

SURVEYING + SPATIAL

June 2020
Issue 102

SPATIAL

**COVID-19:
reflecting on lockdown**

**Bandits and survey
hazards in 1960s Iran**

**Social mortgages: a
new way for the future**

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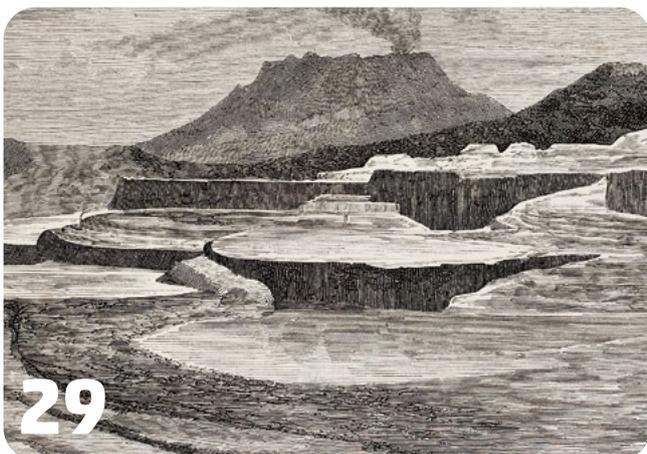
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Moving forward

As we emerge from the COVID-19 lockdown, the way we live and work in New Zealand has changed in so many ways.

From a business perspective, we have found new and innovative ways of working from home, gained new industry insights and online meetings have become de rigueur for many people around the country.

It has shown us a new way to work that doesn't involve commuting, a heavy reliance on motorised vehicles or even an office and some of these measures may become permanent fixtures for a number of businesses around New Zealand.

Despite the ensuing economic turbulence that has resulted over the last few months, there are many positive moves emerging in the construction sector and its associated industries with the \$50 billion COVID-19 Response and Recovery Fund poised to invest in New Zealand's infrastructure across several regions which will provide plenty of scope for companies to seize new contract opportunities in the near future.

Among the many bleak news reports of the last few months, the country did have some good news on the survey front. Last edition *Survey + Spatial* presented Dunedin surveyor Toby Stoff's research findings on Baldwin Street and steepest street contender Ffordd Pen Llech in Wales.

After many months of work and an official appeal to Guinness World Records, the Baldwin Street team received the good news that Baldwin Street has once again claimed the title of World's Steepest Street.

Guinness World Records validated Toby's gradient measurements and methodology findings, confirming Baldwin Street's gradient of 34.8 percent compared to Ffordd Pen Llech's 28.6 percent gradient. Congratulations to Toby and the Baldwin Street appeals team for their dedicated effort!

This edition features a wide range of topics from post-lockdown perspectives to LiDAR technology and recession-era business management.

With the recent COVID-19 lockdown making working arrangements challenging for many, Stephanie Harris and Mitch Singh examine the contractual obligations, rights and remedies during times of restricted movement and trade in our legal column this edition.

Continuing our series on survey hazards, Peter Otway recalls his perilous encounter with Iranian bandits in the 1960s whilst surveying in Southern Iran.

And researcher Rex Bunn presents the third instalment of his research findings of Hochstetter's 1859 survey of the Pink and White Terraces.

Tired of Plan Generation?

Anselm Haanen

Surveyor-General / Kairūri Matua

OVER THE NEXT FEW YEARS, WE ARE PLANNING ON MAKING SIGNIFICANT CHANGES TO THE CADASTRAL SURVEY SYSTEM. THESE WILL BE DRIVEN THROUGH LINZ'S REBUILDING LANDONLINE PROGRAMME THAT WILL ENHANCE THE SURVEY AND TITLES PROCESSES AND PRODUCE A NEW GENERATION OF LANDONLINE.

Most of the initial effort is focused on enhancing the platform to replace legacy technology and ensure the system is secure and sustainable.

This involves updating or replacing many of the core components and improving interoperability. This will include introducing an API capability that will enable third parties such as survey software providers to interface directly to the database and enable much more agile application development.

While such 'infrastructural' changes are essential to the sustainability and security of Landonline, they won't in themselves enhance the way the cadastral survey system works. In this respect we are proposing some significant changes to the way cadastral survey datasets are prepared, validated and lodged.

Early in the Rules Review Process I raised the possibility of not requiring surveyors to prepare plans. Surveyors were rightly sceptical. However, they indicated that they could support such a change if they could see an alternative means of visualising the data. We were therefore very excited when STEP innovators developed a prototype CSD viewer that showed how most of these concerns could be addressed. The functionality automatically generates an interactive web-based view of the CSD. Rather than providing fixed views, such as diagrams, the functionality enables the user to easily zoom in to reveal increasing levels of detail. Separate 'survey' and 'title' views could be presented at the click of a button.

It is worth recalling how the process for creating CSDs and plans changed with the introduction of Landonline. Before that surveyors only lodged plans. Landonline introduced the concept of 'automation' which required the presentation of data that could be checked by a computer rather than a person. But we also continued to require the traditional preparation and submission of plans, effectively duplicating the information in two different forms. The plan was, and is, still seen as the authoritative record. We currently find that the vast majority of the data required in a CSD is captured in survey software and exported into a Landonline e-survey.

Before we can consider not requiring surveyors to generate plans, we would need to have all the necessary data

submitted and stored in Landonline. The most notable elements missing are the annotations typically provided as user-added text on the plan graphic.

We have started discussions with survey software providers in New Zealand and Australia to see if they would be able to include 'all' the required data in the digital dataset prepared by surveyors using their applications. Several are very keen to continue working with us on this initiative.

The potential benefits in not requiring surveyors to generate plans are significant. As well as the obvious savings in effort and cost, the concentration on data should improve quality, reduce rework, concentrate workflow in the surveyor's environment, and avoid time in Landonline.

Much of the devil will be in the detail. We need to ensure that any proposals deliver the quality that surveyors and all users of the cadastre require – sustainably and for the long term.

We will continue working closely with vendors and with S+SNZ representatives through the Survey Working Group to refine the prototype CSD viewer and the enhanced data requirements. We hope to start sharing this information with surveyors later this year.

The move to fully digital cadastral survey processes will no doubt challenge us all – especially when we eventually move on to 3D. However, it will also provide the survey profession with a huge opportunity to show leadership across the property space. The streamlined data flows from surveyors to lawyers, territorial authorities and on to LINZ will improve data quality, reduce rework, and foster better interaction between the professions. Similarly, the availability of rich connected data will enable surveyors to deliver customised products for architects, engineers and, of course, clients.

The survey profession is well represented on the Rebuilding Landonline programme. LINZ has several surveyors with recent private sector experience, the Survey Working Group that meets every three months, and lead consulting surveyor Nick Stillwell who also provides the interface for questions and additional input. Together we can make it happen – He waka eke noa!





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Kat Salm

WHEN I WROTE THIS COLUMN FOR THE LAST EDITION OF THE *SURVEY AND SPATIAL* MAGAZINE, I COULD NOT HAVE IMAGINED THE EVENTS THAT HAVE EVENTUATED BETWEEN THEN AND NOW. IT HAS CERTAINLY BEEN THE START TO A NEW YEAR AND A NEW DECADE UNLIKE ANY OTHER I CAN REMEMBER.

This time has been very different for each of us, but Covid-19 has changed our landscape. For some, lockdown meant a hiatus from work that may have brought with it its own set of anxieties. For others, it has been a blur of Zoom meetings and planning for 'what next'. There have been concerns for those among us who are vulnerable, and also some heartening stories of essential workers and neighbourhoods reconnecting. Personally, in my street, I have seen the rise of some very impressive pavement chalk art by children practising 'art classes from home', got to know which local dogs were getting more than their fair share of walks, as well as being exposed to some alarmingly eclectic collections of bears in windows.

While I think we can all be proud of the impact that our efforts have had on the virus numbers, I am also conscious that for many of us the next months and years may be the real challenge – for our professional lives, for our industry, and also for the communities we live and work in. I would like to think this is that time that we most need to pull together as a community – supporting each other and working to shape our industry for the future we face.

I've heard a lot of people talking about getting 'back to normal', and I realise there is some comfort in that concept. But I also think we have an opportunity to think about how we could go 'back to better'. This time has given me an opportunity to examine my habits, and what I

may have placed disproportionate value in over a 'normal' work week. It has also given me an opportunity to observe what has worked – and not worked – for organisations of all types as they have undergone shifts in their usual operations. What makes us more resilient? What helps us adapt, grow and solve the challenges we are presented with more effectively?

As an organisation, like every organisation, Survey and Spatial NZ will be challenged over the next year to deliver within increased constraints. I would like to think we can rise to that challenge. We have members across our range of diverse streams and divisions doing incredible things – connecting, collaborating, contributing, and pushing the boundaries of what was thought possible. Our National Office has done a fantastic job of keeping calm and carrying on over the lockdown. The activities that our Council members are engaging with and championing – around resilience, sustainability, capability growth, mentoring, and connection – make me so excited about our future.

Yes, there will be some rocky times ahead. But I hope that this is the time that we can focus on lifting each other up and growing a more resilient and engaged organisation as a result. If you have been waiting for a good time to get involved, what better time than now? Reach out. I truly believe that our members have so much to offer, and that we need to learn and grow together.

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Cadastral Stream

Wow, what a difference a couple of months can make! Everyone's lives have been significantly impacted over the last couple of months and most likely for the many months to come as people are speculating what the 'new normal' will look like. At the time of writing we are in Level 2, many are returning to work and some are waiting to see what the impact will truly be. It's clear from the communication that I have been able to have with others is that those companies with more flexible working practices who were already set up to work from home have been able to adapt more quickly.

From a Cadastral Stream point of view, work continues. We provided feedback to LINZ on the Draft Rules and thanks to those members who shared their feedback with us. I would like to thank Rita Clark for collating the stream responses and drafting the feedback we submitted to LINZ. I know that a number of members presented feedback directly to LINZ and it was good to hear LINZ are happy with the overall response of the submissions. LINZ has recently published guidance for surveyors on Unit Plans on their website. This is a prototype for the type of guidance LINZ are proposing to publish in conjunction with the Cadastral Rules later in the year. We would encourage those that have some time at the moment to have a look at this guidance material, whether or not you work with Unit Titles to provide feedback to LINZ (SGRulesreview@linz.govt.nz) on the structure, layout and accessibility of the guidance.

Zoom meetings have become a regular occurrence now. We have continued our regular stream meetings and National Technical Committee (NTC) meetings organising Conference. There have also been a couple of Thought-Leadership meetings and we transition out of lockdown and communicate what is happening around the country and streams. From the communications I have had with members, everyone's situation is different and varied, however it is not completely unique with many facing the same challenges. From a drop in workloads and wondering what to do, reduced hours or making tough calls to let staff go, to there not being enough hours in the day to get everything that needs to be done with family interruptions, less than ideal workspace setups or the extra communication required to connect with and supervise staff remotely. I'd encourage anyone who needs to, reach out to those offering assistance. Know you are not alone in what you are going through.

Kia Kaha and stay safe.

Toni Hill, Cadastral Stream Chair.

Engineering Surveying Stream

With these uncertain times we are seeing a few surveyors out there looking at what is a bit more certain, and with all the announcements about 'shovel ready' projects and the investment being made in infrastructure, the engineering surveying world is looking about as certain as we can get.

Although this cannot be said for all projects. Transmission Gully is in the news again with an unknown future, and the \$1 billion Auckland Airport Terminal project has been cancelled. But on the other hand, all work on the City Rail Link in Auckland is progressing well and the lockdown had a relatively minimal effect on progress. The Hamilton bypass section of the Waikato Expressway and the Puhoi to Warkworth projects are facing some delays, but work continues, and we look forward to the benefits brought, as was shown by the completion of the amazing work that is the Huntly bypass.

Some of the large projects that we are looking out for that will maintain job security are: The Tauranga Northern Link, valued at nearly \$500 million; Papakura to Drury South improvements at \$423m; and the \$360m Northern Pathway, the pedestrian and cycle link attached to the Auckland Harbour Bridge.

Michael Cutfield, Engineering Stream Chair
engineering@surveyspatialnz.org

Hydrographic Stream

Whilst the Covid-19 lockdown levels have stopped most field hydrographic work, surveys for the maintenance of ports and approaches were considered an essential service. Some companies have been able to continue surveying and dredging operations throughout the period, albeit with reduced capacity.

Maritime New Zealand has released the final version of the 2020 Good Practice Guidelines for Hydrographic Surveys in New Zealand Ports and Harbours. This document was last revised in 2004 and has been under review for the last 18 months. The Hydrography Stream have been involved from the start and provided technical input feedback and recommendations to the review team as part of S+SNZ objectives to improve standards of hydrography in New Zealand. Although the guidelines are not mandatory, it is hoped that port operators and surveyors alike will make the most of the information, particularly the use of suitably qualified and certified hydrographic surveyors to carry out surveys to recognised standards and specifications.

The MNZ press release can be found at:

<https://www.maritimenz.govt.nz/public/news/media-releases-2020/20200519a.asp>

and a copy of the new guidelines can be found at:
<https://www.maritimenz.govt.nz/commercial/ports-and-harbours/documents/Hydrographic-surveys-guidelines.pdf>

Some Hydrography Stream members with experience of surveying after disasters, (such as the Kaikoura Earthquake) provided contributions to a new S+SNZ document on Resilience being developed. This document was initially drafted by the Positioning and Measurement Stream and it is hoped the final version will gain wider S+SNZ acceptance.

iXblue's new cloud deployment floats business through lockdowns

The following short summary of new technology being used during the lockdowns has been provided by Geoff Lawes, Chief Technical Officer, iXBlue, Australia. The full article can be found at:

<https://www.linkedin.com/pulse/ixblues-multi-user-cloud-based-data-processing-enabling-lawes/?trackingId=OHqbhu%2FFSWyRnc%2FgHQEuQ%3D%3D>

iXblue's survey teams in Australia and New Zealand recently transitioned from fixed ICT infrastructure into a virtual private cloud environment to meet their expanding corporate information management and geospatial data processing needs. Initially deployed in November 2019 as a means to provide access to processing tools and corporate data across borders, iXblue's new cloud-based infrastructure arrived in time to keep business moving during the recent lockdown. Although many organisations were forced to scramble to support a newly home-based workforce, iXblue's data storage and processing capabilities remained securely and seamlessly available to employees working from home.

The new cloud infrastructure now permits iXblue employees, contractors and clients to instantly shift between any computer or mobile device while staying connected with their data and processing power. Andrew Price, Hydrographic Surveyor at iXblue, has already seen the benefits, "Having access to all software and documents decoupled from my physical workstation allowed me to complete a complex, time-sensitive task and meet the deadline even when my field PC suffered a critical malfunction."

David Donohue, Managing Director at iXblue Pty Ltd is impressed by the productivity boost from the new system, "This cloud transition has helped us to get high quality geospatial products to our clients more quickly and securely with much less reliance on our physical office locations," he said.

Finally, the previous Chair of the Hydrography Stream, Emily Tidey is pleased to announce the arrival of a baby

girl on 14 May with the consequential delay of lectures in hydrography.

HPS Team

P&M Stream

After a successful workshop in Christchurch, which was very well attended with some really interesting practical papers, the thought process turns to what can be improved and where to next year. If anyone who attended the workshop did not fill in the feedback form and has ideas, please do send them through to positioning@surveyspatialnz.org.

In conjunction with the Spatial Stream we are looking to develop a workshop/spatial day with a focus around mixed reality and machine learning – this day will need to be squeezed into next year's calendar. It will be quite a different focus for the P&M group but offers the chance to look at how technology is coming together across the spatial sector. Look out for more details in the new year.

Resilience initiative

This initiative is in its early stages of development. The overarching goal is to be able to provide, equip and train a volunteer group of surveyors, who are prepared to offer their services in times of national emergency. The need for such a group has been seen during the recent Christchurch and Kaikōura earthquakes. The first documents in the kit are now in draft form for review by the Council.

