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Soil quality — Sampling —

Part 205: Guidance on the procedure for investigation of natural, near-natural and cultivated sites

Qualité du sol — Échantillonnage —

Partie 205: Recommandations relatives aux modes opératoires d'investigation des sites naturels, quasi naturels et cultivés

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Contents

Page

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ISO 18400-205:2018
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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

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This document was prepared by Technical Committee ISO/TC 190, *Soil quality*, Subcommittee SC 2, *Sampling*.

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This first edition of ISO 18400-205, together with ISO 18400-104 and ISO 18400-202, cancels and replaces the first edition of ISO 10381-4:2003, which has been technically and structurally revised. The new ISO 18400 series is based on a modular structure and cannot be compared to ISO 10381-1 clause by clause.

A list of all parts in the ISO 18400 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

This document is one of a group of standards providing guidance on site investigation in general, and sampling in particular, for the principal purpose of determining soil quality. It is intended to be used in conjunction with the other parts of the ISO 18400 series. The role/position of the standards within the total investigation programme is shown in Figure 1.

This document describes investigation and sampling procedures for determination of soil quality on natural, near natural and cultivated sites. Its structure is generally similar to that of ISO 18400-203 which provides guidance on the investigation of potentially contaminated sites. In accordance with ISO 18400-104, it recommends that investigations should be undertaken in three phases:

— preliminary investigation (desk study and site reconnaissance) in accordance with ISO 18400-202;

— exploratory investigation (this document);

— detailed site investigation (this document).

It is recognized that:

— the preliminary investigation needs to be no more detailed than required by the task in hand (objectives of the investigation), but some basic information is always required for reasons of legality, safety of those carrying out site work including site reconnaissance, and protection of the environment;

— the preliminary investigation might show that no intrusive investigation is required;

— an exploratory investigation might suffice in some cases with no requirement for a detailed investigation;

— an exploratory investigation is not always needed in advance of a detailed investigation;

— it might be desirable to carry out each phase of an investigation in stages;

— during any phase of an investigation it might become apparent that the site should be treated as a potentially contaminated site — decisions will then be required whether to proceed as planned, to delay the investigation, and/or carry out an investigation in accordance with ISO 18400-203.

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The guidance also calls for the formulation of a conceptual site model as described in ISO 18400-202. This synthesis and interpretation of the available information needs to be no more detailed than required by the task in hand but helps in the design of intrusive phases of investigation. In practice, the investigator will always have a mental image of the site and formal development of the conceptual site model helps to reveal what could be serious flaws in this mental image.

NOTE Clauses 4, 5 and 6 provide guidance applicable to sampling on the generality of natural, near-natural and cultivated sites. Clause 7 provides additional guidance in relation to sampling for particular purposes (e.g. determination of mobile nitrogen) and soil types (e.g. peat soils).

