SCOTTISH ENVIRONMENT PROTECTION AGENCY	Procedure No: CAS-G-002
Operational Quality Manual	Page no Page 1 of 12
	Issue No: 1
Compliance Assessment Scheme	Issue date: 12 January 2011
	Originator: Simon Olley
Calibration of monitoring and measurement equipment at STW's	Issued by: Quality Manager
	Authorised by: Simon Bingham

# SEPA CAS Guidance Calibration of monitoring and measurement equipment at Sewage Treatment Works

# 1. Purpose

- 1.1 This paper presents SEPA guidance for use in the compliance assessment scheme, CAS, when assessing the calibration of monitoring and measurement equipment at sewage treatment works, STW. It applies to Scottish Water and all other operators of sewage treatment works.
- 1.2 The paper also presents information submitted by Scottish Water outlining its approach to calibration and the methods and techniques that are used
- 1.3 The principles and approach in this paper have been agreed between SEPA and Scottish Water
- 1.4 The guidance in this paper is only for use in SEPA's compliance assessment scheme, it does not affect SEPA's enforcement policies/guidance or any enforcement action against any licence.

# 2. Background

- 2.1 The calibration of monitoring and measuring equipment is important to ensure that the operator of any STW and SEPA have confidence that the measured data produced is accurate. SEPA is largely concerned with the measurement of inlet flows, storm overflow and flow to full treatment. The operator of a STW may have many other measuring devices detecting sludge blankets and sludge pumps which also require calibration and maintenance.
- 2.2 There is usually limited ability of an operator to control flows arriving at a STW, as such inlet flow recording is required less for operational control and more for information on the flows and loads being treated at a works to establish whether a works is becoming hydraulically overloaded (by assessment of the dry weather flow (DWF)).
- 2.3 It is important to ensure that the required flow of sewage is being passed forward for full treatment in order to avoid premature operation of storm overflows. This flow to full treatment (FFT) must be accurately established.
- 2.4 The importance and sensitivity of such flow information to SEPA and the operator can vary depending on the current hydraulic capabilities and overall performance of the particular STW's and the environmental sensitivity.
- 2.5 Most SEPA STW licences contain a condition which requires that all monitoring/ measuring equipment shall be calibrated e.g.
  - All << monitoring/ measuring>> equipment referred to in this licence shall be calibrated regularly and in accordance with the recommendations of the

SCOTTISH ENVIRONMENT PROTECTION AGENCY	Procedure No: CAS-G-002
Operational Quality Manual	Page no Page 2 of 12
	Issue No: 1
Compliance Assessment Scheme	Issue date: 12 January 2011
	Originator: Simon Olley
Calibration of monitoring and measurement equipment at STW's	Issued by: Quality Manager
	Authorised by: Simon Bingham

manufacturer << and/or>> to any relevant current certification standard. Evidence of calibration shall be maintained and available for inspection by a SEPA Officer.

- 2.4 Conditions such as these are assessed under the Environmental Management Attribute: Plant and Infrastructure: Maintenance of plant, infrastructure and monitoring equipment (including calibration) in the Compliance Assessment Scheme, CAS.
- 2.5 Guidance on assessing this attribute over the whole year is contained within Annex 5 of the CAS guidance manual (an extract of which is reproduced in Table 1 below:
- 2.6 Supplementary guidance as presented in this paper is required to aid SEPA staff in assessing monitoring and measurement equipment at all sewage treatment works to ensure consistency of approach.

Table 1: Extract of Annex 5 'STW and Trade': CAS guidance manual (2011)

Environmental Management					
EMC attribute	Licence condition	Compliant	Minor non- compliance	Major non- compliance	Comments

The EMC aspects below should be assessed at a level of detail appropriate to the scale and risk of the licensed activities.

(eg very good knowledge by most staff at higher risk larger sites).

Plant and infrast	ructure			
Maintenance of plant, infrastructure and monitoring equipment (including calibration)	Fully maintained.  Maintenance procedures in place and adhered to.  Full calibration of monitoring equipment.	Evidence of lack of maintenance of effluent treatment works and/or  Maintenance procedures incomplete or inadequate; and/or  Deviation from maintenance procedures which have not been notified to and/or agreed by SEPA and/or which are liable to cause a minor environmental event. Cat. 3)  Partial calibration of monitoring equipment.	Significant lack of maintenance of effluent treatment works and/or  No maintenance procedures in place; or  Significant deviation from maintenance procedures, which are liable to cause a significant or major environmental event (Cat. 1 or 2) and/or  No calibration of monitoring equipment.	Is it being maintained? are maintenance procedures being followed?  This attribute is assessed where there is a requirement in a licence for maintenance of plant, infrastructure and monitoring systems (e.g. the plant will be operated and maintained in accordance with best practice condition and conditions relating to monitoring equipment).  The focus should be on maintenance of critical plant and equipment.  For Scottish Water use SEPA/Scottish Water protocol for ensuring compliance during maintenance;

SCOTTISH ENVIRONMENT PROTECTION AGENCY	Procedure No: CAS-G-002
Operational Quality Manual	Page no Page 3 of 12
	Issue No: 1
Compliance Assessment Scheme	Issue date: 12 January 2011
	Originator: Simon Olley
Calibration of monitoring and measurement equipment at STW's	Issued by: Quality Manager
	Authorised by: Simon Bingham

	construction and adverse operating conditions as a guide.
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Note: Some minor adjustment of the wording regarding flow calibration in Annex 5 in the CAS manual may take place during 2012 to better reflect this supplementary guidance.

