Blackpool Entry Checklist					
Equipment	Yes	No	Signature (Check)	Date	Signature (Entrant)
Gas Detection	✓			24/9/14	
Head light	✓				
Helmet	✓				
Gloves Nitrite	✓				
Gloves Kevlar	✓				
Safety Waders	✓				
Back up safety supplies including First Aid Kit	✓				
10 min Oxygen escape mask	✓				
Moblie phone fully charged	✓				
Rope communication	✓				

Standby Person

Print Name: [illegible]

Signature: [illegible]

Date: 24/9/14

Blackpool Entry Checklist					
Equipment	Yes	No	Signature (Check)	Date	Signature (Entrant)
Gas Detection	✓				
Head light	✓				
Helmet	✓				
Gloves Nitrite	✓				
Gloves Kevlar					
Safety Waders	✓				
Back up safety supplies including First Aid Kit	✓				
10 min Oxygen escape mask	✓				
Moblie phone fully charged	✓				
Rope communication	✓				

Standby Person

Print Name: Fabian Ryndak

Signature: Fabian Ryndak

Date: 27/6/2014

Team : Sean.

Blackpool Entry Checklist

Equipment	Yes	No	Signature (Check)	Date	Signature (Entrant)
Gas Detection	✓		[signature]	31/07/2014	[signature]
Head light	✓		[signature]	"	[signature]
Helmet	✓		[signature]	"	[signature]
Gloves Nitrite	✓		[signature]	"	
Gloves Kevlar	✓		[signature]	"	
Safety Waders	✓		[signature]	"	
Back up safety supplies including First Aid Kit	✓		[signature]	"	
10 min Oxygen escape mask	✓		[signature]	"	
Moblie phone fully charged	✓		[signature]	"	
Rope communication	✓		[signature]	"	

Standby Person

Print Name: FINBARR O RIORDAN

Signature: [signature]

Date: 31st July 2014

Appendice D: Equipment data sheets

Isco Product Data

Isco 2150 Area Velocity Flow Module

NEW!

The sleek, new 2150 Series Area Velocity Flow Module combines Isco's proven area velocity flow measurement technology with the flexibility and versatility of a modular design. The 2150 is a self-contained, field-interchangeable measurement and data storage system in an environmentally sealed enclosure. Now, you can configure a monitoring system to meet your specific needs.

- Stack modules you need to build a compact, integrated system.
- Monitor multiple flow streams at the same time.
- Obtain redundant measurements to guarantee integrity.
- Remotely locate modules and connect them via cable.
- Expand your monitoring system as your requirements evolve.

All without returning your meter to the factory. The possibilities are limitless!

You can stack Flow Modules for multi-point or redundant monitoring.

Large, Secure Memory

The 2150's large memory and extremely long battery life substantially reduce the need to visit monitoring sites to retrieve data and replace batteries. Each 2150 stores up to 65,000 readings in a database at intervals from 15 seconds to 24 hours. For example, you can store 9 months of level and velocity readings at 15 minute intervals.

The 2150 Flow Module features rollover memory with variable rate data storage, allowing you to change the data storage interval when programmed conditions occur. For example, for Inflow & Infiltration (I&I) Studies, you can set up your 2150s to store data more frequently when the flow rate increases.

All data is stored in "flash" memory, protecting your data against glitches that can cause other storage technologies to lose your valuable data forever.

Stored data is retrieved and analyzed using Flowlink 4 for Windows Software (Version 4.1) on your PC. The 2150 communicates at a brisk 38.4k baud rate, minimizing your time in the field.

1

Up to One Year Battery Life

Power is provided by the 2191 Battery Module, which uses 2 standard alkaline lantern batteries or 2 rechargeable lead-acid lantern batteries. The highly efficient power management system in the 2150 provides battery life up to 15 months (two alkaline batteries and 15 minute data storage interval). And the 2150 stores battery voltage to let you know when to change batteries.

Rugged, Submersible Enclosures

The 2150 Flow Module is permanently sealed to meet NEMA 4X, 6P and IP68 requirements for prolonged submersion and watertight, dust-tight and corrosion resistant operation. This ensures dependable operation in the harshest environments.

The 2150 is permanently sealed to survive the most demanding conditions.

Two alkaline lantern batteries provide power for up to 15 months.

Easy to Upgrade

Non-volatile "flash" memory makes it easy to use the latest software in your 2150s. You can easily reprogram this memory using a PC, without opening the Flow Module or returning it to the factory. The 2150 retains its program and all stored data during software updates.

Advanced Area Velocity Technology

The new Isco area velocity sensor is engineered to meet the increasing demand to measure shallow flows in small pipes. Its streamlined, low profile design minimizes flow stream obstruction, while its patented* Doppler technology senses velocity in flows down to 1 inch (25 mm) in depth. The Isco sensor is encapsulated in epoxy to give you improved chemical compatibility in tough applications.

*US Patent No. 5,371,686

2

Maximum Accuracy

Isco's area velocity sensor mounts at the bottom of the channel and uses Doppler technology to directly measure average velocity in the flow stream. An integral pressure transducer measures liquid depth to determine flow area. Flow rate is then calculated by multiplying the area of the flow stream by its average velocity.

The area velocity method gives you greater accuracy where weirs and flumes are not practical, and where submerged, full pipe, surcharged and reverse flow conditions may occur. You don't have to estimate the slope and roughness of the channel, and silt correction allows you to compensate for debris that accumulates on the bottom of the channel.

The pressure transducer's venting system automatically compensates for changes in atmospheric pressure to maintain accuracy. An exclusive, high-capacity internal desiccant cartridge keeps the vent free of moisture during normal operation, while a replaceable hydrophobic filter protects the vent against the intrusion of water during submersion.

The 2150's quick connect sensor makes setup a snap. The area velocity sensor can be easily removed and interchanged in the field for maximum convenience.

Easy Setup

Isco's Doppler system eliminates the problems of electromagnetic probes by continuously sensing the velocity profile of the flow stream. This saves you time, eliminating the manual profiling and calibration required by electromagnetic systems. And the 2150 stores sensor diagnostics to assist with troubleshooting.

Unlike electromagnetic probes, sealed Isco sensors resist fouling by oil and grease, so you're not bothered by frequent cleanings. You can count on the Isco area velocity sensor for long term, dependable operation.

Isco's 500 KHz Doppler is ideal for applications such as sewer flow monitoring, I&I Studies, combined sewer overflow (CSO) monitoring, and storm water runoff monitoring.

Our 500 KHz signal provides a longer wavelength that penetrates farther into deep flow streams than 1 MHz systems, whose shorter wavelength can cause their Doppler systems to be "nearsighted" in typical wastewater applications.

3

Flowlink® 4 for Windows Software

Isco's new Flowlink 4 for Windows Software (Version 4.1) on a PC is used to set up 2150 Flow Modules, and to retrieve and analyze stored data. Flowlink 4 harnesses the power of *Microsoft Windows* to streamline your flow monitoring program, allowing you to conduct advanced studies and generate sophisticated reports.

Flowlink also retrieves and analyzes stored data from Isco 4100 Series Flow Loggers, 4200 Series Flow Meters, 6700 Series Samplers with 700 Modules, and 675 Logging Rain Gauges. In addition, Flowlink imports data from spreadsheet files. All data is stored in an industry-standard *Microsoft Access* database.

Advanced Data Analysis and Reporting

Flowlink generates a variety of informative graphs and tables. You can display simple graphs with a single mouse click, or conduct very sophisticated analyses of your data. Flowlink offers a number of advanced capabilities designed specifically for managing flow data.

- ➤ Compare data from multiple sites
- ➤ Display wet and dry weather flows
- ➤ Compare flows based on the Continuity Equation and the Manning formula
- ➤ Analyze flow, rainfall and sample data together
- ➤ Add, subtract, multiply and divide data

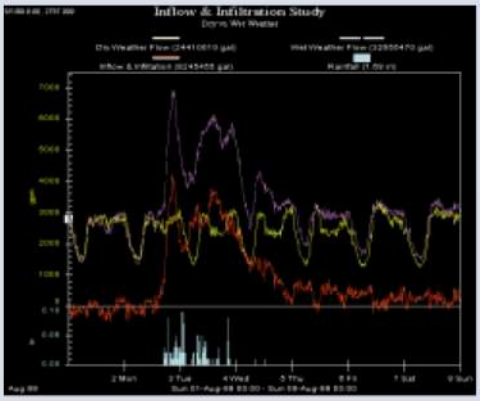
Flowlink also allows you to:

- ➤ Include graphs and tables in *Microsoft Word, Excel* and *PowerPoint*
- ➤ Schedule tasks to automate your monitoring system
- ➤ Export data to spreadsheet files
- ➤ Edit, archive and back up your data

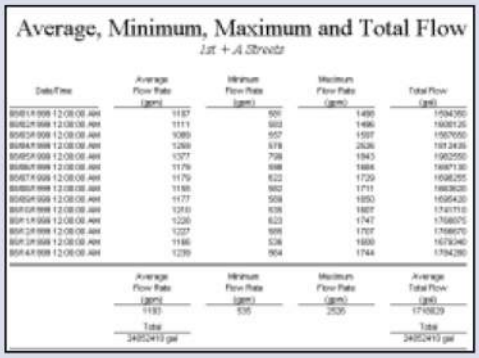
Please refer to Flowlink 4 for Windows literature for specifications and additional information .

Free Program Preview CD

To receive a free CD demonstrating the many powerful features in Flowlink 4 for Windows, please contact your local Isco representative.



Compare dry and wet weather flows, plus rainfall, for Inflow & Infiltration Studies.



Any graph can quickly be converted to a table, including average, minimum, maximum and total values.

4

Isco 2150 Specifications

2150 Area Velocity Flow Module

Size *(H x W x D)*	2.9 x 11.3 x 7.5 in.	7.4 x 28.7 x 19.1 cm	
Weight	2.0 lbs.	0.9 kg	
Material	High-impact molded polystyrene		
Enclosure *(self-certified)*	NEMA 4X, 6P	IP68	
Power	6.6 to 16.6V DC, 100 mA typical at 12V DC, 1 mA standby		
Typical Battery Life *(with 1 module)*	**Data Storage Interval**	**Alkaline Lantern Batteries**	**Lead-Acid Lantern Batteries**
	15 minutes	15 months	2½ months
	5 minutes	8 months	1½ months
	1 minute	2 months	11 days
Program Memory	Non-volatile, programmable flash; can be updated using PC without opening enclosure; retains user program after updating		
Number of Modules Connected Together	Up to 4, field interchangeable		
Maximum Distance Between Modules	3300 ft.	1000 m	
Wiring Between Remote Modules	Twisted pair for communication, pair for power, gauge dependent on distance		
Flow Rate Conversions	Up to 2 independent level-to-area conversions and/or level-to-flow rate conversions		
Level-to-Area Conversions			
Channel Shapes	Round, U-shaped, rectangular, trapezoidal, elliptical, with silt correction		
Data Points	Up to 50 level-area points		
Level-to-Flow Rate Conversions			
Weirs	V-notch, rectangular, Cipolletti, Isco Flow Metering Inserts, Thel-Mar		
Flumes	Parshall, Palmer-Bowlus, Leopold-Lagco, trapezoidal, H, HS, HL		
Manning Formula	Round, U-shaped, rectangular, trapezoidal		
Data Points	Up to 50 level-flow rate points		
Equation	2-term polynominal		
Total Flow Calculations	Up to 2 independent, net, positive or negative, based on either flow rate conversion		
Data Storage Memory	Non-volatile flash; retains stored data during program updates		
Capacity	395,000 bytes (up to 79,000 readings, equal to over 270 days of level and velocity readings at 15 minute intervals, plus total flow and input voltage readings at 24 hour intervals)		
Data Types	Level, velocity, flow rate 1, flow rate 2, total flow 1, total flow 2, input voltage		
Storage Mode	Rollover with variable rate data storage based on level, velocity, flow rate 1, flow rate 2, total flow 1, total flow 2, or input voltage		
Storage Interval	15 or 30 seconds; 1, 5, 15, or 30 minutes; or 1, 2, 4, 12, or 24 hours		
Bytes Per Reading	5		
Setup and Data Retrieval	Serial connection to IBM PC or compatible computer with Isco Flowlink for Windows Software Version 4.1		
Baud Rate	38,400		
Operating temperature	0° to 140°F	-18° to 60°C	
Storage temperature	-40° to 140°F	-40° to 60°C	

Area Velocity Sensor

Size *(H x W x L)*	0.75 x 1.31 x 6.00 in.	1.9 x 3.3 x 15.2 cm
Cable Length	25 ft.	7.6 m
Cable Diameter	0.37 in.	0.9 cm
Weight *(including cable)*	2.1 lbs.	0.95 kg
Level Measurement		
Method	Submerged pressure transducer mounted in the flow stream	
Transducer Type	Differential linear integrated circuit pressure transducer	
Range	0.033 to 10 ft.	0.010 to 3.05 m
Maximum Allowable Level	20 ft.	6.1 m
Accuracy[1]	**Level**[2]	**Error**
	0.033 to 5.0 ft. (0.03 to 1.52 m)	±0.008 ft./ft. (±0.008 m/m)
	Greater than 5.0 ft. (1.52 m)	±0.012 ft./ft. (±0.012 m/m)
Maximum Long-Term Drift	0.033 ft.	0.010 m
Temperature Coefficient[3]	±0.0035 ft/°F	±0.0019 m/°C
Velocity Measurement		
Method	Doppler ultrasonic	
Frequency	500 kHz	
Transmission Angle	20° from horizontal	
Typical Minimum Depth for Velocity Measurement	0.08 ft.	25 mm
Range	-5 to +20 ft./s	-1.5 to +6.1 m/s
Accuracy[4]	**Velocity**	**Error**
	-5 to +5 ft./s (-1.5 to +1.5 m/s)	±0.1 ft./s (±0.03 m/s)
	5 to 20 ft./s (1.5 to 6.1 m/s)	±2% of reading
Operating Temperature	32° to 160°F	0° to 71°C
Compensated Temperature Range	32° to 122°F	0° to 50°C
Materials		
Sensor	Epoxy, chlorinated polyvinyl chloride (CPVC), stainless steel	
Cable	Polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC)	

2191 Battery Module

Size *(H x W x D)*	6.0 x 9.6 x 7.6 in. x 15.2 x 24.4 x 19.3 cm	Alkaline Lantern Batteries	25 Ahrs
		Lead-Acid Lantern Batteries	5 Ahrs
Weight *(without batteries)*	3.2 lbs. 1.4 kg		
Material	High-impact molded polystyrene		
Enclosure *(self-certified)*	NEMA 4X, 6P	IP68	
Batteries	6V alkaline lantern or lead-acid lantern, quantity 2		
Capacity			

[1] *Non-linearity and hysteresis at 77°F (25°C) (per foot of change from calibration depth)*
[2] *Actual vertical distance between the area velocity sensor and the liquid surface*
[3] *Maximum error within compensated temperature range (per degree of change from calibration temperature)*
[4] *In water with a uniform velocity profile and a speed of sound of 4850 ft./s (1480 m/s)*

Contact the factory or your Isco representative for additional specifications.

5

Teledyne Isco 2160 LaserFlow™ Module

The 2160 LaserFlow™ Module uses non-contact Laser Doppler Velocity technology and non-contact Ultrasonic Level technology to remotely measure open channel flow. The sensor has advanced technology to measure velocity with a laser beam at single or multiple points below the surface of the wastewater stream.

The LaserFlow is ideal for a broad range of wastewater monitoring applications.

During submerged conditions, flow measurement continues without interruption with optional Doppler Ultrasonic Area Velocity technology.

In field use, the 2160 is typically powered either by two alkaline, or Isco Rechargeable Lead-acid batteries, within a 2191 Battery Module. Other power options (including solar) are available.

Applications

- Permanent and portable flow measurement for CSO, SSO, I&I, SSEs, CMOM, and other sewer monitoring programs
- Shallow flow measurement in varying pipe sizes
- Wastewater treatment plant influent, process, and effluent flow measurement
- Stormwater conveyance and outfall
- Irrigation canals and channels

The LaserFlow™ velocity sensor transmits level and velocity data back to the 2160 module.

Standard Features

- Rugged, submersible enclosure fulfills IP68 enclosure requirements
- The quick-connect sensor can be easily removed and interchanged in the field without requiring recalibration
- Up to four 2100 Series flow modules can be networked by stacking and/or extension cables
- Modbus output interface

Options and Accessories

- Flow measurement during submerged conditions via Ultrasonic Doppler technology
- Redundant flow measurement w/ simultaneous Continuous Wave Doppler and/or Ultrasonic Level Sensing
- Remote cell phone communication options
- Analog output module

Flowlink® Data Analysis

Isco Flowlink® Software is a powerful tool for analyzing flow and water quality data. It provides site setup, data retrieval, and comprehensive data analysis, as well as advanced reporting and graphing. See separate data sheets for details on Flowlink and Flowlink Pro software.

Specifications – 2160 LaserFlow™ Module	
Size (H×W×D)	2.9 × 11.3 × 7.5 in. 7.4 × 28.7 × 19.1 cm
Weight Alone Weight w/ 2191 Battery Module	2.0 lbs 0.9 kg 6.0 lbs 2.7 kg
Material	High-impact polystyrene, Stainless steel
Enclosure (self-certified)	IP 68
Power	7.0 to 16.6 VDC, Typical operating current 25 mA at 12 VDC Nominal, 1.0mA standby.
Typical Battery Life[a] (2160 module w/ 2191 Battery Module & LaserFlow Sensor)	Data Storage Interval Alkaline Batteries[a] 15 minutes 12 weeks
Program Memory	Non-volatile, programmable flash; can be updated using PC without opening enclosure; retains user program after updating
Number of Modules	Up to 4, field interchangeable
Maximum Distance between Remote Modules	3300 ft 1000 m
Wiring between Modules	Twisted pair for communication, pair for power, gauge dependent on distance
Total Flow Calculations	Up to 2 independent level-to-area and/or level-to-flow rate conversions, net, positive or negative, based on either flow rate conversion
Level-to-Area Conversions	
Channel Shapes	Round, U-shaped, rectangular, trapezoidal, elliptical, with silt correction
Data Points	Up to 50 level-area pairs
Level-to-Flow Rate Conversions	
Weirs	V-notch, rectangular, Cipolletti, Isco Flow Metering Inserts, Thel-Mar
Flumes	Parshall, Palmer-Bowlus, Leopold-Lagco, trapezoidal, H, HS, HL
Manning Formula	Round, U-shaped, rectangular, trapezoidal
Data Points	Up to 50 level-flow rate pairs
Equation	2-term polynomial
Data Storage Memory	Non-volatile flash; retains stored data during program updates
Capacity	798,000 bytes (up to 158,000 readings, equal to over 270 days of level, velocity, flow rate, ultrasonic signal, Doppler frequency, and input voltage readings at 15 minute intervals).
Data Types	Combined Flow, Flow Rate, Flow Rate 2, Total Flow, Input Voltage LaserFlow: Level, Distance, Velocity, Case Temperature, Laser Temperature, X-Axis, Y-Axis, Laser Diode Current, Ultrasonic Signal, Sense Voltage, Air Temperature, Doppler Power, Window Temperature Optional 350 AV Sensor: Level, Temperature, Velocity, Signal, Spectrum, Spectrum Ratio
Storage Mode	Rollover with variable rate data storage
Storage Interval	15 or 30 seconds; 1, 2, 5, 15, or 30 minutes; or 1, 2, 4, 12, or 24 hours
Bytes per reading	5
Setup and Data Retrieval	Serial connection to IBM PC or compatible computer with Isco Flowlink software
Baud Rate	38,400
Temperature range	-40° to 140°F -40° to 60°C Operating and Storage

a. Specification for Eveready Energizer® alkaline lantern batteries, model #529, Isco part #340-2006-02. Eveready Energizer® is a registered trademark of Union Carbide Corporation.

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Certified
ISO 9001

Isco Product Data

Isco 674 Rain Gauge

Connects directly to 6712 and Avalanche™ Samplers, 4200 Flow Meters, and 4100 Flow Loggers

The 674 rain gauge features a precision tipping bucket and 3-point leveling system for easy setup.

The Isco 674 Rain Gauge is a precision instrument that uses a tipping bucket design for rainfall measurement. It has an 8-inch diameter orifice and is factory-calibrated to tip at either 0.01 inch or 0.1 mm of rainfall. With a 674 Rain Gauge connected, an Isco flow meter or sampler will:

- Store rainfall data in internal memory for retrieval and analysis with Isco Flowlink® Software
- Activate sampling based on rainfall
- Plot graphs and print reports of rainfall data on the flow meter's built-in printer

A 674 rain gauge connected to an Isco 6712 or Avalanche sampler is ideal for collecting rainfall data as well as runoff-triggered samples at remote monitoring sites.

Applications

- Stormwater runoff monitoring
- TMDL and Watershed surveys
- Inflow and infiltration studies
- cMOM and CSO/SSO programs (Sewer overflow monitoring and prevention)
- General rainfall measurement

Standard Features

- Three-point leveling and integral bubble level make it easy to align the rain gauge for maximum accuracy.
- Sapphire jewel bearings on the tipping bucket are spring-loaded to prevent damage to the bearings and ensure consistent operation over a wide temperature range.
- Screens cover all openings to prevent leaves, insects, and other debris from clogging the gauge.
- Included 50-foot cable connects directly to compatible Isco flow meters and samplers.

