



Farm Data Standards

Irrigation and Effluent Data Standard

Version 1.2



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1 Document Management

1.1 Referenced Documents

[Irrigation Code of Practice and Irrigation Design Standards](#), Irrigation New Zealand Inc and Sustainable Farming Fund, March 2007

[Irrigation Glossary Book 2](#), Irrigation New Zealand, 2013

[Guide to Agricultural Meteorological Practices \(GAMP\) 2010 Edition \(WMO-No.134\) Updated in 2012](#), World Meteorological Organisation

[Guide to Climatological Practices WMO-No. 100 \(third edition\), Chapter 4 Characterizing Climate from Datasets](#), World Meteorological Organisation

[OGC® WaterML](#), Open Geospatial Consortium

INSPIRE Data Specification on Administrative Units – Technical Guidelines
<https://inspire.ec.europa.eu/id/document/tg/au>

International System of Units - https://en.wikipedia.org/wiki/International_System_of_Units

1.2 Related Documents

Related standards documents to be published in 2014 on the [Farm Data Standards website](#) include:

- Stock Reconciliation Data Standard
- Financial Data Standard.

1.3 Latest Revisions

The users of this standard should ensure that their copies of the above-mentioned documents are the latest revisions. The latest version of this Standard will always be published at

www.farmdatastandards.org.nz.



1.4 Version History

Date	Changes Made	Version #	Authors
24 August 2018	Update Referenced Documents section 1.1 Inclusion of Version History section 1.4 Update measurement units for area to include m ²	1.2	Don Wilson, Andrew Cooke, Sailee Patel
6 December 2016	Removal of Identification of Farm Entities Section 3.2 Addition of Spatial Attributes section 3.2 Changes to Irrigation and Effluent Application Observations Section A.11	1.1	Don Wilson, Jenna Thornborough, Andrew Cooke, Harry Tucker
12 November 2015	Published version	1.0	Don Wilson, Jenna Thornborough, Andrew Cooke, Harry Tucker

1.5 Review of Standards

Suggestions for improvement of this document will be welcomed. Submit your comments using the feedback mechanisms at www.farmdatastandards.org.nz.



2 Introduction

2.1 Overview

Pastoral farming is becoming a data rich activity. Most biophysical processes from soil nutrient management to animal performance have both paper based and more organised data bases recording status, productivity, and intentions. There are a significant number of tools covering livestock, nutrition, and financial management¹. Most of these require the user to re-enter data from other sources and they overlap in functionality. It is probable that if data had been more accessible their design would have better focussed on the service they undertook to provide. Farmers will benefit from a highly innovative technology sector that delivers applications that are simple to use and access, which source the information they need without impedance and deliver value.

This document is part of a work stream focusing on Data Standards for interchanging land information for agriculture. Work on this project commenced in early 2013, funded by DairyNZ and with contributions from FarmlQ Systems and Rezare Systems.

2.2 Outcome Statement

Broad adoption of a common vocabulary and data dictionary for exchange of farm information will result in farmers and other industry parties entering data only once and having that data readily accessible for populating multiple decision-making systems. As a result, industry and individual farm businesses will be better placed to undertake systems analysis to inform management practice. More accurate and structured interchange of farm data will also support industry breeding objectives and other information system targets.

2.3 Scope and Application

This standard addresses the following areas:

1. Irrigation equipment and water supply
2. Production, collection, storage, and treatment of effluent
3. Irrigation and effluent application
4. Characteristics of soil focusing on those related to soil moisture
5. Use of water by plants

¹ Wolfert, S and Allen, J. Farming for the future: Towards better information-based decision-making and communication. 2011. A Report for the Centre of Excellence in Farm Business Management pp 27.



6. Climatic observations relevant to irrigation and the spreading of effluent

2.4 Interpretation

For the purposes of this standard, the word SHALL refers to requirements that are essential for compliance with the standard, while the word SHOULD refers to practices that are advised or recommended. The term MAY is used to distinguish a permissible or optional practice.

The terms 'Normative' and 'Informative' have been used in this standard to define the application of the Appendix to which they apply. A 'Normative' Appendix is an integral part of a standard while an 'Informative' Appendix is only for information and guidance.

2.5 Definitions and Abbreviations

For the purposes of this standard, the following definitions shall apply:

Term	Definition
KPa	Kilopascal is a unit of pressure
kW	Kilowatt is a unit of power
m	metre
psi	Pound per square inch is a unit of pressure

3 Identification of Observations

This section focusses on the identification of the observations and attributes defined in this standard. The identifier of the observation may be a location (such as of a farm or irrigation scheme), a block or paddock within a farm, a transect or a geographic feature, a pond, a system, or piece of equipment.