Certification

In conjunction with the Engineering Stream, the goal is to be able to provide a certification path for those who choose not to follow the cadastral or hydrographical survey path.

Bruce Robinson, Chair

Spatial Stream

The Spatial Stream is excited to organise a webinar, *The Value of Information*, at 12pm-1pm on 29 May for Survey and Spatial NZ members.

We hope to tackle the different uses of information in the different streams. We also want to create a better understanding of the spatial industry and the wider streams. Hopefully we can some engagement and interest in this activity. Depending on the turnout and interest of this panel discussion/webinar, we are hoping to organise similar type webinars in different related topics. Please send in your suggestions to: spatial@surveyspatialnz.org.

(continued page 8)



Baldwin St reclaims steepest street title

*Daisy Hudson,
Otago Daily Times*

AFTER AN UPHILL BATTLE, DUNEDIN'S BALDWIN ST HAS RECLAIMED ITS WORLD RECORD.

Guinness World Records has reversed its controversial decision to strip Baldwin St of its claim to fame, admitting its measuring method had been wrong.

The street was dethroned by Ffordd Pen Llech in Harlech, Wales, last July.

The backtrack was thanks to months of hard work by Dunedin surveyor Toby Stoff, who argued that because the record-setting bid was measured on the inside verge of a curve, it greatly exaggerated Ffordd Pen Llech's steepness and disadvantaged Baldwin St, which is straight.

Mr Stoff campaigned hard for his appeal, even travelling to Wales to measure the opposition himself.

This week Guinness said after checking it out, and getting expert opinions, Mr Stoff was right.

In an email to Mr Stoff, Guinness also said it would use the right methodology for all future record bids.

"Guinness World Records takes appeals of this nature very seriously and we have thoroughly investigated the claim," it wrote.

"Following a review of your survey report, as well as consulting with industry specialists, we have concluded that for the 'steepest street' record title the best practice for gradient is to take the measurement from the centreline of the street.

"As a result, we will be reinstating Baldwin Street as the Guinness World Records title holder with a value of 34.8%."

(continued from page 7)

Our guest speakers are:

- Bruce Robinson – Chair, Positioning and Measuring Stream
- Michael Cutfield – Chair, Engineering Surveying Stream
- Stuart Caie – Chair, Hydrography Stream

- Anne Harper – Coordinates and President of SIBA to represent the Spatial Stream, will also act as the moderator.

So far we had about 134 registrations and the committee is happy to connect to as many people as possible in the industry.

Jasmin Callosa-Tarr



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Behind THE BLACK BOX

Marginal strip creation in 2020

Hannah Reader, Landpro



SINCE MOVING TO CENTRAL OTAGO, MY PARTNER AND I HAVE BEEN HEAVILY INVOLVED IN CANYONING IN THE REGION. THE MOVE HAS ALSO MADE ME WANT TO HAVE A GO AT PACKRAFTING (A BIT LIKE WHITEWATER KAYAKING) AND IN THE MODERN ERA, IF YOU HAVE AN INTEREST, YOU GENERALLY FOLLOW EVERY POSSIBLE PAGE ASSOCIATED TO IT ON FACEBOOK.

It is on these pages, after filtering through all the rubbish, a common question is asked regarding access to waterways. 'Who holds access rights over those waterways?' and, 'Does the Queen's Chain exist? Does that mean I can access a particular body of water?' Also, recently I have read the question, 'Is it true that the width of the Queen's Chain has been reduced?' I don't often engage with these posts on Facebook, as someone else usually steers the curious person in roughly the right direction, however, a recent thread had a response stating:

Marginal strips are created when Crown land adjacent to the sea, a lake or a river over 3 metres wide is sold or disposed of. One of the more common situations of interest to trampers is during the tenure review process. Because part of the previously leased land is sold to the leaseholder, marginal strips are automatically created and can provide useful access to the part of the property that has become public conser-

vation land. (<https://wilderlife.nz/2017/02/marginal-strips-and-the-queens-chain/>)

One thing I would like to tell the author of this response is that marginal strips are not automatically created, at least, not from the surveyor's perspective.

Over the past year, one of the projects that the Survey Team at Landpro has worked on has been getting qualifying water body plans approved, in conjunction with Land Information New Zealand (LINZ) and Department of Conservation (DOC), for this supposed, automatic marginal strip creation process.

To get to the finished product, where the curious recreational user can access the water body via a legal mechanism, takes hours and hours of time, and involves helicopters, aerial photography, and a whole lot of CAD and Landonline draughting. Hopefully this article will shed some light on what is behind the black box of the automatic marginal strip creation, and maybe even give some insight into how the widths of these strips are determined.

As a quick bit of background, the marginal strips being



created in this past year by the Landpro Survey Team have been in instances where the pastoral lease is coming up for renewal. The renewal of the pastoral lease is deemed a disposal of Crown land and is subject to s24 Part 4A of the Conservation Act 1987. LINZ has prepared the *Survey prescription for surveys recording movable marginal strips for the purpose of Crown pastoral lease renewals*, dealing with the specific circumstances that are associated with these datasets.

This is how the marginal strips are able to be added. The requirement is to have the survey plans approved by LINZ before the lease renewing, so that at the time it is renewed, these marginal strip parcels can be excluded from the lease.

The first aspect to the marginal strip creation process is the glamorous part. It is the creation of the qualifying water body report. Preparing reports isn't usually fun, but in this instance, the fieldwork required is something that not many people would get to experience – helicopter flights over high-country stations. The aim is to determine which water bodies require a marginal strip as per the surveyor's expert assessment of the Conservation Act 1987. How this is done is also detailed in a guideline titled *The identification of water bodies that will qualify for marginal strips* produced by DOC in 2008, the entity that approves the qualifying water body report. The report states the expertise of the person making the assessment and shows a plan of where all the water bodies are that qualify, with photographic evidence accompanied by

a written description from the exciting helicopter ride to back up the assessment.

If you ever see one of these reports, note that the lines indicating the qualifying bodies are shown on a topo plan and that does not necessarily reflect what the final survey plan is going to look like, for reasons that I will get into later. Once the report is approved by DOC, the survey plan creation process can start.

During the latest round of plans we prepared, I learnt that not all qualifying water bodies are created equal. In some instances, DOC, via the Minister of Conservation, required that the strips be wider than 20m. In some leases, the strips range from 20m wide (note: this is either side of the river) to 50m wide.

In some instances, the strips have followed an edge of a gully to ensure a walking track is included making the plans look very different than your typical offset strip. This has made for some interesting descriptions of the strip boundaries on the survey plan; otherwise I can be fairly certain future surveyors will look at these and question the sanity of the person who signed the survey plan.

Landpro is lucky in the sense that it has a fixed-wing aircraft, the people to pilot it, capture data, and process said data at its disposal. Aerial photography used to determine the marginal strip boundaries can be sourced from LINZ data service, but if required, the area can be flown to get accurate aerial imagery to digitise from.

The way that we do the capture is to bring the image into CAD, trace the water boundaries as required, then bring them into 12d to create the traverse spreadsheets. We aim to involve LINZ in the decision-making process as much as possible here, asking for dispensations where required, so that the class of the boundaries reflects the quality of the data. When using LINZ data service for example, the metadata would suggest that Class C, at best, would be suitable for new marginal strip boundaries.

In many instances, the underlying data for the leases is very poor. To create new marginal strips, however, you do not end up having to deal with boundary definition issues, this is left for the tenure review process. The *Survey prescription for surveys recording movable marginal strips for the purpose of Crown pastoral lease renewals*, which regulates how to create these strips, is explicit in this through the requirement to create the strips offset from the documentary boundary, regardless of the location of the actual river bank.

For a lease renewal where all the rivers flow in the same direction, with very little confluence and braiding, to follow this prescription makes the data-capture process fairly straightforward, especially if the start and end points of the river have a bearing and distance that can be found.

The most difficult lease area requiring marginal strip

capture that I have experienced, however, is when the underlying survey plans are topo plans, with the roads being irregular lines and the rivers braided. This raised a lot of questions. If the documentary positions of the streams/ rivers in Landonline do not match the river banks now, however, the qualifying water bodies not shown on the underlying plan or captured in the cadastre flow into these, how is the gap and/or overlap addressed? If there are no vectors to connect into when creating the strip, how can I connect into the existing road boundaries?

I have learnt that whichever way you do it, talking to LINZ and getting dispensation as required is the only right way to do it. I've ended up getting LINZ to create for me a whole lot of nodes where my strips intersect current irregular lines. These nodes I connect to existing nodes via an extensive network of calculations, for example. To do this however, I had to get dispensation from LINZ as that would not be the usual way to capture a secondary/tertiary parcel under the current rules. It ended up making for a survey plan so large it took half a day for plans to generate, and months of draughting. There might be a better way to do it, and if I were to do it again, I would probably do it differently, but that was the best way at the time.

Once the capture is complete, getting the dataset into Landonline is no different than would be expected. The interface between the third party software and Landonline is clunky, and sometimes it takes a few iterations of the traverse spreadsheet to get it to work. Once it is in there, you also better hope you do not need to make any changes, that is all I can say. For my large lease area, to give all the boundaries strips the necessary attributes took days. To right click on each line (remembering that every single line in my underlying survey was irregular, so I had thousands of irregular lines) almost made my eyes go square, and I cannot say that this did not result in pages of requisition items, despite my best efforts.

Generally, Landonline over time has been made more user friendly with the ability to

multi-select. Not in this case. You cannot multi-select irregular lines. If there is one thing I hope changes with the Survey and Title Enhancement Programme, it is that irregular lines are much easier to deal with.

Once you start dreaming about marginal strips, you've probably had your title plan approved by LINZ and are up to the stage of survey plan draughting. Survey plan draughting for these marginal strip plans, I have found, can be as hard or as easy as you make it. LINZ staff are awesome here too, I'd highly recommend talking to them to get advice on what you can do to make your draughting or last-minute capture tidy-ups easier. For example, the 'prepare layout' button is very helpful. Tick it next time you want to open a large dataset, it will change your life.

All of the above doesn't even take into account what needs to be done from the legal side of things to get the strips added to the title. To say any part of the process of marginal strip creation is automatic is a massive understatement, and shows how little the public knows of what surveyors do.

To be fair, I'd say most of the public would be asleep by the time I tried to explain what a qualifying water body was, let alone explain the downfalls of Landonline irregular boundary capture, however, maybe this shows we need to advocate more, even if we talk about flying in helicopters for 19 minutes of a 20-minute spiel, because I sure was wound up when I heard the phrase automatic used in the same sentence as marginal strip.



Seven years since we put a diamond on it



IN 2013, GLENN STONE (GSI MANAGING DIRECTOR) SIGNED HIS FIRM ON AS SURVEY AND SPATIAL NEW ZEALAND'S FIRST DIAMOND PARTNER. HE SAW AN OPPORTUNITY TO IMPROVE THE INSURANCE OPTIONS AVAILABLE TO OUR INDUSTRY AND SOUGHT TO CHANGE THINGS BY DIGGING DEEPER AND LOOKING FURTHER. SEVEN YEARS LATER, WE'RE STILL WORKING STRONGER TOGETHER. AND HERE, HE SPEAKS ABOUT HOW HIS FIRM HAS GROWN SINCE OUR PARTNERSHIP BEGAN.

It's been nearly a decade since we learnt you weren't getting the cover you needed. But if our years of involvement have taught me one thing, it's that land surveyors and engineers are always quick to adopt new technology.

This continues to give us the challenge of predicting and researching future changes before they are presented. And over the past seven years we have seen a vibrant

and forward-thinking industry evolve and grow with the support of Survey and Spatial New Zealand, its board, council and the many talented professionals and business owners who make up this wonderful industry.

Being so closely aligned with the industry has taught our business to think differently, and it has given us the confidence to ask underwriters the hard questions when advocating for Survey and Spatial New Zealand members.

Taking the first position as a Diamond Partner wasn't an easy decision financially for our young company. The sponsorship was more than we were earning annually, but for numerous reasons, we felt a real affinity for the work of land surveyors, engineers and the people involved. Having assisted a few land surveying and engineering clients to obtain the right cost-effective cover (where previously there had been a lack of options), we took the punt to get involved.

These valuable insights have meant our claim acceptance rates for all members, across all policies, are incredibly high; a result we are truly proud of.

This has also helped us develop habits and policies that have benefited everyone. A prime example being the introduction of drones – a tool rapidly adopted by the industry amongst other commercial professions.

Seeing the potential of this tool based on overseas trends – and after discussions with S+SNZ thought leaders – we were able to be one of the first firms in New Zealand (if not the first) to bring specific drone and drone liability cover to the market. Moments like these have been incredibly valuable to our business, not just in the surveying and spatial sector.

The success we've had working alongside your industry has enabled us to apply our knowledge across a range of businesses and industries. Our insurance offerings remain on the cutting edge of what's available. And over the years, as more and more members have trusted us to help protect them, our practical knowledge on what could go wrong (and often what does) has enabled our growth and current focus on enhancing coverage.

These valuable insights have meant our claim acceptance rates for all members, across all policies, are incredibly high; a result we are truly proud of. It's one that has only come about by deeply understanding your unique and historical industry, and it's one that we hope will continue to set a standard for what's expected.

Our commitment from here is to continue being proactive, to keep challenging underwriters, and to always be available to answer questions or hear your ideas. We will also continue to sponsor events and donate to the Kairūri Community Trust to support education within the sector.

If you or your firm have any interest in finding out how we can help protect you from the challenges inherent to your work, we would love to hear from you.

Glenn Stone and the team at GSI Insurance.



Hard Yards for AHSCP Certification Pays Off

Andrew Price

AS A HYDROGRAPHIC SURVEYOR IN THE FIELD, FREE TIME CAN BE SEEN AS A RARE COMMODITY, BUT SCRAPING TOGETHER ENOUGH TIME TO APPLY FOR PROFESSIONAL CERTIFICATION THROUGH THE AUSTRALASIAN HYDROGRAPHIC SURVEYORS CERTIFICATION PANEL (AHSCP) PAYS DIVIDENDS. A QUALIFICATION ALONE IS INSUFFICIENT TO DEMONSTRATE A HYDROGRAPHIC SURVEYOR'S COMPETENCE. PROOF OF HOW THAT QUALIFICATION HAS BEEN PUT INTO PRACTICE, BOTH IN THE FIELD, AND IN THE OFFICE, IS ESSENTIAL TO DEMONSTRATING COMPETENCE.

I have done most of my fieldwork for LINZ which does not require AHSCP certification below the surveyor-in-charge (SIC) role so I took a relaxed approach to certification.

This has all changed with the prospect of the Hydro-Scheme Industry Partnership Program (HIPP) in Australia, which asks for all contractors to have achieved either Level 1 or Level 2 certification. The AHSCP application requires a number of documents, but the main focus of the application is the logbook, where you marry the S5, S5-A or S5-B syllabus to the projects you have undertaken.

