

# Fossil Management Office

## Fossil Impact Assessment (FIA) Guidelines for Paleontology Consultants

These guidelines outline the standards, procedures and elements of the FIA process in British Columbia



Heritage Branch

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## Purpose of Fossil Impact Assessment Process

In British Columbia (B.C.), fossil resources have scientific, educational, cultural, and natural heritage values that warrant management and protection. The purpose of a Fossil Impact Assessment (FIA) is to provide a professional and credible assessment of fossil resources so that the Province can make appropriate decisions in guiding land development.

These guidelines describe the process for proponents who are planning developments that may impact fossil resources. This includes assessing the impact of a project on fossil resources and taking appropriate steps to mitigate that impact. These guidelines also outline qualifications for consulting paleontologists contracted to work on a FIA.

## Fossil Impact Assessment (FIA) Standards

The following standards are recommended for all FIA activities. The Fossil Management Office (FMO), within Heritage Branch, retains the right to modify these requirements depending upon the development project and the availability of expertise.

- A high professional level of performance and co-operation is expected from the proponent, the Lead Paleontologist and crew, and Land Adjudicator, to reduce adverse effects of project development activities on existing fossil resources.
- The FIA process typically begins with a desktop Preliminary Study Report (Appendix A) and Chance Find Protocol (Appendix B), in either a basic or detailed format.
- The proponent must share the Chance Find Protocol document with all crew members and post the protocol visibly, such as in an office or construction trailer on site.
- A FIA Plan (Appendix C) for paleontological field investigation must be submitted to FMO for review prior to starting field studies.
- The FIA report (Appendix D) must be produced soon after field inspections and forwarded to FMO for review. Reports must be clear, concise, and comprehensive.
- Impact mitigation recommendations in a FIA report may require monitoring of a project area during and after ground disturbance, for which an Impact Mitigation Plan (Appendix E) for field activities must be submitted to FMO for review prior to starting field studies.
- An Impact Mitigation Final Report (Appendix F) must be produced soon after field inspections and forwarded to FMO for review.
- Templates for the Preliminary Study Report, Chance Find Protocol, FIA Plan, Impact Mitigation Plan, and Impact Mitigation Final Report documents are available on the website: [For industry, consultants and users - Province of British Columbia](#)

- FIA activities should be led and performed by qualified paleontologists to the specifications of the role (Appendix G). These qualifications are subject to modifications depending upon the project specifics or availability of expertise. Paleontological expertise should be sought from within B.C. to promote development of a resident pool of qualified paleontological assessment workers.
- The Lead Paleontologist is responsible for maintaining high standards of safety, performance, and reporting for the paleontological work crew throughout the project's duration. Responsibilities include mentoring, heritage preservation, and scientific discovery. Weather dependent activities, such as field surveys and excavations of significant fossils, should not be performed during inclement weather.
- Discoveries of significant fossils, including a Chance Find, must be protected and reported to FMO and the Royal BC Museum (RBCM) for further instructions.
- The Province serves as custodian of fossil resources. Fossils must be handled and prepared for curation according to the standards set by the RBCM. Collected materials should remain inside B.C. unless otherwise authorized.
- Records should be kept by the Lead Paleontologist for 10 years after the FIA, and after any mitigative actions.

## Fossil Impact Assessment Process

The fossil impact assessment process involves the proponent, the Lead Paleontologist, FMO, and the Land Adjudicator. Not all projects will trigger needing a Preliminary Study nor FIA Report, for example if only a basic Chance Find Protocol is required, companies do not necessarily need to hire a Paleontologist to complete this.

Assessment of potential impact to fossils begins with a Preliminary Study Report. When findings suggest a very low or low risk to fossil resources, a Chance Find Protocol is developed. When preliminary study findings indicate that project activity is likely to encounter areas with medium or high risk to fossil resources, a FIA Plan and Report are required, including a Chance Find Protocol and potentially an Impact Mitigation Plan and Report.

### Step 1. Land Use Application and Preliminary Study Report

FMO's evaluation of a land disposition application, either through FrontCounter BC or via the Environmental Assessment Office for major projects, requires determining whether the development project could potentially adversely impact fossil resources. Following submission of a land use application, when a project overlaps with one of B.C.'s Important Fossil Areas, a desktop or preliminary study report may be required.

