

**REPORT # ESD/LM/01-1
PUB NO. T/573**

Phase 1 Environmental Site Assessment Guideline for Upstream Oil and Gas Sites

April 2001



**Environmental Service
Environmental Sciences Division**

Pub. No: T/573

ISBN: 0-7785-1421-8 Printed Edition

ISBN: 0-7785-1422-6 On-line Edition

General Department Web Site: <http://www.gov.ab.ca/env>

Decommissioning and Remediation Web Site:

<http://www.gov.ab.ca/env/protenf/soilgrndwater>

Any questions on this document may be directed to:

Environmental Sciences Division
Alberta Environment
4th Floor, Oxbridge Place
9820 – 106th Street
Edmonton, Alberta T5K 2J6
Phone: (780) 427-5883
Fax: (780) 422-4192
Email: environmental.science@gov.ab.ca

Additional copies of this document may be obtained by contacting:

Information Centre
Alberta Environment
Main Floor, Great West Life Building
9920 – 108th Street
Edmonton, Alberta T5K 2M4
Phone: (780) 944-0313
Fax: (780) 427-4407
Email: env.infocent@gov.ab.ca

This publication may be cited as:

Alberta Environment. 2001. Phase 1 Environmental Site Assessment Guideline for Upstream Oil and Gas Sites. Alberta Environment, Edmonton, Alberta. Report # ESD/LM/01-1. ISBN: 0-7785-1421-8 (Printed Edition), 0-7785-1422-6 (On-line Version), Publication No: T/573. 16 pp.

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1.0 Introduction

Environmental site assessments (ESAs) are routinely used to determine the environmental condition of a property. Specifically, the objectives of an ESA are to:

- determine if there is reason to suspect that contamination has occurred;
- identify the nature of contaminants;
- define the distribution of contamination in the environment, including air, water and soil;
- determine the risk from the exposure to these contaminants; and
- evaluate the possibility of mitigating these risks.

The site assessment process consists of three phases:

Phase 1 ESAs involve:

- the collection of information about past activities and/or events which have resulted or could result in contamination on a property;
- a site visit to identify visible evidence of contamination sources or actual contamination (no actual soil or water testing is carried out); and
- establishing the need for a Phase 2 ESA.

Phase 2 ESAs are a field evaluation, which typically involve the collection of soil and water samples. The field evaluation program must be designed and implemented to collect the site-specific information necessary to establish the presence or absence of adverse affects.

Phase 3 ESAs typically involve exploring remedial options, developing a hazard assessment, exposure modeling and risk assessment, carrying out remediation and verifying the success of remediation.

2.0 Intent of Document

The intent of this document is to provide guidance on conducting Phase 1 ESAs for wellsites and small upstream petroleum facilities and to clarify how these assessments relate to the reclamation process. In the context of this guideline, the Phase 1 ESA will be used as a screening tool to:

- provide evidence to satisfy the regulators, surface landowner(s) and stakeholders that contamination is not likely present on the property; and/or
- to determine if a Phase 2 ESA is required.

3.0 Qualifications of the Investigator

The investigator should be objective in his assessment and:

- possess an appropriate combination of formal education, knowledge, skills and experience to conduct a technically sound and rational ESA;
- be familiar with applicable federal, provincial and municipal legislation and published guidelines used to evaluate the presence of contamination on a property; and
- be familiar with upstream oil and gas operations.

4.0 Phase 1 Environmental Site Assessment – Desktop Review and Site Visit

The goal of a Phase 1 ESA is to gather a sufficient amount of information to estimate the likelihood, types and location of surface and/or subsurface contamination that may be present at the property and adjoining land. The information generated in a Phase 1 ESA can be used by the property owners, facility operators, purchasers, lenders and lessees to make informed decisions about the need for further assessments, property management, facility operations, options for future land use, investment and remedial actions.

4.1 Desktop Review

The desktop review requires gathering and examining the existing information available on the site without actually collecting physical data in the field. A comprehensive desktop review of existing and historical information about activities and events at the site can facilitate appropriate planning and ensure implementation of an efficient, safe and thorough field investigation program. Desktop reviews are conducted to:

- obtain information about current and historical land uses and activities that may indicate the existence or likelihood of surface and subsurface contamination at the site;
- identify potential surface and/or subsurface contamination sources and any environmental concerns at the site (common contamination sources at upstream petroleum facilities are listed in Appendix 1 and a list of contaminants commonly found at upstream petroleum facilities is in Appendix 2); and
- establish the framework for any subsequent site investigation and work plan.

