

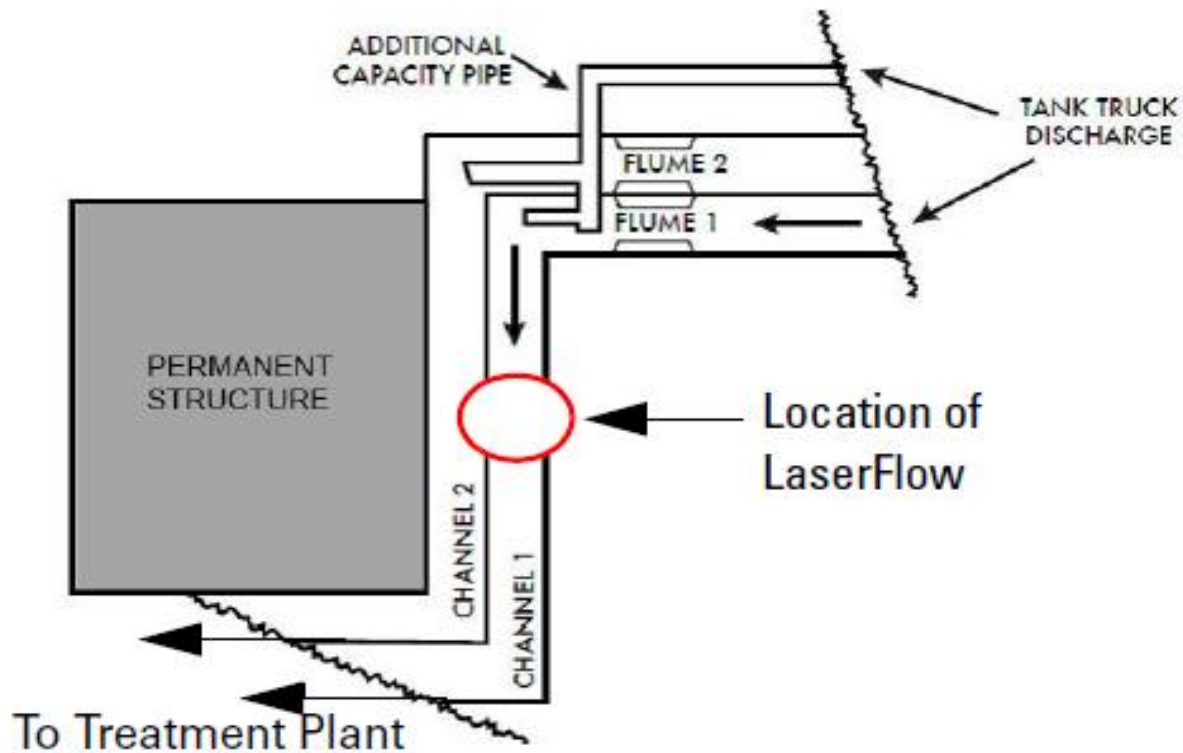
A COST EFFECTIVE SOLUTION FOR FLOW MONITORING A WASTE WATER TREATMENT INFLUENT CHANNEL

Dr Peter Hulmston

Common Design requirements?

Accurate measurement	+/- 4%
Reliable operation under challenging conditions	24/7
Wide range of velocity & depth	0.15 to 4.6 m/s & 0.01 to 3m
Minimal maintenance	Simple/infrequent
Data processing	Comprehensive
Sensor diagnostics	real time
Costs less than flume based solution.	<\$50,000
Minimal interruption of service	simple installation

Example: Al-Ansab, Muscat, Oman, water treatment plant 53,000 m³/day



Points to consider for this application

Technology/Methodology	Potential Issues
Flume with Level Measurement	During increased truck traffic the flume gets submerged and provides incorrect readings.
Contact Area Velocity Sensor	Debris covering the sensor and hinders flow measurement.
Non-Contact Surface Area Velocity measurement	Surface turbulence results in incorrect velocity measurement.

