

FOSSIL MANAGEMENT

Fossil Impact Assessment (FIA) Guidelines for Industry



The following guidelines outline the procedures and elements of the FIA process in British Columbia

TABLE OF CONTENTS

Purpose of Fossil Impact Assessment Process.....	3
FIA Standards	3
Fossil Assessment Process	4
1. Preliminary Study by Proponent and Land Disposition Application.....	4
2. Review of Preliminary Study and Application	8
3. Chance Find Protocol	8
4. Fossil Impact Assessment (FIA).....	8
Fossil Resources Inventory and Review	9
Systematic Pedestrian Field Study	9
Fossil Resources Evaluation.....	9
Impact Identification and Assessment.....	10
Impact Mitigation Recommendations	10
Report Submission and Review	10
5. Fossil Impact Reduction.....	10
Mitigative Action Plan Approval	10
Mitigation During Early Development.....	11
Subsequent Mitigative Actions.....	11
Project Decommissioning	12
Appendix A: Qualifications for Paleontologists	13
Lead Paleontologist	14
Assistant Paleontologist.....	14
Paleontologist-in-training	15
Paleontological Technician	15
Field participant	16
Appendix B: FIA Plan for Paleontological Field Investigation Template.....	17
Appendix C: Guidelines for Fossil Impact Assessment (FIA) Report	19
Title Page	19
Credit Sheet.....	19
Executive Summary.....	19
Table of Contents	19
List of Figures, Tables, Appendices	19
Introduction.....	19
Project Description.....	20
Study Area and Geological Setting	20
Methodology	20
Results: Fossil Resource Inventory.....	21
Fossil Resource Evaluation.....	21
Impact Identification and Assessment.....	21
Impact Mitigation Recommendations	21
References	22
Appendices.....	22

PURPOSE OF FOSSIL IMPACT ASSESSMENT PROCESS

Fossil resources are part of British Columbia's natural heritage. The scientific, educational, cultural and heritage value of fossils warrants management, protection, and preservation. The purpose of a Fossil Impact Assessment (FIA) is to provide a professional and credible assessment of the fossil resource so that the Province can make appropriate decisions about the disposition of land. These guidelines identify the process for proponents who are planning developments which 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 identify the qualifications for consulting paleontologists contracted to work on a FIA.

FIA STANDARDS

The following standards are recommended for all FIA activities. The BC Fossil Management Office (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.
- FIA activities should be led and performed by qualified paleontologists to the specifications of the role (Appendix A). 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 BC 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 cold or wet weather.
- A FIA Plan (Appendix B) for paleontological field investigation must be submitted to the BC Fossil Management Office for review prior to starting field studies.
- All discoveries of significant fossil resources should be protected and reported to the BC Fossil Management Office and the Royal BC Museum (RBCM) for further instructions.
- The FIA report (Appendix C) should be produced soon after field inspections and forwarded to the BC Fossil Management Office for review. Field data notations should be recorded on-site. Reports must be clear, concise, and comprehensive.

- Records should be kept by the Lead Paleontologist for 10 years subsequent to the FIA, and any mitigative actions.
- All fossils collected remain the property of the Crown and should be handled and prepared for curation according to the standards set by the RBCM. Collected materials should remain inside BC unless otherwise authorized.

FOSSIL ASSESSMENT PROCESS

The fossil assessment process involves the proponent, the Lead Paleontologist, the BC Fossil Management Office, and the Land Adjudicator.

Assessment of potential impact to fossils begins with a preliminary study. Results of the preliminary study should be included in the land application by proponent. If the preliminary study indicates very low or low risk to fossil resources, a Chance Find Protocol needs to be developed. If the preliminary study indicates that project activity is likely to encounter areas with medium and/or high risk to fossil resources, a FIA is required, including a Chance Find Protocol and Mitigation Plan prior to project construction phase.

1. Preliminary Study by Proponent and Land Disposition Application

The proponent or their representative agent first needs to undertake a concise analysis of the potential impact on fossils called a preliminary study which must accompany the land disposition application. Proponents may choose to engage a professional paleontologist to conduct the study and make use of tools such as the Fossil Occurrence Database available through the BC Fossil Management Office website.

