does not present an unacceptable risk to the environment or human health) the site can be considered remediated as per Section [17](#) of the CSR.

Upon completion of remediation all Areas of Environmental Concern (AECs) with associated Contaminants of Concern (COCs) must be considered remediated to numerical standards or in case of risk-based standards, the site does not present an unacceptable risk to the environment or human health.

4.5.7 Remediation at Grade

Where surface reclamation activities change the depth of cover or result in vertical movement within the soil profile, remediation is only considered to be complete if soils continue to meet the standards applicable with respect to the existing depth of cover. For example, on a sloped site with a cut and fill, a pre-reclamation soil at depth may meet applicable standards (e.g. CL at 3 metres or greater) but upon re-contouring the site to replace the cut, the CL quality soils may be exposed or at shallower depth to which AL or PL standards may be applicable.

4.5.8 Reporting

The site remediation report must satisfy the Regulator's minimum reporting requirements. The site investigation and remediation reporting requirements are presented in the Appendix B of this manual.

4.5.9 Professional Statements

The Regulator requires that a qualified environmental professional must certify the following statements:

- The investigations and remediation referred in this report has been conducted in accordance with all requirements in EMA and the CSR.
- The reported information is true based on the current knowledge as of the date completed.
Where data gaps exist in the report, professional judgement has been used.
- The signatory has demonstrable experience with remediation of the type of contamination at the site for which the statement applies and is familiar with the remediation carried out on the site.

In order for a site to obtain certification or demonstrate compliance with the DASR, the Regulator requires that site investigation and remediation at oil and gas sites be

conducted by or under the direct supervision of a qualified environmental professional and requires that the professional statement be signed and dated by the qualified professional.

Chapter 5: CoR Part 1 Applications and Dormant Site Assessment Reporting

The Certificate of Restoration [Part 1](#) Application process involves site screening and site investigation to assess the presence and potential impacts of any residual contamination and the effectiveness of remedial actions associated with the activity. The Certificate of Restoration (CoR) Part 1 Application Form evaluates the acceptability of site screening, site investigation and remedial actions allowing the Regulator to assess and confirm that all regulatory requirements are met before approving a CoR Part 1 Application for an oil and gas site.

Please Note:

A CoR Part 1 Application is not required for sites that have received written notification of BCER satisfaction with remediation under Section 8 of the Dormancy and Shutdown Regulation.

This chapter provides an overview of the Certificate of Restoration Part 1 Application process and Dormant Site Assessment Reporting including:

- Regulatory requirements
- Submission requirements
- Application form information
- Professional statement

5.1 Regulatory Requirements

It is the obligation of the permit holder to fulfill the regulatory requirements associated with the permit. The permit holder must adhere to the requirements outlined in the Energy Resource Activities Act ([ERAA](#)), Environmental Management Act ([EMA](#)), Petroleum and Natural Gas Act ([PNGA](#)), Contaminated Sites Regulation (CSR), Oil and Gas Waste Regulation ([OGWR](#)), Hazardous Wastes Regulation ([HWR](#)), Dormancy and Shutdown Regulation (DASR), and the Environmental Protection and Management Regulation ([EPMR](#)) for site screening, site investigation, site remediation and surface reclamation.

5.1.1 Permit Holder Obligations for Site Restoration

The Dormancy and Shutdown Regulation details requirements for the decommissioning, assessment, remediation, and restoration of dormant sites. Sections 40(a) to 40(d) of

ERAA establish that if a permit, a permission specified in a permit or an authorization is cancelled, is declared spent, or expires, the permit holder or former permit holder, unless otherwise ordered by the Regulator, must perform the obligations imposed in relation to the permit, permission or authorization under ERAA or a specified enactment, and under the permit or authorization that has not been performed by the date of the cancellation, declaration or expiry.

As per Section 40(e) and 40(f) of ERAA, the permit holder or former permit holder must, unless otherwise ordered by the Regulator, comply with the prescribed requirements of the EPMR, and carry out any other actions for the purposes of restoration or the protection of public safety that the Regulator orders the permit holder or former holder to carry out.

5.1.2 Certificate of Restoration Part 1

Sections 41(1) and 41(2) of ERAA, establish that a permit holder may apply to the Regulator for a Certificate of Restoration (CoR) by submitting the required forms and that the Regulator may issue a CoR to the permit holder certifying that the Regulator is satisfied with the site restoration. Permit holders are required to continue Crown land surface tenure payments at oil and gas sites on Crown land until a Certificate of Restoration has been issued.

As per Section 41(3) of ERAA, the issuance of a CoR does not relieve the permit holder from any obligations of any matter that was not known to the Regulator at the time the CoR was issued.

5.1.3 Environmental Management Act Requirements

Under Section 43(2) of ERAA, the Regulator may not approve a CoR application for a site where a site profile is required, until both the applicant and the Regulator have fulfilled their obligations under EMA. If the EMA requirements have not been met and/or the Regulator is not satisfied with the information provided then the Regulator will require further information or reject the application.

5.1.4 Site Profiles

Under Section 40(3) of EMA, the permit holder must provide a site profile to the Regulator at the time the permit holder applies for a Certificate of Restoration with respect to an oil and gas activity in accordance with Section 41 of ERAA.

Under Section 5 of the CSR, it is the permit holder's obligation to provide a completed site profile under Section 40 (1), (2), (6), (7) and (8) of EMA. The CSR is not satisfied until the person provides all the information required in the site profile.

Pursuant to Section 2(1) of the CSR a person is exempt from the duty to provide a site profile under Section 40 (1), (2), (3), (6) and (7) of EMA with respect to industrial or commercial purposes and industrial or commercial activities which are not described in Schedule 2.

Pursuant to Section 4(1) of the CSR, a person is exempt from the duty to provide a site profile under Section 40 of EMA if the site is the subject of a Certificate of Restoration issued under ERAA, but only if the person has no reason to believe that there is contamination at the site that was not otherwise addressed in the Certificate of Restoration.

Assessing and Forwarding Site Profiles

Pursuant to Section 6(2) of the CSR, for the purposes of Section 40(4) of EMA, on receipt of a site profile the Regulator must, within 15 days after receiving it:

- Assess if the site profile is satisfactorily completed.
- Notify the person who provided the site profile if the site profile is not satisfactorily completed; and
- Forward a copy of the satisfactorily completed site profile to the registrar.

Regulator's Responsibilities After Receiving a Site Profile

Pursuant to Section 7(3) of the CSR, the Regulator, within 15 days after receiving a site profile under Section 40 (3) of EMA, must notify the person who provided the site profile whether the Regulator intends to require or order a preliminary site investigation under Section 41 of EMA.

Pursuant to Section 7(4) of the CSR, the Regulator may extend the time for notification under Subsection (3) to a maximum of 30 days if the extension is necessary to obtain information to determine whether or not a preliminary site investigation will be required or ordered, and in doing so the Regulator must inform the persons described in Subsection (3) of:

- The duration of the extension; and
- The nature of the information required.

5.1.5 Site Contamination Triggers

This subsection identifies the potential sources of contamination on an oil and gas site. As a legal requirement under Section 40(3) of EMA, a site profile provides the following two forms of information to identify potential sources of contamination at a property:

- CSR Schedule 2 Industrial and Commercial Purposes and Activities; and
- Areas of Potential Environmental Concerns.

5.1.6 Site Investigations

If potential sources of contamination are identified through a site profile on an oil and gas site, each potential source should be investigated so the permit holder can demonstrate that the site does not pose unacceptable risk to human health or the environment in accordance with the CSR standards or accepted risk based approaches. If risks have not been resolved to the satisfaction of the Regulator, pursuant to Section 43(2) of ERAA, the Regulator will not approve a CoR application for a site and will either reject the application,

require further actions to meet the requirements, or will forward the file to the MoE Director.

5.1.7 Site Remediation

If substances encountered during site investigations have concentrations exceeding the applicable standards, remediation will be required. Section [16](#) of the CSR, states that either numerical standards, or the risk based standards prescribed under Section [18](#) [Application of Risk-based Standards for Remediation] or [18.1](#) [Application of Risk-based Standards for Remediation at Wide Area Sites] of the CSR, may be used as the criteria for remediation of a contaminated site.