3.1 Location Identification

A farm or irrigation scheme SHALL be defined as a location. The Animal Data Standard² discusses in section 3.1 the identification of locations or farms. The standard specifies several identifiers that are accepted for property identification in New Zealand and supports the interchange of data using these mechanisms. This Irrigation and Effluent Data Standard adopts the same location identification.

Several identifiers are accepted for property identification in New Zealand:

² Animal Data Standard (<http://www.farmdatastandards.org.nz/animal-data/>)



- Ministry of Primary Industry FarmsOnLine identifier;
- NAIT Location identifier (one or more FarmsOnLine identifiers registered with NAIT)
- AgriBase³ farm_id (based on a coordinate pair in lat/long, NZTM or NZMG coordinates)
- EPCglobal Serialised Global Location Number⁴ (as used by the NZ Business Number system); and
- Herd Testing Location identifier using the NZMS1 (1939 to 1975) map grid reference.

For historic reasons, it will be necessary to support the interchange of data utilising all of these mechanisms. This standard therefore requires that location identifiers shall be prefixed with a URN namespace identifier. Acceptable URN namespaces for use in New Zealand location identifiers shall be:

- urn:epc:id:sgln or
- a nzl: registered location namespace.

For specific interchanges agreed between two parties, the parties may agree to exchange identifiers within a single namespace only, and dispense with the namespace prefix.

3.2 Spatial Attributes

Features with location attributes can be described by a set of geographic information. **When transferring data about physical farm features, the following Geographic Coordinates, Geographic Shape, and Feature Identifier SHOULD be interchanged with that data. Geographic coordinates and shape are applicable for each location feature so will not be replicated throughout the document.**

Attributes	Data Types and Notes
Geographic Coordinates	Coordinates representing a location, using latitude and longitude, or a recognised coordinate system identified using the European Petroleum Survey Group (EPSG) parameter registry guide .
Geographic Shape	OGC Web Feature Service URL or string of embedded feature, using a recognised coordinate system identified using the European Petroleum Survey Group (EPSG) parameter registry guide .
Feature Identifier	String: Identifier used to identify the feature
Feature Name	String: Name used to identify the feature
validFrom	ISO Date: Date at which this spatial data object begins

³ AgriBase, AsureQuality (<https://secure.asurequality.com/capturing-information-technology-across-the-supply-chain/agribase-database-for-new-zealand-rural-properties.cfm>)

⁴ EPCglobal SGLN and GLN are defined at <http://www.gs1.org/gdsn/standards>



Attributes	Data Types and Notes
validThrough	ISO Date: Date at which this spatial data object ends

4 Irrigation and Effluent Observations and Attributes

For the purpose of this Standard, an observation is the act or instance of viewing or noting a fact or occurrence for some scientific or other special purpose. Thus, an observation can include a note or record of an activity carried out, an event that has occurred, or a measurement taken.

An attribute is a characteristic or inherent part of something. Some attributes will not change over time. For example, characteristics of irrigation equipment are attributes. The maximum flow rate of the equipment is an attribute whereas the flow rate is an observation – it is measured on a specific date and time.

4.1 Irrigation Equipment and Water Supply

This section of the standard is concerned with:

- The physical characteristics (attributes) and operational observations of the irrigation equipment
- Details of the irrigation water source and observations relating to use of water.

The identifier for these data may consist of the farm identifier and optionally an additional string naming the equipment or the water supply respectively and/or a spatial representation identifying its location. Examples of irrigation equipment include the irrigator, irrigation pump, transfer pump, vat, water tank, agitator. Alerts on the equipment are also identified, by the type of the alert.

Observations regarding continuous monitoring of Water Supply (for example, flow rates) SHALL be interchanged using the WaterML 2.0⁵ standard.

For the data dictionaries refer to Appendices A.1 Irrigation Equipment Attributes, A.2 Irrigation Equipment Observations, A.3 Irrigation Equipment Alert Observations, A.4 Water Supply Attributes and A.5 Water Supply Observations.

⁵ OGC® WaterML (<http://www.opengeospatial.org/standards/waterml>)



4.2 Production, collection, storage, and treatment of effluent

The production and collection of effluent data defines the source of the effluent, the associated volumes, the methods of removal and separation and the washing down of surfaces. These data are identified by the farm identifier and optionally an additional string naming the storage facility and/or a spatial representation identifying its location.

The storage and treatment of the effluent includes the parameters of the storage pond, the level of nutrients involved and the treatment employed.