4.1.1 Company File Review

A thorough review of corporate files is a critical step in the Phase 1 ESA process. The following should be reviewed:

- process flow diagrams, blue prints, "as-builts" and similar plans indicating underground storage tanks, vessels, pipelines and other subsurface structures that may be contaminant sources;
- historical records of spills, releases and accidents that may have residual environmental effects;

- corporate files including, but not limited to, previous environmental audits and impact assessments, geotechnical investigations, and environmental monitoring reports; and
- underground utility services that may serve as conduits for contaminant migration.

4.1.2 Air Photo Review

Regardless of whether or not facilities/structures currently exist on the property of concern, a thorough air photo review should be conducted. In the course of reviewing the air photos for the history of the site, changes to lease size, equipment, buildings, pits/sumps as well as any spills on the lease may be documented and flagged for investigation during the field program. Information that may be collected and documented from the air photo review includes:

- year in which the site or individual component is first identified;
- list of equipment, buildings, pits/sumps on lease for each year an air photo is available over the course of the operating life of the facility;
- evidence of spills or vegetation stress on/off lease for each year an air photo is available over the life of the facility;
- proximity of lease to surface water bodies, residences;
- onsite and adjacent land use, vegetation cover;
- topography, surface drainage direction;
- proximity of lease to other contaminant sources and potential receptors; and
- list of photos reviewed (dates, reference numbers, scales) for future reference in the case of an audit.

4.1.3 Review of Published Information

The Alberta Energy and Utilities Board's (EUB) spill database should be consulted for documentation of spills which may have occurred over the life of the facility and which may require further investigation. Although sites for which spills have been documented in the EUB database may be of greater concern, sites without documented spills cannot necessarily be excluded as free of this type of impact.

Groundwater usage in the vicinity of each site may be established by reviewing Alberta Environment's water well records.

In some instances, general information about the physical properties of a site is desired. This information can be obtained from published information such as soil, surficial geology, bedrock topography and bedrock geology maps. Due to the mapping scale utilized in these documents, the information gathered cannot be used as a substitute for site specific investigations, however they do provide a preliminary screening for areas vulnerable to contaminant impacts (e.g., near-surface fractured bedrock, aeolian sands, etc.). In some cases more detailed information about physical characteristics of a site is available in company site assessment reports.

4.2 Site Visit

A site visit should be conducted to verify the results of the file and air photo review. Specifically, the purpose of the site visit is to identify:

- surrounding land use, topography and vegetation;
- nearby surface water bodies, water wells, residences, livestock and other facilities;
- potential sources of spills, leaks or releases;
- visual evidence of on-site and off-site soil contamination (e.g., surface staining, reduced vegetative growth and visible salt crystals);
- waste management practices used at the facility; and,
- any equipment, infrastructure or underground utilities that may be affected during a subsurface investigation.

During the site visit, there should be meetings with lease or adjacent landowners/occupants and the facility operator and staff to determine historical events at the site related to potential contamination sources. Items to discuss include:

- location of any off-lease associated facilities (e.g., remote sumps);
- location of backfilled and/or previously remediated drilling sumps and pits;
- location, characteristics and extent of unproductive land (e.g., salt, sterilant or hydrocarbon damaged soil);
- location of underground storage tanks, pipelines;
- details of past spills and the clean up procedures implemented; and
- details of waste management and waste disposal practices.

4.3 Documentation of Phase 1 Results

Phase 1 ESA results should be recorded on the form contained in Appendix 3. If the Phase 1 assessment confirms that there are no reasons to suspect contamination at the site, the form must be retained in the company's records and made available upon request of Alberta Environment or the landowner. Documentation obtained for the Phase 1 ESA should not be submitted with the application for a reclamation certificate.

When a Phase 1 ESA concludes that contamination is likely present, appropriate action must be taken before the site is reclaimed and an application is submitted for a reclamation certificate.