5.2 Submission Requirements

There are three possible site conditions and for each of the three conditions there are two application options for submission of a CoR Part 1 Application. The following provides a list of the site conditions and the options available:

- Site is not contaminated.
- Site was contaminated and remediated to numerical remediation standards.
- Site was contaminated and remediated to risk-based remediation standards.

Two options of the submission to the Regulator for each condition include:

- Submission without MoE instrument.
- Submission with MoE instrument.

The subsections below present each site condition along with corresponding submission options.

5.2.1 Site is Not Contaminated

Option 1: Submission without MoE Instrument

CoR Part 1 Application

The permit holder submits a CoR Part 1 application package to the Regulator with investigation report(s) and information indicating that the site does not have concentrations of substances that exceed the standards and criteria prescribed in the CSR for the applicable land, water and sediment uses. If the submitted information is complete and accurate, the submission will be accepted by the Regulator as a CoR Part 1 application. Upon positive decision by the SDM, the Regulator will notify the permit holder in writing as follows:

- The Regulator does not require the submission of a preliminary site investigation (PSI) under Section 41 of EMA;
- Pursuant to Section 41 of ERAA, the permit holder must reclaim the site; and
- Submit a CoR [Part 2](#) Application Form with a reclamation report and a prescribed fee.

Dormancy and Shutdown Regulation Submission

The permit holder submits a report to the Regulator per Section 7 (b) of the DASR with information indicating that the site does not have concentrations of substances that exceed the standards and criteria prescribed in the CSR for the applicable land, water and sediment uses. If the submitted information is complete and accurate, the submission will be accepted by the Regulator and upon positive decision by the SDM, the Regulator will notify the permit holder in writing as follows:

- The Regulator is satisfied, based on the information submitted, that the site and any neighboring lands to which contamination has migrated from the site meet the numerical standards under Section 8 of the Dormancy and Shutdown Regulation.

Option 2: Submission with MoE Instrument

CoR Part 1 Application

A CSAP Numerical Standards Approved Professional submits a site determination application package to the Ministry of Environment (MoE) with recommendations and information indicating that the site does not have concentrations of substances that exceed standards and criteria prescribed in the CSR for the applicable land, water and sediment use. The MoE will issue a final determination if the submitted package meets the requirements of the CSR and is acceptable.

The Regulator will accept a copy of the final determination with the investigation report(s) in lieu of the CoR Part 1 application and will notify the permit holder in writing as follows:

- Pursuant to Section 41 of ERAA, the permit holder must reclaim the site; and
- Submit a CoR Part 2 Application Form with a reclamation report and a prescribed fee.

Dormancy and Shutdown Regulation Submission

A CSAP Numerical Standards Approved Professional submits a site determination application package to the Ministry of Environment (MoE) with recommendations and information indicating that the site does not have concentrations of substances that exceed standards and criteria prescribed in the CSR for the applicable land, water and sediment use. The MoE will issue a final determination if the submitted package meets the requirements of the CSR and is acceptable.

The Regulator will accept a copy of the final determination with the investigation report(s) as and will notify the permit holder in writing as follows:

- The Regulator is satisfied, based on the information submitted, that the site and any neighboring lands to which contamination has migrated from the site meet the numerical standards under Section 8 of the Dormancy and Shutdown Regulation.

5.2.2 Site was Contaminated and Remediated to Numerical Standards

Option 1: Submission without MoE Instrument

CoR Part 1 Application

The permit holder submits a CoR Part 1 application package to the Regulator with investigation, remediation and confirmation of remediation report(s) and information indicating that the site was contaminated and remediated to applicable CSR numerical remediation standards for land, water and sediment use. If the submitted information is complete and accurate, the submission will be accepted by the Regulator as a CoR Part 1 Application. Upon positive decision by SDM, the Regulator will notify the permit holder in writing as follows:

- The Regulator does not require the submission of a preliminary site investigation (PSI) under Section 41 of EMA.
- Pursuant to Section 41 of ERAA, the permit holder must reclaim the site; and
- Submit a CoR Part 2 Application Form with a reclamation report and a prescribed fee.

Dormancy and Shutdown Regulation Submission

The permit holder submits a report to the Regulator per Section 7 (b) of the DASR with information indicating that the site was contaminated and remediated to applicable CSR numerical remediation standards for land, water and sediment use. If the submitted information is complete and accurate, the submission will be accepted by the Regulator. Upon positive decision by SDM, the Regulator will notify the permit holder in writing as follows:

- The Regulator is satisfied, based on the information submitted, that the site and any neighboring lands to which contamination has migrated from the site meet the numerical standards under Section 8 of the Dormancy and Shutdown Regulation.

Option 2: Submission with MoE Instrument

CoR Part 1 Application

A CSAP Numerical Standards Approved Professional submits a Certificate of Compliance (CoC) application package to the MoE with recommendations and information indicating that remediation is complete and does not have concentrations of substances that exceed

standards and criteria prescribed in the CSR for the applicable land, water and sediment use. The MoE will issue a CoC if the submitted package is acceptable.

The Regulator will accept a copy of the CoC with investigation, remediation and confirmation of remediation report(s) in lieu of the CoR Part 1 application and will notify the permit holder in writing as follows:

- Pursuant to Section 41 of ERAA, the permit holder must reclaim the site; and
- Submit a CoR Part 2 Application Form with a reclamation report and a prescribed fee.

Dormancy and Shutdown Regulation Submission

A CSAP Numerical Standards Approved Professional submits a Certificate of Compliance (CoC) application package to the MoE with recommendations and information indicating that remediation is complete and does not have concentrations of substances that exceed standards and criteria prescribed in the CSR for the applicable land, water and sediment use. The MoE will issue a CoC if the submitted package is acceptable.

The Regulator will accept a copy of the CoC with investigation, remediation and confirmation of remediation report(s) and will notify the permit holder in writing as follows:

- The Regulator is satisfied, based on the information submitted, that the site and any neighboring lands to which contamination has migrated from the site meet the numerical standards under Section 8 of the Dormancy and Shutdown Regulation.

5.2.3 Site was Contaminated and Remediated to Risk-based Standards

Option 1: Submission without MoE Instrument Option 1a: Submission by Qualified Environmental Professional

For complex sites and sites where a source pathway receptor approach cannot rule out impact to a receptor be applied or where a detailed ecological risk assessment is required, the Regulator may require involvement of a CSAP Risk-based Standards Approved Professional.

CoR Part 1 Application

A Qualified Environmental Professional submits a CoR Part 1 application package to the Regulator with investigation, remediation and confirmation of remediation and risk assessment report(s) and information indicating that remediation to accepted risk-based approaches such as the source pathway receptor model was used under Protocol 13 [Screening Level Risk Assessment]. The risk meets the site specific risk-based CSR

standards under current and future site circumstances and uses with or without intrinsic controls. If the submitted information is complete and accurate the submission will be accepted as a CoR Part 1 application by the Regulator. Upon positive decision by the SDM, the Regulator will notify the permit holder in writing as follows:

- The Regulator does not require the submission of a preliminary site investigation (PSI) under Section 41 of EMA.
- Pursuant to Section 41 of ERAA, the permit holder must reclaim the site; and
- Submit a CoR Part 2 Application Form with a reclamation report and a prescribed fee.

Dormancy and Shutdown Regulation Submission

A Qualified Environmental Professional submits report under Section 7 (b) of the DASR indicating that remediation to acceptable risk-based approaches such as the source pathway receptor model was used under Protocol 13 [Screening Level Risk Assessment]. The risk meets the site specific risk-based CSR standards under current and future site circumstances and uses with or without intrinsic controls. If the submitted information is complete and accurate the submission will be accepted by the Regulator. Upon positive decision by the SDM, the Regulator will notify the permit holder in writing as follows:

- The Regulator is satisfied, based on the information provided, that the site and any neighboring lands to which contamination has migrated from the site have been remediated in accordance with Section 8 of the Dormancy and Shutdown Regulation.

