

# The big step from carbide to electricity: cavers re-light Ruakuri Cave

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There have been some fine ACKMA papers in the last couple of years - on re-lighting Lucas Cave and the Temple of Baal Cave at Jenolan as well as a delightful diversion to fibre optics at Kelly Hill Caves on Kangaroo Island. Then there is the work of Neil Kell who talks about being creative, inspirational, insightful and arty but is pragmatic enough to say “no light ... no access” – and doesn’t that set the scene.

This paper is a ‘retrospective’ in the sense that it is looking back on a project already completed – or possibly it is an ‘introspective’ in that it deals with personal feelings of achievement (or lack of) with regards to tackling the re-lighting of Ruakuri Cave, Waitomo, NZ.

As with most caves, Ruakuri has seen a progression of lighting –

1904 – 1926: Tallow candles and lanterns

1926 – mid 1940s: mainly bare 110V, 60W incandescent bulbs

mid 40s – 2004: 110V indirect lighting. Sheet brass luminaries with banks of two or four 60W “daylight blue” incandescent bulbs.

2004: a mixture of 12V Quartz/Halogen and LED luminaires.

The politics have been just as interesting with original consultation coming from the Director of the NSW Tourist Bureau, the first system being installed by the Electrical Branch of the Public Works Department, the first criticism being launched by the NZ Tourist League, an upgrade being carried out by the Department of Industries and Commerce, Tourist and Publicity, maintenance and improvements being undertaken by the Ministry of Works, upgrades by roaming electricians met on the street, scoping reports from lighting consultants and finally a complete re-wiring and lighting by roaming electricians, cave guides and cavers.

Tight time frames and possibly unrealistic budgets built our pragmatism right at the ‘coal face’ – virtually, “here’s over 1 kilometre of

state of the art walkways hidden away in dark passages – light them!”. The re-lighting process consumed around 4500 man-hours, supplied by electrical contractors, as well as the better part of \$375,000. Those statistics in no way acknowledge the considerable input from friends, staff and other interested parties.

Apart from a few unrealised hi-tech “dreams”, when we compare the result with the scoping plan that resulted from our early collective cave memories and consultation, we almost succeeded – that is, in keeping a cave *feeling* like a cave.

Throughout the project we learned a lot of “don’ts” and it is these that probably provide the most useful framework for any future project.

## **Don’t presume to know what visitors will want to see or how they will feel.**

In Black Water Rafting we called them the “flat-liners” The ones who, when surveyed, rated “terror” 10/10 at every survey point on their adventure caving experience. And we always thought that we ran “FUN” trips. Wrong!

Even a brief, focused survey can give you a significant amount of information about what you are trying to achieve and what would be the best strategy to achieve it – and certainly if you have achieved it. This was one of the shortcomings of our project. The fact that the cave had been closed to visitors for nearly 20 years and entirely new sections were being opened, precluded compiling any useful client feed back – even from guides.

In the marketing world there is that old adage that, “your branding is not what you think you are but what they (the customers) think you are”. It is the customers gut reaction to the experience that is important.

**Don't forget that caves embrace the "unknown" - so too do lighting budgets.**

We became involved in working with budgets set by quantity surveyors and outside 'experts' with very little knowledge of the underground environment and how expensive it can be to try to put together equipment that will sustain a viable tourist cave business in the long term. We would venture that a few thousand dollars spent sending selected key stakeholders to a similar cave development somewhere would have laid a great 'foundation block'.

As it was, we tried to focus on making everything as cost-effective as we could.

**Don't try to 'cut corners or to 'mix and match' too much.**

Outdoor stainless steel light fittings were on sale at a tenth of the price of those usually specified by lighting consultants!! Buy!

But what about when they suddenly change the maximum wattage rating and they turn out to be IP 62 (protected against dust and vertical drops of water) instead of IP 65 (Protected against wash-down water sprays)?

We knew that #304 stainless steel would withstand corrosion but might tarnish and that we probably didn't need to go to #316 stainless (which has an addition of 3% molybdenum) as there were unlikely to be any solvents, acids stronger than food acids or chlorides in the cave. So, with the addition of selected heat-resistant O-rings and seals and a little copper anti-seize/galling thread paste we made things work.

And then there were the LED luminaires made out of polypropylene plumbing fittings that had to be skimmed ever so slightly to fit 50mm MR16 light units.

And what about the Hella truck and marine LED fittings used for track lighting??

It all works, but we wonder whether or not more design continuity could have tempered the energy output.

**Don't underestimate the human 'wattage' that it will take to effectively light a cave.**

Ever been on a rescue in a challenging cave system and then evaluated the human effort required to make it a success? Well getting material back into a cave can be just as challenging as getting it out.

Until we had walkways in place, everything that went into Ruakuri either had to swim in, be lowered down a 65m shaft or sent zinging down a 65m borehole. Everything! And there was no power in the new sections of cave!

This meant that, although we refined our "lighting kit" down to a bunch of 12V gel-cells, thin leads, portable luminaries on tripods and a box of digital camera gear, there was still a huge human input into getting gear on site and comfortably 'composing' the lighting effects we judged to be acceptable and aligned with the product branding.

