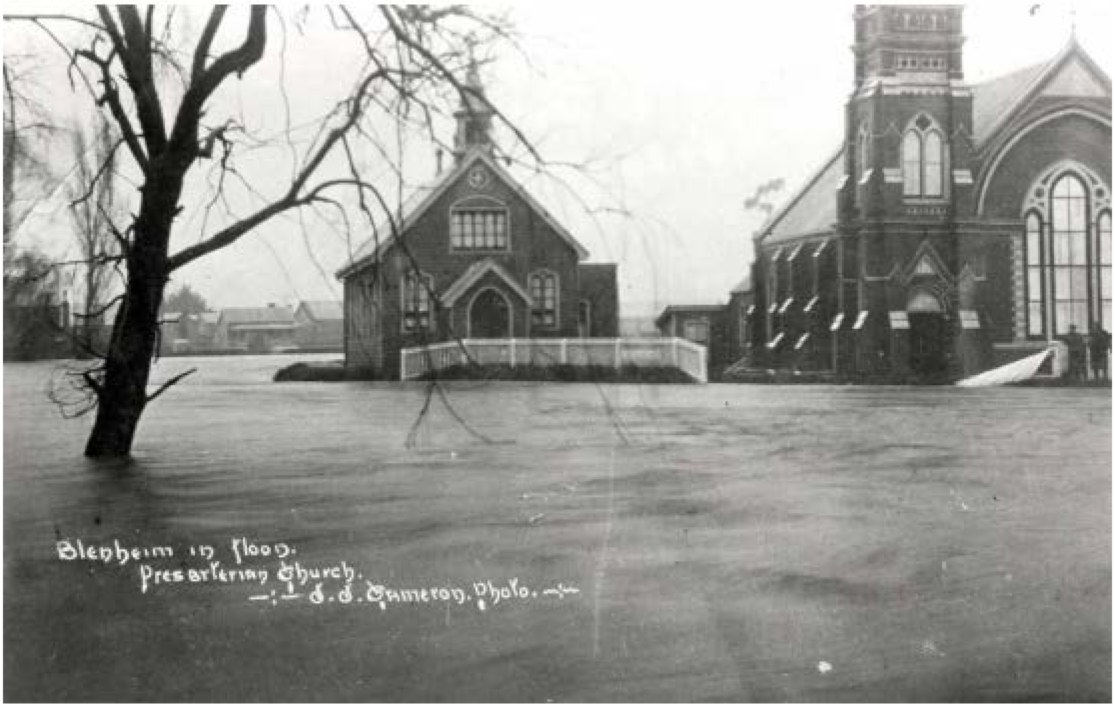
# 2019 NZHS Technical Workshop




## 'Water Quality Monitoring for the future'

Marlborough
Convention Centre
Blenheim, New Zealand

26th- 29th March 2019

## PLATINUM SPONSOR

## GOLD SPONSORS

## BEST PRESENTER PRIZE

## DINNER SPONSOR

## SOCIAL EVENT SPONSOR

# Exhibitor Profiles

# Workshop Program

| Tuesday 26 March | | | |
|---|---|---|---|
| **Time** | **Item** | **Speaker** | **Organisation** |
| | | | |
| **09:30** | Registrations | | |
| **10:00** | Formal welcome | | |
| **10:15** | Setting the Scene | | |
| **10:30** | **Morning tea** | | |
| **11:00** | **Water Quality Session 1** | **Pat Rasmussen** | **USGS** |
| **12:00** | **Lunch** | | |
| **13:00** | Using air bubbles to measure discharge in low-gradient, weedy streams | Jeremy Bulleid | NIWA |
| **13:20** | The Largest Discharge Measurement in NZ | Nick Holwerda | Auckland Council |
| **13:40** | Automated Salt Dilution Gauging | Madison Frank, Jake Connolly | Horizons Regional Council |
| **14:00** | AutoSalt Innovation – Automatic Dilution Gauging System | Evan Baddock | NIWA |
| **14:20** | Research into the Android gauging app ‘Discharge’ | Shane Sullivan | Auckland Council |
| **14:40** | Using a laser sensor for precise water-level measurement | Jeremy Bulleid | NIWA |
| **15:00** | **Afternoon Tea** | | |
| **15:30** | **Water Quality Session 2** | **Pat Rasmussen** | **USGS** |
| **16:30** | Drones in hydraulics | Hamish Biggs | NIWA |
| **16:50** | During: Space Time Image Velocimetry: Measuring High Flow Events in Queensland | Mark Randall | DNRME |
| **17:10** | **Regatta Overview** | | |
| **17:15** | **Social Event - Sponsored by Aquatic Informatics** | **Pre Function Area** | |

*See Appendix 1 for venue details.*

## Wednesday 27 March

| Time | Item | Venue |
|---|---|---|
| **09:00 - 17:00** | **ADCP Regatta.** | To be advised at the workshop |
| **17:00 - 18:30** | **Pre-dinner Drinks** | Pre Function Area Convention Centre |
| **18:30 -** | **Workshop Dinner**<br>**Sponsored by Kisters** | Grand Hall Convention Centre |