Specifications

Isco 674 Rain Gauge	
Type:	Tipping bucket
Compatible equipment:	Isco 6700, 6712, and Avalanche Samplers, 4200 Series Flow Meters, 4100 Series Flow Loggers
Connect cable:	50 ft. (15.2 m), 2 conductor with 4-pin plug
Bearings:	Spring-loaded sapphire jewel
Orifice Diameter:	8 in. (20 cm)
Sensitivity:	English - 0.01 inch; Metric 0.1 mm
Accuracy:	English - ±1% at 2 in/hour; +3%/-4% up to 5 in/hour Metric - ±1.5% at 5 cm/hour; +3.5%/-9% up to 13 cm/hour
Capacity:	English – 22 inches/hour Metric – 38 cm/hour
Output Signal:	Contact closure of at least 50 millisecond duration
Switch Type:	Hermetically sealed magnetic proximity switch. Normally open, 200V DC, 0.5 A maximum.
Height:	13 in. (33 cm)
Diameter:	9.5 in. (24 cm) (at mounting base)
Weight:	10 lbs. (4.5 kg)
Operating Temperature:	32° to 140°F (0° to 60°C)
Storage Temperature:	-40° to 140°F (-40° to 60°C)

The 674 Rain Gauge connects to any 6700 Series or Avalanche Sampler, 4200 Series Flowmeter, or 4100 Series Flow Logger. Rainfall data logged on the host instrument can be analyzed with Flowlink Software.

Ordering Information

The 674 rain gauge includes a 50 ft (15 m) cable for connection to an Isco 6700, 6712, or Avalanche Sampler, 4200 Series Flow Meter, or 4100 Series Flow Logger. Specify English or Metric version.

Description	Part Number
674 Rain Gauge	
English - Tips every 0.01 inch of rainfall	**60-3284-001**
Metric - Tips every 0.1 mm of rainfall	**68-3280-001**

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Isco Product Data

ADFM® Pro20 Velocity Profiler for Large Pipes and Open Channels

Powered by ADFM® Technology

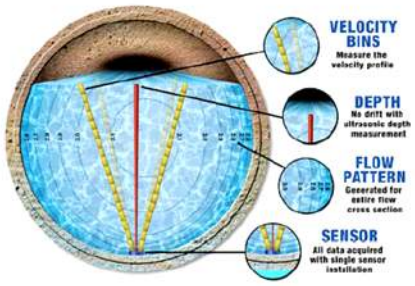
The ADFM® Pro20 flow meter brings unparalleled flow rate measurement accuracy to a traditionally difficult measurement environment: large pipes and channels. The Pro20 measures flow rate to within 2% of actual value, in flow depths up to 20 feet (6 m).

ADFM pulse-Doppler velocity profiling technology measures the velocity distribution within the flow, delivering advanced flow measurement performance. This capability makes it versatile and the most suitable choice for metering sites at large pipes and open channels, particularly those with non-uniform, rapidly changing, backwatered, near zero, zero, or reverse flow conditions.

Principles of Operation

Four (4) piezoelectric ceramics in the sensor emit short pulses along narrow acoustic beams pointing in different directions to measure velocity. A fifth ceramic mounted in the center of the sensor assembly, and aimed vertically, is used to measure the depth.

Each acoustic beam measures velocity at multiple points, known as bins, in the water column. The measured velocity data within each bin are very precise – to within 0.01 ft/s. This distribution of accurate velocity measurements is then used to determine the flow pattern over the entire cross-section of flow. Since the flow pattern and measured velocity distribution are dependent on each other, the ADFM advanced flow algorithms automatically adapt to changing hydraulic conditions within the pipe. This removes the need for in-situ calibration and insures accurate flow rate measurement over a host of different measurement environments and hydraulic conditions.



The ADFM electronics unit houses the signal processing, data logging, and data output electronics. The electronics unit is available as a NEMA 4X box enclosure, suitable for wall or console mounting in permanent applications, and a NEMA 6P cylindrical enclosure for use in manholes or other "wet" environments.

Applications

- Wastewater collection systems
- Combined sewer systems and outfalls
- Wastewater treatment facilities
- Irrigation canals and channels
- Industrial process and discharges
- Stormwater conveyance and outfalls

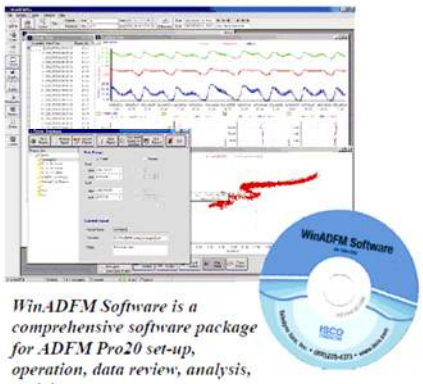
Standard Features

- Pulse-Doppler velocity profiling technology
- Quad-redundant velocity sensors and depth sensor combined in a single housing
- Upward looking sensor mounts on a stainless steel band and is positioned in the channel invert
- Data quality verification information (signal strength and correlation)
- In-situ calibration never required
- Real-time data output
- Industry standard communications protocol interfaces (optional)
- Secondary depth sensor (optional), pressure or ultrasonic

Specifications

ADFM® Pro20 Velocity Profiler	
Measurement Performance	
Flow Rate	
Flow Accuracy:	1-2% of reading
Velocity	
Velocity Range:	±30.0 ft/s (±9 m/s)
Velocity Bin Size:	2 to 12 inches (50 to 300 mm) - user selectable
Vertical Profiling Range:	9 inches to 20 feet (230 mm to 6 m) nominal, for particle concentrations of 50-1000 ppm
Accuracy:	0.5% of reading ± 0.01 ft/sec (3.0 mm/s)
Water Level	
Measurement Range:	4.5 inches to 20 feet (110 mm to 6 m)
Accuracy:	0.5% of reading ± 0.02 in (0.5 mm)
Acoustic Frequency	
Frequency:	1.23 MHz
Physical	
Electronics unit	
Electronics unit enclosures:	Cylindrical canister or wall-mount box
Operating Temperature:	-15 to 125° F (-26 to 52° C)
Storage Temperature:	-65 to 160° F (-54 to 71° C)
Packaging:	NEMA 6P (IP 68) for canister NEMA 4X for box
Dimensions:	Canister - 28.5x10 in. (724 x 254 mm) Box - 17.5x14.8x6.7 in (445x375x170 mm)
Weight:	Canister Housing 36 lbs (16 kg) Box Housing 24 lbs (11 kg)
ADFM Pro20 Sensor	
Operating Temperature:	23 to 95°F (-5 to 35°C)
Housing Material:	Urethane
Static Pressure:	250 psi Nominal
Dimensions:	8 x 3 x 1.5 inches (200 x 75 x 40 mm)
Weight:	3.2 lbs (1.5 kg)
Sensor Signal Cable	
Operating Temperature:	-40 to 125°F (-40 to 52°C)
Material:	Polyethylene jacket
Length:	50 ft (15 m) std. 100ft (30 m) and 150 ft length (45 m) available.
Minimum Bend Radius:	6 in (150 mm)
Outer Diameter:	0.5 in (13 mm) nominal

Data Management	
ADFM Pro20 Data Types	
Q, V, D:	Discharge, average velocity, depth
Velocity:	Velocity profile data (relative to acoustic beam directions) per beam and bin
Echo Intensity:	Echo intensity data (relative backscatter intensity) per beam and bin
Data Quality:	Profile data quality indicators (Correlation magnitude, % - Good) per beam and bin
Temperature:	Transducer temperature output, range 20 to 125°F (-7 to 52°C)
Sound Speed:	One output for speed of sound data
Leader:	Output of general leader information (time, data, record number, etc.), and for vertical beam data
Data Storage and I/O	
Data Storage Capacity:	32 MB std. (300,000 measurements); up to 440 MB optional
Data I/O interface:	RS-232 standard. Multiple industry-standard analog and digital protocols optionally available.
Data Transfer Rate:	Configurable to 57,600 bps
Power	
Internal battery voltage:	24 VDC nominal
Internal Battery Capacity:	26 Ah at 75° F – Alkaline. Battery life 22 weeks at 15 minute sampling interval
External DC:	12 to 36 VDC; 10 VDC absolute minimum; 36 VDC absolute maximum
Software	
WinADFM Software for Windows 98, 2000, NT, XP	



WinADFM Software is a comprehensive software package for ADFM Pro20 set-up, operation, data review, analysis, and data management..

ISCO®
Water is life. Protect it.

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Isco Product Data

Isco 2105 Interface Module

The 2105 Interface Module is a powerful solution for environmental monitoring professionals to interface different monitoring and recording instruments.

The 2105 will monitor the recorded data and take intelligent actions, such as sampler enabling and/or alarm generation, based on user-specified conditions.

Its unique flexibility allows connection to several devices at the same time. Isco 2100 Series Flow Modules, Isco's ADFM pulsed-Doppler flow meters, and Isco Rain Gauges are directly compatible. It can also be used with non-Isco instruments that have SDI-12 or Modbus output. Additional input options are possible using readily-available aftermarket converters (4-20 mA, etc.).

An optional built-in cell phone modem allows remote access to data that has been stored within the 2105, or has been fed to a central server — or the Internet.

Isco's modular design allows the 2105 to be stacked with other 2100 Series flow, communication, interface, or display Modules.

Applications

- Capacity assessments
- I&I, cMOM, SSO and other collection system monitoring
- Permit compliance and enforcement
- Stormwater runoff monitoring
- Non-point source monitoring
- River and stream gauging

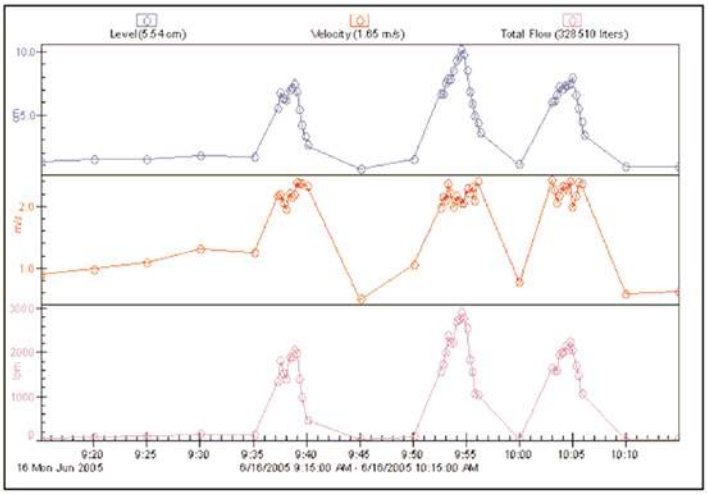
Standard Features

- Rugged, submersible enclosure meets NEMA 4X, 6P and IP68 requirements.
- May be stacked together with up to three other Isco 2100 Modules
- A variety of factory-available cables allows literally dozens of multiple instrument configuration possibilities.

The 2105 system shown above interfaces a rain gauge, flow meters, automatic sampling, and a multi-parameter sonde.

Software Features

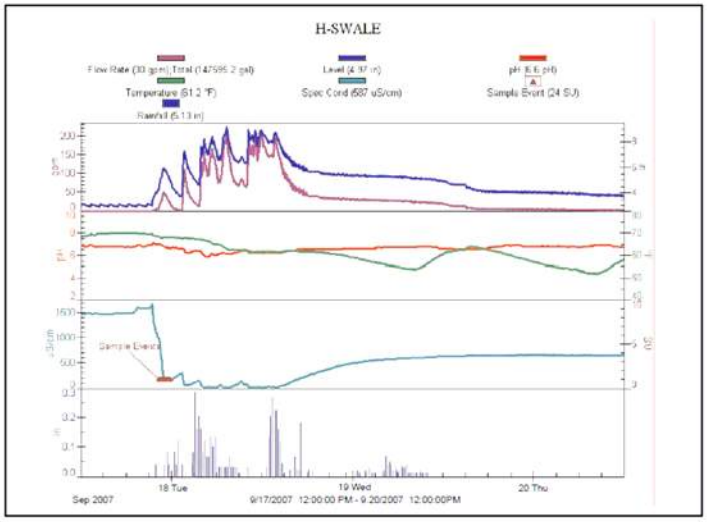
- Secure data storage. All data are continuously stored in flash memory to protect against loss in case of power failure
- Easy to upgrade. New operating software can be downloaded into non-volatile flash memory, without affecting stored program and data.
- Records and stores input voltage and temperature data.
- Variable rate data storage lets you change the data storage interval when programmed conditions occur. This feature assures maximum information about an exceptional event - such as an overflow - while conserving power and data capacity during normal conditions.
- 38,400 bps communication provides speedy setup and data retrieval.



Variable rate data storage

The 2105 module has the ability to automatically switch data storage rates based on varying conditions.

In the example at left, the 5-minute data storage rate automatically changed to 30 seconds when the flow rose above a programmed level.



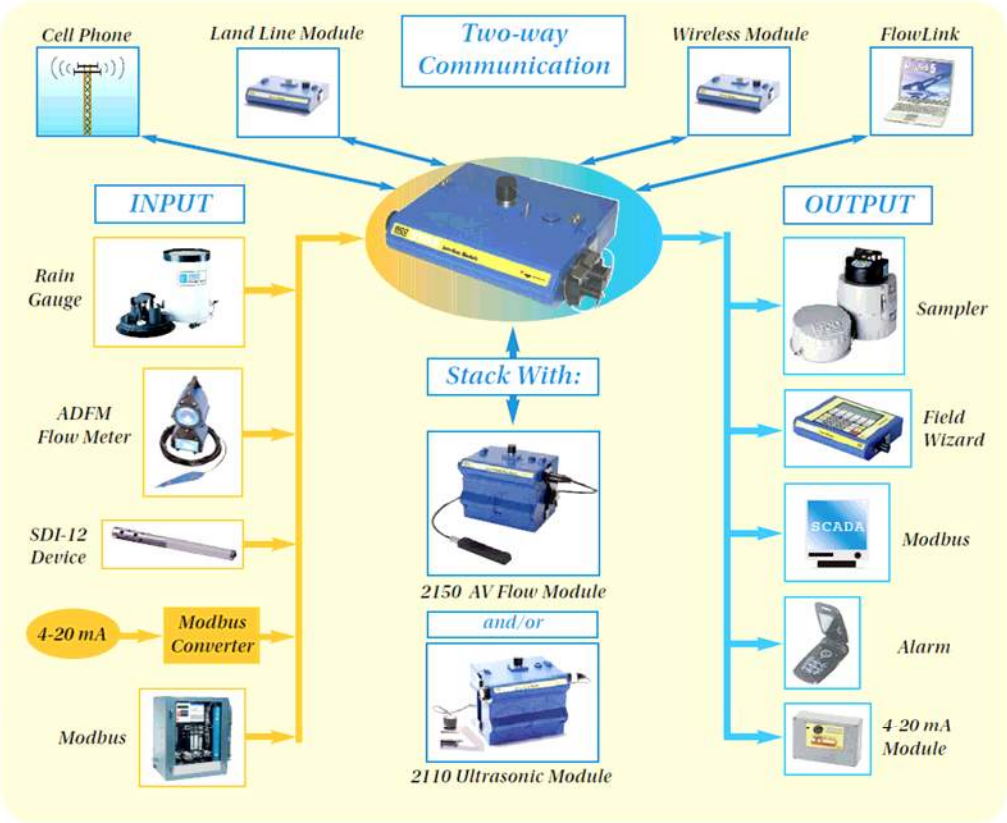
Typical stormwater channel

In the example at left, the single 2105 is recording multiple parameters.

It also triggered the sample at user-defined conditions.

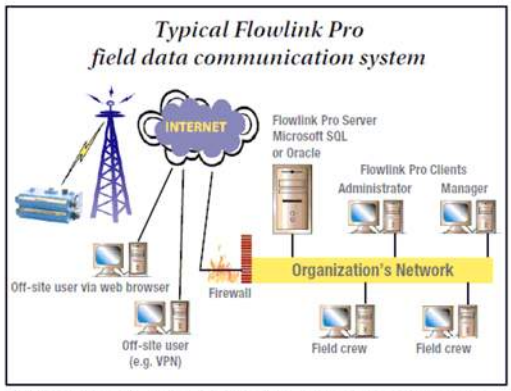
2105 Interface Options

Potential variations for interfacing different hardware and software to make up the comprehensive data system you desire are virtually unlimited with the 2105. Input/output choices are shown below - and may be enhanced by using available aftermarket converters.



Flowlink® Data Analysis

Isco Flowlink® Software is a powerful tool for analyzing flow and water quality data. It provides site setup, data retrieval, and comprehensive data analysis, as well as advanced reporting and graphing. See separate data sheets for details on Flowlink and Flowlink Pro software.



With package switched communication option, data can be made available in the remotely located server or on the Internet.

Specifications

2105 Interface Module

Size (H x W x D)	2.9 x 11.3 x 7.5 in (74 x 287 x 191 mm)
Weight:	2.0 lb (0.9 kg)
Material:	High-impact molded polystyrene, stainless steel
Enclosure:	NEMA 4X, 6P IP68
Temp. Range:	-40° to 140° F (-40° to 60° C) operating and storage
Power Required:	12 VDC nominal (7.0 to 26.0 VDC), 100 mA typical, 1 mA standby, 3 Amp maximum operating current
Power Source:	Typically, an Isco 2191 Battery Module, containing 2 alkaline or 2 rechargeable lead-acid batteries. (Other power options are available; ask for details.)
Typical battery life:	Using 15-minute data storage interval Energizer® Model 529 alkaline - 15 months Isco rechargeable lead-acid - 2.5 months
Program Memory:	Non-volatile, programmable flash; can be updated using PC without opening enclosure; retains user program after updating

Data Handling and Communications

Data Storage:	Non-volatile flash; Retains stored data during program updates. Capacity 798,000 bytes (up to 158,000 readings, equal to over 270 days of rainfall, temperature, conductivity, and pH readings at 15-minute intervals, plus input voltage readings stored at 12 hour intervals)
Data Types:	Flow rate, level, rainfall, conductivity, dissolved oxygen, temperature, pH, percent, velocity, volume, total dissolved solids, salinity, phosphate, ammonia, nitrate, TOC, COD, total suspended solids, sludge index, sludge volume, SAC, turbidity, load, input Voltage, wireless signal, rainfall intensity, specific conductance, chloride, chlorophyll, O.R.P., ammonium
Storage Mode:	Rollover; 5 bytes per reading
Storage Interval:	15 or 30 seconds; 1, 2, 5, 15, or 30 minutes; or 1, 2, 4, 12, or 24 hours. Storage rate variable based on level, velocity, flow rate, total flow, or input voltage
Data Retrieval:	Serial connection to PC or optional 2101 Field Wizard module; optional modules for spread spectrum radio; land-line or cellular modem; 1xRTT. Modbus and 4-20 mA analog available.
Software:	Isco Flowlink for setup, data retrieval, editing, analysis, and reporting
Multi-module: Networking	Up to four 2100 Series Flow Modules, stacked and/or remotely connected. Max distance between modules 3300 ft (1000 m).
Serial Communication Speed:	Up to 38,400 bps

2191 Battery Module

Size (H x W x D):	6.0 x 9.6 x 7.6 in (152 x 244 x 193 mm)
Weight (without batteries):	3.2 lb (1.4 kg)
Materials of construction:	High-impact polystyrene, stainless steel
Enclosure (self certified):	NEMA 4X, 6P, (IP68)
Batteries:	Two 6-volt Energizer Model 529* alkaline (26 Ahrs capacity) or Isco Rechargeable Lead-acid (5 Ahrs capacity) recommended. *Note - Energizer 529 ER does not give specified life.

Ordering Information

2105 Interface Module w/2191 Battery Module	68-2000-048
2105 Interface Module (only)	
2105 Interface Module w/built-in CDMA cell phone device and 2191 Battery Module	68-2000-049
2105 Interface Module w/built-in GSM or GPRS cell phone device and 2191 Battery Module	68-2000-050
Flowlink® Software	68-2540-200
Eveready Energizer® Model 529 6V alkaline battery (two required)	340-2006-02
Isco Rechargeable Lead-acid Battery (2 required)	60-2004-041
Charger Adaptor for Lead-acid Batteries (holds 2 batteries)	60-2004-040

ISCO®
Water is life. Protect it.