5.0 Contacts

Information about this guideline can be obtained from any of the following Alberta Environment regional offices:

REGIONAL OFFICES

Bow Region

Calgary Office (403) 297-7602

Northeast Slopes Region

Stony Plain Office (780) 963-6131 Ext. 222

Parkland Region

Red Deer Office (403) 340-7052

Northeast Boreal Region

Edmonton Office (780) 427-7617

Northwest Boreal Region

Peace River Office (780) 624-6402

Prairie Region

Lethbridge Office (403) 381-5322

Appendix 1. Common Contamination Sources at Upstream Oil and Gas Sites

| Potential Contamination Sources | |
|---|--|
| Wellsites | Well head |
| | Storage tank and area |
| | Flare pit |
| | Emergency earthen pit (brine) |
| | Pits of unknown origin |
| | Drilling waste sumps / Drilling waste disposal sites |
| Batteries, compressors, treatment and processing facilities | Flowline/pipeline |
| | Gas pipeline |
| | Blow down tank and area |
| | Metering equipment |
| | Pig trap (flowline) |
| | Pig trap (pipeline) |
| | Treater and separator |
| | Dehydrator |
| | Salt water storage tank |
| | Crude oil storage tank |
| | Other storage tanks |
| | Tankfarm area |
| | Refined product storage |
| | Ecology pit |
| | Desand pit |
| | Flare knock out tank |
| | Flare line |
| | Flare pit |
| | Emergency earthen pit (brine) |
| | Ponds |
| Pits of unknown origin | |
| Spills | Saltwater |
| | Crude oil |
| | Emulsion |
| | Condensate |
| | Refined products |

Appendix 2. Contaminants Commonly Found at Upstream Oil and Gas Sites

| Feature | Possible products | Associated Parameters |
|-------------------------------------|--|--|
| Wellhead/Injection Wells/Headers | produced water | salinity, sodicity, chlorides, sulphates, soluble metals/inorganics from formation |
| | workover fluids | pH, salinity, methanol, glycol, biocides |
| | sterilants | atrazine, bromacil, diuron, linuron, simazine, tebuthiuron |
| | crude oil | extractable hydrocarbons (C ₁₁ – C ₆₀), PAHs, BTEX compounds, purgeable hydrocarbons, Tier 1 metals/inorganics |
| Drilling Waste Sumps | produced water | salinity, sodicity, chlorides, sulphates, soluble metals/inorganics from formation |
| | crude oil | extractable hydrocarbons (C ₁₁ – C ₆₀), PAHs, BTEX compounds, purgeable hydrocarbons, Tier 1 metals/inorganics |
| | metals | copper, cadmium, chromium, nickel, lead, vanadium, zinc |
| | chemical additives | pH, sodium, potassium, salinity, chlorides, sulphates |
| | solvents | halogenated solvents including but not restricted to: dichloromethane, chloroform, methanol, 1,2 dichloroethane, 1,1,2, trichloroethane |
| Pig Launcher/Receiver | pigging wax | extractable hydrocarbons (C ₂₀ +) |
| | solvents used to clear, de-ice the lines | methanol, halogenated solvents including but not restricted to: dichloromethane, chloroform, methanol, 1,2 dichloroethane, 1,1,2, trichloroethane |
| | produced water condensate | salinity, sodicity, chlorides, sulphates, soluble metals/inorganics from formation BTEX compounds, PAHs, extractable hydrocarbons (C ₁₁ – C ₆₀), purgeable hydrocarbons |
| | crude oil | extractable hydrocarbons (C ₁₁ – C ₆₀), PAHs, BTEX compounds, purgeable hydrocarbons, Tier 1 metals/inorganics |
| | Separator | produced water |
| Compressor | crude oil | extractable hydrocarbons (C ₁₁ – C ₆₀), PAHs, BTEX compounds, purgeable hydrocarbons, Tier 1 metals/inorganics |
| | lube oil | extractable hydrocarbons (mineral oil and grease), PAHs, metal residues from used lube oil (chromium, lead, zinc, copper) |
| | metal residues | Tier 1 metals |
| | mercury from old metering equipment | mercury |
| Dehydration Units/Line Heaters | glycol | glycol, BTEX compounds, salinity, sodicity, chlorides, sulphates, extractable hydrocarbons |
| | produced water | salinity, sodicity, chlorides, sulphates, soluble metals/inorganics from formation |