A Preliminary Study Report (PSR) is a concise analysis of the potential impact on fossils. Proponents hire a professional paleontologist to conduct the study, assisted by the Fossil

Collection Events dataset available through FMO's website. This preliminary assessment of the risk to fossils is based on proximity of the project to known fossils, the underlying geology affected by development activity, and the proposed activity. The PSR includes the following, outlined in a template (Appendix A):

- Study area description, including a brief synopsis of the geological setting and list of each sedimentary unit or deposit to be affected by the proposed development.
- A map showing the project location and boundaries in relation to geological units and known fossil sites, if any are present.
- Note the fossil resource potential of each geological unit possibly encountered based on known fossils. Comment on the likelihood of the geology being favourable for new fossil discoveries (Table 1):
  - **High potential with fossils expected or certain to occur** – geological settings with known fossil finds; includes areas with extensive fossiliferous sedimentary exposures with no vegetation cover, and/or areas minimally disturbed by previous developments.
  - **Medium potential with fossil occurrences possible or unknown** – geological settings with known fossil finds (or as yet unknown); such as in units with sporadic fossil potential, intermittent sediment exposures with thin vegetation cover, and/or areas moderately disturbed by previous developments.
  - **Low potential with fossils unlikely to occur** – geological settings with limited fossil finds; such as areas with sedimentary deposits unlikely to yield fossils, areas of thin soil and/or vegetation cover, and/or areas moderately disturbed by previous developments.
  - **Very low potential where fossils are rare** – geological settings with negligible opportunity to find fossils such as areas of igneous or metamorphic bedrock, thick soil and/or vegetation cover, and/or areas highly disturbed by previous developments.
- A list of protected significant fossil sites in proximity to the project area.
- Assess the potential risk to fossils based on the fossil resource potential, likelihood of geology favourable for fossils (Table 1), and proximity to known resources (Table 2) for the development project.
- If the risk to fossils is Very Low or Low, indicate in your report that the project activities will have low impact on fossil resources. The next step is for the proponent to put in place a Chance Find Protocol.
- If the risk to fossils is Medium or High, recommend that a FIA will commence in advance of the construction or development project to further assess fossil resources. The next step is to have a Qualified Lead Paleontologist prepare a more detailed FIA Report, to be reviewed by FMO.

**Table 1** – Fossil resource potential (likelihood of fossil occurrences) within deposit or rock type.

Fossil Resource Potential/ Likelihood of Fossils	Deposit Type				Management Concern
	Quaternary (unconsolidated, loose)	Sedimentary (layered, cemented) Rock	Igneous (Volcanic) Rocks	Metamorphic (altered) Rocks	
<b>High Potential/ Fossils Expected or Certain</b>	Cave; beach; pit; and marine deposits	Fossiliferous to highly fossiliferous with regular to consistent and predictable yield of significant fossils at risk of impact; e.g., marginal marine deposits, organic-rich rocks.			Concern is high, with FIA and field survey and monitoring of bedrock disturbance justified or necessary.
<b>Medium Potential/ Fossils Possible or Unknown</b>	Moraines; outwash; lacustrine; travertine	Units in which fossil content varies, is unpredictable, scattered, or unknown; e.g., non-marine to distal marine deposits.			Careful consideration, with FIA and field survey likely justified.
<b>Low Potential/ Fossils Unlikely</b>	Thick glacial sand; colluvium; reworked gravel; high altitude fluvial	Units not known or likely to contain significant fossils; e.g., thick, uniform shale; coarse-grained sandstone; conglomerate.	Fossils can rarely be preserved in volcanic rocks		Concern is generally low.
<b>Very Low Potential/ Fossils Rare</b>	Highly weathered or slumped deposits	Weathering, corrosion and recrystallization	Nearly all igneous rocks are void of fossils	Low grade metamorphism can occasionally preserve fossils	Concern is negligible or not applicable.
<b>Nil</b>				High grade metamorphism destroys nearly all visible fossils	Concern is negligible or not applicable.

The risk to fossils is also evaluated based on how the proposed development relates to known fossil sites and degree of ground disturbance (Table 2):

1. **Fossil site(s) occurs locally at the proposed development site:** This category indicates that fossil resources occur locally within the footprint of the proposed development site, or within 1 km of the site boundary. Known fossil finds indicate a high likelihood of new fossil discoveries in the same strata or sediment.
2. **Fossil Site(s) known in the region:** This category includes a known fossil site in similar geological conditions, but greater than 1 km away from the development site. Only a small fraction of fossil sites in B.C. have been recorded, and if fossils have been found in similar geological conditions nearby it indicates there may be unrecorded sites within the development area.
3. **No record of overlap:** This category indicates that fossil resources have not been recorded within 1 km of the development nor in nearby similar geological units, but this does not discount the possibility that fossils could occur in the area.

**Table 2** - Risk matrix for paleontological impact of proposed activity on Crown Land (adapted from Peterson and Townsend, 2013, modified to include paleontological terminology).