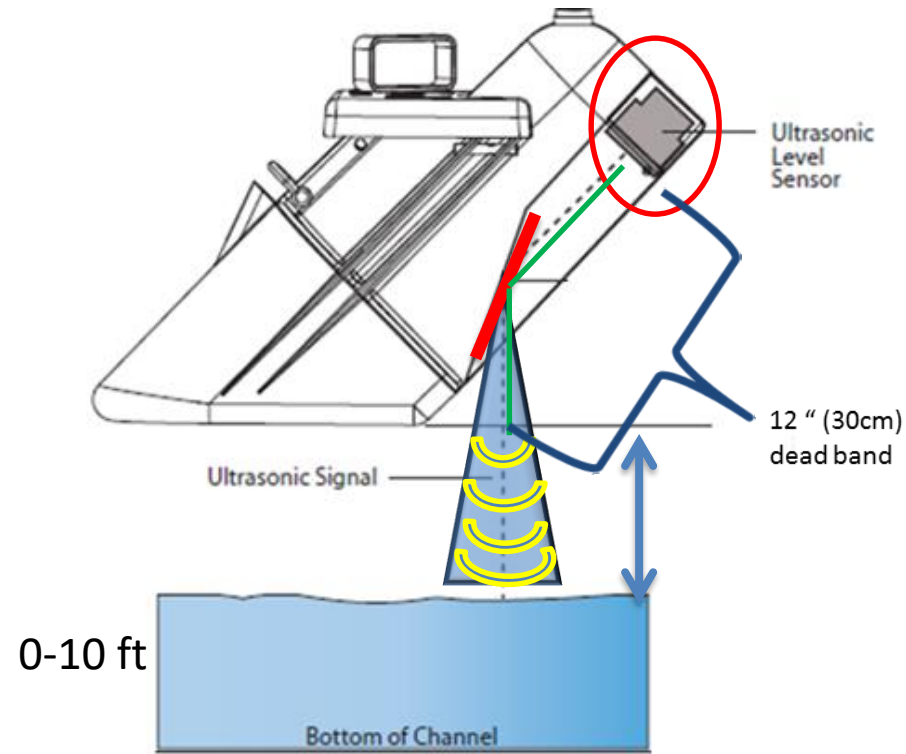
ISCO LASERFLOW – NON-CONTACT SENSOR



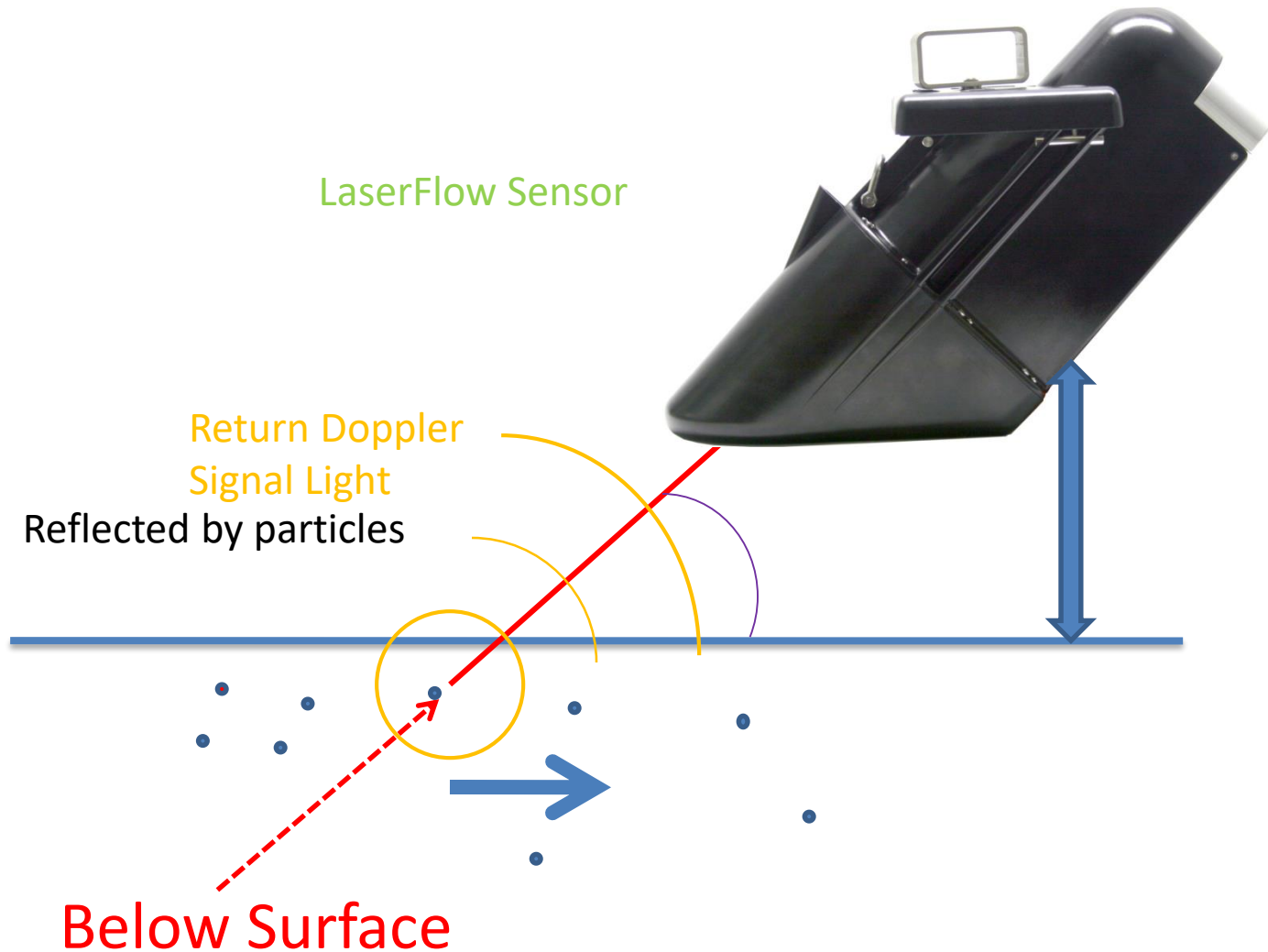
1. Ultrasonics for level measurement
2. Laser Doppler shift measurement for velocity (below the surface).