Teledyne Isco, Inc.
4700 Superior St.
Lincoln, NE 68504 USA
Phone: (402) 464-0231
USA & Canada: (800) 228-4373
Fax: (402) 465-3022
e-mail: iscoinfo@teledyne.com
Website: www.isco.com

Certified
ISO 9001

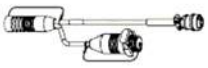
2105 Cables and Interfacing Equipment

60-2004-580
Universal Interconnect
Cable, 10' 2105

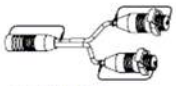
69-2004-581
Rain Gauge Interconnect
Cable, 50' 2105

69-2004-582
SDI-12 YSI Interconnect
Cable, 6" 2105

69-2004-583
Isco 674 Rain Gauge Interconnect
Cable, 10" 2105

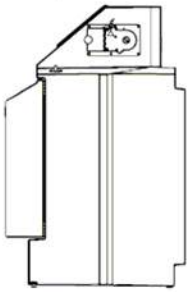


69-2004-584
Y Cable, 2105 to
Sampler, 25'



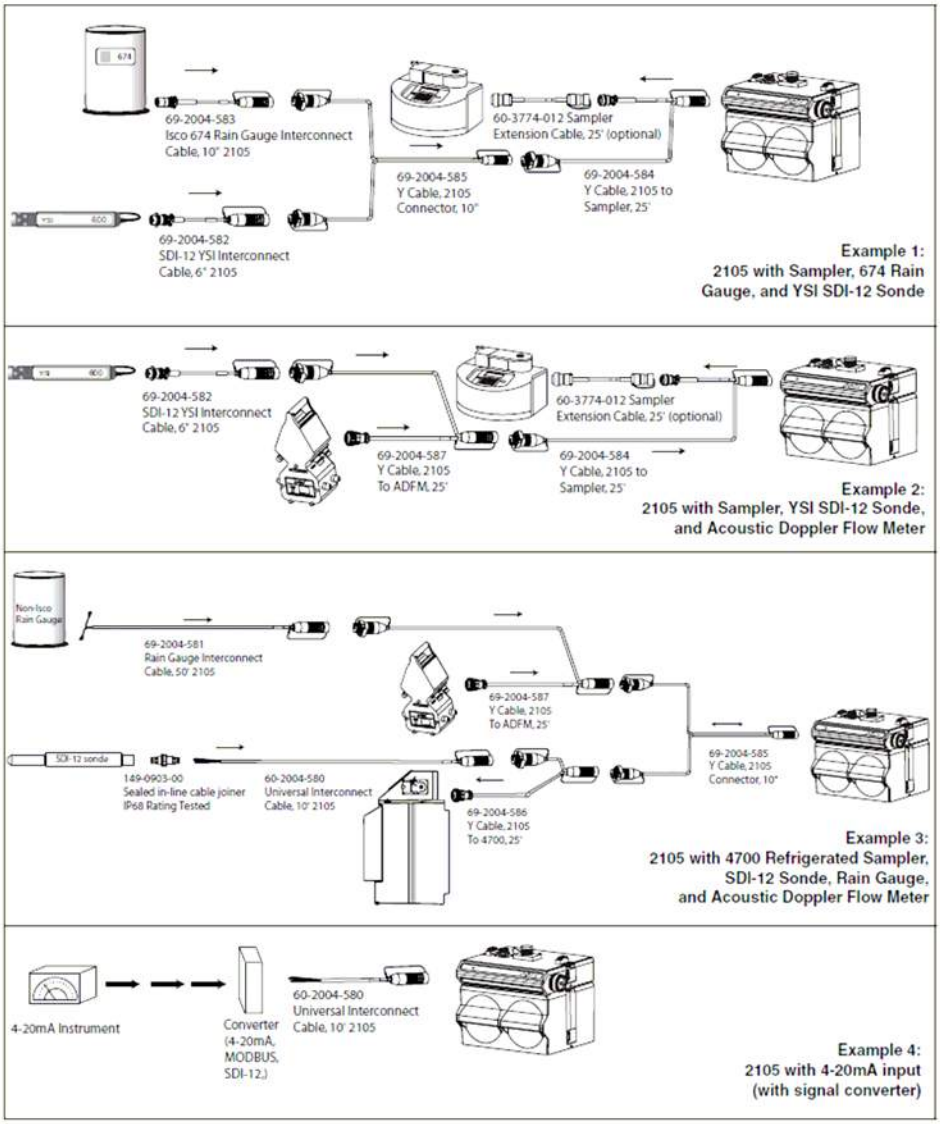
69-2004-585
Y Cable, 2105
Connector, 10"

69-2004-586
Y Cable, 2105
To 4700, 25'



69-2004-587
Y Cable, 2105
To ADFM, 25'

2105 Configuration Examples

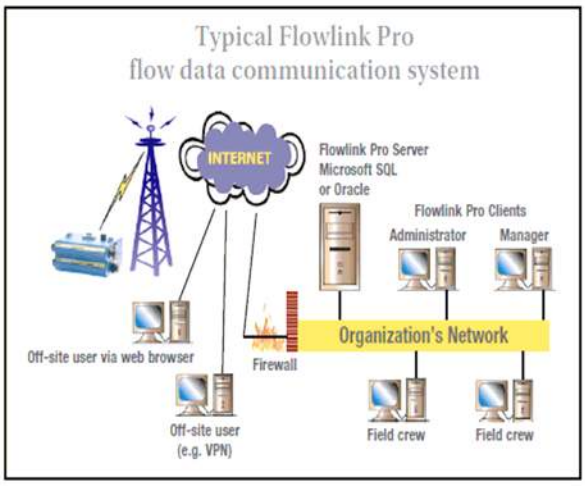


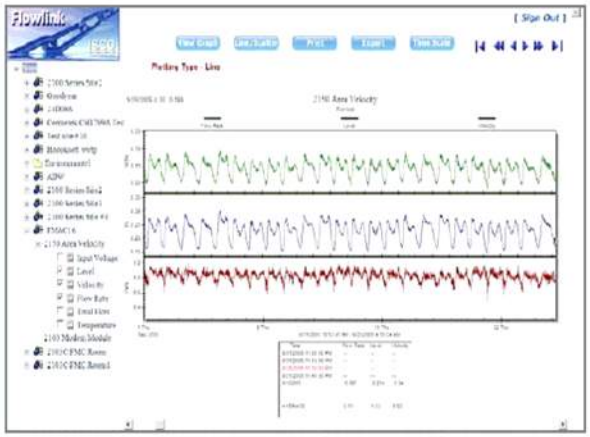
Isco Flowlink® Pro Software

Flowlink Pro is a server/client package for municipalities and service providers who manage multi-site wastewater flow monitoring networks.

In addition to providing the advanced analytical and site management tools of Isco's Flowlink 5 Software, Flowlink Pro meets large-enterprise needs for information delivery, database connectivity, and web-based data access.

- **Data push**
  Instruments deployed at each monitoring site can push packet-switched data to the server at any time via 1xRTT protocol. Data transmission speeds of up to 144 Kbps dramatically reduce communication costs compared to site-by-site dial-up interrogation.
- **Database connectivity**
  Flowlink Pro offers straightforward, seamless data exchange with centralized Oracle® and Microsoft® SQL databases. Database size is limited only by the server storage capacity, and concurrent access by multiple users is supported.
- **Web access**
  Flow data are available via the web for flexible multi-user access. Web access can be configured on either a local or third-party hosted server to meet user requirements.





Browser-based access makes it easy to view your data from anywhere.

Call today, or visit www.isco.com/flowlink for more information.

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USA & Canada: (800) 228-4373
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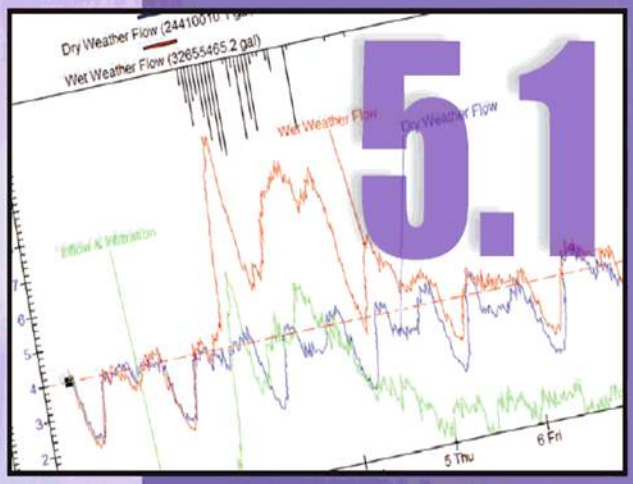
Internet: www.isco.com

ISCO

Flowlink®



5.1

The software solution to complete your flow monitoring program

Flowlink 5.1 software is the central point of your flow data management program. With this software you can:

- **Configure Isco equipment on-site for operation and data logging**
- **Retrieve data from on-site equipment**
- **Prepare graphical and tabular reports of flow monitoring data**
- **Perform advanced analysis for stormwater, WWTP, and collection system studies**
- **Archive data for your organization's retention plan**
- **Automate repetitive tasks**

Overview and Benefits

For the Office and the Field

Teledyne Isco designed Flowlink 5.1 software for the desktop computer in the office and for notebook computers in the field. Flowlink software assists technicians in the field with instrument configuration, equipment maintenance, and data collection. Keyboard shortcuts simplify common on-site tasks — F11 (quick connect), F8 (retrieve data), F7 (disconnect). The F3 (Quick Graph) shortcut displays a graph for a quick assessment of site conditions.

Back at the office, Flowlink 5.1 software aggregates the flow data for reports, analysis, and archiving. When on-site instrumentation is equipped with communication modules, Flowlink software at the office can eliminate many site visits by remotely connecting with the site to collect data, monitor battery levels, and evaluate channel conditions.

One Easy Application

Maintaining complex flow monitoring projects need not be difficult or scattered among several computer applications. Sites and their data, as well as graphs, tables and automated schedules, all appear in Flowlink software's workspace. The workspace gives you quick access to all of your flow data resources in a consistent, easy-to-use window. The software includes powerful graphing and data analysis tools — no longer will you need to export data to spreadsheets or write macros.

With Flowlink 5.1 software, you can reuse many elements to save time and simplify your work. For example, you can use a graph of one site's data as a graph template for all other sites, or apply defined flow conversion settings from one device to others. Wizards guide you through instrument changes at monitoring sites. Automated schedules handle your repetitive tasks.

The Flowlink Family

Teledyne Isco offers a family of Flowlink software products.

Flowlink LE is a basic edition for simple tasks such as instrument configuration, data retrieval, and data exporting. This software produces pre-defined graphs and tables that contain a single type data such as level or velocity, for a quick assessment of site conditions.
[Request Isco product data sheet L-2129]

Flowlink 5.1 software is a full-featured version for small and large flow monitoring projects. In addition to the features of Flowlink LE, Flowlink 5.1 generates user-customized graphs and tables containing many data types with statistical analysis. The Flowlink 5.1 database can be accessed by a single user at a time.

Flowlink Pro is an enterprise version that includes the features of Flowlink 5.1 and supports multiple users with differing roles. This server/client configuration accepts "pushed data" from sites equipped with Isco communication modules via the Internet for hands-off data collection. It also includes advanced server-based alarm notifications. Non-Flowlink users can view Flowlink Pro data in a Web browser, any time, any place.
[Request Isco product data sheet L-2132]

Communications & Data Acquisition

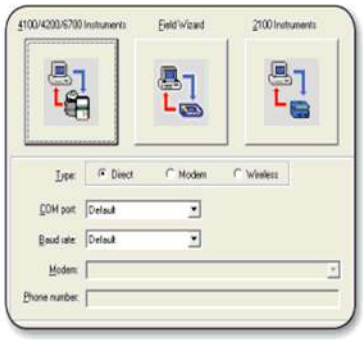
Site Communication

Flowlink software communicates with site instruments to configure the operation and data logging, and to retrieve data. Communication options rely your computer's capabilities and site hardware, and generally may include:

- Direct connections via a cable to your computer's USB or serial port
- Computer modem to site modem via land-line telephone service
- Computer modem to site CDMA or GSM modem via cellular telephone service
- Unlicensed spread-spectrum radio communication using base and remote 2102 Wireless Communication modules.

Direct wired connections

Telephone Modem, Cellular Modem, and Spread-spectrum Radio

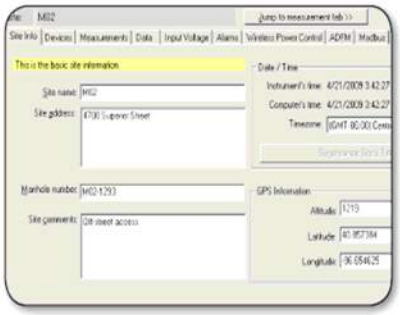


Data Collection Alternatives

Site data may be also be retrieved using an intermediate device such as the 2101 Field Wizard module or the 581 Rapid Transfer Device (RTD).

Options for Non-Isco Data: Isco's 2105 Network Interface module conveniently collects data from non-Isco instruments at the site and stores it alongside Isco data until retrieved by Flowlink 5.1 software. This interface module accepts SDI-12, Modbus, and 4-20 mA (via a third-party Modbus converter).

Flowlink 5.1 software can also import CSV files containing non-Isco data.



Site Configuration

For compatible devices, Flowlink 5.1 software exposes the device's configuration, allowing you to program its operation. If the site is a stack of Isco 2100 series modules, you can configure all of the devices through a single Flowlink connection.

Flowlink can configure SMS and TAP messaging so that on-site equipment monitors the conditions and deliver alarm notifications as needed.

Compatible Devices

- 2100 Series flow, interface, and communication modules
- 4100 Series flow loggers
- 4200 Series flow meters
- 67x logging rain gauges
- ADFM velocity-profiling flow meters
- 6700/Avalanche Series samplers
- 700 Series modules
- Isco-ready sondes connected to 6700 or 4200 devices
- SDI-12 devices connected to a 6712 sampler or 2105 interface module

Graphs and Reporting

Applications

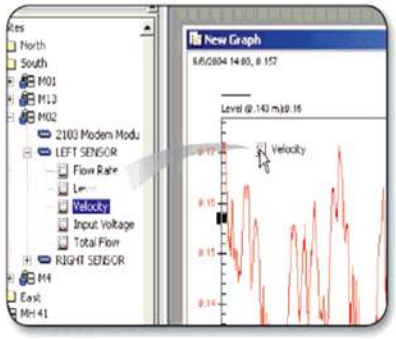
From the collected site data, Flowlink 5.1 software can prepare graphs and tabular reports for many water monitoring projects:

- WWTP influent and effluent
- Custody transfer and billing
- Scatter plots to evaluate channel conditions

Flowlink software also includes statistical functions to produce graphs and reports for advanced studies such as:

- Capacity assessment
- Inflow and infiltration
- Wet vs. dry weather comparisons
- Storm events

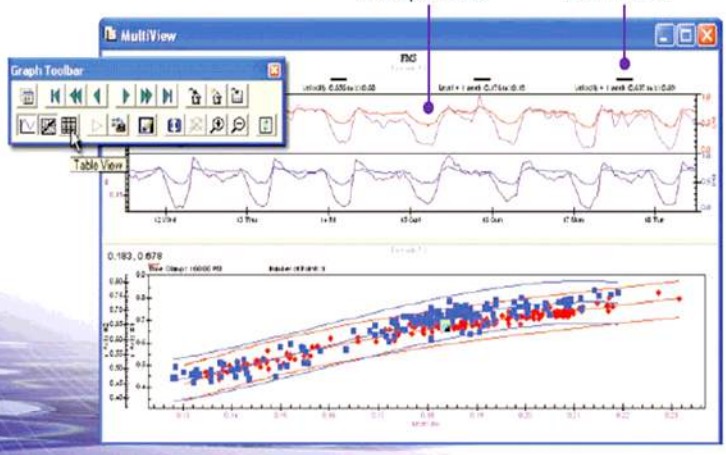
■ Start a graph by double-clicking on your data. Drag-and-drop additional data to see even more.



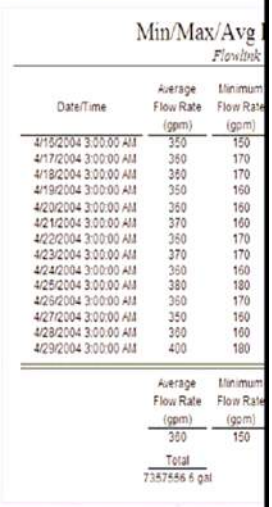
■ Graph, scatter plot, and table views — display one, two, or all at the same time with the click of a button!

Use series formulas to know the relation between sites or parameters.

Compare data from multiple sites (shown), calculated flows, and reference curves.



■ Generating summary data tables can be as easy as dragging and dropping a site onto a table template.



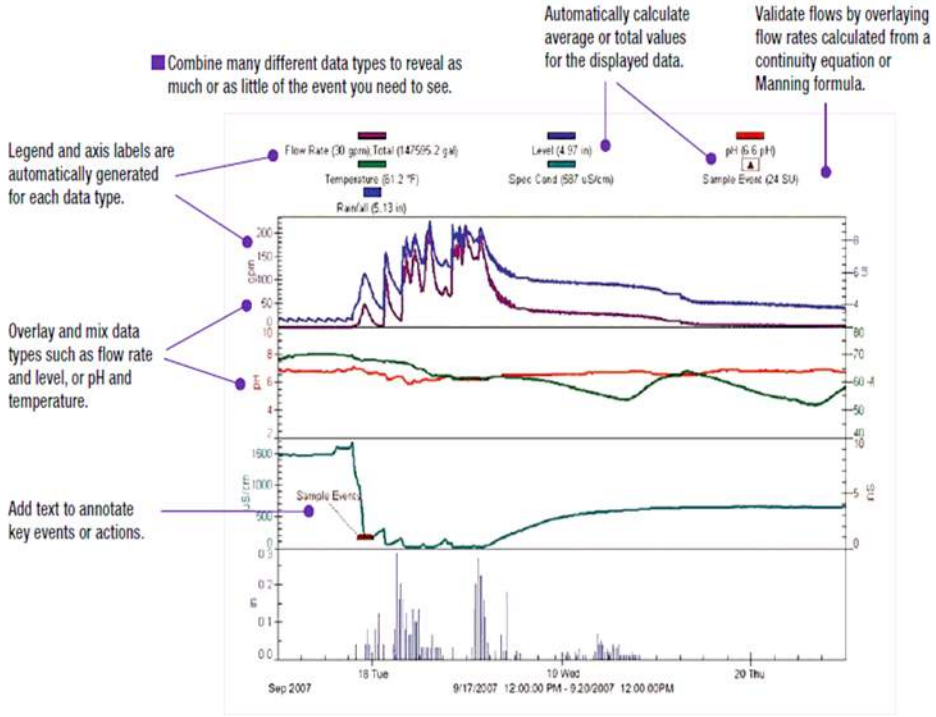
Min/Max/Avg

Flowlink

Date/Time	Average Flow Rate (gpm)	Minimum Flow Rate (gpm)
4/16/2004 3:00:00 AM	350	150
4/17/2004 3:00:00 AM	360	170
4/18/2004 3:00:00 AM	360	170
4/19/2004 3:00:00 AM	350	160
4/20/2004 3:00:00 AM	360	160
4/21/2004 3:00:00 AM	370	160
4/22/2004 3:00:00 AM	360	170
4/23/2004 3:00:00 AM	370	170
4/24/2004 3:00:00 AM	360	160
4/25/2004 3:00:00 AM	380	180
4/26/2004 3:00:00 AM	360	170
4/27/2004 3:00:00 AM	350	160
4/28/2004 3:00:00 AM	300	160
4/29/2004 3:00:00 AM	400	180

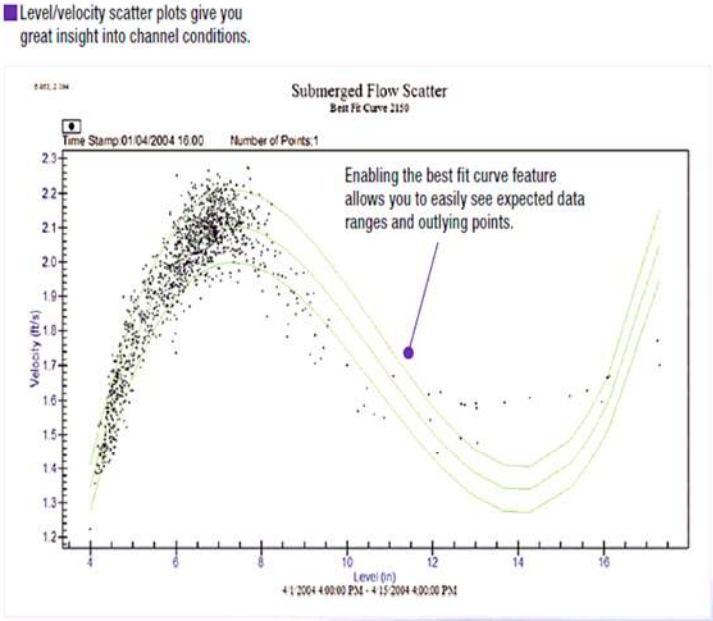
Average Flow Rate (gpm)	Minimum Flow Rate (gpm)
360	150

Total
7357556.6 gal



Time of Minimum Flow Rate	Maximum Flow Rate (gpm)	Time of Maximum Flow Rate
3:30:00 AM	480	7:15:00 AM
3:30:00 AM	500	9:00:00 AM
2:30:00 AM	510	8:45:00 PM
3:30:00 AM	510	6:00:00 PM
3:45:00 AM	510	8:00:00 PM
3:00:00 AM	500	9:00:00 PM
3:00:00 AM	500	8:15:00 PM
2:30:00 AM	480	7:30:00 PM
4:00:00 AM	500	9:15:00 AM
4:00:00 AM	490	10:15:00 AM
2:45:00 AM	510	8:00:00 PM
3:00:00 AM	490	6:45:00 PM
3:30:00 AM	490	9:15:00 PM
3:15:00 AM	640	12:15:00 AM

Time of Minimum Flow Rate	Maximum Flow Rate (gpm)	Time of Maximum Flow Rate
4/15/2004 3:30:00 AM	640	4/30/2004 12:15:00 AM



Appendice E: List of previously submitted Interim Reports:

The following interim reports were previously submitted and are available.

Culvert Visit Reports: (using original title names when submitted).

1. Culvert visit May 20th 2014
2. Culvert Visit 26th May
3. Blackpool report June 21st
4. Culvert visit 27th June
5. Blackpool entry 11th July
6. Culvert visit 31st July
7. Culvert Visit 27th Aug 2014
8. Culvert Visit 24th September
9. Culvert Visit 9th October
10. Culvert Visit 16th Nov,9th Dec,22nd Dec,19th Jan,26th Jan
11. Culvert Data Analyses and Rain event report Nov Dec Jan

Rain Event Reports:

1. Rain event 25th April
2. Rain event 19th July
3. Rain event 1st August – Laser v 2150 FM1 only
4. Major Rain Event 13th and 14th November
5. Rain Event 21st November
6. Rain Event 14th January 2015

water technology limited

Directors:
J.P. Mackey, B.Sc, HDE
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Telephone 021-4965600
Fax 021-4965618

Togher Industrial Estate, Cork Ireland.