Proximity to Significant Fossil Resources	Surface use only (if vegetated)	Minor Surface Disturbance (< 30 cm deep) (if vegetated)	Significant Surface Excavation (>30 cm deep) or directly on sediment exposure
Fossil Site(s) Known Locally	Low Risk	Medium Risk	High Risk
Fossil Site(s) Known in Region	Very Low Risk	Low Risk	Medium Risk
No Record of Overlap	Very Low Risk	Low Risk	Low Risk

The risk levels in Table 2 are defined as:

- **High Risk:** Fossiliferous sedimentary deposit with known fossil resources within proposed development or locally (< 1 km from proposed development site)
- **Medium Risk:** Fossiliferous sedimentary deposit with known significant fossil resources regionally (>1 km from proposed development site) or where surface disturbance will be minor
- **Low Risk:** Occasionally fossiliferous with no local and few regional fossil resources or where there are known fossils but a project has surface use only
- **Very Low Risk:** Non-fossiliferous formations (including metamorphic or igneous) with no known fossil resources or where a project has surface use only

## Step 2. Review of Preliminary Study Report

FMO will review the Preliminary Study assessment and provide a review outcome.

Depending on the identified fossil resource risk, the proponent may need to fulfill some mitigation activities and will be notified of the approval status.

If the risk to fossils is Very Low or Low, the only action required is that the proponent develops and adopts a Chance Find Protocol (Step 3 below) and submits this to FMO.

If the risk to fossils is Medium or High, the proponent is directed to engage a qualified Lead Paleontologist to perform a FIA (Step 4 below).

## Step 3. Chance Find Protocol

A Chance Find Protocol is a procedure document that tells a proponent and construction or development personnel how to manage fossil discoveries made during project activities. The protocol and its procedures will be site specific.

This document must be developed even with a low risk of impact to fossils, where fossils are not expected, because unpredicted fossil discoveries may be unearthed by industrial activity. Example content for a basic Chance Find Protocol can be found in Appendix B.

When there is medium to high risk of impact where fossils are expected, and the types of predicted fossil discoveries are known and can be illustrated, a detailed Chance Find Protocol is needed. An example illustrated version can be found on FMO's website: [For industry, consultants and users - Province of British Columbia](#)

The document will be submitted and approved by FMO.

The purposes of the Chance Find Protocol are:

1. To report new fossil finds as a positive contribution to building the record of fossils in B.C., as part of our shared natural heritage. New discoveries are then available for scientific study, display in museums, or for educational outreach.
2. To make workers aware of the fossil potential and types of fossils that may be encountered during excavation and moving of earth materials.
3. To identify the steps workers and operators should take and who they should contact when a fossil is discovered.

## Step 4. Fossil Impact Assessment (FIA) Plan and Report

The FIA process determines the pre- to post-development effects of ground disturbance activities on fossil resources within the project footprint. The process begins with a FIA Plan for paleontological field investigation. This must be submitted to FMO for review prior to starting field studies and follow the template content in Appendix C.

Upon approval of the FIA Plan, work to prepare a FIA Report can commence and follow the guidelines (Appendix D) to include the content described below.

Objectives of a FIA include:

- Identify fossil sites within the development area and assess fossil types, quality, preservation
- Assess the significance of fossils encountered
- Document, photograph and collect significant fossils encountered to minimize the information lost through development activity
- Evaluate the risk to fossils to make impact management and mitigation recommendations in a FIA Report prepared for the proponent and FMO
- Arrange for transportation and curation of specimens

There are five key parts to the FIA Report:

1. **Introduction** provides a project overview, project history, specific objectives of the FIA and scope of the report, and the timing (dates and duration) of the work.
2. **Project Description** includes details about the project type and its location and schedule information about applications, assessment timing and project lifespan.
3. **Study Area** section of the report provides details about the geological setting and specific stratigraphy and sedimentary units encountered. Include a list of previously recorded fossil sites within the project area.
4. For the **Methodology** section of the report, include these elements:
  - a. Comment on how the fossil resources **Inventory** will be used to select sites for field assessment. Describe data sources for the inventory such as the Fossil Collection Events dataset, accessible by authorized users (Lead Paleontologist). Include additional information about fossil resource information found in publications or through consultation with regional paleontological experts, recreational fossil collectors in the area, local First Nations and stakeholder groups.
  - b. Outline methods for **Site Evaluation** and how the systematic field study, data collection, and sampling are conducted to verify the fossil potential within the development area. This includes making arrangements with a B.C. fossil repository to receive fossils collected as part of FIA surveys and assessment.  
  
Representative samples of identified fossils may be collected to show the condition, composition and abundance of fossil assemblages throughout the surveyed area. Any significant fossils identified that are at risk of immediate damage may also be collected. Fossil identifications made in the field are often

tentative and require representative samples to be collected and examined under proper laboratory conditions and with the use of comparative material.

Use a **standardized fossil collection data spreadsheet** provided by FMO.

- c. A section about **Impact Identification and Assessment** explains how project impacts are identified. Describe the process used to assess impacts on fossil resources, including categories of fossil resource potential (Table 1) and how the field study examines all sedimentary exposures identified as having the highest potential for fossils to then make predictions about impacts to fossils (Table 2). Describe how significance criteria are used to evaluate the importance of fossil resources or fossil sites.
5. **Impact mitigation recommendations** for managing adverse impacts to fossil resources address the question: “Are mitigative actions required to preserve fossil resource values?” Determining what mitigative actions to pursue is best accomplished through a cooperative approach between the Lead Paleontologist, the proponent, and FMO.