| Feature | Possible Products | Associated Parameters |
|----------------|---|---|
| Tankage | produced water (water storage and free water knockout) | salinity, sodicity, chlorides, sulphates, soluble metals/inorganics from formation |
| | crude oil | extractable hydrocarbons (C ₁₁ – C ₆₀), PAHs, BTEX compounds, purgeable hydrocarbons, Tier 1 metals/inorganics |
| | solvents released during cleaning of tanks | halogenated solvents including but not restricted to: dichloromethane, chloroform, methanol, 1,2 dichloroethane, 1,1,2, trichloroethane |
| | tank bottom sludge | extractable hydrocarbons (mineral oil and grease), PAHs, BTEX compounds, Tier 1 metals/inorganics, salinity, sodicity, chlorides sulphates |
| | chemicals (sweetening agents, caustic, glycol, etc.) | amines, sulfolane, salinity, sodicity, glycols, acidity (pH), nitrogenous compounds |
| Drums | chemicals: corrosion inhibitors, methanol, degreasers/solvents | methanol, halogenated solvents including but not restricted to: dichloromethane, chloroform, methanol, 1,2 dichloroethane, 1,1,2, trichloroethane, mercaptan |
| Flare Pit | produced water | salinity, sodicity, chlorides, sulphates, soluble metals/inorganics from formation |
| | crude oil | Extractable hydrocarbons (C ₁₁ – C ₆₀), PAHs, BTEX compounds, purgeable hydrocarbons, Tier 1 metals/inorganics |
| | glycols, amines, pigging wax condensate | ethylene, diethylene glycol, amines, extractable hydrocarbons (C ₃₀ +) BTEX compounds, extractable hydrocarbons (C ₁₁ – C ₃₀ +), purgeable hydrocarbons, PAHs |
| | general waste/domestic waste including tires, glass, cement, filters, metal cable | Tier 1 metals and inorganics |
| | used anodes/cathodes, frac sand | Tier 1 metals and inorganics, including radioactive materials |
| | floor drain liquids including solvents, lube oils | extractable hydrocarbons (C ₁₁ – C ₆₀), PAHs, BTEX compounds, purgeable hydrocarbons, Tier 1 metals/inorganics, halogenated solvents including but not restricted to: dichloromethane, chloroform, dichloroethane, trichloroethane |
| Buildings | floor drain liquids including solvents, lube oils, detergents | extractable hydrocarbons (C ₁₁ – C ₆₀), PAHs, BTEX compounds, purgeable hydrocarbons, Tier 1 metals/inorganics, halogenated solvents including but not restricted to: dichloromethane, chloroform, dichloroethane, trichloroethane |
| | damaged metering equipment | mercury, barium, zinc, lead, chromium, copper, cadmium |

| Feature | Possible Products | Associated Parameters |
|-------------------------------|---|--|
| Amine Sumps | amines | DEA, MEA, DIPA, nitrogenous residues |
| | caustic, elemental sulphur, sulphate | S, SO ₄ ²⁻ , salinity, sodicity, soil acidity (pH), soluble metals (Tier 1 metals/inorganics) |
| | floor drain liquids including solvents, lube oils, detergents | extractable hydrocarbons (C ₁₁ – C ₆₀), PAHs, BTEX compounds, purgeable hydrocarbons, Tier 1 metals/inorganics halogenated solvents including but not restricted to: dichloromethane, chloroform, trichloroethane |
| Sulphur Storage Areas | elemental sulphur | S, SO ₄ ²⁻ , soil acidity (pH), solubilized metals (Tier 1 metals/inorganics), salinity |
| Flare Stack U/G Knockout Tank | condensate | BTEX and purgeable hydrocarbons, extractable hydrocarbons(C ₁₁ – C ₆₀) |
| | produced water | salinity, sodicity, chlorides, sulphates, soluble metals/inorganics from formation |
| Boneyard / Laydown Area | hydrocarbons | extractable hydrocarbons, PAHs |
| | chemicals | salinity, sodicity, pH, Tier 1 metals/inorganics, solvents, EOX phenols |
| Ponds | evaporation pond | salinity, sodicity, chlorides, sulphates, metals, BTEX and TPH, extractable hydrocarbons |
| | sulphur block runoff pond | acidity (pH), salinity, sulphates, Tier 1 metals/inorganics |
| | sewage treatment pond | salinity, nitrogenous compounds, coliform bacteria |
| | amine runoff pond | salinity, sodicity, amines, nitrogenous compounds |
| Fire Training Area | hydrocarbons | BTEX, purgeable and extractable hydrocarbons, PAHs, Tier 1 metals/inorganics |
| Landfills | construction debris (concrete, wood, cables, etc.) | salinity, pH, Tier 1 metals/inorganics |
| | catalyst | salinity, pH, Tier 1 metals/inorganics, leachate metals |
| | lube oils, sludges | BTEX and purgeable hydrocarbons, extractable hydrocarbons, PAHs, Tier 1 metals/inorganics |
| | sulphur | pH, salinity, elemental sulphur, sulphates |
| | chemicals | EOX, phenols, solvents, salinity, sodicity, pH, Tier 1 metals/inorganics |
| | plant waste (filters, herbicides, etc.) | BTEX and purgeable hydrocarbons, glycols, extractable hydrocarbons, amines, herbicides, sterilants |
| | USTs | floor drain liquids |
| fuel | | BTEX, purgeable hydrocarbons, extractable hydrocarbons |
| flare knockout | | BTEX, purgeable and extractable hydrocarbons, salinity, chlorides |

