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AMENDMENT 1
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**Soil quality — Digital exchange of soil-
related data**

AMENDMENT 1

Qualité du sol — Échange numérique de données relatives au sol
AMENDEMENT 1

STANDARDSISO.COM : Click to view the full PDF of ISO 28258:2013/Amd 1:2019



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

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.

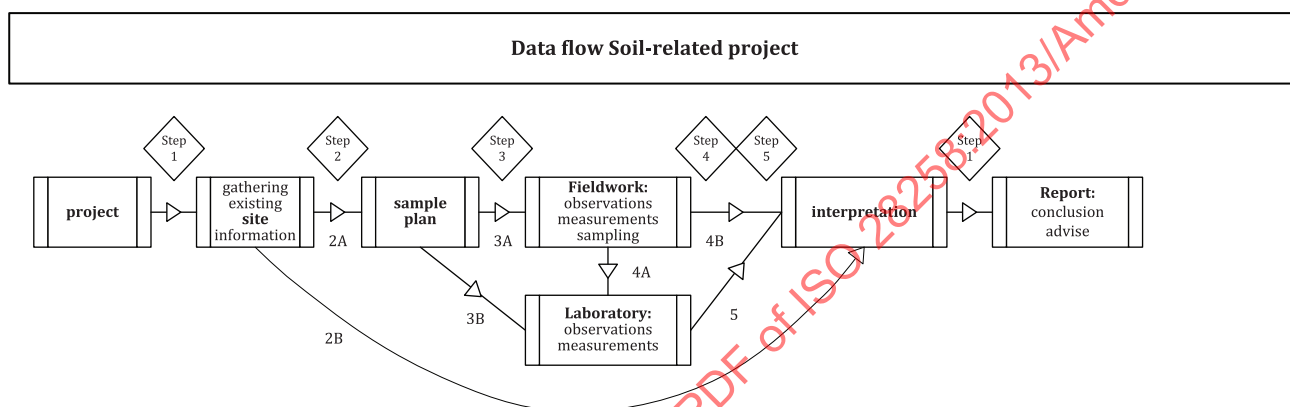
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Soil quality — Digital exchange of soil-related data

AMENDMENT 1

Introduction

Replace Figure 1 with the following one:



Data exchange can be analogue or digital, in maps, documents or as raw or processed data.

The boxes represent soil quality-related activities.

The arrows represent data exchange steps between the activities.

The figure shows that in a typical soil quality project there might easily be 9 main stages where data is exchanged or recorded.

Figure 1 — Common data exchanges in soil quality

Clause 1

Add the following paragraph at the end of the second paragraph:

"(Meta-)Data about the quality of soil information can be included according to ISO 19157."

Clause 3

At the end of definition 3.1, add the following note:

"Note 2 to entry: ISO 19156:2011 uses the term specimen for what is called a sample in soil science."

In Note 1 of 3.20, replace the term "profile information" by "soil profile information" as follows:

"Note 1 to entry: All types of plots only provide locality, but not soil information itself. For example, a borehole is the location where you gather the information to abstract a soil profile information from."

In 3.33, replace the term "profile" by "soil profile" in the definition, as follows:

"excavation prepared to carry out soil profile descriptions, sampling, and/or field tests"

4.1

In the first paragraph, replace the term “soil quality data” by “soil-related data” as follows:

"This International Standard is specifically made for the exchange of soil-related data. It does not deal with the nevertheless very common use and exchange data from other disciplines, like geotechnics, geo-information, or groundwater investigation and management."

In the fourth paragraph, replace the term “soil quality data” by “soil-related data” as follows:

"If soil-related data defined according to this International Standard are combined with other kinds of data, the soil-related part shall be performed, using the XML namespace “ISO 28258”."

In the last paragraph but one, replace the term “soil quality data” by “soil-related data” and the term “soil quality information” by “soil-related information” as follows:

"Clause 5 provides the information model for the exchange of soil-related data used in this International Standard. All soil-related information shall (eventually) refer to a specific place (point, location, mapping unit) in or under the surface of the earth. For all geographical information, the ISO 19100 family of International Standards is used."

4.2

Replace the title “Requirements worked out” by “Provisions for flexible adaptation”.

Replace the first paragraph with the following:

"This International Standard requires that the exchange of soil-related data uses an information model based on ISO 19156. The general model of ISO 19156 is adapted to soil-related data; maintaining flexibility as regards the attribute parameters."

5.1

Replace Figure 2 with the following one:

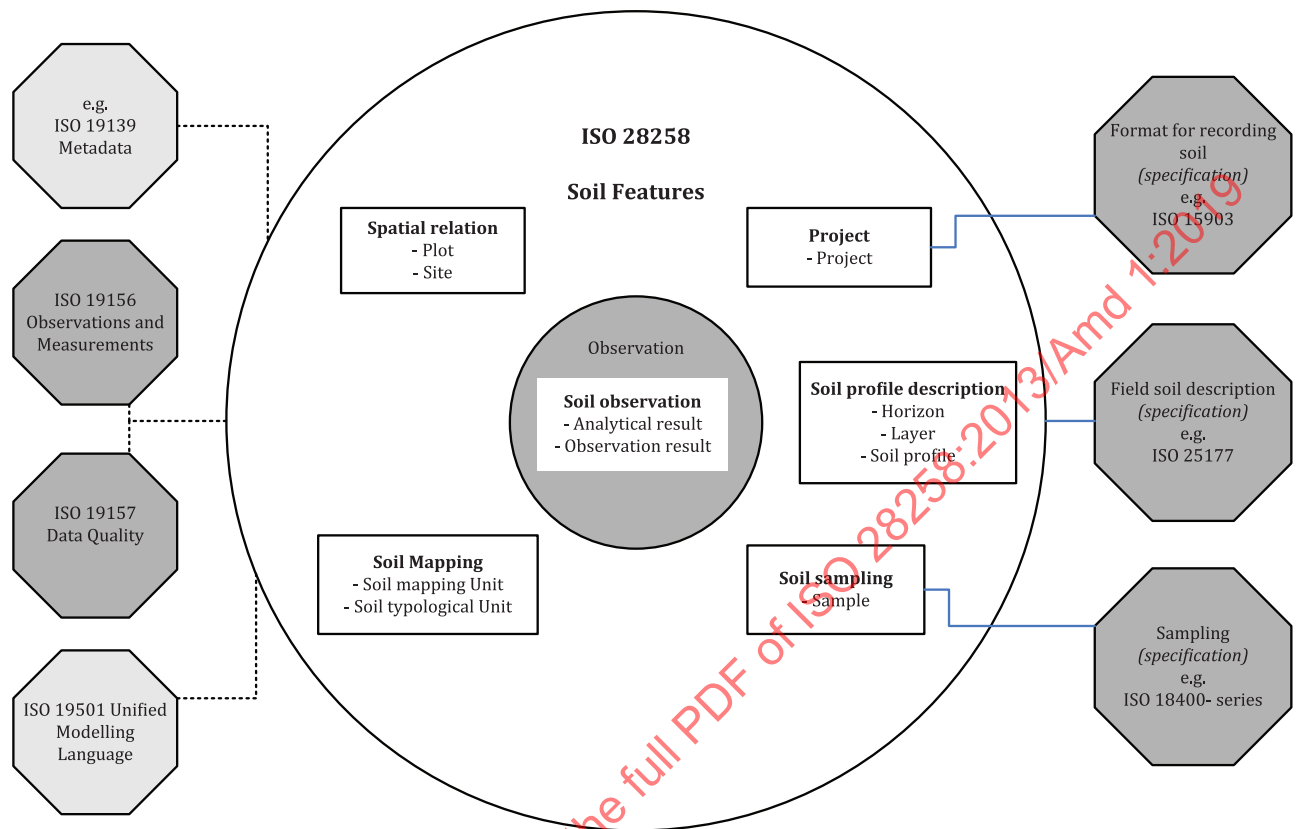


Figure 2 — Inner structure of soil information and its setting within other standards

5.2.1 d), e) and f)

Replace the term "SF_Process" by "OM_Process" and the term "Profile" by "SoilProfile" as follows:

"d) The OM_Process is restricted to *PreparationProcess*."