Actions may include avoidance of a fossiliferous area by revising the development plan and leaving fossil resources intact.

At a minimum, mitigation involves having an updated, and site-specific **Chance Find Protocol** in place. The protocol informs personnel of the types of fossils likely to occur and should be shared with all workers in the event that fossils are encountered before and during development activities. Actions to recommend include:

- a. Suspend ground disturbance work in the vicinity of a fossil find and leave material in place; demarcate a protective buffer around the find area
- b. Pause work to record the GPS location of the fossil, describe its position (e.g., depth below surface) and photograph the site and the fossil
- c. Report the find using the contact information in the Chance Find Protocol
- d. Salvage fossils through systematic excavation, in a scientifically sound yet efficient way, and move them to a safe location

FIA Report submission by the Lead Paleontologist, to both the proponent and FMO for review, will be followed by an evaluation by FMO and response back to the Lead Paleontologist. Subsequent fossil impact mitigation work may be needed for the monitoring of significant fossils exposed or displaced during project development activities, leading to Step 5 below.

### Step 5. Fossil Impact Mitigation Plan and Report

Mitigation paleontology, conducted by a Lead Paleontologist, may be deemed necessary for some projects in highly fossiliferous areas to reduce adverse effects on significant fossil resources through a mitigation and monitoring plan.

When a FIA Report recommends mitigation measures, and these are approved by FMO, additional work by consulting paleontologists will be needed such as construction monitoring and/or recovery of fossils threatened by ground disturbance as a project proceeds.

Like the FIA process, Impact Mitigation begins with a Fossil Impact Mitigation Plan for field activities such as surveys and monitoring. This must be submitted to FMO for review prior to starting the field work and follow the suggested template content in Appendix E.

Upon completion of the monitoring and mitigation work, the Lead Paleontologist submits a Fossil Impact Mitigation Final Report, with suggested template content in Appendix F.

Mitigative actions must be staged appropriately with project development activities to reduce paleontological impact while maintaining safety standards. Information sessions can be held by the Lead Paleontologist before and during the development activities to acquaint principal operators with their mitigative activities and fossil recognition. Mitigative actions include:

- Monitoring by a qualified paleontologist during mechanical excavations. Close communication between the excavator operators and the paleontologist is necessary to complete successful and safe monitoring. A second person may be necessary to relieve and spot the monitoring paleontologist in complex and busy sites. Monitoring may include fossil specimen recovery, data management (arranging curation of specimens) and reporting.
- Intermittent inspection of rock exposures, in areas where continuous monitoring is too dangerous or inefficient to be performed, during quiet construction periods.
- Systematic excavation and salvage of fossil discoveries by the paleontologists.
- Continued use of the adopted Chance Find Protocol.

The plan for chance fossil discoveries should be followed for the lifetime of the project development activities.

## Appendix A: Preliminary Study Report – Template

### **Title Page**

- Report Title with project name and location, called a Preliminary Study Report
- Prepared for - Name and address of the proponent for which the report was prepared
- Prepared by – Name and address of paleontology consulting company
- Date

**Table of Contents** - Including List of Maps and/or Figures, List of Tables, Appendices

**Executive Summary** - Key points of the report stating its purpose, results and recommendations

**Abbreviations** (optional) - list of frequently used abbreviations and their meaning

### **Introduction**

- Describes the project and study area location, include map(s)
- State the purpose (objectives) of the preliminary study

**Methods** - List the tools, datasets and information sources used in the study

### **Geological Setting**

- Review of geological units affected and summarize geological setting
- Include geological map(s) showing project location and boundaries

### **Results - Fossil Resource Potential**

- Discussion of fossil resource potential and fossil sites
- Include a table of known fossil sites, if present
- List protected fossil sites or significant fossils in, or in proximity to, the project
- May include the classification of fossil resource potential based on deposit/rock types or the Risk Matrix for impact to paleontological resources

**Recommendations** - Discuss likelihood of project impacts to fossil resources; Propose next steps

**References** - List of sources cited

**Appendices** - May include project plans, additional maps or photographs

## Appendix B: Chance Find Protocol for Fossil Discoveries – Template

Text in black may be cut and paste into your Protocol, with some customization and additions as needed. **Provide the text sections in blue.**

### Title Page

- Chance Find Protocol Title with project name and location
- Prepared for - Name and address of the proponent or operator
- Prepared by – Name and address of paleontology consulting company or geologist
- Date

### Description of the project

Provide a brief description of the project.