Culvert Entry 20th May 2013 Report

Entry Team.

1. Liam O Riain.
2. Martin Dunne.
3. Denis O Connell.
4. Sean O Riordan.

Reasons for Entry.

1. Implement new safety plan with emphasis on communications and rescue plan.
2. Replace all battery supplies at FM 1, FM 2 & FM 4
3. Clean probes of debris.
4. Set up the low level probe for the ADFM
5. Replace power source for ADFM from 6V batteries to 12V deep discharge battery
6. Align the correct times on all the flow monitors
7. Check water levels and change as required to the correct water level
8. Take pictures of probes in situ

Note: No works scheduled at FM 2 until further notice.

ADFM.

The ADFM probe was badly fouled with ragging and vegetation. This was cleaned off.
The bolt connecting the probe to the culvert floor had broken and we rebolted the bar onto the floor to secure properly.
The ADFM low level probe was attached to the bar approximately .3m away from the ADFM blue probe.
The ADFM was connected up to a 12V battery supply. We were unable to log on to the equipment but it is pushing 2 x level data sources to the website as expected and is working satisfactorily.

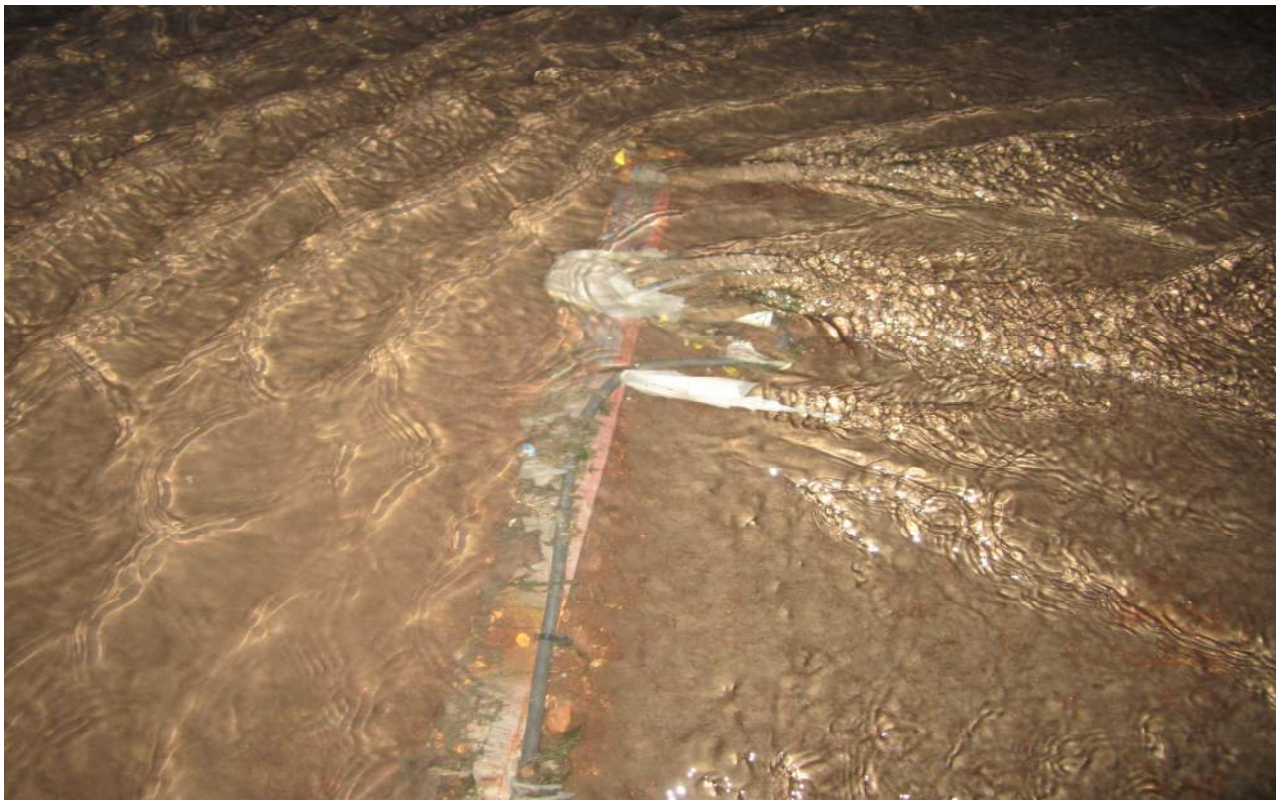
FM 1 probe.

The probe was fouled with ragging and was cleaned up and calibrated.
The battery supply was replaced.
The time was changed to daylight savings time.
The level was calibrated to .13m corresponding to water level and is now back pushing to the website.

FM 2 probe.

No work has been done on FM 2 on this visit until a decision has been made regarding outputs required for this site.

FM 3 probe.



The probe was partially fouled with ragging and was cleaned up and calibrated.
The battery supply was replaced.
The time was changed to daylight savings time.
The level was calibrated from .03m to .055m corresponding to water level.

FM 4 probe.

The probe was fouled with ragging and vegetation and was cleaned up and calibrated. A large branch had gotten entangled in the area velocity probe causing it to partially become disengaged from the bar, flipping it backwards and giving erroneous data. The probe was reattached and is working satisfactorily again.
The battery supply was replaced.
The time was changed to daylight savings time.
The level was calibrated from .205m to .13m corresponding to water level.

water technology limited

Directors:
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Telephone 021-4965600
Fax 021-4965618

Togher Industrial Estate, Cork Ireland.

Culvert Entry 26th May 2013 Report

Entry Team.

1. Liam O' Riain.
2. Martin Dunne.
3. Denis O' Connell.
4. Paul O' Dwyer.

Reasons for Entry.

1. Move FM 2 (brewery) back up towards the H junction.
2. Stack FM 2 module at manhole location.
3. Replace area velocity probes for all 4 flow monitor locations.
4. Clean probes of debris.
5. Check levels for all sites and record.
6. Replace battery and correct the time on level monitor 1.01
7. Take pictures of probes in situ.

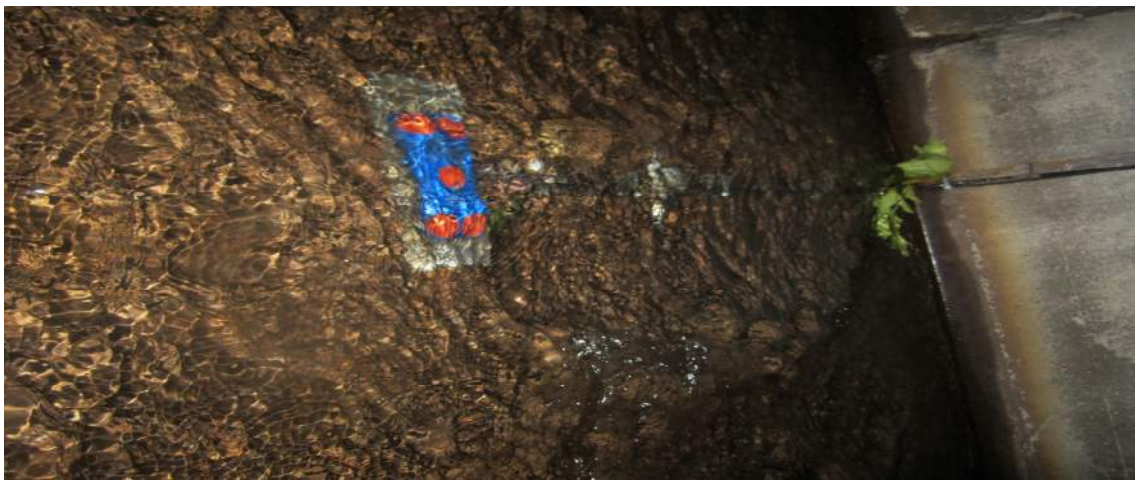
New website format.

Due to FM 2 being moved to the "H" location, the 2150 module is not stacked and powered at the same location as FM1, level monitor and ADFM. The unique Flow Monitor 2 site is now redundant. For purposes of clarity, the sites are presented below as represented on the website.

Go to drop down menu for **Flow Monitor 1**

- 2150 Area Velocity …… This is FM 1
- 2110 Ultrasonic Module…… This is the level monitor at the "H".
- ADFM…….. ADFM
- 2150 Area Velocity……. This is FM 2

ADFM Probes.



The ADFM probes look clean with very little ragging and vegetation compared to the previous week. The area around the probes was inspected and cleaned as per schedule.

FM1 probe.

The probe was fouled with ragging and was cleaned up and calibrated.

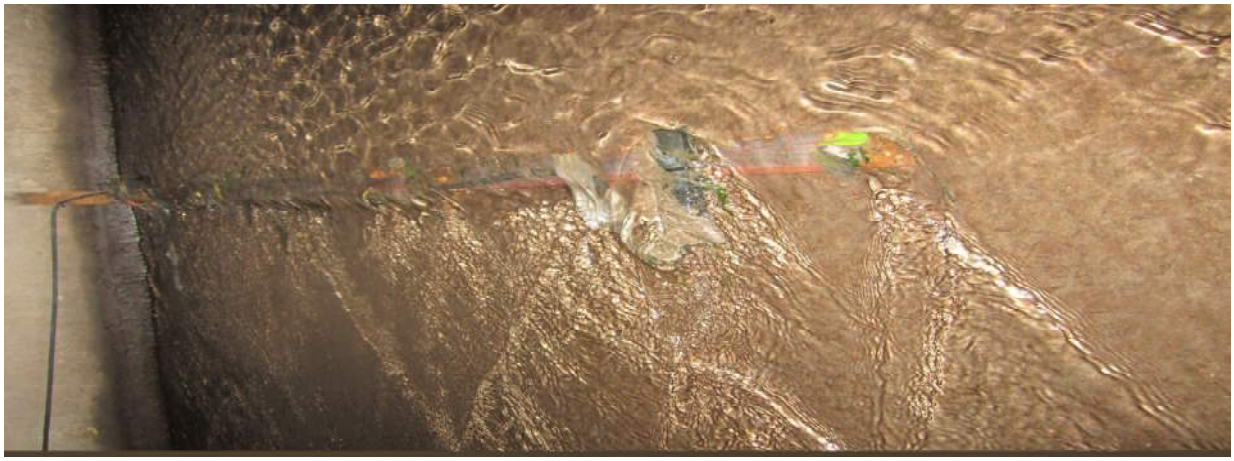
The level was calibrated to .11m corresponding to water level and is now back pushing to the website.

FM2 probe

The probe has been moved close to the H Junction at a location where the rectangular profile was available and the culvert surface was flat and even. Width at this location was recorded as 4.5m. The probe was secured onto the surface of the culvert and the area velocity cable was also secured closely to the wall of the culvert to prevent extraneous ragging and fouling of the flow meter.

No picture was taken due to oversight.

FM3 probe



The probe was slightly fouled with ragging and was cleaned up and calibrated.
The level was taken using a stick rule and was reading .035m which corresponded with the flow meter.

Note: levels are very low at this location and we are almost at the limit of what the flow meter can record accurately.

FM4 probe

The probe was slightly ragged and was subsequently cleaned and the level monitored.
The level was taken using a stick rule and was reading .035m which corresponded with the flow meter.

The level was calibrated from .205m to .10m corresponding to water level.

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Blackpool Flow Survey:

General Update 21st June 2014.

A report on the culvert entry on May 30th previously submitted by Liam o Riain outlined the following work was completed.

1/ AV probes were replaced at FM3 and FM4

2/ All batteries were replaced

3/ All times were synchronised to UTC.

4/ All probes were cleaned after significant fouling and levels were re-calibrated

5/ photographs taken

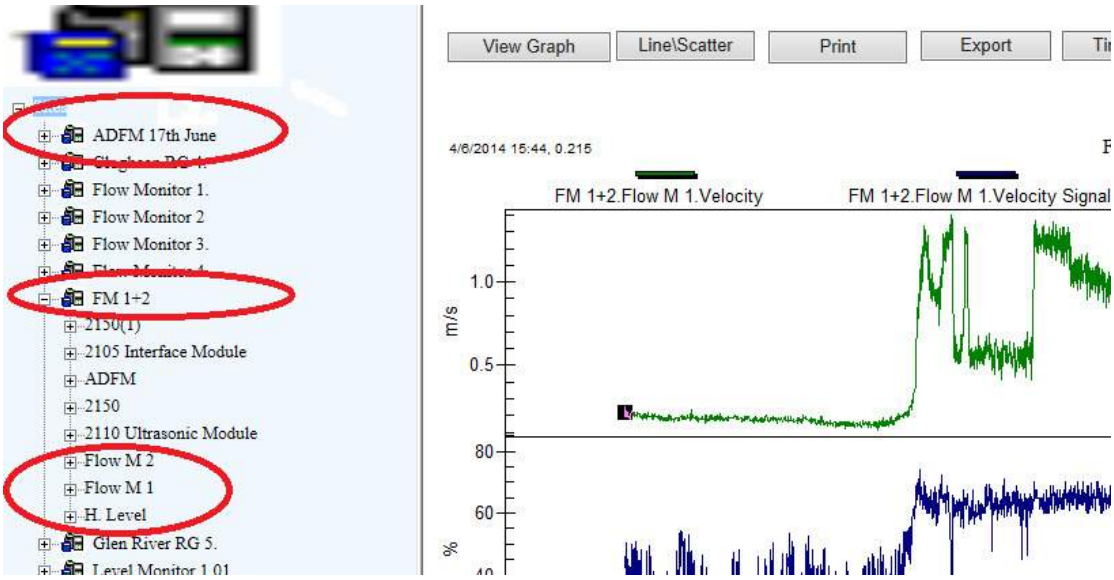
6/ ADFM re-programmed after battery ran down. A secondary pressure sensor level probe was fitted which connects to the ADFM. This is primarily to provide levels at lower levels.

Further culvert entries were carried out on the 4th, 12th, and 19th of June.

Further work has included moving the FM2 site back up to near the H section on the 4th June. A new site known as FM1+2 was/ created which has combined the sites FM1 , FM2 and H level.

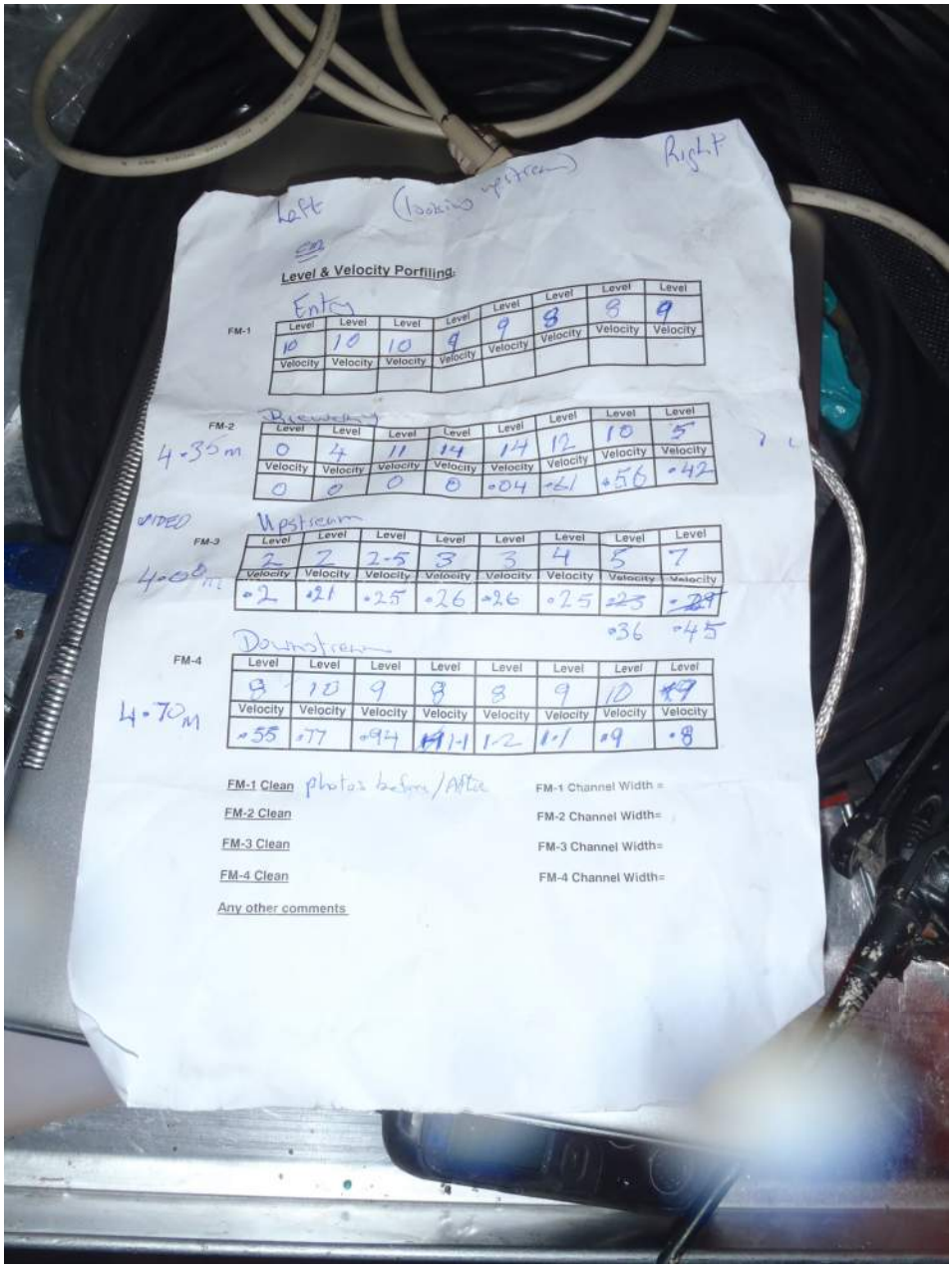
Going forward, data from FM1 and FM2 and level in H section can be found by clicking on + of site FM1+2 and selecting Flow M1, Flow M2 and H level as seen in screen shot below. There is now a new site for the ADFM called ADFM 17th June which is also highlighted in the screen below.

FM3, FM4, level monitor at Blackpool church and all rain gauges are still at original sites, namely; Flow Monitor 3, Flow Monitor 4, Level Monitor 1.01, Clogheen RG4, Glen River RG5, White Church RG1.



The ADFM was removed temporarily further to a problem were it had hung up and needed to be reset. It was removed on the 12th June and replaced on the 19th June.

On the 12th June level velocity profiling was carried out again at the 4 sites. A back-up AV logger was also fitted at FM4. there is some further work required to analyse this. We also plan to establish a new rating curve for FM2 based by repeating this exercise at different levels if possible.

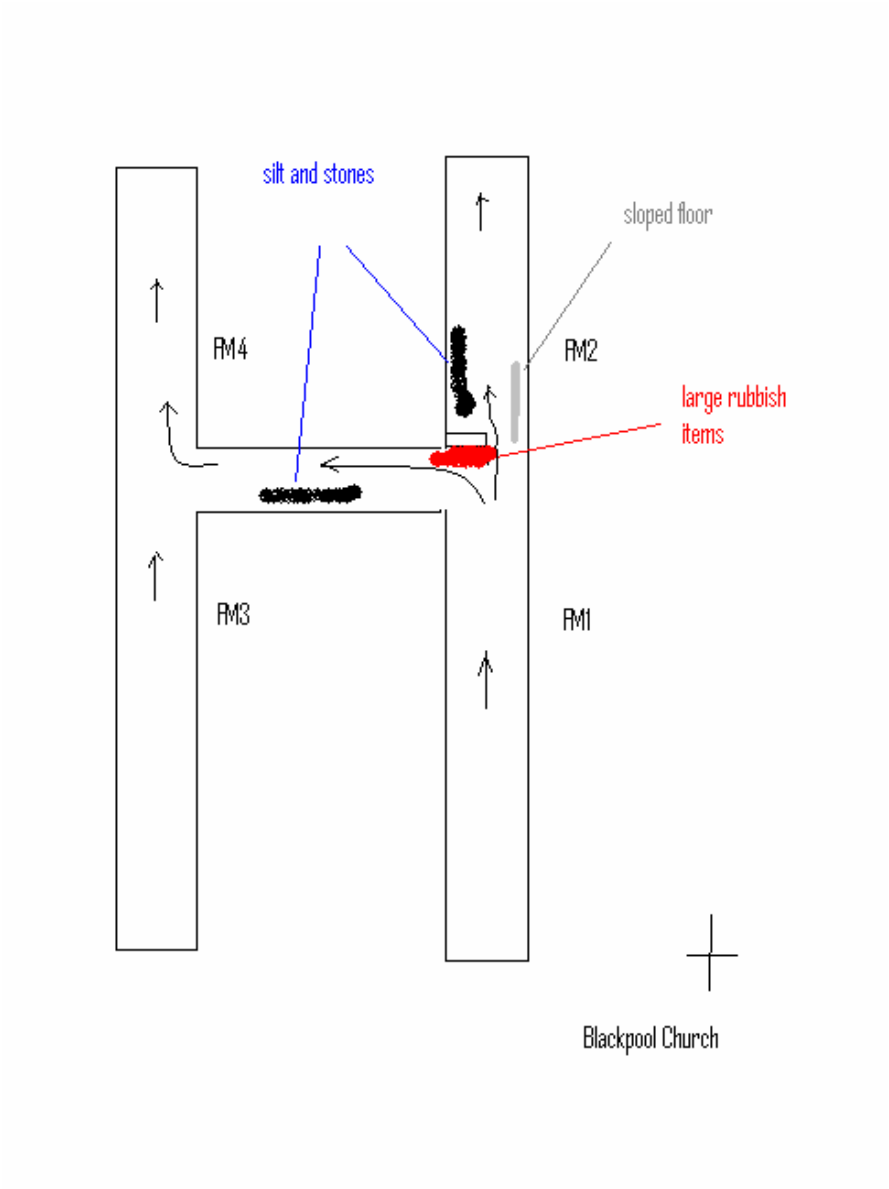

Left (looking upstream)
Right
Level & Velocity Profiling
Entry
FM-1
FM-2
4.30m
Upstream
FM-3
4.00m
Downstream
FM-4
4.70m
FM-1 Clean photos before/After
FM-2 Clean
FM-3 Clean
FM-4 Clean
Any other comments
FM-1 Channel Width =
FM-2 Channel Width=
FM-3 Channel Width=
FM-4 Channel Width=

Picture shows FM2 at the new location in the brewery line but near the H section.