# 3. Supplementary Guidance

# SEPA's High Level Approach

- 3.1 The assessment of calibration should always be made in a risk proportionate and pragmatic way, ensuring that the calibration aspects are put into perspective with all other aspects of this EMC attribute e.g. the wider maintenance of monitoring equipment and proportionate to the risk of harm to the water environment.
- 3.2 As a guide any failure to maintain and/or calibrate monitoring equipment at a STW which is performing well, has no significant non compliance issues with flow or premature overflows and whose receiving water is in a good condition and provides good levels of dilution, and hence pose little risk of significant harm, should usually be assessed under CAS as a minor breach.
- 3.4 On the other hand any failure to maintain and/or calibrate monitoring equipment at a STW which has suspected or known problems with hydraulic overloading, premature operation of storm overflows and/or limited dilution in the receiving waters should be assessed more harshly (tending towards major breaches but not excluding the recording of minor breaches) as the impact of not calibrating such equipment is potentially greater. This is especially important if it has become impossible to measure the flow to full treatment and/or to establish the Dry Weather Flow, DWF.
- 3.4 The following criteria can be used as a guide to establish the basic sensitivity of a STW for this EMC attribute:

## Sensitive STW's:

- Those known or perceived to be at or above hydraulic design;
- Those with known or suspected problems with premature operation of storm overflows;
- STW's with storm overflows in or near designated bathing and ,shellfish waters and/or could adversely affect other designated and protected areas;
- STW's whose discharges receive low dilution.

Less sensitive STW's

SCOTTISH ENVIRONMENT PROTECTION AGENCY	Procedure No: CAS-G-002
Operational Quality Manual	Page no Page 4 of 12
	Issue No: 1
Compliance Assessment Scheme	Issue date: 12 January 2011
	Originator: Simon Olley
Calibration of monitoring and measurement equipment at STW's	Issued by: Quality Manager
	Authorised by: Simon Bingham

- Those that are not considered sensitive above, and
- unlikely to cause a significant environmental impact; and/or
- those that are have no major breaches of plant and equipment and /or no significant breaches of environmental limit conditions (e.g. generally performing and operated well)

Note: this does not represent an exhaustive list of criteria and others may be relevant to a site specific situation, however the SEPA officer must always be able to justify why a site is considered sensitive or less sensitive on the basis on risks to or actual harm to the water environment.

- 3.5 Note that detailed calibration checks on some flow monitors may be extremely difficult to carry out due to their location within a STW. A pragmatic approach should be taken by SEPA when assessing whether detailed calibration checks need to be carried out, as this may mean the removal of the equipment for some time. A common sense approach should be taken in that if no significant problems with flow are suspected then the need for carrying out detailed checks will be less and any breaches under compliance scheme are considered less serious. If a STW is considered sensitive and there is evidence that a key flow monitor (e.g. one which establishes DWF etc) may be out of calibration (discovered by looking at the long term flow monitoring data to establish trends and/or where storm overflows are operating prematurely) then a discussion of the long term situation regarding flow monitoring should be carried out between SEPA and the operator (e.g. Scottish Water), as it would be unacceptable to retain a monitor which could not be easily maintained and calibrated. This would usually involve SEPA's 'Quality and Standards' staff.
- 3.6 Note the licence condition for calibration does not stipulate that evidence of calibration is kept on site but that it 'is available for inspection'. SEPA should take a pragmatic and common sense approach to this and where not immediately available provide a reasonable timescale (suggested 7 working days) for this evidence of calibration to be provided.
- 3.7 SEPA officers should ensure that CAS assessments on the calibration of flow meters can be fully justified, are considered proportionate to the risks of harm and are in line with the general principles above.
- 3.8 Details of Scottish Water's calibration systems and SEPA's approach to this is detailed below:

## Scottish Water's System for Calibration:

- 3.9 Scottish Water has a system called Maintenance Scheduled Tasks (MST's) for carrying out calibration checks of flow monitors (Magflows and Ultrasonic open channel flow meters). This is presented in Appendix 1.
- 3.10 Note this system does not produce calibration certificates per se but does generate and record the MST in one of their works management systems

SCOTTISH ENVIRONMENT PROTECTION AGENCY	Procedure No: CAS-G-002
Operational Quality Manual	Page no Page 5 of 12
	Issue No: 1
Compliance Assessment Scheme	Issue date: 12 January 2011
	Originator: Simon Olley
Calibration of monitoring and measurement equipment at STW's	Issued by: Quality Manager
	Authorised by: Simon Bingham

'Ellipse'. The record of calibration checks should be checked by a SEPA officer by asking to see evidence of it being recorded in this system.

- 3.11 Note any requirement for a calibration certificate in the licence conditions should be considered met if a record of the MST and, where relevant, any more detailed checks can be viewed using 'Ellipse' and the records are satisfactory to the SEPA officer.
- 3.12 Note the MST checks are carried out by personnel separate from the local operational teams e.g. Electrical and Mechanical craftsmen, other personnel and contractors. Some of this maintenance and calibration is recorded electronically on corporate systems rather than on paper at the site. As such local operations staff may not have any knowledge of the MST checks being done. However the SW wastewater team leader should be able to gain access to the 'Business Objects' reporting system to produce evidence of when the flow meters at the STW were last checked and when they are next due to be checked failing which the records will be made available to SEPA as soon as possible (usually 7 working days).
- 3.13 An extract from 'Ellipse' is presented below. This extract has been prepared using a data analysis and reporting tool called Business Objects. This shows how often it is checked (in days), when the check was last carried out and when it is next due. A further extract is presented in Appendix 2.

# **Business Objects**

Region: WEST
Function
Description: WASTE WATER TREATMENT

Region Description	Equipment Location Description	Ellipse Equipment No	Equipment Description	Tag No	Schedule Description 1	Schedule Frequency 1	Last Scheduled Date	Last Performed Date	Next Scheduled Date
WEST	CRAIGENDORAN PUMPING	005000261753	WET WELL A LEVEL CONTROLLER	LT2101/1	ULTRASONIC MEASUREMENT CALIBRATION	364	10/01/2011	21/12/2010	09/01/2012
WEST	CRAIGENDORAN PUMPING	005000261755	WET WELL B LEVEL CONTROLLER	LT2101/2	ULTRASONIC MEASUREMENT CALIBRATION	364	10/01/2011	21/12/2010	09/01/2012

Example of download of calibration MST's

3.14 Where a problem is identified through the MST then a more detailed examination of the flow meter/ structure is carried out. An example of such an investigation is presented in Appendix 3.