1. Ultrasonic Principle of Operation

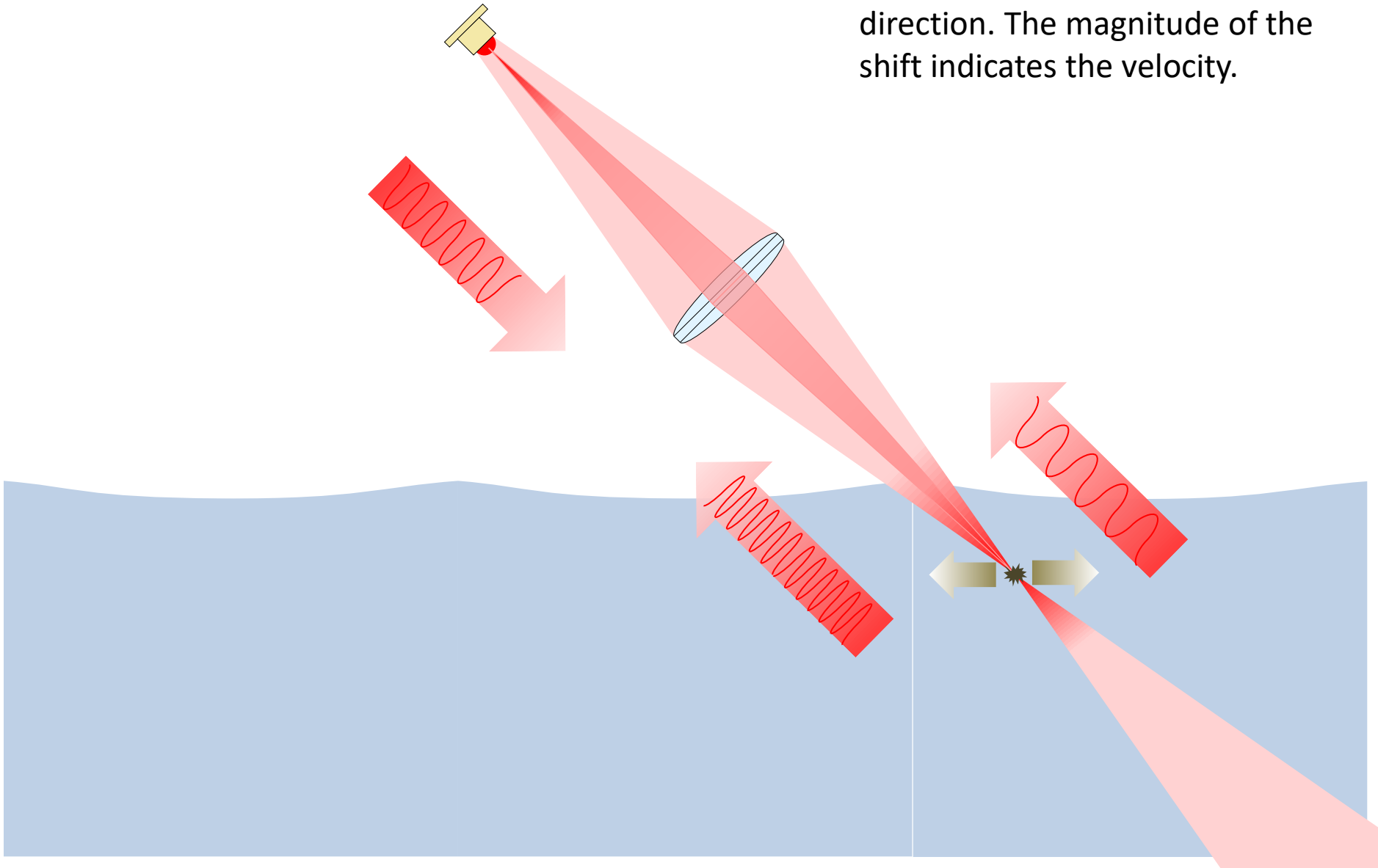
- Sensor angle prevents moisture accumulation
- Deflector Plate
 - Dead Band inside sensor
 - Zero Dead Band
- Range 0 – 10 feet



2. Laser Doppler- Principle of operation



The frequency shift between the transmitted indicates the flow direction. The magnitude of the shift indicates the velocity.





Laser Velocity
Measurement

Ultrasonic Level
Measurement

Multi-point/Multi-depth
Velocity Method

QC - Isco Flow Measurement Laboratory



Performance specification

Parameter	Specification	
Operational Temperature range	-20°C to 60°C	
Laser - Velocity Range	-4.6 m/s to 4.6 m/s	(-15'/s to 15'/s)
- Max distance from liquid	3 m	(10')
- Min depth	10 mm	(0.5")
- Min velocity	0.15 m/s	(0.5'/s)
- velocity accuracy	+/- 0.5% ... +/-0.03 m/s	(0.1'/s)
Ultrasonic – level range	0 to 3 m	(0-10')
- level accuracy	+/- 0.012 m	(0.04')
Flow Accuracy	+/- 4% of reading	

QA - 2016- Alden Research Lab Inc Flow Accuracy Lab

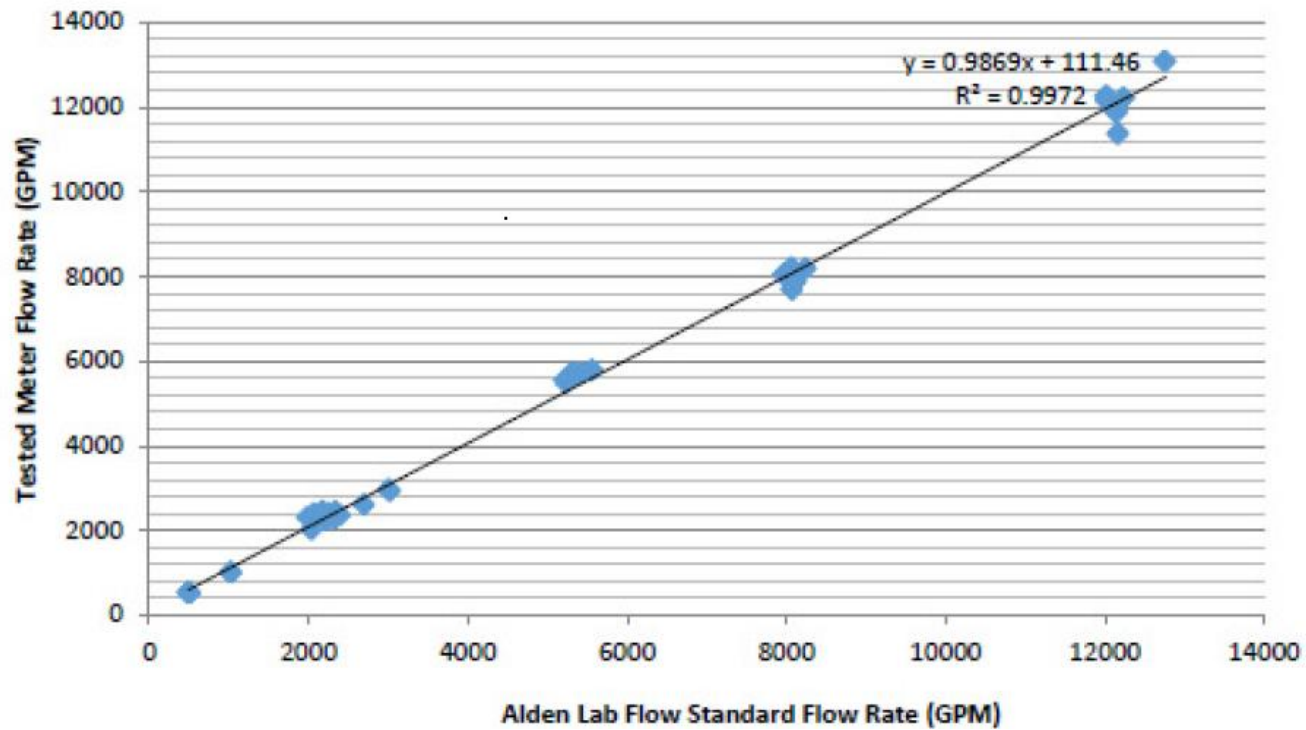
Alden equipment calibrated to NIST standards.
(accuracy of 0.02%)

5 days tested over range of levels and velocity.