General situation on debris, silt and stones

There is more or less the same amount of debris trapped at the concrete weir at the entrance to brewery line at H section, for the last few months, which can be seen in the photograph taken below, looking back up from the Brewery culvert towards the H section.

The level and silt and stones has not changed much in the last few months, there is an accumulation of 5 to 10 cm approx at sections of the H section and along the brewery line. In general FM1, FM3 and FM4 are free of debris. The diagram below indicates where the stones are gathering.



Fouling Issues:

There are ongoing issues with plastic and other debris catching on the probes and this is our main concern in relation to the getting accurate data especially during the rain events. Pictures shown in rain even below and its effect on the data illustrate this clearly.

Summary Report on Rainfall event Friday June 6th

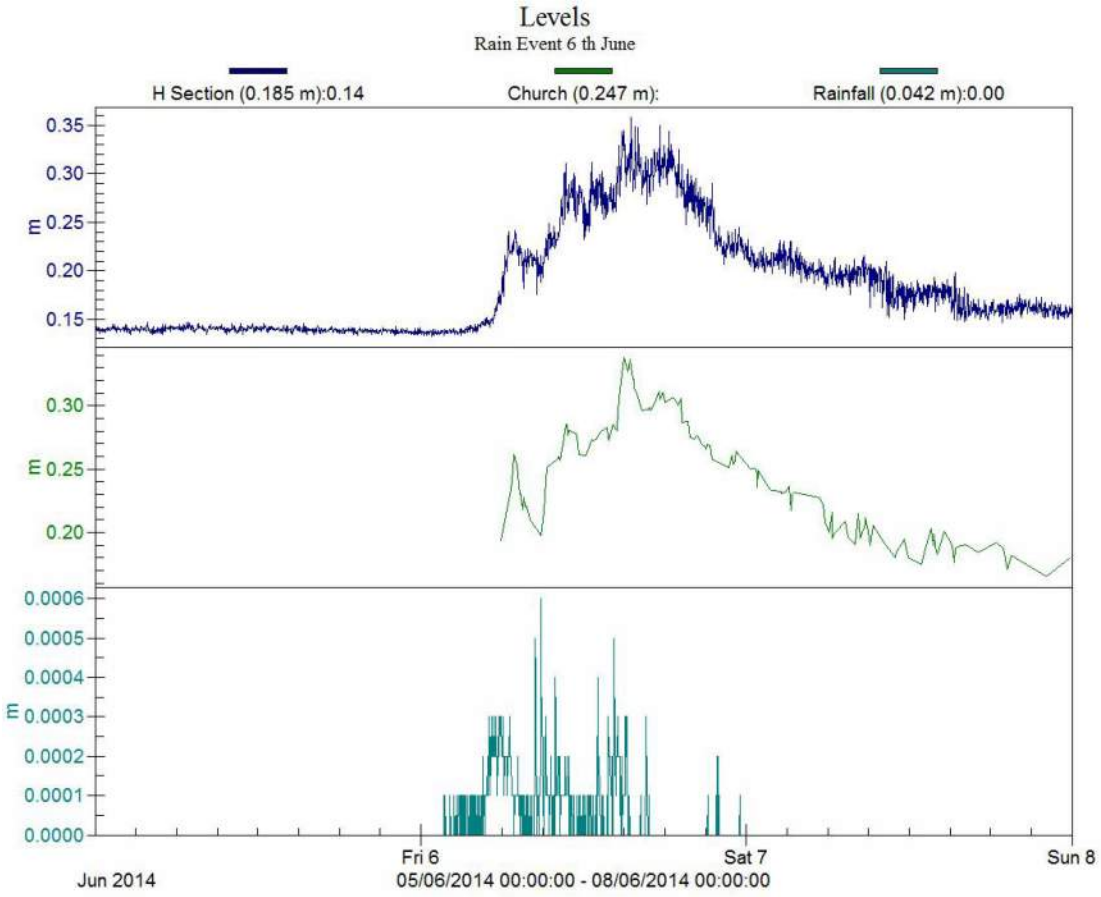
Significant rain fell on 6th June over most of the day with 41.9 mm recorded for the 24 hours on the gauge at Clogheen .

	Glen rainfall	Clogheen Rainfall	White Church Rain
Date and Time	mm	mm	mm
06/06/2014 00:00	0	0	0
06/06/2014 01:00	0.1	0.2	0
06/06/2014 02:00	0.3	0.9	0.2
06/06/2014 03:00	0.6	1.2	0.4
06/06/2014 04:00	1.2	2.1	0.6
06/06/2014 05:00	4.6	6.7	3
06/06/2014 06:00	4.9	4.9	2.7
06/06/2014 07:00	1.5	1.8	0.7
06/06/2014 08:00	3.2	4.2	1
06/06/2014 09:00	3.3	3.5	2
06/06/2014 10:00	5.1	3.6	3
06/06/2014 11:00	1	0.9	1.3
06/06/2014 12:00	3.2	1.1	1.5
06/06/2014 13:00	1.2	2.9	0.9
06/06/2014 14:00	3.4	4.5	2.6
06/06/2014 15:00	1.7	1.7	0.9
06/06/2014 16:00	0.2	0.9	0.1
06/06/2014 17:00	0	0	0.1
06/06/2014 18:00	0	0	0
06/06/2014 19:00	0	0	0
06/06/2014 20:00	0	0	0
06/06/2014 21:00	0.1	0.7	0.1
06/06/2014 22:00	0.2	0	0.2
06/06/2014 23:00	0	0.1	0
Totals	**35.8**	**41.9**	**21.3**

Rainfall amounts were significantly higher than the previous rain event on the 25th May, which recorded as follows;

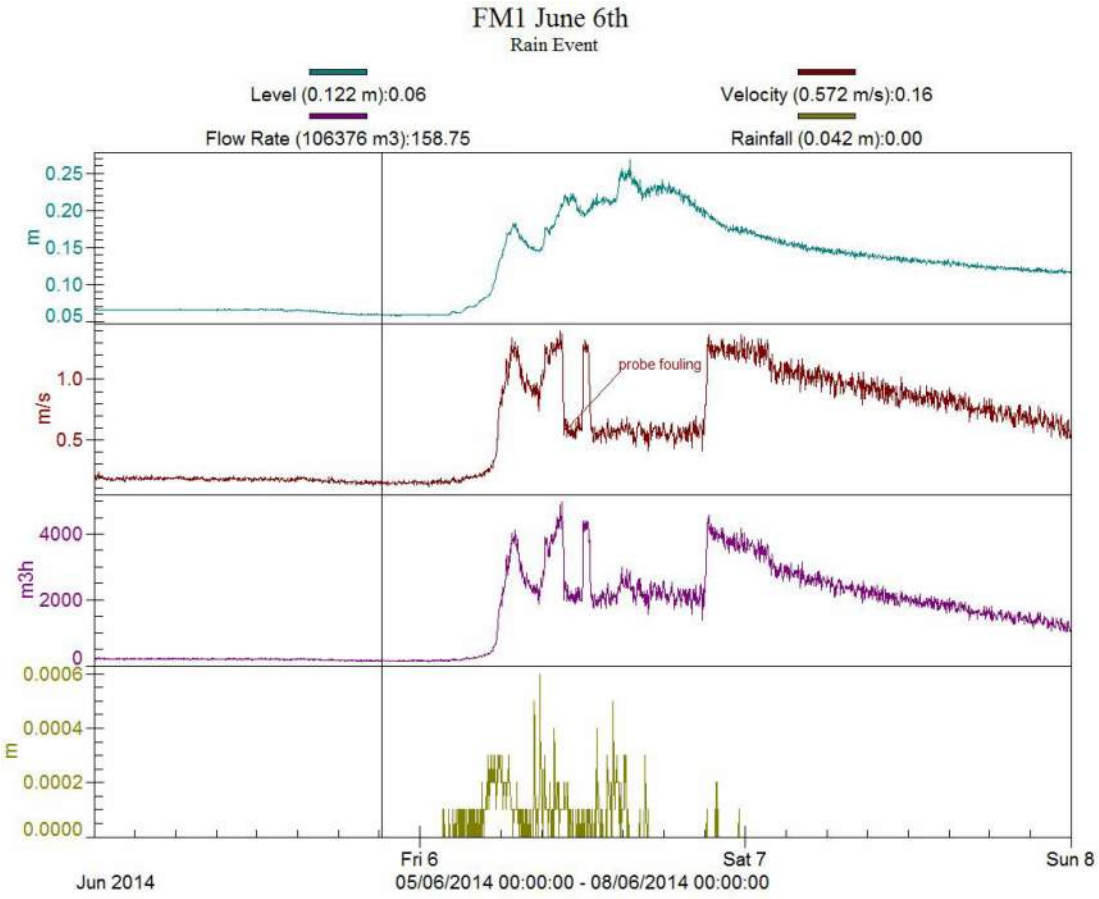
Totals	**19.3**	**13.7**	**24.1**

Levels recorded at Blackpool Church and in the H Section are seen in graph below. The level in H section was similar to levels recorded in May 25th event , however the level at Blackpool church was lower. It recorded a max level of 0.32 metres on the 6th June, but had a peak of 0.42 in May 25th. The level at the church is recording only during the rain event because the level prior to this is too low at the measuring point and the probe, which is near the side under the bridge, is picking up a signal from silt rather than water.



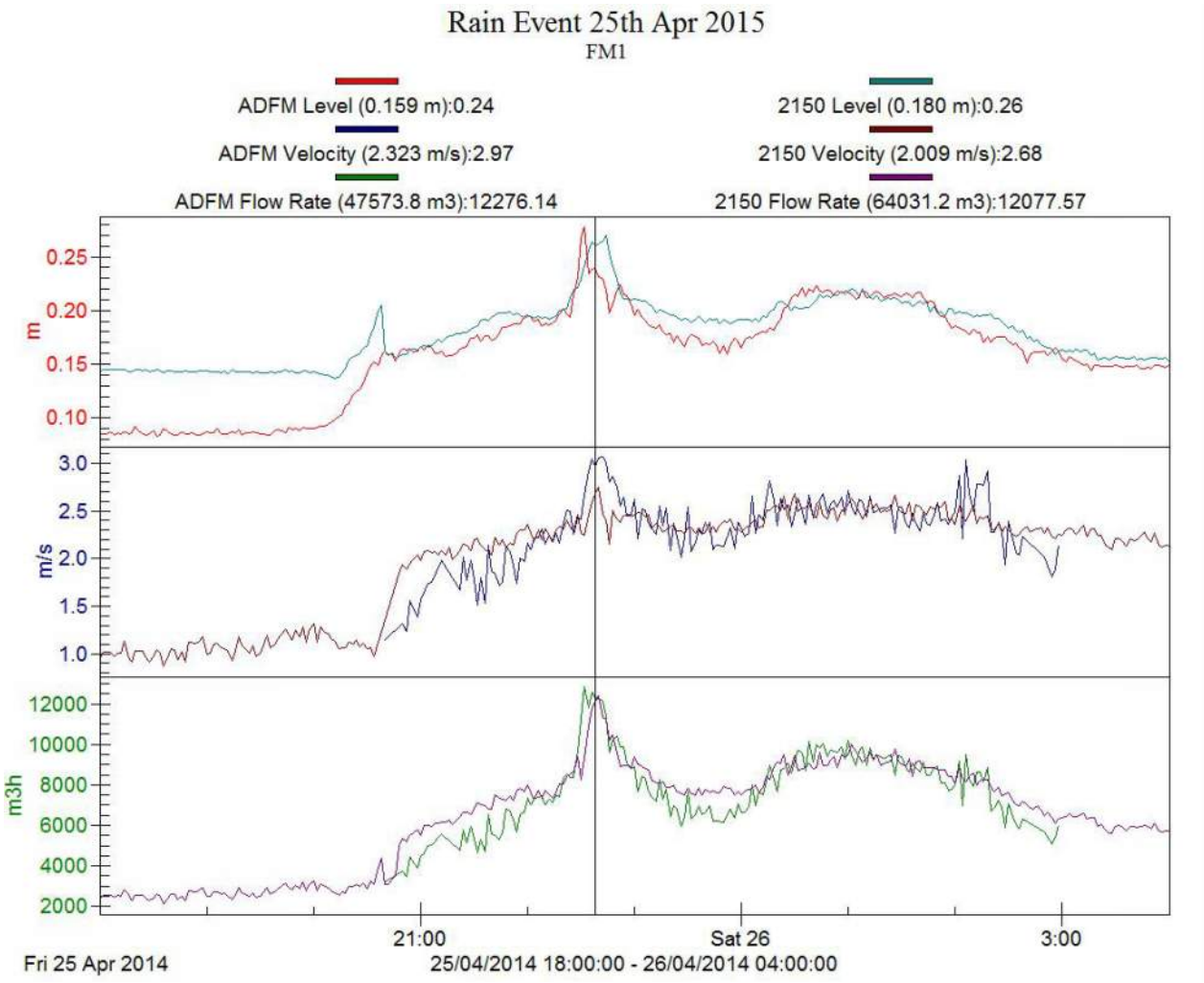
Fm1 during rain Event:

The graph below illustrates the step up in level and velocity during the rain event .



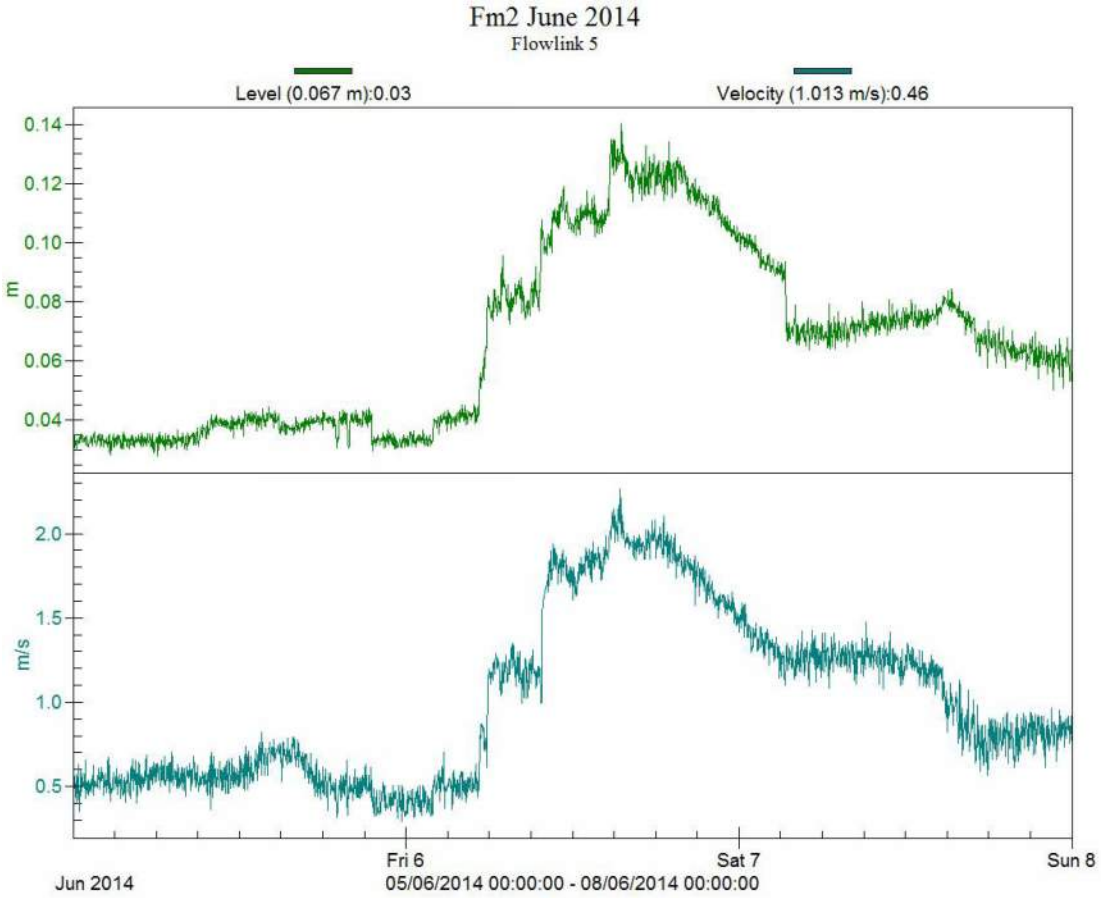
The level and velocity increased with rainfall as expected but it is assumed that the sudden drop in velocity is due to fouling where plastic and tissues are catching at the front of the probe. The following pictures shows the extend of the fouling on the next culvert entry after the rain event.

It is interesting to compare this to the rain event back in May 25th at FM1 as seen in then graph below. On that occasion the ADFM was logging during the event and compared well to the 2150, providing a good level of confidence in this set of data. A significant difference between the two rain events is that the baseline velocity recorded much lower prior to the event on this occasion as would be expected after the dry weather prior to the event. Thus, despite the higher rainfall the recorded flow rates are lower for the 6th June event.



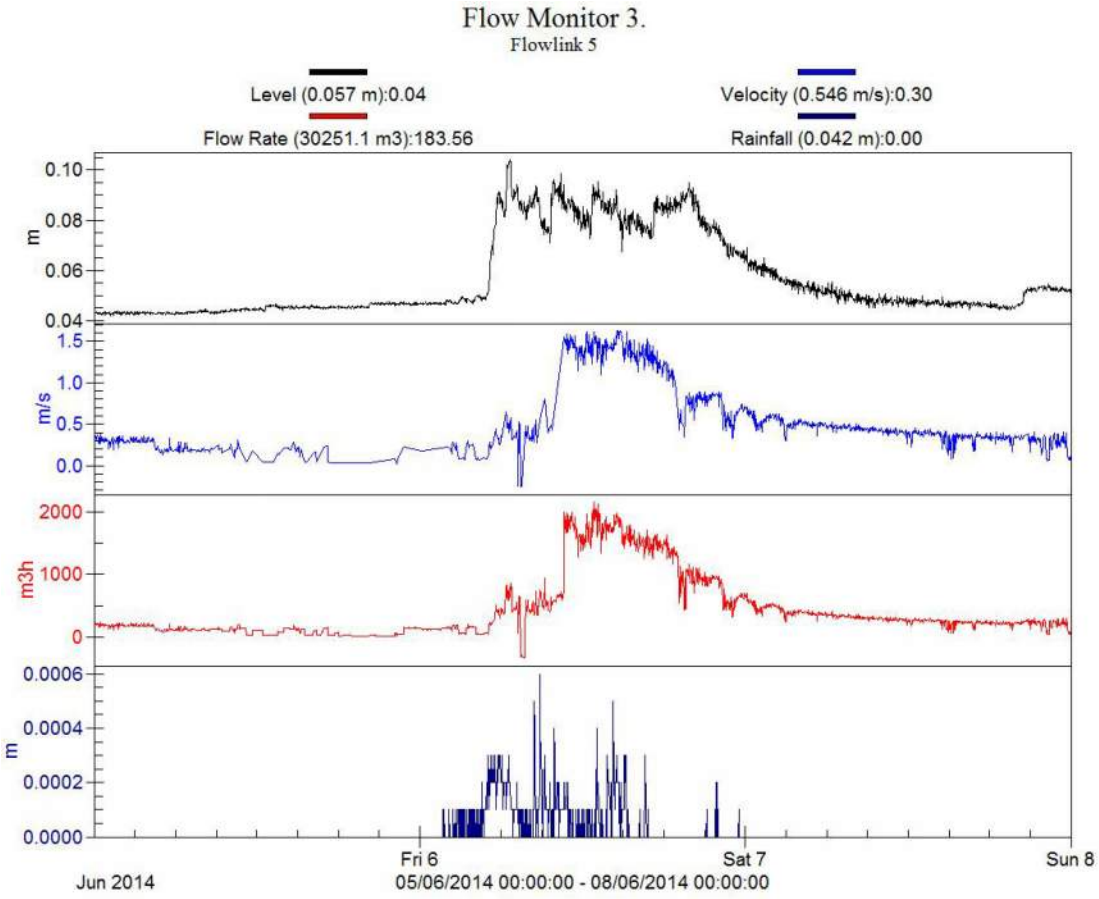
FM2- Brewery Channel:

The graph below shows the rain event level and velocities at FM2. This seems to have work well. We are working on generating a rating curve for flow by section profiling as the velocities are not evenly distributed in this channel.