### Why are fossil discoveries important?

British Columbia (B.C.) is home to many globally significant fossil sites. Fossils are essential to the understanding of B.C.'s natural history and geology, provide opportunities for scientific discovery and education, and help locate mineral, oil and gas deposits. Fossils constitute a valuable resource which is administered under the Land Act by the Fossil Management Office, Heritage Branch. All fossils on Crown Land are property of the province and may not be sold or removed from the province. Collection of fossils is prohibited without a permit, except for recreational collecting of some common fossil types. Developers are asked to report any fossils unearthed on their site to the Fossil Management Office (Heritage Branch) or Royal British Columbia Museum.

### What kinds of fossils occur in British Columbia?

Fossils are preserved remains of organisms such as bones, teeth and shells or impressions of organisms in the rock such as a plant leaf. Trace fossils are preserved biological activity such as dinosaur footprints or tracks and burrows. Fossils range from thousands of years old to hundreds of millions of years old and are often the remains of extinct species. Fossils are the historical record of the evolution and development of life on earth. They are important globally as well as in British Columbia for their scientific, heritage, educational and economic value.

Fossils are primarily found in sedimentary rocks from ancient marine and lake basins in the province. Volcanic rocks, such as ash, also may preserve fossils. The distribution of fossil resources remains poorly understood within British Columbia so there is always a chance that new fossil sites will be encountered. Known fossil site concentrations are found on Vancouver Island, Haida Gwaii, in the Princeton-Merritt-Kamloops area, in southeastern and northeastern British Columbia and the Central Interior Plateau.

## What should you do if you discover fossils?

If any fossil sites or fossil remains are encountered or unearthed during development or industrial activity, the following steps must be taken:

1. Suspend work and all forms of ground disturbance in the immediate vicinity of the find and leave all possible fossil material in place.
2. Establish a protective buffer of at least 30 metres, around the extent of the find area. Demarcate the buffer in a highly visible way (e.g., with “No Work Zone” flagging).
3. Work at that location may not resume until the measures below are implemented.
4. Report your discovery to the site supervisor (**Insert name and contact phone number of Site Manager or Project Geologist or qualified Lead Paleontologist**).
5. Site supervisor will photograph the site and fossils using a scale, record the GPS location of where the fossils were found and note how fossils were found. Relay this information to the qualified Lead Paleontologist or the Fossil Management Office (Fossil.Management@gov.bc.ca).
6. Depending on the nature of the find, the qualified Lead Paleontologist will assess the find and may:
  - a. Document the site fully and relay the information (photographs, fossil information, stratigraphy, site locality information) to the Fossil Management Office and to (**Insert name of repository if this has been arranged**).
  - b. If the qualified Lead Paleontologist determines the fossil or the site is significant, they will contact the Fossil Management Office and (**Insert name of repository if this has been arranged**). Work must not resume at the location until approved by the Fossil Management Office.
  - c. The qualified Lead Paleontologist will develop a mitigation plan in consultation with the Fossil Management Office.
7. All images, data and samples collected will be reported to the Fossil Management Office.

## What kinds of fossils may occur on-site?

**Proponent should add photos here of the types of fossils expected to occur within the geological units being impacted by ground disturbance [Optional but recommended].**

## Appendix C: Fossil Impact Assessment (FIA) Plan for Field Investigation – Template

### Title Page

- Report Title with project name and location, called a Fossil Impact Assessment (FIA) Plan
- Prepared for - Name and address of the proponent for which the report was prepared
- Prepared by – Name and address of paleontology consulting company
- Date

### Table of Contents

- Includes List of Maps and/or Figures, List of Tables, Appendices

### Background

- Overview of investigative work to be done at the site

### Locality Description

- Include a map of the site, showing the area(s) of interest
- Description of the geology and known fossil discoveries near or at the site

### Personnel

- Name and qualifications of the Lead Paleontologist
- Names, roles and experience of other professionals, field supervisor, or assistants

### Work Schedule

- Propose dates for field work tasks with estimate of total number of field days

### Field Methodology

- Survey and/or sampling approach
- Tools and equipment to be used
- Data collection techniques
- Specimen collecting strategy
- Data recording

### Site Considerations – include information under the following subheadings:

- **Safety/Hazard Plan** - Briefly describe the plan in place.
- **Site Access** - Describe how you will be accessing the site(s).
- **Temporary Structures** - Describe any temporary structures planned at the site during the fieldwork.
- **Vegetation Clearing and Working near Water Courses** - Note any need to clear trees or vegetation and if you be working near water or needing to use water?

- **Site Restoration** - Identify the clean-up or restoration that will be undertaken upon completion of the field work. The site must be restored to a condition comparable to that prior to the field investigation.

### **Curation**

Identify arrangements made with a recognized B.C. repository for the curation of fossils collected. Include, as an Appendix, a signed copy of the written repository agreement. Please contact the FMO to discuss the appropriate institution.

### **Reporting**

Describe the reporting needed upon completion of the field investigation. Indicate that a standardized collection data spreadsheet provided by FMO will be included to record the location of fossils sites, lists of fossils found and collected.