For the data dictionaries refer to Appendices A.6 Effluent Production and Collection, A.7 Effluent Storage and Treatment Attributes, A.8 Effluent Storage and Treatment Attributes, A.9 Effluent Storage and Treatment Observations and A.10 Effluent Nutrient Observations.

4.3 Irrigation and effluent application

Observations of irrigation and effluent application will be for a period or for a specific date. These may identify the land where the substance is being applied and the rate at which it is applied.

The land areas affected may be identified by a farm identifier with optionally an additional string naming the block(s) or paddock(s) receiving the application. Alternatively, a spatial representation may define the land areas.

For the data dictionary refer to Appendix A.11 Irrigation and Effluent Application Observations.

4.4 Soil attributes and observations

Soil data fields in the standard are particularly concerned with characteristics affecting soil moisture. These observations will be for a specific date. Soil tests may be for a transect, block, paddock or geographic feature which may be identified by a farm identifier with optionally an additional string naming the area represented by the tests. Alternatively, a spatial representation may define the area.

The data fields in section A.12 are considered a proxy for formal descriptions of the soil that will be able to be interchanged using the Australia-New Zealand Standard for Soils – SoilML.

For the data dictionaries refer to Appendices A.12 Soil Moisture Attributes, A.13 Soil Moisture Observations and A.14 Soil Nutrient Observations.



4.5 Use of water by plants

This section of the standard concerns plants use of water. The subject of these observations may be a transect, block, paddock or geographic feature which may be identified by a farm identifier with optionally an additional string naming the area represented by the tests. Alternatively, a spatial representation may define the area. For the data dictionary refer to Appendix A.15 Plants Use of Water.

4.6 Climatic and Weather Observations

This section of the standard is for weather and climatic observations relevant to irrigation and the spreading of effluent. Climatic observations are defined for a period and are expressed in a generalised form to provide for different quantitative summary measures (total, mean, median, minimum, maximum). Weather observations are for the current day defined by the observation date. The subject of these observations the identified location.

For the data dictionary refer to Appendix A.16 Climatic and Weather observations.



Appendix A Irrigation and Effluent Data Dictionary (Normative)

A.1 Irrigation Equipment Attributes

This data dictionary SHALL be used in developing messages for interchange of data concerned with attributes of the irrigation equipment.

Attributes	Data Types	Notes
Equipment identifier	String:	Name or identifier of equipment
Equipment type	Enumeration: <i>see Appendix B.3</i>	Type of equipment or device
Change in head	Float: KPa	The effects of elevation and friction on the head, taken as the difference in pressure on the inlet vacuum gauge and the intake pressure.
Elevation change	Integer: m	The difference between the intake elevation and pump elevation.
Energy per unit volume	Float: kW hour/m ³	Amount of energy used to deliver a volume of water.
Friction loss	Float: KPa	Amount of pressure lost due to water movement and turbulence.
Full load motor efficiency	Float: %	Efficiency of the irrigation pump motor when run at full load
Headworks efficiency	Float: %	Pressure loss through intake structure, pump and headworks (excluding pump pressure and elevation differences)
Hydraulic efficiency	Float: %	Pressure lost between the delivery (mainline entry) and discharge points (machine entry, hydrant, or take-off in drip-micro systems), excluding variations in elevation.
Intake elevation	Integer: m	Surface level of the water supply.
Intake pipe internal diameter	Integer: mm	Internal diameter of the irrigator intake pipe;
Irrigation system type	Enumeration: <i>see Appendix B.2</i>	Enumeration: The irrigation system in use.
Mainline entry elevation	Integer: m	Elevation at the exit point of the headworks.
Mainline entry pressure	Float: KPa, bar, psi	Pressure at the exit of the headworks.
Mainline exit elevation	Integer: m	Elevation at the exit point of the mainline.
Mainline exit pressure	Float: KPa, bar, psi	Pressure at the exit of the mainline.



Attributes	Data Types	Notes
Mainline internal diameter	Integer: mm	Internal diameter of the irrigator mainline pipe.
Mainline length	Integer: m	Length of the mainline pipe from entry to exit.
Maximum flow rate	Float: litres/second (l/s), m ³ /hour	Maximum speed at which water can be pumped through the irrigator.
Maximum velocity	Float: m/s	The standard maximum velocity in the mainline pipe under standard operating conditions.
Minimum flow rate	Float: litres/second (l/s), m ³ /hour	Minimum speed at which water can be pumped through the irrigator.
Overall pump efficiency	Float: %	Energy efficiency of the irrigator pump. Also known as system pumping efficiency .
Pressure at irrigator	Float: bar, psi, KPa	Pressure at the sprinkler heads. Also known as operating pressure.
Pump inlet elevation	Integer: m	Relative to the water level at the intake.
Pumping rate	Integer: l/s or m ³ /hr)	Volume of water per unit time that a pump is designed to deliver at the design pressure.
Design travel speed	Float: m/hour	Speed which the irrigation unit travels at.
System capacity	Integer: l/s/ha or mm/d	Flow of water per unit of irrigated area on the basis of the system operating 24 hours per day.