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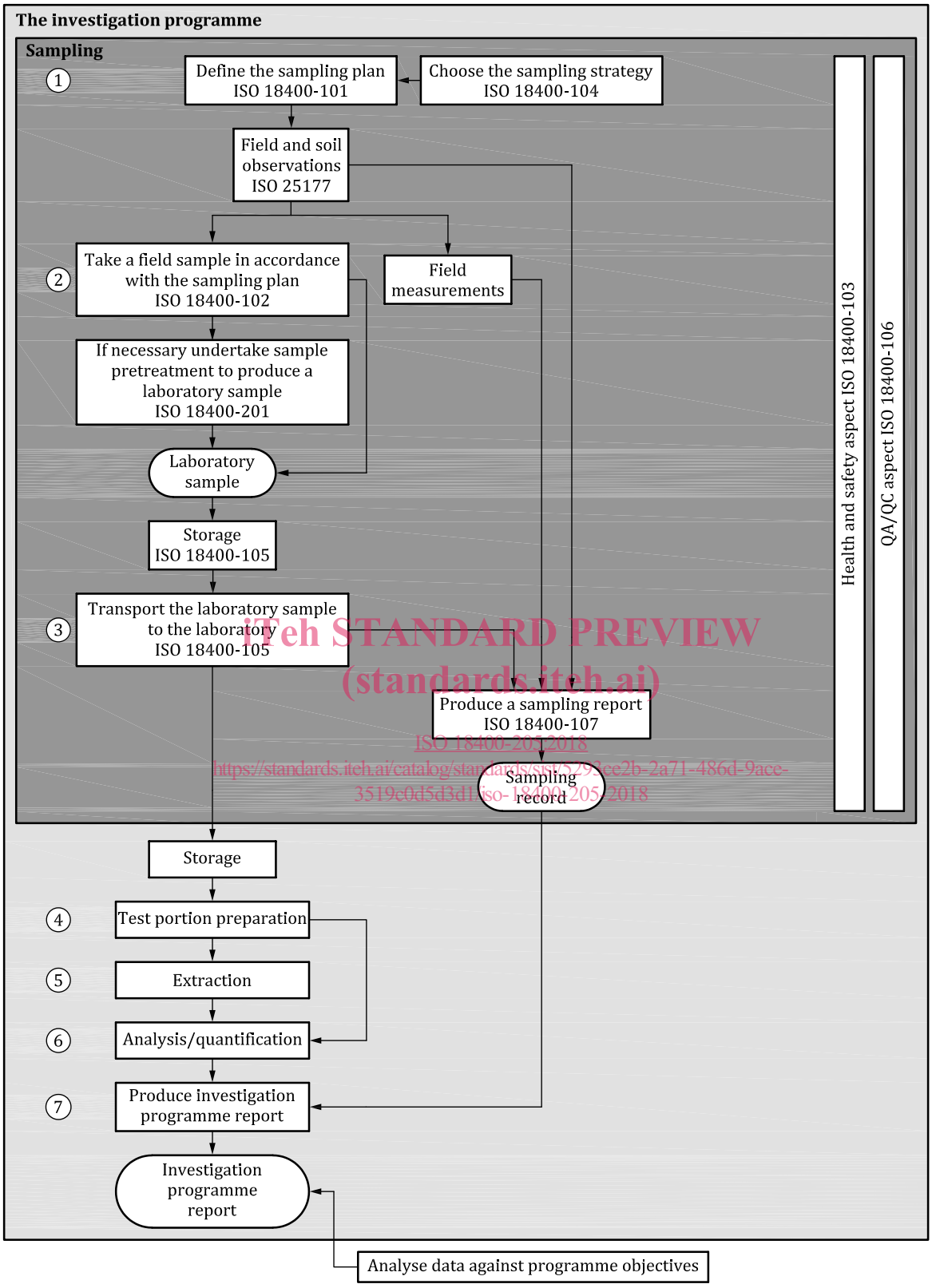

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NOTE 1 Numbers in circles define the key elements (1 to 7) of the investigation programme.

NOTE 2 Figure 1 displays a generic process which can be amended when necessary.

Figure 1 — Links between the essential elements of an investigation programme

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Soil quality — Sampling —

Part 205: Guidance on the procedure for investigation of natural, near-natural and cultivated sites

1 Scope

This document provides guidance on the sampling of soils of

— natural and near-natural sites,

— natural arboreal areas including forests and woods,

— areas used for agriculture (arable and pasture sites),

— areas used for horticulture (including domestic gardens, allotments), and

— areas used for special crop-cultivation, orchards, vineyards, commercial plantations and forests, etc.

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It is applicable to

— soil investigations and evaluations in the field, and

— collection of samples for chemical, geochemical, physical, and biological characterization of soil and soil materials in the laboratory.

