

# Data Management Guidelines – Water Use





# Contents

Glossary	2
<b>1. INTRODUCTION</b>	<b>3</b>
<b>2. TELEMETRY DATA</b>	<b>4</b>
2.1 Uploading files via File Transfer Protocol (FTP) server	4
2.2 Upload frequency and timeframe	4
2.3 Data format	4
2.4 Open channel data	7
2.5 Missing records/data gaps	8
2.5.1 Notification of data gap	8
2.5.2 Failure of equipment	8
2.6 Data cleansing, synthesising and editing records	9
2.6.1 Data cleansing	9
2.6.2 Synthesising and editing records	10
<b>3. ANNUAL DATA</b>	<b>11</b>
3.1 Consent holders using third party service providers	11
3.1.1 Uploading files via FTP server	11
3.1.2 Upload frequency and timeframe	11
3.1.3 Data format	11
3.1.4 Missing records/data gaps	11
3.1.5 Data cleansing, synthesising and editing records	11
3.1.6 Missing records	11
3.2 Consent holders who submit water use data annually	11
<b>ANNEX A – BIBLIOGRAPHY</b>	<b>12</b>
<b>ANNEX B – REQUIREMENTS FOR CONSTRUCTING STAGE-DISCHARGE AND VELOCITY-INDEX RATINGS</b>	<b>13</b>

## GLOSSARY

NAME	DESCRIPTION
NEMS	National Environmental Monitoring Standards
Noise (noisy data):	The excessive variability in a parameter's measurement results that alters or obscures the signal representative of the parameter
Third party service provider	A provider that provides a level of service within the flow measuring industry such as data hosts, flow measurement verifiers, installers, irrigation designers etc.

# 1. Introduction

The purpose of this document is to standardise and describe the methodologies for collecting, processing, archiving and conducting quality assurance of real-time data from water measuring devices submitted to Environment Canterbury in accordance with the Resource Management (Measurement and Reporting of Water Takes) Regulations 2010 and conditions of water permits in the Canterbury region (Water Use Data). It contains information on the whole process of data management, from handling data from the field, in its original form, to data processing and editing, to final archiving.

It defines Environment Canterbury's requirements for:

- Uploading Water Use Data files via Environment Canterbury's FTP server
- Upload frequency and timeframes
- Data format
- Open channel data
- Missing records/data gaps
- Data processing, synthesising and editing records.

This guideline is in two main sections: the first section details Environment Canterbury's requirements for Water Use Data that is submitted daily, and the second section outlines the requirements for annual data submitted for the 1 July to 30 June period each year (the Water Year).

Environment Canterbury will align its data management guidelines with the National Environmental Monitoring Standards (NEMS) for *"Measurement, Processing and Archiving of Water Meter Data for Hydrological Purposes"* when these standards become available.