### **Closing**

Include brief closing remarks and include a signature of the plan author that lists their title and organization.

**References** - List of sources cited

## Appendix D: Fossil Impact Assessment (FIA) Report – Template

### **Title Page**

- Report title with project name and location, called a Fossil Impact Assessment (FIA) Report
- Prepared for – Name and address of the proponent for which the report was prepared
- Prepared by – Name and address of paleontology consulting company
- Date

### **Credit Sheet**

- Includes names, addresses and professional affiliations of the contributors to the FIA: Lead Paleontologist, supporting personnel and reviewer

### **Executive Summary**

- Key points of the report stating its purpose, results and recommendations

### **Table of Contents**

- Includes List of Maps and/or Figures, List of Tables, Appendices

### **Introduction**

- Project overview
- Project history
- FIA objectives and scope
- Dates and duration of the study

### **Project Description**

- Provide a summary of proposed project plans and site, including a location map showing boundaries of the proposed project site(s)
- Describe projected extent and level of land alteration or disturbance
- Explain project designs or locations that differ from original project design
- Describe access and terrain
- Describe past land uses or previous FIAs
- Include project scheduling details

### **Study Area and Geological Setting**

- Provide overview of the geological setting
- Identify sedimentary unit(s) or deposits affected by the proposed development
- Include a map showing the units
- Indicate the fossil resource potential and fossil occurrences in proximity to the project

## Methodology

- Inventory
  - list known fossil occurrences by geological unit, including fossil types, age, lithological unit, locations, and information sources that were reviewed (this may refer to the Preliminary Study Report)
  - describe how sites for field assessment were selected
- Site Evaluation
  - describe the survey area, outcrop exposure and access
  - list the types of data and information recorded in the field
  - explain fossil collecting and recording procedures
  - identify the B.C. fossil repository for the curation of collected fossils
- Impact Identification and Assessment – explains how project impacts are identified
  - describe the process used to assess impacts on fossil resources, including categories of fossil resource potential (Table 1)
  - describe significance criteria used in the evaluation of importance of fossil resources or fossil sites
  - predict the risk level associated with adverse effects to fossil resources, using the risk matrix (Table 2)

## Results

Content may be arranged by each area of the project footprint examined to describe results using the suggested headings:

- Fossil Resource Inventory and Evaluation
  - description of each site, nature of the sedimentary exposure (good or poor)
  - list of fossil sites recorded (also prepare a separate standardized data collection spreadsheet to submit to FMO)
  - maps showing areas examined (or if areas were exempt from the study), with waypoints and recorded fossil localities in relation to the project footprint
  - discussion of fossil resource evaluation including site-specific significance assessment and comments on fossil sites with high, medium, or low significance within the project footprint
  - include field photographs (may be arranged into Plates within Appendices)
- Impact Identification and Assessment
  - discuss potential impacts on fossils related to significance and project actions
- Impact Mitigation Recommendations
  - discuss recommendations for managing adverse impacts to fossil resources

## **Summary and Conclusions**

- Summarize the impact assessment results and recommendations to reduce adverse impacts on fossils encountered during ground disturbance, such as monitoring of excavation by a qualified paleontologist during development activities.
- Make updates to the initial Chance Find Protocol, if one was submitted with the Preliminary Study Report, and include as an Appendix (also submit a separate Chance Find Protocol to FMO)

## **References** – List of sources cited

## **Appendices** – Append relevant items to the report including:

- Maps
- Photographs of stratigraphy, fossil sites and fossils
- Chance Find Protocol

## Appendix E: Fossil Impact Mitigation Plan – Template

### Title Page

- Report Title with project name and location, called a Fossil Impact Mitigation Plan
- Prepared for - Name and address of the proponent for which the report was prepared
- Prepared by – Name and address of paleontology consulting company
- Date

### Table of Contents

- Includes List of Maps and/or Figures, List of Tables, Appendices

### Background

- Provide overview of monitoring and mitigative work to be done at the site

### Locality Description

- Include a map of the site, showing the area(s) of interest
- Description of the geology and planned fossil monitoring or collection sites

### Personnel

- Name and qualifications of the Lead Paleontologist
- Names, roles and experience of other professionals, field supervisor, or assistants

### Work Schedule

- Propose dates for field work tasks with estimate of total number of field days

### Field Methodology

- Survey and/or sampling approach
- Tools and equipment to be used
- Data collection techniques
- Specimen collecting strategy
- Data recording

### Site Considerations – include information under the following subheadings:

- **Safety/Hazard Plan** – Briefly describe the plan in place.
- **Site Access** – Describe how you will be accessing the site(s).
- **Temporary Structures** – Describe any temporary structures planned at the site during the fieldwork.
- **Vegetation Clearing and Working near Water Courses** – Note any need to clear trees or vegetation and if you be working near water or needing to use water?