*See Appendix 2 for regatta location details.*

| Thursday 28 March | | | |
|---|---|---|---|
| **Time** | **Item** | **Speaker** | **Organisation** |
| **FORMAL WORKSHOP PRESENTATIONS** | | | |
| **09:30** | Automated Water Quality Profiling | Daniel Wagenaar | Xylem |
| **09:50** | Water quality sampling from an unmanned aerial vehicle | Thom Gower | PDP |
| **10:10** | Drones : What's Next Breakout Session | All | |
| **10:30** | **Morning tea** | | |
| **11:00** | **Water Quality Session 3** | **Pat Rasmussen** | **USGS** |
| **12:00** | **Lunch** | | |
| **13:00** | Is that water quality data reliable? | Juliet Milne | NIWA |
| **13:20** | The Value of Data and Monitoring Program Efficiency | Christopher Heyer | Aquatic Informatics |
| **13:40** | Reducing uncertainty, optimisation of field programmes, and client satisfaction | Ross Hector | Aqualinc |
| **14:00** | AWS Lamda - cost effective cloud data acquisition? | Paul Sheahan | Kisters |
| **14:20** | Applications of continuous nitrate-N analysers in New Zealand for improved nutrient estimation | Neale Hudson | NIWA |
| **14:40** | Tradestand Presentations<br>5 mins for all trade stands what's new from them | | |
| **15:00** | **Afternoon Tea** | | |
| **15:30** | Tradestand Presentations (Continued)<br>5 mins for all trade stands what's new from them | | |

| Friday 29 March | | | |
|---|---|---|---|
| Time | Item | Speaker | Organisation |
| **09:30** | To calibrate or not to calibrate? That is the question! | Dirk van Walt | Van Walt Ltd |
| **09:50** | Suspended sediment & turbidity monitoring in NZ – will any old sensor do! | Evan Baddock | NIWA |
| **10:10** | Comparability of ISO7027 compliant turbidity sensors | Andrew Hughes | NIWA |
| 10:30 | Morning tea | | |
| **11:00** | Installation of continuous water quality loggers in groundwater bores | Dave Evans | ECan |
| **11:20** | Land Use Change: Monitoring a Catchment to Observe the Effectiveness of Resource Consents | Martin Meyer | Auckland Council |
| **11:40** | Water Quality Monitoring in the Waikato | Aroha Salu | Waikato Regional Council |
| **12:00** | **Close and Prize Giving** | | |

# Abstracts – Tuesday

## Using air bubbles to measure discharge in low-gradient, weedy streams

Jeremy Bulleid - NIWA

The Rising Bubble Method (RBM) provides a solution that enables the measurement of total discharge in ‘difficult’, weedy, lowland streams. Its purpose is to ‘fill data gaps’, particularly during low flows, when existing technology struggles. It is intended to better-inform councils who manage the demands of water users, while protecting the environment. RBM enables direct measurement (in metres and seconds) and doesn’t require the empirical relationships and assumptions required by most currently-used technology. NIWA is developing an RBM system in collaboration with Hawkes’ Bay Regional Council. We will present an overview on how it works, why it is needed and how the project is progressing, using Artificial Intelligence to make the process automatic to minimise cost-per-measurement.

## The Largest Discharge Measurement in NZ

Nick Holwerda- Auckland Council

Flow discharge measurements are always a challenge especially in flood conditions or where extremes are encountered. So we tasked ourselves to see just how large a flow measurement we could capture in Auckland. ADCP technology was the only viable option, considering our cross sectional area and location. It was no easy feat with weather playing a huge role, high velocities and suspended sediment. This presentation will cover the challenges, equipment choices, location, issues encountered, did it even work, and would we do it again.

## Automated Salt Dilution Gauging

Madison Frank, Jake Connolly Horizons Regional Council

Salt dilution gauging.
Experience of installing and getting equipment working.
What we are removing and replacing.
Comparison gaugings and results.
The R Tools developed for gauging calculation  and ingestion into hilltop.
Future – rating development….

## AutoSalt Innovation – Automatic Dilution Gauging System

Evan Baddock, NIWA Dunedin.

This presentation overviews a NIWA Innovation project investigating the application of dilution gauging to automatically measure stream discharge and telemeter flow results, in near real-time.

Tracer or dilution method of flow measurement are well proven and a relatively convenient and accurate method to measure discharge, especially in turbulent streams and rivers where conventional current metering flow measurement may not suitable or safe. However, it can be difficult to obtain a full range of flow measurements for the development of a hydrometric rating curve, especially at remote locations, or in flashy streams where timely access is difficult. Resources are often wasted visiting sites at similar flow conditions, and it can be difficult and dangerous to attempt flow measurements during peak flow events in active water courses.

Over recent years as measurement technologies have changed, dilution gauging has re-emerged as a potentially useful tool within the hydrometric tool kit of hydrology practitioners across the world. As well as providing reliable discrete measurements, the method now lends itself to automation and remote control of gauging's.

NIWA has teamed up with Fathom Scientific in Canada and Unidata from Australia to investigate the use a combination of equipment to achieve this purpose, with some very interesting and promising results.

## Research into the Android gauging app ‘Discharge’.

Shane Sullivan – Auckland Council

A study and trial of the gauging app ‘Discharge’. A presentation outlining the app’s processes in measuring stream flow, challenges in site setup and capture, and also limitations within a variety of streams. An insight to the results in comparison to other technologies such as Flowtracker and/or some ADCP’s, and how it compares on site rating tables. Also a look into where the application would be beneficial across a number of different types of channels and hydrological disciplines.