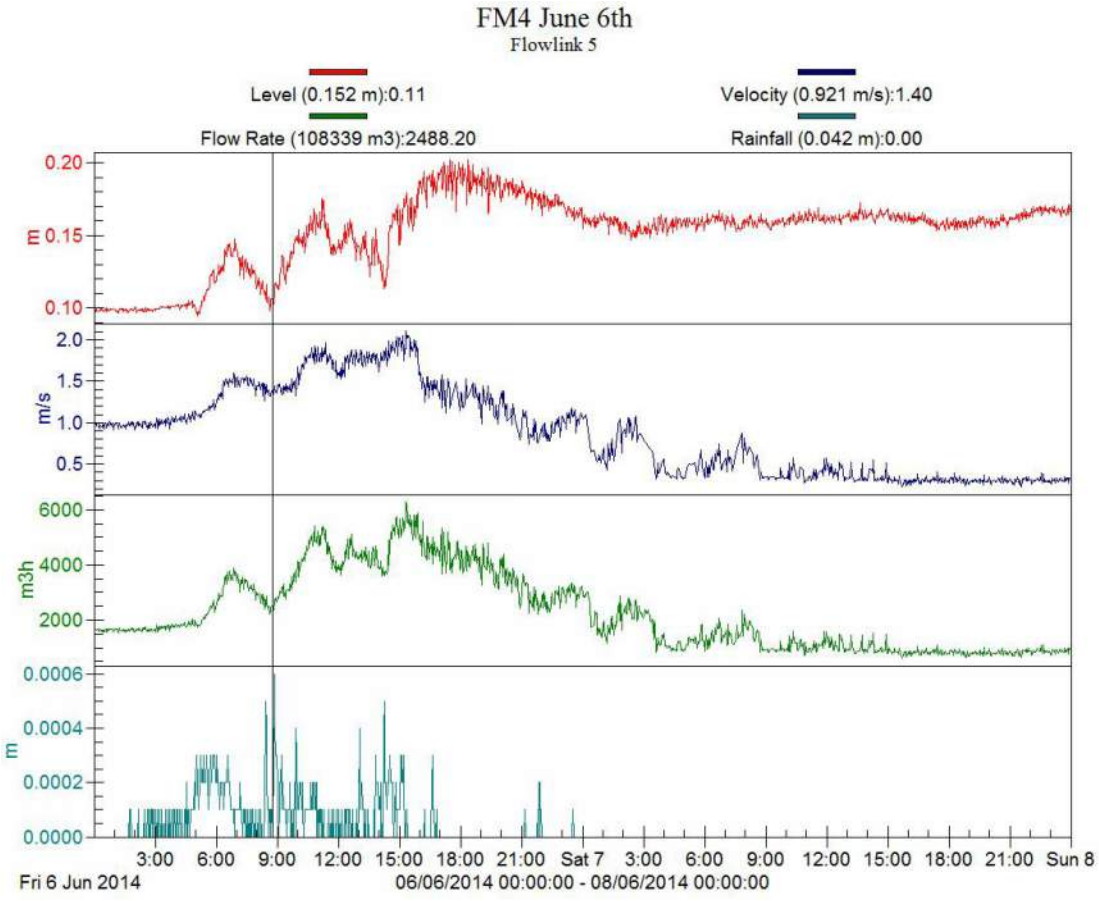
FM3- Upstream culvert N20:

The graph shows the rain event at FM3.

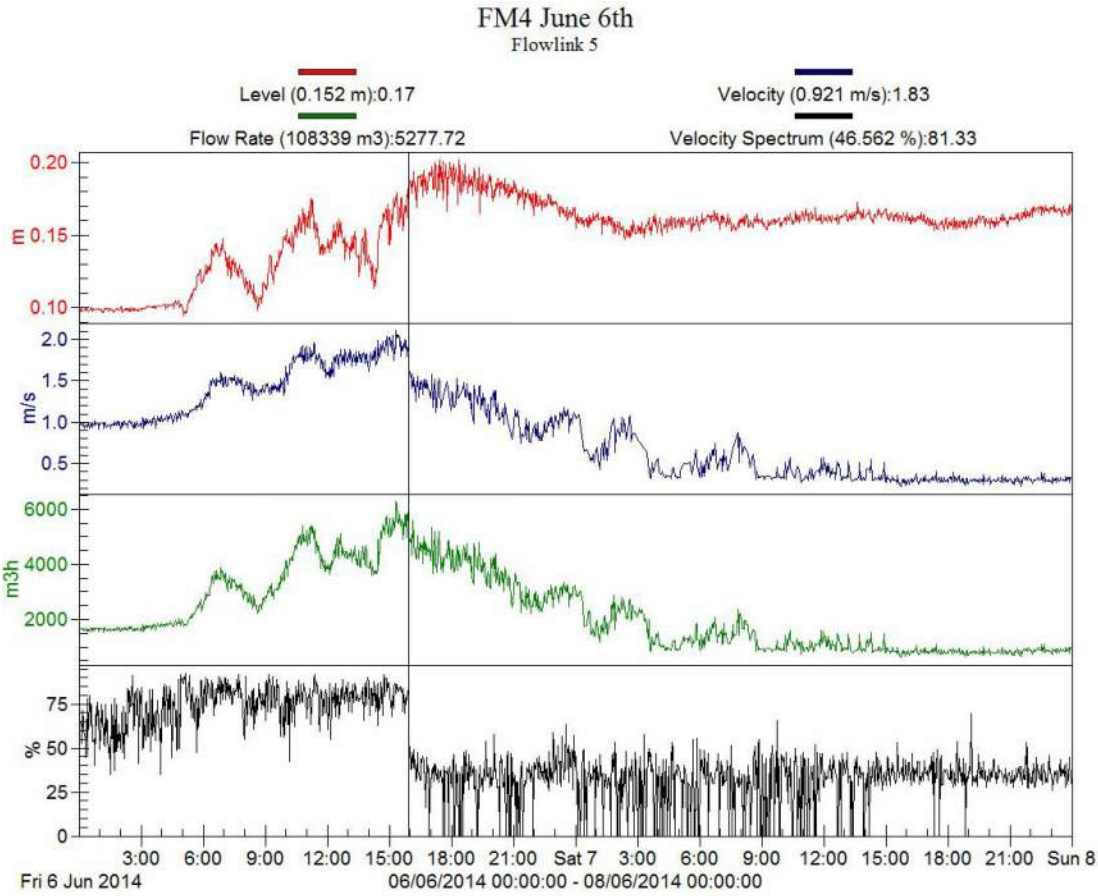


FM4 - Downstream culvert N20 :

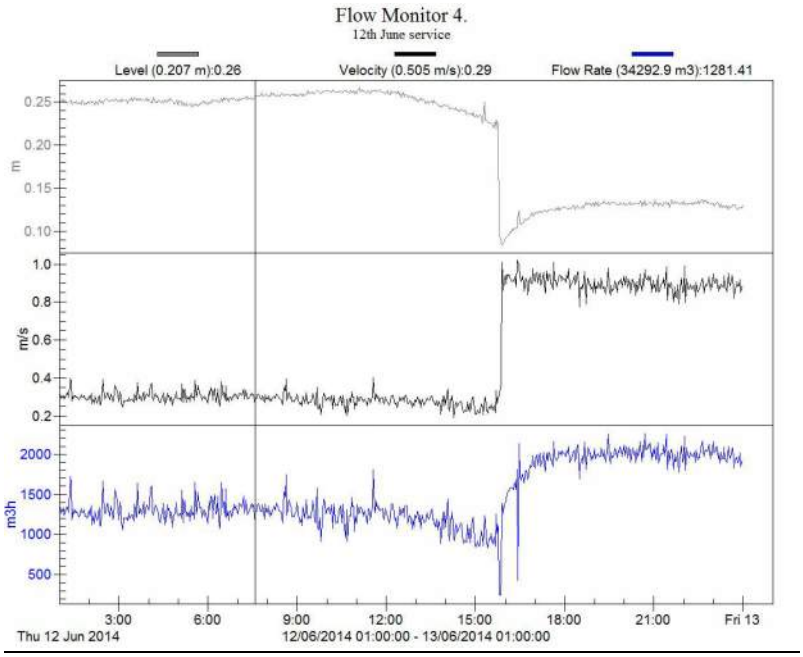
The event recorded at FM4 is seen in the graph below. We expect that at the peak of this event that the probe fouled resulting in an incorrect high level being maintained after the event.



The graph below shows the velocity spectrum on the lower pane which provides information as to when the probe may have fouled.



The graph below shows before and after cleaning of the probe at FM4 following the next culvert entry on 12th June.



this report was compiled by Finbarr O Riordan
Water Technology Limited
21st June 2014

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Togher Industrial Estate, Cork Ireland.

Culvert Entry Friday 11th July 2014

Team.

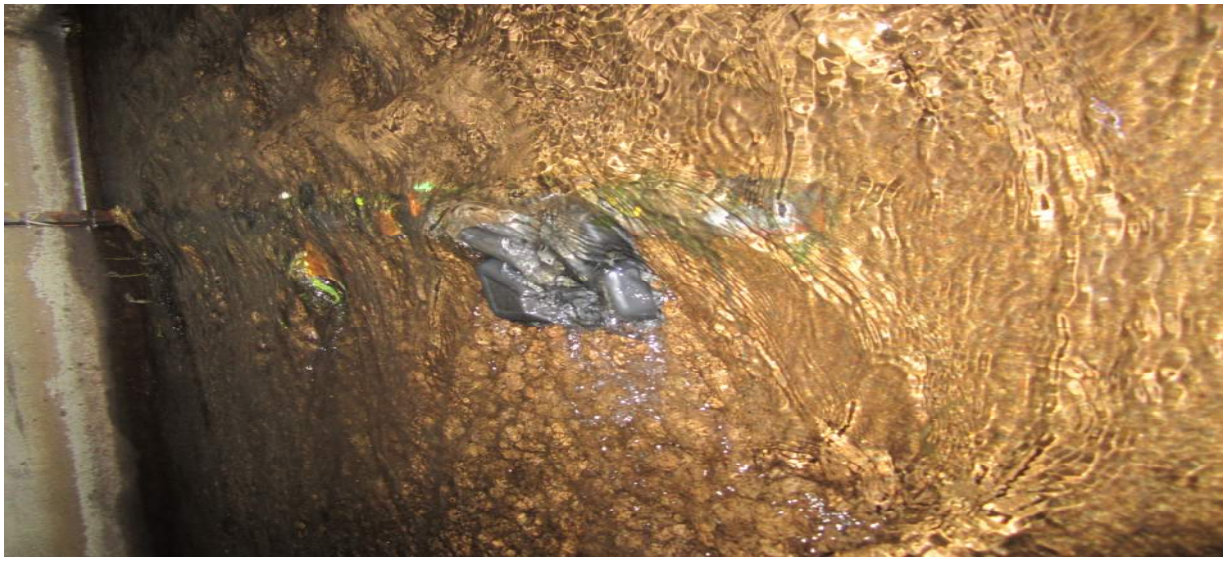
Liam O Riain
Dennis O Connell
Martin Dunne

Objectives.

1. Due to rubble removal at Blackpool church; the level probe needs moved.
2. Take pictures of the sites and any noticeable changed parameters
3. Clean the probes and check levels at probes.
4. Check voltages on all batteries.
5. Do ADFM checks for operation and data push.

See entry to culvert where the area has been completely cleared of rocks and rubble.

FM 1.



Time 11.15 Probe cleaned of debris after level measurement.
. FM 1. level reading taken with measuring stick was .09m

ADFM Probe.

Probe was relatively clean and free of debris.
ADFM level reading taken with the measuring stick was .08m

FM 2. Probe

There was very little flow at the probe as evidenced by the debris lodging on top of the metallic support structure in the picture. Levels are so low that there is probably only 10-20m3/hr going down FM 2 at present as shown in the picture below.
The level at the probe read .045m for the tiny flow.

Entry to FM 2 area.

Notice the dry area to the right of the entry and also at the ruler the level is about .02m so we are barely getting flow down the brewery culvert at the moment.
There is rubble buildup in front of where the ruler is located which would need to be moved at some stage.

H Area.

The “H” area showing the buildup of rubble which is more noticeable at the lower levels and will be cleared out shortly.

FM 3.

Level at the probe was .03m or slightly less.
The probe was slightly covered with debris and was cleaned with a brush.

FM 4.

Level at FM 4 was .08 prior to cleaning.
The probe did have some extraneous lodged on and around the probe which was cleaned.

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Togher Industrial Estate, Cork Ireland.

Culvert Entry 31 July Report

Entry Team.

1. Liam O' Riain.
2. Martin Dunne.
3. Denis O' Connell.
4. Finbarr O' Riordan.

Reasons for Entry.

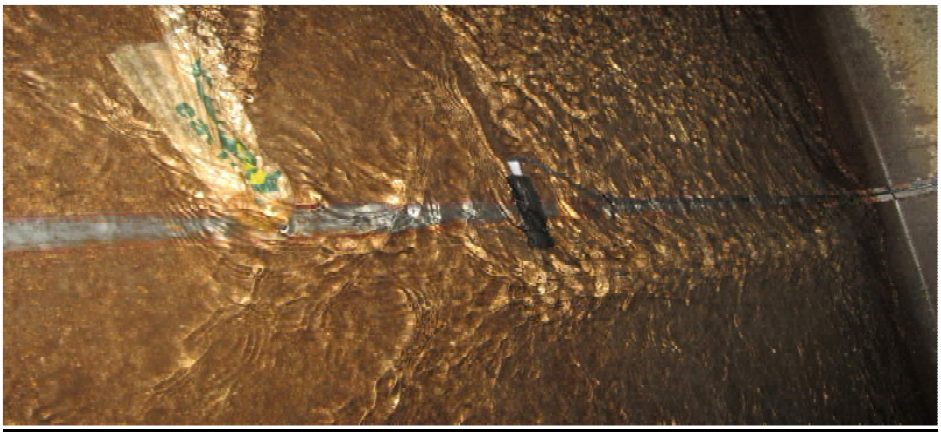
1. Remove the ADFM back to office for testing and review.
2. Install the new 2160 Laser Module and the LaserFlowMeter.
3. Check the parameters of the other flow meters and change if necessary.
4. Clean probes of debris.
5. Check levels for all sites and record.
6. Replace batteries if low voltage
7. Take pictures of probes in situ.

Laser FlowMeter.

The laser flow meter was mounted close to FM 1 on the roof of the culvert as shown in the picture below. Using ultrasonic technology for level measurement and velocity data measured by emitted laser light; the flow is calculated.
The spec sheet does provide more information on operation and technology used.

FM1 probe.

The area velocity probe was relatively clean on inspection. The level was checked and recalibrated slightly. Although it is the same location as the laser flowmeter; their actual levels are different which is recorded as per site specific level measurement.
Velocity data is falling off at low levels which can affect the daily total flow data. We may need to examine this more closely on the next entry.



FM2 probe

The flow at FM2 was non-existent as shown from the photograph on entry to the brewery culvert. We adjusted the level on the flow meter to more accurately reflect the actual flow data.

FM3 probe

The probe was slightly fouled with ragging and was cleaned up and calibrated.
The level at FM3 was lower than the actual profile of the area velocity probe at approximately 2 to 2.5cm. With flows at this very low level, we actually get more debris getting caught on the probe.
As it was found to be reading accurately both level and velocity data, there was no need to make any adjustments to the data.

FM4 probe

The flow meter and the probe were found to be working satisfactorily with no changes required. The equipment was cleaned and levels were confirmed.

Report completed by:

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Culvert Entry 26th August Report

Entry Team.

1. Liam O' Riain.
2. Paul O Dwyer.
3. Finbarr O' Riordan
4. Sean O Riordan (standby).

Reasons for Entry.

1. FM 1 velocity not accurate
2. change FM1 and laser to same level
3. Re-fix the ADFM probe to the floor of the culvert
4. Clean probes of debris.
5. Check levels for all sites and record.
6. Replace batteries if low voltage
7. Take pictures of probes in situ.

FM1 probe.

FM2 probe

there was no flow over the probe as can be seen by the sediment which is covered by approx .02m of water.
There was some water flow down the side of this culvert but still not very much.

Barrier at entry to FM 2 is in the process of being dismantled.

Area at juncthion of FM 1 and the manhole still needs debris and rocks removed.

Notice the trolly that is in the middle of the channel.
Also rocks and debris this needs moved.
Close up of the trolly

FM 3

FM4 probe

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Togher,
Cork.

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Culvert Entry 26th May 2013 Report

Entry Team.

1. Liam O' Riain.
2. Martin Dunne.
3. Denis O' Connell.
4. Paul O' Dwyer.

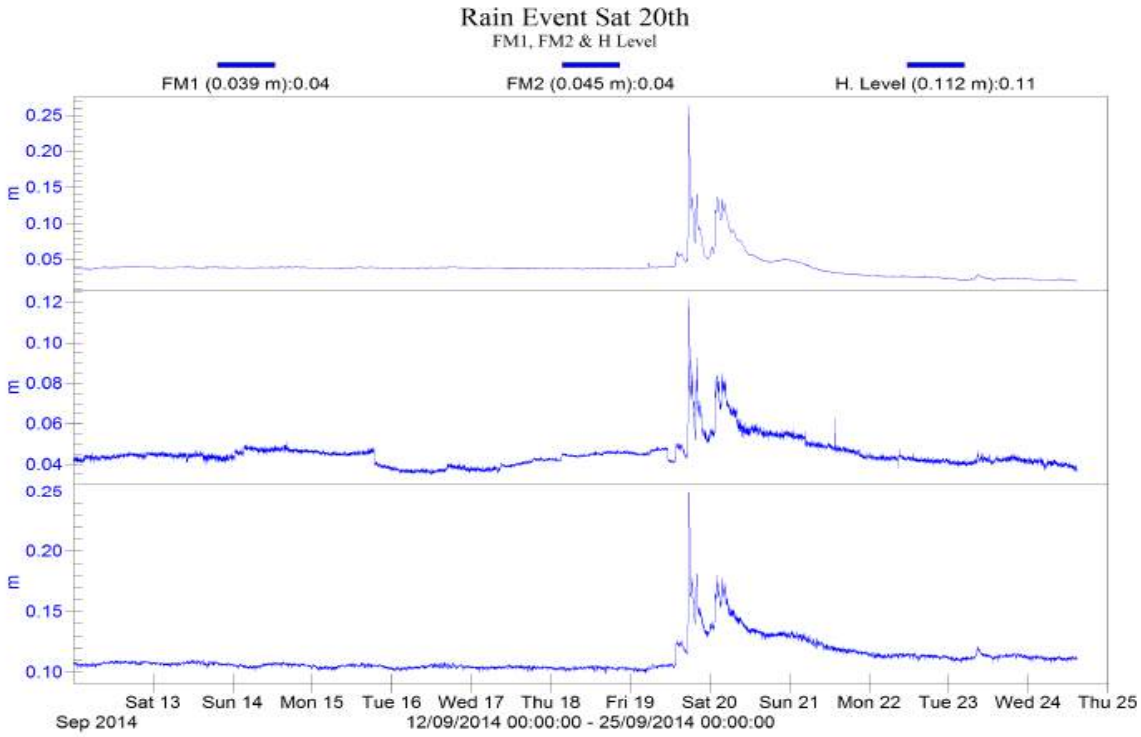
Reasons for Entry.

1. Do periodic inspection.
2. Flow meters not pushing to website.
3. Clean probes of debris.
4. Check levels for all sites and record.
5. Replace batteries where voltage is running low.
6. Take pictures of probes in situ.

Purpose of entry.

A culvert entry was performed mainly because the data for FM1, FM2 and H level which are all connected to the same module are not pushing to the main website.
We attempted to get the module to push unsuccessfully as it turned out. We have downloaded all the data for these locations so it is not being lost at any rate.
Below also see the data for the rain event for sat 20th sept presented on the graph.

Graph of data flows.



ADFM Probe.

The ADFM probes look clean with very little ragging and vegetation compared to the previous weeks. The area around the probes was inspected and cleaned as per schedule.

FM1 probe.

The probe was fouled with ragging and was cleaned up and calibrated.
The probe data is not pushing to the website but was downloaded on site.
After entry it was still not pushing to the website.

H Area.

As can be seen, the barrier entering FM 2 concrete part has been removed. The steel bar reinforcements are still in place. Also, note the water level is very low and is dry on entry to FM2 for the most part.

Also, note in the centre of the "H" area, we still have the obstruction which was removed from the entry to FM2.
It will take flood waters to flush out of the area if it is not being manually removed.

FM2 probe

See entry to FM2 where there is no water flow except for a tiny trickle.

See the probe for FM2 which is submerged in stagnant nonflowing water.

FM3 probe

The probe was badly fouled with ragging and was cleaned up and calibrated.
The level within FM3 is barely covering the probe at this stage and the probe is getting ragged out due to the trickle flows which are not keeping the culvert clean.

FM4 probe

The probe was ragged out with plastic and was subsequently cleaned and the level monitored.

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Culvert Entry 7th October 2014 Report

Entry Team.