A.2 Irrigation Equipment Observations

This data dictionary SHALL be used in developing messages for interchange of data concerned with observations of the irrigation equipment.

Attributes	Data Types	Notes
Equipment identifier	String:	Name or identifier of equipment
Equipment type	Enumeration: <i>see Appendix B.3</i>	Type of equipment or device
Equipment location	String:	A recognised coordinate system identified using the European Petroleum Survey Group (EPSG) ⁶ parameter registry code (e.g. EPSG::4326) or associated common name
Device identifier	String:	Identifier of device or field sender in equipment
Device type	Enumeration: <i>see Appendix B.9</i>	Type of device

⁶ [EPSG Geodetic Parameter Registry](#)



Attributes	Data Types	Notes
Flow rate	Float: litres/second (l/s), litres/minute, m ³ /hour	Speed at which effluent or water is being pumped through the irrigator. Also known as system flow rate .
Fluid type	Enumeration: water, effluent, chemical, fertilizer	Type of substance being sprayed.
Intake pipe velocity	Float: m/s	Velocity of the water in the intake pipe.
Mainline velocity	Float: m/s	Velocity of the water in the mainline pipe.
Pump inlet pressure	Float: KPa, bar, psi	Amount of pressure at the inlet of the irrigation pump.
Pressure operating	Float: KPa, bar, psi	
Calibration pressure	Float: KPa, bar, psi	Calibration level
Relative velocity	Float: m/s	The difference between the standard maximum velocity and mainline velocity.
Total flow rate	Float: litres/second (l/s)	Total irrigator flow rate.
Unit travel speed	Float: m/hour	Speed which the irrigation unit is travelling at.
Movement speed	Float: seconds/revolution	Speed meter reading
Watering time	ISO 8601 Duration: days, hours, minutes, seconds	Amount of time an irrigator is set to water for.
Sensor identifier	GUID:	Unique identifier of sensor
Sensor type	String:	
Equipment status	Boolean:	Flag identifying the current status of the equipment. True means equipment is running
Valve Status	Boolean:	Indicates whether valve is on or off
Battery voltage	Float: v	
Signal strength	Integer	Signal strength of received message
Temperature	Float: oC	Temperature in equipment
Water level	Float: m	Water level in equipment

A.3 Irrigation Equipment Alert Observations

This data dictionary SHALL be used in developing messages for interchange of data concerned with observations of alerts from the irrigation equipment.



Attributes	Data Types	Notes
Equipment identifier	String:	Name or identifier of equipment
Equipment type	String: <i>includes values in Appendix B.3</i>	Type of equipment or device
Alert type	Enumeration: <i>see Appendix B.4</i>	Type of alert issued by the equipment or device
Alert value	Boolean:	

A.4 Water Supply Attributes

This data dictionary SHALL be used in developing messages for interchange of data concerned with attributes of the water supply.

Attributes	Data Types	Notes
Drainage index	Float: m ³ /ha/year	Volume of water draining through the area irrigated.
Drawdown	Float: m	Difference between the static and pumping water level.
Flow rate	Float: m ³ /s	Flow rate of water from a pipe.
Maximum well flow rate	Float: l/s	Highest flow rate which a well can be pumped at.
Natural water storage volume	Float: m ³	Amount of water naturally held by a reservoir.
Pump type	Enumeration: Surface, submersible	
Intended pumping water level	Integer: m	Water level during pumping. Also known as dynamic water level .
Redistribution index	Float: m ³ /ha/year	Volume of water reaching the target area.
Typical water electrical conductivity	Float: decisiemens/metre (dS/m),	Salinity level of irrigation water reported as electrical conductivity.
Typical salinity	Float: mg/l, parts per million (ppm)	Concentration of salts in the irrigation water reported as total dissolved solids
Expected seasonal water use	Float: mm/season	Amount of water used for irrigation in a season;
Intended static water level	Integer: m	Water level relative to the ground level when the well is not being pumped. Also known as standing water level



Typical stream velocity	Float: m ³ /s	Velocity of the flow of water in a stream or channel. Also known as channel velocity .
Total storage volume	Float: m ³	Total volume of a reservoir or dam.
Typical water lost	Float: mm/season	Typical amount of water lost to drainage and runoff.
Water source	Enumeration: see <i>Appendix B.5</i>	
Typical water use efficiency	Float: mm tonne/DM	Amount of water used in irrigation per tonne of dry matter produced.