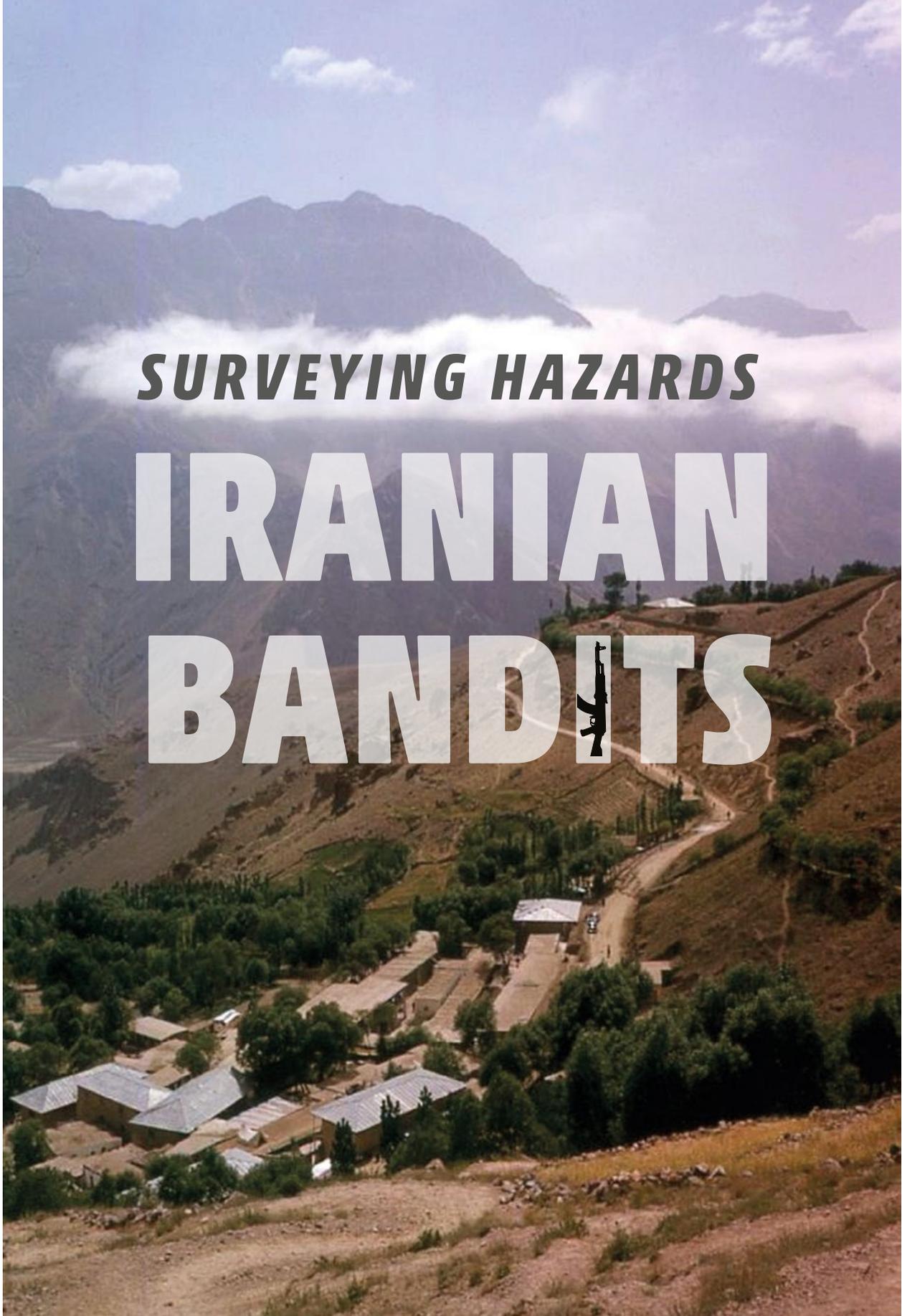
Putting together the AHSCP logbook can be a daunting prospect, and it certainly is time consuming. However, taking stock of what I have done, and more importantly, what I haven't done has really helped me focus on areas for personal development, and has forced me to put my hand up for different work, to broaden my experience.

I'm still short of in-charge sea days for Level 1, so my application was for Level 2. Building on this logbook with more in-charge sea days over the next year or two will get me into the realms of Level 1, so this helps focus me on where I need to be.

For those on the AHSCP journey, the one piece of advice I have is to keep chipping away at the logbook, it's a marathon not a sprint! As projects wrap up, it's important to make note of what you did and when while it's fresh in the mind – I wish I had been better at this. I resolved to take advantage of the lockdown to update my logbook properly.

For my employer, it's helpful to have more of their staff certified as it boosts their credibility, and helps their compliance with HIPP requirements. Having a pool of Level 1 & 2 surveyors to hand is an asset.

For clients, it reduces their risk because they have more certainty around the quality of the people undertaking work for them. It's heartening to see this message filtering out, and is well outlined in the *Draft Good Practice Guidelines for Hydrographic Surveys in New Zealand Ports & Harbours*.



Peter Otway

I HAVE SURVIVED PROLONGED BLIZZARDS AND BEEN THREATENED WITH EXPOSURE AND FROSTBITE WHILE SURVEYING IN ANTARCTICA BUT IT WAS HUMAN CONTACT THAT BROUGHT ABOUT MY FIRST CLOSE ENCOUNTER WITH DEATH.





In May 1964, I was a temporary employee of Huntings Surveys, London, well known for its big survey and engineering projects throughout the old British Empire, now the Commonwealth. I had already spent six months on survey work for Huntings in the Libyan Sahara oilfields and, after a long break to cool down on skis at my favourite Swiss resorts, had been sent to the barren Zagros mountain region in southern Iran, then still under the reign of the Shah.

Our four-man team was based in the small town of Behan with the mission of providing the ground control for a base map, the first stage of a large irrigation and hydroelectric scheme, with a dam to be built across a deep gorge of the Karun River. Never before or since have I worked in such hot, barren and forbidding mountains. We had been promised helicopter support for access to the most remote areas but, on our arrival, they had morphed into donkeys – whether due to a shortage of funds or a translation error, we never knew.

Surprisingly, perhaps, the whole experience was much the better for this. Most of the local people in some of the isolated villages we stayed in with our local English-speaking guides had never encountered Westerners before so we were met with both curiosity and genuine friendliness in their small basic houses, living in a style surely little changed since biblical times. I think they also understood how the promise of water, electricity and employment would finally give them the opportunity to

join the 20th century. Their natural hospitality was so overwhelming that the chief in one village offered me (*I think*) his nine ravishing daughters in marriage, but I had a sneaking feeling my mother would never approve. Pity!

Fun times were about to end. On about my second week on the job, I was working on a desolate ridge high above the gorge with my two guides, identifying and marking prominent points on the aerial vertical photographs taken several months earlier. We were to survey them in by theodolite and geodimeter the following day. As we picked our way through the rocky terrain, two men suddenly jumped out from behind a large boulder about 20 metres away with a lot of shouting, aiming their rifles straight at us. Being unarmed – a company policy following a recent ambush in which five US workers were shot dead as they reached for their guns – we had no choice but to obey their obvious demands. With a rifle jabbing me in the back, I obediently handed over my wallet, my precious watch inscribed by my late father, powerful small binoculars (to their great delight), and a first aid kit which puzzled them. As though in a bad comedy, I had to show them how to use it by getting one of them to hold out his finger while I applied antiseptic cream and bandaged it up.

And then they pointed to an even more desirable prize – my sturdy size 12 boots. This was a bit more serious as I would be completely hobbled without them on this rough ground. I took off one and handed it over and watched him slip off his home-made sandal and his small bare



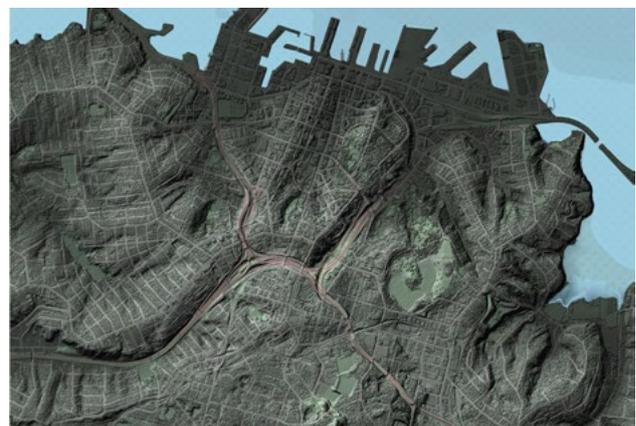
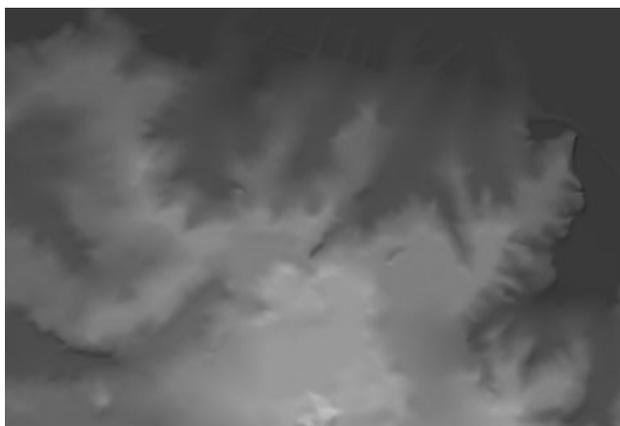
NEW ZEALAND'S CURRENT NATIONAL DIGITAL ELEVATION MODEL (DEM) IS $\pm 8\text{M}$ IN VERTICAL ACCURACY WHICH HAS BEEN DERIVED FROM THE LAND INFORMATION NEW ZEALAND (LINZ) 20M CONTOURS. ALTHOUGH THIS HAS BEEN SUITABLE FOR PRODUCING THE 1:50,000 TOPOGRAPHIC MAPS, THE ACCURACY OF THE DATA IS NO LONGER FIT FOR PURPOSE AND IS OF LITTLE USE FOR OTHER APPLICATIONS.

Over the past 10-plus years, LiDAR has become an enabling technology to obtain data with greater accuracy and resolution. With the introduction of new LiDAR sensors, the capability and efficiency capabilities from these sensors are rapidly improving. Eighteen months ago, the top-of-the-range LiDAR sensors were outputting 1 million pulses per second. Today we have LiDAR sensors outputting 2 million sensors, with some even getting up to 4

million pulses per second. These rapid improvements to the LiDAR sensors make them far more efficient in the capture which makes the survey of large regional areas economically viable.

So what is the difference between the current DEM and the new LiDAR-derived DEM? Vertical accuracy is improved by 40 times.

The difference is stunning. The accuracy of the LiDAR

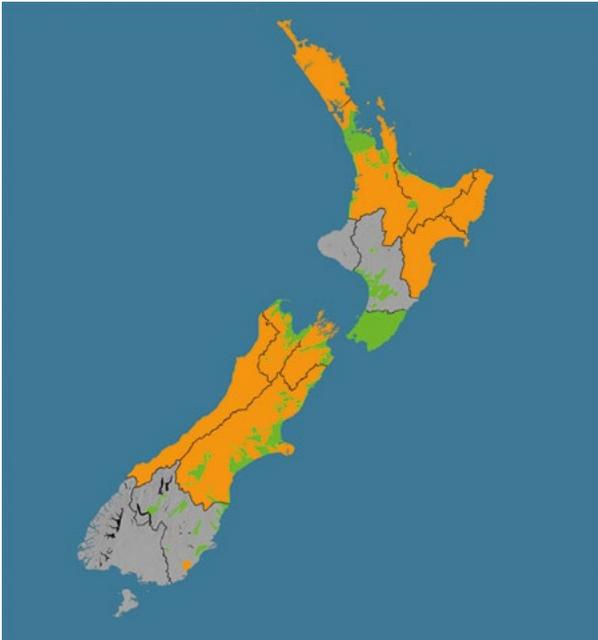


A visual comparison of two images showing the Auckland CBD area and surrounding areas: The current LINZ 8m DEM derived from 20m contours, left, compared with the 1m DEM derived from LiDAR (colour enhanced). Source: LINZ website

products provides the ability to reuse the data for other purposes and applications. All this data is available under a Creative Commons 4.0 licence, and available as open data through the LINZ Data Service (<https://data.linz.govt.nz>). This data will deliver enormous practical value and multiple uses over the coming decades to councils and regional industries.

How long will it take to get a LiDAR-derived New Zealand DEM?

The diagram shows the current situation as of April 2020. LiDAR-derived DEM is already available in the green areas, including Wellington and Auckland regions and scattered areas of low lying or flat plain area captures in Waikato, Bay of Plenty, Horizons, Nelson/Tasman, Marlborough, Canterbury and Otago regions. The orange areas are regional LiDAR programmes that are currently being captured or processed.



Source: LINZ website

This year, LINZ is managing Round 1 of the Provincial Growth Fund (PGF) regional elevation data capture project on behalf of the Ministry of Business, Innovation and Employment's Provincial Development Unit. The project provides co-funding to help regions obtain a baseline elevation dataset. LINZ is coordinating the programme on behalf of eight councils participating in the first of two project funding rounds: Waikato, Bay of Plenty, Hawke's Bay, Tasman, Marlborough, Canterbury, West Coast and Southland.

It is envisioned that we will have most of New Zealand covered with LiDAR-derived DEM within the next five years.

Can the data products be used for land development and other site-specific use?

The LiDAR-derived products are great for regional analysis, flood modelling and other regional development, but can the products be used for site-specific locations such as a new land development?

The rest of this article will go through an example of a small land development site to show what LiDAR data products are available, and how they can be used by surveyors and other geospatial professionals for site-specific locations.

LINZ has created a LiDAR base specification, and more recently a modified specification for the PGF LiDAR programmes. This specification provides a foundation for New Zealand public sector LiDAR procurements and sets out the minimum standards to ensure high-quality LiDAR point cloud data and digital elevation models that are suitable for inclusion in the National Elevation Programme.

The minimum specification is at least two laser pulses per square metre, horizontal accuracy of 100cm (95%) or better and a vertical accuracy of 20cm (95%) or better. Local councils may also choose an improved specification over certain areas, such as increased vertical accuracy over flood-prone areas to provide a product more suited for their requirements.

What are the LiDAR products? A Gisborne example:

The LiDAR products are delivered in New Zealand Transverse Mercator (NZTM)/GD2000 with heights in terms of New Zealand Vertical Datum 2016 (NZVD2016). The data is cut into full 1:1000 tiles (720m x 480m), which is a sub-tile of the NZTopo50 tile layout.

The diagram below shows the Gisborne urban area overlaid with the 1K tile layout. To demonstrate the products, I have randomly chosen six tiles on the edge of the town.

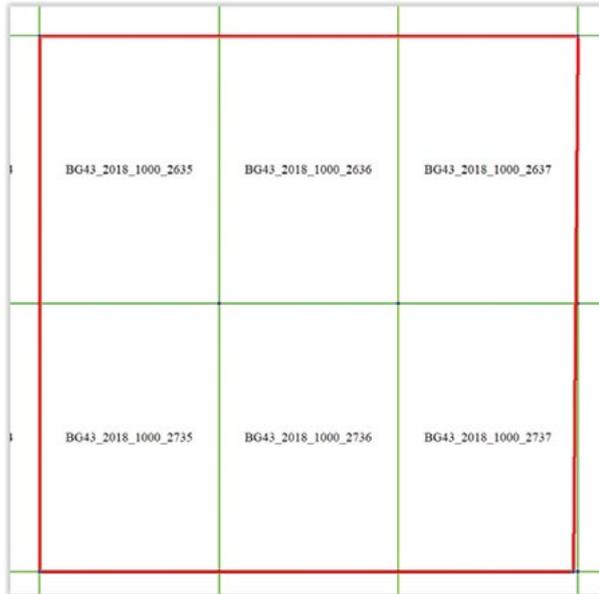
This is an imaginary development area solely for the purpose of demonstrating the LiDAR products available.



It is a bit like being back at Survey School doing a subdivisional design exercise.

The tiles are named in the format *[sheet]_[year]_[scale]_[tile].[file extension]*

In the diagram below, the six tiles for this example are shown. For each tile there are the following products:



- Classified Point Cloud – .LAS 1.4 file format
- 1m Gridded Bare Earth Digital Elevation Model (DEM) in Geotiff (.tif) file format
- DEM with hydro-flattened Breaklines in Shapefile (.shp) format
- Digital Surface Model (DSM) in Geotiff (.tif) file format

The file naming for these products uses a *[product]_tilefilename* files relate to bare earth DEM.