# Other STW Operators

- 3.15 SEPA will expect that all other operators, such as those that operate Public Finance Initiative schemes, PFI, will have a suitable planned and prioritised system in place to carry out calibration checks and more detailed calibration investigations.
- 3.16 It is not practical to present details of all other systems by all other operators for the calibration of flow monitors in this document. However, Operators should be able to show evidence to SEPA officers when requested that these calibration checks have been carried out as planned.

SCOTTISH ENVIRONMENT PROTECTION AGENCY	Procedure No: CAS-G-002
Operational Quality Manual	Page no Page 6 of 12
	Issue No: 1
Compliance Assessment Scheme	Issue date: 12 January 2011
	Originator: Simon Olley
Calibration of monitoring and measurement equipment at STW's	Issued by: Quality Manager
	Authorised by: Simon Bingham

3.17 SEPA will adopt the same principles of assessment for flow calibration under CAS for all operators which discharge effluents to the water environment and are regulated through the Water Environment (Controlled Activity Regulations) (Scotland)

# **Key Points:**

- 3.18 The key points for SEPA to bear in mind are that:
  - Scottish Water has a system in place for carrying out routine calibration checks of flow meters (MST) see Appendix 1.
  - The MST checking is done on a frequency dependant on its sensitivity in providing operational control for Scottish Water.
  - Scottish Water will carry out more detailed calibration checks, but only
    where a problem is suspected through the MST check or justifiable
    concerns raised by SEPA. This should be documented as in the
    example in Appendix 3.
  - SEPA would expect other operators (e.g. private operators including those operating PFI schemes) to have a system of calibration checks in place and be able to demonstrate this system and show evidence of carrying out the planned checks to SEPA officers when requested.
  - A proportionate and pragmatic approach should be taken in assessing calibration under the compliance assessment scheme.

SCOTTISH ENVIRONMENT PROTECTION AGENCY	Procedure No: CAS-G-002
Operational Quality Manual	Page no Page 7 of 12
	Issue No: 1
Compliance Assessment Scheme	Issue date: 12 January 2011
	Originator: Simon Olley
Calibration of monitoring and measurement equipment at STW's	Issued by: Quality Manager
	Authorised by: Simon Bingham

# Appendix 1: Scottish Water's Procedures for the Calibration of Flow Meters:



## SW Procedures for Calibration of flow meters

Scottish Water have a robust system for carrying out routine maintenance called MST's (Maintenance Scheduled Tasks: ) on Magflows and Ultrasonic Open Channel Flow Measurement Devices.





Magflow devices

Ultrasonic open channel flow measurement

No certificates are generated or recorded on site however the MST's are recorded in Business Objects (one of our corporate data management systems).

This information is available upon request.

The system automatically generates Work Orders which are then actioned by our E&M / ICAT teams through the corporate Click system.

# **Business Objects**

Region:	WEST		
Function Description:	WASTE WATER TREATMENT		

Region Description	Equipment Location Description	Ellipse Equipment No	Equipment Description	Tag No	Schedule Description 1	Schedule Frequency 1	Last Scheduled Date	Last Performed Date	Next Scheduled Date
WEST	CRAIGENDORAN PUMPINS	005000281753	WET WELL A LEVEL CONTROLLER	LT2101/1	ULTRASONIC MEASUREMENT CALIBRATION	384	10/01/2011	21/12/2010	09/01/2012
WEST	CRAIGENDORAN PUMPINS	005000281755	WET WELL B LEVEL CONTROLLER	LT2101/2	ULTRASONIC MEASUREMENT CALIBRATION	364	10/01/2011	21/12/2010	09/01/2012

# Example of download of calibration MST's

The MST's are carried out on a frequency determined by their criticality. Flow meters that control processes are visited once or twice a year, less important meters (not controlling and not providing process or regulatory critical information might be scheduled to be checked once every two years.

The checks required by the MST replicate most of those recommended by the manufacturer but also require that drop tests be carried out if any inaccuracy is suspected.

See Scottish Waters MST's requirement for:

IIFE1C – Electromagflow Calibration
IILU1C – Ultrasonic Calibration

SCOTTISH ENVIRONMENT PROTECTION AGENCY	Procedure No: CAS-G-002
Operational Quality Manual	Page no Page 8 of 12
	Issue No:
Compliance Assessment Scheme	Issue date: 12 January 2011
	Originator: Simon Olley
Calibration of monitoring and measurement equipment at STW's	Issued by: Quality Manager
	Authorised by: Simon Bingham



IILU1C

## ULTRASONIC MEASUREMENT CALIBRATION

If this signal is alarmed through telemetry, prior to starting these checks, contact Control/ Call Centre and inform them to ignore any alarms generated relating to this instrument during the MST process.

#### Visual Inspection

- Check the instrument head, transmitter and cables for any signs of damage, grounding, labelling, alarm status etc.
- Check that the signal path is unobstructed and is not being interfered with by obstacles or surface water disturbances.
- Check connections of Head, Transmitter and Cables Internally etc.

#### Instrument Checks

- Check the unit for any diagnostic alarms set within the unit in accordance with the Makers instructions.
- Check that all parameter settings are in accordance with the manufacturers recommendations. This is particularly important where the unit is used for flow measurement in conjunction with a standard weir. Ensure that the weir parameters entered match the weir being used.
- Put the unit back on line.
- Check that the values indicated are consistent between the meter, SCADA and telemetry systems.
- Where the signal is used for priority alarming (Out of Hours alarm), the high and low alarm points should be initiated where possible and the alarm checked with Control/ Call Centre/ ICAT section as appropriate. This may require any Telemetry Keyswitch to be in the 'Unmanned' position temporarily.
- Return all signals to their original state and inform Operations that the task is complete. Update Control/ Call Centre where appropriate.
- Complete work order and sign off.
- Where the reading is suspect, a more detailed investigation may be required using set distance checks, drop tests etc. This should be part of a separate repair work order.