The preliminary assessment of the risk to fossils is based on the proximity of development activity to known fossils, the type of underlying deposits or rock affected by development activity, and the proposed activity.

The preliminary study should include:

- 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 known fossil sites, if present, (information about fossil resource potential of geological units is available to Lead Paleontologists through the BC Fossil Management Office).
- Notes about the fossil resource potential of each geological unit possibly encountered based on known fossils and 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 that provide known opportunities to find fossils; 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 opportunities to find fossils (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 opportunities to encounter fossils, 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 the BC Fossil Management Office.

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	
High Potential/ Fossils Expected or Certain	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.
Medium Potential/ Fossils Possible or Unknown	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.
Low Potential/ Fossils Unlikely	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.
Very Low Potential/ Fossils Rare	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.
Nil				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 locally known significant fossil resources occur within the footprint of the proposed development site, or within 1 km of the site boundary. Known finds indicate a good chance of making new 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 significant 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, with modifications 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

2. Review of Preliminary Study and Application

The BC Fossil Management Office will review the Preliminary Study assessment and provide a review outcome.

The Land Adjudicator will evaluate the land disposition application and assess whether the development project could potentially adversely impact fossil resources. 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 and submits the plan to the BC Fossil Management Office. Read more about Chance Find Protocol below.

If the risk to fossils is Medium or High, the proponent is directed to engage a qualified Lead Paleontologist to perform a FIA. Read more about FIA requirements below.

3. Chance Find Protocol

A Chance Find Protocol must be developed because fossil resources may be discovered during industrial activity. This plan must be submitted (via e-mail) and approved by the BC Fossil Management Office.

The plan and its procedures will be site specific. See example documents on the BC Fossil Management website.

The purpose of the Chance Find Protocol is:

- 1) To make workers aware of the fossil potential and types of fossils that may be encountered during excavation and moving of earth materials; and
- 2) To identify the steps workers and operators should take and who they should contact when a fossil is discovered.

4. Fossil Impact Assessment (FIA)

The FIA determines the pre- to post-development effects of the development activities on fossil resources within the project footprint.

Objectives of a FIA include:

- Provide the Proponent with a plan for assessing and mitigating damage to fossil resources
- Identify fossil sites within the development area and assess their composition, quality and preservation
- Assess the significance of fossils encountered
- Document and photograph fossils encountered to minimize the information lost through development activity

- Make impact management and mitigation recommendations
- Arrange for transportation and curation of specimens

A FIA should include the following components:

Fossil Resources Inventory and Review

The Lead Paleontologist will review all available information sources on fossils within the development area including: 1) public and academic literature, 2) government lists of fossil locations and protected areas, 3) collections held at museums and private institutions, 4) consultation with regional paleontological experts, recreational fossil collectors in the area, local First Nations and stakeholder groups.

From this information the Lead Paleontologist will plan a systematic field study and make arrangements with a qualified B.C. fossil repository for fossils collected as part of FIA surveys and assessment.

A FIA Plan (Appendix B) for paleontological field investigation must be submitted to the BC Fossil Management Office for review prior to starting field studies.

Systematic Pedestrian Field Study

A systematic pedestrian field study is a hands-on, in-the-field survey of the fossil resource occurrences within the vicinity of the development project, including the footprint, exterior activity zones and nearby proxy exposures.

The field survey will be used to verify the fossil potential within the development area. The survey will examine all sedimentary exposures which have been identified as having the highest potential for fossils, and a representative sample of areas with lower potential for fossils.

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 which 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.

Ensure that fossil collection Data Sheets, available on the BC Fossil Management Office website, are used.

Fossil Resources Evaluation

Once the field survey is completed, the Lead Paleontologist will review the field data, including the identification of observed and collection fossils, assessing the significance of those fossils, and preparing them for submission to a qualified repository. This information will be included in the FIA report to be submitted to the BC Fossil Management Office.