"e) FeatureType of Observation:featureOfInterest is restricted to *Site*, *Plot*, *SoilProfile*, *ProfileElement*, and *SoilSpecimen* including all their subclasses. It means that only properties of these feature types may be observed."

"f) FeatureType of SF_SamplingFeature: *sampledFeature* is restricted to *Site*, *Plot*, *SoilProfile*, and *ProfileElement* including all their subtypes."

5.2.3

In Tables 1 and 2, replace the term "Profile" by "SoilProfile".

Replace the last paragraph with the following:

"An observation may be done only on observable properties of any feature of interest; however, features of interest are restricted to *Site*, *Plot*, *SoilProfile*, *ProfileElement* (i. e. *Layer* and *Horizon*), and *SoilSpecimen*, including all their subtypes. General observable properties introduced by this model are listed in Table 2. Additional observable properties may be introduced by a data provider.

Any other properties introduced by this model except for those listed in Table 2 are considered to be exact."

5.3

Replace Figure 3 with the following one:

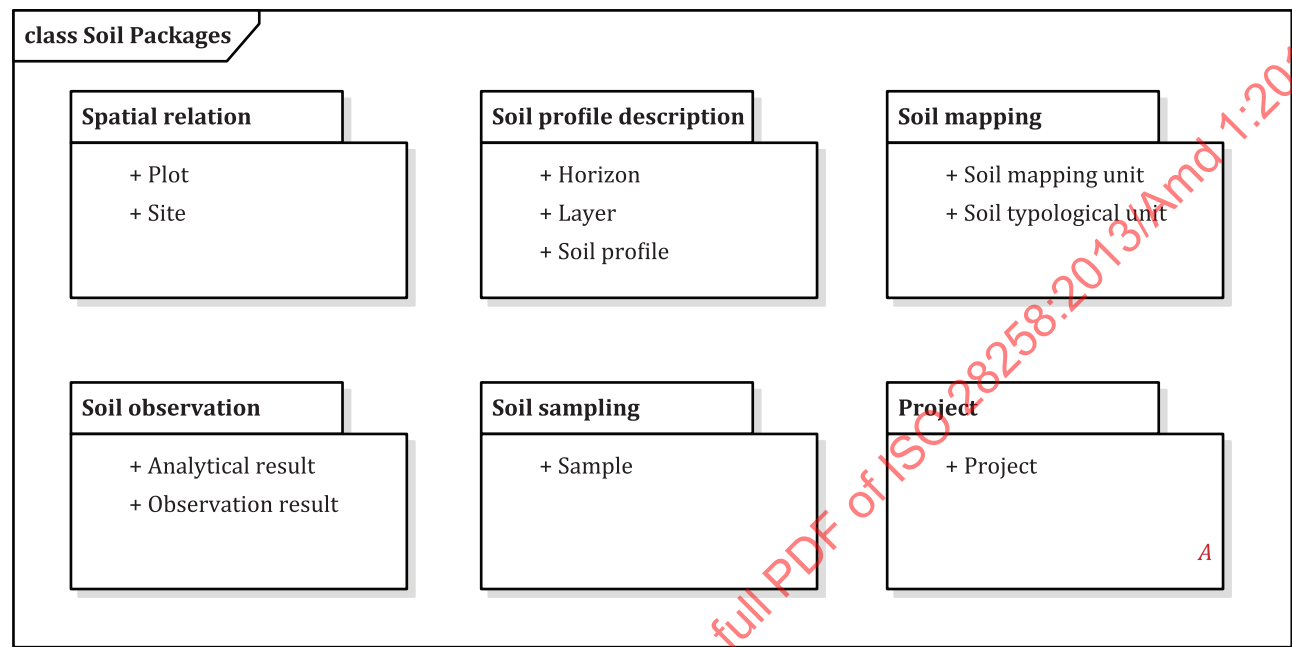


Figure 3 — General SoilQuality packages

[illegible]

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6.1

Replace Figure 5 with the figure one:

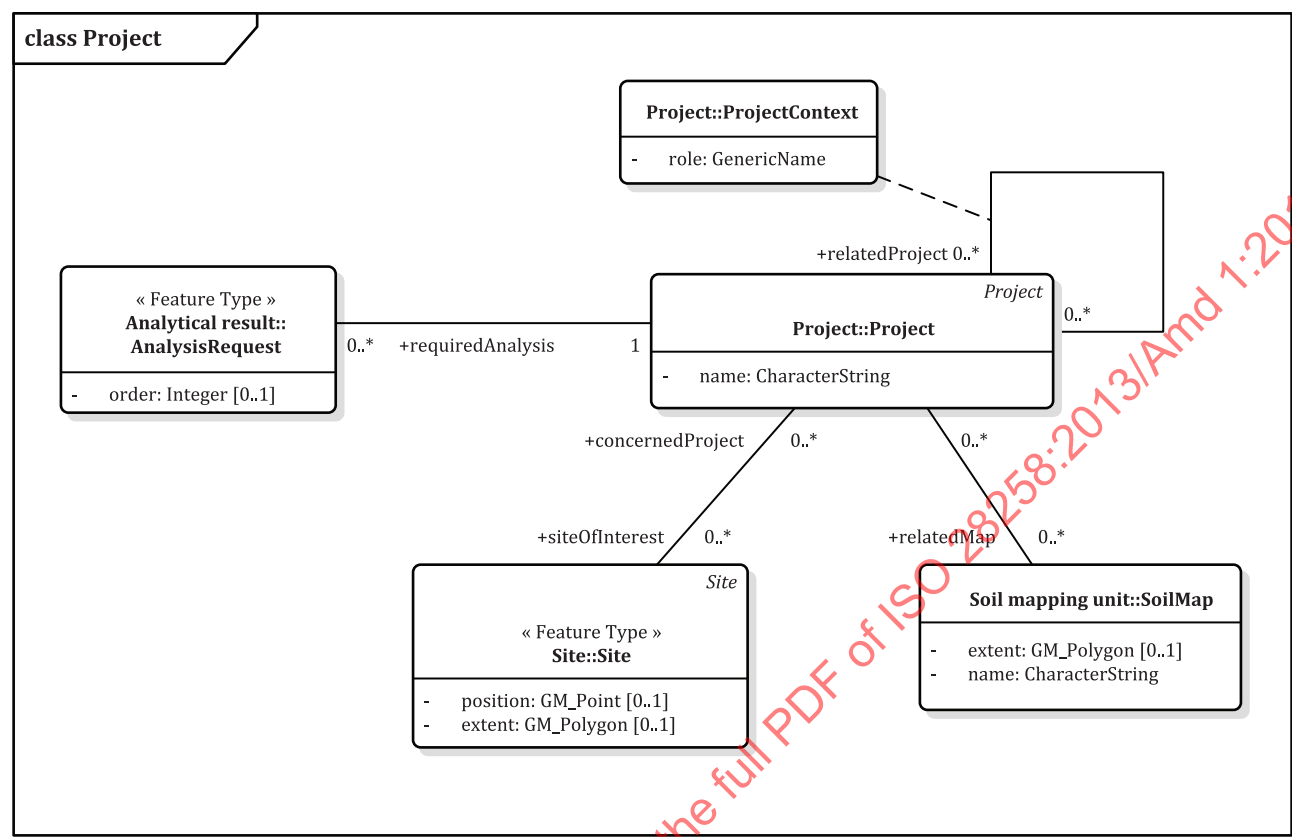


Figure 5 — Details — Project

6.2

Replace Figure 6 with the following one:

