The City of Winnipeg

Water & Waste Department

Wastewater
Historical Data Retention Standard

Document Code: 612620-0016-40ER-0001

Revision: PA (DRAFT)

Approved By:	NOT APPROVED - DRAFT	
	Geoff Patton, Manager of Engineering	Date

REVISION REGISTER					
Rev.	**Description**	**Date**	**By**	**Checked**	**Approved**
PA	Issued for 60% Review	2014-07-01	SNC Lavalin	-	-

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TABLE OF CONTENTS

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1 INTRODUCTION

This Water and Waste Department Historical Data Retention Standard is intended to serve as a reference for ensuring consistent retention and archival of data produced by the control systems at City of Winnipeg owned wastewater facilities. This document provides guidance to department personnel, as well as external consultants, regarding historical data retention requirements.

1.1 Scope of the Standard

These design requirements will apply to the following facilities:

- Wastewater treatment plants
- Wastewater lift pumping stations (CONFIRM)
- Land drainage and underpass pumping stations. (CONFIRM)
- Other collections facilities including pumping. (CONFIRM)

1.2 Application

This document is intended to convey general guidance regarding historical data retention at wastewater facilities.

This document does not address specifics related to equipment type, selection, and configuration. It is not within the scope of this document to provide detailed design direction, and it will be the responsibility of the respective system designers to fully develop the control system historian with general conformance to the concepts presented herein.

This standard shall not be construed as comprehensive engineering design requirements or negate the requirement for professional engineering involvement. Any design must be executed under the responsibility and seal of the respective engineer in each instance, and must be performed in conformance with all applicable codes and standards, as well as good engineering practice.

Where significant deviations from this standard are deemed to be appropriate by the design engineer, these shall be approved by the City.

As technology evolves and new application requirements are identified, it is recommended that this document is updated to ensure that it remains relevant and applicable.

Existing facilities do not necessarily comply with this standard. The expectations regarding application of this standard to new designs at existing facilities must be assessed on a case-by-case basis, however general guidelines for application are presented as follows:

- All new designs, not related to an existing facility, are expected to comply with this standard.
- All major upgrades to a facility, or a larger facility's process area, are expected to comply with this standard, however in some cases compromise with the configuration of the existing facility design may be required.
- All minor upgrades should utilize this standard as far as practical for new equipment, however in some cases compromise with the configuration of the existing facility design may be required.

1.3 Definitions

I/O	Input / Output
RAID	Redundant Array of Independent Disks
SCADA	Supervisory Control and Data Acquisition

1.4 Reference Documents

- The Environment Act (Province of Manitoba) - C.C.S.M. c. E125
- Limitation of Actions Act (Province of Manitoba) - C.C.S.M. c. L150
- Canada Water Act (R.S.C., 1985, c. C-11)
- Canadian Environmental Protection Act (S.C. 1999, c. 33)
- Wastewater Systems Effluent Regulations (The Fisheries Act) - SOR/2012-139

2 GENERAL PRINCIPLES

2.1 Availability of Data

The control systems at City of Winnipeg wastewater facilities are capable of monitoring and generating extremely large amounts of data concerning the operation, maintenance, and performance of the wastewater treatment process. This data is available to be archived in a historian database for access at a later date. The archived data may later be used to re-create trends and observe operating conditions from a given timeframe for a variety of purposes including maintenance, troubleshooting, performance monitoring, and regulatory approval.

2.2 Archival Principles

The amount of data archived by a historian can quickly grow to a very large volume if left unmanaged. Although modern storage devices are capable of storing extremely large amounts of data, it is poor design practice to archive more data than is necessary. As an archive is allowed to grow in size, the associated hardware and maintenance costs required to store the data also increase substantially. Backup copies of the archives similarly take longer to create and require additional storage media. Excessively large historical archives also decrease the efficiency of queries and retrieval.

To help ensure the efficiency and effectiveness of the control system historian, archival retention guidelines corresponding to the expected useful life of various types of data are specified in Section 3.1. In addition to configuring the historian software to conform to these guidelines, provisions must be made to ensure that the hardware and software required to access the historical data is maintained throughout the lifetime of the historical records. Alternatively, as the historian hardware and software nears the end of its lifespan, the historical data may be exported to a format that is easily accessed and widely supported at that time.

3 REQUIREMENTS FOR TYPICAL APPLICATIONS

3.1 Retention Periods

The minimum retention periods for various types of information recorded by the control system are shown in Table 3-1 through Table 3-6. The majority of modern historian software packages are able to dynamically adjust the recording interval for control system data. This allows rapid changes in points to be captured with higher resolution, while avoiding unnecessary logging of points that do not substantially change for long periods of time. As a result, the Recording Intervals shown in these tables are an order-of-magnitude estimation of the average interval between consecutive samples for each type of data, rather than a pre-set recording interval.

Each type of data is categorized as either discrete or analog data. It is anticipated that analog data will require a larger amount of storage per point than the discrete data primarily due to more frequent variation in value. As such, the retention period of analog data is generally shorter than that of discrete data. Despite this, certain analog data that is important for regulatory and environmental protection purposes, such as effluent flow and analysis, shall be maintained over an extended period of time. Additionally, the majority of the most important data for many analog points may be captured by recording the average, minimum, or maximum value over a longer time period (hourly or daily), resulting in fewer samples.