SCOTTISH ENVIRONMENT PROTECTION AGENCY	Procedure No: CAS-G-002
Operational Quality Manual	Page no Page 9 of 12
	Issue No: 1
Compliance Assessment Scheme	Issue date: 12 January 2011
	Originator: Simon Olley
Calibration of monitoring and measurement equipment at STW's	Issued by: Quality Manager
	Authorised by: Simon Bingham



IIFE1C

#### **ELECTROMAGNETIC FLOWMETER CALIBRATION**

If this signal is alarmed through telemetry, prior to starting these checks, contact Control/ Call Centre and inform them to ignore any alarms generated relating to this instrument during this MST process.

#### Visual Inspection

- Check the Flow meter Head, Transmitter and Cables for any signs of damage, grounding, labelling, alarm status etc.
- Check the earth connection to the grounding flanges inserted into the pipe work immediately upstream and/or downstream of the flow meter.
- Check connections of Head, Transmitter and Cables Internally etc.
- Check the unit for any diagnostic alarms set within the unit in accordance with the Makers instructions.
- If used as an events logger check functionality.
- Check that all parameter settings are in accordance with the manufacturer's recommendations.
- Put the unit back on line.
- Check that the values indicated are consistent between the meter, SCADA and telemetry systems.
- Where the signal is used for priority alarming (Out of Hours alarm), the high and low alarm points should be initiated where possible and the alarm checked with Control/ Call Centre/ ICAT section as appropriate. This may require any Telemetry Key switch to be in the 'Unmanned' position temporarily.
- Return all signals to their original state and inform Operations that the task is complete. Update Control/ Call Centre where appropriate.
- · Complete work order and sign off.
- Where the flow reading is suspect, a more detailed investigation may be required using additional meters, drop tests etc. This should be part of a separate repair work order.

SCOTTISH ENVIRONMENT PROTECTION AGENCY	Procedure No: CAS-G-002
Operational Quality Manual	Page no Page 10 of 12
	Issue No: 1
Compliance Assessment Scheme	Issue date: 12 January 2011
	Originator: Simon Olley
Calibration of monitoring and measurement equipment at STW's	Issued by: Quality Manager
	Authorised by: Simon Bingham

Appendix 2: Extract of Scottish Water MST checks

# SCOTTISH ENVIRONMENT PROTECTION AGENCY

**Operational Quality Manual** 

**Compliance Assessment Scheme** 

Calibration of monitoring and measurement equipment at STW's

**Procedure No:** CAS-G-002 Page no Page 11 of 12 Issue No: 1 12 January 2011 Issue date: Originator: Simon Olley Issued by: Quality Manager Authorised by: Simon Bingham