## Using a laser sensor for precise water-level measurement

Jeremy Bulleid - NIWA

NIWA has developed an SDI laser-based water-level sensor. The sensor detects changes as small as 0.1 mm, meets NEMS' 'top-shelf' QC600 quality code for groundwater (< ±10 mm) and surface water (< ±3 mm). It enables accurate, calibration-free, drift-free, non-contact water-level monitoring. We have been trailing three applications for measuring: groundwater levels (in collaboration with Tasman District Council), leakage from effluent ponds (to show compliance with Environment Southland regulations) and river water in a new way that may make conventional stilling wells unnecessary – this would significantly reduce the costs associated with installing new flow-monitoring sites. We will present an overview of the laser sensor systems and update the outcomes of these applications.

## Drones in hydraulics

Hamish Biggs - NIWA

The rise of drones in hydraulics reflects the demand for higher resolution data at lower cost. Drones are now affordable, reliable and easy to use, making them well suited for investigation of finer scale processes (mm to cm), compared to the landscape scales covered by aircraft and satellites. This talk provides an overview of the use of drones in hydraulics, covering established techniques for river surveying, aquatic vegetation monitoring, and quantification of sediment transport. The talk also discusses emerging techniques for drone based physical habitat surveys and aerial discharge gauging that are being developed as part of the drone-flow project. The talk closes with an update on hardware development and testing for the drone-flow project, with plans for future deployments.

## During: Space Time Image Velocimetry: Measuring High Flow Events in Queensland

Mark Randall- Department of Natural Resources, Mines and Energy , Queensland

Collecting data during high flow events presents a number of challenges to hydrographers. Having to deal with measurement site access, staff numbers, and of course workplace health and safety requirements can mean that many high flow events pass unmeasured. As concerns about climate change grow so does the focus on "Extreme Flow Events" and the need to measure these events.

Since 2016 the Queensland Government, Department of Natural Resources, Mines, and Energy (DNRME) has been trialling the use of image velocimetry to measure high flows. Image Velocimetry is a non-intrusive measurement technique that measures surface velocities from a short video collected via an onsite IP camera or a drone. This is a method gaining increasing interest around the world as monitoring agencies try to solve the same problems associated with high flow events.

DNRME is now considered one of the lead agencies in the world for implementing Space Time Image Velocimetry providing training/information workshops in the USA, and later this year in Iceland and the UK.

# Abstracts – Thursday

## Automated Water Quality Profiling Platforms

Daniel Wagenaar Xylem

The development of automated vertical profiling platforms were driven by number of key objectives in Hydrographic and Water Quality fields. The ability to perform real-time water quality profiling without the need to deploy personnel on the water was just one of the focus areas.
The YSI automated vertical profiling platform provide an in-depth view of water quality throughout the entire water column by sampling at different depths. These cost effective solutions keep you one step ahead of monitoring site challenges, by detecting short-term events routinely missed by traditional field sampling programs such as: early identification of algal blooms, diurnal low-oxygen events, and changes in thermocline and pycnocline.

Recent addition by Xylem Water Solutions Australia is the unmanned aerial vehicle (UAV) for water quality profiling. The UAV is able to accommodate EXO3 that allows the operator to perform vertical profiling at user defined locations in the water body. The ability to perform vertical profiling with an UAV allows for quick response time in identifying plume entering the storage and the projected travel through the storage to the offtake tower. The UAV in conjunction with the traditional VPS allows for dispersion mapping, plume identification e.g. TSS /Algae and allows advanced preparation for chemical treatment at the time of drawing the water for consumption.

## Water quality sampling from an unmanned aerial vehicle

T. Gower and E. Clayton (Pattle Delamore Partners Ltd), T. Porter (Auckland Council),

Water quality sampling can be a hazardous activity. Field staff contend with weather, exposure to potential contaminants, use of various sampling platforms and access that can be restrictive due to bank vegetation and heights. While Professional Scientific and Technical Services is not recognized as a high-risk industry by New Zealand legislation, Worksafe notified injuries occurred at a rate of twenty-five incidents per thousand employees in 2017. In the last ten years there has been one registered fatality. Finding sampling solutions that keep hazards to a minimum and reduce staff risk can mean eliminating sampling points that are deemed too hazardous to access.

This presentation will detail a new process for the collection of marine water samples. Samples were required for enterococci analysis from four popular swimming beaches along Auckland's east coast; Takapuna, Narrow Neck, Kohimarama and Mission Bay. These beaches are popular not only for casual swimming and access by members of the public, but also support organized summer swimming events (Summer Swim Series), and tourist operations (kayaking and stand-up paddleboarding) where the 'contact zone' of human interaction with water extends much further off shore. Typical water quality sampling that consists of a grab sample at knee depth may not be accurately measuring enterococci counts at representative locations for such activities.

In order to measure enterococci at these locations (and provide validation of the current Safeswim model), samples are required to be collected from varying depths along transects that extend from the beach out to deep water. Across each transect 6 samples need to be collected: at Knee, waist, 1.5 m, 2 m, 4 m and 6 m depths. In the past, this would have required the use of a Maritime New Zealand surveyed powered vessel with qualified crew and the added expense that is associated with such a sampling platform, or the use of a non-powered vessel (such as a kayak) that would increase the risk of staff being exposed to water related health and safety hazards.