Option 1b: Submitted by a CSAP Risk-based Standards Approved Professional CoR Part 1 Application

A CSAP Risk-based Standards Approved Professional submits a CoR Part 1 application package to the Regulator with investigation, remediation and confirmation of remediation and risk assessment report(s) and information indicating that after remediation, the quantified risks meet the site specific risk-based CSR standards under current and future site circumstances and uses with or without intrinsic controls. If the submitted information is complete and accurate the submission will be accepted as CoR Part 1 application by the Regulator. Upon positive decision by the SDM, the Regulator will notify the permit holder in writing as follows:

- The Regulator does not require the submission of a preliminary site investigation (PSI) under Section 41 of EMA.
- Pursuant to Section 41 of ERAA, the permit holder must reclaim the site; and
- Submit a CoR Part 2 Application Form with a reclamation report and a prescribed fee.

Dormancy and Shutdown Regulation Submission

A CSAP Risk-based Standards Approved Professional submits an assessment report under Section 7 (b) of the DASR indicating that after remediation, the quantified risks meet the site specific risk-based CSR standards under current and future site circumstances and uses with or without intrinsic controls. If the submitted information is complete and accurate the submission will be accepted as CoR Part 1 application by the Regulator. Upon positive decision by the SDM, the Regulator will notify the permit holder in writing as follows:

- The Regulator is satisfied, based on the information provided, that the site and any neighboring lands to which contamination has migrated from the site have been remediated in accordance with Section 8 of the Dormancy and Shutdown Regulation.

Option 2: Submission with MoE Instrument

CoR Part 1 Application

A CSAP Risk-based Standards Approved Professional submits a Certificate of Compliance – Risk-based Application Package to the MoE with recommendations and information indicating that after remediation, the quantified risks meets the site specific risk-based CSR standards under current and future site circumstances and uses with or without intrinsic controls. The MoE will issue a risk-based CoC if the submitted package is acceptable. The Regulator may accept a copy of the CoC with investigation, remediation, confirmation of remediation and risk assessment report(s) in lieu of the CoR Part 1 application. Upon positive decision by the SDM, the Regulator will notify the permit holder in writing as follows:

- Pursuant to Section 41 of the ERAA, the permit holder must reclaim the site; and
- Submit a CoR Part 2 Application Form with a reclamation report and a prescribed fee.

Dormancy and Shutdown Regulation Submission

A CSAP Risk-based Standards Approved Professional submits a Certificate of Compliance (CoC) – Riskbased Application Package to the MoE with recommendations and information indicating that after remediation, the quantified risks meets the site specific risk-based CSR standards under current and future site circumstances and uses with or without intrinsic controls. The MoE will issue a risk-based CoC if the submitted package is acceptable. The Regulator may accept a copy of the CoC with assessment report. Upon positive decision by the SDM, the Regulator will notify the permit holder in writing as follows:

- The Regulator is satisfied, based on the information provided, that the site and any neighboring lands to which contamination has migrated from the site have been remediated in accordance with Section 8 of the Dormancy and Shutdown Regulation.

5.3 CoR Part 1 Application and Dormant Site Assessment Report

The Regulator maintains high standards of environmental quality to ensure that all oil and gas sites are returned to the landowner in acceptable condition for current and future use. In order to maintain this high standard, the BCER's Certificate of Restoration Part 1 Application process involves site screening and investigations to assess the presence and potential impacts of any residual contamination and confirm effectiveness of remedial actions.

If the submitted application information is incomplete or inaccurate, the permit holder must provide further information as required or the application will be rejected.

Each CoR Part 1 application is adjudicated by a statutory decision maker (SDM) at the Regulator who decides whether the risks to the environment from potential contaminants have been adequately mitigated in light of all other site specific factors.

For risk-based remediation approaches, the Regulator recommends the permit holder conduct pre-remediation and pre-application meetings with the BCER's Supervisor, Environmental Stewardship for sites that are planned to be remediated to risk-based remediation standards in order to clarify the site-specific requirements.

5.3.1 Application or Assessment Form

The [Dormant Site Assessment Form](#) and the [Certificate of Restoration Part 1 Application Form](#) must be completed by a qualified professional or technologist registered as a member in good standing with an organization operating under an act of the British Columbia legislature.

Sections A – K of these forms may be completed using the information collected as part of the site screening. Section L of the form must be completed stating the outcome of site screening, investigation, remediation, and confirmation of remediation and risk assessment.

The outcomes must include, but are not limited to, the following.

Site Screening

Identify oil and gas sites that require investigations and a list of areas of potential environmental concern (APECs) and potential contaminants of concern (PCOCs) must be provided.

Site Investigations

Confirm the presence or absence of potential contaminants of concern within the areas of potential environmental concern. If the site is contaminated, then a list of areas of environmental concern (AECs) and associated contaminants of concern (COCs) must be provided.

Site Remediation

Confirm if all AECs with associated COCs are remediated to numerical standards or, in case of risk-based standards, that the site does not present an unacceptable risk to the environment or human health.

5.3.2 Environmental Site Assessment Checklist

A completed copy of the [Environmental Site Assessment Checklist](#) must be submitted to the Regulator as part of a dormant site assessment under Section 7 of the Dormancy and Shutdown Regulation (DASR) or with an application for a Certificate of Restoration Part 1 under Section 41(1) of the Energy Resource Activities Act.

The Regulator will review and validate the following information in the Environmental Site Assessment Checklist submitted, before certifying an oil and gas site.

- Are all the regulatory requirements fulfilled?
- Have the investigation and remediation been completed and are they acceptable?
- Is the quality of data acceptable?
- Are investigation and remediation conclusions acceptable?
- Can the Regulator rely on the professional who submitted the application?
- Is the site ready to be certified?

The permit holder provides yes or no answers in the checklist based on the information collected during the site screening, site investigation and remediation. Based on the information submitted in the checklist, the Regulator will certify a site if the answer is yes to the above questions.

5.3.3 Attachments

The Regulator requires the following documentation to be included with the Dormant Site Assessment or as part of the CoR Part 1 application package:

- Completed CoR Part 1 Application Form, or Dormant Site Assessment Form
- Completed Environmental Site Assessment Checklist
- Site investigation, remediation, confirmation of remediation and risk assessment report(s), if applicable
- Site Profile
- Site Classification Report
- Original aerial photographs
- Photographs of the site during the site visit
- Drilling Waste Checklist or Intrusive Sampling Results
- Diagram showing sump location and other features

- Site Survey Plan

5.4 Professional Statements

Professional statements are included in Section M of the CoR Part 1 Application Form and the Dormant Site Assessment Form and in Section G of the Environmental Site Assessment Checklist. These statements must be signed, sealed and dated by a qualified professional.

5.4.1 Declaration – Section M

The declaration section (Section M) of the CoR Part 1 Application Form or the Dormant Site Assessment Form must be completed, acknowledging that the information provided is true and that no relevant information has been omitted.

5.4.2 Professional Signature – Environmental Site Assessment Checklist

A qualified professional must sign the checklist indicating that the investigations and information in the checklist are true based on the current knowledge as of the date completed and have been conducted in accordance with approved procedures and standards of professional practice. The qualified professional must also confirm that they have demonstrable experience in conducting investigations of the type reviewed above.

Chapter 6: Site Reclamation and CoR

Part 2 Application

The intention of site reclamation is to ensure that the site surface conditions are restored to equivalent conditions as predevelopment when the site is no longer required for the oil and gas activity or ancillary activity. The Certificate of Restoration (CoR) [Part 2](#) Application Form evaluates the acceptability of surface reclamation allowing the Regulator to assess and confirm that all the regulatory requirements are met before certifying an oil and gas site. This chapter briefly outlines the site reclamation and CoR part 2 application process, as described in the following sections:

- Certificate of Restoration Part 2 requirements
- Site reclamation in the Agricultural Land Reserve
- Site reclamation outside of the Agricultural Land Reserve
- Reclamation assessment
- Certificate of restoration part 2 application information
- Certificate of Restoration Part 2 Application

6.1 Certification of Restoration Part 2 Requirements

It is the obligation of the permit holder to fulfill the regulatory requirements associated with the permit. The permit holder must also adhere to the requirements outlined in the Energy Resource Activities Act ([ERAA](#)), the Environmental Protection and Management Regulation ([EPMR](#)), the [Pipeline Regulation](#) and the [Delegation Agreement](#) of December 8, 2017 signed between the Regulator and the Provincial Agricultural Land Commission (ALC). The regulatory requirements in this chapter are derived from [ERAA](#), the [EPMR](#), the [Pipeline Regulation](#) and the [Delegation Agreement](#) between the Regulator and the ALC.