Business Objects

Maintenance schedule Tasks (MST) for Calibration of flow meters

| Paging | Wall Project | Paging | Pa



-										Name of Street, or other teachers		serving Services
Description	Equipment Location	Equipment No.	Squipment Description	Tag No:	Stage	METER		Schedule Description 1	Schedule	Law Schadules	Festioned Date	Next Schoolser
WEST	DALCARDS STC	00800000000013	THOUGHED GLUDGE FLOWMETER AND I	PRODE	25	HER	Ho.	ELECTROMAGE REFLOWING THE CALIBRATION M	764	15150016	73000010	10/10/2011
WEST	DATES RIC	009000998057	THID ICHED SLUDGE FLOWER THANCO	PES06	25	1100		ELECTROMACNETIC FLOWARTER CALIBRATION ME	364	19100010	7808576	16787011
WEST	CALDENGE STC.	005000318661	DESCRIPTION OF THE SERVICE OF THE SE		25	1990	RFE1C	ELECTROMOMETIC FLOWAR TER CALBRATION IN	364	1919000		15152011
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WEST	47000H 9.T.W. (DI		PALET PLOWINGTON - PLOWINGTON PAT DESCRIPTION PLANTED TO THE TRANSPORTER	PE1505	31	1016	WEST	ELECTROMODE TO FLOWING THE CALIFORNIA ON ME ELECTROMODE TO FLOWING THE CALIFORNIA ON ME	102	20/10/010		2009/2011
WEST	4200019.TW.(00	0000001G9181	FREA BLUDGE DUTLET PLOVMETER	FE1500A	34	HITS	0991C	ELECTROMAGNETIC FLOWNETER CALIBRATION M	187	20/13/2910		29000011 29000011
WEST	ARDOOH S.T.W. (DI	DONOTO-SOURA	FOT C SUDGE OUTLET FLOWMETER	FRISCO	38 54	HOTE	WEST	ELECTROWAGNETIC FLOWESTER CALIBRATION M	92	20/12/5910		20/08/09/11
WEST	MODOR STW. (S)	805000150151	FST O SUDGE OFFICE FLORING THE	PERMIT	- 04	+0×		ELECTROMORETICAL DIMENTIAL DIL IMPUNOVIMI ELECTROMORETICAL DIMENTAL DIL IMPUNOVIMI	962	26/10/09 No 26/10/09 No		20/06/2011
WEST	480001 STW (DL 480001 STW (DL	000000159070 000000159073	MFORTED BLUCOS TO BORREAS FLOWARTER  MFORTHO BLUCOS PLANTS FLOWARTER	/E/000	37	142°00.		REPORTS MAKE THE REDVINCTOR GALIDRATION ME	161	29/12/09/E		30/06/2011
WEST	ARDOOH BTW. (IX		SUDDE THOREMEN S - FOCO FLOWING FOR	SENION.	27	Hára.		BLECTROMACHETIC FLOWARTER SALERATION ME CLICITECHNORETIC FLOWARTER CALERATION ME	187	2912/304E		20/06/2011
West	MEDODH 8.T.W. JOX	000000240064	FILTRATE PLANTING STATION - PLONI MONTION	F81804	31	16553	RESC	ELECTROMACHETIC FLOWMERING CALIBRATION ME	192	20120010		20/06/2019
West West	ARCOCH STW. (X		RETURN LIQUOR PURP STN - PLOW MONTOR SAS PLOWMERSE	PERSON	31	16368	REPRO	ELECTROMAGNETIC R. OWNETHER CALIBRATION IN ELECTROMAGNETIC PLOWARTER CALIBRATION IN	192	2011/0018 2011/0018		20/06/2011
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West	ARCOCH 8 THE EX	009000246988	RAS PURP C - PLOW METER		37	1000		ELECTRORISME TIC FLOWRITTER CALIFFACTOR M	162	20/0/010		20060011
WEST	ARDOCH S.T.H. (D. ARDOCH S.T.H. (D.		RAS PURP D. FLOW METER SERVICE WATER TASK ALFT PLOWING TER	FC1901	37			ELECTROMOMETER CALIBRATION M	1817	20/13/2010		20060011
	ARDOCHSTAY (DI		DESIGN CONTROL RECIPCULATION PUMP (LOWNING	FE1003	10	HOTE	0FE10	ELECTROMOMETIC PLOWMETER GLUBONTON M ELECTROMOMETIC PLOWMETER ON BROUTON M	1907	20/07010		20/06/00/1 20/06/00/1
	ROTHESAY S.T.W.	DORDOZNASIA	REPART ON TRAKES PLOW METER - WASH, DW SLADGE RECOPTION THE DUT METER - MAGN, IS	-	34	8.60X	areso	ELECTROMAGNETIC FLOWING FAIR CHLISTORING	1,002	9519/2009	23/06/2210	\$1/10/00/2
DEST	righterwy sit w	005000265390	REGIZAÇÃO SUDGE DUTURI METER MATOR O		37	1640X	IFEIC	ELECTROMAGNETIC PLOYMETER CHEMISTRY ELECTROMAGNETIC PLOYMETER CALBRATION	1,000	05/10/2009 05/10/2009	23/08/9993 23/08/9993	\$1/16/2012 \$1/16/2012
HEST	HOTHESAY S.T.W.		FRALEFRUENT ROWMITTEN WAS NOW		- 50	8400.	19610	ELECTROMAGNETIC PLONMETER CALIBRATION	1.000	09/19/2009	29/06/2010	01/10/2012
WEST	ROTHESAYS TW	DOSODOWINESS 1	ASS PLOWARTER - MICROW BAS PLOW WETER - RESTLOW	1	59	KACE	IPEIG	REPORT OF THE PROPERTY OF T	1,000	09/10/2009 05/10/2009	23/08/2010 23/08/2010	91159912 91159912
. WEST	DISDERSE STW	000000000047	WET FLOW METER - FLOWMETER		- 31	11300	HENG.	CLOCTROMAGNETIC ROWNS THRICALIBRATION MI	364	1010000s	24090070 24090070	15150011
WEST	DATE SERVED NO.	005000566567 005000046514	STORM FLOWAL TRASCARIC PROMARY SLUCKE TO THICKNEY TRAIC PLOYAGES	PEOSI	33	11100	HEE/C	ELECTROMORE THE PLOWMETER CALIFFORTION IN ELECTROMORPHIC PLOWMETER CALIFFORTION IN	364	HH0ggts	2309000D	19190911
		005000067902	FLOW TO FILL TREATMENT IS GOMETER	FD0881	33		WELL	FIFCHOMOMETIC/LOWNETER GALDRATION IN	304	11/10/2010	290900012	19100011
West	DALDERSE STW	000000000107	EMPROPROY OUTPALL FLOWNETER STORM ERSO MASSE FLOWNETER		36	1111	SPETS SPETS	ELECTRONICALETIC FLOWNICTER CALIBRATION MI	364	11/10/2010		10102011
West	DALOERSE STW.	009000908002	EFFLUENT OUTLET ROWMETER		38	1115		ELECTROMASACTIC FLOWMETER DILEMENTON M ELECTROMASASTIC FLOWMETER DILEMENTON M	364	16/16/2010		10/10/2011 10/10/2011
	ALOA STW	005000500015 005000500017	FOUL DELET CHANNEL PLOW MONTON		29		90010	ELECTROMAGNETIC PLOMMETER CALIBRATION M.	364	19100010	28/98/0010	90/10/2011
			DESCRIPTION OF THE WASTER		30	BIX	1691C	ELECTROMAGNET IC PLONMETON CALIDATION AN ELECTROMAGNETIC PLONMETON CALIDATION AN	304	03/08/2010 -03/08/2010	03000000	01080011 01080011
		DOCUMENTOS	EASTER MAGELOW I		34	mix	SPENC	BLECTROMAGNETIC RUDAMETER CALIBRATION NO	364	03080010	12000000	91089911
	ALLOA SITW	005000986714	STORM NUCT DIVISED FLOW - MONITOR		36	(5-00)	HTCHC	DUDGEROMAGNETIC FLOWAR THE CALIBRATION HE DUDGEROMAGNETIC ALGORATION CALIBRATION HE	364	02/09/2016	126Ydone 126Ydone	03080011