The LaserFlow performed well and measured flow accurately with the average error of 2.7%.

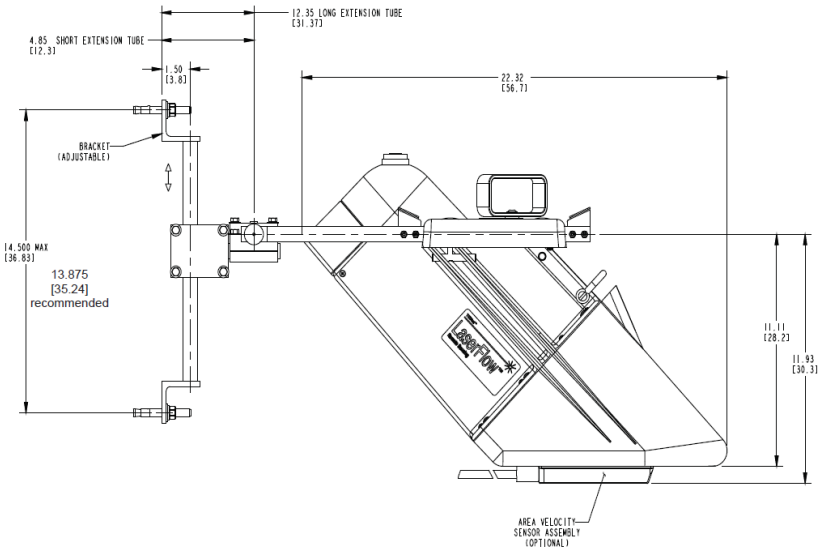
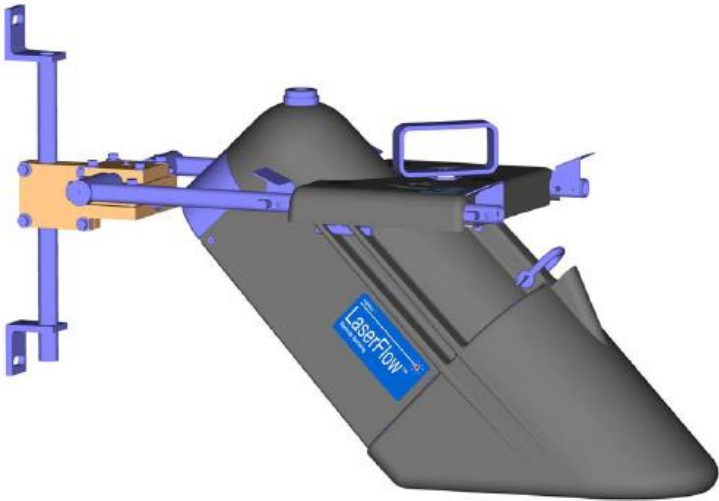
2016 - Alden Research Lab Inc