## 2. Telemetry data

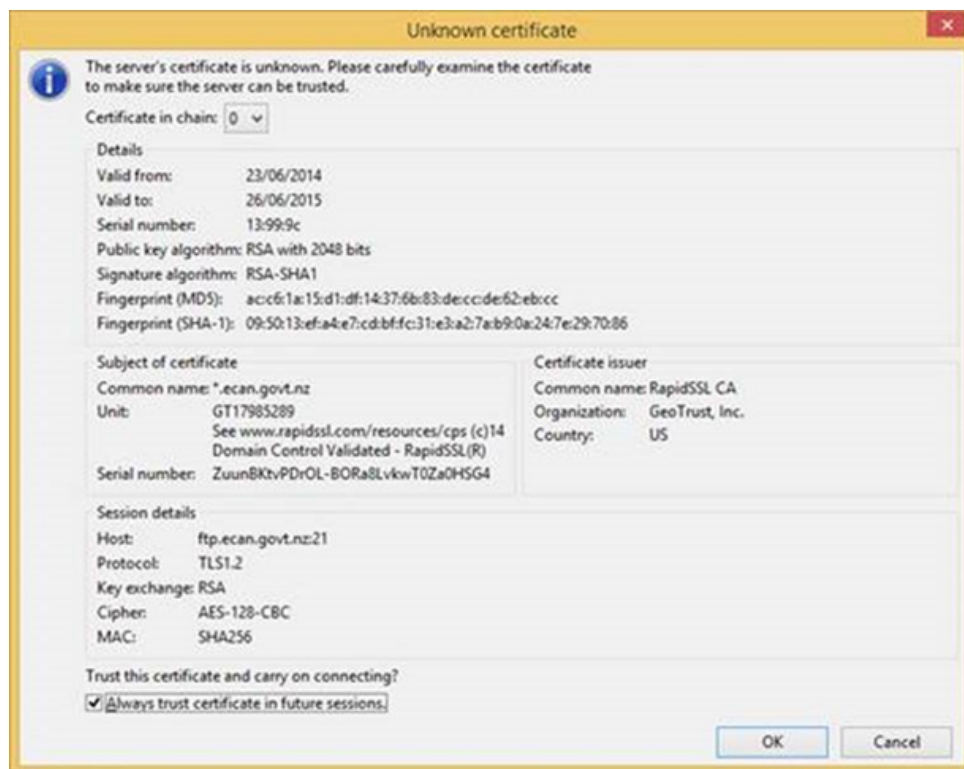
You may be providing Water Use Data daily to Environment Canterbury as telemetry data in a number of situations. In some cases, consent conditions on a water permit require daily data, and in other situations the data is volunteered daily. This section outlines the requirements for telemetry data.

### 2.1 Uploading files via File Transfer Protocol (FTP) server

You must upload Water Use Data files using Environment Canterbury's FTP server. Environment Canterbury will not accept emailed or posted data files.

To access the FTP server, go to: <ftpes://ftp.ecan.govt.nz> This is an FTP server using SSL in an explicit mode.

When you first connect to the FTP server you may receive a prompt with an unknown certificate error as follows.



To resolve this issue:

- Tick the checkbox 'Always trust certificate in future sessions'. You will be using FileZilla version 3.9.0.3
- Request a Username and Password from [water.metering@ecan.govt.nz](mailto:water.metering@ecan.govt.nz)
- Insert your username and password to access the FTP server.

### 2.2 Upload frequency and timeframe

You must upload the Water Use Data daily by 6am throughout the Water Year unless requested otherwise.

If you get an FTP upload error the third party service provider must contact Environment Canterbury via the water metering inbox ([water.metering@ecan.govt.nz](mailto:water.metering@ecan.govt.nz)) immediately to identify the source of the error. To ensure a quick response, write 'FTP Upload Error' as the subject heading. Please resubmit the Water Use Data that had an FTP upload error on the following day.

### 2.3 Data format

#### REQUIREMENTS:

#### 1. Name the file using the following format:

[DATE]\_[CONSENT]\_[WAP].xml

[DATE] is in the YYYYMMDD format.

[CONSENT] is the consent or CRC number. The consent number in the name of the file must be the 'Issued – Active' consent for the time period of Water Use Data in the file.

[WAP] is the water abstraction point.

Example: 20170315\_CRC000000-1\_ZZ-0000

The consent number in the name of the file has to be the 'Issued – Active' consent for the time period of water use data in the file.

*Note: Environment Canterbury will accept cleansed or updated data submitted after your initial submission but you must tag such data appropriately in the metadata you submit.*

## **2. You must submit data using the WML2 format.**

WML2 is an Open Geospatial Consortium (OGC) standard format adopted globally to transfer time series data between organisations. It is a derivative of XML. For more information on this format, go to: <http://www.waterml2.org/>

*Exception: Environment Canterbury will accept Hilltop XML as a valid data transfer format until 1 October 2017 to allow service providers time to transition to WML2.*

## **3. The WML2 format must include the required indicators from the following list.**

### **REQUIRED INDICATORS:**

- Service provider e.g. Water Check
- Consent number e.g. CRC000000
- WAP number e.g. Z00/1000
- Take type e.g. Take Surface Water
- Use type e.g. Irrigation
- Allocation block e.g. A
- Data quality e.g. RAW
- Measurement type i.e. abstraction volume
- Unit of measurement i.e. m<sup>3</sup>

*Note: You must convert flow or water meter reading to volume before you transfer data.*

Quality tag e.g. original record or working file

*The consent number in the required indicators must be the 'Issued – Active' consent for the time period of the Water Use Data in the file and must correspond to the consent number in the name of the file.*

### **OPTIONAL INDICATORS:**

- Meter serial number e.g. 1Z1234567890123
- Datalogger serial number e.g. 011A

### **WML2 EXAMPLE:**

#### **Local Dictionary**

#### **DictionaryEntry**

WML tag allows a flexible definition to carry multiple descriptor data.