18.80	ALLOR KTW	005000586785	STORW WATER STREET, DISCRETE RE	74	36	19100	HEETO.	BLECTHOMASHETIC PLOWNETER CALIFORNIA TOHAN	304	000000010	19010010	01093011
HEST HEST			FEMALET DISCHARGE POAT IN BE MONTOR	- 19	36		IFFIG.	BLECTHOMIZMETTC/T, OWNETER CALIBRATION MI BLECTHOMIZMETTC/T, OWNETER CALIBRATION MI	204	DOGMOOD	00010015	01/05/2011
WEST	ALLCA STW	DOSEDOMBORS	PRINCEPTURE TLOWS	F10	38	1318		ELECTROMACAGING FLOWING THE CALLINATION M	364	010040000 0100400000	82/87/2013 82/87/2013	61/06/00/1 61/06/00/1
			INLET FLOW METER - FLOW METER	-	31	1400.	HFE10	ELECTROMASMETIC FLOWRETER CALIFFRATION	364	22/03/2010	16/93/213	21/04/0013
WEST	BAUFECH STW		TROUNG FILTER RED FLOW TRANSMITTER FE HEADER TANK RECIRCIE, DW TRANSMITTER	F(1930)	34	006 006	NFE10	ELECTROMOMETIC PLOWER THE CALIFORNION  FLECTROMOMETIC PLOWERTER CALIFORNION	364	28/05/0210	29/08/2010	21050011
			MATERIONNESS MATERIONNESS DE METOS	- 5	in.	HIER	SERIC	REFERMINAGE TO FLOW METER ONLE SECTION	100	20/08/7030	30/08/2010	2100/2011
			PRET FLOW METER - PLOW METER	81200	38	HEK	MAIC.	ELECTROMAGNETIC FLOWAGTER CHLISIONICS ELECTROMAGNETIC FLOWAGTER CALIBRATICS	182	29/08/2010 20/19/2010	365863310	21/03/2011
WEST	NE SOGNESANCE	009000254205	ARCATION THE WIFM - METER	P11204	34		stoto	ELECTROMAGNETIC R. DIRMINTER CALIBRATION	364	23/190/c	30130000 30130000	291990H
	NTS SOURSHANCE NTS SOURSHANCE	005000254430	SAND FILTERS INLET FM - MADRIOW SAND FILT PLXTS - OUT PLOW MONITOR	P(1)001	35		(99010)	SECTION OF THE PROPERTY OF T	364	22/10016	30/10/2009	241100H
Weer	OCHMBADOE STV	000000031500	BETCHM TANK OUT FW - MACFLOW	200	30	DEX :	19690	ELECTROMAGNETIC PLOYMETON CALIBRATION 5. SCIPCOMAGNETIC PLOYMETOR CALIBRATION	364	23/1/50/E	30/10/2008 30/10/2008	25/15/2011
	VIS BOOKENINGS		SE DWF PUMP STV - OUTLET MAGELOW STOOM PUMP STV - OUTLET MAGELOW	97	36	HXX	INEIC	ELECTROMAGNETIC FLOWMETER GALIBRATION	364	2011/00/0	30100009	21010011
WAST	ALS STOLEGIVEN PAR	D0500025+500	SUGGE F91 1 WASFLOW - WASFLOW	E0200	37		HFENC	GLOCIFOMAGE THE RECOVARITIES CALIBRATION BLIGGIFOMAGE THE RECOVARITIES CALIBRATION	364	22/11/00/0	30/10/2008	20110011
1830	NA 300RBWKDB	005000051609	BLUDGE FOT 2 MAGFLOW MAGFLOW BLUDGE ORDER THE MAGFLOW	F/1208	31		16630	BLICTROMORTIC FLOWETCR CALBRATION	364	31711/2013	30/10/2000	211110011
PEST			MARKET PART STO. SASSAGELOW	Fitting	31		BFEIG.	PLECTROMORETIC FLOWNETER GALBRATION  PLECTROMORETIC FLOWNETER GALBRATION	261	22711/2000	30/10/2009 30/10/2009	21/11/00/1
		100000000174	WLET WORKS PLONING I DR	F121	31	1212	MAIC	ELECTROMISACTIC FLOWNETER DALBRATION M	364	29/862640	89967210	22/08/00/1
		005000047257 V	ORTOCIRTORY - DUTLET ROWMERS. ORTOCIRTORY - INLET ROWMERS		32			ELECTROWISHS THE FLOWING THE CHLINICITION IN ELECTROWISHS THE PLOWING ON INVIDENCE	907	23/06/2010 23/06/2010	36/36/2010 ·	21/03/0011
West :	KIRL NO STW	069090016563	FLOW FROM PRESSURY: LT BURNET		30		(FE10	ELECTROWNSWITTIC FLOWWEITER CALEDIATION AS	301	73/08/1010 73/08/1010	98/98/1919 98/98/1919	23/98/2011
			SBR DIST CHAMPER PLET FLOW SBR BAS LIBE	SHEEDS	34	D16	#81C	REPORTOMAGNETIC PLONMETER CALBRATION ME PLECTROMAGNETIC PLONMETER CALBRATION IN	364	2M582010 2M582010	09/09/2010	23/56/2011
WCST	STRUMS STW	000000000776	COMBINED SAS FLOWINGTOR	F110700	54		HEC10	DLECTROMAGNETIC PLOYMETER CALIBRATION BY	364	29080076	09/09/20/10 09/09/20/10	20/08/2011 20/08/2011
West o			RUCT OHMBOR - FLOWING HAX MPORTED SLUDGE PLOHMETHY	FT008	15	HOW	(FC10)	DESCRIPTION OF THE PROPERTY OF	152	29/11/2008		7405/330
West a	WES SESSE	005000395050 3	PROPERTURNIES DISMETERS - PROPE	F7002	24	HICK		BLECTROMARINETIC R. DAMETOR CAUSTATION H. HCTROMARINETIC R. DAMETOR CAUSTATION IN	192	29/12/30/00 1/00/00/00	20090001	29/09/2011 29/09/2011
		005000005/747   5 00000000000071   5	KLEES REPORT PLATING SLIGGE PLONACTER	FTTQS	37	HS10.	(PESC	BLACTROMIGNETIC PLOWNETCR CALIBRATION IN	110	10000003	12/99/2019	39690011
INEST I	NR.ESTW.		TOPM PLOWNETER		35		HENG HENG	OLD CTROMAGNICTIC PLOYMETER CALIBRATION	364	19980000	1995/2012	22/08/00/1 23/08/00/1
			STORM OVERFLOWFLOWNERS	PRESENT CO. IDANO.		129X	HEER	SUBCIRCOMMINENC A OWNERSHIOW WITHOUT ON	364	23/06/2013	19705/2010	219M2011
year t	MOHPARK (PAIS).	0050005149C	NET FLOWMERS 1 SETER NET FLOWMERS 2 SETER					ELECTROMISMENT OF OWNETER CALIBRATION M.	112	DIVENDESS:	16/06/2010	EXEMPSON
	ACHEVIEW (PARS)	2000000681450 A	MENTION DUTILET ON LIFE DAMESTER		34	10011	BFF1G	PLECTRONICAETIC/LOWNETER CALIBRATION M	187	00/06/2010	16962110	EUESVERY
		2004000681481 A	ERATION OUTLET CHI2 FLOWS	-	34		METERS .	DECTRORAGAETIC FLOWNETER OLLERATION M. DECTRORAGAETIC FLOWNETER OLLERATION M.	967	01303000	1506/2012	E3/03/2011
		G05000587454 F	WAL EXPLUENT FLOW MUTER - MICHIN		36	1916	MEETO .	ELECTROMISMETIC PLOWMFTER CALIBRATION M		09080210	16/06/2010	23/20/2011
		005000587541 S 005000314318 F	LUDGE TO SAULI R OWNERSHIP LOVAN THE T	-			BFB1C BFB1C	ELECTROMISANTICE, DAWLETER CALIBRATION M ELECTROMISANTICE, DAWLETER CALIBRATION	361	23/03/7010	18/98/2010 28/93/2010	EVENOUS -
	CONTRIDORS (	000000014316 F	LOWWETER 2		00		SEE LO	ELECTROMASACTIC FLOWING TEX CALIBRATION	364	23/93/2010	11/03/2006	2493/2611 2493/2615
			LOWACTER 5 RUDGE FLOWACTER 1		99		WENC.	ELECTROMAGNETIC FLORMSTER CALBRATION ELECTROMAGNETIC FLORMSTER CALBRATION	364	13/97/2910 88/98/2910	2408/2910 2010/0909	1197/2011