- **Site Restoration** – Identify the clean-up or restoration that will be undertaken upon completion of the field work. The site must be restored to a condition comparable to that prior to the field investigation.

### **Curation**

Identify arrangements made with a recognized B.C. repository for the curation of fossils collected. Include, as an Appendix, a signed copy of the existing or updated repository agreement. Please contact the FMO to discuss the appropriate institution.

### **Reporting**

Describe the reporting needed upon completion of the field investigation. Indicate that a standardized collection data spreadsheet provided by FMO will be included to record the location of fossils sites, lists of fossils found and collected.

### **Closing**

Include brief closing remarks and include a signature of the plan author that lists their title and organization.

**References** – List of sources cited

## Appendix F: Fossil Impact Mitigation Final Report – Template

### **Title Page**

- Report title with project name and location, called a Fossil Impact Mitigation Report
- Prepared for – Name and address of the proponent for which the report was prepared
- Prepared by – Name and address of paleontology consulting company
- Date

### **Credit Sheet**

- Includes names, addresses and professional affiliations of the contributors: Lead Paleontologist, supporting personnel and reviewer

### **Executive Summary**

- Key points of the report stating its purpose, results and recommendations

### **Table of Contents**

- Includes List of Maps and/or Figures, List of Tables, Appendices

### **Introduction**

- Project overview and history (cite FIA report for brevity)
- Mitigation and monitoring objectives and scope
- Dates and duration of the study

### **Methodology**

- Describe procedures and approaches

### **Field Survey Results**

- Provide a summary of project areas monitored

### **Monitoring and Mitigation Results**

- Provide overview of stratigraphy and fossils recovered, if any
- List fossil sites recorded (also prepare a separate standardized data collection spreadsheet to submit to FMO)

### **Impact Mitigation Recommendations**

- Discuss future strategies for managing adverse impacts to fossil resources

### **References** – List of sources cited

### **Appendices** – Documentation of areas monitored

## Appendix G: Qualifications for Paleontologists

Paleontology is an interdisciplinary science that combines knowledge from the fields of geology (or Earth science), biology, and ecology. Paleontologists may specialize in one or more sub-disciplines in university: invertebrate paleontology, vertebrate paleontology, paleobotany, micropaleontology, palynology, ichnology, or paleoecology.

The following recommended five-fold schedule of paleontological roles (Table 1) is intended to serve the primary functions within a paleontological impact assessment process and ensure professional treatment of B.C.'s fossil resources. Foremost, a **Lead Paleontologist** is eligible to conduct paleontological studies and services related to fossil resource management.

List of Paleontological Roles and Qualifications

Status	Education	Qualifications	Responsibilities
<b>Lead Paleontologist</b>	Ph.D. (preferred), or M.Sc. degree with equivalent experience, in a paleontological discipline	<ul style="list-style-type: none"> <li>Project leadership</li> <li>Demonstrated ability to design and conduct paleontological research</li> <li>Fieldwork expertise and supervision (24 weeks)</li> <li>Laboratory and/or curation training (24 weeks)</li> <li>Produce reports in a timely fashion and have a record of peer-reviewed reports and/or publications</li> </ul>	<ul style="list-style-type: none"> <li>Project leader</li> <li>Paleontology permit holder</li> <li>Final assessment report approval</li> <li>Mitigative recommendations</li> <li>Responsible for all aspects of the FIA and mitigation plan execution</li> <li>Respond in a timely and consistent manner</li> <li>Communicate and collaborate well</li> </ul>
<b>Assistant Paleontologist</b>	M.Sc. degree with emphasis in paleontology or equivalent	<ul style="list-style-type: none"> <li>Working towards Lead Paleontologist status</li> <li>Supervised Fieldwork (16 weeks)</li> <li>Laboratory and/or curation experience (16 weeks)</li> </ul>	<ul style="list-style-type: none"> <li>Supervise site management in Lead Paleontologist's absence</li> <li>Assessment report writing</li> <li>Paleontological research</li> <li>Supervise site survey</li> <li>Sample curation</li> </ul>
<b>Paleontologist In-training</b>	B.Sc. degree with emphasis in paleontology	<ul style="list-style-type: none"> <li>Working towards an M.Sc. with paleontology emphasis</li> <li>Combined supervised fieldwork, laboratory and/or curation (8 weeks)</li> </ul>	<ul style="list-style-type: none"> <li>Assist in site survey</li> <li>Supervised site excavation</li> <li>Assist with background review</li> <li>Supervised sample curation</li> </ul>
<b>Paleontological Technician</b>	Post-secondary degree or diploma with some paleontology	<ul style="list-style-type: none"> <li>Combined supervised fieldwork, laboratory and/or curation (4 weeks)</li> </ul>	<ul style="list-style-type: none"> <li>Assist in site survey</li> <li>Supervised site excavation</li> <li>Assist with background review</li> <li>Supervised sample curation</li> </ul>
<b>Field Participant</b>	Secondary school diploma preferred	<ul style="list-style-type: none"> <li>Minimal experience and keen interest in paleontology</li> <li>Physical capacity to participate</li> </ul>	<ul style="list-style-type: none"> <li>Supervised site excavation</li> <li>Field crew assistant</li> <li>Supervised sample curation</li> <li>Field observation</li> </ul>

## Lead Paleontologist

The Lead Paleontologist serves as project leader, and must have a well-developed professional interest, education and experience in paleontology, and demonstrate the ability to implement field studies and communicate through written work. They may be affiliated with an academic institution or research centre or repository, or work with a consulting company that focuses on the assessment of fossil resources.