A.5 Water Supply Observations

This data dictionary SHALL be used in developing messages for interchange of data concerned with observations of the water supply.

Attributes	Data Types	Notes
Pumping water level	Integer: m	Water level during pumping. Also known as dynamic water level .
Redistribution index	Float: m ³ /ha/year	Volume of water reaching the target area.
Water electrical conductivity	Float: decisiemens/metre (dS/m),	Salinity level of irrigation water reported as electrical conductivity.
Salinity	Float: mg/l, parts per million (ppm)	Concentration of salts in the irrigation water reported as total dissolved solids
Seasonal water use	Float: mm/season	Amount of water used for irrigation in a season;
Static water level	Integer: m	Water level relative to the ground level when the well is not being pumped. Also known as standing water level
Stream velocity	Float: m ³ /s	Velocity of the flow of water in a stream or channel. Also known as channel velocity .
Water lost	Float: mm/season	Amount of water lost to drainage and runoff.
Water use efficiency	Float: mm tonne/DM	Amount of water used in irrigation per tonne of dry matter produced.



A.6 Effluent Production and Collection Attributes

This data dictionary SHALL be used in developing messages for interchange of data concerned with attributes of effluent production and collection.

Attributes	Data Types	Notes
Depth of wash water	Float: mm	Depth of the water applied during wash-down.
Effluent removal method	Enumeration: wash-down hoses, flood washing, scrapers	Method used to remove effluent from the area.
Effluent separation method	Enumeration: weeping wall, sludge bed, sump	Method used to separate solid and liquid effluent.
Source of effluent	Enumeration: <i>see Appendix B.6</i>	Location where effluent is collected.
Effluent fluid state	Enumeration: Liquid, slurry, solid	
Wash water velocity	Float: m/s	Velocity at which the wash water is delivered.
Yard fall	Float: %, m/m	Slope of the wash-down area.
Yard area	Integer: m ²	Area of the wash-down area

A.7 Effluent Production and Collection Observations

This data dictionary SHALL be used in developing messages for interchange of data concerned with observations of effluent production and collection.

Attributes	Data Types	Notes
Hours spent on collection areas	Integer: hours	Number of hours each day that animals spend on effluent collection areas.
Animal species	Enumeration: <i>see Animal Data Standard Appendix A.1 Animal Characteristics</i>	Species binomial name or common name
Number of animals	Integer:	Number of animals of species.
Effluent production rate	Float: m ³ /day, l/animal/day	Amount of effluent produced in a time period.
Total daily water use	Integer: litres/day (l/day), m ³ /day	Amount of water used to wash down surfaces which collect effluent



Attributes	Data Types	Notes
Total effluent solids	Integer: kg/animal/day	Total amount of solid effluent produced by an animal over a time period.
Total effluent volume produced	Float: l/animal/day	Volume of effluent produced by an animal over a time period.
Diluted effluent volume	Float: l/animal/day	Volume of effluent which has been diluted with wash-water and other materials.
Undiluted effluent volume	Float: l/animal/day	Volume of undiluted effluent produced.
Wash-water volume	Float: l/animal/day	Volume of wash-water used per animal per day.

A.8 Effluent Storage and Treatment Attributes

This data dictionary SHALL be used in developing messages for interchange of data concerned with attributes of effluent storage and treatment.

Attribute	Data Types	Notes
Batter angle	Float: degrees, radians	Angle between the top edge of the pond and the side of the pond.
Typical BOD5	Float: kg/animal/day	The biochemical oxygen demand of effluent over a 5-day period.
Primary nitrogen form	Enumeration: organic, nitrate, ammonia	Nature of the effluent.
Effective liquid storage volume	Float: days, m ³	Storage capacity for liquid effluent, represented as volume or a timeframe.
Effective solids storage volume	Float: m ³	Storage capacity for solid effluent, represented as volume or a timeframe days.
Effluent storage type	Enumeration: sump, settling pond	Type of storage used for effluent.
Loads per hectare	Integer: loads per hectare	Number of loads of effluent required to cover a hectare of land.
Percentage unpumpable	Float: %	Percentage of the total volume which makes up the unpumpable area.
Pond capacity	Float: m ³	Volume of the effluent treatment pond.