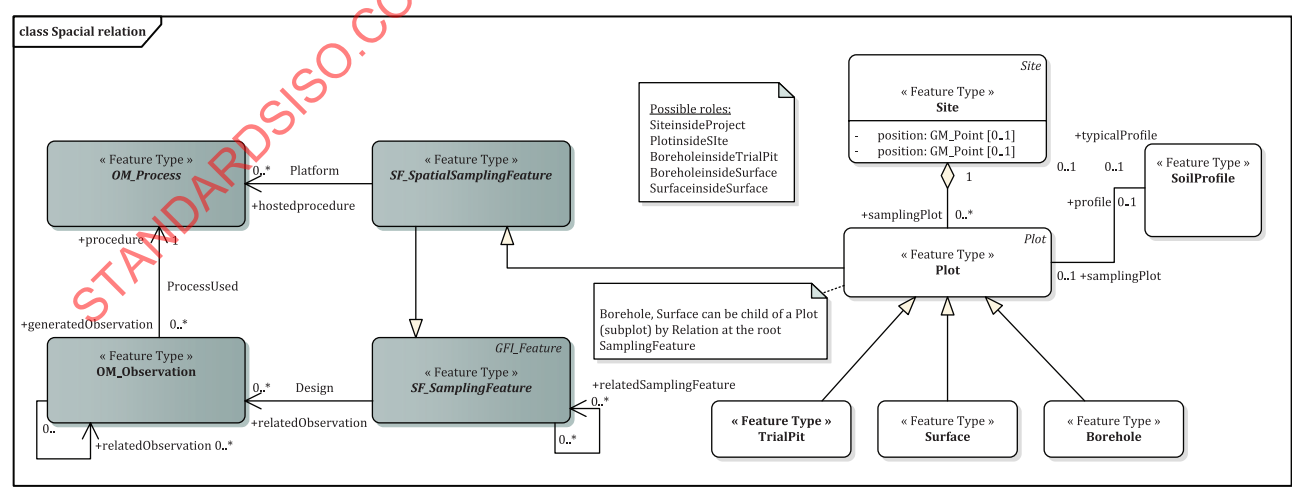


Figure 6 — Details — Spatial relation

6.5

Add the following Note at the end of the last paragraph:

"NOTE The attribute *extent* of the feature SoilMap describes the spatial (geographic) extent of the complete soil map. ISO 19107 refers to this as *envelope*."

In Table 5, add the following new row:

SoilMappingUnit	geometry	attribute	GM_Object	0..*
-----------------	----------	-----------	-----------	------

after this existing row:

SoilMappingUnit	explanation	attribute	CharacterString	1
-----------------	-------------	-----------	-----------------	---

Replace Figure 7 with the following one:

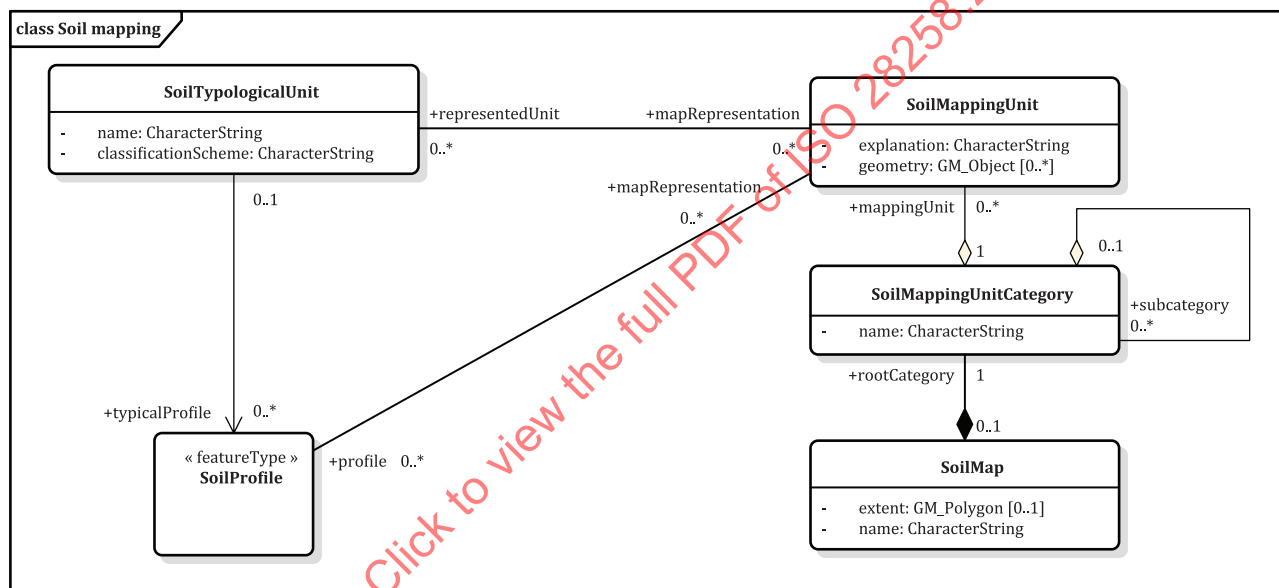


Figure 7 — Details — Soil mapping

[illegible]

Figure 8 — Details — Soil observation

6.7

Replace Figure 9 with the following one:

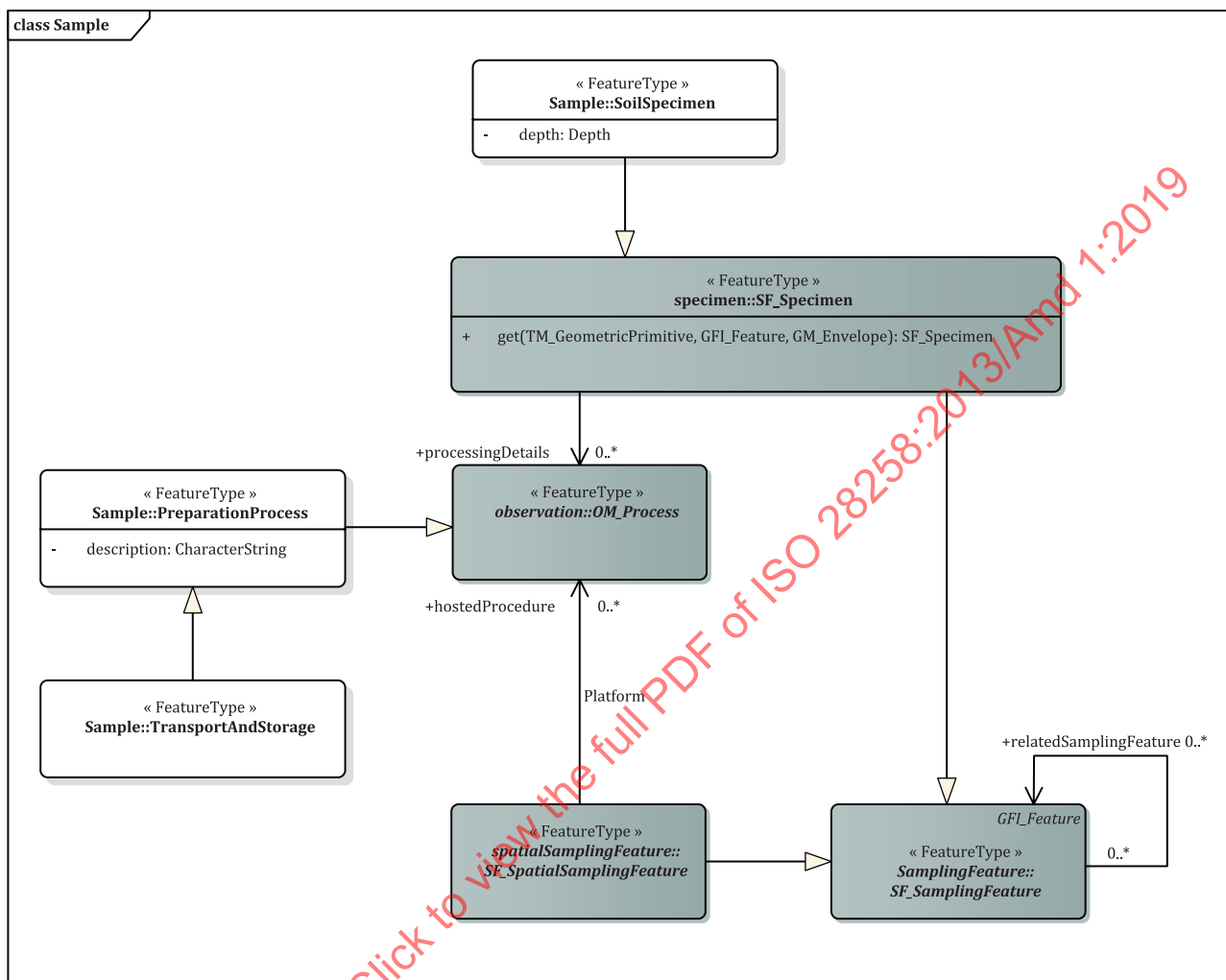


Figure 9 — Details — Sample

6.8

Replace the title “Profile description” by “Soil profile description”.

In the first paragraph, replace the term “profile” by “soil profile” as follows:

"The submodel soil profile description contains and relates the typical soil scientific concepts of soil profile, layer and soil horizon. The soil profile is an abstract, ordered set of soil horizons and/or layers. Horizons develop in layers which in turn have been developed through geogenesis or anthropogenic action. Furthermore, layers can be used to describe common characteristics of a set of adjoining horizons. Horizons may be associated with the layer in which they have been developed through pedogenesis. Because layers and horizons share the same basic properties (i.e. both have upper and lower depth information and have a position in the order within the soil profile), both are subclasses of the feature type ProfileElement. See Table 8."

In Table 8, replace the term “Profile” by “SoilProfile”.

Replace Figure 10 with the following one:

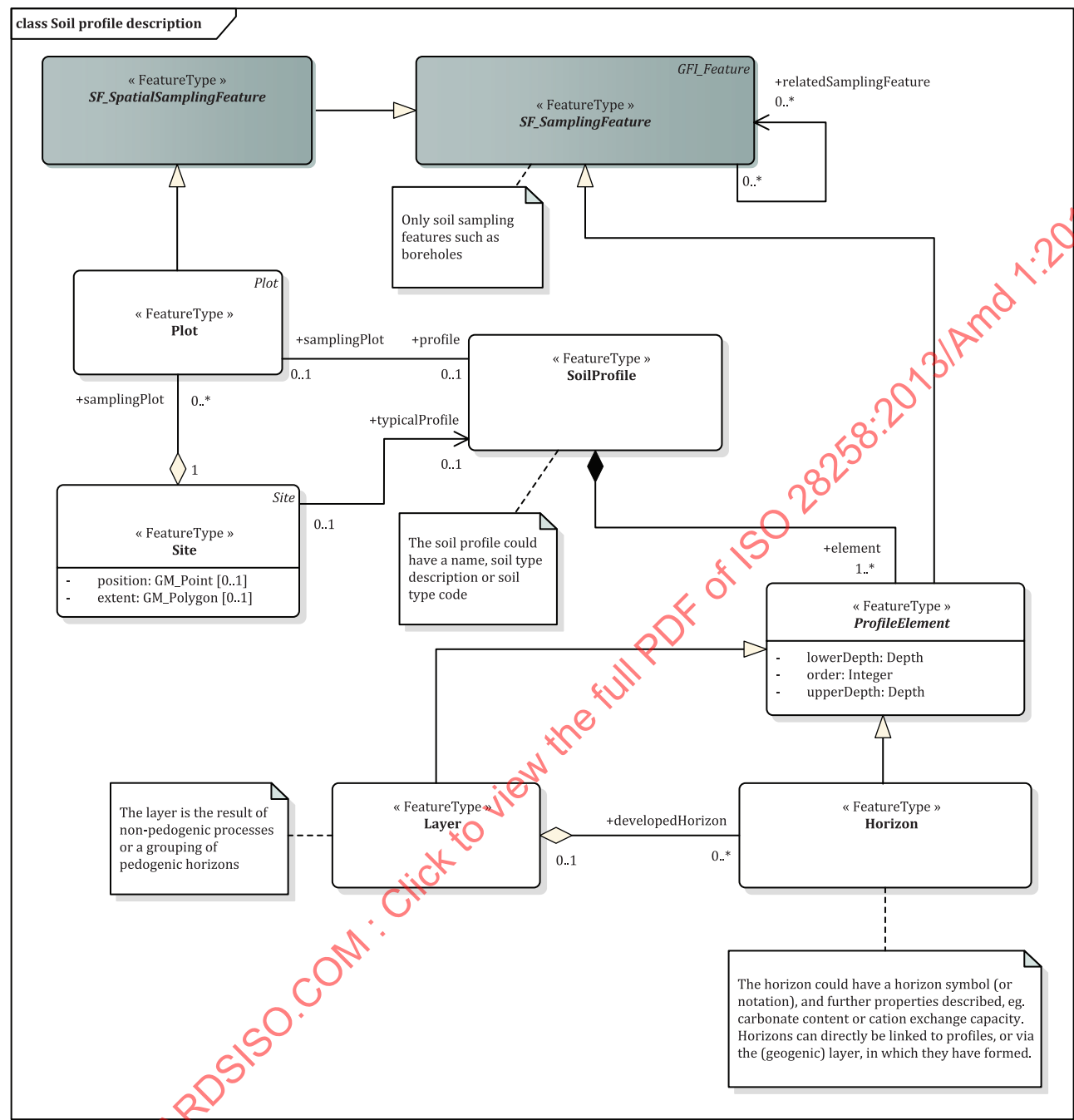


Figure 10 — Details — Soil profile

Clause 8

Replace the title “Validation software (control tools)” by “Validation software (check tools)”.

Annex A

In the column “Feature type”:

Replace “Soilobservation” by “SoilObservation”.

Replace "Profile" by "SoilProfile".

Replace "Profileelement" by "ProfileElement".