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This document sets out appropriate strategies for the design of sampling programmes, field procedures and subsequent treatment of samples for transport and storage prior to sample pretreatment (e.g. drying, milling). It is intended to be used in conjunction with the other parts of the ISO 18400 series. Attention is, in particular, drawn to the requirements concerning collection, handling and storage of soil for assessment of biological functions in ISO 18400-206.

NOTE 1 Groundwater and surface water can be adversely impacted by agricultural and related activities, such as nitrates and pesticides, and by translocation of soil particles. In turn, knowledge about water quality can provide information about possible sources of groundwater contamination or contaminating run-off. Investigation of groundwater and surface water quality is outside of the scope of this document; relevant guidance is given in the ISO 5667 series of standards. ISO 15175 provides guidance on the relationship between soil properties and groundwater quality.

NOTE 2 It could also be appropriate to investigate ambient air, vegetation, potable water supplies and a variety of other media depending on the findings of the preliminary investigation.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 11074, *Soil quality — Vocabulary*

ISO 18400-103, *Soil quality — Sampling — Part 103: Safety*

ISO 18400-104:2018, *Soil quality — Sampling — Part 104: Strategies*

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3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11074 and ISO 18400-104 apply.

NOTE When the definitions in these two documents differ, those in ISO 18400-104 take precedence.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Objectives of sampling

The investigation, sampling and analytical strategies are determined mainly by

— the objective of the investigation, and

— current and previous soil/land use.

The objective of investigations can be various but might be:

— collection of information on general soil quality with regard to preservation and improvement of ecological soil functions;

— collection of information for evaluation of soil quality and nutrient supply or nutrient demand with regard to preservation and improvement of the productivity of soils;

— collection of information to manage and evaluate the effects of the addition of soil amendments materials such as sewage sludge;

— collection of information for soil mapping, classification and taxation;

— collection of information on the quality of forest and woodland (arboreal) soils in connection with study of damaged trees or other vegetation;

— collection of information for establishment and maintenance of soil monitoring areas;

— collection of information for replicate samples used for soil specimen banks or environmental specimen banks.

Further guidance about the setting of objectives for soil sampling is given in ISO 18400-104.

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ISO 18400-205:2018
https://standards.iteh.ai/catalog/standards/sist/5295ee2b-2a71-486d-9ace-3519c0d5d3d1/iso-18400-205-2018

5 Principles, requirements and general considerations for soil sampling

5.1 General

This document should be used in conjunction with ISO 18400-104 which gives general guidance on the development of site investigation strategies and detailed guidance on sampling strategies.

This clause summarizes general principles, requirements and considerations for soil sampling which should be taken into account for natural, near-natural and cultivated sites.

The aspects in 5.3 to 5.16 should be considered when developing a sampling strategy and preparing the sampling plan in accordance with ISO 18400-101.

NOTE 1 Clause 5 and 6 provide guidance applicable to sampling on the generality of natural, near-natural and cultivated sites. Clause 7 provides additional guidance in relation to sampling for particular purposes (e.g. determination of mobile nitrogen) and soil types (e.g. peat soils).

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NOTE 2 A supposed natural site or near-natural site (e.g. an agricultural site or a wooded site) could be a potentially contaminated site, not only because of activities carried out on the site, but because they were developed in the past on potentially contaminated land, for example an old refuse disposal site (landfill) or mining waste. This could have significance for agricultural performance of a site and the health and safety of the investigator; hence the need for a good site history to be developed as part of the preliminary investigation.

5.2 General strategy of site investigation

5.2.1 General

The principal site investigation phases are

— preliminary investigation (see 5.2.3),

— exploratory investigation (see 5.2.5), and

— detailed (main) site investigation (see 5.2.6).

The relationship between these phases is illustrated in Figure 2.

On completion of soil sampling activities during any phase or stage of investigation, a sampling report should be prepared in accordance with ISO 18400-107 (see Clause 8).

Following completion of the investigation, a report giving its results should be prepared.

The strategy for the investigation (whether preliminary, exploratory or detailed) will be determined by the objectives (see Clause 4).