LaserFlow

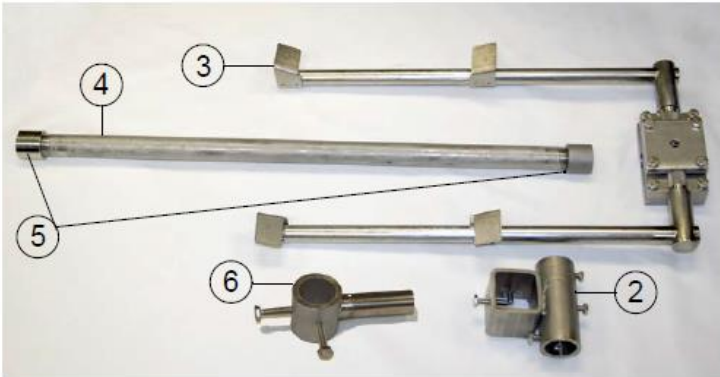


Installation

Semi permanent



Temporary



Al-Ansab installation





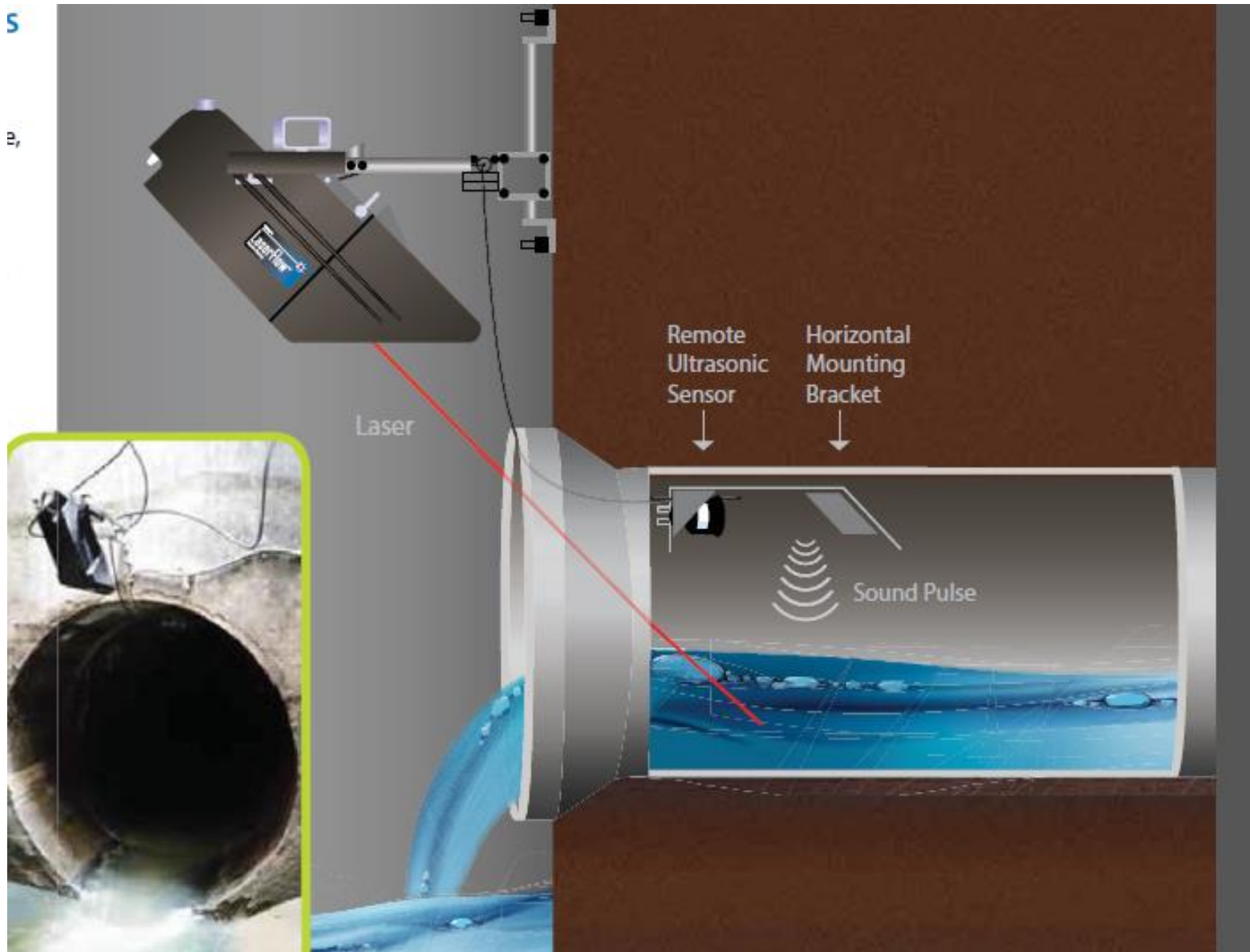


ISCO

Drinking Water Influent



Remote Ultrasonic Sensor



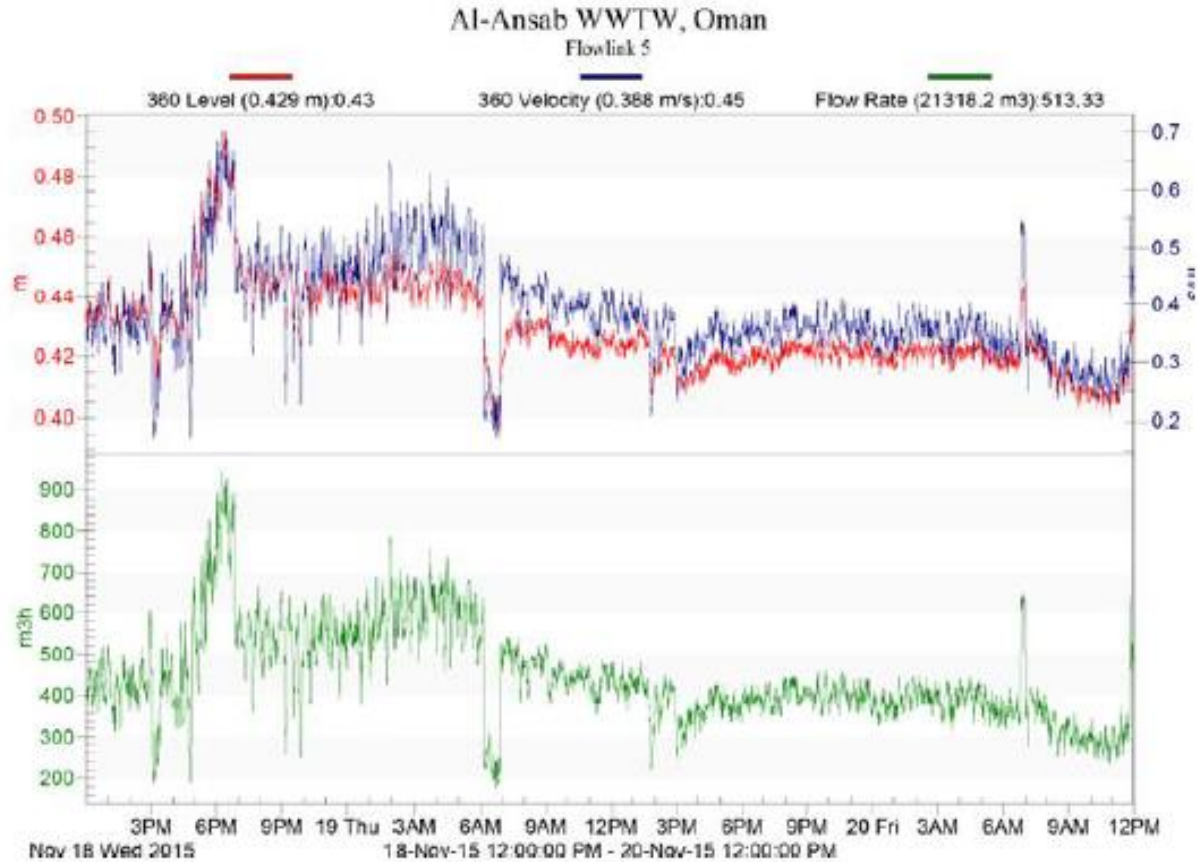


Equipment Options

- Power
 - AC or DC
- Meter Choices
 - Permanent
 - Signature
 - Portable
 - Signature
 - 2160