**Don't stop listening, questioning, researching and networking.**

What happened to the correspondence with Neil Kell going way back and the dinners with Andy Spate where we just didn't ask the right questions? We missed out on valuable networking opportunities by becoming too engrossed with the task at hand. Too focused and too blinkered. "Don't ask them it will only make things more complicated." We undoubtedly could have saved ourselves quite a bit of frustration and time if we had taken advantage of our professional networks. Luckily we managed to fill some of the void by latching on to anything that gave off a lumen.

Technology is changing extremely rapidly and the lighting system put in this year could easily be redundant next year. It is difficult to keep up but thankfully most cave operators and cave professionals are only too willing to share their experience and expertise and the internet has become an electric forum to be reckoned with. We tried to keep everything very simple – probably because that was our frame of reference. There is no Clipsal C-bus system, infra-red remotes, choreographed light displays or music in Ruakuri. Perhaps there should be.

**Don't assume that consultants will "just tell you what you already know" (or tell you anything for that matter).**

We 'inherited' a consultant and had an exciting trip underground with him and exchanged passionate concept plans. We really had no idea of his credentials, apart from the fact he lit the Auckland Sky Tower.

Then we 'lost' him when he was taken out for a month or two with an injury and followed that with a meeting where he showed us lots of coloured lights.

Had he heard what we talked about? Did he have a feel for the subterranean environment? What was his hourly charge out rate? How many visits would he have to make and what support would we have to provide? Somewhere amid all of these questions Mick Chalker's booming Wombeyan wisdom urged us to "use local resources", which we ended up doing. I suspect that our final decision was based on a lack of initial choice.

**Don't forget that, not only is electricity like water – it doesn't like water.**

Capacity, capacity, capacity – although with C-bus and newer LED luminaires this is not so much of an issue. We elected to go with a hard wired, two way switching system and mainly Quartz/Halogen dichroics because it was familiar territory and a supplier could provide bulbs with a consistent colour temperature in a wide variety of wattages and beam angles. This gave a great deal of flexibility especially as the MR16 fittings meant that we could just replace luminaires with LED units as the comparative wattages of the latter increased.

However, some of the electrical contractors were not too vigilant about working out loadings, voltage drops and installing the appropriate wiring. With a 12V 'pressure' system a few of the 'pipes' could have been a bit larger.

Ruakuri is a wet cave. So far we have not experienced any leakage issues (as they have recently in the Glowworm Cave) and this could be because we made every effort to house cables in dry conduits or run them alongside suspended walkways, attached to support members.

**Don't try to be the consummate "peacemaker", politician and team player.**

We ended up with two sets of engineers, two different local electricians, a Quantity Surveyor, the Department of Conservation (and for a while a consultant) all having input to some degree or another. Responsibilities became blurred in some areas, performance was not necessarily critically evaluated and there were definitely 'walls' where there should have been constructive, open communication.

As a result, what should have turned out to be an on-line uninterruptible power supply turned out to be an "almost but not quite". The glitch is easily rectified but it illustrates a case where an autocratic leader would not have allowed local politics and fragile egos to affect solid, sensible outcomes.

**Don't forget that old wise statement that says, "you can do twice as much if you go at half the speed".**

Previous ACKMA authors on cave lighting – Daniel Cove, Neil Kell, Michael Kidd, Russell Commins, Andy Spate ... have all stressed what seems to be obvious – the need for thorough planning and the need to take the time to make sure that all interested parties understand the objectives and the game plan. Time taken for daily meetings to review progress and discuss the next schedule of work is time well spent.

The records from these meetings give continuity and allow for clear task-oriented roles as well as accountability. Send the impatient 'toe-tappers' home - and, make sure that you actually have a comfortable physical space in which to meet!

**Don't forget that impacts can be long term as well as short term.**

We were lucky in that our Resource Consents demanded that we closely monitor the cave environment – both before and after the project. This meant that we had a baseline of information from which we could detect change.

Temperatures were only allowed to move by one degree Celsius and humidity was to be kept in the 95-100% range. Sensitive formations were also photomonitored. While the latter might only ring the alarm after the effect the other two can inform about insidious change, which could result in irreversible damage. And the neat part is that we can control some of the parameters (type of luminaires, output, wavelength, temperature, intensity, on-time, distance from source to target....) in order to operate as close to our natural baselines as possible.

### **Don't forget to "leave no footprints".**

Our Resource Consents also decreed that we should remove all of the accumulated 100 years worth of previous infrastructure! While we are still completing this task the process did instil in us an ethic to minimise our own impact and to make sure, within feasible limits, that all of our inputs could be removed. As a result, light fittings are held in place by slender 1mm stainless steel pins, sit on loose rocks or are bolted directly to the prefabricated walkways; switching and control boxes are held to handrail stanchions with a couple of bolts and trunk wiring can be pulled back through conduits and sent off to the lucrative scrap metal market.

### **Don't think that the job has been done the moment the switch is turned and the door opened.**

How we vividly remember the opening day – the pride, excitement and celebration - and the scurrying around in the shadows to tweak things up. Then there was the state of exhaustion before the feedback starts to sink in and you realise that you haven't finished. There are the surveys and the review process and the exposure of blank canvasses or areas of over indulgence. Lighting a cave leaves a legacy and it is this legacy that will wake you at night or ensure that you keep a box of speleological paraphernalia under your bed.

On reflection, the old timers did a damned good job considering the limitations and knowledge of their time. We trust that we have done the same.