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Before embarking on any phase or stage of investigation, it is important to set data quality objectives in terms of the type, quantity and quality (e.g. analytical quality) of the data and other information that is to be collected. These data quality objectives will depend in part on the nature of the decisions to be made on the basis of the investigation, and the confidence required in those decisions.

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When deciding on the strategy, consideration should be given to the applicability and use of on-site analysis and/or *in situ* measurement techniques (e.g. see ISO 12404 and ISO 13196).

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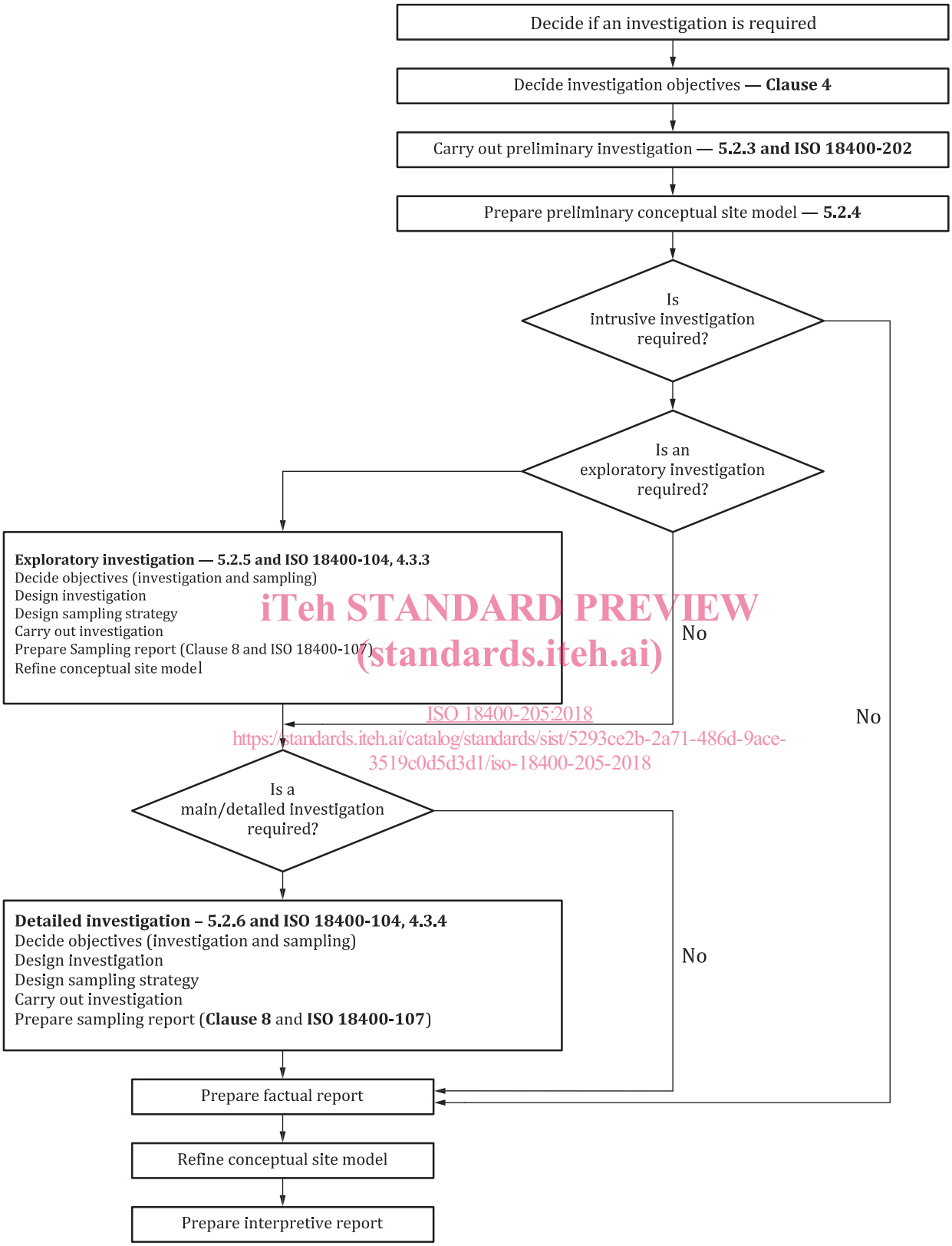