Impact Identification and Assessment

The assessment should include a map showing recorded fossil sites (known and from field study), and areas of direct and indirect impact in the project footprint. This section of the report discusses potential impacts on fossils related to project actions.

Impact Mitigation Recommendations

Recommendations for managing adverse impacts to fossil resources are the most important part of the FIA.

The principle question the Lead Paleontologist seeks to answer is: “Are mitigative actions required to preserve the paleontological resource values?” Determining what mitigative actions to pursue is best accomplished through a cooperative approach between the Lead Paleontologist, the proponent, and the BC Fossil Management Office. A mitigative action plan should address all stages of development activities and be submitted as part of the FIA report.

See Appendix C for more details in the FIA reporting guidelines.

Mitigation also involves having a site-specific Chance Find Protocol in place for unanticipated fossil discoveries. The plan and its procedures will be site specific. See example documents on the BC Fossil Management website.

Report Submission and Review

The FIA report must be submitted by the Lead Paleontologist to both the proponent and the BC Fossil Management Office for review.

Based on the FIA evaluation, the BC Fossil Management Office will make recommendations to the Land Adjudicator. The proponent must then have a Chance Find Protocol in place for when fossils are encountered during development activities.

5. Fossil Impact Reduction

Upon receipt of comments and concerns, the proponent may address the risk issues with a review of the paleontological concerns related to the project development plan. The proponent may attempt to reduce the paleontological impact by revising the project development plan and/or revising the mitigative action plan with the advice of the Lead Paleontologist.

Mitigative Action Plan Approval

The revised project development and mitigative action plans must be reviewed and assessed by the BC Fossil Management Office. Attention should be given to providing effective mitigative actions to reduce adverse effects on the fossil resources.

Mitigation During Early Development

Pre-development fossil mitigative requirements are completed in advance of any development that will directly impact significant fossil resources and include:

- Inform personnel of the types of fossils likely to occur
- Suspend ground disturbance work in the vicinity of a fossil find and leave material in place; demarcate a protective buffer around the find area
- 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
- Report the find using the contact information in the Chance Find Protocol, and notify the BC Fossil Management Office
- Salvage fossils through systematic excavation, in a scientifically sound yet efficient way, and move them to a safe location
- Avoidance of a fossiliferous area by revising the development plan and leaving fossil resources intact

Subsequent Mitigative Actions

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.

In mid-development phases of the project, fossil mitigative requirements are performed such as:

- Monitoring by a qualified paleontologist during mechanical excavations. Close communication between the excavator operators and the palaeontologist 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.
- In areas where continuous monitoring is considered too dangerous or inefficient to be performed, opportunities should be taken for close paleontological inspection during quiet construction periods.
- Systematic excavation and salvage of fossils may be required for discoveries by the paleontologist and chance finds by the project staff throughout the project “life-time”.
- Post-disturbance fossil inspection of the project sites following ground disturbance provides an optional mitigation measure where remoteness or unavailability of paleontological expertise interrupts continuous monitoring.

- Continue to use the adopted Chance Find Protocol to ensure:
 - Training of the operators and staff on fossil recognition and reporting procedures
 - Halting work in the area of a chance find, and leaving all possible fossil material in place and protected from the weather
 - Establishing a protective buffer of at least 50 metres around the discovery area and demarcate the buffer in a highly visible way
 - Reporting the discovery as outlined in the Chance Find Protocol
 - Awaiting further instructions from the paleontology resource specialist as outlined in the Chance Find Protocol

The plan for chance discoveries should be followed for the “life-time” of the project development activities, rather than simply the initial excavation phase.

Project Decommissioning

Mitigation procedures should be anticipated at the end of the “life-time” of the project during the decommissioning in areas with high potential for fossils. These procedures could include mitigation actions as outlined in the FIA.

APPENDIX A: 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 BC's fossil resources. Foremost, a **Lead Paleontologist** is eligible to conduct paleontological studies and services related to fossil resource management.

Table 1 - List of paleontological roles and qualifications.