<http://www.opengeospatial.org/standards/gml>

In the WML2 example below the **Datalogger** is the **Dictionary** tag.

The WML2 format uses Child **Definition** tags such as **SerialNumber**, **ServiceProvider**, **ConsentNumber** and **Water Abstraction Point** (WAP), previously called Well or SWAP.



You could use other dictionary tags to carry other site-specific data if required.

```
<wml2:localDictionary>
  <gml:Dictionary gml:id="DataLoggers">
    <gml:identifier>DataLogger</gml:identifier>
    <gml:dictionaryEntry>
      <gml:Definition gml:id="SerialNumber">
        <gml:identifier>SerialNumber</gml:identifier>
        <gml:name>op0000</gml:name>
      </gml:Definition>
    </gml:dictionaryEntry>
    <gml:dictionaryEntry>
      <gml:Definition gml:id="ServiceProvider">
        <gml:identifier>ServiceProvider</gml:identifier>
        <gml:name>ProvidersName</gml:name>
      </gml:Definition>
    </gml:dictionaryEntry>
    <gml:dictionaryEntry>
      <gml:Definition gml:id="ConsentNumber">
        <gml:identifier>ConsentNumber</gml:identifier>
        <gml:name>CRC000000.1</gml:name>
      </gml:Definition>
    </gml:dictionaryEntry>
    <gml:dictionaryEntry>
      <gml:Definition gml:id="WaterTakePoint">
        <gml:identifier>WaterAbstractionPoint</gml:identifier>
        <gml:name>Z00/0000</gml:name>
      </gml:Definition>
    </gml:dictionaryEntry>
  </gml:Dictionary>
</wml2:localDictionary>
```

## SITE DESCRIPTION

### featureOfInterest

This is defined in the Observations & Measurements standard;

<http://www.opengeospatial.org/standards/om>

### observedProperty

This is the type of site (in most cases it will be a Water Meter).

### ObservationProcess

The Process type is the type of observation. In most cases it will be a sensor but in some cases it could be a manual method. Options are in the url in the attached file for this tag.

### Example:

```
<om:featureOfInterest xlink:title="CRC000000-1_Take-Groundwater_Z00-0000" />
<om:observedProperty xlink:title="Water Meter" />
<om:procedure>
  <wml2:ObservationProcess>
    <wml2:processType xlink:href="http://www.opengis.net/def/waterml/2.0/processType/Sensor"
      xlink:title="Sensor" />
  </wml2:ObservationProcess>
</om:procedure>
```

## DATA DESCRIPTION

### interpolationType

The interpolation type of the time series point describes the nature of the value to the time with which it is associated. Options are in the url in the attached file for this tag.

### uom

This defines the default unit of measure across the series. The uom code is specified using the UCUM code.



## Quality

This defines the quality of data. For example, unchecked means original record. Options are in the url in the attached file for this tag.

### Example:

```
<wml2:DefaultTVPMeasurementMetadata>
  <wml2:interpolationType xlink:title="Preceding total" href="http://www.opengis.net/def/waterml/2.0/interpolationType/TotalPrec" />
  <wml2:uom uom="m3" />
  <wml2:quality xlink:href="http://www.opengis.net/WaterML2.0/def/quality/unchecked" xlink:title="originalrecord" />
</wml2:DefaultTVPMeasurementMetadata>
```

## Time Series

These tags contain the time series Date/Time and Value in the format shown. You can also use these tags for comments relating to events like missing records or data gaps as shown below.