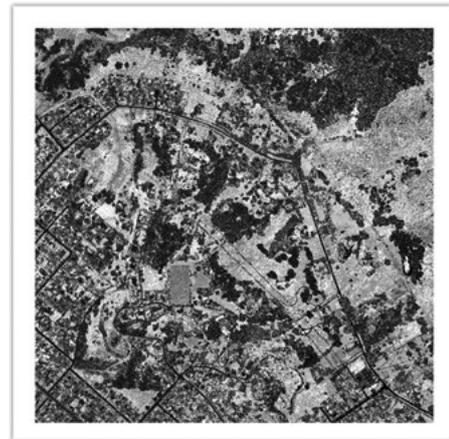
Classified point cloud

Raw LiDAR data consists of millions of points in a 3D point cloud. During processing, each point is classified into various classes such as ground, above ground, water and high/

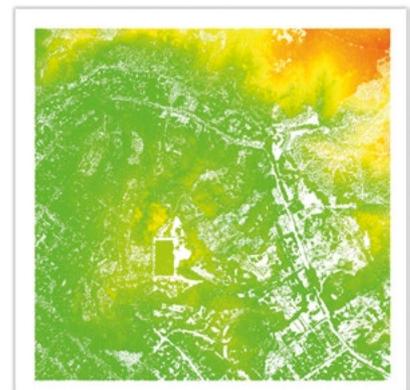
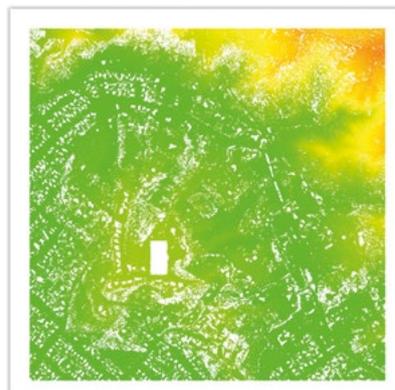
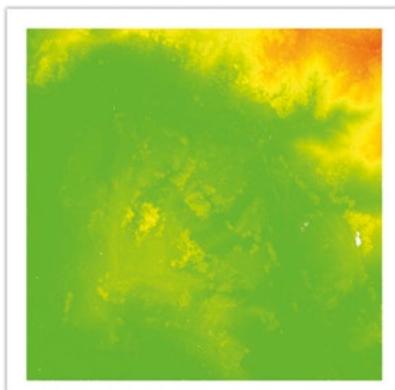
low noise. The PGF LiDAR specification further classifies the above ground into the classes: low, medium and high vegetation and buildings.

The classified point cloud files can be around 100 to 200MB per tile, so a reasonably high specification on the computer is required when loading multiple tiles of classified point cloud data.

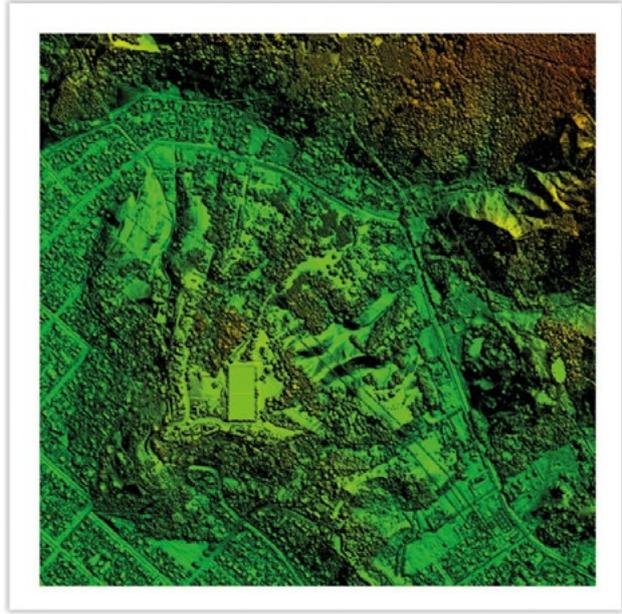
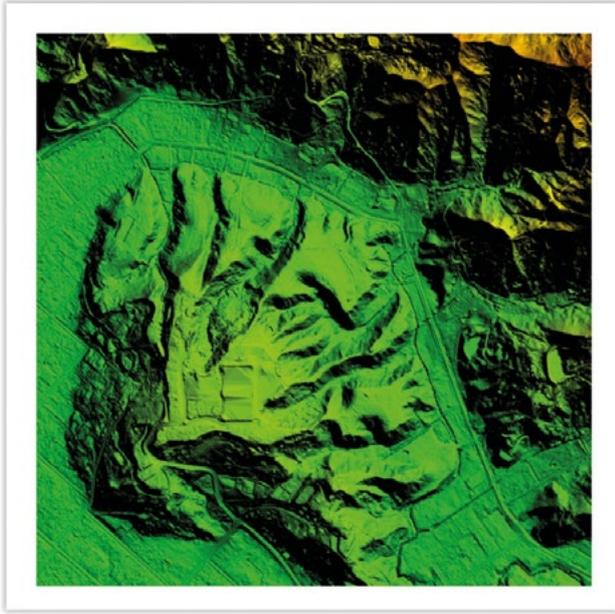
The classified point cloud also has additional information stored for each point. One of these is the 'intensity' value which is effectively the return signal strength from each return recorded in the LiDAR sensor.



Intensity image point cloud – similar to b/w ortho and optional RGB imagery to colourise point cloud.



From left, classified point cloud – all points; ground classified point cloud; above ground and classified point cloud.



A 1m Gridded DEM (Digital Elevation Model) and a 1m Gridded DSM (Digital Surface Model).

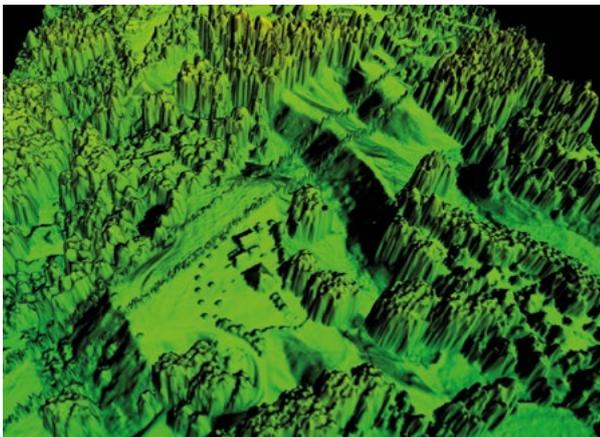
1m Gridded DEM (with hydro-flattening)

The gridded DEM is a uniformly spaced (1m in this case) bare earth elevation model, with above ground features removed. It can be thought of as a regular even grid of spot heights. The file size for these tiles will be around 2.5MB and are a far less strain on computer resources compared with the point cloud data sets.

The DEM is 'hydro-flattened' which means that the water/land interface line of permanent Islands, large lakes and ponds, inland streams and rivers, and other non-tidal boundary waters are created and stored as a Shapefile.

1m Gridded DSM

The gridded DSM (Digital Surface Model) is a uniformly spaced (1m in this case) of the first returns from the laser pulse. A laser pulse can have multiple returns when it goes through gaps in the vegetation or other above ground features. The first return over vegetation, for example, will be the top of the vegetation. The DSM can be



A 3D view of DSM showing trees and powerlines.

thought of as a silk sheet draped over a 3D model, so it drapes over trees and other above ground features, including powerlines. These files are of a similar size to the DEM files of around 2.5MB.

Create additional products

The above example has shown the standard LiDAR products available on the LINZ Data Service for download from the comfort of your office desk. Additional products can be generated from these standard products and the data can be used for additional applications and uses. Some examples of additional products are:

Additional LiDAR processing:

- Colourised point cloud using ortho imagery
- Separate out the ground classification data set for design of roads and other infrastructure
- Create a normalised DSM (nDSM) or normalised point cloud to measure heights above ground of buildings, trees and the profile structure of other above ground features
- Ground surface improvement for hydraulic modelling of the site
- Additional classification of the point cloud to identify other features such as powerlines, roads, rail lines and bridges
- Data thinning to reduce the size of the point cloud using key model points to define and keep topographic change points defining terrain change such as top and bottom of banks and removing points that do not add any improvement to the terrain definition.



Reflecting on New Zealand's Covid-19 shutdown

Mick Strack

The Aotearoa New Zealand response to the global pandemic was sharp and decisive and brought in measures to protect public health at an unprecedented and almost incredible level. We have been influenced by a mutual moral duty to act in concert against this common enemy (with notable renegade leaders bucking the trend). Of course, public health demanded an immediate response, but now is a chance to look at the other crises we are facing.

There has been a rapid rise of environmental concerns over my lifetime: famine, natural disasters, overpopulation, poorly managed urban growth, resource exploitation, atmospheric ozone loss, peak oil, and climate change. There have been urgent, even desperate calls for global action. But little has been done. The costs on society, the economy, business as usual have seemed too high – diversion of investment dollars, job losses and even global recession. It has taken the pandemic, which in spite of relatively low chances of infection has mobilised change – previously unimaginable change – with dire consequences for the economy and for many businesses and individuals. But the sky has not fallen in.

Parts of our natural environment have illustrated remarkable resilience, responding immediately to the brief

respite from our overwhelming presence and our destructive actions. Perhaps most significantly, less air pollution in and around our industrial cities. Cleaner urban air will in itself save millions of lives around the world. Time will tell how the rest of our natural environment will bounce back, but there has certainly been a sudden drop in carbon emissions and fossil fuel use, a return of bird life (and other wildlife) to our cities, cleaner waterways (the Venice canals are flowing with clear water for the first time in memory) and fish population recovery.

How may we take some positives from this shutdown? There should no longer be business as usual. The infrastructure development signalled to occur after shutdown to kick-start the economy should be directly focused on green infrastructure and energy: public transport to keep private cars off the roads, renewable energy to reduce carbon emissions, digital infrastructure to facilitate continued work from home or local business hubs, health-care infrastructure, a massive boost in healthy housing construction, and the restoration of damaged ecosystems. That is something we should all take a lead on with the same commitment we applied to our period of isolation.

Additional mapping:

- Vectorising additional features such as fence lines, powerlines, building outlines
- Import the data into other software packages such as engineering design and CAD packages for advanced mapping and design work
- Create slope maps, slope direction maps, contours (suitable for 0.5m contour interval) and intensity images
- Change detection over time by comparing new data with existing data.

Combine with ground field survey data:

- Combine your survey data with the LiDAR products to create more feature rich and detailed base maps
 - Take the LiDAR data products into the field by importing the data into data collectors and other surveying/GIS mobile devices for use on site.
- 3D visual displays and 3D fly-through:
- Promote your land development project using 3D views and a 3D flythrough.

Conclusion

The New Zealand Government's initiative to create a LiDAR-derived national DEM and to provide this data and products to the public under a Creative Commons licence is commendable. Although the large regional data sets are used by central and local governments for large area planning and analysis, the data can also be used for site-specific locations and provide valuable data and products which are freely available for surveyors and other geospatial professionals to use in their work.

5 differences between a good recruiter – and a cowboy...

Here are 5 tell-tale signs to help you discern a kick-ass recruiter from a drop-kick...

1. Good recruiters will meet you face to face

Clever recruiters have deep insights of the companies they represent so they'll meet you in real life to get an understanding of your personality. This will help them decide whether you'll be a good cultural fit for a business or not, which contributes massively to how much you'll enjoy working at your new company.

2. Good recruiters have in-depth knowledge of the industry

The best recruiters usually work with a specific industry and have in-depth knowledge of that industry. Amateur recruiters "dabble" in multiple industries. Good recruiters have built exceptional relationships with the decision-makers in their chosen industry and have access to those jobs that don't even get advertised – often the best roles...

3. Good recruiters keep you updated

If you find yourself desperately emailing your recruiter, pleading for progress, move on. A good recruiter will happily (but metaphorically) hold your hand through the process – they won't leave you feeling needy, like a bad recruiter will.

4. Good recruiters respect your career goals

If you're ever involved in a conversation where the recruiter's trying to persuade you to accept a role that you're not really interested in and it makes you feel undervalued, despite you being clear about what you want? Hang up as soon as you can.

5. Good recruiters focus on long-term relationships, bad recruiters on one-night stands

Bad recruiters dump your CV into the recruitment pipeline and only contact you if there's good news. Maybe they hate to be the bearers of bad news, or maybe they're just emotionless pimps. Either way, it's no good for a candidate or a business. A good recruiter walks the extra mile to ensure their clients and candidates achieve what they want.

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— RECRUITMENT —

 **Survey
and Spatial
New Zealand**
Diamond Partner



Managing retreat with regulation and compensation

Mick Strack mick.strack@otago.ac.nz

A DISPUTE HAS BEEN BREWING IN MATATĀ OVER THE PROTECTION OR EXTINGUISHMENT OF EXISTING USE RIGHTS – SPECIFICALLY, WHETHER TO ALLOW CONTINUED RESIDENTIAL OCCUPATION OF PROPERTY SUBJECT TO A HIGH RISK OF LOSS OF LIFE. INDEPENDENT HEARING COMMISSIONERS, IN A REPORT ISSUED AT END OF MARCH 2020, HAVE SIDED WITH THE COUNCIL’S POWERS TO FORCE RETREAT FROM THE PROPERTIES.

In 2005 a major debris flow from the Awatarariki Fanhead in Matatā caused significant destruction of property and infrastructure – 27 homes destroyed and damage to 87 others. In the following years, several houses were rebuilt while the council investigated ways to protect the area from future debris flows.

It was eventually decided that there is no practical and economic way to avoid or mitigate the hazard. The engineered solutions investigated “while technically feasible (but not reasonably practical) would in all likelihood be cost-prohibitive and have little material impact on the risk of future debris flows occurring”.

The Whakatane District Council (WDC) and the Bay of Plenty Regional Council, therefore, determined that the risk to human life was such that residential occupation of the high-risk zoned land must be avoided, and that voluntary managed retreat was the most effective measure to reduce the risk. To implement this policy, the WDC initiated a Plan Change (PC01) to its District Plan that rezoned the fanhead into ‘high’, ‘medium’ and ‘low risk’ areas. Concurrently, the WDC applied for a private Plan Change to the BOPRC Regional Plan (PC17) which extinguishes residential activity existing use rights in the ‘high risk’ area.

The Resource Management Act 1991 specifically protects existing uses in section 10, but this protection does not extend to a land use that is controlled for the purpose of avoiding or mitigating natural hazards. Regional councils have an explicit statutory responsibility to protect human life, health and safety (RMA s30(1)(c)). Furthermore, the RMA is silent on whether compensation is available for lost property rights. However, to facilitate the implementation of this managed retreat, district, regional and central government also agreed to contribute one-third each to a fund to compensate property owners the full value (not discounted to reflect the existing hazard) of their lost property rights – an offer that is voluntary but must be accepted before the end of May 2020.

The final decision of the Planning Commissioners included the acknowledgment that: **“Managed Retreat is a valid policy; that a rule in a regional plan can extinguish existing use rights, that continued occupation of the land is not a ‘reasonable’ use of the land, that a precautionary approach to defining risk areas by the WDC is appropriate in the case of loss of life, that protection of health and safety of people should be the dominant concern in a high-hazard area, and that the valuation process is robust and fair”**.

The commissioners found significant support for the policy of managed retreat from the NZ Coastal Policy Statement (Objective 5 and Policy 25) although a debris flow is not strictly a coastal hazard; and from the Regional Policy Statement objective of avoiding or mitigating natural hazards by managing risk for people’s safety.

This situation provides an opportunity to consider the protection of property rights and the powers of land use regulation vested in local authorities, and to see what courts have decided about managed retreat in recent years.

In New Zealand, property does not have absolute statutory or constitutional protection, and local government regulation is legitimate if it serves the stated purpose (for example section 5 RMA 1991).

In *Falkner v Gisborne District Council* ([1995] NZRMA 462), the High Court decided that the managed retreat policy was a legitimate response to coastal erosion and the local authority was not required to continue protection works, nor even allow for the land owners to build their own coastal defences. The court stated “common law property rights regarding the use of land or the sea are subject to the RMA 1991”.

The Supreme Court in *Waitakere City Council v Estate Homes Limited* ([2006] NZSC 112) observed that there is no general statutory protection for property rights and denial of consent to develop land is a legitimate regulation rather than a taking of property.