	WE MANAGER BLUE	009000354305 F	TANL DUTLET BLUDGE FL RENGTON - MACFLOW		13	000	(FS10)	ELECTROMAGNETIC PLOWMETER CALIBRATION	368		03100008	26/36/2011
	MLMARKOCK SLU 1		LUCKE TRANSPER WIT WILL BEET MIGHORN LUCKE TRANSPER WIT WILL BEET MIGHORN		tà.		IPE IC	ELECTROMAGNETIC FLORMETER CALIFFATION ELECTROMAGNETIC FLORMETER CALIFFATION		76/04/7008	78/347006	27/94/2009
183W	ALMARBOOK S.TV	DODDOOTAMOR P	CURSE TO DALDOWE - FLOWMETCR		32	NATIX	PERC	DEETROMAGNETIC REDWARFIER CALIBRATIEN IN	192	2012/2010	29090000	27/06/2011
		DONDOOR12146 P	ST 1 - MAGROW/LOWNETER ST 2 - MAGROW/LOWNETER	PTROS			FE10	D.DETROMAGNETIC R.DWMETER CAUSEATION IS: D.DETROMAGNETIC R.DWMETER CAUSEATION IS:	152	14120009		14069810 14069810
MART 2	WESTARD HAROLISH	005000012122	ST 3 - MAGFLOWFLOWRITER	FT300	30	HQ1X I	IFE1C	LECTROMAINETIC PLOWMETER CALIFFATION MI		1912/000s		14060013
meat is west to	HELDHIL STW	DOCUMENTAL IN	ST4 MAPLOW/LOWETER	FT304 F1305				EXCERCIMENTE FLOWNETER CALIBRATION IN	tio .	terroos terroos		1408/2010
WEST S	HELDHALL STAY O	2000000012126	ST 5 - MACFLOWFLOWING FER	F1300	28	HERE	IPE10	DOCTROMAGNETIC ROWNETER OUTERATION M.		14/12/0009		14090310 14090310
WEST S	HELDHILL STW. 0	0 7015/20000000	67.7 - MAGFLOWFLOWETER CF.5 - MAGFLOWET CAME TOR	F1300		HENR I	HEEVO.	LOCTROMASMETIC FLOWNERIER CALIFERATION M	162	10120000		160600000
West is	HELDHALL STAY O	00500000U136 P	SEP-MORLOWFLOWETER	F1300			IFE1C I	LECTROMEMETIC PLOWNETER GALIGRATION M		10/33/000B	-	10000000
	HELDHALL STAY O	DESCRIPTION P	SE 19 MAGNOWINOVMETER RETE MAGNOWINOVMETER	FIRE	23-	HOIE	WF1G	DECTRORAGNETIC FLOWNETER GALBRATION M	182	11/15/2009		140000010
Wor 9	HELDHAL STATE	GH0000612160 P	ET 12 - MAGPLOWFLOWNETER	PERT	33			SECTIONACAETIC FLOWNETER CALBRATION M.	90	W-0/2000		16/05/2016 16/05/2016
		0090000612157 R	AS TO AGRATION TANK 1 FLOWWEIGH	West	34	RISI	WEIG!	LECTROMAGNETIC PLOWMETER ON BRIGHTON M.	182	14/13/2009		100000000
WEST S	HIS DHALL STAIL O	0050000012147 R	KS TO ASPANDAL WAR 2 PLOWNETER	3A643 3A643			IFEIC I	LECTROMONETICE, OWNETER CALIBRATION M.		14/13/1909		10000001
HERT S	HOLDHALL STW. C	000000017155 W	KR TO JEMATION TANK 4 FLOWNETER	65512	24	HOTEX :	SPEEC 1	LECTROMAGNETIC FLORMETER CHURRYTON M		18/12/7980		1405/2018
WEST S	HELDHUL STW. D	0000000012140 5	NS TO ACRATION TANK SITLOWNIETER AS TO ACRATION TANK SITLOWNIETER	M812			FEID -	LECTROMAGNETIC FLORMATER DILBERTION M. LECTROMAGNETIC PLORMATER DILBERTION M.	195	44737900 4737900		14/06/2018 14/06/2018
06:S1 20	HELDHAU STW - 0	050000 t0722.   0	UTLET FROM STORM TRUX FLOWMETER. METER	-	.36	12:0X 1	FEET .	LECTROMODETICH, DWMHTER CALBRATION M	162	1413/2009		16060011
West b	RELONAL STW. II	05000510771 PA	NALSER UNIT - ULTHANDAICE, GWARTER LET PLOW METER					LECTROMACHETIC PLOWNETOR CALERATION M	780	16120000		34/36/2010
West b	ALDON/COTW 0	0000006F161 PA	AS PLANS PHASE TUTLOW MESER		36	HITS. I	PERC 8	LECTROMACHER OF DOWNCHOR CALIBRATION AS				\$163/2611
	s Down 21W 0	D5000087167 PL	NS PEMPS IPHASC 21 FLOW METER LLTRONESS ULTRASONICIMETER 1				PE40 (	LOCITROMACHETIC FLOWNETIER CALIBRATION AT	192	00000000	210002910	8103/2011
West D	NOOWERTW 0	(05000567294 W	LLTRONGOS UL TRASOLVIC MATRIA 7.				FEIC I	LECTROMATINE THE PLOWING THE CALIFFACTION IN				21/23/2011 21/23/2011
WHIT IS	AMENOGO S.T.A. O	CONTROL PO	S R DAMETER WITER TORNEL DAMETER			Hitz.	SPEC 1	LECTRORISATION PLOWNETER CALIBRATION IN	190	12100000		10/04/2013
WEST IO		MINORETRANSFE DA	SCHARGE FLOW METER-FLOW					LECTROMISAETIC FLOWNETER CALIBRATION III.  LECTROMISMETIC FLOWNETER CALIBRATION III.		THANKS I HANKS	010000000 010000000	11/04/2011
MEST 10	WELKERS ST. O	asoassareta U	DIPD SCUDGE SUMP OUTLET HUDINWETEN	44.00	24	HATE !	PERC D	LECTROMASNE REFLOWING THE CALIFORNIA ON MI	180	00/05/2016		07/00/7611
20F33 1G	WELKERSEST O		XCD SELECTION PLANT 1 PLONE WE'THIN DOED SELECTION PLANT 2 PLONE WE'THIN	PERMAN.		HATE I	FEIC F	LECHOWANE TICELOWINTER CALINIATION M				00000011
WEST KE	MACH, KERSE 971 O	0500csirised M	ORD STUDGE FLARE STLOW METER	FETTORE	28	HHIK I	PEIC F	LECTRONICACTIC FLOWRETER CALIBRATION MI	182	DIVIDADDES.	1509000E	07000011
WEST RE	MEL KERSE STE D	M 1981 BROODS	ALD SUDDE FUND A FLOREMETER T FLOW MORNTOR	F8310187 F811000			PEIG E	LECTROMAGNETIC FLOWNETER CALERATION MI LECTROMAGNETIC FLOWNETER CALERATION M	182	09/06/2013	15/05/2010	07/09/2011
WEST KE	MARK KENSEST OF	06000583981 W	ORIGINALET FLOWINGTER	milielo	м	1000	FEID I	LECTHOMORY TICE, DIAMPTER DIL, MINTON MI	102		1009/2012	000000111
What 48	WHEN MERSE STEELS	051005k1969 36	ROLLERS FLOW METERS DRAW WATERS TO REVORE PLOW METERS	F1T1000		HHIX I	FEIL 1	DECTROMAGNETIC PLORMETER CALIBRATION M	100	DM26/2010	1100/00/11	60699911
WEST NO	WELL HERSE SIN IN	CÓGDOSBATIS PE	WILEPPLUENT PLOWINGTON	F111008	38 1	SEC 1		ECTROMAGNETIC FLORMETER CALIBRATION IN				000000911
WEST AR	CONTRACO	Decided Stocks (P.C	PER PRET FLOWNETER	PENNO.	35 4	85/0C (8	F010 4	LECTROMAGNETIC REDWARFING CALIBRATION RE	182	2013/2910		20000011
WEST	OCHOCKEN O	0500045400s	ASSOCIATION FAMOUS BURGET FLOW SENSOR	VG402				LECTROMARIES OF THE DAMPTHE CALIBRATION AS FETROMARIES OF DAMPTOS CALIBRATION AS		2012/2010		20060011
			THE STREET STREET, STR	THE PERSON NAMED IN		10000			7.		-	-