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

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 has attained a Ph. D. from an accredited university in a paleontological discipline is preferred. The Ph.D. paleontologist should 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 has attained 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. The M.Sc. paleontologist should have a written thesis in which there has been field research and laboratory components, or subsequent 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 a similar skill-set to those outlined above, to be determined at the discretion of the Land Adjudicator.

Experience: The supervised fieldwork should include a minimum of 24 weeks along with 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 and requires a demonstrated 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 skillset to that of someone with a M.Sc. degree.

Experience: The supervised fieldwork should include a minimum of 16 weeks, as well as a minimum 16 weeks of laboratory and/or curation experience.

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 pedestrian site survey, mitigative actions and sample curation are among the duties performed by an assistant paleontologist.

Paleontologist-in-training

A Paleontologist-in-training also provides project support and is considered to be 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 has attained a minimum of a Bachelor's degree from an accredited university with emphasis in paleontology is preferred. Such a person 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 pedestrian 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 could

serve as a Paleontological Technician. A person who has 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 pedestrian 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 and enduring at times.

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 be 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 particular 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.

APPENDIX B: FIA PLAN FOR PALEONTOLOGICAL FIELD INVESTIGATION TEMPLATE

Fossil Impact Assessment (FIA) Plan for Paleontological Field Investigation

Proponent/Company Name

Date

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 fossil discoveries near or at the site

Personnel

Name and qualifications of the Lead Paleontologist

Names, roles and experience of other professionals or field supervisor

Work Schedule

Start and end date of field work; total field days

Field Methodology

- Survey and/or sampling approach
- Tools and equipment to be used
- Data collection techniques
- Specimen collecting strategy
- Data recording; identify each location where fossils are collected (use Fossil Collection Data Sheets available on the BC Fossil Management Office website)

Site Considerations

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

Will you need to clear trees or vegetation?

Will you be working near water or needing to use water?

Site Restoration

The site must be returned to a state of no substantial difference from its condition prior to the field investigation. Identify the clean-up or restoration that will be undertaken on completion of the field work.

Curation

Indicate the prearrangements that have been made with a qualified BC institution to ensure appropriate management of fossil resources at the site. Attach a copy of a written agreement between the proponent and a recognized BC repository that will receive and have the long-term care of the collections. Please contact the BC Fossil Management Office to discuss the appropriate institution.

Reporting

On completion of the field investigation, the following information must be reported to BC Fossil Management Office:

- a) The location and nature of any sites found
- b) A list of fossils found at each site
- c) A list of fossils collected (submit Data Sheets)

The FIA plan should indicate that the fossil site locations and/or Data Sheet will be provided to the BC Fossil Management Office, and when delivery is expected. Delivery may be made by e-mail to Fossil.Management@gov.bc.ca

Signature of Plan Author

This FIA plan has been prepared/approved (choose one) by

Signature

Name

Title

Organization

APPENDIX C: GUIDELINES FOR FOSSIL IMPACT ASSESSMENT (FIA) REPORT

Title Page

The title page includes:

- a. Project name and location;
- b. Name and address of the Proponent for which the report was prepared,
- c. Report date; and
- d. Lead Paleontologist's signature, title or affiliation.

Credit Sheet

The credit sheet includes names, addresses and professional affiliations of the contributors to the FIA:

- a. The Lead Paleontologist; and
- b. Supporting researchers and report authors.

Executive Summary

The executive summary contains a brief overview of the study, emphasizing important findings and major recommendations.

Table of Contents

The table of contents is arranged in accordance with the sequence of topical headings and their corresponding page numbers.

List of Figures, Tables, Appendices

All figures, tables and appendices are referenced by title and page number, and listed according to the order in which they appear in the FIA.

Introduction

The introduction includes:

- a. Proponent name and general nature of the proposed development;
- b. FIA objectives and scope;
- c. Name of the consultant and persons conducting the FIA, and description of their professional expertise;
- d. Dates and duration of the study; and
- e. Organizational format of the report.