In *Otago Regional Council v Dunedin City Council* ([2010] NZRMA 263), the Environment Court, in a seemingly divergent decision, stated: “Adequately informed land owners can choose to accept responsibility for the natural hazard at their own risk”, and: “There comes a point where a consent authority should not be paternalistic but leave people to be responsible for themselves, provided they do not place the moral hazard of things going wrong on other people.”

However, 10 years later in *Taranaki Energy Watch Inc v South Taranaki District Council* ([2020] NZEnvC 18), the Environment Court stated that “residents are not the sole arbiter of risk in a situation where hazard risk is involved”.

The hearing commissioners reached their decision with strong backing from court precedents to the effect that “councils have statutory obligations to act on behalf of communities to reduce or mitigate risk to life from natural hazard”, and therefore the Plan Changes that prohibited residential occupation should be allowed.

The fact that full compensation is offered to the evicted landowners, perhaps made the court more confident in deciding in favour of the Plan Changes. As was noted, and quoting from *Hastings v Auckland City Council* (NZEnvC AO68/2001), compensating the owners “may make reasonable an otherwise unreasonable zoning, where this furthers the purpose and principles of the Act”.

This decision is likely to be appealed in the Environment Court by residents who remain convinced of their right to continue their residential occupation of their properties, but it would appear that the balance between protecting and extinguishing property rights is well founded. The decision confirms that:

1. Managed retreat is a legitimate policy goal for local authorities
2. Property rights are not absolutely protected, but are subject to legitimate regulation.

However, this decision may have long lasting and complicating implications for local government. Increasing sea-level rise and climate-change effects exacerbating the coastal erosion hazard are likely to require retreat from most New Zealand coastal margins. The fact that in this case, compensation is offered to property owners, provides a strong precedent and expectation that any policy of managed retreat from the coast must be accompanied by full compensation. Is the Government prepared to face the compensation bill when perhaps thousands of coastal properties are about to be lost to the sea? And at what point will local government assess that the risk to life is such that it enforces retreat? Such conflicts on the coast are likely to increase.



Working from home

(now a real option
for many professionals)

David Crerar, Registered Surveyor (1991)

I CAN GUESS WHAT YOU ARE SAYING, WORKING FROM HOME IS FOR THOSE UNFORTUNATE FELLOWS WHO CAN'T HOLD DOWN A 'REAL' JOB!

Well, I have news for you, the world wasn't invented to clock in every morning five days a week to a job run by an overseas multinational company, or being stuck in Auckland traffic while listening to Easy Listening hits from the 90s.

I work from home, and I'm proud of it.

We all can trace where we were when the notion of lockdown was announced by Prime Minister Jacinda Ardern. On Monday, March 23 when Level 3 was announced, and we had 48 hours before Level 4, I was wondering how we could do field work and keep our staff safe.

Monday morning was spent cleaning out the office of all the clutter that is archetypical of a surveyor and disinfecting all surfaces with a trusty bottle of Janola and water. Our world was about to be turned upside down, and it was

almost a relief to hear what the PM was saying, taking responsibly for our collective future, health and security.

Like many families, we got our uni daughter home from Wellington, and we were secure in our bubble. In the first week, we were worried about Amy travelling through the airport from Wellington, and Lauren studies at Marist College. So initially both girls were in different parts of the house self-isolating as both got tested for Covid-19.

During this time I was busy feeding everyone (although in different parts of the house), and looking after my wife Susan, as her carers finished work, and, of course, doing all the dishes. Susan has multiple sclerosis (MS) and the carers not only help Susan get the best out of her day, but allow me to work and have time out from my family responsibilities.

That was my greatest fear coming into this lockdown, having to be the sole carer, not having the respite that we usually get. As it turned out, our daughters were deputised as Susan's carers and this worked well for us all.

I live and work from home, as I have done for the past 28 years. Twenty years in Mt Albert and eight in Sandringham.

We employ one graduate and part-time field assistant, and a part-time accountant.

Other than that, we are a small but awesome business, and it has been this way for a long time.

When Susan met me in 1995, I was running my business from my single bedroom, while renting out the rest of my house in Sandringham to flatmates. She inspired me to look beyond my narrow focus and start treating my business professionally. Not long after we were married (engaged after three weeks), we got rid of all the flatmates, starting the business afresh from one of the three bedrooms.

Susan has always inspired me to treat this business professionally and be paid accordingly. "What is the point if you don't, haven't you spent six years qualifying?" she would ask me over and over. Like most husbands, I finally got the message.

At our new house in Mt Albert, we have expanded and built the new office, again treating the business professionally.

As time has gone by, and surveying information and survey lodgement has all gone online, and computers become more powerful we find that an office of 30m² is more than enough space.

Of course, any amount of fieldwork can be done anywhere in Auckland, as this is not limited by where your office is located.

Most people love their jobs, and need to get out of the house to bring them into contact with the rest of humanity, but once you get the hang of it, working from home is very stimulating and a great option for many folk.

We have raised two young ladies while working from home. In the early days I would help out with the child-rearing, as Susan couldn't do everything from her wheelchair. It was a pleasure being able to contribute to the formation of two beautiful girls, and having that time together is something I will cherish forever. They say that kids need our time in their upbringing, and working from home provides this flexibility.

Many people probably have changed their perspective on life during the lockdown, and I hope for you that you can experience the joys of parenthood like we have. We had a lot of help from Susan's parents who were over from Titirangi many times during the week. Getting help is one of the fundamentals to our family, and today, we have carers over most days allowing me to continue to work.

We have all found that during lockdown a certain amount of work can be done from home, and our business was forced to adapt as best as we could like everyone else. I did a couple of council applications online and managed to get some income in despite the lack of urgency in the marketplace. For some people, lockdown was an opportunity, but for others with young families and lots to deal with home, it became an extra burden.

Nothing really changed much for us apart from the uncertainty that we all experienced. After 28 years in business, in some ways, I was pleased to have a forced break from work, and look at life differently as a New Zealand and global community member.

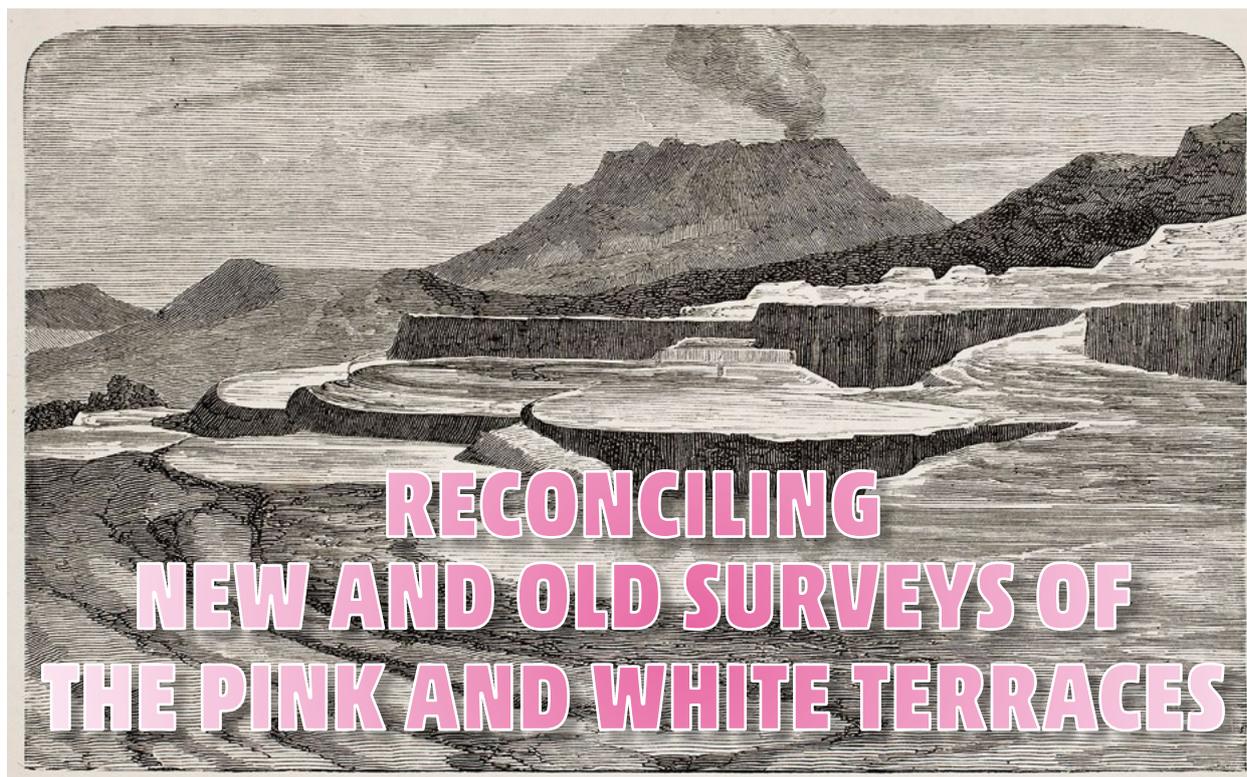
If you are thinking of a change from your regular job, why not consider working from home? It is the most flexible business system around.

Working from home takes a change in attitude. At a job, you get told what to do, and what your boss expects from you. I ended at odds with this arrangement as I always wanted to try new things, but was told it wasn't my department to take the initiative. I wanted more. From home, you have to form new disciplines and new habits that generate income through faith that will keep food on the table.

Finally here are a few handy hints that relate to our experience that may be helpful to you to continue working from your new home office. These are things that Susan and I use to help us overcome MS and try to keep a positive attitude.

1. Believe that you will succeed and get through all obstacles.
2. Take one day at a time (there is always tomorrow).
3. Sleep well, exercise, limit your alcohol consumption (keep healthy).
4. Take time out for yourself; this may mean adjusting your timetable to suit.
5. Get a hobby; for me that is now triathlon.
6. Always go to bed before you get tired. Working from home requires that you keep alert.
7. Get help from family, friends or business associates (other surveyors).
8. Don't fret about what you don't have, and don't beat yourself up about it.
9. Try to relax, as stress and anxiety only takes away your energy and vitality.
10. Delegate responsibilities to everyone.

Good luck out there. Working from home, isn't actually that bad, eh?



RECONCILING NEW AND OLD SURVEYS OF THE PINK AND WHITE TERRACES

A. R. Bunn

THIS IS THE THIRD IN A SERIES OF RESEARCH PAPERS ON A UNIQUE CHRONICLE FROM NEW ZEALAND'S SURVEYING HERITAGE. IT COMPILES THE SURVEY NOTEBOOKS OF FERDINAND HOCHSTETTER, ALSO REMEMBERED AS THE *FATHER OF NEW ZEALAND GEOLOGY*. IN 1859, THE GOVERNMENT COMMISSIONED SURVEYORS JULIUS HAAST, DRUMMOND HAY AND CARTOGRAPHER AUGUSTUS KOCH TO JOIN HOCHSTETTER ON A THREE-MONTH SURVEY COVERING 259,000 HECTARES AND 200 PEAKS ACROSS THE NORTH ISLAND. IT WAS A SIGNAL ACHIEVEMENT IN THE SURVEYING PROFESSION'S HISTORY. IT ALSO PRODUCED THE ONLY SURVEY OF OUR LOST EIGHTH WONDER OF THE WORLD, THE *PINK AND WHITE TERRACES*.

1.0 Introduction

The silica sinter *Pink and White Terraces* were an *Eighth Wonder of the World*. In 1886, the Tarawera eruption led to their disappearance. Due to the lack of any survey, it was impossible to confirm where the Terraces were located and whether they lay buried or destroyed. Controversy followed until World War II.

In 2011, an interdisciplinary oceanographic team announced they'd rediscovered the *Pink and White Terraces* in Lake Rotomahana (GNS Science, 2011a, b). They cited sonar and underwater photography, suggested by old maps and photography. Their claims were published in institutional journals (Winner, 2012). In 2016, the team published articles describing the rediscovery (De Ronde et al., 2016a, b [DR-2016a, b] and Keam, 2016 [K-2016]).

In 2016 a forgotten survey of the *Pink and White Ter-*

*rac*es was digitally repatriated from Switzerland. It was by nineteenth century surveyor and geologist Ferdinand Hochstetter: the *Father of New Zealand Geology* (1829-1884). I noted the survey data might be reverse engineered to plot the *Pink and White Terrace* coordinates. Hochstetter's included maps enabled georeferencing to validate the data. His survey was published in issues 94 and 99 of this journal (Bunn et al., 2018 [BDS-2018]; Bunn, 2019b [B-2019b]). These articles concluded the three Terrace spring locations lie buried on land around Lake Rotomahana. The Terraces may no longer be considered destroyed.

The marine team findings conflict with Hochstetter's survey. In this article, I reconcile the disparate conclusions. The Terraces remain a subject of scientific, economic and cultural fascination. It's important to settle the survey record for Māori, who grieve for lost relatives.

2.0 Findings

In 2.1 I examine the background provided to the marine team by Prof. Ron Keam (1932-2019). This comprised four pieces of research – his map of Lake Rotomahana, his altimetry, his prediction Rangipakaru Hill became Patiti Island and his Pinnacle (K-2016). These provided a scaffold for marine team sonar, photography and georeferencing. He also produced a skyline photo-analysis, recently refuted in Bunn, 2020, pp.200-202. In 2.2 I review the marine team’s findings; explaining the disparity with Hochstetter’s survey.

2.1 Keam’s Contributions

2.1.1 Lake Rotomahana map

Between 1864-2011, one large-scale lake map was accepted. This was attributed to Hochstetter but produced by August Petermann (1822-1878), (Hochstetter and Petermann, 1864). From 2011, when Hochstetter’s lake maps were published, it’s necessary to differentiate these (Johnston and Nolden, 2011). After 2017, when 12 defects in Petermann’s map were published, Hochstetter’s mapping becomes the preferred resource (B-2017).

In K-2016, Keam published his large-scale map. The marine team claimed this showed the *Pink and White Terrace* locations better than Petermann (DR-2016a). Keam described it as a draft, *outline map* for it was unfinished from 1959. It drew on period photography; hence caveats on photo-interpretation apply (B-2019a). He used trigonometry and *all sorts of extra elements* (R. Keam, pers. comm., March 8, 2016).

In Figure 1, Keam has four landmarks, including a pyramidal feature on the White Terrace embankment that he coined *The Pinnacle*. This *pyramidal feature* appears in pre-eruption photography. It became a landmark for marine team georeferencing the old lake over new Lake Rotomahana (see 2.1.3).

Keam’s landmarks were on the northern third of the lake. No photographs survive from the southern shore. Two-thirds of his map – Pink Terrace to Koingo is *mud mapped*. How he oriented it is unknown. There are 14 mapping errors (B-2017, B-2020).

Keam recognised the deficiencies: *I felt that the map – even in its outline and incomplete form – could still be usefully employed in conjunction with Hochstetter’s published sketch-map* (K-2016). Hochstetter’s surveying and draughting expertise is evident in his books and cartography. He was the only cartographer to visit the lake: I am confident had Ron the opportunity to consider all Hochstetter’s mapping, he’d acquiesce.

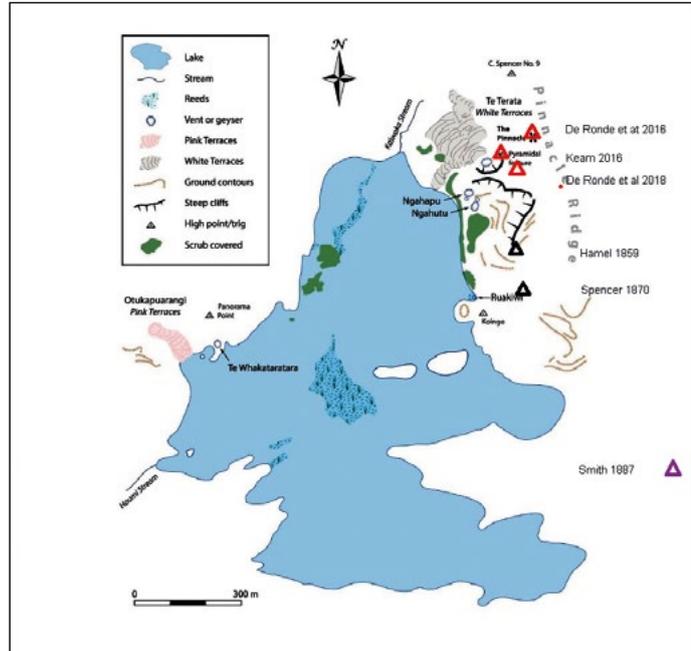


Figure 1: Keam’s draft map. (© Copyright R. Keam 1988, 2004; B-2016a reproduced with permission, annotated).