In this project example, a water proof drone was fitted out with a tether to fly to waypoints and dip a sampling vessel. The drone can lift up to a one kilogram weight, allowing for adequate sampling volume for a range of tests if required. For each sampling transect, a one kilometer profile was surveyed at high tide using an Acoustic Doppler Profiler (ADP), allowing for the measurement of depth at a known tide datum. As each sampling run is conducted at different tide levels, reference to this surveyed transect can be made when calculating sample depth locations and GPS coordinates can be pulled from the surveyed profile. These GPS points can then be loaded to the drone and set as waypoints, allowing for accurate recording of location and depth.

This methodology eliminated two major Health and Safety hazards that were identified at the beginning of the project: Working around deep water and working from a mobile sampling platform.

## Is that water quality data reliable?

Juliet Milne (NIWA), Rob Davies-Colley (NIWA), Mark Heath (GWRC), Eve Bruhns (ORC)

Quality assurance (QA) is commonplace in laboratory testing. However, formal QA of field sampling procedures, such as those relating to water quality, is less common, despite mistakes at any stage in the sampling process having the potential to result in substantial errors within the resulting data. In July 2015 we initiated a pilot for a national QA programme with the aim of demonstrating ongoing 'reliability' (reproducibility) of river state-of-environment (SoE) water quality data. NIWA and GWRC field staff sampled river waters in the Wellington Region side-by-side (simultaneously), and collected in-situ measurements:

(1) bi-monthly at the same SoE site, and

(2) annually at a small but diverse range of regional SoE sites.

Our presentation will summarise the findings to date, along with the key findings from a recent joint sampling day in the Otago Region between NIWA Dunedin and ORC field staff.

The NEMS for Discrete Water Quality recommends inter-agency 'audit' exercises on at least a 12-monthly basis. If field and water sample measurements collected by two agencies agree well, this provides strong evidence for overall reliability – not only for the compared SoE data, but for all data collected by the collaborating agencies (by the same protocols) within a region.

## The Value of Data and Monitoring Program Efficiency

Presenter: Christopher Heyer - Aquatic Informatics

There are many well documented benefits to continuous water quality monitoring, and established programs that enhance traditional discrete sampling are ubiquitous. Advancements in technology result in frequent development of new sensors that are routinely making what was once unmeasurable now measurable (e.g., nutrient sensors and biosensors). These new sensor technologies are not without their cost, and the resulting data they collect have a high value (extrinsic and intrinsic). Therefore, it is imperative for monitoring programs to maximize the quality and usability of data collected. Modern data review tools can help achieve this goal while decreasing the amount of time spent manually reviewing data. With these tools, thresholds and flags are utilized to identify and suppress suspect data for manual review, while publishing clean provisional data to key stakeholders in real-time. Discrete calibration and check data are used within these modern tools to suggest recommendations for automatic sensor drift and fouling corrections, increasing the amount of useable data while reducing the amount of manual data review required.

While capital investment in continuous monitoring technology is often high, typically operations and maintenance costs associated with running monitoring programs are significantly higher. Field trips to maintain instrumentation and collect samples, especially in remote areas that are difficult to access, are expensive and increasingly organizations are finding themselves doing more work each year with less staff. For these reasons it is critical to minimize unnecessary field trips while maximizing the quality of time spent in the field maintaining monitoring networks and collecting ancillary samples and data. Monitoring professionals require more than data to achieve this balance, they also require insight. Modern software tools can provide the insight and context needed to adaptively guide field crews. Map-based information, reports and alerts on monitoring network health are used to inform technicians of common problems (e.g., telemetry currency, battery voltage, sensor errors, etc.) before they go in the field so they can prepare in advance. Real-time alerts and notifications, coupled with historical data context and information from neighboring monitoring locations, guide field crews in their adaptive sampling programs (e.g., storm sampling), ensuring that critical events are fully captured.

This presentation will provide examples and best practices recommendations to help optimize continuous water quality monitoring programs, with the aim of helping to increase their efficiency and output of usable, quality data and information.

## Reducing uncertainty, optimisation of field programmes, and client satisfaction

Ross Hector and Helen Rutter - Aqualinc

Ongoing water quality sampling regimes are often required, in order to demonstrate environmental impacts, or lack of environmental impacts, associated with various industry activities. Field work is expensive, and should therefore be optimised to ensure "best bang for buck". Often sampling programmes result in collection of substantial data sets, some of which are essentially unused, and sometimes the programmes can result in lack of inclusion of parameters and/or sample sites. As a result, the sampling programme can result in wasted time and money, or can require repeated visits to sites. If time is taken in the planning stage of consent applications and research projects to think about conceptualisation of hydrological/hydrogeological systems, then the field sampling programmes and analytical suites required may be able to be optimised, without impacting on the robustness of the associated data sets.

As important, is that fact that conceptual models should be updated as new data are collected: the more information that is used to build a conceptual model, the less uncertainty there will be. Field technicians often have the best field knowledge of sites and limitations of data, and should therefore be heavily involved in data processing, initial analyses, and in discussions regarding the results of field programmes. This can aid hugely in the development of conceptual models.