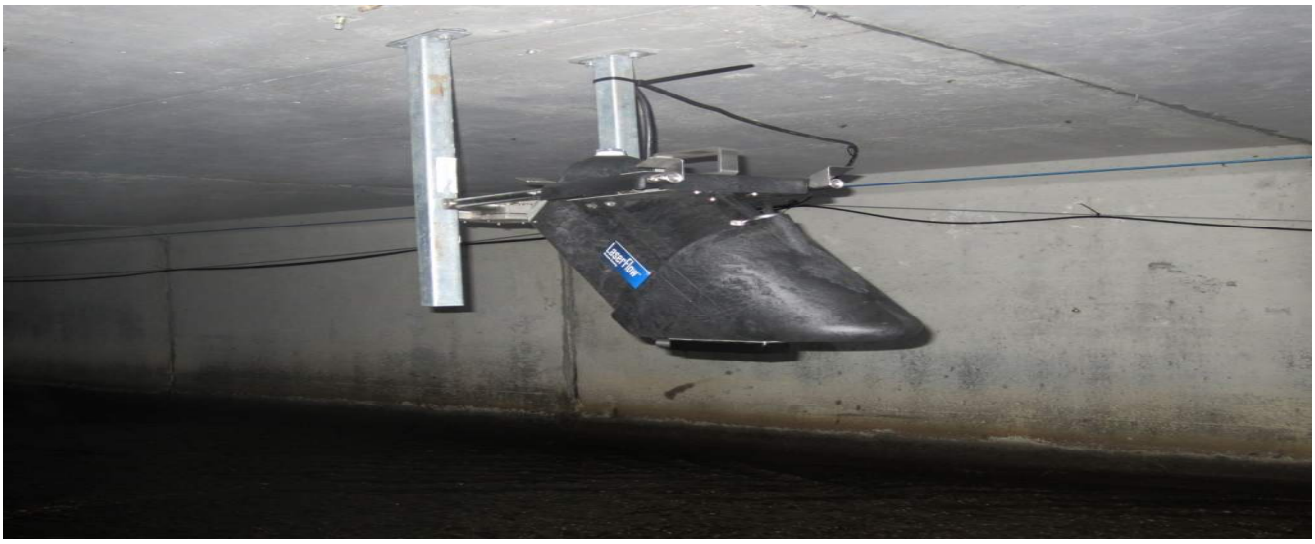
1. Liam O' Riain.
2. Martin Dunne.
3. Sean O' Riordan.
4. Finbarr O' Riordan.

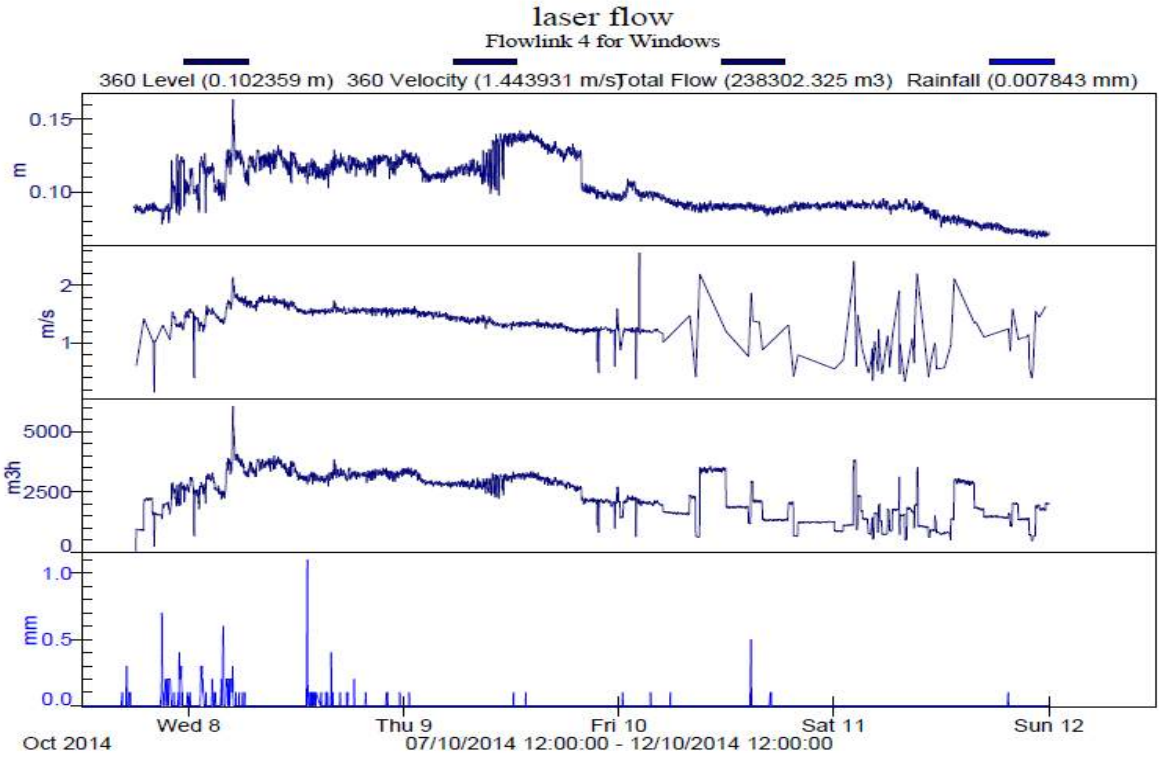
Reasons for Entry.

1. Review sites after the previous 24hr heavy rain event.
2. Power back up the laser which is temporarily down.
3. Clean probes of debris.
4. Replace batteries if low voltage
5. Take pictures of probes in situ.

Laser FlowMeter.

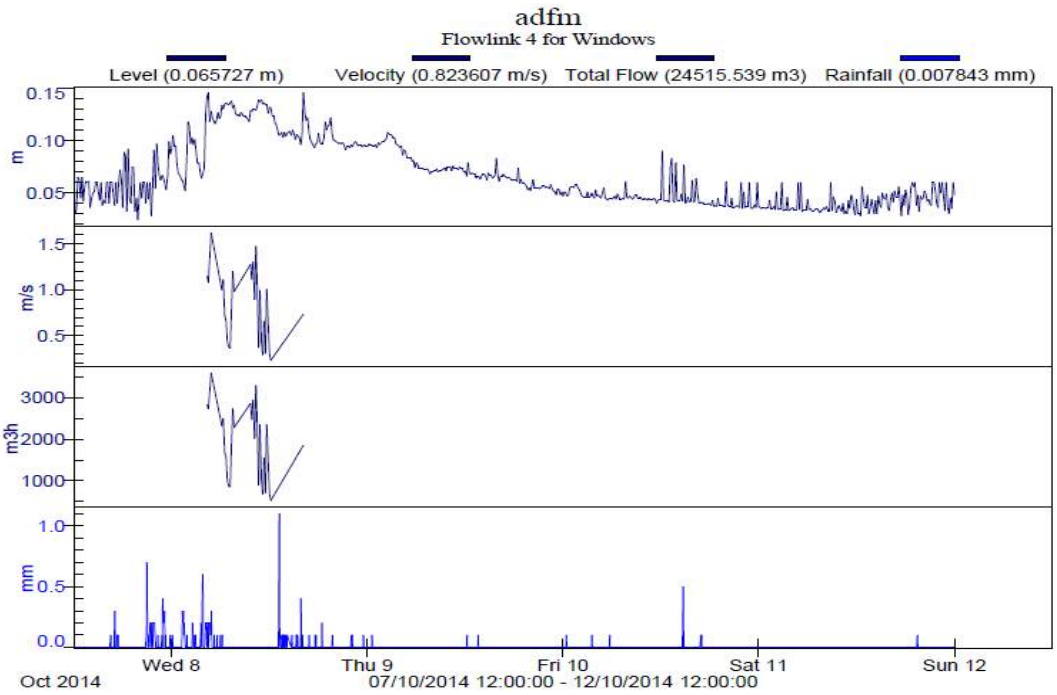
The laser flow meter was mounted close to FM 1 on the roof of the culvert as shown in the picture below. Using ultrasonic technology for level measurement and velocity data measured by emitted laser light; the flow is calculated.
The spec sheet does provide more information on operation and technology used.



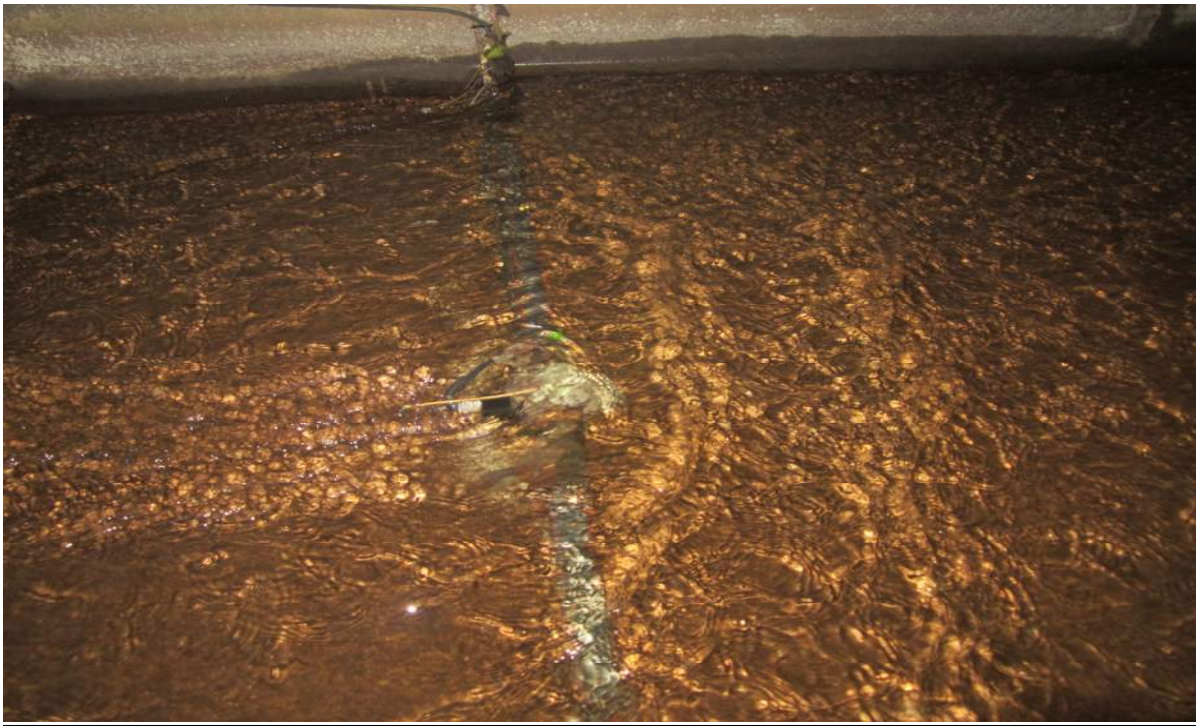


ADFM probe.

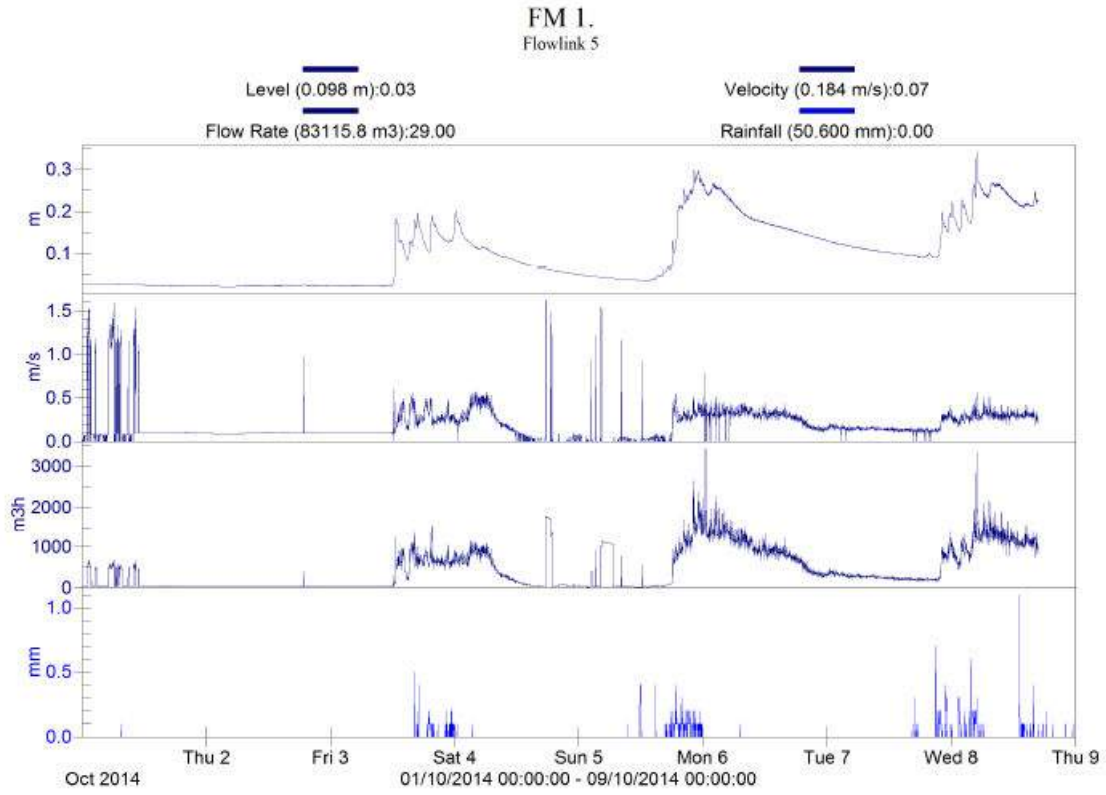
The velocity kicked in temporarily at the higher level trigger before falling off again at the end of the rain event.



FM1 probe.

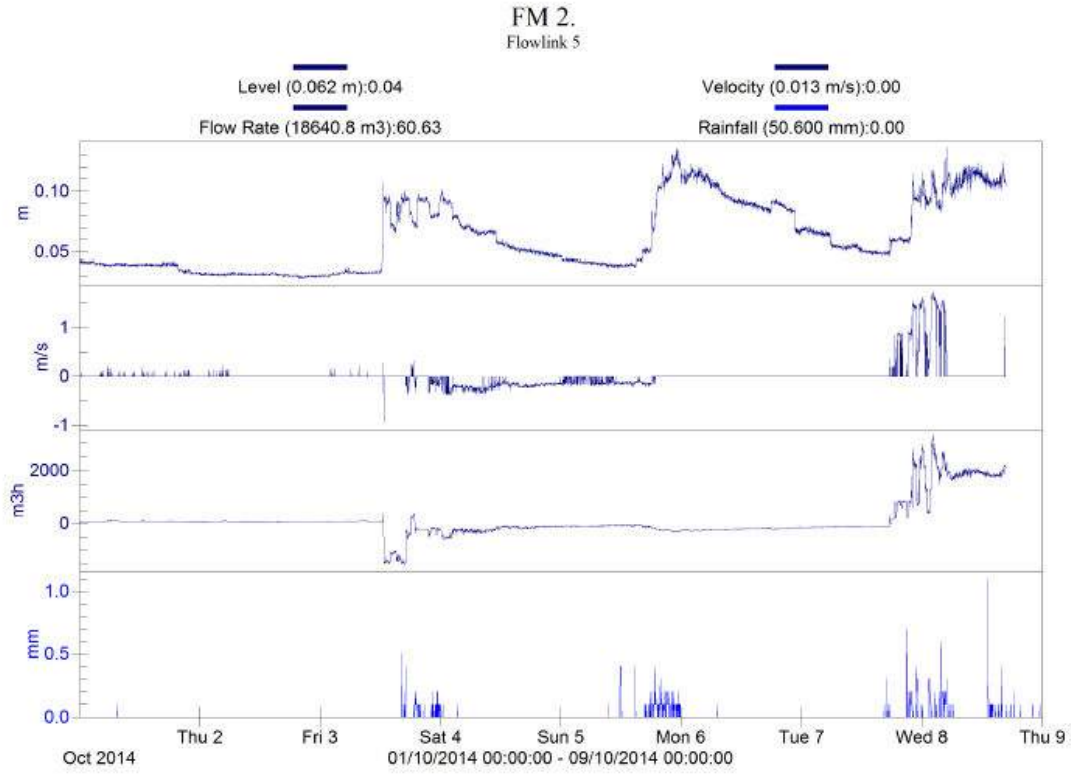


The area velocity probe was relatively ragged on inspection and cleaned on site.
Although we have velocity issues at low levels, we will continue to monitor the flow data.
The battery was also replaced.



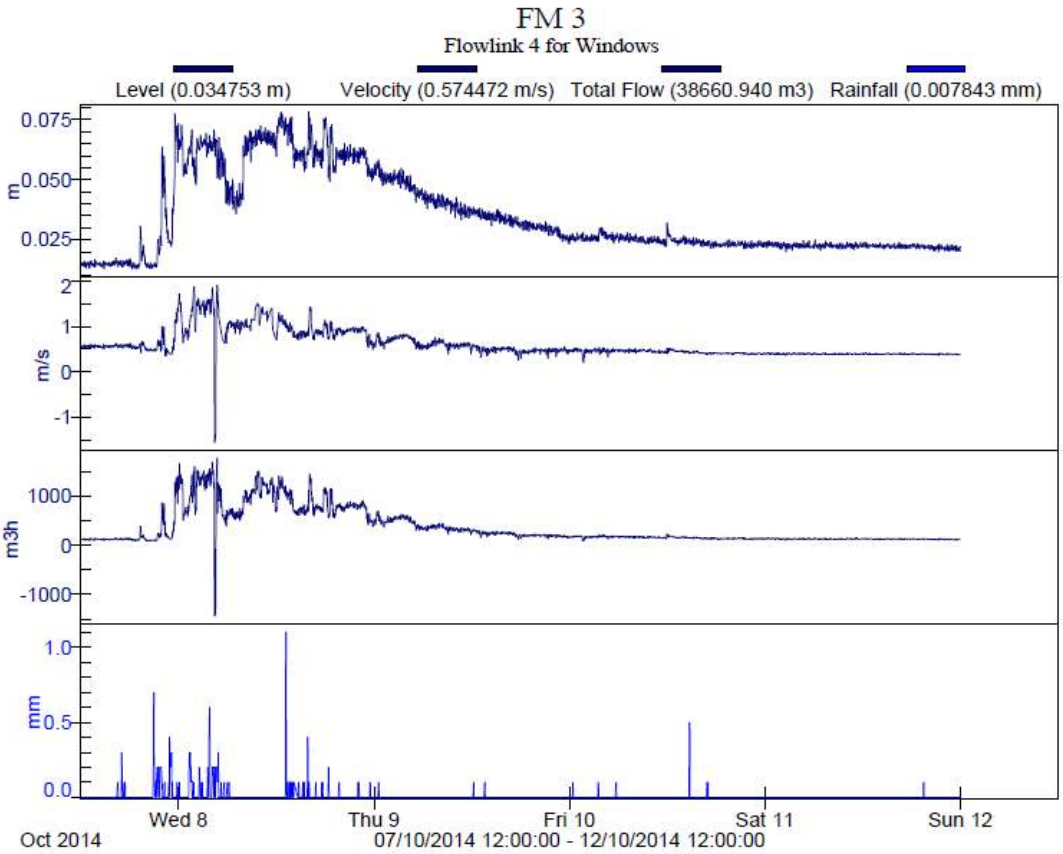
FM2 probe

The flow at FM2 was low as but we are just starting to get a low flow profile across the width of the channel. We replaced the battery supply.

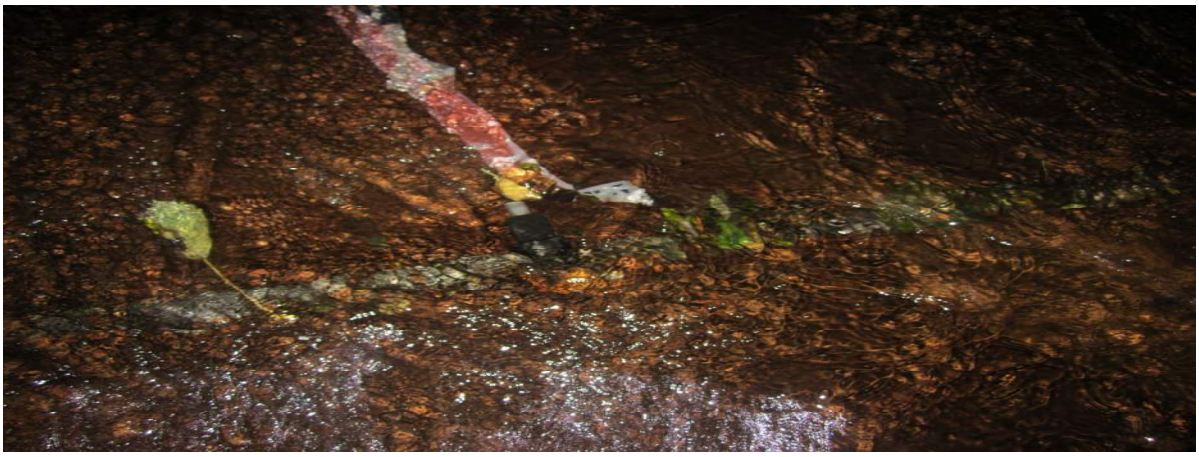


FM3 probe

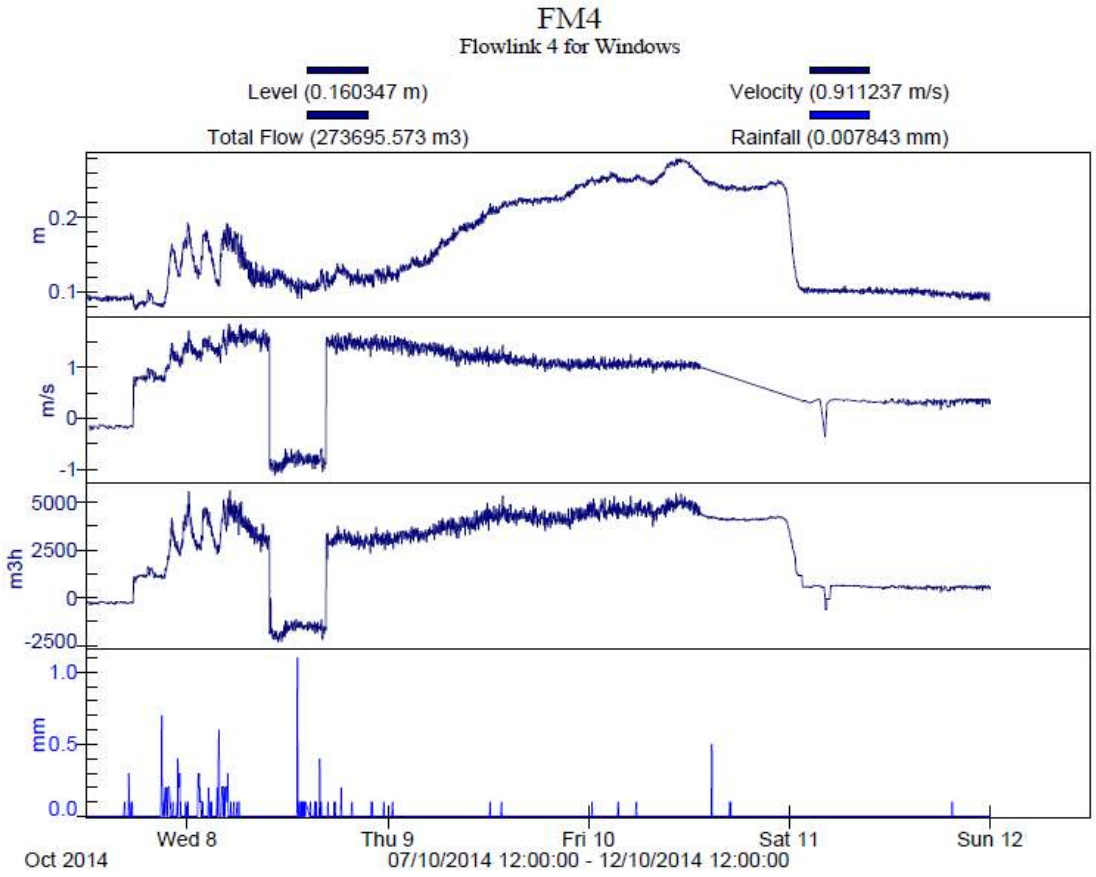
The data at FM3 was affected by ragging during and after the recent rain event. The velocity data had inverted and gone negative for a long period before turning slightly positive again. On cleaning of the probe, it looks like the velocity data has corrected itself again. The battery supply was replaced at this location.