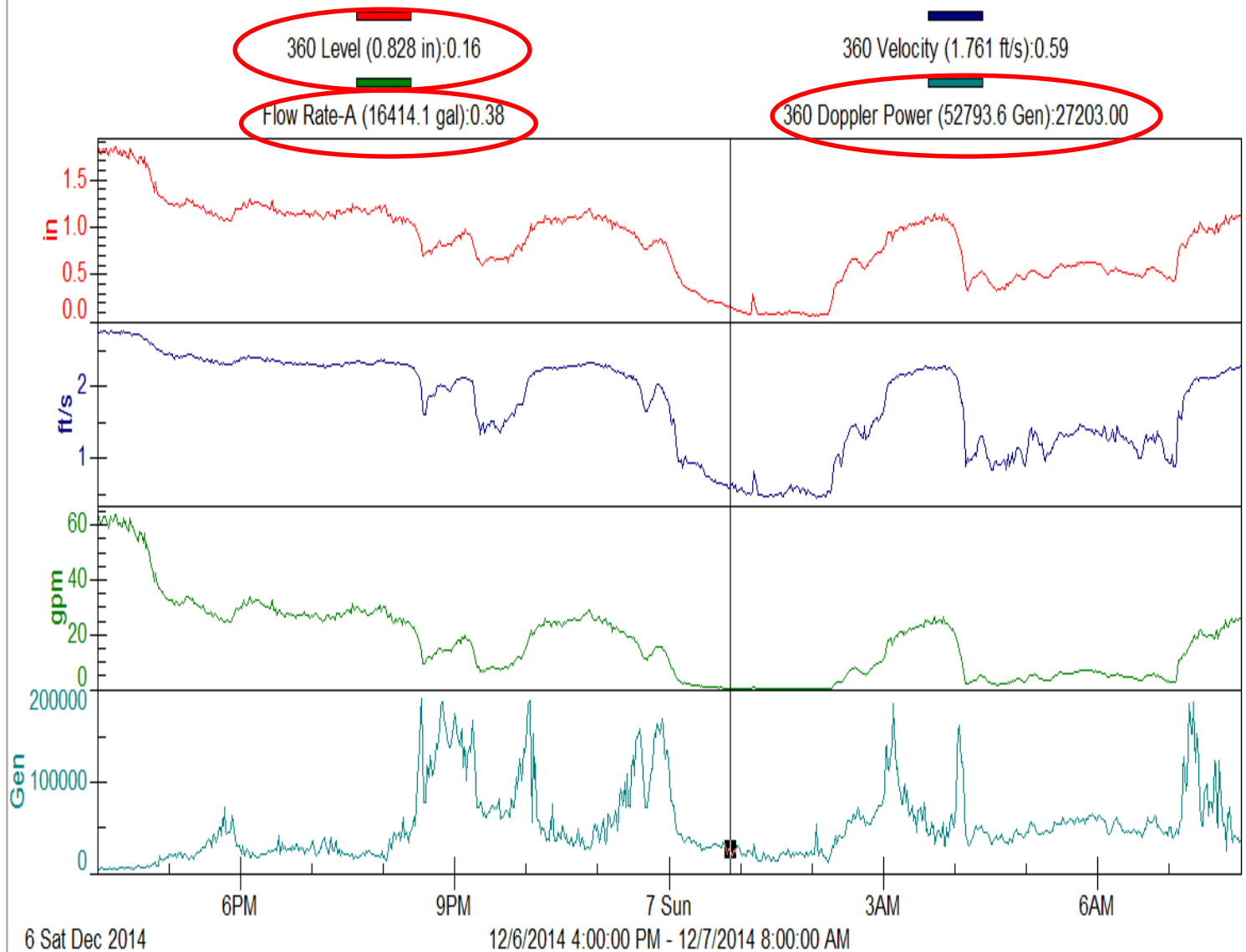


FlowLink software



Measurement results displayed using Flowlink[®] software

Low Level/Flow



Level, Velocity & Flow

11/8/2016 18:30, 7.374

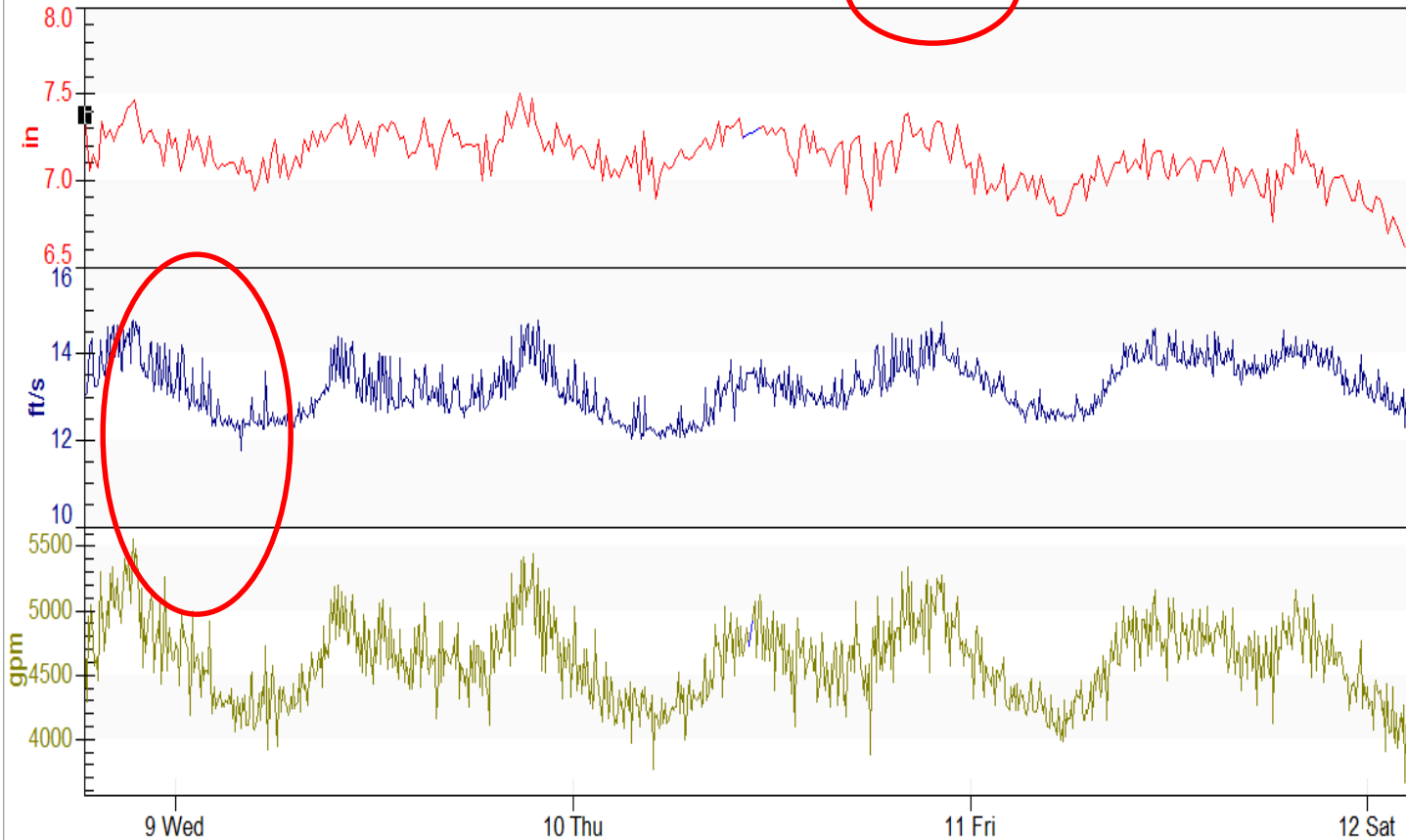
Canada High Velocity Low Level

LaserFlow

360 Level (7.133 in):7.37

360 Velocity (13.261 ft/s):13.02

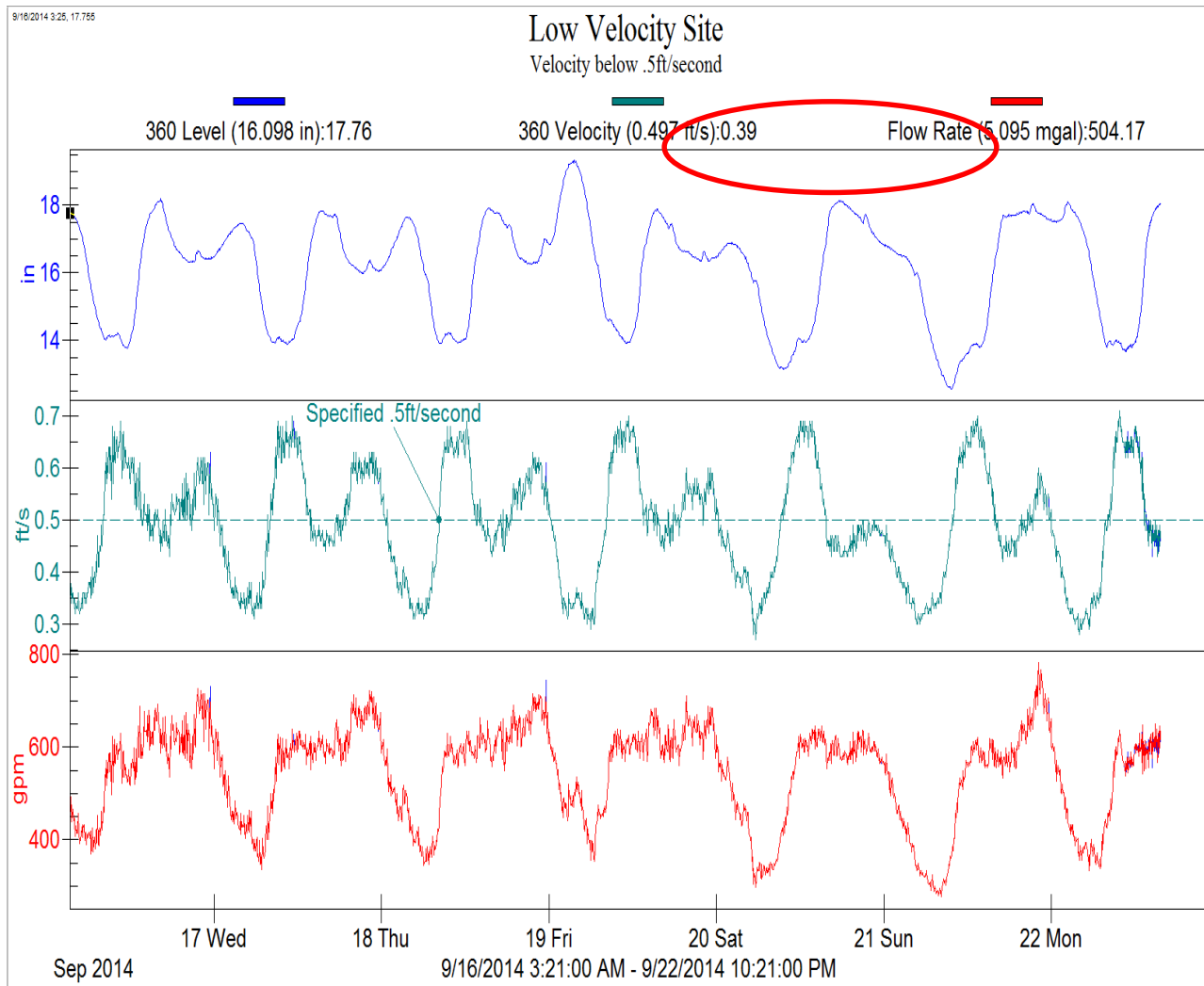
Débit (22.122 mgal):4747.85



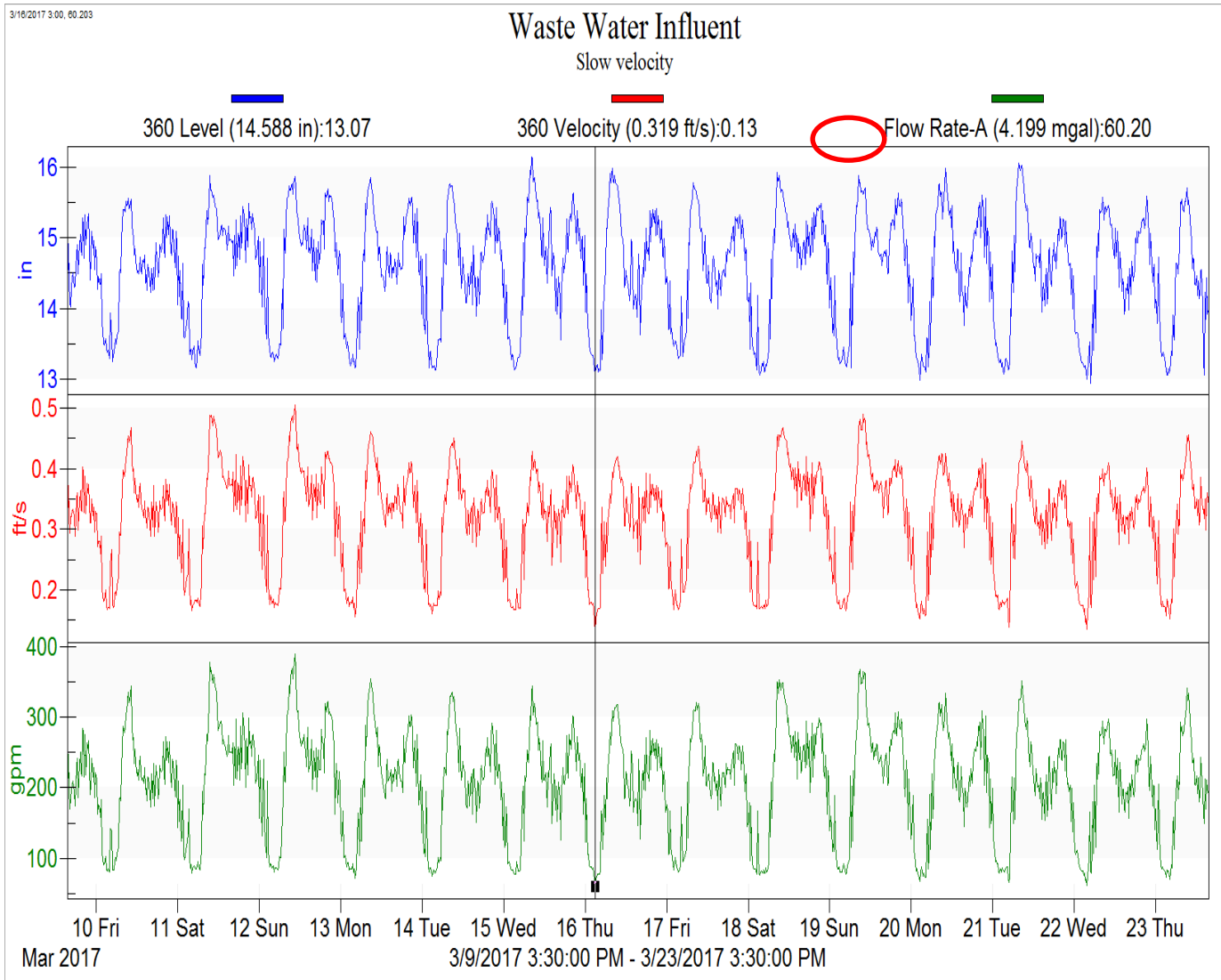
Nov 2016

11/8/2016 6:26:00 PM - 11/12/2016 2:26:00 AM

Slow Velocity



Wide Channel - Slow Velocity!



Reliability

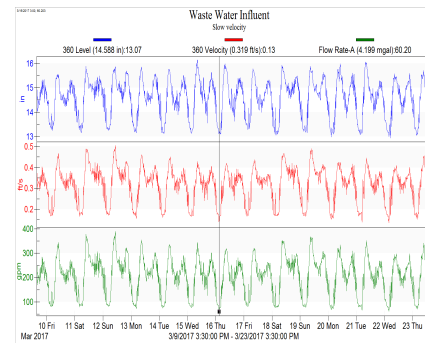
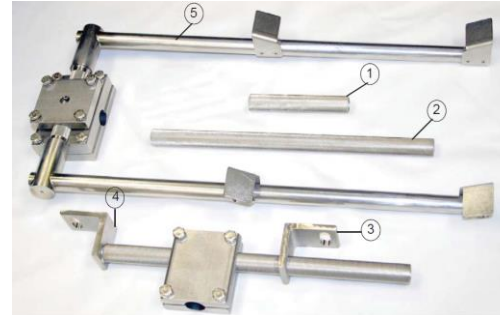
- LaserFlow units installed 4 years ago have required no maintenance.
- Kansas City – under 30' water – no intervention.
- Deployment increased over the 4 years.
- Returning customers.
- Foam, oil film.

Maintenance