If all lines of evidence are used in the conceptualisation of the systems, then the uncertainties can be reduced and justifiable reductions in the length and scope of field sampling programmes may be possible. In other words, if we can reduce uncertainty, we can optimise field programmes, and we can reduce the cost to our clients/stake holders.

## AWS Lamda - cost effective cloud data acquisition?

Paul Sheahan - Kisters

AWS Lambda is an event-driven, serverless computing platform provided by Amazon as a part of the Amazon Web Services. It is a computing service that runs code in response to events and automatically manages the computing resources required by that code. AWS costs can appear small on the surface but quickly add up as you utilise the environment. We engaged an intern to investigate if AWS Lamda was suitable as a low cost web service (API) data acquisition tool. We found that for relatively light effort, organisations can use Lamda for this purpose as part of their cloud strategy.

## Applications of continuous nitrate-N analysers in New Zealand for improved nutrient estimation

Neale Hudson, Evan Baddock, Lucy McKergow, James Sukias, Stephan Heubeck, Valerio Montemezzani, Greg Olsen – NIWA

Nutrient enrichment is a major contributor to water quality impairment internationally. The New Zealand response to water quality problems includes the National Objectives Framework (NOF), and the National Policy Statement for Freshwater Management (NPS-FM 2014, amended in 2017), which describe water quality targets and resource management actions. These targets include nitrate-N concentrations and loads.

Recently NIWA reviewed data derived from hyperspectral devices used to measure near real-time nitrate-N concentrations in several catchments in New Zealand. Several themes were explored, with implications for resource management:

1. Relationships between discrete grab sample and continuous data.

   Good relationships between grab water quality samples and spectral data were achieved over wide concentration ranges, and very different river discharge conditions. Bias between grab sample estimates and nitrate sensor results could be addressed using regression techniques.

2. Understanding flow and concentration dynamics.

   High frequency data allow discharge-concentration relationships to be determined during multiple flood events under different seasonal conditions, providing insights regarding contaminant mobilisation, which may be used to guide mitigation strategies.

3. Understanding short-term variability and potential drivers of this variability.

   High frequency data reveals diurnal trends in nitrate concentration similar to those observed for dissolved oxygen, and will prove informative regarding nutrient cycling and short-term ecological processes.

4. Trend assessment.

   High frequency data are likely to be very useful for trend detection once adequate data exist. The case studies indicate that estimates of concentration at frequencies greater than fortnightly appear necessary to provide estimates of trend over two-year periods.

5. Nitrate-N load estimation.

   The case studies indicate that reasonable estimates of nitrate-N load may be derived from sensor data collected at daily frequency. The uncertainty in the load estimation decreases as the frequency of concentration measurement increases.

This presentation also addresses questions arising from high frequency water quality measurements. What factors need to be considered before including this equipment in routine monitoring activities? How much data is enough? Is there an optimal measurement frequency? What quality management issues exist, and how may these be addressed? Are there any pitfalls for current or prospective users of these instruments, and the data that they generate?

# Abstracts – Friday

## To calibrate or not to calibrate?  That is the question!

Dirk van Walt - Van Walt Ltd

The short answer to the question is Yes!  Of course you should calibrate a sensor if you want to get meaningful data out of it.  But there is also a longer answer which is less clear cut and full of variables and uncertainties.  Up for discussion are some of these such as, acceptable serviceability of equipment, threshold of accuracy, requirement of accuracy, environmental conditions, calibration tools and environment, expected range of fluctuation, frequency of calibration, user competence and training.

Also up for discussion is bump testing or verification - How often should it be done?  How important is the method of verification? What tolerance of error can be applied?

These are all questions that should be considered before pushing the calibrate button.

## Suspended sediment & turbidity monitoring in NZ – will any old sensor do!

Evan Baddock, Andrew Hughes NIWA.

This presentation overviews some important things to know about suspended sediment and turbidity monitoring in New Zealand rivers.

In New Zealand it is common to use turbidity to derive suspended sediment concentrations. However, estimating suspended sediment loads from continuous turbidity measurements is complicated by numerous factors including; stream flow changes, type and positioning of sensors, sediment flux, and biological fouling and debris causing false readings (to name a few). There is an increasing ‘confusion’ on how to best conduct the monitoring, instrument validation procedures, and in particular how to use the data for various purposes.

Continuous turbidity monitoring is becoming more frequently used in our networks around the country for a variety of purposes, ranging from use as a proxy variable to determine suspended sediment concentrations through to using it as an absolute value for environmental state assessment.  While New Zealand has developed a turbidity ‘National Environmental Monitoring Standard’ (NEMS), this does not seem to cover or satisfy all use cases and challenges encountered when measuring turbidity. Obtaining consistent and robust relationships between turbidity and suspended sediment are particularly challenging and this presentation will illustrate some of those challenges, what we have learnt from them, and possibly raise some questions for discussion.

## Comparability of ISO7027 compliant turbidity sensors

Andrew Hughes, Evan Baddock – NIWA

The New Zealand National Environmental Monitoring Standard (NEMS) states that field turbidity sensors should meet the ISO 7027:1999 Water Quality – Determination of Turbidity Standard. This recommendation is based on the expectation that the response of different ISO7027 compliant-sensors should be closely comparable. However, recent NIWA experience as well as recently-published research suggests that the response of different turbidity sensors, even when ISO-7027-compliant, can vary appreciably.