Attribute	Data Types	Notes
Pond depth	Integer: m	Depth of the effluent treatment pond.
Pond floor size	Float: m ²	The area of the floor of the effluent treatment pond.
Pond surface area per animal	Float: m ² /animal	Area of pond per animal producing the effluent.
Storage volume	Float: litres/animal/day	Volume of effluent storage facilities
Top area	Float: m ²	Area of the top of the effluent pond.
Total loads	Integer:	Number of loads of effluent required to cover a specified area
Total working volume	Float: m ³	Total working volume of the effluent pond.
Treatment method	Enumeration: land application, treatment pond, constructed wetlands, barrier ditches	
Unpumpable depth	Float: m	Depth of the effluent pond which cannot be pumped due to build-up of solids.
Volume of unpumpable area	Float: m ³	Volume of the area of solids at the bottom of the pond

A.9 Effluent Storage and Treatment Observations

This data dictionary SHALL be used in developing messages for interchange of data concerned with observations of effluent storage and treatment.

Attributes	Data Types	Notes
BOD5	Float: kg/animal/day	The biochemical oxygen demand of effluent over a 5-day period.
Limiting nutrient	Enumeration: nitrogen (N), phosphorus (P) or potassium (K)	The nutrient present in the highest quantity in effluent which will limit how much can be applied.
Limiting nutrient concentration	Float: mg/l, g/m ³	Concentration of the limiting nutrient in the effluent.
Freeboard height	Integer: m	Distance between the top of the pond and the waterline.
Percentage Freeboard	Float: %	Percentage of the total volume which makes up the freeboard.
Pond level %	Integer: %	Pond/tank level percentage



Attributes	Data Types	Notes
Flag pond high level	Boolean:	True = pond/ tank level is higher than high threshold
Flag pond low level	Boolean:	True = pond/ tank level is lower than low threshold
Volume of Freeboard	Float: m ³	Volume of the area between the top of the pond and the waterline.
pH	Integer:	A measure of the acidity or basicity of effluent
Solid content of diluted effluent	Float: % by weight	Percentage of solids in diluted effluent.
Solid content of undiluted effluent	Float: % by weight	Percentage of solids in undiluted effluent.
Storage period	Integer: days, months	Period of time for which effluent has been stored between emptying events.

A.10 Effluent Nutrient Observations

This data dictionary SHALL be used in developing messages for interchange of data concerned with observations of effluent nutrients.

Attributes	Data Types	Notes
Nutrient	Enumeration: Nitrogen (N), phosphorus (P) or potassium (K)	
Nutrient captured	Float: kg/cow/day of N, P or K	Amount of nutrient captured per animal per day.
Effluent Nutrient concentration	Float: mg/l of N, P or K	Concentration of a nutrient in effluent.
Nutrient produced	Float: kg/animal/day of N, P or K	Amount of nutrient produced per animal per day.

A.11 Irrigation and Effluent Application Observations

This data dictionary SHALL be used in developing messages for interchange of data concerned with observations for irrigation and effluent application.

Attributes	Data Types	Notes
Application area	Float	Area of land which the substance is being applied to. Also known as area or surface area . Area in m ² (SI unit) or hectares (ha, accepted non-SI unit). Implementations must clearly specify which unit is used, and



Attributes	Data Types	Notes
		ensure consistent use. For spatial data interchange m ² should be used. ⁷
Application depth	Float: mm	Depth of a substance applied to an area.
Application rate	Float: mm/hour	Rate at which the substance is applied. Also known as application intensity .
Distribution uniformity	Float: %	Measure of how evenly a substance has been applied to an area.
Return interval	Integer: days, hours	Interval between application events.
Maximum effective loading	Float: kg/ha/year	Maximum amount of the limiting nutrient which can be applied. Also known as maximum loading criteria.
Effluent Application Months	String:	List of months in which effluent has been applied to areas

A.12 Soil Moisture Attributes

This data dictionary SHALL be used in developing messages for interchange of data concerned with attributes for soil moisture data relating to irrigation and effluent. See the [Farm Features and Attributes Data Standard](#) for a definition of soil body and references to the INSPIRE and ANZSoilML standards.