Appendix 3. Phase 1 ESA Guideline Form for Upstream Oil and Gas Sites

Please Note:

The original Phase 1 Environmental Site Assessment form has been revised.

The original form was released in this document in 2001

The attached revised version of the form must be used for all Phase 1 Environmental Site Assessments submitted after November 1, 2002.

Location: _____

1.0 GENERAL SITE INFORMATION

Facility Name: _____ Surface Location (LSD): _____

License No.: _____ MSL/ROE /LOC/PLA, if Public Land: _____

Licensee: _____ Operator: _____

Current Regulatory Status: _____

Type of Reclamation Certificate Applied For:

 Pipeline Battery Oil Production Site Wellsite**Pipeline Information (answer if Pipeline is checked)**Pipeline type? Oil Gas Saltwater Other _____

From: _____ To: _____

Diameter: _____ Depth: _____ Abandoned: In-Place Removed**Well or Oil Production Site Information (answer if Oil Production Site, or Wellsite are checked)**Well type?: D&A Oil Gas Disposal Other _____Producer well: Fluid was piped from the site Fluid was trucked from the siteDisposal well: Fluid was piped to the site Fluid was trucked to the siteSour: (>1%) yes no**Battery Information (answer if Battery is checked)** Single well battery Multi-well battery Fluid was piped to the site Fluid was trucked to the site**2.0 RECORDS REVIEW****2.1 COMPANY FILE REVIEW**

Review Date: _____ Reviewed By: _____

2.1.1 Drilling Information (wells and oil production sites)Were drilling records reviewed? Yes No If NO, why not? _____

Drilling Date: _____

Sump Location (attach diagram if present): _____

Mud Type: _____

Mud/Fluid Disposal Method(s): _____

Mud/Fluid Disposal Location(s): _____

Other (includes waste storage/handling, etc.): _____

2.1.2 Production/Storage Information (wells, oil production sites, batteries)Was production/storage information obtained? Yes No If No, why not? _____

Historical or current associated infrastructure (includes tankage, pipeline infrastructure, process skids, and access roads.) _____

Flare Pits (wells, oil production sites): Yes No Unknown

Details/Location: _____

Underground Storage Tanks: Yes No Unknown If YES, number of tanks _____

Location: _____

Capacity: _____

Location: _____

Aboveground Storage Tanks: Yes No Unknown If YES, number of tanks _____

Capacity: _____

Location: _____

Herbicide Used: Yes No Unknown

Details: _____

Other (includes waste storage/handling/chemical storage, buried pits and landfills, etc.):

2.1.3 Environmental Information (all facilities)

Spills/Releases: Yes No Unknown (If YES, attach a brief description including spill material, volume and date)

Location/Extent: _____

Type (EUB codes): _____ Volume Recovered: _____

Remediation Action (when initiated, target completion date, attach assessment and remediation details if available):

Reported to Regulatory Agency: Yes No Unknown

If Yes, Identify Regulatory Agency and Date: _____

2.1.4 Land Information (all facilities)

Landowner/Occupant Complaints From Company File Review: Yes No

Identify Issue(s) of Concern: _____

2.1.5 Former Third Party ESA(s) Information (all facilities)

Has a previous ESA been conducted? Yes No

If Yes, Consultant: _____ Report Title: _____ Report Date: _____

Report Findings: _____

2.2 HISTORICAL AERIAL PHOTOGRAPH REVIEW

For producing wells and batteries the following aerial photographs are required, if available: one pre-disturbance; one post-disturbance; one photograph for every 2 to 3 year interval while the site was active.