6.1.1 Requirements under ERAA

Sections [40\(a\)](#) to [40\(d\)](#) of ERAA establishes that if a permit, a permission specified in a permit or an authorization is cancelled, declared spent, or expires, the permit holder or former permit holder, unless otherwise ordered by the Regulator, must perform the obligations imposed in relation to the permit, permission or authorization under ERAA or a specified enactment, and under the permit or authorization that has not been performed by the date of the cancellation, declaration or expiry.

As per Sections [40\(e\)](#) and [40\(f\)](#) of ERAA, the permit holder or former permit holder must unless otherwise ordered by the Regulator, comply with the requirements, and carry out any other actions for the purposes of restoration or the protection of public safety that the Regulator orders the permit holder or former holder to carry out.

6.1.2 Requirements under EMPR

Pursuant to Section [19](#) (1) of the EMPR, a person who carried out an oil and gas activity on an operating area and who no longer intends to do so must, as soon as practicable, restore the operating area by:

- De-compacting any soils compacted by the oil and gas activity.
- Redistributing any retrievable surface soils that were removed from the operating area during construction so that the soil structure is restored, to the extent practicable, to its condition before the oil and gas activity began.
- If the natural surface drainage pattern was altered by the oil and gas activity, restoring, to the extent practicable, the drainage pattern to its condition before the alteration.
- Re-vegetating any exposed soil on the operating area using seed or vegetative propagules of an ecologically suitable species that:
- Promote the restoration of the wildlife habitat that existed on the area before the oil and gas activity began, and
- Stabilize the soil if it is highly susceptible to erosion.
- Removing any structure that was constructed to cross a stream, wetland or lake and ensuring that the site of the structure is in a stable condition.
- Stabilizing any cut slopes or fill slopes in wellsites and facility areas; and
- Re-contouring bladed areas or excavations in pipeline corridors and seismic lines.

Pursuant to Section [19](#) (3) of the EMPR, Subsection (1) (a) and (b) does not apply to an operating area that is a road right-of-way.

6.1.3 Requirements under Pipeline Regulation

Pursuant to Section [5](#)(2) of the Pipeline Regulation, A pipeline permit holder must restore the surface of the land disturbed by the construction of a pipeline in accordance with Subsection (3), by:

- Removing all structures installed to facilitate construction and not required for the operation of the pipeline, and
- Stabilizing, contouring, conditioning or reconstructing the surface of the land to the extent reasonable in the circumstances.

Pursuant to Section [5](#)(3) of the Pipeline Regulation, restoration work under Subsection (2) must be carried out:

- As soon as practicable, considering, without limitation, weather and ground conditions, while construction of the pipeline is underway, and,
- With respect to any restoration work not completed when construction of the pipeline is completed, as soon as practicable after construction of the pipeline is completed.

Pursuant to Section [11](#) of the Pipeline Regulation, the following requirements are prescribed with respect to a pipeline permit for the purposes of Section [40](#)(e) of ERAA:

- Abandonment of the pipeline in accordance with CSA Z662;
- Completion of the requirements in Section 19 (1) (a) to (g) of the Environmental Protection and Management Regulation.

6.1.4 Requirements under Delegation Agreement between BCER and ALC

Surface reclamation requirements for lands in the Agricultural Land Reserve (ALR) are detailed in Schedule B of the [Delegation Agreement](#) of December 8, 2017 signed between the BCER and the Provincial Agricultural Land Commission (ALC).

6.2 Site Reclamation in the Agricultural Land Reserve

The purpose of site reclamation is to ensure that the surface soil, topography and the vegetation of the surface lease is restored to an equivalent condition and capability as predevelopment when the site is no longer required for the oil and gas activity.

Site reclamation requirements for lands in the Agricultural Land Reserve (ALR) are detailed in Schedule B of the Delegation Agreement signed between the BCER and the ALC. Site reclamation work must be completed in compliance with the applicable requirements in the Delegation Agreement. These requirements do not address site contamination and the disposal of wastes as these matters fall under EMA and CSR and must have been already addressed during the CoR Part 1 application process.

Schedule B reclamation criteria were established in 1995 under General Order 293/95. As per the Delegation Agreement, all sites developed after 1995 must meet the Schedule B criteria in the agreement unless the qualified specialist completing the report concludes that there is appropriate rationale for not fully applying the criteria to a site. Sites developed between 1976 and 1995 were subject to an ALC general order (either 132/82 or 4473/76) that required sites be restored to a condition as good or better than existed prior to the development. Schedule B reports must be submitted for all sites in the ALR regardless of when the oil and gas activity was initiated. For sites on private land the BCER requires permit holders to attempt to obtain landowner signoff to demonstrate that the landowner has no outstanding concerns with the reclamation. Where landowner signoff cannot be obtained the permit holder must provide any reasons given by the landowner for not providing sign off and the BCER will follow up on site specific concerns with the landowner.

6.3 Site Reclamation outside of the Agricultural Land Reserve

Site reclamation requirements for lands not in the ALR are detailed in Section [19](#) of the EPMR and include de-compacting soils, redistributing surface soils, restoring natural surface drainage,

removing structures, stabilizing slopes, re-contouring, removing stream crossings and re-establishing vegetation with a Ministry of Forests approved seed mix or propagules of an ecologically suitable species. Site reclamation work must be completed in compliance with the applicable requirements in Section 19 of the EPMR. Further guidance on reclamation may be found in Appendix C of the [Environmental Protection and Management Guideline](#) and in the Peace – Liard Re-vegetation [Manual](#), 2010.

6.4 Reclamation Assessment

The Regulator's CoR Part 2 Application process requires that the site reclamation assessment and reporting is conducted and completed by a qualified reclamation specialist to confirm the effectiveness of the reclamation efforts. The level of effort required for monitoring and assessing reclaimed sites may vary depending on site and conditions, but the reclamation requirements in the Delegation Agreement between the BCER and the ALC are the minimum that must be met.

The reclamation reports for all sites must satisfy the minimum reporting requirements. The site reclamation reporting requirements are presented in Appendix D of this manual. The site reclamation report may be submitted to the Regulator in order to document the state of restoration under Section 9 of the DASR or as information supporting a CoR Part 2 Application.

The length of time necessary to monitor and complete a reclamation assessment of the reclaimed sites varies depending on the site situations. The reclaimed areas may be assessed in the spring to ensure the land conditions are stable and the vegetation growth is reasonable and if there are any outstanding reclamation issue, then those can be addressed immediately. When the site appears to be reclaimed, then it should be assessed at the end of the establishment period. In many cases, the required reclamation objectives may take several growing seasons to be achieved.

According to the Delegation Agreement, upon completion of site reclamation on ALR land, a Schedule B report must be submitted to the Regulator. If the site reclamation occurred on private land, a Schedule B report must also be submitted to the landowner(s). The Schedule B report must be completed and signed by a qualified reclamation specialist.

6.5 Certificate of Restoration Part 2 Application

The Regulator maintains high standards on environmental quality ensuring that the surface conditions of all oil and gas sites are restored. The Regulator's Certificate of Restoration Part 2 Application process requires site reclamation inspections and reporting be completed by a qualified reclamation specialist to confirm the effectiveness of the reclamation efforts. The Regulator will review and validate the submitted information and will certify a site if the application is complete and for those sites in the ALR confirm that the reclamation meets all the requirements of the Delegation Agreement signed between the BCE and ALC and Section 19 of the EPMR.