FM4 probe



The flow meter probe was cleaned and is working satisfactorily. The equipment was cleaned and levels were confirmed. The battery supply was also replaced.



Report completed by:

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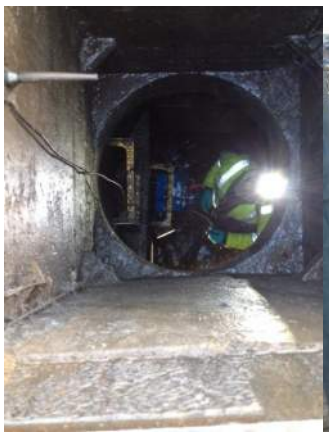
Culvert Entry 16th November 2014 Report


Entry Team.

Liam O' Riain, Denis O' Connell, Paul O' Dwyer.

Above Ground Team:

Sean O Riordan, Finbarr O Riordan

Reasons for Entry.

1. Retrieve vital data from FM1 2150 and FM2 2150.
2. take Photographs

Comment:

The entry took place on Sunday afternoon 16th November to retrieve data from the big rain event on the 13th and 14th November earlier in the week. This was our first time entering through the manhole after implementing our traffic management plan submitted previously to Cork City Council. Levels were still elevated so work was reduced to retrieving the required data and taking photographs.
The data and photographs were comprehensively reported in the 'Nov Rainfall Event Report' previously submitted.

Culvert Entrance Reports 16th Nov, 9th Dec, 22nd Dec, 19th Jan, 22nd Jan

Culvert Entry 9th December 2014


Entry Team.
Liam O' Riain, Denis O' Connell, Martin Dunne.

Above Ground Team:
Sean O Riordan , Finbarr O Riordan

Reasons for Entry.

1. Install Ultrasonic Level Probe at FM4
2. Move Ultrasonic Level Probe from bifurcation ,(H)culvert to FM2
3. Retrieve data from FM1 2150 and FM2 2150.
4. take photographs
5. Clean debris off AV probes
6. change batteries

Comment:

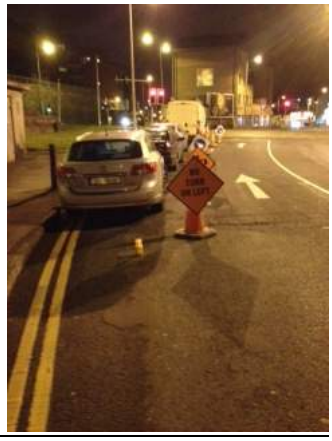
Culvert was entered from the manhole at 23:00 with traffic management plan implemented as seen in pictures above. The primary purpose of the entrance was to fit the ultrasonic probe in FM4 and to move the probe in the bifurcation section , to the FM2 channel. This was requested by JBA consultancy further to consultation which had confirmed issues with the 2150 AV at FM4, and also the fact that the level measurement in the bifurcation was not at a critical measuring point and would be better installed in the FM2 channel. We decided that we would leave the 2150 AV loggers at both FM2 and FM4 for the time being for additional information.

Note:

The ultrasonic probe mounted in FM4 is about 3 metres upstream from the original AV 2150 logger position. This was the most suitable location to ensure non turbulent flow conditions at the time and to ensure suitable signal strength. The probe is fixed off the side wall using a deflector plate as seen in picture above. Also in FM2 the probe is 3 meters approx upstream from the original probe position. This location was chosen to ensure a suitable location in the brick ceiling and also to centre above the water depth.

Culvert Entry 22nd December 2014





Entry Team.
Liam O' Riain, Denis O' Connell, Martin Dunne.

Above Ground Team:
Sean O Riordan , Finbarr O Riordan

Reasons for Entry.

1. change batteries
2. take levels
3. retrieve data from FM1 and FM2
4. take photographs
5. Clean debris off AV probes

Comment:
The culvert was entered at 23:00. The primary purpose was to change batteries, clean probes and check levels prior to the Christmas break.

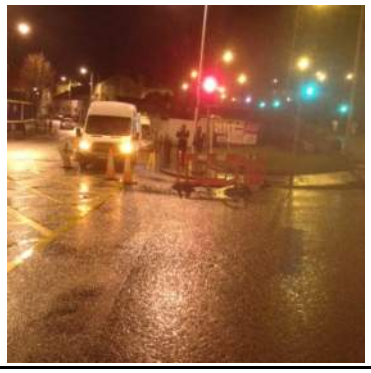
Note:
In general the levels are recorded and the clock time taken. We stopped entering and adjusted levels in the loggers unless they were being newly fitted or a probe being exchanged, to avoid any confusion after when interpreting data. Instead levels are offset as required at the reporting stage.

date **22/12/2014**

Spot Level checks

Meter	Level	Time	comment
FM1 2150 AV	0.11	23:48	
FM1 Laser	0.1	23:40	
FM2 2150 AV	0.16	n/a	
FM2 2110 US	0.18	n/a	
FM3 2150 AV	0.06	n/a	
FM4 2150 AV	0.14	00:31	
FM4 2110 US	0.14	n/a	

Culvert Entry 19th January 2015


Entry Team.

Liam O' Riain, Denis O' Connell, Martin Dunne.

Above Ground Team:

Sean O Riordan , Finbarr O Riordan

Reasons for Entry.

1. change batteries
2. take levels
3. remove old FM4 AV and carry out firmware upgrade
4. remove new ultrasonic logger at FM4 and retrieve data
5. stack new ultrasonic FM4 logger with old FM4 2150 on the same push data modem
6. take photographs
7. Clean debris off AV probes

Comment:

Culvert was entered at 23:00 on the 19th January. It was raining prior to this and during the entry. It was decided to proceed with caution as we were interested to try and acquire pictures and take spot levels with slightly elevated flow conditions. The new ultrasonic level logger at FM4 was not on a modem so it was decided to remove this to retrieve data and reinstall. We also removed the old FM4 2150 and carried out a firmware upgrade and reinstalled both on a stack with modem to push to website. We were anxious to have the new ultrasonic FM4 pushing to the website as we are reliant on this apparatus to ensure continuous data at all channels.

Culvert Entrance Reports 16th Nov, 9th Dec, 22nd Dec, 19th Jan, 22nd Jan

Note 1:

Conditions were too wet in the manhole to retrieve data from FM1 and FM2 2150's and also new ultrasonic probe in FM2 which is also on this stack. In fact it was noted that water was pouring on top of the equipment from the manhole cover when the rain was heavy.
A decision was made to enter the manhole later that week when it was dry to retrieve the missing data.

Note: 2

Observing the channel in wet conditions with slightly higher flows showed some interesting findings as seen in the pictures and comments below.

Debris Building on old weir wall frame:

The weir wall was removed at the start of the summer 2014, however the metal reinforcement uprights were left in place. Over time these uprights have been catching debris and causing a restriction to flows down the old brewery channel FM2. Near floor level there is pieces of plastic and leaves caught. In the picture we can see there is now a tree branch caught at the weir. We expect therefore that the flow distribution must be approaching something similar to when the weir wall was in place. We will be looking in more detail at this in reports following.

The picture on the left shows this debris looking back from the bifurcation at the debris at the entrance to FM2 brewery channel. The picture on the right shows this debris at the entrance to FM2 from the FM1 side.

Culvert Entrance Reports 16th Nov, 9th Dec, 22nd Dec, 19th Jan, 22nd Jan

The picture on the left shows a closer look at the restriction to FM2 brewery culvert. The picture on the right looks back towards the entrance into FM2 from downstream


The picture on the left below looks back towards the FM2 brewery entrance in the bifurcation but this picture also shows the build up of stones on the right hand side where the flow is calm. The picture on the right looks back towards the bifurcation from FM4 and shows the flow entering the FM3 to FM4 Limerick Rd culvert.


It was also noted that there was a wave in front of the AV probe at FM4 with level varying from 0.17M to 0.24 M.

date **19/01/2015**

Spot Level checks

Meter	Level	Time	comment
FM1 2150 AV	0.16 to 0.17	23:40	
FM1 Laser	0.14 to 0.15	23:46	
FM2 2150 AV	0.27	12:50	
FM2 2110 US	0.27	n/a	
FM3 2150 AV	0.06	n/a	
FM4 2150 AV	0.17 to 0.24	00:20	wave at probe
FM4 2110 US	0.15 to 0.16	n/a	

Culvert Entry 22nd January 2015

Entry Team.
Liam O' Riain, Denis O' Connell, Paul O Dwyer.

Above Ground Team:
Sean O Riordan , Finbarr O Riordan

Reasons for Entry.

1. retrieve data from FM1 2150 AV, FM2 2150 AV, and FM2 ultrasonic
2. take levels
3. fit new AV probe at FM4
4. Clean debris off AV probes

Comment:

Culvert was entered at 23:00, 3 days after the last entrance on the 19th January. The main requirement was to download the data from FM1 2150 AV, FM2 2150 AV, and FM2 ultrasonic, since it was too wet on the previous visit. Spot levels were taken again.
We also decided to fit a new AV probe at FM4. Although this AV logger is no longer part of our brief we want to try and get some good velocity data to help with overall data analyses. We wanted to remove any ambiguity as to whether the issues where with the probe or with the application conditions.

date **22/01/2015**

Spot Level checks

Meter	Level	Time	comment
FM1 2150 AV	0.15 to 0.17	23:18	some ragging
FM1 Laser	0.14 to 0.17	23:20	
FM2 2150 AV	0.24 to 0.26	23:21	
FM2 2110 US	0.26 to 0.28	23:22	
FM3 2150 AV	0.1 to 0.12	n/a	wave in front of probe
FM4 2150 AV	0.2 to 0.22	23:24	
FM4 2110 US	0.18 to 0.2	23:26	

Report completed by: Finbarr O Riordan, .Water Technology Ltd.,Togher, Cork.

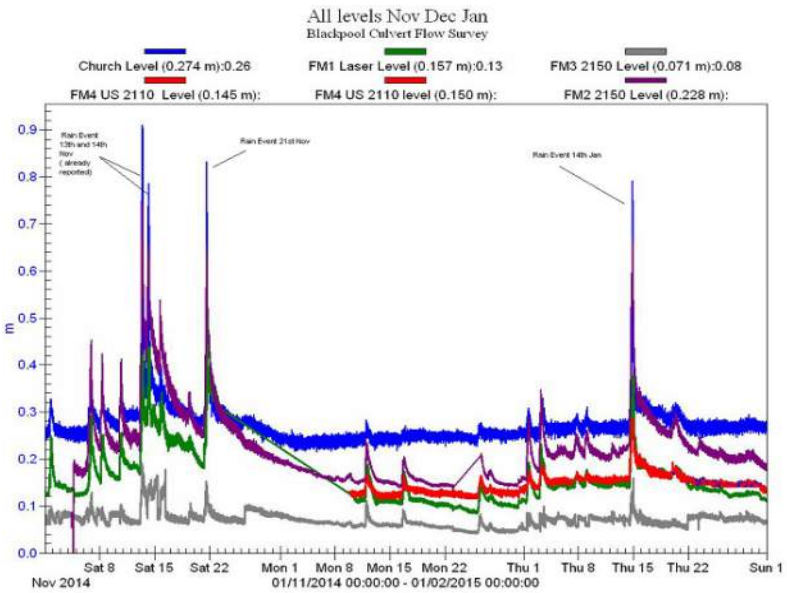
water technology limited
Togher Industrial Estate, Cork Ireland.

Blackpool Culvert – Data Analyses and Rainfall Events between November December 2014 and January 2015

Introduction:

The most significant rain event occurred back on the 13th and 14th November and is covered on a separate report. Figure 1 below shows all levels recorded between November 2014 and January 2015 . The blue trend displays the level recorded at Blackpool church which shows peaks between 0.8 and 0.9 meters during the main rain events. The next most significant levels within the culvert are recorded in the FM2 old brewery line, (purple trend), with levels between 0.6 meters and 0.7 meters. Two other significant rain events occurred since the 13/14th November event. These occurred on the 21st November and on the 14th January.

Fig 1: All level recorded Nov Dec Jan

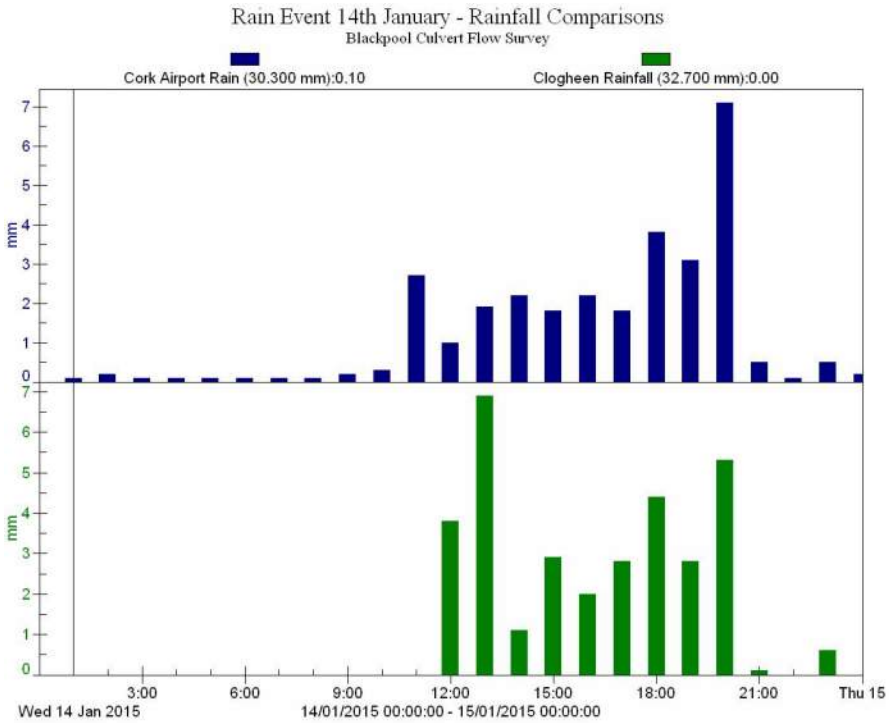


This report looks at the 21st November and the 14th January rain event, particularly at the January event. During this event we have the newly positioned ultrasonic level probes recording at this time and in general the data set is more complete for this event. This report also look at the current situation and data from the new ultrasonic probes and reports on each site between November and January.

Rainfall Event 14th January 2015

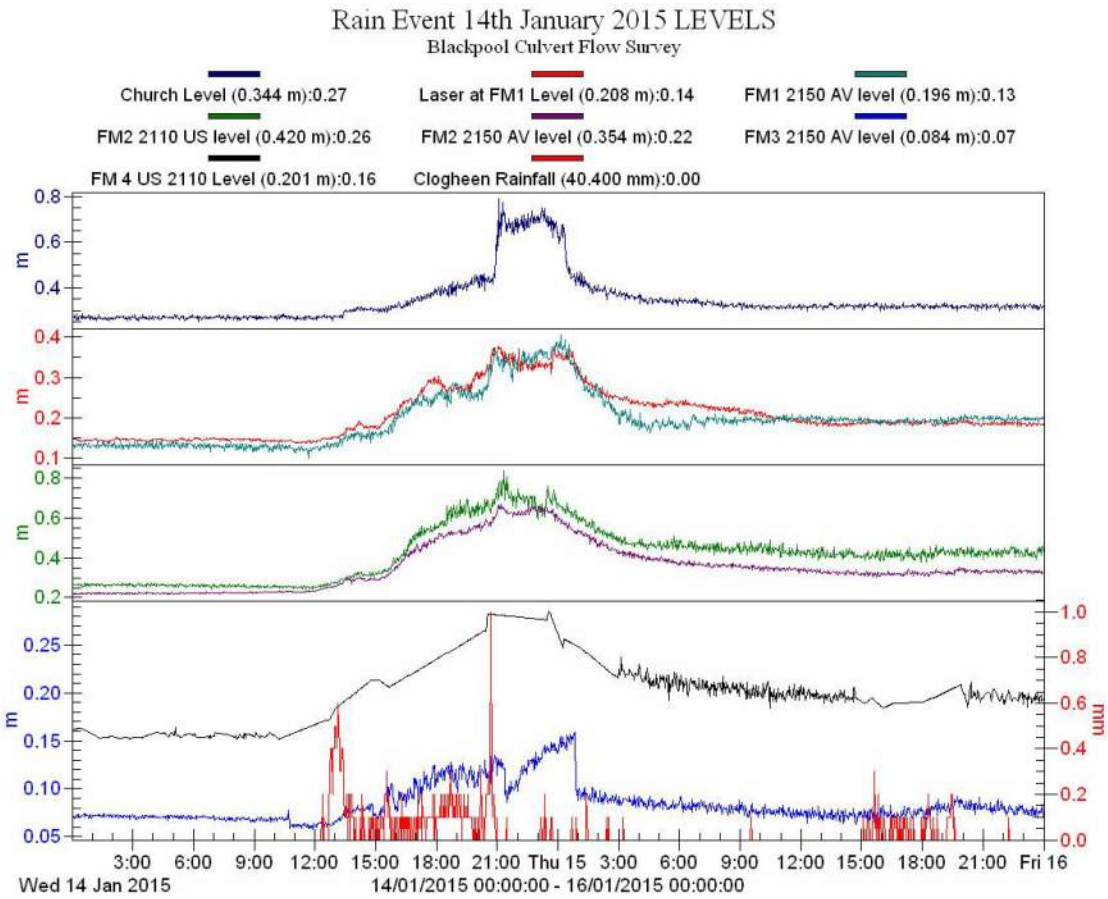
This was an unusual event as the day started with a few centimeters of snow covering the catchment. Later in the day a storm with heavy wind and rain occurred. All snow quickly melted and one assumes contributed to the flows entering the culvert**.** A problem occurred with the Whitechurch Rain gauge which was resolved in the middle of the event. However, as the Whitechurch rain data set was incomplete the Clogheen rain data was used for the report. Data was also retrieved from Cork Airport which compared well to the Clogheen data. Figure 2 below shows hourly rainfall sums with Cork Airport recorded 30.3 mm of rainfall while Clogheen recorded 32.7 mm during the event.

Fig 2: Rainfall during 14th January Rain Event



Note: A new ultrasonic flow logger was placed in FM4 as requested. We also repositioned the Ultrasonic probe that was in the bifurcation into the FM2 old brewery line about 3 meters upstream of the original 2150 AV logger. We did leave the original FM2 2150 AV logger in the old brewery line. The original FM1 2150 AV logger is also still in place. Figure 3 below shows all levels. The Laser and 2150 at FM1 are compared on the same pane, as is the newly position ultrasonic, (FM2 2110 US), and the original FM2 2150.

Fig 3: All Levels recoded during the 14th January Rain Event :



Note that the new FM2 US logger positioned 3 meters upstream is reading slightly higher levels than the original 2150 AV but trends are similar.

The new US logger a FM4 had broken data during the rain event with many drop outs to zero. It is assumed that there was a lot of turbulence at the location making it difficult to accurately read the levels, however the trend was clearly picked out after the zeros were removed as we show in the black trend above.

Figure below illustrates the levels during this event more clearly. In this graph we look at the smoothed hourly averages and leave out the FM1 2150 and original FM2 2150 for clarity. A significant peak level, (blue trend) of 0.73 meters was recorded on the ultrasonic probe at FM2 which was higher on this occasion than the Church level, (green trend), which recorded at 0.68 meters.