The minimum retention period selected for most operational and process data is 2 years. This is based on the Limitation of Actions Act for the Province of Manitoba, which generally limits legal action to a minimum of 2 years following an incident. The Canada Water Act and the Canadian Environmental Protection Act similarly have a limitation period of 2 years. Additionally, the Environment Act for the Province of Manitoba requires that data be retained for at least 2 years for any deviations from normal operating procedures and any details of equipment failure or maintenance.

A brief survey of guidelines for data retention in other provincial and state wastewater jurisdictions showed that historical data is typically retained for a minimum of 3 - 5 years. As such, the minimum retention periods selected for most types of historical data does not exceed 5 years. A notable exception is historical data pertaining to overall plant performance, such as effluent analysis and effluent flows. As this data is critical to assessing and tracking overall plant performance and environmental impact, extended retention of this data is recommended.

The following tables contain generalized guidelines for different types and classes of equipment. It is anticipated that there will be exceptions and additions to these guidelines. Exceptions are to be reviewed and approved on a case-by-case basis.

3.1.1 Overall Performance Data

Overall performance data shows the performance of the wastewater plant as a whole, as well as its environmental impact. Retention of this data over an extended period of time is recommended.

Table 3-1 : Data Retention – Overall Performance Data

Data Type	Recording Interval	Minimum Retention	Legal Req.	Notes
Treatment Plant Inflow	Minute	2 yrs		
Treatment Plant Inflow Hourly Total	Hour	20 yrs		
Inflow Laboratory Analysis		20 yrs		Currently offline measurement
Inflow Laboratory Analysis Daily Max	Day	20 yrs		
Inflow Laboratory Analysis Daily Avg	Day	20 yrs		
Outflow Laboratory Analysis	Minute	1 yr		
Outflow Laboratory Analysis Daily Max	Day	20 yrs	TBD	Required for licence compliance.
Outflow Laboratory Analysis Daily Avg	Day	20 yrs	TBD	
Treatment Plant Outflow	Minute	2 yrs		
Treatment Plant Outflow Hourly Total	Hour	20 yrs		5 years retention required for the Fisheries act

3.1.2 Major Equipment Data

Major equipment is directly related to the process. Some examples of major equipment include:

- Sewage Pumps
- Grit Screens
- Grit Tanks and Pumps
- Clarifiers
- Sludge Pumps
- Reactors
- Aeration Blowers
- Digesters
- Dewatering Centrifuges
- Nitrogen and Phosphorus Removal Equipment

Historical data associated with major equipment is likely to be useful in determining the cause of failures and inefficiencies of the overall process. Major equipment has the most direct impact on the process, so it is recommended that its historical data be kept for a longer period of time, as compared to historical data for other types of equipment.

Within historical data collected from major equipment, analog data that directly measures process flows and levels should be retained for longer periods of time. Similarly, discrete points that record failure and alarm states have the most potential to provide information relevant to determining the cause of process failures and inefficiencies, and should be retained longer. Analog data that may prove useful for equipment maintenance, but does not directly measure process performance shall be discarded after a shorter period of time.

Table 3-2 : Data Retention – Major Equipment Data

Data Type	Recording Interval	Minimum Retention	Legal Req.	Notes
Analog Data				
Motor Speed	Minute	5 yrs		
Valve Position	Minute	5 yrs		
Tank Level	Hour	5 yrs		
Flow Indication	Hour	5 yrs		
Discrete Data				
Equipment Start/Stop	Event	5 yrs		
Valve Open / Close	Event	5 yrs		
Trouble / Warning Alarms	Event	10 yrs		
Failure Alarms	Event	10 yrs		
Analog Maintenance Data				
Motor / Pump Vibration	Minute	2 yrs		
Motor / Pump Vibration Daily Max	Day	5 yrs		
Motor Amps Average	15 Minute Average	5 yrs		

3.1.3 Minor Equipment Data

Minor equipment may or may not be directly related to the process, but the value of the equipment is typically much lower than the major equipment and may have a lower impact on the overall process performance. Some examples of minor equipment include:

- Valves – Electric Actuated
- Valves – Solenoid
- Chemical Feed Pumps
- Sluice/Slide Gates

Historical data associated with minor equipment will be useful in maintenance planning and diagnostic activities, but may be less useful in determining the cause of overall process issues. Minor equipment has less direct impact on the process, so it is recommended that its historical data be retained for a shorter interval.