### Abstraction Volume Example:

```
<wml2:point>
  <wml2:MeasurementTVP>
    <wml2:time>2017-01-27T01:15:00</wml2:time>
    <wml2:value>0</wml2:value>
  </wml2:MeasurementTVP>
</wml2:point>
<wml2:point>
  <wml2:MeasurementTVP>
    <wml2:time>2017-01-27T01:30:00</wml2:time>
    <wml2:value>0</wml2:value>
  </wml2:MeasurementTVP>
</wml2:point>
<wml2:point>
  <wml2:MeasurementTVP>
    <wml2:time>2017-01-27T01:45:00</wml2:time>
    <wml2:value>0</wml2:value>
  </wml2:MeasurementTVP>
</wml2:point>
<wml2:point>
  <wml2:MeasurementTVP>
    <wml2:time>2017-01-27T02:00:00</wml2:time>
    <wml2:value>0</wml2:value>
  </wml2:MeasurementTVP>
</wml2:point>
```

## 2.4 Open channel data

You must submit Water Use Data to Environment Canterbury daily from telemetered sites.

You must submit the data in the format as described in Section 2.3.

The third party service provider must keep all original records for a minimum of five years because the original records may be required at a later date, if the archive data:

- Is found to be in error
- Becomes corrupted
- Is lost.

You must document the methodology used to process and preserve data and make the documentation available on request.

After completing a site gauging, attach the stage-discharge or velocity index ratings, and the record of gaugings to the site folder when you are transferring data.

Please refer to Annex B for requirements on construction of stage-discharge and velocity-index ratings.

*Note: If the stage/discharge ratings change the original record, tag as described in **Section 2.3 under Required Indicators**.*

## 2.5 Missing records/data gaps

Missing records or data gaps often occur due a failure of equipment or power and system maintenance interruptions.

### 2.5.1 NOTIFICATION OF DATA GAP

From the first day of a missing record/data gap the third party provider must notify Environment Canterbury's data steward within seven working days at [HilltopServer@ecan.govt.nz](mailto:HilltopServer@ecan.govt.nz), providing information on the site, situation, proposed solution and timeframe.

If there is a missing record or a data gap this problem must be corrected as soon as practicable. If a third party service provider has been engaged, all parties (consent holder, third party service provider and Environment Canterbury) are involved in three-way communication to agree on how to correct the problem.

If Environment Canterbury is not notified or the problem or error is not resolved, then the consent holder will incur associated compliance monitoring and enforcement costs if Environment Canterbury is required to take actions to address the missing record or data gap.

The following paragraphs explain how the third party service provider and Environment Canterbury will address each type of cause of a missing record or data gap.

### 2.5.2 FAILURE OF EQUIPMENT

*The type of fault will establish who is responsible. The following scenarios demonstrate how responsibility (who contacts who) will be determined under different types of equipment failure.*

#### **Data logger or pulse output failure**

When a data logger or pulse output fails during transmission to the third party service provider, then you must provide daily manual flow meter readings to measure the abstraction. Upload the missing records as soon as data transmission issue is resolved and/or a manual download has occurred from the equipment.

If the data logger or pulse output fails, contact Environment Canterbury at [HilltopServer@ecan.govt.nz](mailto:HilltopServer@ecan.govt.nz). In the email subject heading enter 'Consent #, WAP #, Device Failure' (including consent and WAP numbers).

#### **Water measurement device failure**

If the water measurement device fails, contact Environment Canterbury immediately at [HilltopServer@ecan.govt.nz](mailto:HilltopServer@ecan.govt.nz) before further abstraction use. In the email subject heading enter 'Consent #, WAP #, Device Failure' (including consent and WAP numbers).

If further abstraction occurs, then as a minimum during the water measurement device failure, the consent holder must manually keep a record of water measurement readings and/or pump operation hours (at consented maximum rate) until the equipment is fully functional. The consent holder must forward the manual records to the third party service provider who will append it to the time series. Missing records still require an explanation to Environment Canterbury and a timeframe for resolution via [HilltopServer@ecan.govt.nz](mailto:HilltopServer@ecan.govt.nz). In the email subject header also enter 'Consent #, WAP #, Device Failure Resolution'.