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ISO 18400-205:2018
https://standards.iteh.ai/catalog/standards/sist/5293ce2b-2a71-486d-9ace-3519c0d5d3d1/iso-18400-205-2018

NOTE This is an example of a site investigation process for agricultural sites.

Figure 2 — Site investigation process

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5.2.2 Conceptual site model

A conceptual site model should be developed and refined as the investigation proceeds in accordance with the guidance in ISO 18400-104. It should be presented in narrative, tabular or graphical form, or a combination of forms. It needs to be no more complex than the objectives of the investigation require.

NOTE 1 A conceptual site model is a synthesis of all that is known about a site and its surroundings that is relevant to the task. Preparation of the conceptual site model requires some interpretation of the information available and explicit recognition of the uncertainties in the information. Even when a formal conceptual site model is not prepared, investigators will have a conceptual site model of the site in their mind. This could be dangerously misleading if a proper preliminary investigation has not been carried out and, for example, the presence of an animal burial pit in the corner of a field is not known about.

NOTE 2 Although the conceptual site model is usually first formally prepared following a preliminary investigation, it first comes into existence the moment the question is asked whether the site needs to be investigated. At that stage, for example, it might be recognized that the site is agricultural land used for keeping livestock and the investigator will immediately form an initial picture about what the site might be like and act accordingly. Thus, it is this initial conceptual site model and the purpose of the overall investigation that guide decisions about the scope and depth of preliminary investigation required.

5.2.3 Preliminary investigation

A preliminary investigation in accordance with ISO 18400-202 should be carried out prior to any intrusive investigation. The depth and detail of the preliminary investigation should be tailored to the objectives of the investigation. The preliminary investigation should lead to the development of a preliminary conceptual site model and possibly to hypotheses that can be tested during the subsequent investigation.

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NOTE 1 The preliminary investigation needs only to be as detailed as required by the task in hand, but there will usually be a requirement for a minimum information set relating for example to site location and setting, site ownership, site access, safety and protection of the environment.

ISO 18400-205:2018
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NOTE 2 Detailed guidance on preliminary investigations is provided in ISO 18400-202, including the type of information that could be required in relation to particular types of site, such as agricultural and near-natural sites, wooded sites and potentially contaminated sites. ISO 18400-202 includes reference to activities other than normal farming activities that might give rise to contamination of farmland. Land used for horticulture, orchards, etc. can also be contaminated.

NOTE 3 The preliminary investigation might provide information that suggests that the site, or part of the site, is “a potentially contaminated site” requiring investigation in accordance with ISO 18400-203. A decision might be required as to whether to proceed with an investigation in accordance with this document, to delay the investigation, or to constrain the area to be investigated, until the results of the investigation for contamination are available.

5.2.4 Preliminary conceptual site model

A preliminary conceptual site model should be developed from the results of the preliminary investigation. It needs to be no more complex than the objectives of the investigation require.

Formal hypotheses about the site that can be tested during an on-site investigation should be developed when appropriate.

NOTE During the site reconnaissance, areas of poor plant growth within an otherwise healthy looking crop might be seen. Ideas (hypotheses) about possible causes can be postulated and tested during the subsequent on-site investigation.

5.2.5 Scope of exploratory investigation

The exploratory investigation involves a limited on-site investigation. The data and information produced are assessed to determine if the hypotheses from the preliminary investigation are correct, and, where appropriate, to test other aspects of the conceptual site model. In some cases where the

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