C.1.1

Replace the fourth paragraph with the following:

"This International Standard expects that every data provider or anyone who needs an exchange format for soil-related data extends SoilML classes with properties which are suitable for his or her data model, or simply fill the attributes for which (s)he has data. This extension of the SoilML UML model shall also appear in the XSD. Therefore, the data provider (or the one who defines the exchange format) has to create two different kinds of files:"

C.1.2

Replace "Profile" by "SoilProfile" in the 8th list item.

C.2

Replace the last example with the following:

"EXAMPLE 2 See the xlink:href = "#plot1" listing that enables linking the *plot1* from the *project1*."

C.3.2

Replace the last but second paragraph and the example with the following:

"Both ways of expression incorporate definition of units of measure, i.e. the *uom* concept similarly to other International Standards (e.g. ISO 19115-1 and ISO/TS 19139). In other words, each depth element presented above contains the mandatory *uom* attribute.

EXAMPLE Minimum depth 23,7 cm and maximum depth 56,2 cm would be encoded in the following way:

```
<sq:maxDepth uom="cm">56.2</sq:maxDepth>
```

```
<sq:minDepth uom="cm">23.7</sq:minDepth>
```

C.5.2.1 a)

Replace the term "Profile" by "SoilProfile" as follows:

"a) Property SoilObservation.**featureOfInterest** is restricted to Site, Plot, SoilProfile, ProfileElement, and SoilSpecimen including all their subtypes."

C.5.2.1

In the sentence before EXAMPLE, replace the term "Profile" by "SoilProfile" as follows:

"However, the set of observable properties can and should be extended with provider-specific properties related to Site, Plot, SoilProfile, ProfileElement and/or SoilSpecimen, including their subtypes."

In the sentence after EXAMPLE, replace the term "Profile" by "SoilProfile" as follows:

"Observed property can be a simple attribute as well as an association role, so it is possible to observe Plot.elevation as well as Plot.profile. Observation of a Plot.profile can be considered as related not only to SoilProfile itself, but also to its property values (elements, meaning Layers and Horizons, their order, depths, etc.)."

In Table C.3, replace the term "Profile" by "SoilProfile".

C.5.3.2

In the last sentence before EXAMPLE 3, replace the term "Profile" by "SoilProfile" as follows:

"In the case of object types (e.g. sq:SoilProfile, sq:ProfileElement), the duplicity should be avoided using the by-reference mode."

C.6

Replace the text with the following:

This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of the Web references named.

```
<?xml version="1.0" encoding="windows-1252"?>
<schema
  xmlns="http://www.w3.org/2001/XMLSchema"
  xmlns:gml="http://www.opengis.net/gml/3.2"
  xmlns:sq="http://www.iso28258.org"
  xmlns:om="http://www.opengis.net/om/2.0"
  xmlns:sam="http://www.opengis.net/sampling/2.0"
  xmlns:sams="http://www.opengis.net/samplingSpatial/2.0"
  xmlns:spec="http://www.opengis.net/samplingSpecimen/2.0"
  elementFormDefault="qualified"
  targetNamespace="http://www.isotc190.org/SoilML.xsd"
  version="2.0">
  <import namespace="http://www.opengis.net/gml/3.2" schemaLocation="http://schemas.
  opengis.net/gml/3.2.1/gml.xsd"/>
  <import namespace="http://www.opengis.net/om/2.0" schemaLocation="http://schemas.
  opengis.net/om/2.0/observation.xsd"/>
  <import namespace="http://www.opengis.net/sampling/2.0" <import namespace="http://
  schemas.opengis.net/iso/19139/20070417/gss/geometry.xsd"/> schemaLocation="http://schemas.
  opengis.net/sampling/2.0/samplingFeature.xsd"/>
  <import namespace="http://www.opengis.net/samplingSpatial/2.0" schemaLocation="http://
  schemas.opengis.net/samplingSpatial/2.0/spatialSamplingFeature.xsd"/>
  <import namespace="http://www.opengis.net/samplingSpecimen/2.0" schemaLocation="http://
  schemas.opengis.net/samplingSpecimen/2.0/specimen.xsd"/>

  <element name="PreparationProcess" type="sq:PreparationProcessType" substitutionGroup="g
```

```

ml:AbstractFeature">
  <annotation>
    <documentation>PreparationProcess

```

Preparation process is a subtype of OM_Process (also known as SF_Process). It is a process used to prepare the specimen. It has one subtype TransportAndStorage.</documentation>

```

  </annotation>
</element>
<complexType name="PreparationProcessType">
  <complexContent>
    <extension base="gml:AbstractFeatureType">
      <sequence>
        <element name="description" type="string"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>
<complexType name="PreparationProcessPropertyType">
  <sequence minOccurs="0">
    <element ref="sq:PreparationProcess"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
  <attributeGroup ref="gml:OwnershipAttributeGroup"/>
</complexType>
<element name="Project" type="sq:ProjectType" substitutionGroup="gml:AbstractFeature">
  <annotation>
    <documentation>project

```

The project holds the background information for soil studies. A project does not describe the soil as such. It is of importance to exchange project data along with other soil quality data in order to know the aim and circumstances of data collection. The project provides the context of the data collection as a prerequisite for the proper use or reuse of these data.

The project information also may be the starting point to retrieve further information that cannot be exchanged using soil quality. For example, the name of an author or the project number may be the key for finding a report or decision document.</documentation>

```

  </annotation>
</element>
<complexType name="ProjectType">
  <complexContent>
    <extension base="gml:AbstractFeatureType">
      <sequence>
        <element name="name" type="string"/>
        <element name="siteOfInterest" type="sq:SitePropertyType" minOccurs="0"
maxOccurs="unbounded"/>
        <annotation>
          <appinfo>
            <reversePropertyName xmlns="http://www.opengis.net/
gml/3.2">sq:concernedProject</reversePropertyName>
          </appinfo>
        </annotation>
      </sequence>
      <element name="relatedMap" type="sq:SoilMapPropertyType" minOccurs="0"
maxOccurs="unbounded"/>
      <element name="relatedProject" type="sq:ProjectContextPropertyType"
minOccurs="0" maxOccurs="unbounded"/>
      <element name="requiredAnalysis" type="sq:AnalysisRequestPropertyType"
minOccurs="0" maxOccurs="unbounded"/>
    </sequence>
  </extension>
</complexContent>
</complexType>
<complexType name="ProjectPropertyType">
  <sequence minOccurs="0">
    <element ref="sq:Project"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
  <attributeGroup ref="gml:OwnershipAttributeGroup"/>
</complexType>
<complexType name="ProjectContextPropertyType">
  <sequence>