6.5.1 Attachments

The Regulator requires the following listed items must be submitted with the CoR Part 2 Application:

- Completed CoR Part 2 Application Form.
- Reclamation inspection report prepared by a qualified reclamation professional.
- Schedule B: Site Reclamation Assessment Report – for activities on ALR land.
- Landowner signoff – for activities on private land.
- Application fee made to the Regulator.

6.6 Certificate of Restoration Part 2 Application Form

The Certificate of Restoration Part 2 Application Form is completed and submitted by the permit holder. This form must be completed by a qualified professional or technologist registered as a member in good standing with an organization operating under an act of the British Columbia legislature. Section D of the form is for BCER use only and does not need to be completed by the applicant. The Regulator will certify the following statement and assign a Certificate Number.

“This is to certify that the surface of the land held in conjunction with, or incidental to, the above application is deemed to be satisfactorily restored. Despite the issuance of this certificate, the Ministry of Environment has the authority to order further site investigation or remedial action upon inspection of the site or file. Issuance of this certificate does not relieve the applicant of any restoration requirements for which the applicant is subsequently held responsible by the Regulator”.

Chapter 7: Restoration Verification

Audit Program

The Regulator's Restoration Verification Audit Program (RVAP) was created to provide the Regulator and the public with assurance that Certificate of Restoration (CoR) regulatory requirements are being met. On a yearly basis, the Regulator randomly selects a certain percent of certified sites to conduct reviews of files and submitted documentation as well as field verification.

The results of the Restoration Verification Audit (RAV) will not affect the site's status as having been certified. A CoR will not be rescinded based on the results of the audit however, if major documentation errors, technical errors and/or omissions are found, the Regulator may require the permit holder to complete further investigation and/or remediation work.

For complete information regarding the Regulator's restoration verification audit processes, please refer to the [2013 Restoration Verification Audit Program Procedure Manual](#).

This chapter summarizes the Restoration Verification Audit Program (RVAP) including the following:

- Audit objective
- Site selection
- Work plan
- Notification to permit holders
- Field verification
- Audit results and reporting
- Classification of errors and omissions
- Notification of unacceptable applications
- Permit holder justifications and/or investigation/remediation
- Regulator's decision

7.1 Restoration Verification Audit Objective

The objective of the RVA is to evaluate industry compliance with the CoR regulatory requirements under [ERAA](#) Sections 40 to 43 and the Environmental Management Act Section [40](#) (3).

7.2 Application Selection

The RVAP is managed by the Regulator's Director, Environmental Management and Reclamation. The Director coordinates the selection of the certified sites for audit annually and will designate BCER professionals to conduct restoration verification investigations.

A stratified random sampling strategy is used to select applications for audit. The population of applications is divided into subpopulations based on site location and site ownership (i.e., Crown land versus private land). Sites are selected for audit from the population that was certified in the past fiscal year.

7.3 Work Plan

The RVA includes a review of the CoR Part 1 application and any related documentation. Areas of potential environmental concern (APECs) are identified for field verification of the site conditions. The designated BCER professional will review the information and prepare a site-specific work plan. Based on the information, the APECs, along with any associated potential contaminants of concern (PCOCs) are identified and a work plan is prepared for field verification of the site conditions.

7.4 Notification to Permit Holders

When an application for a site is selected as part of the RVA, a notification letter is sent to inform the permit holder. The work plan that has been prepared for the field verification of the site conditions is also provided to the permit holder for review. The permit holder must submit any concerns regarding the work plan for the audit directly to the designated BCER professional conducting the audit. Concerns submitted to the BCER are resolved to the satisfaction of the BCER prior to the field verification.

7.5 Field Verification

Field investigation of the identified APECs are conducted in accordance with the RVAP Procedure Manual using a truck or track mounted solid stem drill rig, or using a Dutch auger for helicopter accessed sites during summer. If an electromagnetic (EM) survey was not completed in the previous investigations, it will be conducted to help locate unknown APECs.

The investigation includes a sample collection from the boreholes. Two soil samples are selected per location for laboratory analysis for the PCOCs, except where field screening indicates the need to select more or less than two samples per location. An investigation rationale for each potential location is presented and all soil samples are discrete. Groundwater monitoring wells may be installed and sampled as part of the investigation where field screening indicates potential for groundwater impacts.

Field quality assurance and quality control (QA/QC) for the RVA includes the collection of blind field duplicate samples and calculated Relative Percent Difference (RPD) values for the duplicate samples.

7.6 Audit Results and Reporting

The RVA results are summarized in the audit report upon completion of the investigations to support the Regulator's grading of the application as per the Regulator's RVAP Procedure

Manual. The analytical results are compared with the information provided by the permit holder in the CoR Part 1 application and also compared to applicable BC Contaminated Site Regulation (CSR) standards for petroleum hydrocarbons, metals and salinity to determine if all parameters meet the applicable criteria. Finally, the report will verify if the CoR regulatory requirements are met.

7.7 Classification of Errors and Omissions

After completion of the RVA, the results are reviewed by the designated Regulator professional for errors and omissions that may have caused uncertainty in the conclusions supporting the original CoR application. The level of effort required by the permit holder to resolve the outstanding issues depends on the types of errors and omissions. Errors and omissions may be related, but not limited to, the documentation submitted and/or technical errors made by the permit holder or the permit holder's representative.

7.7.1 Documentation Errors and Omissions

Documentation errors and omissions may include, but are not limited to, the following:

- Incomplete, incorrect or missing tables and figures.
- Incomplete, incorrect or missing analytical data and/or quality control and quality assurance information; and
- Uncertain conclusions due to insufficient evidence.

7.7.2 Technical Errors and Omissions

Technical errors and omissions may include, but are not limited to, the following:

- Incomplete site investigation.
- Incomplete site remediation and/or risk assessment; and
- Uncertain conclusions due to insufficient technical information.

7.8 Notification of Application Grade

After completion of the RAV, the site is graded in accordance with the RVAP Procedure Manual. The grades include:

- Fully acceptable
- Acceptable
- Unacceptable

7.8.1 Fully Acceptable

The Regulator deems the application for a site as fully acceptable if the assessment supports the CoR application confirming that the investigation and remediation or the risk assessment is complete at the site. The supporting documentation must also be complete and correct and demonstrate compliance with the numerical standards or accepted risk-based requirements. The permit holder will be notified by notification letter.

7.8.2 Acceptable

The Regulator deems the application for a site as acceptable if the application lacks documentary support or the assessment does not fully support the application, but no areas were identified that exceed accepted risk-based closure requirements. The permit holder will be notified by a notification letter.

7.8.3 Unacceptable

The Regulator deems the application for a site unacceptable if the site investigation or remediation or the risk assessment is incomplete and the audit results indicate potential for significant risk to either human health or the environment. The permit holder will be informed through a formal letter stating that the Regulator's investigation requirements have not been met and further clarification from the permit holder is required. The permit holder will be required to clarify and address the potential issues at the site that have not been fully addressed in the past.

Prior to assigning a grade of unacceptable to the application for a site, the Regulator will provide an opportunity for the permit holder to clarify and address any perceived concerns.

7.9 Permit Holder Justification and/or Investigation/Remediation

After receiving notification of any potential issues identified at the site, the permit holder must provide the Regulator with evidence based justification of the issues and demonstrate how the site meets the requirements. If the permit holder is unable to justify the identified issues they will be required to conduct further investigation and/or remediation as required by the Regulator.

7.10 Regulator's Decision

Once the required investigation/remediation is complete and all outstanding issues at the site have been addressed, the permit holder or their representative is required to notify the Regulator by submitting an investigation/remediation report. The Regulator will review the investigation/remediation report and decide if the supporting evidence is satisfactory and if the potential issues identified at the site have been addressed.