**Education:** A person who holds a Ph.D. from an accredited university in a paleontological discipline is preferred. They have written a thesis in which there has been field research and laboratory components or have subsequent field and/or laboratory experience.

*or*

A person who holds a M.Sc. degree from an accredited university with a thesis in a paleontological discipline and a minimum of 3 years post-M.Sc. experience as a paleontologist could also serve as the project leader. They have a written thesis in which there has been field research and laboratory components, or supervised field and/or laboratory experience demonstrating the capacity to act as the project leader for an equivalent project size.

*or*

A person who has a combination of education and experience that offers similar skill sets to those outlined above.

**Experience:** Minimum of 24 weeks of supervised fieldwork and 24 weeks of supervised laboratory and/or curation training.

**Responsibility:** The Lead Paleontologist is the project leader and paleontological excavation permit holder who is responsible for all aspects of the FIA and mitigative plans. The person performs or supervises the field and laboratory work, commits their signature to the final assessment report documents, and makes the mitigative recommendations.

## Assistant Paleontologist

An Assistant Paleontologist provides project support in FIAs with interest, education, and experience in paleontology. The person must have demonstrated a developing capacity to implement field studies.

**Education:** A person who has attained a minimum of a M.Sc. degree from an accredited university with a thesis in a paleontological discipline, and is working towards gaining experience required for Lead Paleontologist status, could serve as an Assistant Paleontologist

*or*

A person who has a combination of education and experience, who offers a similar skill set to that of someone with a M.Sc. degree.

**Experience:** Minimum of 16 weeks of supervised fieldwork and 16 weeks of laboratory and/or curation training.

**Responsibility:** The Assistant Paleontologist provides support to a Lead Paleontologist in project management, and report writing, and can supervise or perform field work and laboratory duties in the Lead Paleontologist's absence. Paleontological review research and writing, supervising a site survey, performing mitigative actions and preparing samples for curation are among the duties performed by an assistant paleontologist.

### Paleontologist-in-training

A Paleontologist-in-training also provides project support and is in a career-development role. A candidate must demonstrate an interest in paleontology and be seeking the education and experience required for a professional career in paleontology.

**Education:** A person who holds a minimum of a Bachelor's degree from an accredited university with emphasis in paleontology is preferred. They could be seeking or exploring a career as a paleontologist or be working towards a M.Sc. degree with emphasis on paleontology.

**Experience:** A minimum combination of 8 weeks of supervised fieldwork, laboratory and curation experience.

**Responsibility:** The Paleontologist-in-training can assist in site surveys, perform supervised mitigative actions, site excavations and sample curation, and assist in the compilation of paleontological background reviews.

### Paleontological Technician

A Paleontological Technician provides technical support whereby the person must demonstrate a strong interest in paleontology and apply highly skilled aspects of technical field and laboratory work.

**Education:** A person with a post-secondary degree or diploma from an accredited community college or university with some paleontological courses completed is preferred. Someone with demonstrated skills to perform the duties through personal study and experience, such as a recreational fossil collector, could also qualify.

**Experience:** A minimum combination of well supervised, 4 weeks of field, laboratory and curation work is expected before some duties can be performed unsupervised.

**Responsibility:** The Paleontological Technician assists in supervised site surveys and site excavations, paleontological background reviews and sample curation. As skill levels develop with additional experience and education, small-scale field inspections, and mitigative actions such as excavations and monitoring could be performed.

## Field participant

Field participation of interested parties is encouraged as it leads to the positive development and public profile of the paleontological profession. A participant should demonstrate a keen interest in paleontology, be a stakeholder or a First Nation representative. The person should have the physical capacity to endure the required fieldwork, which can be strenuous.

**Education:** Preferably a secondary school or college diploma.

**Experience:** Minimal experience is required, but a keen interest in paleontology is preferred.

**Responsibility:** Field participants cannot perform any official paleontological duties nor are they allowed to function independently. They can, however, serve as field crew assistants who search for fossils, take field notes or be on-site to perform field observer roles to make sure their stakeholder interests are regarded adequately. They can also participate in supervised site excavation and sample curation, if they demonstrate to the Lead Paleontologist that they have, or desire to obtain, the necessary skill set.