```

```

    <element ref="sq:ProjectContext"/>
  </sequence>
</complexType>
<element name="ProjectContext" type="sq:ProjectContextType"/>
<complexType name="ProjectContextType">
  <sequence>
    <element name="role" type="gml:ReferenceType"/>
    <element name="relatedProject" type="gml:ReferenceType">
      <annotation>
        <appinfo>
          <gml:targetElement>sq:Project</gml:targetElement>
        </appinfo>
      </annotation>
    </element>
  </sequence>
</complexType>
<element name="Depth" type="sq:DepthType" substitutionGroup="gml:AbstractObjectType">
  <annotation>
    <documentation>
      Depth is a datatype which can both simple depth (e.g. 60cm) or depth extent (e.g.
      60-70cm).
      Depth is implemented as a choice of GML Quantity or GML QuantityExtent.</documentation>
    </annotation>
  </element>
<complexType name="DepthType">
  <choice>
    <element name="extent" type="gml:QuantityExtentType"/>
    <element name="simple" nillable="true">
      <complexType>
        <simpleContent>
          <extension base="gml:MeasureType">
            <attribute name="nilReason" type="gml:NilReasonType"/>
          </extension>
        </simpleContent>
      </complexType>
    </element>
  </choice>
</complexType>
<complexType name="DepthPropertyType">
  <sequence>
    <element ref="sq:Depth"/>
  </sequence>
</complexType>
<element name="SoilSpecimen" type="sq:SoilSpecimenType" substitutionGroup="spec:SF_
Specimen">
  <annotation>
    <documentation>soil specimen

    Soil specimen is a subtype of SF_Specimen. Soil specimen may be taken in the Site, Plot,
    SoilProfile, or ProfileElement including their subtypes.</documentation>
  </annotation>
</element>
<complexType name="SoilSpecimenType">
  <complexContent>
    <extension base="spec:SF_SpecimenType">
      <sequence>
        <element name="depth" id="SoilSpecimen_depth" type="sq:DepthPropertyType"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>
<complexType name="SoilSpecimenPropertyType">
  <sequence minOccurs="0">
    <element ref="sq:SoilSpecimen"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
  <attributeGroup ref="gml:OwnershipAttributeGroup"/>
</complexType>
<element name="SoilObservation" type="sq:SoilObservationType" substitutionGroup="om:OM_

```

```

Observation">
  <annotation>
    <documentation>soil observation

```

Soil observation is a subtype of OM_Observation.

[ISO 19156]

An observation is an act associated with a discrete time instant or period through which a number, term or other symbol is assigned to a phenomenon. It involves application of a specified procedure, such as a sensor, instrument, algorithm or process chain. The procedure may be applied in situ, remotely, or ex situ with respect to the sampling location. The result of an observation is an estimate of the value of a property of some feature. Use of a common model allows observation data using different procedures to be combined unambiguously.</documentation>

```

  </annotation>
</element>
<complexType name="SoilObservationType">
  <complexContent>
    <extension base="om:OM_ObservationType">
      <sequence/>
    </extension>
  </complexContent>
</complexType>
<complexType name="SoilObservationPropertyType">
  <sequence minOccurs="0">
    <element ref="sq:SoilObservation"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
  <attributeGroup ref="gml:OwnershipAttributeGroup"/>
</complexType>
<element name="Site" type="sq:SiteType" substitutionGroup="gml:AbstractFeature">
  <annotation>
    <documentation>site

```

defined area which is subject to a soil quality investigation

A site is a defined, spatially extended area and provides the real world object to which soil data are related. It represents the spatial link between point, linear and areal soil observations on the one hand and its environment (e.g. the landscape or larger spatial objects) on the other. As such, it provides the possibility to connect data on spatially extended phenomena, e.g. vegetation, with point, linear and areal sampling features (plots). It also allows for the possibility to combine the results of (quasi-)synchronous repetitions of observations of the same kind. The site is furthermore the time link between repeated soil observations, e.g. in the framework of a soil monitoring. Generally, within one single project, a site is spatially invariant, but contains all plots for single or repeated observations and samplings, both related to one point in time or several points in time. Very often, the data obtained on a site are considered to originate from one single point in further data processing and evaluation.

In terms of OM, each site is a sampled feature of its plots which are spatial sampling features. Site serves also as a typical feature of interest of soil observations.</documentation>

```

  </annotation>
</element>
<complexType name="SiteType">
  <complexContent>
    <extension base="gml:AbstractFeatureType">
      <sequence>
        <element name="concernedProject" type="sq:ProjectPropertyType" minOccurs="0"
maxOccurs="unbounded">
          <annotation>
            <appinfo>
              <reversePropertyName xmlns="http://www.opengis.net/
gml/3.2">sq:siteOfInterest</reversePropertyName>
            </appinfo>
          </annotation>
        </element>
      </sequence>
    </extension>
  </complexType>
</choice>

```

```

    <element name="extent" id="Site_extent">
      <complexType>
        <complexContent>
          <extension base="gml:AbstractMemberType">
            <sequence minOccurs="0">
              <element ref="gml:Polygon"/>
            </sequence>
            <attributeGroup ref="gml:AssociationAttributeGroup"/>
          </extension>
        </complexContent>
      </complexType>
    </element>
    <element name="position" id="Site_position" type="gml:PointPropertyType"/>
  </choice>
  <element name="typicalProfile" id="Site_typicalProfile"
type="sq:ProfilePropertyType" minOccurs="0"/>
  <element name="samplingPlot" type="sq:PlotPropertyType" minOccurs="0"
maxOccurs="unbounded"/>
</sequence>
</extension>
</complexContent>
</complexType>
<complexType name="SitePropertyType">
  <sequence minOccurs="0">
    <element ref="sq:Site"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
  <attributeGroup ref="gml:OwnershipAttributeGroup"/>
</complexType>
<element name="TrialPit" type="sq:TrialPitType" substitutionGroup="sq:Plot">
  <annotation>
    <documentation>trial pit, test pit, trench

```

excavation prepared to carry out profile descriptions, sampling, and/or field tests

Trial pit is a subtype of a plot with point shape. A trial pits may have an associated soil profile. TrialPit represents the location of a dug soil opening made to observe the soil.

[ISO 11074]

For the purposes of this International Standard, the term trial pit is used.</documentation>

```

  </annotation>
</element>
<complexType name="TrialPitType">
  <complexContent>
    <extension base="sq:PlotType">
      <sequence/>
    </extension>
  </complexContent>
</complexType>
<complexType name="TrialPitPropertyType">
  <sequence minOccurs="0">
    <element ref="sq:TrialPit"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
  <attributeGroup ref="gml:OwnershipAttributeGroup"/>
</complexType>
<element name="Layer" type="sq:LayerType" substitutionGroup="sq:ProfileElement">
  <annotation>
    <documentation>layer

```

domain of a soil with a certain vertical extension developed through non-pedogenic processes, displaying an unconformity to possibly over- or underlying adjacent domains

Note 1: In the framework of soils deeply modified by human activity, artificial layers may be due to different kinds of deposits (concrete, bricks, etc.).

Note 2: Layers may be part of a horizon.</documentation>

```

</element>
<complexType name="LayerType">
  <complexContent>
    <extension base="sq:ProfileElementType">
      <sequence>
        <element name="developedHorizon" id="Layer_developedHorizon"
type="sq:HorizonPropertyType" minOccurs="0" maxOccurs="unbounded"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>
<complexType name="LayerPropertyType">
  <sequence minOccurs="0">
    <element ref="sq:Layer"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
  <attributeGroup ref="gml:OwnershipAttributeGroup"/>
</complexType>
<element name="TransportAndStorage" type="sq:TransportAndStorageType" substitutionGroup=
"sq:PreparationProcess">
  <annotation>
    <documentation>TransportAndStorage

```

TransportAndStorage is a subtype of preparation process. It represents transportation and storage of soil specimen.</documentation>

```

  </annotation>
</element>
<complexType name="TransportAndStorageType">
  <complexContent>
    <extension base="sq:PreparationProcessType">
      <sequence/>
    </extension>
  </complexContent>
</complexType>
<complexType name="TransportAndStoragePropertyType">
  <sequence minOccurs="0">
    <element ref="sq:TransportAndStorage"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
  <attributeGroup ref="gml:OwnershipAttributeGroup"/>
</complexType>
<element name="AnalysisRequest" type="sq:AnalysisRequestType" substitutionGroup="gml:Ab
stractFeature">
  <annotation>
    <documentation>analysis request