Attributes	Data Types	Notes
Profile drainage class	Enumeration: Well, Moderately well, Imperfect, Poor, Very poor	
Hydrophobic condition	Enumeration: Rain always soaks in, Generally soaks in occasionally runs easily off slopes, Mostly runs off unless there is a long period of gentle rain	
Susceptibility to pugging	Enumeration: Rare, Occasional, Winter, Winter or rain	Susceptibility to pugging or treading damage.
Drainage method	Enumeration: None, Mole/tile system, Other	Artificial drainage system

⁷ See section 6.1.3 at <https://inspire.ec.europa.eu/id/document/tg/au>



Attributes	Data Types	Notes
Percentage of block drained	Integer: %	
Field capacity	Float: mm, millimetres per meter (mm/m)	Amount of water in the soil once drainage by gravity has stopped.
Infiltration rate	Float: mm/hour	Rate at which soil can absorb moisture.
Permanent wilting point	Float: mm, millimetres of water per meter of soil (mm/m)	Soil moisture content at which a plant will die from drought stress; also known as stress point .
Available water	Float: mm, millimetres of water per meter of soil (mm/m)	Amount of water plants can extract from the soil, the difference in moisture content between field capacity and permanent wilting point.
Readily available water	Float: mm, millimetres of water per meter of soil (mm/m)	Amount of water plants can extract from the soil before growth is limited due to the difficulty of extracting water; the difference in moisture content between field capacity and the stress point. Also known as plant readily available water .
Refill point	Float: mm, millimetres of water per meter of soil (mm/m)	Point at which the soil water level needs to be topped up to avoid dropping to the permanent wilting point. Also known as trigger point .
Saturation point	Float: mm, millimetres of water per meter of soil (mm/m)	Point at which the soil can no longer hold water.
Soil texture	Enumeration: <i>see Appendix B.8</i>	
Stone content of upper soil layer	Float: %	Percentage of the upper soil layer which is stone.
Water holding capacity	Float: mm, millimetres of water per meter of soil (mm/m)	Amount of water the soil can hold.

A.13 Soil Moisture Observations

This data dictionary SHALL be used in developing messages for interchange of data concerned with observations for soil moisture data relating to irrigation and effluent.

Attributes	Data Types	Notes
Critical deficit	Float: mm, millimetres of water per meter of soil (mm/m)	Difference between the current soil moisture content and the field capacity. Also known as soil moisture deficit .
Dry weight	Float: mg	Dry weight of soil.



Attributes	Data Types	Notes
Soil moisture test method	Enumeration: type of test used to test soil moisture; see <i>Appendix B.7</i>	
Soil temperature	Float: °C	Observed temperature of the soil.
Soil water content	Float: mm, millimetres of water per meter of soil (mm/m)	Amount of water currently in the soil.
Volumetric soil moisture content	Float: V%	Percentage of the soil which is made up of water.
Wet weight	Float: mg	Wet weight of soil.

A.14 Soil Nutrient Observations

This data dictionary SHALL be used in developing messages for interchange of data concerned with observations of soil nutrients.

Attributes	Data Types	Notes
Nutrient	Enumeration: Nitrogen (N), phosphorus (P) or potassium (K), Sulphur (S)	
Nutrient load	Float: kg of nutrient/ha	Amount of a nutrient present in the soil.
Nutrient loss	Float: kg of nutrient/ha	Amount of a nutrient which has been lost.

A.15 Plants Use of Water

This data dictionary SHALL be used in developing messages for interchange of data concerned with plants use of water relating to irrigation and effluent application.

Attributes	Data Types	Notes
Average daily crop water use	Float: l/day	Average amount of water consumed by crops
Crop factor	Float:	The ratio of the water requirements of a particular crop to that of a reference crop (usually average grass pasture).
Estimated crop water use	Float: mm/day, mm/week	Amount of water used by a crop over a time period.
Root depth	Float: mm, m	depth of soil profile that has enough rooting density for extraction of available water.ciency
Transpiration	Float: mm	Amount of water which is lost to transpiration through plant leaves.



A.16 Climatic and Weather observations

This data dictionary SHALL be used in developing messages for interchange of data concerned with climatic observations affecting irrigation and the spreading of effluent.

Attributes	Data Types	Notes
Duration	ISO 8601 duration	The period of the observation
Metric	Enumeration: variable being measured; <i>See Appendix B.10</i>	
Aggregation	Enumeration: total, mean, median, maximum, minimum	
Value	<i>See Appendix B.10 for type and units</i>	

This data dictionary SHALL be used in developing messages for interchange of data concerned with weather observations affecting irrigation and the spreading of effluent.