Table 3-3 : Data Retention – Minor Equipment Data

Data Type	Recording Interval	Minimum Retention	Legal Req.	Notes
Analog Data				
Motor Speed	Minute	3 yrs		
Valve Position - Modulating	Minute	3 yrs		
Tank Level	Hour	3 yrs		
Flow Indication	Hour	3 yrs		
Discrete Data				
Equipment Start/Stop	Event	5 yrs		
Valve Open / Close	Event	5 yrs		
Trouble / Warning Alarms	Event	5 yrs		
Failure Alarms	Event	5 yrs		
Analog Maintenance Data				
Motor / Pump Vibration	Minute	2 yrs		
Motor / Pump Vibration Daily Max	Day	10 yrs		
Motor Amps	15 Minute Average	5 yrs		

3.1.4 Auxiliary Equipment Data

Auxiliary equipment is generally not directly part of the process, but will provide miscellaneous services to allow for overall operation of the facility. Some examples of auxiliary equipment include:

- HVAC
- Hot Water Pumps
- Cooling Water Pumps
- Glycol Pumps
- Heat Exchangers
- Potable water system
- Sump pumps

Historical data associated with auxiliary equipment may be useful in the troubleshooting and maintenance of that particular equipment, but is unlikely to prove to be important in the direct analysis of process performance. As such, this data will typically be retained for a shorter duration, except for critical data such as MCC voltage, which can be utilized to reference process disturbances.

Table 3-4 : Data Retention – Auxiliary Equipment Data

Data Type	Recording Interval	Minimum Retention	Legal Req.	Notes
Analog Data				
Motor Speed	Minute	2 yrs		
Valve Position	Minute	2 yrs		
Tank Level	Hour	2 yrs		
Flow Indication	Hour	2 yrs		
Discrete Data				
Equipment Start/Stop	Event	3 yrs		
Valve Open / Close	Event	3 yrs		
Trouble / Warning Alarms	Event	5 yrs		
Failure Alarms	Event	5 yrs		
Analog Maintenance Data				
Motor / Pump Vibration	Minute	2 yrs		
Motor / Pump Vibration Daily Max	Day	5 yrs		
Motor Amps	15 Minute Average	2 yrs		
MCC Voltage	Minute	5 yrs		
MCC Voltage Daily Average	Day	10 yrs		
MCC Voltage Daily Max	Day	10 yrs		
MCC Voltage Daily Minimum	Day	10 yrs		

3.1.5 Fire, Gas Detection, and Security

Some examples of fire, gas detection, and security equipment include:

- Combustible gas detectors
- H_2S gas detectors
- Motion detectors and door switches
- Smoke and heat detectors
- Fire alarm and security panels

Although this equipment does not typically directly affect the process, it may prove to be important as evidence in legal proceedings.

Table 3-5 : Data Retention – Security and External Access Data

Data Type	Recording Interval	Minimum Retention	Legal Req.	Notes
Analog Data				
Hazardous gas level	Minute	3 yrs		
Hazardous gas daily maximum	Day	10 yrs		
Discrete Data				
Security Alarm / Trouble	Event	5 yrs		
Door open/close	Event	3 yrs		
Motion Sensor	Event	3 yrs		
Fire Alarm / Trouble	Event	5 yrs		
Hazardous Gas Alarm	Event	5 yrs		

3.1.6 Operator Action Data

Operator Action Data refers to the record data of all operator commands issued from the HMI, field device panels, and local equipment controls (if they are monitored by the control system). Operator commands, and particularly setpoints, are crucial in understanding the operation of the wastewater facility. This data is usually required to reconstruct a sequence of events after a significant abnormal operating event. The importance of this historical data, combined with relatively low frequency of operator commands, results in longer minimum retention times for this data.

Table 3-6 : Data Retention – Operator Action Data

Data Type	Recording Interval	Minimum Retention	Legal Req.	Notes
Discrete Events				
Login / Logout	Event	5 yrs		
Equipment Operation	Event	5 yrs		
Alarm Acknowledgement	Event	5 yrs		
Analog Setpoints				
Setpoint Changes	Event	5 yrs		

3.2 Logging Interval Requirements

3.2.1 Analog Data

The majority of modern historian software packages are able to dynamically adjust the recording interval of analog data to more rapidly capture rapid changes in values. Similarly, duplicate data that does not vary within a pre-defined deadband is sampled at a much slower rate. In general, deadband and sampling settings must be configured to allow for re-creation of significant spikes and deviations in data.

3.2.2 Discrete Data

As with analog data, discrete data is typically recorded at a variable rate wherein only changes in state are recorded. Thus, the logging interval will vary directly in proportion to the number of state and event changes observed.

3.3 Archival Requirements

Control system historical data will initially be archived on the local hard drive of the historian server. Consequently, this historian hardware must incorporate some form of local data redundancy. This may include a redundant set of hard drives or storage devices in RAID configuration, or a hot-standby Historian server.

In some rare cases, the size of the historical data archive may exceed the storage capacity of the historian server hardware, resulting in the historian server being only able to maintain a rolling window of the most recently collected data. If this situation cannot be avoided by limiting data archival, historical data will need to be periodically copied to a means of external storage in order to maintain a complete archive of historical data.

3.4 Backup and Disaster Recovery Requirements

In addition to local redundancy provided by RAID storage and server hardware redundancy, measures must be taken to maintain an off-site copy of historical data to safeguard it against physical harm at the local facility. Nightly incremental backups to an off-site server would protect the historical data archive in the event of a catastrophic event at the wastewater facility.