Project Description

This section contains a brief summary of proposed project plans, including a location map and some details about:

- a. Location and boundaries of the proposed project site(s);
- b. Projected extent and level of land alteration or disturbance;
- c. Any alternative project designs or locations subsequent to original project design;
- d. Access and terrain;
- e. Description of past land uses or previous FIAs; and
- f. Project scheduling.

Study Area and Geological Setting

This section provides an overview of the geological setting, identifies sedimentary unit(s) or deposit affected by the proposed development, indicates the fossil resource potential and if fossils are known in proximity to the project.

Methodology

This section outlines the research plan, methods, and equipment used for the FIA.

Three assessment activities to be described:

1. Inventory
 - a. List of known inventory from the fossil occurrence database by geological unit, including fossil types, age, lithological unit, locations, and references;
 - b. Map showing geological units and their fossil resource potential (if applicable);
 - c. Identification of areas where systematic pedestrian field study is required to verify fossil potential and areas exempt from the study.
2. Site Evaluation
 - a. Rationale for a systematic pedestrian field study to assess the adverse effects of the development activities;
 - b. Identification of potential areas of rock and sediment exposure where fossils are located and identified within the footprint; describe the exposure such as partial cover by vegetation or scree, or thinly covered with vegetation or scree, or intermittent small outcrop patches;
 - c. Explanation of fossil collecting and recording procedures;
 - d. Identification of a qualified B.C. repository for the curation of collected materials in advance of the permit application. Please consult with the BC Fossil Management Office.
3. Impact Identification and Assessment
 - a. Explain how project impacts are identified; and

- b. Describe the process used to assess impacts on fossil resources, including significance criteria and risk level associated with adverse effects to fossil resources.

Results: Fossil Resource Inventory

This section contains results of the recorded paleontological sites and observed sites from the field survey, including:

- a. Maps showing areas examined;
- b. Maps showing recorded fossil localities in relation to the project footprint;
- c. List of the number of sites recorded and total anticipated in the project area;
- d. Description of each site, including fossil lists and abundances, nature of the sedimentary exposure (good or poor), and fossil resource potential (if applicable); and,
- e. Collected material should be catalogued and submitted to a qualified B.C. fossil repository for curation; ensure a collection Data Sheet is used for reporting to the BC Fossil Management Office.

Fossil Resource Evaluation

Significant fossils from each site evaluated are discussed here, including:

- a. Appraisal of significance, using a significance rating scale of 1 to 5 for each criterion, including qualitative comments about contextual significance of the fossil or fossil site;
- b. List of site-specific significance assessment (in tabular form); and,
- c. Map showing the fossil sites with high, medium, or low significance within the project footprint.

Impact Identification and Assessment

The assessment should include a map showing recorded fossil sites (known and from field study), and areas of direct and indirect impact in the project footprint. This section of the report discusses potential impacts on fossils related to project actions.

Impact Mitigation Recommendations

This section discusses recommendations for managing adverse impacts to fossil resources.

Mitigation involves having a site-specific Chance Find Protocol in place for unanticipated fossil discoveries.

Mitigation also requires development of a mitigation plan that lists, and implements, recommended measures to reduce adverse impacts on fossils encountered during ground disturbance.

Impact mitigation measures will be site-specific but may include:

- Inform personnel of the types of fossils likely to occur
- Suspend ground disturbance work in the vicinity of a fossil find and leave material in place; demarcate a protective buffer around the find area
- Pause work to record the GPS location of the fossil, describe its position (e.g., depth below surface), photograph the site and the fossil
- Report the find using the contact information in the Chance Find Protocol, and notify the BC Fossil Management Office
- Salvage fossils through systematic excavation, in a scientifically sound yet efficient way, and move them to a safe location
- Avoidance of a fossiliferous area by revising the development plan and leaving fossil resources intact
- Monitoring of excavation by a qualified paleontologist during development activities. This may include fossil specimen recovery, data management (arranging curation of specimens) and reporting.

References

List all literary sources cited in the report such as publications, documents and records, and maps. The reference list should also include names and dates of all personal communications.

Appendices

Append any relevant items to the report including:

- a. Photographs of fossil sites and fossils;
- b. Tables and maps.