```

AnalysisRequest is a description of an analysis which should be carried out on soil specimens.</documentation>

```

  </annotation>
</element>
<complexType name="AnalysisRequestType">
  <complexContent>
    <extension base="gml:AbstractFeatureType">
      <sequence>
        <element name="order" type="integer" minOccurs="0"/>
        <element name="requiredProperty" type="gml:ReferenceType" nillable="true">
          <annotation>
            <appinfo>
              <gml:targetElement>xs:anyType</gml:targetElement>
            </appinfo>
          </annotation>
        </element>
        <element name="observationProcess" type="sq:ObservationProcessPropertyType"/>
        <element name="specimenOfInterest" type="sq:SoilSpecimenPropertyType"
maxOccurs="unbounded"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>

```

```

<complexType name="AnalysisRequestPropertyType">
  <sequence minOccurs="0">
    <element ref="sq:AnalysisRequest"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
  <attributeGroup ref="gml:OwnershipAttributeGroup"/>
</complexType>
<element name="SoilMappingUnit" type="sq:SoilMappingUnitType" substitutionGroup="gml:AbstractFeature">
  <annotation>
    <documentation>SoilMappingUnit (SMU)

```

Soil mapping unit is a map legend category with unique map symbol within the soil map. Each mapping unit is related exactly to one map (through category tree). Mapping unit may represent one or more soil typological units, whereas soil typological unit may occur within one or more mapping units.</documentation>

```

  </annotation>
</element>
<complexType name="SoilMappingUnitType">
  <complexContent>
    <extension base="gml:AbstractFeatureType">
      <sequence>
        <element name="representedUnit" type="sq:SoilTypologicalUnitPropertyType"
minOccurs="0" maxOccurs="unbounded">
          <annotation>
            <appinfo>
              <reversePropertyName xmlns="http://www.opengis.net/
gml/3.2">sq:mapRepresentation</reversePropertyName>
            </appinfo>
          </annotation>
        </element>
        <element name="delineation" minOccurs="0" maxOccurs="unbounded">
          <complexType>
            <complexContent>
              <extension base="gml:AbstractMemberType">
                <sequence minOccurs="0">
                  <element ref="gml:Polygon"/>
                </sequence>
                <attributeGroup ref="gml:AssociationAttributeGroup"/>
              </extension>
            </complexContent>
          </complexType>
        </element>
        <element name="explanation" type="string"/>
        <element name="profile" type="sq:ProfilePropertyType" minOccurs="0"
maxOccurs="unbounded">
          <annotation>
            <appinfo>
              <reversePropertyName xmlns="http://www.opengis.net/
gml/3.2">sq:mapRepresentation</reversePropertyName>
            </appinfo>
          </annotation>
        </element>
      </sequence>
    </extension>
  </complexContent>
</complexType>
<complexType name="SoilMappingUnitPropertyType">
  <sequence minOccurs="0">
    <element ref="sq:SoilMappingUnit"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
  <attributeGroup ref="gml:OwnershipAttributeGroup"/>
</complexType>
<element name="ProfileElement" type="sq:ProfileElementType" abstract="true" substitution
Group="gml:AbstractFeature">
  <annotation>
    <documentation>profile element

```

Profile element is an abstract feature type grouping layers and horizons. Profile element

may be considered as a horizontal feature that is parallel to the earth surface and that is part of the profile.</documentation>

```

    </annotation>
  </element>
  <complexType name="ProfileElementType" abstract="true">
    <complexContent>
      <extension base="gml:AbstractFeatureType">
        <sequence>
          <element name="order" id="ProfileElement_order" type="integer"/>
          <element name="upperDepth" id="ProfileElement_upperDepth"
type="sq:DepthPropertyType"/>
          <element name="lowerDepth" id="ProfileElement_lowerDepth"
type="sq:DepthPropertyType"/>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
  <complexType name="ProfileElementPropertyType">
    <sequence minOccurs="0">
      <element ref="sq:ProfileElement"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
    <attributeGroup ref="gml:OwnershipAttributeGroup"/>
  </complexType>
  <element name="SoilTypologicalUnit" type="sq:SoilTypologicalUnitType" substitutionGroup=
"gml:AbstractFeature">
    <annotation>
      <documentation>SoilTypologicalUnit (STU)

```

Soil typological unit is a non-spatial unit of systematically similar soils. Each soil typological unit is related exactly to one map (see constraint).</documentation>

```

    </annotation>
  </element>
  <complexType name="SoilTypologicalUnitType">
    <complexContent>
      <extension base="gml:AbstractFeatureType">
        <sequence>
          <element name="name" type="string"/>
          <element name="classificationScheme" type="string"/>
          <element name="typicalProfile" type="sq:ProfilePropertyType" minOccurs="0"
maxOccurs="unbounded"/>
          <element name="mapRepresentation" type="sq:SoilMappingUnitPropertyType"
minOccurs="0" maxOccurs="unbounded">
            <annotation>
              <appinfo>
                <reversePropertyName xmlns="http://www.opengis.net/
gml/3.2">sq:representedUnit</reversePropertyName>
              </appinfo>
            </annotation>
          </element>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
  <complexType name="SoilTypologicalUnitPropertyType">
    <sequence minOccurs="0">
      <element ref="sq:SoilTypologicalUnit"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
    <attributeGroup ref="gml:OwnershipAttributeGroup"/>
  </complexType>
  <element name="SoilMap" type="sq:SoilMapType" substitutionGroup="gml:AbstractFeature">
    <annotation>
      <documentation>SoilMap

```

SoilMap is a soil map or soil map series with unified classification of soil mapping units and soil typological units.</documentation>

```

  </annotation>

```

```

</element>
<complexType name="SoilMapType">
  <complexContent>
    <extension base="gml:AbstractFeatureType">
      <sequence>
        <element name="name" type="string"/>
        <element name="extent" minOccurs="0">
          <complexType>
            <complexContent>
              <extension base="gml:AbstractMemberType">
                <sequence minOccurs="0">
                  <element ref="gml:Polygon"/>
                </sequence>
                <attributeGroup ref="gml:AssociationAttributeGroup"/>
              </extension>
            </complexContent>
          </complexType>
        </element>
        <element name="rootCategory" type="sq:SoilMappingUnitCategoryPropertyType"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>
<complexType name="SoilMapPropertyType">
  <sequence minOccurs="0">
    <element ref="sq:SoilMap"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
  <attributeGroup ref="gml:OwnershipAttributeGroup"/>
</complexType>
<element name="Surface" type="sq:SurfaceType" substitutionGroup="sq:Plot">
  <annotation>
    <documentation>surface

```

Surface is a subtype of a plot with surface shape. Surfaces may be located within other surfaces.</documentation>

```

  </annotation>
</element>
<complexType name="SurfaceType">
  <complexContent>
    <extension base="sq:PlotType">
      <sequence/>
    </extension>
  </complexContent>
</complexType>
<complexType name="SurfacePropertyType">
  <sequence minOccurs="0">
    <element ref="sq:Surface"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
  <attributeGroup ref="gml:OwnershipAttributeGroup"/>
</complexType>
<element name="SoilMappingUnitCategory" type="sq:SoilMappingUnitCategoryType" substituti
onGroup="gml:AbstractFeature">
  <annotation>
    <documentation>SoilMappingUnitCategory