#### **Power and system maintenance interruptions**

It is appreciated that systems may be offline in the off-season because of power interruptions or system maintenance. These events are acceptable in the record when defined and documented and the recording devices are operational when abstraction begins. You must still send an explanation of missing records to Environment Canterbury and provide a timeframe for resolution at [HilltopServer@ecan.govt.nz](mailto:HilltopServer@ecan.govt.nz). In the email subject heading, enter 'Consent #, WAP #, Power Off' (including consent and WAP numbers).

You must document missing records and data gaps and make the documentation available on request.

Check for faults in the equipment regularly to ensure faults are identified and corrected as soon as possible to avoid gaps in the data.

## 2.6 Data cleansing, synthesising and editing records

### 2.6.1 DATA CLEANSING

The purpose of data cleansing is to detect and correct any occurrences of noisy data (spikes, data gaps and negative values) in accordance with Environment Canterbury's requirements to cleanse, synthesise and edit the original record.

From the first occurrence of noisy data the third party provider must notify Environment Canterbury's data steward within seven working days at [HilltopServer@ecan.govt.nz](mailto:HilltopServer@ecan.govt.nz) providing information on the issue, cause and the timeframe for resolution. In the email subject heading enter 'Consent #, WAP #, Invalid Data' (including consent and WAP numbers).

If Environment Canterbury is not notified or the problem or error is not resolved, then the consent holder will incur associated compliance monitoring and enforcement costs if Environment Canterbury is required to take actions to address noisy data.

When the cause of noisy data has been resolved the third party service provider will correct the data in accordance with section 2.6 and submit it to Environment Canterbury with the appropriate quality tag. The third party service provider must file the explanation and resolution details in the site metadata.

#### **Spike removal**

Spikes are individual (usually) values that are implausibly high or low compared with the values on either side. Typically they will be values that signify the sensor's full range default or zero, but sometimes they are not so definitive. Depending on the parameter and your knowledge of the recording system, it can be valid to simply delete these values and interpolate from the values on either side.

#### **Possible enhancement**

Removing spikes may enhance or degrade data:

- It can make the data more sensible and usable by eliminating values that would otherwise skew the results. Such errors may have been introduced by errors in the recording system or by interferences in the environment; e.g., drifting debris catching on a sensor.
- If the assumption that values are not 'real' is incorrect, then you risk removing valid values and discarding significant data.

#### **Effect on quality code**

If you know your assumptions are correct - that is, the spikes are spurious data - then the data set will be improved, and you do not need to change the quality code. However if you have any doubts about these assumptions, then you should downgrade the quality code accordingly and file comments providing this information.

#### **Guidance for use**

Cleanse data with caution and with full awareness that you may introduce potential errors if the relevant assumptions are incorrect.

You must document the methodology used to cleanse data and make the documentation available on request.

## 2.6.2 SYNTHESISING AND EDITING RECORDS

If the third party service provider or consent holder edits data in any way that combines, corrects, modifies or interpolates water use data in the working folder, they must comply with the following methods.

### Percentage of record required

Although your goal should be to have no missing records, a managed amount of lost data is acceptable. However, if you have data loss in excess of 5% over the Water Year should result in a process to determine and correct the root cause of the failure to ensure that the problem is not ongoing.

### Flow and time corrections

You must store as the recorded data set with no correction to the water measurement device data. The only acceptable exception will be where you must make a correction because you used an incorrect multiplier.

You must document any changes to the original record and archive them accordingly.

### Synthetic and interpolated data

#### Application

You can only apply synthetic data and interpolation to the Water Use Data record under the following conditions:

Where a gap occurs, the data can be filled with:

- Manual water meter readings, either daily or start/finish readings within the day
- Zero flow when no abstraction has occurred, confirmed by meter readings
- A derived volume from other meters in the same distribution where the total abstraction and individual off-takes are known.

You must file a comment (in the site metadata) that explains the reason for the missing record and comprehensively justifies the use of synthetic data or interpolation.

When relevant, you must also file a comment containing the details of the relationship between sites.

### On-site trained personnel

Where trained personnel were on-site for the whole period, e.g. for verification, maintenance and inspections, and these personnel recorded manual observations, you may fill the gap with these values and interpolate accordingly.