Faked, embellished Terrace photography and pitfalls in photo-interpretation undermine Keam’s photo-based mapping (B-2019a). Sightlines from composite prints where the skyline is from another negative, form poor scientific evidence. The cameras/lenses/exposure factors are unknown. We remain uncertain whether prints were cropped/enlarged. These are preconditions for photogrammetry (B-2019a).

It is misleading to claim Keam’s map used photogrammetry or is *the first ‘... correctly scaled, oriented and positioned outline map of the original Rotomahana...’* (DR-2018). Keam never mentioned photogrammetry privately or in K-2016.

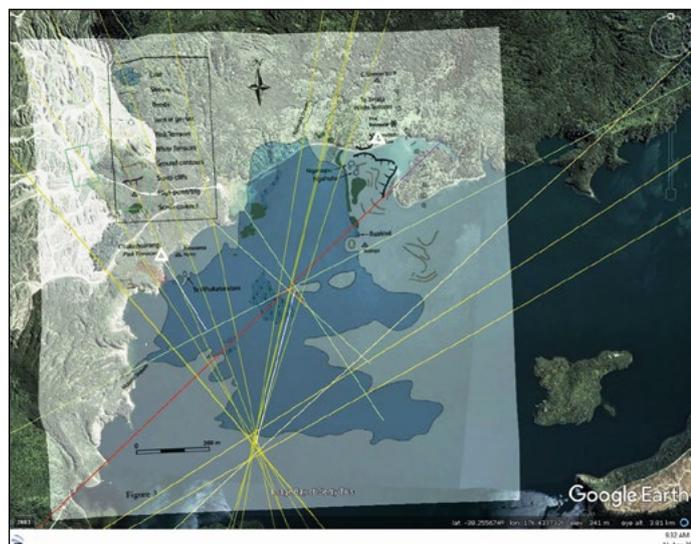


Figure 2: Keam’s map over Hochstetter’s Stations 21 and Puai. (© Copyright Google Earth™ and R. Keam, used with permission; B-2019b.) White triangles show adjacent Hochstetter survey *Pink and White Terrace* locations.

In Figure 1, Keam's coined *Pinnacle* or *pyramidal feature* is the left red triangle. The marine team's first relocation is shown to the north-east in a red triangle, labeled *The Pinnacle*. They later moved this south-west to the third red triangle. Remaining triangles show other documented pinnacle features (see Figures 4, 5).

To reconcile Keam and Hochstetter's mapping, I georeferenced Keam's map over Hochstetter's observation stations in Figure 2 (B-2019b).

In Figure 2, Keam's Pink and White Terrace locations about Hochstetter's (B-2019b). Keam's and Hochstetter's spring sites lie on land. American marine team members also georeferenced Keam's map. Their spring locations also about Figure 2 locations (Winner, 2012). Despite Keam's map errata, his Terrace locations agree with Hochstetter's. The marine team disparity doesn't derive from his map.

2.1.2 Altimetry

Given landform changes, establishing the old-Lake Rotomahana altitude is mandatory before geospatial analysis of Terrace locations. Keam assumed an altitude ~2 m above Lake Tarawera level i.e. ~292 MASL (K-2016). This conflicts with evidence-based altimetry. Our 1858-1886 altimetry of 303 m ± 1-2 m derives from borehole evidence, artwork and 15 published eyewitnesses (B-2017; BDS-2018; B-2019b). It confirms altimetry by James Healy OBE (1910-1994) of ~301 MASL (Healy, 1975a and 1975b). Healy's meta-analysis of Healy/Smith/Malfroy/Warbrick agrees at ~303 MASL (Healy, 1975b). Keam and the marine team ignore their distinguished predecessor on a hunch.

2.1.3 Pinnacle

After the 1886 eruption, two rocky outcrops north and south of the Rotomahana crater rift were christened *the pinnacles* in Figure 3. The high point of the northern set

was christened the *Pinnacle*. Keam asserted this was also a pyramid-shaped summit above the White Terrace in Figure 4. To him, it *seems sufficiently 'pinnacle-like' to justify the name's use in the pre-eruption era also* (K-2016). His assumption provided a marine team landmark; enabling georeferencing of old-lake features over new-Lake Rotomahana.

Figure 4 shows the feature Keam termed ...*the Pinnacle*.



Figure 4: White Terrace showing pyramidal feature. (Spencer c. 1880, Te Papa, O.027194).

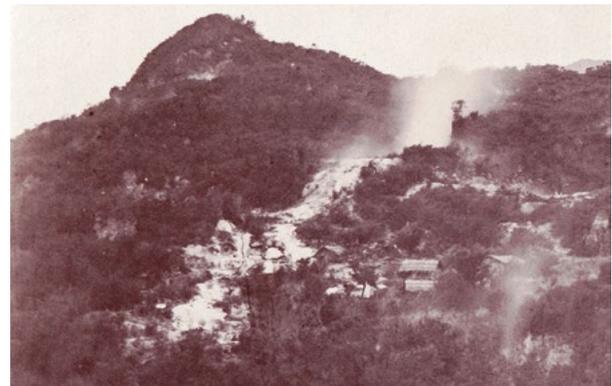


Figure 5: The Pinnacle feature above Tekapo ~0.5 km south. (Hamel, 1859, Hochstetter Collection Basel, 2.7.31-copy1).



Figure 3: Burton photograph of christened Pinnacles, 1886 (Te Papa MA_1323002).

To photo-historians there were similar features in the landscape. Figure 5 shows a *pyramidal feature* ~500 m south of Keam's.

There is no photographic, survey, cartographic or historical evidence for the Figure 3 Pinnacle to be in Figure 4. I sent Figures 4 and 5 to Keam and he didn't challenge Figure 4 as his *Pinnacle* (R. Keam, pers. comm., July 11, 2016). In Figure 1, his Pinnacle lies on the White Terrace embankment, at ~355 MASL. DR-2016a include Keam's map with the *Pinnacle* relabeled *Pyramidal feature* and a second point labeled *The Pinnacle* to the north-east. We now have two pre-eruption Pinnacles.

The marine team admitted their 2016 Pinnacle relocation was mistaken (DR-2018). In Figure 1, after moving the Pinnacle ~100 m north-east

in 2016, they moved it ~105 m south-west in 2018 (DR-2018). They now had three pre-eruption Pinnacles against one post-eruption Pinnacle. Let's term them Pinnacle I by Keam and marine team Pinnacles II and III (Figure 1), with Pinnacle IV at ~323 MASL in the new lake (Figure 3). The pyramidal summit in Figure 5 we term Pinnacle V and the southern outcrop, Pinnacle VI (Figure 3). There is a surfeit of pinnacles contributing inter-survey disparity.

The new lake took many years to fill. The crater floor was ~222 MASL. The Pinnacle was ~100 m above. The area surrounding the Pinnacles was in view for years when three government survey teams worked around the crater as did university, photographic and Māori teams. Records exist from tourists and guides. None report terrace-like features in the crater, in marine team locations. While the lake filled, erosion progressed and any terrace near the Pinnacle would be exposed. Keam's Pinnacle if it existed before the eruption (other than Figures 4 or 5), lay hidden ~35 m underground. This is the crux- there is no pre-eruption photographic, artwork, survey, historical or map evidence for Pinnacles II, III, IV or VI.

Had the marine team selected the Figure 5 pinnacle, their georeferencing aligns with Hochstetter's survey. Both concur with Keam's suggestion the Rotomahana *climatic base surge (cbs)* began on land and *somewhere in or close to the Waikanapanapa Valley* (K-2016). The Pinnacle constructs explain much inter-survey disparity.

2.1.4 Rangipakaru Hill-Patiti Island

Te Rangipakaru Hill lay on the south-east side of the lake. Hochstetter described it: *... in the rear there rises an isolated hill, Te Rangipakaru (broken sky) on the west side of which, from a crater-shaped excavation, a powerful solfatarata steams forth...* (Hochstetter, 1867). In the crater lay a hill the colonists named *Banded Hill*. It became *Patiti Island*.

Ron Keam claimed Patiti was conterminous with Te Rangipakaru Hill (pers. comm., June 6, 2016). In 2018-2019, we showed Patiti Island overlaps Rangipakaru Hill in Figure 6 (B-2019b). Hochstetter's Rangipakaru bearing corroborates Keam's claim, for it bisects Patiti (B-2019b). Rangipakaru Hill survives as Patiti Island at credible altitude (B-2019b). Other proximal landmarks may now be determined by triangulation/trilateration.

In marine team georeferencing with Keam's map, Pa-

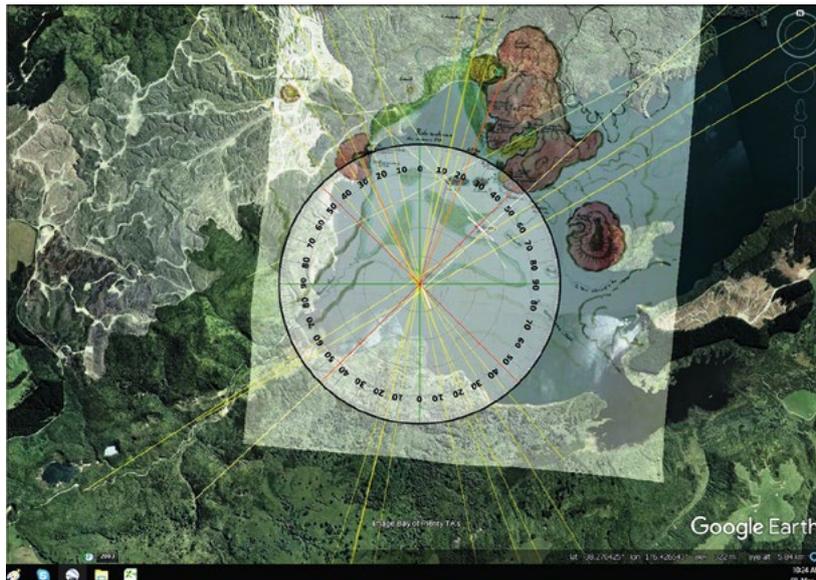


Figure 6: Rangipakaru Hill overlapping Patiti Island.
(© Copyright Google Earth™/Surveying+Spatial used with permission/ B-2019b).

titi Island is distant from Rangipakaru Hill, indicating an error. From Opokoruru Flat to Rangipakaru is ~1,200 m. On Hochstetter's and Petermann's maps it is ~720 m and ~670 m. The marine team georeferencing has a serious error of ~0.5 km, explaining more disparity (DR-2018).

2.2 Oceanographic Team Findings

In 2.1, Keam's errata were insufficient to explain the disparity between the marine team Terrace locations and Hochstetter's survey. Both surveys rely on georeferencing pre-eruption geospatial data over today's topography. Here, we examine the geospatial measures used by the marine team.

2.2.1 Arcuate Ridges

On 2.2.2011, marine team institutions began media claims: *we are now 95 percent certain we are seeing the bottom two tiers of the Pink Terraces* (GNS-2011).

The team based their claim on an underwater ridge in the new lake, associating it with one on Keam's map and Figure 7. Navigating from sonar of this ridge, they took sonar and photographic imagery of their Pink Terrace location and three days later published their Pink Terrace claim (GNS-2011).

Error entered when they assumed there was one ridge and their sonar image showed it. In photography and cartography there were adjacent ridges over the old lake. Today there are adjacent ridges in the new lake in Figure 9; but are they the same ridges? The latter may date from 1886.

Figures 7-8 show the Pink Terrace lay below the first ridge, yet in Figure 9 their vehicle is in the next bay (DR-2016a; GNS-2012). In Figures 7 and 8, the Pink Terrace is in foreground and the first ridge in midground. The sec-



Figure 7: Photograph cited by marine team (Charles Spencer. Te Papa (O.030702).



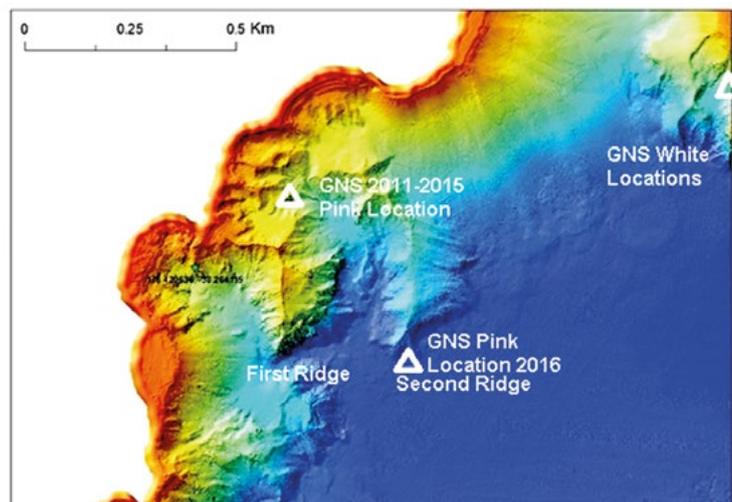
Figure 8: Pink Terrace. (Mundy, c.1870. Te Papa, MA_136306).

ond ridge is obscured by steaming-fog but conspicuous in Figure 8. The fog marks where the marine team *found* the Pink Terrace (GNS-2011, GNS-2012). In Figures 7-8, the first ridge is silhouetted against fog, which is silhouetted against the second ridge. This mistake explains more disparity.

2.2.2 Pinnacles

In 2016, the marine team altered their Pink Terrace location to below the second ridge in Figure 9 (Tivey-2016). I was advised it was moved after comparing angles and distances from Keam's Pinnacle against sonar of a second location (De Ronde, pers. comm. February 18, 2016). It follows that sonar, photography, bathymetry

Figure 9: Bathymetry in Pink and White Terrace areas. Green dot is our 2016 dive location in Pink Terrace Bay. (© Copyright de Ronde, 2016 used with permission and reproduced from B-2016a with annotation).



and cartography evidence over 2011-2015 for the marine team's Pink Terrace claim, cannot apply to this new location.

Later in 2016, I noted the Pinnacle location differed on the Keam maps and enquired about it (R. Keam, pers. comm. July 20, 2016). I was advised the new location better fitted the distance and angle to sonar of the new Pink location (Keam and de Ronde, pers. comm. July 20, 2016). From 2.1.3 it appears these revised locations were *ex post* attempts to reconcile Keam's map, sonar, photo-interpretation and underwater photography. Moving this Pinnacle about during georeferencing; removes claims of independence for their Terrace coordinates.

2.2.3 Altimetry and bathymetry

In 2.1.2 I outlined disparity with the marine team altimetry. Keam's ~292 MASL old-lake level disagrees with their sonar depths: there is a ~30-50 m variance in their revised Pink Terrace sonar locations (Tivey-2016). It is ~40-60 m on our altimetry. No matching sonar data for the new White Terrace location was given.

The altimetry error led the marine team to believe the old lake was ~31 m deep (DR-2016a). There is published evidence it was <10 m deep and the modal depth was 1-2 m (Bunn and Nolden, 2018; B-2020). These mistakes bias their

bathymetry and restrict them to planar analysis, which is inadequate for georeferencing. Accurate altimetry is re-

quired to establish buried Terrace locations (Bunn and Nolden, 2018; B-2020).

2.2.4 Sonar

The marine team claims first relied on sonar imagery, interpreted as terrace basins. We are the only investigators to scuba-dive Lake Rotomahana, and their sonar imagery resembles basin-shaped vents and wave-terraces we filmed. The basin-vents emitted gas and could not be terrace basins; for they had imperforate bases. Wave-terraces formed on rocky shelf features as the new lake filled. Both were videoed in B-2016b and see Figure 10.