For dry and abandoned wells, one aerial photograph of the active site, if available, is required.

For pipeline above ground facilities and spills, aerial photos of the site before, during (if available), and after the spill cleanup or facility removal are required.

For all aerial photographs, please use a scale of 1:5000 or 1:7500 to show detail. This scale will likely require an enlargement of the original aerial photograph.

Review Date: _____

Reviewed By: _____

Location: _____

Photo ID: _____ Year: _____ Scale: _____

Evidence of Former Infrastructure or Areas of Potential Contamination: _____

Photo ID: _____ Year: _____ Scale: _____

Evidence of Former Infrastructure or Areas of Potential Contamination: _____

Photo ID: _____ Year: _____ Scale: _____

Evidence of Former Infrastructure or Areas of Potential Contamination: _____

Photo ID: _____ Year: _____ Scale: _____

Evidence of Former Infrastructure or Areas of Potential Contamination: _____

Photo ID: _____ Year: _____ Scale: _____

Evidence of Former Infrastructure or Areas of Potential Contamination: _____

Photo ID: _____ Year: _____ Scale: _____

Evidence of Former Infrastructure or Areas of Potential Contamination: _____

3.0 INTERVIEWS (e.g., Present and Past Operators and Landowners)

Interview Held With: Landowner(s) Operator(s)

Is the Interview Information: Specifically for this Site Generally for the Area or Type of Operation

Interview Date: _____ Interviewed By: _____

Name of Person Interviewed and Position: _____

Location: _____

Details of the Interviewee's Comments: *(request information on previous complaints, former facilities, presence and details of spills, pits, waste storage/handling, vegetation control, etc.)*: _____

4.0 SITE VISIT

Date (m/d/y): _____ Assessor: _____

Surrounding Land Use: N: _____ S: _____ E: _____ W: _____

Topography: _____

Vegetation: _____

Proximity to (fill in distance to all that apply):

Residence _____; Water well _____; Surface waterbody (e.g., dugout, stream, river): _____

Equipment or Tankage Present (or visual signs of former facilities): Yes No

What was observed?: _____

Visual Signs of Open or Potentially Buried Earthen Pits: Yes No

What was observed?: _____

Evidence of Past Spills (includes cumulative releases and well centre impacts): Yes No

What was observed?: _____

Adjacent land affected by operations on the site? Yes NoVegetation Stress Apparent: Yes No

Details (location, evidence): _____

Does Site Visit Information Conflict with Specific File or Air Photo Review Information: Yes No

If YES, explain: _____

Photographs of the Site: (not aerial photographs)

Photo 1 (*photo description*): _____Photo 2 (*photo description*): _____Photo 3 (*photo description*): _____*(add additional photographs if necessary)*

5.0 CONCLUSIONS AND RECOMMENDATIONS

Phase 1 ESA information is sufficient to form a conclusion about contamination? Yes No

If NO, indicate what was done to gain sufficient information (e.g., Phase 2 ESA)

Details (type of investigation, date): _____

Phase 1 ESA showed contamination is likely present? Yes No

If YES, indicate what follow-up work was done on the site (e.g., Phase 2 ESA, remediation work):

Details (type of investigation, date): _____

Location: _____

6.0 DECLARATION

I _____ of _____ certify that, to the best of my knowledge, all of the aforementioned information is accurate. This Phase I Environmental Site Assessment (ESA) was conducted for _____, for the above noted location. All the pertinent information gathered during the Phase I ESA has been provided within this report.

Date: _____

Mailing Address: _____

Phone: _____ Fax: _____

Email: _____

Operator Contact Information, if different than above

Mailing Address: _____

Phone: _____ Fax: _____

Email: _____

7.0 ATTACHMENTS

- ⇒ Original aerial photographs (from Section 2.2)
- ⇒ List of available aerial photographs from Air Photo Services
- ⇒ Photographs of the site from the site visit
- ⇒ Lease Survey Plan (with field notations)