Appendix A: Tables

Table 1: Site Investigation, Requirement

Scenario	Well Status	Investigation Required	Note
1	Well authorized and cancelled	N	
2	Well authorized, surface cleared and cancelled	N	
3	Well authorized, surface cleared and used for drilling waste storage and disposal as a remote location with checklist that passes the criteria	N	
4	Well authorized, surface cleared and used for drilling waste storage and disposal as a remote location with checklist that fails the criteria	Y	
5	Well authorized, surface cleared, spudded and abandoned		*
6	Well authorized, surface cleared, drilled, cased, abandoned, and case cut off	Y	
7	Well authorized, surface cleared, drilled, cased, completed, produced, abandoned and case cut off	Y	
8	Well authorized [test hole], surface cleared, drilled and abandoned	Y	
9	Well authorized [test hole], surface cleared, drilled, cased, abandoned and case cut off	Y	

10	Well authorized [produced water well], surface cleared, drilled, cased, completed, produced, abandoned and case cut off	Y	
11	Well authorized [fresh water well], surface cleared, drilled, cased, completed, produced, abandoned and case cut off		*
12	Well authorized [injection well], surface cleared, drilled, cased, used for injection, abandoned and case cut off	Y	
13	Oil and gas facilities	Y	**

Please Note:

(*) Denotes that site investigation will be required if the site screening process triggers it is required. (**) Denotes that site investigation must be conducted until the screening process triggers it is not required.

Table 2: Common Areas of Potential Environmental Concerns at an Oil and Gas Site

This table provides common APECs on upstream oil and gas sites. There may be other activities that may generate contaminants which may need to be address on site-specific basis, as following:

- Naturally Occurring Radioactive Materials (NORM) may appear in flare pit and at the surface as drilling wastes from the subsurface formation. Drilling waste storage and disposal areas may need to be investigated and tested for potential contaminants.
- Imported soil for fill and padding may need to be characterized for a minimum of metals.
- Herbicides may have been used and may need to be tested for potential contaminants.

#	APECs	PCOCs	CSR Regulated Parameters
1	Wellhead and surrounding area	Drilling mud, additives, petroleum hydrocarbon, condensate, metals, drill cutting, workover fluids, solvents, hydraulic oil, well production chemicals and produced water	BTEX, VPH, LEPH, HEPH, PAHs, metals, extractable barium for barite sites, sodium and chloride
2	Drilling waste storage and disposal areas [i.e., known buried or land spread area]	Drilling mud, additives, petroleum hydrocarbon, condensate, metals, drill cutting, workover fluids, well treatment chemicals and produced water	BTEX, VPH, LEPH, HEPH, PAHs, metals, extractable barium for barite sites, sodium and chloride
3	Flare pit or flare stack including knock-out tanks	Petroleum hydrocarbons, condensate and produced water	BTEX, VPH, LEPH, HEPH, PAHs, metals, sodium and chloride
4	Spills, above ground and underground storage tanks	Petroleum hydrocarbon, condensate, drilling fluid, additive, produced water and treatment chemicals	BTEX, VPH, LEPH, HEPH, PAHs, metals, sodium, chloride and parameters associated with treatment chemicals
5	Former site infrastructure – dehydrated, separator, etc.	Natural gas, crude oil, produced water, glycol and methanol	BTEX, VPH, LEPH, HEPH, PAHs, metals, sodium, chloride, methanol and glycol

6	Buildings, and other production and processing facilities	Petroleum hydrocarbon, condensate, produced water, process and treatment chemicals	BTEX, VPH, LEPH, HEPH, PAHs, metals, sodium, chloride and other parameters associated with specific treatment chemicals
7	Metering stations	Natural gas, crude oil, produced water and metal	BTEX, VPH, LEPH, HEPH, PAHs, metals, sodium and chloride
8	Pigging stations	Natural gas, crude oil, produced water	BTEX, VPH, LEPH, HEPH, PAHs, metals, sodium and chloride
9	Pipeline associated with oil and gas wells	Natural gas, crude oil, produced water	BTEX, VPH, LEPH, HEPH, PAHs, metals, sodium and chloride
10	EM anomaly, depressions, bare area, stained surface and stressed vegetation	Drilling wastes and weed control chemicals	Salinity, metals and parameters associated with herbicides and if evidence then hydrocarbons
11	Camp sites	Gasoline, diesel, lubricant, heating oil and glycol	BTEX, VPH, LEPH, HEPH, PAHs, metals and ethylene glycol
12	Land Treatment Area	Drilling mud, additives, petroleum hydrocarbon, condensate, metals, drill cutting, workover fluids, well treatment chemicals and produced water	BTEX, VPH, LEPH, HEPH, PAHs, metals, extractable barium for barite sites, sodium and chloride

BTEX – benzene, toluene, ethylbenzene and xylenes

VPH – volatile petroleum hydrocarbons

PAH – polycyclic aromatic hydrocarbons

LEPH – light extractable petroleum hydrocarbons

HEPH – heavy extractable petroleum hydrocarbons

Table 3: Areas of Potential Environmental Concerns and Minimum Investigative Requirements to Identify Contamination

This table provides guidance on the minimal level of assessment considered adequate to identify the presence of contamination at common APEC on upstream oil and gas sites. The level of efforts required to complete an investigation on other areas of the site will be site-specific.

APECs	Investigative Locations	Note
Wellhead and surrounding area	1) Completion of 2 boreholes at 2m maximum radius around wellhead to a minimum 2m depth by using hand auger, or 2) Completion of 2 boreholes at 5m radius around wellhead to a minimum 3m depth by using a rig.	**
Drilling waste storage and disposal areas [i.e., known buried or land spread area]	1) 3 investigative locations for <1500m well depth, 4 locations for 1500-2500m and 5 locations for >2500m well depth, or 2) 1 sample per 30m ³ (waste quality), or 3) Follow MoE TG1 [Site Characterization and Confirmation Testing]. Note: boreholes will be extended 1m into native material at target locations.	* **
Flare pit or stack including knock-out tanks	Complete two boreholes or test pits extending 1m into native material at target locations based on professional judgement.	**
Spill, above and underground storage tank locations	Complete one borehole or test pit to defensible depths at each target locations based on professional judgement.	**
Former site infrastructure – dehydrated, separator, etc.	Complete one borehole or test pit to defensible depths at each target locations based on professional judgement.	**

Building and other production and processing facilities	Complete one borehole or test pit to defensible depths at each target locations based on professional judgement.	**
Metering stations	Complete one borehole or test pit at EM identified locations to defensible depths and also use professional judgement for targeting investigation locations.	**
Pigging stations	Complete one borehole or test pit at EM identified locations to defensible depths and also use professional judgement.	**
Onsite pipeline associated with oil and gas wells	Complete one borehole or test pit per 10m of the onsite line length and can be biased towards joints; and Complete one boreholes or test pits at each EM identified locations to defensible depths and also use professional judgement for targeting investigation locations.	**
EM anomaly, depressions, bare area, stained surface and stressed vegetation	Complete one borehole at each locations to defensible depths and also use professional judgement for targeting investigation locations.	**
Camp sites	Due to limited potential for contamination camp site may not need be investigated as an APECs unless there are reasons to investigate.	
Land Treatment Area	Complete assessment to defensible depths using hand auger with spacing as on base of remedial excavation.	

Please Note:

(*) Denotes it is found not in compliance – failed checklist.

(**) Denotes multiple soil samples collected at appropriate depths and a minimum of two samples per borehole should be selected for laboratory analysis for the PCOCs and will be more than two per location where field screening indicates.