```

Soil mapping unit category is a map legend category used for grouping soil mapping units or another categories. Each category is either root category of a map or subcategory of another category. Concerning this, each category is related exactly to one map through root category of the tree structure (see subcategory).</documentation>

```

  </annotation>
</element>
<complexType name="SoilMappingUnitCategoryType">
  <complexContent>
    <extension base="gml:AbstractFeatureType">
      <sequence>
        <element name="name" type="string"/>
        <element name="subcategory" type="sq:SoilMappingUnitCategoryPropertyType"

```

```

minOccurs="0" maxOccurs="unbounded"/>
    <element name="mappingUnit" type="sq:SoilMappingUnitPropertyType" minOccurs="0"
maxOccurs="unbounded"/>
    </sequence>
</extension>
</complexContent>
</complexType>
<complexType name="SoilMappingUnitCategoryPropertyType">
    <sequence minOccurs="0">
        <element ref="sq:SoilMappingUnitCategory"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
    <attributeGroup ref="gml:OwnershipAttributeGroup"/>
</complexType>
<element name="Profile" type="sq:ProfileType" substitutionGroup="gml:AbstractFeature">
    <annotation>
        <documentation>SoilProfile is the describable representation of the soil that is
characterised by a vertical succession of horizons or one or several (e.g. parent
material) layers.

```

A soil profile is an ordered set of soil horizons and/or layers. These are subtypes of the abstract feature type ProfileElement. SoilProfile is also a typical feature of interest of soil observations.</documentation>

```

    </annotation>
</element>
<complexType name="ProfileType">
    <complexContent>
        <extension base="gml:AbstractFeatureType">
            <sequence>
                <element name="samplingPlot" type="sq:PlotPropertyType" minOccurs="0">
                    <annotation>
                        <appinfo>
                            <reversePropertyName xmlns="http://www.opengis.net/
gml/3.2">sq:SoilProfile</reversePropertyName>
                        </appinfo>
                    </annotation>
                </element>
                <element name="element" id="Profile_element" type="sq:ProfileElementPropertyT
ype" maxOccurs="unbounded"/>
                <element name="mapRepresentation" type="sq:SoilMappingUnitPropertyType"
minOccurs="0" maxOccurs="unbounded">
                    <annotation>
                        <appinfo>
                            <reversePropertyName xmlns="http://www.opengis.net/
gml/3.2">sq:SoilProfile</reversePropertyName>
                        </appinfo>
                    </annotation>
                </element>
            </sequence>
        </extension>
    </complexContent>
</complexType>
<complexType name="ProfilePropertyType">
    <sequence minOccurs="0">
        <element ref="sq:SoilProfile"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
    <attributeGroup ref="gml:OwnershipAttributeGroup"/>
</complexType>
<element name="Plot" type="sq:PlotType" substitutionGroup="sams:Sf_
SpatialSamplingFeature">
    <annotation>
        <documentation>plot elementary area where individual observations are made and/or
samples are taken

```

Plot is a subtype of Sf SpatialSamplingFeature. The plot provides the connection between the discrete location of a sampling or an observation and the site. Plot is also a typical feature of interest of soil observations. Plot has three subtypes: Surface, TrialPit and Borehole.</documentation>

```

    </annotation>
  </element>
  <complexType name="PlotType">
    <complexContent>
      <extension base="sams:SF_SpatialSamplingFeatureType">
        <sequence>
          <element name="profile" id="Plot_profile" type="sq:ProfilePropertyType"
minOccurs="0">
            <annotation>
              <appinfo>
                <reversePropertyName xmlns="http://www.opengis.net/
gml/3.2">sq:samplingPlot</reversePropertyName>
              </appinfo>
            </annotation>
          </element>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
  <complexType name="PlotPropertyType">
    <sequence minOccurs="0">
      <element ref="sq:Plot"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
    <attributeGroup ref="gml:OwnershipAttributeGroup"/>
  </complexType>
  <element name="ObservationProcess" type="sq:ObservationProcessType" substitutionGroup="g
ml:AbstractFeature">
    <annotation>
      <documentation>observation process Observation process is a subtype of OM_Process.
It is a process used to generate the result of the observation.

```

Implementation note: OM_Process is modelled as FeatureType, but within OGC XML schema (version 2.0.0) it is only anyXML. ObservationProcess should be implemented as FeatureType.</documentation>

```

    </annotation>
  </element>
  <complexType name="ObservationProcessType">
    <complexContent>
      <extension base="gml:AbstractFeatureType">
        <sequence>
          <element name="description" type="string"/>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
  <complexType name="ObservationProcessPropertyType">
    <sequence minOccurs="0">
      <element ref="sq:ObservationProcess"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
    <attributeGroup ref="gml:OwnershipAttributeGroup"/>
  </complexType>
  <element name="Borehole" type="sq:BoreholeType" substitutionGroup="sq:Plot">
    <annotation>
      <documentation>borehole

```

Penetration into the subsurface with removal of soil/rock material by using e.g. a hollow tube-shaped tool. Synonyms: Boring and bore.

Borehole is a subtype of a plot with point shape. A boreholes may have an associated soil profile.

[ISO 11074]

Note 1: Generally, it is a vertical penetration.

Note 2: For the purpose of this International Standard, the term borehole is used.</documentation>

```

    </annotation>
  </element>

```

```

<complexType name="BoreholeType">
  <complexContent>
    <extension base="sq:PlotType">
      <sequence/>
    </extension>
  </complexContent>
</complexType>
<complexType name="BoreholePropertyType">
  <sequence minOccurs="0">
    <element ref="sq:Borehole"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
  <attributeGroup ref="gml:OwnershipAttributeGroup"/>
</complexType>
<element name="Horizon" type="sq:HorizonType" substitutionGroup="sq:ProfileElement">
  <annotation>
    <documentation>horizon

```

domain of a soil with a certain vertical extension, which is more or less parallel to the surface and is homogeneous for most morphological and analytical characteristics, developed in a parent material through pedogenic processes or made up of in-situ sedimented organic residues of up-growing plants (peat)

```

NOTE Horizons may be part of a layer.</documentation>
</annotation>
</element>
<complexType name="HorizonType">
  <complexContent>
    <extension base="sq:ProfileElementType">
      <sequence/>
    </extension>
  </complexContent>
</complexType>
<complexType name="HorizonPropertyType">
  <sequence minOccurs="0">
    <element ref="sq:Horizon"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
  <attributeGroup ref="gml:OwnershipAttributeGroup"/>
</complexType>
</schema>

```

C.7

Replace the text with the following:

This is an example of an extended SoilML XML schema. The Plot is extended with elevation property becoming XYPlot, whereas the Horizon is extended with humusContent and colour properties becoming XYHorizon. The example is described in detail in C.3.

```

<?xml version="1.0" encoding="utf-8"?>
<xsd:schema
  xmlns="http://www.iso28258.org"
  xmlns:sq="http://www.iso28258.org"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  targetNamespace="http://www.iso28258.org"
  elementFormDefault="qualified"
  xmlns:gml="http://www.opengis.net/gml/3.2"
>
  <xsd:include schemaLocation="path/to/soilml.xsd"/>
  <xsd:import namespace="http://www.opengis.net/gml/3.2" schemaLocation="http://schemas.
  opengis.net/gml/3.2.1/gmlBase.xsd"/>
  <xsd:import namespace="http://www.opengis.net/gml/3.2" schemaLocation="http://schemas.
  opengis.net/gml/3.2.1/basicTypes.xsd"/>

  <xsd:element name="XYPlot" substitutionGroup="Plot" type="XYPlotType" />

  <xsd:complexType name="XYPlotType">

```