To test the comparability of the response of different ISO 7027 compliant sensors (in FNU) a lab-based experiment was conducted. Multiple units of three different field-type sensors (Forest Technology Systems DTS-12 (3 units), YSI Exo Sondes (3 units) and Observator Analite NEP5000 (2 units)), one laboratory turbidimeter (Hach TL2310 LED) and one portable turbidimeter (Hach 2100Q is) were tested. All sensors meet the ISO 7027 standard, except for the DTS-12 sensor which has a laser diode with a peak wavelength of 780 nm peak wavelength, slightly outside the range specified of 830-890 nm.

The field-type sensors were set up side-by-side in a laboratory water circulation tank and known volumes of natural river sediment (sieved to <63 µm) were incrementally added, and responses recorded. Water samples were also obtained from the circulation tank after each sediment addition for measurement by laboratory and portable turbidimeters. Our results showed that the FNU outputs varied considerably, with up to a factor of four difference across the different sensor types. The outputs of the three YSI Exo Sonde units were in very good agreement (‘interchangeable’). However, the outputs of the Observator Analite NEP5000 and the Forest Technology Systems DTS-12 sensors were less consistent between units. This experiment demonstrates that different ISO 7027 compliant sensors cannot be used interchangeably. Interchanging sensors of the same make and model may also be problematic (depending on type used). The experiment also suggests that nephelometric turbidity should not be regarded as an ‘absolute’ measurement – for example in environmental standards.

## Installation of continuous water quality loggers in groundwater bores

Dave Evans - Environment Canterbury

At Environment Canterbury, we have recently installed several continuous conductivity and nitrate sensors within groundwater bores. The aim of the installs is to record higher frequency measurements to identify potential concentration variation between sampling events. The initial focus is on some specific areas where high nitrate levels in groundwater are known and specific investigations are underway.

The successful installation and operation of continuous sensors in groundwater bores has been a challenge and has led to many learnings. The mechanics and physical aspects of optical nitrate sensors requires careful site selection and a degree of flexibility with installation and control units.

Our intention is to share our learnings from the installation of the sensors in groundwater bores. And to start discussions with other experienced users to share information and collectively improve our current level of knowledge and progression forward.

## Land Use Change: Monitoring a Catchment to Observe the Effectiveness of Resource Consents

Martin Meyer – Auckland Council

Auckland has in recent times experienced huge demand for housing expansion. This has led to fast decisions being made to convert green field land to houses. The issues we are seeing is that little evidence exists to prove urban expansion is causing the direct impact on stream flow and water quality.

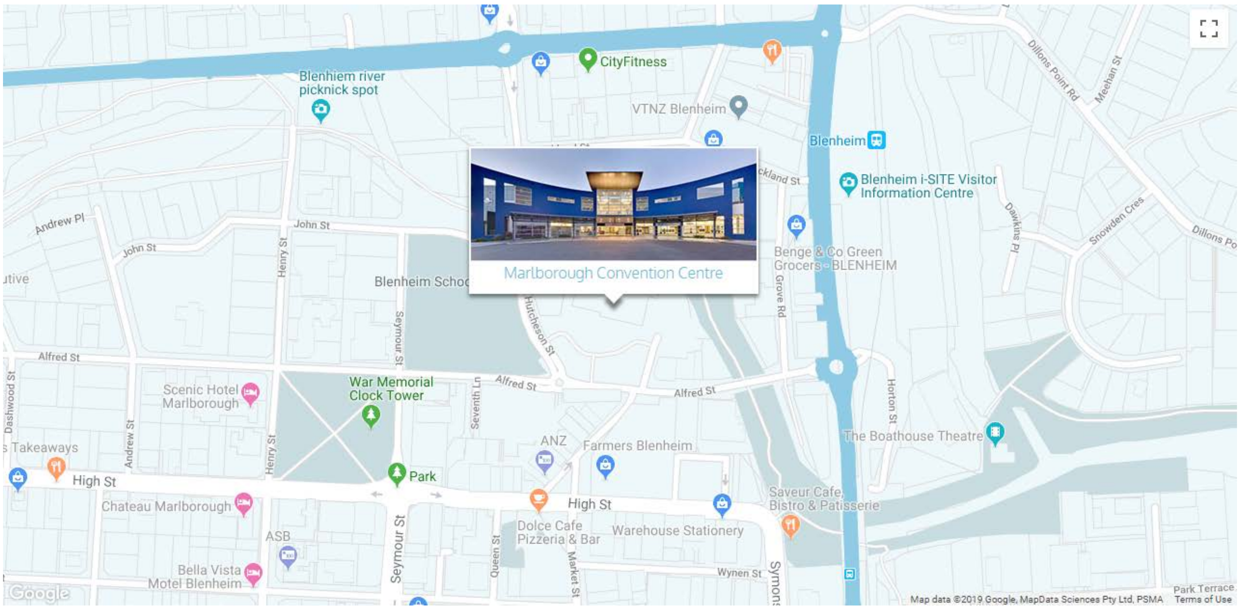
Our team have started targeted monitoring of a small catchment where the entire landscape is being urbanised. Here we are hoping to observe how land use change from green fields to a suburban environment will impact on the waterway. Installed at this site is an in-situ EXO2, monitoring dissolved oxygen, conductivity, temperature, turbidity, as well as a pressure transducer for water level and an automatic sediment sampler. The site is also on the regional water quality and ecology run . Over time the data set will aim to show the positive and negative effects of land development and how much impact the impervious surfaces will have on the 1.4km2 catchment.