Table 4: Certificate of Restoration Part 1 and Part 2 Requirements

Scenario	Well Status	CoR Part 1 Required	CoR Part 2 Required
1	Well authorized and cancelled.	N	N
2	Well authorized, surface cleared and cancelled.	N	Y
3	Well authorized, surface cleared and used for drilling waste storage and disposal as a remote location with checklist that passes the criteria.	Y	Y
4	Well authorized, surface cleared and used for drilling waste storage and disposal as a remote location with checklist that fails the criteria.	Y	Y
5	Well authorized, surface cleared, spudded and abandoned.	Y	Y
6	Well authorized, surface cleared, drilled, cased, abandoned, and case cut off.	Y	Y
7	Well authorized, cleared, drilled, cased, completed, produced, abandoned and case cut off	Y	Y
8	Well authorized [test hole], surface cleared, drilled and abandoned.	Y	Y
9	Well authorized [test hole], surface cleared, drilled, cased, abandoned and case cut off.	Y	Y
10	Well authorized [produced water well], surface cleared, drilled, cased, completed, produced, abandoned and case cut off.	Y	Y
11	Well authorized [fresh water well], surface cleared, drilled, cased, completed, produced, abandoned and case cut off.	Y	Y

12	Well authorized [injection well], surface cleared, drilled, cased, used for injection, abandoned and case cut off.	Y	Y
13	Oil and gas facilities.	Y	Y

Appendix B: Site Investigation / Remediation Assessment and Reporting Requirements

Assessment reports detailing site investigation and remediation activities required under Section 7 of the DASR or in support of a CoR Part 1 Application should contain the information outlined below.

Executive Summary

Information in the summary may include:

- The site operator(s) and the investigator(s).
- Site location with current/future land uses.
- Investigation objectives.
- Investigation findings, areas of potential environmental concern (APECs), potential contaminants of concern (PCOCs), areas of environmental concern (AECs) and contaminants of concern (CoC).
- If contaminated, a brief summary of remediation and confirmation.
- Conclusions.

Introduction

- Background.
- Investigation objectives.
- Scope of work.

Site Information

Site information may include:

- Site location (NTS, Lat/long and/or UTM).
- Well/facility authorization number, name and status with dates.
- Land owner, onsite land uses and surrounding land uses.
- Former/current onsite facilities.
- Underground pipelines, if any.
- Site and regional topography.
- Site general hydrology/hydrogeology.
- Applicable criteria/standards.
- Site map with site features.

Information Sources and Screening

- Well file, operational records and related documentation with BCER/MoE including aerial photographs.
- Site visits to identify signs of contamination.
- Interviews with people familiar with the site conditions.
- EM survey maps may be helpful for locating unknown potential areas.
- Identify CSR Schedule 2 industrial and commercial activities.
- Identify regulatory non-compliance, i.e., drilling waste management and spill reporting noncompliance.
- Identify other potential contamination sources, i.e., AST and UST for fueling machinery and vehicles.
- Table presenting areas of potential environmental concern (APECs) with associated potential contaminants of concern (PCOCs).
- Site map showing approximate location of APECs with PCOCs.

Applicable Standards

Identify investigation standards with site-specific factors for all relevant environmental media (soil, groundwater, surface water, sediments and vapour).

Field Methods

- Rationale for sampling program.
- Map showing accurate sampling location relative to APECs.
- Sample collection method - augering or/and drilling or/and test pitting.
- Rationale for sample and parameter selection for laboratory analysis.
- Sample handling, preservation and submission to laboratory for analysis.
- QA/QC plan.

Data Presentation

- Soil stratigraphy with logs (augering or drilling or test pitting).
- Analytical results tables and maps.
- Graphics showing sample locations and analytical results.
- Hydrologic and hydrogeologic information.
- QA/QC results tables. □ Others.

Results Discussion

- Discuss analytical results to confirm areas of environmental concern (AECs) with associated contaminants of concern (COCs) and areas not of environmental concern.
- Provide justification and underlying assumptions if concentrations of substances in excess of CSR standards are not an environmental concern.

- Identify triggers for priority sites. □ Contaminant migration.
- Table presenting AECs with COCs.
- Site map showing location of AECs and COCs with concentrations – CSM preferred.

Conclusions

- Conclusions with specific references to the investigation findings if there is environmental concern.

Remediation and Confirmation of Remediation

- Redefine AECs and COCs that require remediation.
- Applicable remediation standards.
- Remediation options – numerical remediation standards and/or risk-based standards.
- Remediation under Notice of Independent Remediation (NIR).
- Remedial work with rationale – brief.
- Confirmation of remediation.
- Tables presenting confirmation of remediation analytical results.
- QA/QC results table.
- Site map showing location(s) of remediation – x-sections on CSM (2 x-sections per location) are preferred.

Professional Statement

The Regulator requires that a qualified environmental professional attest to the following statements:

- The investigation and remediation referred to in this report have been conducted in accordance with all requirements of EMA and the CSR.
- The reported information is true based on the signatory's current knowledge as of the date completed. Where data gaps exist in this report, the judgment of the qualified professional have been used.
- The signatory has demonstrable experience with remediation of the type of contamination at the site for which the statement applies and is familiar with the remediation carried out on the site.

The Regulator expects all site investigations to be conducted by or under the direct supervision of a qualified professional and requires the professional statement to be signed and dated by a qualified professional.

References

- Provide references of all previous studies, data sources, interviews that contributed information to the investigation and remediation.

- Provide references to regulatory documents and technical literature that provide details on provisions and procedures used in the investigations and remediation.

Reliance and Limitations

Provide a brief reliance statement for regulatory authorities to rely on the reported information within the context of the report's general limitations in meeting the regulatory requirements regarding the applicable environmental standards.

List of Tables

- Table 1: Site Information.
- Table 2: Areas of Potential Environmental Concerns and Potential Contaminants.
- Table 3: Applicable Investigation Standards.
- Table 4: Investigation Rational.
- Table 5: Analytical Results (may be more than one tables).
- Table 6: QA/QC results – Investigation.
- Table 7: Area of Environmental Concerns and Contaminants of Concerns.
- Table 8: Applicable Remediation Standards.
- Table 9: Confirmation of Remediation Analytical Results.
- Table 10: QA/QC Results – Remediation.

List of Figures

- Figure 1: Site Map – site's general features (CSM preferred).
- Figure 2: Locations of APECs with PCOCs.
- Figure 3: Investigation (borehole) Locations.
- Figure 4: Analytical Results - Investigation (may be more than one figures).
- Figure 5: Locations of AECs with COCs (CSM preferred).
- Figure 6: Groundwater Gradient and Flow Direction.
- Figure 7: Analytical Results – Remediation.
- Figure 8: Locations of Remediation (x-sections on CSM preferred).

List of Appendices

- Laboratory Analytical Reports with Chain of Custody and Sample Integrity Receipts.
- Borehole Logs.
- Site Photographs. □ Others.

Appendix C: Qualifications for an Environmental Professional

Site screening, investigation and remediation must be completed meeting the requirements of Oil and Gas Activity Act, Environmental Management Act and Contaminated Sites Regulation. The person submitting certificate of restoration application must be an environmental professional with following qualifications:

- a) Is registered as a member in good standing with a recognized professional or technologist organization, which operates under an Act of the British Columbia legislature, who is subject to the organization's Code of Ethics and is subject to disciplinary action by that organization;
- b) Possesses an appropriate combination of formal education, knowledge, skills and experience to conduct a technically sound and rational environmental site assessment;
- c) Is familiar with applicable federal, provincial and municipal legislation, regulation, policies, protocols and guidelines used to evaluate the presence of contamination on a property; and
- d) Is familiar with upstream oil and gas operations and understands how to identify potential sources or areas of contamination from review of well files, tower sheets, and drilling information.

Appendix D: Site Reclamation Reporting Requirements

Site reclamation must be completed meeting the objectives outlined in Table 1 and the reports must be signed by a qualified reclamation specialist (QRS) and submitted with the CoR Part 2 Application. The report should contain the information outlined below.

Introduction

- Background:
- Reclamation Objectives:
- Soil Objectives.
- Landscape Objectives.

- Vegetation Objectives.

Site General Information

Site information may include but not limited to the following:

- Site location.
- Well/facility authorization number.
- Site and regional topography.
- Site general hydrology/hydrogeology.
- Applicable criteria/standards.