*Note: For the to the NEMS guidelines on the 'Measurement, Processing and Archiving of Open Channel Flow Data, Section 6 – Data Processing and Preservation' go to: <https://www.lawa.org.nz/media/16578/nems-open-channel-flow-measurement-2013-o6.pdf>*

## 3. Annual data

For consent holders that use a third party service provider, the requirements for annual data are the same as they are for daily data. The only difference is that annual data is submitted to Environment Canterbury once a year, rather than daily, via the FTP server.

Some consent holders submitting annual data do not use third party service providers. The requirements for providing annual data relating to these consents are also set out below.

### 3.1 Consent holders using third party service providers

#### 3.1.1 UPLOADING FILES VIA FTP SERVER

Upload data following a similar process to daily data. You will have a separate file for seasonal data transfer.

Please refer to 2.1.

#### 3.1.2 UPLOAD FREQUENCY AND TIMEFRAME

On 31 July each year Environment Canterbury must receive data that encompasses a complete year's worth of data, i.e. from 1 July – 30 June. This is also a requirement of the Resource Management (Measurement and Reporting of Water Takes) Regulations 2010.

For the Resource Management (Measurement and Reporting of Water Takes) Regulations 2010, go to:

<http://www.mfe.govt.nz/fresh-water/regulations-measurement-and-reporting-water-takes>.

#### 3.1.3 DATA FORMAT

Environment Canterbury will only accept data in the WML2 format.

Please refer to 2.3.

#### 3.1.4 MISSING RECORDS/DATA GAPS

Please refer to 2.5.

#### 3.1.5 DATA CLEANSING, SYNTHESISING AND EDITING RECORDS

Please refer to 2.6.

#### 3.1.6 MISSING RECORDS

Environment Canterbury will follow up missing data if data is not submitted by 31 July. Consent holders who fall into this category will be graded significant non-compliant and will incur associated compliance monitoring and enforcement costs to retrieve missing data. Data gaps must be explained and can result in a (significant) non-compliance e.g. when data is irretrievable or explanation is insufficient or missing.

### 3.2 Consent holders who submit water use data annually

Consent holders without a third party service provider and who have less than 10 sites can submit data to [waterusage@ecan.govt.nz](mailto:waterusage@ecan.govt.nz). In the email subject heading enter 'Consent #, WAP #, Annual Data' (including consent and WAP numbers).

The consent holders in this category will incur costs to:

- Format the data to WML2 before upload
- Upload data into the Hilltop server
- Process data
- Cleanse, synthesise and edit records.

Consent holders without a third party provider and who have 10 sites or more cannot submit data to [waterusage@ecan.govt.nz](mailto:waterusage@ecan.govt.nz). Consent holders who fall within this category can only submit data in the WML2 format via a Blue tick accredited third party service provider. For a list of accredited companies, go to: <http://irrigationaccreditation.co.nz/watermeasurement/accredited-companies/>

# Annex A – Bibliography

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Resource Management (Measurement and Reporting of Water Takes) Regulations 2010. Available from <http://www.mfe.govt.nz/fresh-water/regulations-measurement-and-reporting-water-takes>

# Annex B – Requirements for constructing stage-discharge and velocity-index ratings requirements

the construction of stage–discharge and velocity-index ratings has to comply with the Environment Canterbury standards or NEMS to provide hydro meteorological information of sufficient accuracy.

**The Environment Canterbury standards are:**

- Measurement of Stage Specifications in clause 7 of ISO Standard ISO 4373-1979(E)
- Field practice standards specified in the Environment Canterbury Surface Water Hydrology Field Procedures Manual (July 1997)
- Flow gauging shall conform to the appropriate ISO standards as outlined in ISO Handbook 16 (ISO, 1983)
- Stage discharge rating curves shall conform to specifications of ISO Standard ISO 1100/2-1982, clause 7.1.

**For the NEMS guidelines** on the construction of stage–discharge and velocity-index ratings, go to:

<https://www.lawa.org.nz/media/2982090/NEMS-Rating-Curves.pdf>