For example, sonar from the Pinnacle locality naturally returns strong signals. The marine team reported bubble-plumes here, indicating vents as in Figure 10 (B-2016b). On sonar, these may resemble Terrace basins. We found such rocky lake-floor at each dive location; something unsurprising in a crater lake.

2.2.5 Cartography

Keam's lake size transformed with marine team georeferencing. As scale enlarged, the lake length shrank from ~1,474 m to ~1,100 m in 2016-2018. Their lake is too small against the historical record. Eyewitnesses report it was nearer 1,600 m than 1,100 m (BDS-2018). The marine team error is ~0.5 km. Keam published his large-scale map 57 years after drawing it (K-2016). He advised it was *essentially unaltered* (R. Keam, pers. comm. March 8, 2016).

2.2.6 Photo-interpretation

The 2011 marine team Pink Terrace claims were based on sonar, cartography and photography. The White Terrace claim based on sonar. No georeferencing was published until 2016. Of 5,123 photographs the marine team exposed, 14 were published and two were foremost.

(a) Photograph 2011_01_30_23_53_55-enhanced.

From 2.2.2011 the marine team promoted their Pink Terrace claim with this photograph across institutional and

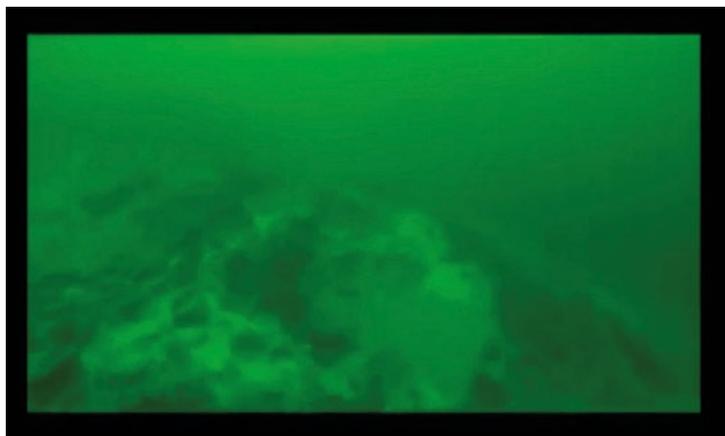


Figure 10: Basin-shaped gas-vent in Lake Rotomahana. (Frame-capture © Copyright W. Fisher; B-2016b).

online media. It was described as: "... the strong reflectors of the Pink Terraces ... show the vertical edge of a terrace head on." <http://juliansrockandiceblog.blogspot.com/2011/02/>

It was published as slide 55 at <https://www.slideshare.net/peterngz01/pink-white-terraces-cornel-de-ronde> and in DR-2016a, Figure 12C.

In 2012, the Woods Hole Oceanographic Institution journal *Oceanus* published a version, captioned: "... the rosy, bumpy buttress of one tier of Pink Terraces that was found near the bottom of Lake Rotomahana in 2011. (Photo by Dan Fornari, WHOI)" (Winner, 2012). The article claimed: 'The Terraces were never destroyed', he said. 'They never went **anywhere**. What happened to them is that they got completely and utterly covered in up to 10 meters of thick mud, which was all excavated out of the old lake. And then, when the waters rose, they and their muddy cloak disappeared from view entirely' [emphasis in original] (Winner, 2012).

In 2016, this photograph was republished, but now as the White Terrace [sic]: *Photograph taken ... immediately west of The Pinnacle ... where the ridge shallows to ~40 m. ... The pronounced runnel texture seen on the face of the outcrop is remarkably similar to the textures seen on the outward facing buttresses to the White Terraces* (DR-2016a).

An authority on photo-manipulation in scientific publications confirms these images are the same photograph (Elisabeth Bik, pers. comm., May 16, 2020). One (or both images) and/or captions are false and are excluded from this reconciliation.

(b) Photograph 2011_01_30_23_54_05.

On 2.2.2011 a second photograph was published. Figure 11 also claimed to show the Pink Terrace. It is slide 57 at: <https://www.slideshare.net/peterngz01/pink-white-terraces-cornel-de-ronde>. It is unassociated with sonar. No coordinates were given.

Caption- *On the right, the dark shadow is one of the terrace steps, whilst further to the left, across the sloping muddy lake floor there are some smaller exposed vertical sections of rock. These shapes are typical of hydrothermal silica deposits.* <http://juliansrockandiceblog.blogspot.co.nz/2011/02/final.html>

On enlarging the image the *dark shadow* appears an artifact. The feature extends out of shot. On it, there is no sign of any shelf, terrace basin, regular surface or stalactites ... only mud-covered rock.

By 2016, the marine team photography (except 2011_01_30_23_53_55-enhanced) makes no specific claim to be a Terrace tier. While one or both

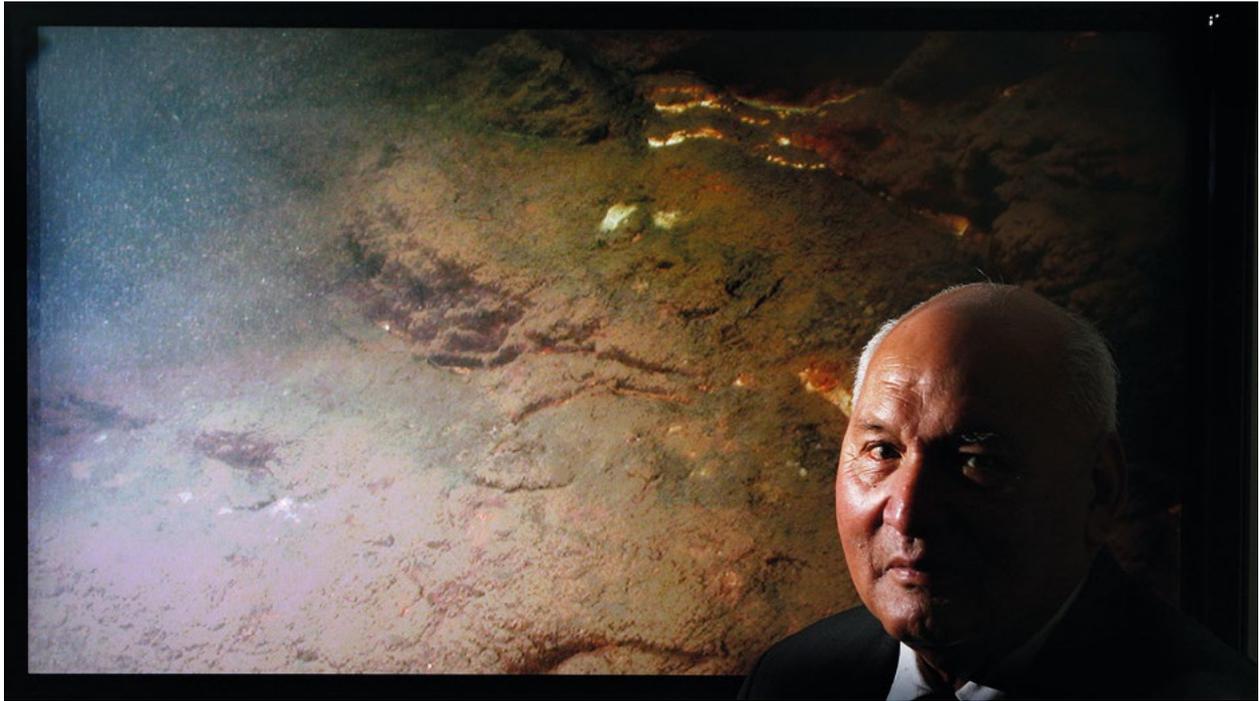


Figure 11: Image 2011_01_30_23_54_05- Image of the Pink Terraces under water, with kaumatua Anaru Rangihuea. (Used with permission *Stuff / Dominion Post*, 2.2.2011).

images might resemble silica sinter, this cannot prove they attached to a Terrace. Sinter existed around old Lake Rotomahana at many places. Sinter findings on land by our 2017 PAWTL2 Project and 2016 scuba team didn't support Terrace claims. The marine team didn't produce evidentiary samples. Their photo-interpretation adds to the disparity.

2.2.7 Replicating georeferencing.

From 2011-2015 the marine team claims relied on sonar and photo-interpretation. The imagery was specific to stated lake-floor locations. Coordinates of claimed Terrace locations cannot be established beyond their large markers on small illustrations. In 2016, the marine team introduced georeferencing, using the Pinnacle construct as a landmark:

Keam ... top of the Pink Terraces would be located ~1160 m bearing ~245° from The Pinnacle. If we then project a line from the present-day position of The Pinnacle in Figure 5B towards 245°, remarkably we intersect the terrace-like features seen in Figure 10 after ~1085 m ... (DR-2016a)

From cited 2016 correspondence, the 245° azimuth did not strike the team's 2011 Pink location. There was another sonar signal ~0.5 km south, closer to the azimuth. In 2016, the Pink Terrace moved to this in Figure 9 (Tivey-2016). The marine team was handicapped with only one landmark. In survey resection three are required.

However, Keam's map could accommodate Terrace locations off their azimuth in two ways:

- a) If Keam's map shifted along the azimuth, one or both Terrace locations might align with lake-floor returning a sonar signal.
- b) If it was anchored at the Pink end, the map could be shrunk or enlarged to relocate the White Terrace along the azimuth. A range of White locations becomes available.

These gave dubiety and a problem: the new Pink sonar location is ~1,200 m from the Figure 3 Pinnacle versus ~1,100 m on Keam's 2016 map (K-2016). This could be solved by shifting Keam's Pinnacle ~100 m north-east along their azimuth, to reconcile the relative positions of sonar and Pinnacle coordinates in today's lake; with the locations of both Terraces and Keam's Pinnacle on his map (de Ronde, pers. comm., July 11, 2016). This was apparently done.

With Keam's map, I replicated this marine team b) georeferencing. To align Terrace locations, the new Pink sonar site and the lake Pinnacle along the azimuth; Keam's lake must be reduced to ~1,100 m length. Coincidentally, this is the length in DR-2016, DR-2018. This conflicts with Hochstetter's survey, historical records and earlier publications of Keam's map (K-1988, K-2004).

The marine team georeferencing uncouples the 2011-2015 sonar and photography used to justify the Pink Terrace claim. These locations are not along their azimuth.

From 2016, the Pink and White locations moved south to fit the revised narrative. The photography was from 2011 and 2014, hence no new sonar or photography exists of these revised Terrace locations. The authors were restricted to claiming their sonar and photography was from nearby locations.

The inter-survey horizontal differences between Terrace spring locations are ~0.5 km. The perpendicular differences are ~50 m (Tivey-2016: DR-2018). Their georeferencing adds to disparity.

2.2.8 Bubble Plumes and Magnetic Anomalies

The marine team's focus on an east-west lake axis is sub-optimal, for a north-south axis integrates the old and new lake topography with their geoscience. This latter axis follows the Steaming Ranges (aka Pinnacle Ridge) from Tarata Point south to Patiti Island. The Ranges lie north-south in Figure 6, (rendered in burnt umber). Keam divided them into northern and southern sections with their interstice at Waikanapanapa Valley (rendered in ochre), (K-2016).

The northern Ranges down to Tarata Point are consistent with current topography and altimetry. Note the south-east shore of Tarata Point and its pre-eruption ground level of 315-333 MASL, are excised along a ~57° azimuth: the same azimuth as the *Tarawera Rift*. The Waikanapanapa Valley followed this azimuth.

South of the point, the marine team charted magnetic data consistent with an 1886 basalt dike (Tontini et al., 2016). They recorded bubble plumes across this locality (Walker et al., 2016). Their findings support Keam's assertion the *cbs* swept from near Waikanapanapa Valley; for georeferencing places this valley south of the point, close to the Figure 3 pinnacle. Note the Figure 5 pinnacle is a better georeferencing fit for such dike than Figure 4.

The southern section of the Ranges is lost as is Lake Rangipakaru and the country towards Rangipakaru Hill. The western half of this hill abuts the Rotomahana east crater and is lost. The eastern half and submerged foothills survived the eruptions as Patiti Island, likely saved by the west-northwest surge direction. The geoscience supports Hochstetter and Keam.

3.0 Discussion

This reconciliation focuses on the 2016-2018 marine team claims the Terraces were destroyed, against their 2011-2015 claims they were discovered *in situ* (Winner, 2012). Their 2016-2018 georeferencing of the *Pink and White Terraces* was replicated.

Keam's map proved reliable in georeferencing the Terrace locations against Hochstetter's survey. His lake orientation was remarkable, with a 2° error. However, his map

flaws and mistaken altimetry led to errata which were avoidable had he followed Healy. His Pinnacle invention was adopted by the marine team who lacked a means of georeferencing their sonar and photography. Keam was aware of multiple Pinnacles in 2016 and I listed six: which question marine team reliance on it.

Providing one bearing, the Pinnacle was inadequate for resection or triangulation. It required adjustments which disconnected earlier sonar and photography, damaging the validity of Terrace claims. The marine team compiled Keam's map but omitted Rangipakaru; the proximal feature correctly claimed by Keam to exist in the pre and post-eruption landscapes. Rangipakaru forms a better survey landmark than arcuate ridges or pinnacles.

The marine team altimetry and bathymetry contradict the historical record. Their shrinkage of Keam's lake to accommodate their 2016-2018 Terrace locations, conflicts with historical records and Hochstetter's survey. Their best photography is compromised by confusion.

The marine team employed surveying and georeferencing methodology without formal discussion of survey error. A bearing error of $\leq 1-2$ degrees is required (McFadgen, 1999). No latitude or longitude coordinates were provided. Of the inter-survey spatial differences, the elevations are more significant when ground truthing, drilling or excavating.

The marine team claims from 2011 appear based on cartographic, photographic and sonar misinterpretation. Efforts in 2016-2018 to strengthen their findings by georeferencing Keam's map were unable to establish credible *Pink and White Terrace* locations. Keam's contributions appear more consistent with Hochstetter's survey than with marine team iterations.

The north-south lake axis analysis offers a *Pareto optimal* solution, incorporating Keam and marine team geoscience, with Hochstetter's survey location of the Pink and White Terraces. Hochstetter's remains the only primary, pre-eruption survey evidence of the Pink, Black and White Terrace locations. The survival of the northern Steaming Ranges and Rangipakaru; increase the likelihood the White Terrace location may also survive.

Acknowledgements

I acknowledge Sascha Nolden and Ferdinand von Hochstetter. Ascribed material is included for review under Australian *fair dealing* copyright law.

References

For a full list of references, please contact the author: rexbunn2015@gmail.com



Contractual obligations during Covid-19

Stephanie Harris and Mitch Singh, Glaister Ennor

THE COVID-19 PANDEMIC HAS CAUSED SIGNIFICANT DISRUPTION TO THE DOMESTIC AND GLOBAL COMMERCIAL LANDSCAPE, NOT LEAST WITH REGARD TO THE PERFORMANCE OF CONTRACTS. RESTRICTIONS ON MOVEMENT AND TRADE HAVE MEANT THAT MANY BUSINESSES HAVE BEEN UNABLE TO PERFORM VARIOUS CONTRACTUAL OBLIGATIONS. WHETHER YOU ARE LOOKING AT YOUR OWN EXISTING CONTRACTS, OR WANTING TO PLAN FOR THE FUTURE, IT IS HELPFUL TO KNOW WHAT RIGHTS AND REMEDIES EXIST FOR PARTIES IN THESE SITUATIONS.

Some contracts contain *force majeure* clauses which are aimed at lawfully excusing a party from performance of contractual obligations due to specified events outside of their control. These are strictly by agreement (including as to when and how it would apply) so outcomes under these clauses can vary remarkably.

A typical *force majeure* clause might look something like this:

“The parties’ performance under this Agreement is subject to acts of God, war, government regulation, terrorism, disaster, civil disorder, curtailment of transportation facilities, or any other emergency beyond the parties’ control, making it impossible to perform their obligations under this Agreement. On the occurrence of any of these events, either party may cancel this Agreement with immediate effect upon written notice to the other.”