Site Reclamation Information

The reclamation inspection report should contain the following information:

- **Soil Information:** indicating that all salvaged surface soil has been replaced to a sufficiently uniform depth across the site.
- **Landscape Information:** detailing how the site meets the landscape criteria and a description of the landform characteristics of the site (i.e. slope, drainage, contour, areas with gravel or rock, bare areas).
- **Vegetation Information:** a description of on-site and control vegetation (i.e. species composition, height, vigour, plant density).
- **Details of Reclamation:** a description of what activities have been undertaken to reclaim the site and any areas that were not reclaimed at the request of the landowner.
- **Recommendations:** The QRS should detail a recommendation. There may be some sites that do not quite fulfill all of the criteria for reclamation but, in the opinion of the QRS further remedial activity at the site may result in more damage than benefit. For these locations the QRS must stipulate what criteria are deficient and provide justification for accepting the site as being sufficiently reclaimed.
- **Signature Block:** A qualified reclamation specialist must provide professional sign off to confirm that the site is adequately reclaimed and satisfies all applicable provincial criteria for surface reclamation.

Attachments

- **Site Diagram:** detailing the location of the lease area, access road, and any ancillary disturbances that were constructed.
- **Site Photographs:** photographs must be taken which show the condition of the entire surface lease and any associated developments after reclamation. Each photograph should have noted with it the location, direction and any comments.

Site Reclamation Objectives

The following tables outline the Regulator's expectations for sites reclamation outside of the Agricultural Land Reserve.

Table 1: Site Reclamation Objectives

<p>Soil Objectives: The differences between the reclaimed site and adjacent land should not be significant enough to interfere with normal land use and should be no evidence of negative impact on vegetative growth.</p>	
<p>Surface Soil Replacement</p>	<ul style="list-style-type: none"> • Salvaged surface soil should be replaced throughout the site. • Soils compacted by the oil and gas activities should be de-compacted.
<p>Landscape Objectives: The differences between the reclaimed site and adjacent land should not be significant enough to interfere with normal land use and there should be no evidence of negative impact, either on or off-site.</p>	
<p>Drainage</p>	<ul style="list-style-type: none"> • Restoring to the drainage pattern, to extent practicable, to its condition before the alteration, or otherwise compatible with the surrounding landscape. • Facilities that are left in place (i.e. clay pads) should not negatively impact natural drainage. • There should not be evidence of surface water ponding on the location. It is important to ensure that surface water does not pond over a sump location as this may result in the upward movement of salts over time.
<p>Contours</p>	<p>Contour and roughness should conform and blend with the adjacent contours, or be consistent with the present or intended land use.</p>
<p>Stability</p>	<ul style="list-style-type: none"> • Site should be geotechnically stable (no visible slope movement, slumping, subsidence, tension cracks). • Site should be stable from erosion due to overland water flow. • On-site cut and fill slopes should be stabilized.
<p>Debris</p>	<ul style="list-style-type: none"> • Site should be free of industrial debris. • Slash and roots and woody debris should not interfere with the intended land use and should not conflict with current forest protection policy and regulation.
<p>Gravel and Rocks</p>	<ul style="list-style-type: none"> • No piles or windows. • No increase in concentration of gravel and rock compared to control.
<p>Vegetation Objectives: Vegetative characteristics between the reclaimed site and adjacent land should not show adverse impact as a result of oil and gas activities.</p>	

Species Composition	<ul style="list-style-type: none"> • The species planted on the site should form a sustainable desired plant community that is, or is likely to become, similar to the original or control plant community, or that is compatible with accepted end land use and land management objectives of the landowner. • There should be no prohibited or noxious weeds onsite. • Nuisance weeds should not exceed the degree or extent of offsite infestation.
Plant Health	Plant growth should be healthy and vigorous with no evidence of plant disease or stress than is found on off-site controls.
Plant Density	Vegetation should be well distributed across the site with no bare areas.

Appendix E: References

This appendix lists the applicable documentation for reference.

BC Energy Regulator Documentation

- 1) [Energy Resource Activities Act](#) (ERAA)
- 2) [Environmental Protection and Management Regulation](#) (EPMR)
- 3) [Pipeline Regulation](#)
- 4) Agricultural Land Reserve - Oil and Gas Commission (Commission, now BCER or Regulator) and Provincial Agricultural Land Commission (ALC) [Delegation Agreement](#)
- 5) [Oil and Gas Activity Application Manual](#)
- 6) [Certificate of Restoration Application Form – Part 1](#)
- 7) [Environmental Site Assessment Checklist](#)
- 8) [Certificate of Restoration Application Form – Part 2](#)
- 9) [Oil and Gas Handbook Drilling Waste Management Chapter](#).
- 10) [Restoration Verification Audit Program \(RVAP\) Procedure Manual](#)
- 11) [Site Classification Tool](#)
- 12) [Site Classification Tool Form](#)
- 13) [Environmental Protection and Management Guideline](#)
- 14) [Dormancy and Shutdown Regulation \(DASR\)](#)
- 15) [Dormant Site Assessment Form](#)

Ministry of Environment Documentation

- 1) [Environmental Management Act](#) (EMA)
- 2) [Water Sustainability Act](#)
- 3) [Contaminated Sites Regulation](#) (CSR)
- 4) [Oil and Gas Waste Regulation](#) (OGWR)
- 5) [Hazardous Waste Regulation](#) (HWR)
- 6) [Spill Reporting Regulation](#) (SRR)
- 7) [Waste Discharge Regulation](#) (WDR)
- 8) [Schedule 1: Site Profile](#)
- 9) [Schedule 2: Industrial and Commercial Purposes and Activities](#)
- 10) [Schedule 3.1](#) – Part 1: Matrix Numerical Soil Standards
- 11) [Schedule 3.1](#)- Part 2: Generic Numerical Soil Standards to Protect Human Health
- 12) [Schedule 3.1](#)- Part 3: Generic Numerical Soil Standards to Protect Ecological Health
- 13) [Schedule 3.2](#): Generic Numerical Water Standards
- 14) [Schedule 3.3](#): Generic Numerical Vapour Standards
- 15) [Schedule 3.4](#): Generic Numerical Sediment Standards
- 16) Hazardous Waste Regulation (HWR) - [Schedules 1 to 8](#)
- 17) Waste Discharge Regulation (WDR) - [Schedule 1: Definition](#)

- 18) [Technical Guidance 1](#): Site Characterization and Confirmation Testing
- 19) [Technical Guidance 3](#): Environmental Quality Standards
- 20) [Technical Guidance 4](#): Vapour Investigation and Remediation
- 21) [Technical Guidance 6](#): Assessment of Hydraulic Properties for Water Use Determination
- 22) [Technical Guidance 7](#): Supplemental Guidance for Risk Assessments
- 23) [Technical Guidance 8](#): Groundwater Investigation and Characterization
- 24) [Technical Guidance 14](#): Operation of Soil Treatment Facilities for the Bioremediation of Hydrocarbon Contaminated Soil
- 25) [Technical Guidance 15](#): Concentration Limits for the Protection of Aquatic Receiving Environments
- 26) [Technical Guidance 19](#): Assessing and Managing Contaminated Sediment
- 27) [Administrative Guidance 13](#): Guidance on Schedule 2 Purposes and Activities
- 28) [Protocol 2](#): Site-specific Numerical Standards
- 29) . [Protocol 3](#): Blending, Mixing, or Dilution as a Remediation Approach
- 30) [Protocol 4](#): Determining Background Soil Quality
- 31) . [Protocol 9](#): Determining Background Groundwater Quality
- 32) [Protocol 12](#): Site Risk Classification, Reclassification and Reporting
- 33) [Protocol 13](#): Screening Level Risk Assessment
- 34) [Protocol 14](#): Requirements for Determining Barite Sites
- 35) [Protocol 15](#): Soil Treatment Facility Design and Operation for Bioremediation of Hydrocarbon Contaminated Soil
- 36) [Protocol 17](#): Forms for Notifications of Independent Remediation and Migration
- 37) [Protocol 20](#): Detailed Ecological Risk Assessment
- 38) [British Columbia Field Sampling Manual](#)
- 39) [British Columbia Environmental Laboratory Manual](#)
- 40) [19 Facts on Contaminated Sites](#): The Site Profile System

Ministry of Natural Gas Development

- 1) [Petroleum and Natural Gas Act](#) (PNGA)
- 2) [Land Act](#)
- 3) [Peace – Liard Re-vegetation Manual](#), 2010