SCOTTISH ENVIRONMENT PROTECTION AGENCY	Procedure No: CAS-G-002
Operational Quality Manual	Page no Page 12 of 12
	Issue No: 1
Compliance Assessment Scheme	Issue date: 12 January 2011
	Originator: Simon Olley
Calibration of monitoring and measurement equipment at STW's	Issued by: Quality Manager
	Authorised by: Simon Bingham

Appendix 3 Example of a detailed calibration check by SW Process Science Team

Conly done where a problem identified at MST clack etc).

SITE: NeilstonWwTW

MODEL: OCM 111

MEASURING DEVICE: Rectangular Flume

LOCATION: FE

#### MAIN INSTRUMENT PARAMETER CHECKS

Parameter	Definition	Entered Values	Measured Values	Comments
Р3	Measurement Device	1	-	Rectangular flume
P46	Range at zero head	131.9cm	131.5cm	Changed to 131.5cm
P7	Height max head	40cm	-	
P6	Flow at max head	1841/s		Auto changed to 1851/s after PMD changes
U0	Approach Width	70cm	69cm	
U1	Throat Width	40cm	40cm	
U2	Hump height	0cm	0cm	
U3	Throat Length	63.0cm	63.0cm	

## SEWAGE DEPTH CHECK

OCM111 Sewage Depth	Measured Sewage Depth	Comments	
15.2cm	15.4cm	Flow meter and measured depths correspond	

#### FLOW CALCULATION CHECK

OCM111	OCM111	Flow Calculation Check	Comments
Head	Flow	(BS 3680 calc)	
15.1cm	41.31/s	42.41/s	Flow meter and calculated flows correspond

## COMMENTS

Ancillary OCM 111 parameters related to correct operation of the flow meter were verified. Free discharge through flume and "standing wave" after flume observed.

The OCM 111 temp sensor reading at 14°C corresponded closely with thermometer temp check of 16°C.

Date Calibration: 23/9/2010

Calibrated by: Stuart Runciman

Next Calibration due: Sept 2011 - March 2012

Process Support