Table 5-2 Recommended Maintenance (Difficult-to-Access Locations)

Action	Recommended Frequency	Location
Check Ultrasonic level sensor (built-in or remote) for obstructions (e.g., spider webs, debris)	Every 6 months or following surcharge event	On-site
Check Horn for obstructions (e.g., spider webs, debris)	Every 6 months or following surcharge event	On-site
Check 350 Area Velocity sensor (if applicable) for debris	Every 6 months or following surcharge event	On-site
Ensure suitable alignment - check x-axis (roll) and y-axis (pitch)	Weekly	Via Flowlink application or Signature™ flow meter
Check Doppler Power and assess historical trend	Weekly	Via Flowlink application or Signature™ flow meter
Check Ultrasonic Signal and assess historical trend	Weekly	Via Flowlink application or Signature™ flow meter

Cost



- Purchase cost NZ \$25,000

Conclusions

- The LaserFlow is the most advanced and versatile open channel flow measurement system available on the market well suited to WWTP influent application.
- Accurate high/low velocity flow measurement.
- Reliable under real conditions.
- Provides real time graphical data.
- Easy to install
- Little maintenance involved
- Economical

Useful links

https://en.wikipedia.org/wiki/Laser_Doppler_velocimetry

https://en.wikipedia.org/wiki/Doppler_effect

<http://www.teledyneisco.com/en-uk/water-and-wastewater/flow-meters/case-studies>

<http://www.teledyneisco.com/en-uk/water-and-wastewater/flow-meters/application-notes>

<http://www.teledyneisco.com/en-us/water-and-wastewater/laserflow>

<http://www.teledyneisco.com/en-us/water-and-wastewater/flow-meters/seminars-and-webinars>

<https://www.johnmorrisgroup.com/NZ/Results?division=Environmental&brand=ISCO>

Thank you for your attention