Attributes	Data Types	Notes
Barometric pressure	Float: KPa, bar, psi	Air pressure of the Earth's atmosphere. Also known as atmospheric pressure .
Daily rainfall	Integer: mm	Amount of rainfall for the observation day.
Potential Evapotranspiration	Float: mm/day	Rate of water loss from a combined surface of vegetation and soil. It includes evaporation of water from the soil surface, from free water on plants and transpiration by plants. Penman method.
Expected rainfall	Integer: mm	Amount of rain expected.
Frost occurrence	Boolean:	If minimum air temperature less than 0.0°C
Maximum air temperature	Integer: °C	Daily maximum air temperature.
Minimum air temperature	Integer: °C	Daily minimum air temperature.
Probability of rainfall > 10mm	Float: %	Probability that there will be more than 10mm of rain today.
Relative humidity	Float: %	The measure of water vapour content in the air at a given temperature.
Solar radiation	Float: mega joules/m ² /day (MJ/m ² /day)	Amount of solar radiation over a period of time.
Temperature	Integer: °C	Current ambient air temperature.
Wind speed	Float: km/hour, m/s	

Appendix B Lists of Enumerated Values

B.1 Geometry Type

Geometry Type may be used in spatial representations for geographic identification for a number of observation types.

Valid values for **Geometry Type** are:

Point
LineString
Polygon
MultiPoint
MultiLineString
MultiPolygon

B.2 Irrigation system type

Irrigation System Type is used in the **Irrigation Equipment** observation.

Valid values for **Irrigation System Type** are:

border-strip
centre-pivot
drip (point source)
drip line
fixed boom (low pressure)
fixed boom (medium pressure)
hand shift
linear move
micro sprinkler
rotary boom



side roll
solid set sprinklers
travelling gun

B.3 Equipment Type

Equipment Type is used in the **Irrigation Equipment Attributes**, **Irrigation Equipment Observations** and **Irrigation Equipment Alert** observation.

Values for **Equipment Type** include:

irrigation pump
transfer pump
greenwash pump
agitator pump
vat
water tank
water trough
pond
data logger
transmitter

B.4 Irrigation Equipment Alert Type

Irrigation Equipment Alert Type is used in the **Irrigation Equipment Alert** observation.

Valid values for **Irrigation Equipment Alert Type** are:

low pressure
high pressure
no pressure



no movement
movement too slow
movement too fast
end of travel
high temperature
high level
low level
no signal

B.5 Water Source

Water Source is used in the **Water Supply** observation. See the [Farm Features and Attributes Data Standard](#) Section 3.1 for definitions of Watercourses and Waterways.

Valid values for **Water Source** are:

confined aquifer (groundwater)
water table aquifer (groundwater)
run-of-river surface water
stored surface water

B.6 Source of Effluent

Source of Effluent is used in the **Effluent Production & Collection** observation.

Valid values for **Source of Effluent** are:

dairy	stand-off pad
feed pad	winter barn
loafing pad	wintering pad



B.7 Soil Moisture Test Method

Soil Moisture Test Method is used in the **Soil Moisture Characteristics** observation.

Valid values for **Soil Moisture Test Method** are:

capacitance probe
electric resistance
gravimetric
neutron thermalisation
soil suction
soil thermocouple psychrometers
thermal dissipation methods
time domain reflectometry
time domain transmission

B.8 Soil Texture

Soil Texture is used in the **Soil Moisture Characteristics** observation.

Valid values for **Soil Texture** are:

unknown	clay
clay loam	loam
loamy peat	loamy sand
peat	peaty loam
peaty sand	peaty sandy loam
peaty silt loam	sand
sandy clay sandy clay loam	sandy loam
sandy silt	silt
silt loam	silty clay



silty clay loam	silty peat
silty sand	

B.9 Device Type

Equipment Type is used in the **Irrigation Equipment Observations**

Valid values for **Device Type** are:

Devices:

pump controller
travelling irrigator monitor
k-line irrigator monitor
centre pivot irrigator monitor

Field Senders:

bore monitor
flow monitor
pond monitor
vat monitor
soil monitor
sump monitor
magflow monitor
pimstop monitor
tank monitor

B.10 Weather Metric

Metric is used in the **Weather** observation to identify the variable concerned.

Valid values for **Metric and associated units** are:

Metric	Type	Units
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Rainfall	Integer	mm
Temperature	Float	°C
Maximum Temperature	Float	°C
Minimum Temperature	Float	°C
Soil Temperature	Float	°C
Wind speed	Float	Km/hour, m/s
Wind gust	Float	Km/hour, m/s
Wet days	Integer	Days
Relative humidity	Float	%
Barometric pressure	Float	KPa, bar, psi
Potential evapotranspiration	Float	mm/day
Solar radiation	Float	MJ/m ² /day
Frost occurrence	Boolean	
Day length	Float	hour



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