## Water Quality Monitoring in the Waikato

Aroha Salu - Waikato Regional Council

Water quality monitoring of the Waikato River is a very important, long term priority of the Waikato Regional Council. So, to effectively manage, protect and enhance the values and the quality of our regional rivers and streams, evaluations of their state, the pressures on them and their response to these pressures are undertaken regularly. The implementation of the water quality monitoring programme was in 1989 and a restructure of the longstanding programme was undertaken and implemented in 2018. Since the first implementation of the programme, a history of comprehensive, reliable and good quality data has been collected from over one hundred different sites using a range of techniques and equipment. These sites were chosen to ensure representation of the effects of different land uses, climates and geology within the region on our rivers and streams. We have a separate programme for the Waikato River including a broader range of chemical analyses and two permanent continuous logging sites. The field processes, equipment and instruments used in how we monitor the water quality to collect the data will be presented, as well as challenges and different factors that are encountered while undertaking water quality monitoring.

# *Appendix 1: Marlborough Convention Centre*




**Car Parking**

Early bird all day parking is available at MDC's Alfred Street Carpark over the road from the convention centre for $4 if in arrive before 9am and leave after 4pm. Outside of this hourly charges apply.

Parking at the convention centre has a maximum stay of 4 hours.

Some limited free parking is available on the John, Henry and Alfred Streets to the west of the venue.

## Conference rooms – Grand Hall and Pre Function Area

# *Appendix 2: Marlborough Gauging Regatta*

**Objectives:**

1) Validate instrument performance by conducting comparison measurements. To assess the repeatability of measurements and instruments.
2) Compare data collection techniques and procedures. Instruments, users, methods, and field conditions. Quality code results using the NEMS standard.
3) Test different instrumentation. Demonstrations are planned for alternative techniques.

**Location:**

Currently the regatta is planned for two locations depending on flows at the time of the workshop.

**Location 1** Gibson Creek at Control Gate

This will be a straight reach downstream of a control gate off the Waihopai River re watering the old Gibson Creek channel. This site is 20 minutes' drive from the conference venue. The control gate on site will enable us to set the flow between 0 – 700 L/s.

The channel will be 2-3 metres wide and up to 0.5m deep.

Bring your PPE (lifejackets, high viz vests), extra taglines, and continuous loops. We recommend that you do not use travelers as interference between remote controls has caused issues at previous regattas.

Please note this site is on private land and help us respect that.

**Location 2** Wairau River at State Highway Six

Is a straight reach on the Wairau River upstream of State Highway 6. This could be anything from 5-5000 m3/s unfortunately the flows at this site cannot be controlled and will experience changes during the day due to power generation discharges and irrigation takes. Looking at current conditions it should be wadeable in the range of 5 to 30 m3/s in March. At this range there will be cross sections typically with water depths from 0.5 to 1.2m with widths 20- 30 m. This section is also suitable for RC boats. Bring your PPE, and extra taglines and continuous loops if you have room.

**Logistics:**

A briefing will be given Tuesday afternoon to finalise the location and other details.

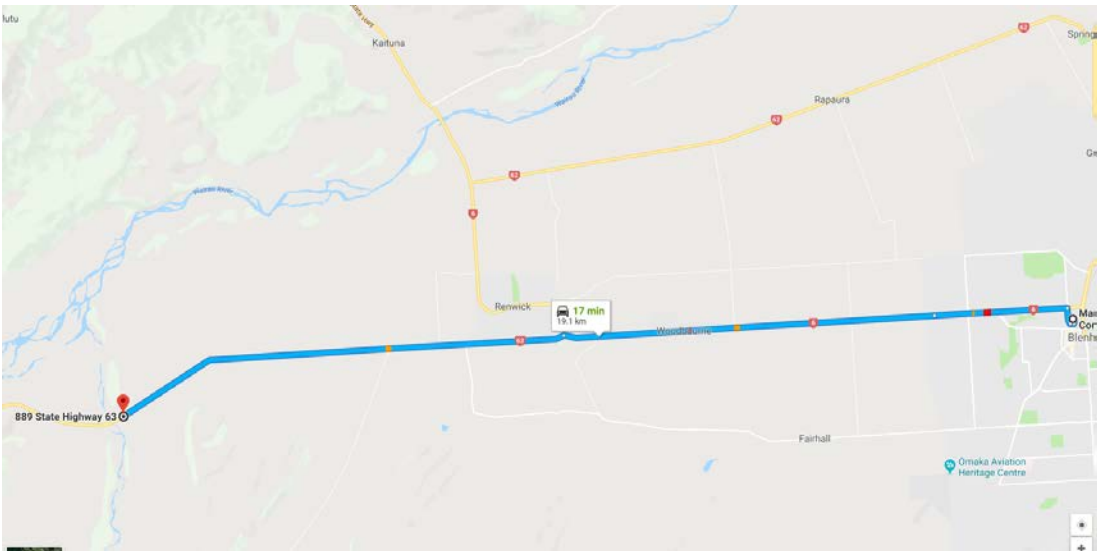
- If you plan to fly and want to freight your instruments they can be sent to the below address and we can arrange to take them to the site or you can pick them up from the MDC office. Enclose some return courier tickets for the trip back otherwise they will be added to the MDC asset management system.