Parties can, in addition to rights of immediate termination, agree instead to a temporary suspension of obligations on the occurrence of specified events.

The primary challenge with such clauses is often at the negotiation stage. Parties entering into contractual relationships are often (and understandably) reluctant to address non-performance, even where this might be outside of their control. Further, it is rarely practical for such clauses to exhaustively provide for all conceivable events (a *force majeure* event is by its very nature unexpected). Clauses must therefore be workable; but also enforceable. Overall, the aim of such clauses is to avoid, as much as possible, costly disputes about non-performance of contracts in times of uncertainty.

Taking into account the above example then, while a pandemic is not specifically listed, it is certainly a weighty argument that the pandemic has resulted in an emergency outside of the parties’ control. Yet, the other party may not agree. This is where another challenge may arise; the party seeking to rely on the clause must show a clear causal link between the agreed *force majeure* event and the inability to perform. In some cases, such as an international airline facing border closures, this is unlikely to be controversial; the emergency has clearly prevented

(continued p44)



**National Science Challenge:
Building Better Homes, Towns and Cities
Programme: Kāinga Tahī, Kāinga Rua**

Co-housing means residents can pool resources – this playroom is available to any kids in the 21-home development.

WHAT IS A SOCIAL MORTGAGE? (An insight into shared ownership and co-housing models)

James Berghan

(THIS ARTICLE INITIALLY APPEARED IN *REAL ESTATE* AND IS REPRINTED HERE WITH PERMISSION.)

With the release of New Zealand's first Wellbeing Budget earlier this year, it's more obvious than ever that the built environment needs to move towards planning models that deliver social and environmental sustainability.

Until now, our prevailing land ownership and development models have tended to talk about property as a commodity. Something that was to be bought and sold on the open market at a price set by the demand.

Yet now more than ever, we are seeing pressure from New Zealand communities, especially in our major cities, seeking changes to the way we own and develop housing. Not only is it just about the physical architecture, but the social architecture that our neighbourhoods create is also key.

Deeply invested in the places they live and wanting to ensure their property provides spaces for generations, communities are looking for the option of alternative developments that aren't subject to the same commercial demands as the open market.

One way to do this is for people to introduce a social mortgage.

What this means is there is a social component to the property rights that binds communities together, meaning property can be about more than just the financial bottom line. This recognises that other bottom lines – environmental, social, and cultural – are just as important.

James Berghan is in his third year of a PhD at Otago University undertaking research funded by the Building Better Homes, Towns and Cities National Science Challenge. His research examines the different ways the built environment can deliver housing based on this idea of a 'social mortgage'.

Social mortgage is a term that he and his supervisors Dr David Goodwin and Dr Lyn Carter have coined to more easily describe principles of socially based tenure. Socially based tenure is an ownership model based on social norms, processes and relationships and is a feature of many indigenous cultures where land and resources are managed from a collective, rather than individual, standpoint. It is one that facilitates a more holistic approach to the way communities can develop housing.

The research investigates urban papakāinga and



Main 'streets' within co-housing development tend to be designed for people, not cars.

co-housing models that incorporate principles of socially based tenure. It looks at one of each type of development in Auckland, as well as a range of co-housing initiatives in Denmark and Sweden that were first developed up to 50 years ago.

It's a common misconception, especially with co-housing, that everything is shared but this is not the case. One important note is that every household has their own self-sustaining home or unit. What sets these models apart is that every household also has access to shared spaces and facilities on top of what they might own themselves – shared spaces such as a communal garden, a shared playground or a full multi-purpose community building.

What is most interesting is that in a long-term shared ownership model (such as the co-housing case studies in Denmark and Sweden), certain physical and social norms have developed over time that enable even these close-knit communities to protect individual privacy.

For example, in these developments, there are unwritten rules about how residents behave and interact that ensure a degree of privacy even where you might be able to see a

neighbour within their own private space or backyard.

Everyone in the community has access to larger shared spaces, where residents have opportunities to socialise. This recognises that both public and private spaces are important to wellbeing and shows how people develop social norms to help them live comfortably in a more closely confined space.

The research undertaken into co-housing developments both in New Zealand and in Europe also show how economies of scale can be achieved, particularly for the environment. In co-housing, residents might share one or two lawnmowers between 30 households. Tools

and luxuries like music and gym equipment are more accessible because the cost can be spread across multiple households and shared rather than everyone needing to own (and find space for) their own. We might also start to see other sharing economies become more prevalent such as car sharing and charging hubs for electric vehicles.

Both papakāinga and co-housing models also recognise the importance of family ties to the overall make-up of the community. Unlike private ownership models, there is often more respect and reverence for the land because



Individual-use areas merge into shared spaces in this Danish co-housing community.

there is a sense of identity, belonging and continuity that must occur in order to preserve the built environment for future generations.

The ownership structure is hugely important. In the central Auckland papakāinga development, for example, the hapū instigated a 15-year buy-back scheme with a capped price. This sidestepped the inflated buying and selling occurring in the private Auckland market during the time of the development and meant the community was able to provide affordable housing to those who needed it. This places the focus on long-term, inter-generational wealth rather than a quick sale and is a good example of how socially based models can work.

On a larger scale, these types of housing models could allow for enclaves of land nested within the normal property system where prices could be fixed. It takes the money motivation out of the market and specifically addresses housing as a human right.

The research shows there may be benefits to introducing elements of socially based tenure into some local housing developments to facilitate strong, thriving communities in our biggest cities.

BBHTC background

Building Better Homes, Towns and Cities (BBHTC) is one of 11 National Science Challenges, funded by the Ministry of Business, Innovation and Enterprise. BBHTC undertakes world-class research to shape New Zealand's built environment and strengthen communities. The challenge develops findings that will empower public, planners and policymakers with reliable information and new tools for fresh thinking and better decisions and is discovering new pathways to address the long-standing housing challenges of our most disadvantaged.

To learn more and access the research, head to: www.buildingbetter.nz



Individual units in this co-housing community in Denmark overlook the shared courtyard.



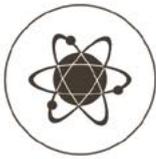
Sharing economies mean residents don't need to own individual tools.



Papakāinga often include shared play areas for kids, as well as maara kai (communal gardens).



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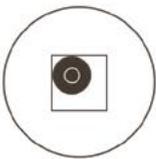
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Seven tips to manage your business through the Global Recession

Edward O'Leary,
Abtrac Time Management & Invoicing Software



AS THE WORLD FALLS INTO A RECESSION, NOW'S THE TIME TO FOCUS ON YOUR NUMBERS.

At this stage we can only imagine what a pandemic really is like, and what impact it will have. Health professionals are saying nobody is alive today who has lived through a phenomenon like Covid-19. And they added it could last up to two years.

The probability of a global economic recession is high.

Whilst our own, our loved ones and our community's health is paramount, attention also needs to be given to the health of our businesses.

You need hard data. And you'll need your numbers to be up to date every day. So here's some tips I've been collating. I hope each one provides food for thought and is actioned.

1 Keep in touch with your major clients so you can find out as soon as possible which contracts are going ahead and which are likely to be postponed or cancelled.

2 If you haven't already got one, you need a cash flow through which you can run multiple scenarios – best case – worst case – most likely. This has to be up to date. Each reforecast should be projected out at least a year ahead. It will be your decision-making tool. Do we need this project. Can we afford to take on more

staff. Can we afford to keep all our staff. We know of excellent cash flow systems we can refer you to.

3 Concentrate on revenue. Push projects through and get them out the door ASAP. If you can afford to do some things on a goodwill basis then good for you. But if things become tight, goodwill won't pay the bills. So signal variations as soon as they arise.

4 To maximise revenue, plan time ahead. Staff need clear expectations of how long each piece of work should take. You'll blow your budget and hurt the business if staff regularly spend 30 hours on 20-hour pieces of work.

5 Reduce staff hours if needed. Staff will understand and appreciate you're at least keeping them on the payroll rather than laying them off or going bankrupt with 'all hands on deck'. In either of those last two cases, they'll be worse off.

6 Get your invoices out ASAP. Don't wait until month end. Also ask for nominal deposits up front if you can. If you don't ask you won't know if clients will accept this request or not, nor if they're willing to pay.

7 Use cloud-based commercial software. Your in-house IT or spreadsheet expert might be the salt of the earth, but you can't afford the risk of them becoming seriously ill. Your business could be 'flying blind' if this person is away. So while commercial software mightn't be the same as your home grown system, it will be as good if not better. It will have the reports you need to steer your business through. Plus, cloud-based also means people can use it from anywhere, so you won't need the costs of remote desktop connections to your office network if people are working from home. And being cloud-based and commercial you'll receive updates without the need for people in your office to do the installs.

Graeme Evans BSc (Comp Sci)
Managing Director

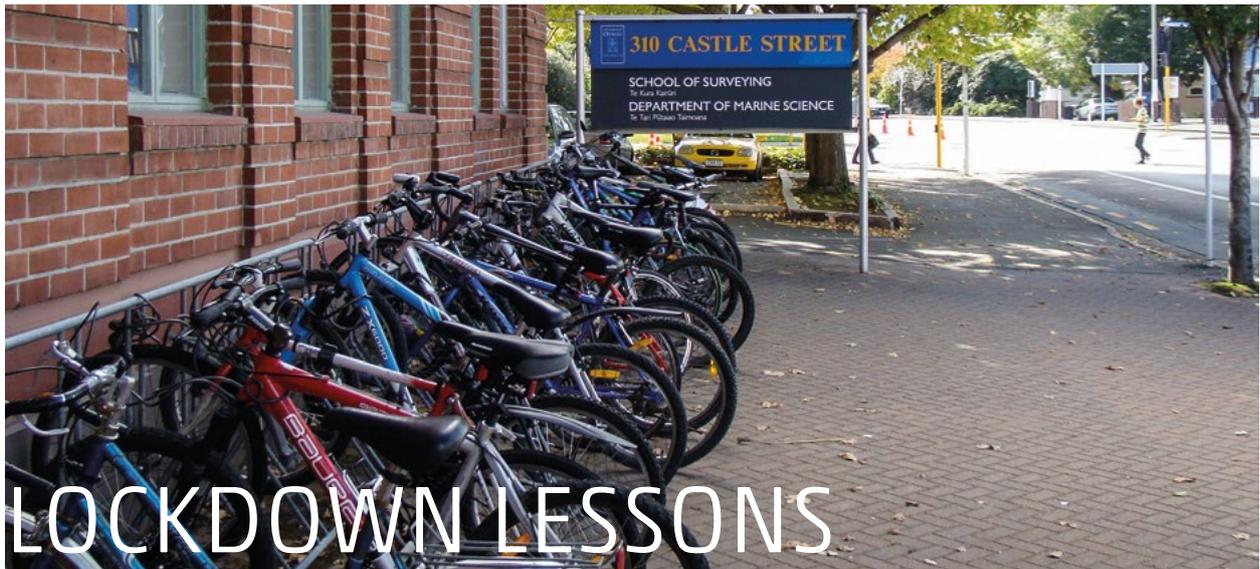
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Richard Hemi

It has been interesting during the Covid-19 lockdown period to read education commentators' views on the future of remote online teaching. Pre-pandemic online tertiary education has been around for some time with the best programmes aiming to be high quality, aspirational courses, even using immersive and other top-end technologies to deliver programmes and inspire students.

Will the rapid shift to distance learning be the catalyst that traditional tertiary institutions need to adopt *technology-enabled learning permanently* into their programmes, or would the experience leave staff and students with a bad taste from this style of learning? Equally important questions follow – will student learning still be to a high standard and can a course such as surveying still provide its hands-on, practical content effectively in an online setting?

The School of Surveying, as with perhaps all New Zealand spatial organisations, was able to set up staff at home and continue with their business remotely. Lectures, tutorials and computer labs have all been provided via online using video-conferencing, recording and virtual network systems. While about half of Otago students returned home, the semester has continued in a similar structure, albeit very dependent upon the quality of computers and internet connections.

Fortunately, a number of staff at the school had already been using both Zoom and lecture recording systems, and this experience was able to be quickly shared among all teaching staff. Equally the school and University's IT staff managed to get the most critical surveying and spatial software working successfully on Otago's virtual student desktop system.

This allowed students to obtain remote access to software and continue to work on tutorials and practicals. The

university desktop system had been in development for some time before the lockdown, but this work was able to be accelerated rapidly in the short time around the start of the lockdown. The School of Surveying is grateful to a number of local software agents for their assistance in working with the university in getting the software working successfully.

But can online learning adequately replace those core parts of spatial science education that are typically taught 'in the field'? Field work and practical teaching have been adapted where possible but also deferred in some papers. Early-degree papers with significant field work content such as Sur101 and 201 have supplied students with field measurement data for computation exercises, and some staff members have even taken surveying equipment home to film certain field procedures for student viewing. While there appears to be good student engagement in these exercises and recordings, they will never be able to fully replace the practical skills learnt in handling the equipment for oneself. In the final year cadastral paper involving a large reinstatement field exercise, the project has been deferred until later in the year.

Another very positive feature of study during normal times within the school and Otago University is no doubt the human connection and camaraderie that students experience. While some might think this is merely about socialising and parties, this lack of connection may also affect student wellbeing and mental health. Students do learn from each other – particularly in surveying where students often work in pairs – and rely on each other for peer support.

The school prides itself on the close relationship students enjoy both with fellow students and also with staff and while a virtual open-door policy has remained for stu-

dents to seek help from lecturers, interaction has certainly been reduced during the lockdown period. Many students will have found this period stressful with concerns about being able to complete and pass papers, and while the school and university have worked hard to provide consideration for the practical limitations during this time, it is inevitable that the student experience has suffered.

But New Zealand has now reached levels of greater freedom and normality and, as we shortly move into Semester 2, the school looks forward to seeing all students

back in person. We also look forward to getting out into the field with sanitised equipment and at appropriate social distancing. At this stage the university is intending to continue limitations on spacing in lecture rooms and as this will put pressure on capacity, it is likely that some remote teaching will continue for lectures and tutorials into the second semester. The results from upcoming online exams may provide us all with lessons about the success or viability of remote teaching and learning.

(Legal Column continued from p37)

performance. However, a retailer that continues to be able to receive stock (but cannot on-sell it) may find that a standard *force majeure* clause does not assist.

Contracts that do not have such clauses are generally left with a remedy under the law of frustration. Frustration of a contract refers to a situation where an unanticipated event (for which neither party is responsible) interrupts or changes an existing situation such that some or all of their contractual obligations are incapable of being performed as originally intended. The obligations must be impossible to perform, or otherwise radically different from what the parties originally bargained. If this threshold is met, the parties are discharged from further performance of the contract (and in some cases can recover monies already paid under the contract).

Frustration was once strictly a common law remedy, meaning it was created by the courts to arrive at just outcomes in situations not otherwise covered by contract or legislation. It is now part of our legislative framework in the Contract and Commercial Law Act 2017, although older case law continues to guide its application.

While this remedy has many similarities to *force majeure* clauses, it is often much harder to establish,

due to the high threshold that parties have to meet and because it is not a remedy found in the contract. Such disputes must be resolved by the courts on a case-by-case basis, and whether the performance of contractual obligations is radically different to what was agreed depends on:

- the terms of the contract
- the factual matrix or context of the contract
- the parties' knowledge, expectations, assumptions, and contemplations about risk at the time the contract was entered into
- the nature of the interrupting event
- the parties' reasonably and objectively ascertainable calculations as to the possibility of future performance in the new circumstances.

The Covid-19 pandemic is unlikely to result in a large volume of contracts being legally frustrated. For many parties, although performance may temporarily be impossible, the substance of the contract has not altered to such a radical degree. Caution must be exercised when asserting that a contract is frustrated; if the court ultimately decides that it was not, then the party refusing to perform on this ground will be held to have wrongfully breached the contract.



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