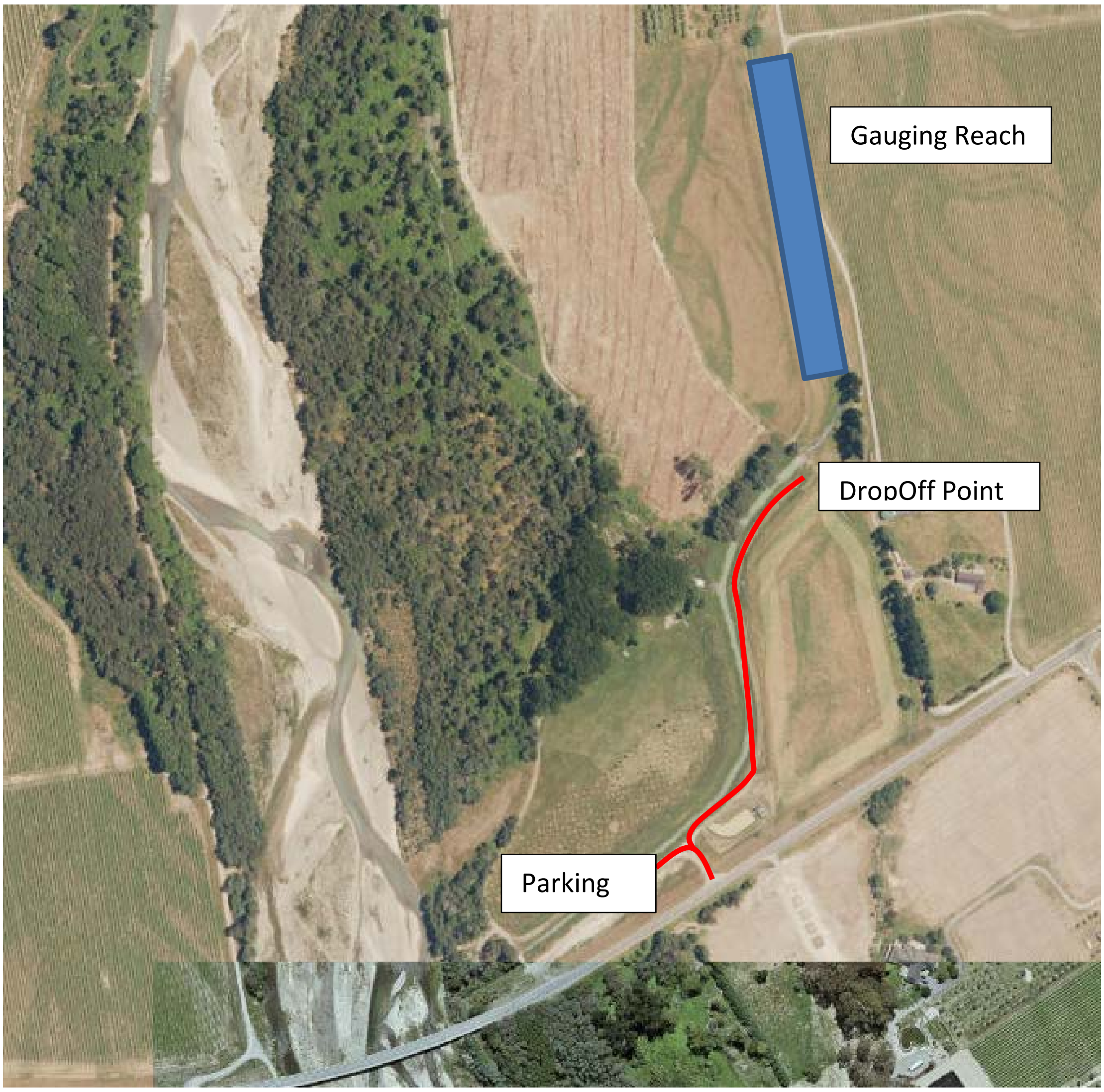
  **Marlborough District Council**
  **Seymour Blenheim**
  **Attention John Sutherland**

- Gourmet Pies will be provided for lunch, bring your own food if you don't like pies a selection of pies will be available including vegetarain. Mobile coffee cart will also be there and has been included in your registration.
- Bring your own hazards ID system, and PPE.
- A toilet will be on site.
- Be prepared to hand in a reviewed discharge measurement and result.
- Contact John Sutherland (027 807 6384) or Mike Ede (021 442 911) if you have any queries

## Location 1 – Gibosn Creek at Control Gate

Take SH63 to Nelson Lakes( St Arnaud) and stop just short of the Waihopai River Bridge.



## Location 2 – Wairau River at State Highway Six

Easy as follow SH6 to Nelson and stop just short of the Wairau River Bridge.


## In case you get lost between the two sites