



# Cumulus Consulting Ltd

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NELSON

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Dear Tim

## Performance of Pool Cover

Here is the letter you asked me to write regarding the performance of the pool cover which you supplied to us for our new pool.

### **Background**

When you found that I had a technical background, and was taking temperature measurements of our new pool for my own interest, you asked me if I would formalize what I was doing, and write a report for you. I have no connection with Tasman Bay Pools except as a happy customer.

### **Qualifications**

First, just a quick note about the likely reliability of my conclusions. I have a Masters degree with honours in Physics, and extensive experience in the measurement of physical properties including temperature. I spent some years in charge of a calibration laboratory, where I designed and built specialist measuring equipment. I was a member of the Physical Measurements Committee of the NZ Standards Association and participated in the writing of international measurement standards.

### **Temperature measurement**

The temperature measurements were taken with a pair of K-type thermocouples whose calibration was checked before and after these measurements. Although the absolute accuracy of the measurements may be in error up to 1.5°C, the expected maximum *relative* error (which is what is important in this case) is  $\pm 0.3^\circ\text{C}$ , and in practice the results from the two thermocouples never differed by more than 0.2°C.

Measurements were always taken with the pool thoroughly stirred by the filter pump, and temperatures at the top and bottom of the pool never differed by more than 0.1°C. Conditions in the pool ranged between 22.3 and 28.5°C.

### **The Pool**

Our pool is a simple rectangle approximately 9.5 x 4.5m in size, with depth varying from 1m to 1.4m. Its volume is about 51,000 litres. At this time of year (summer) there is no shade on the pool surface between about 8:30am and 7pm.

## The Cover

The cover which you supplied is labelled as coming from Cantar Products in the U.S.A. It is about 9.5 x 4.5m, having been cut down a little to fit the pool. It covers the entire water surface of the pool. It is made of blue plastic film and resembles “bubble wrap”, being smooth on the top and covered with triangular bubbles (sides about 15mm) on the underside.

## The Data

My conclusions are based on sporadic measurements taken between mid-November 2006 and 3 January 2007, and intensive measurements (usually several daily) for the next three weeks until 25 January, along with sporadic measurement until the date of this letter.

During the intensive measurement period, I recorded the date/time, temperature, weather and whether the cover was on or off, repeating the measurements when there was a significant change in any of these. In this way, there were between 1 and 6 measurements in a day, depending on conditions. I have not included the detailed measurements in this letter, but they are available for inspection if anyone is interested.

## The Conditions

January 2007 was a good month to test pool covers, because it had the second-lowest sunshine hours on record for Nelson, and was unusually wet and windy. During the 20 days of intensive measurement, there were only three days on which there was sun all day. The cover was on most of the time unless it was taken off to allow swimming or to test the effect on temperature. The pool was in full sun (if there was any!) from about 8:30am until 7pm.

The temperature of a swimming pool depends on many factors, but the most important are the weather (sun, cloud, wind, rain & humidity), and the pool cover. The effect of other factors like the surface area of the pool can be ignored in this case because we are dealing with only one pool, not comparing results between different pools.

Of course these measurements were taken in mid-summer, and other times of year will be less favourable, with lower heat capture due to lower sun angles and more shadowing of the pool surface, and greater heat loss due to lower air temperatures and higher rainfall.

## Conclusions

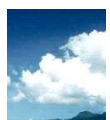
My conclusions drawn from our pool and cover are:

### Sun

- In sunny, calm conditions with no cover, our pool will gain 0.5 – 1.0°C during daylight hours.
- In sunny conditions with the cover on all day, it will gain 2.5 - 5°C.

### Cloud

- In calm light overcast conditions with no cover, our pool will generally lose around 0.5 – 1°C during daylight hours. Wind will increase this loss.
- With the cover on all day, it will *gain* 0.5 - 1°C almost independent of wind.



## Night

- With the cover off, temperature loss during night hours varies greatly between 1.5 and 4°C, depending on cloud cover, air temperature, humidity and wind.
- With cover on, the nightly loss is much more predictable, being between 0.5 and 1.2°C.

It is obvious that using a pool cover of this type has a marked effect on the temperature in the pool, increasing heat capture even on cloudy days, and greatly reducing heat loss at night. Before putting in our pool, I was wondering whether we should eventually install solar heating to extend the swimming season. With the experience we have had with this cover, I doubt I will think of it again – it's unnecessary.

When we first filled the pool in November, the water temperature was 17.4°C. It took only three days of variable weather with the cover on for the temperature to reach the mid 20s.

Even with the unseasonable weather during the measurement period, the lowest temperature I ever measured was 22.3°C (at 8:00am after several days of heavy cloud and intermittent rain). The sun came out at 9:30am, and by 4:30pm that day it was back up to 26.5°C!

With somewhat better weather since then, we find that we generally leave the cover on until about 10:30am to recover the small overnight heat loss, then remove it until around 10:30pm. That way we maintain the temperature around 27-28°C which suits us.

In summary, the advantages of this cover for us have been:

- Reduced heat loss at night and in heavy overcast conditions;
- Far greater heat gain during the day, even with light overcast conditions;
- More predictable temperatures due to smaller effects of wind and humidity;
- Ability to easily control the temperature of the pool by using the cover. It's getting too cool? Put the cover on. Too warm? Take the cover off.
- For a pool with good sun exposure there is no need for any other form of heating to get a long swimming season.

That's all I can think of at the moment – I hope it's what you wanted. I'm happy to be contacted through you to confirm these conclusions if anyone wants to. You have my permission to use this letter as you wish in an unmodified form only.

John Elder

Update: It's now 11 April, and we are still swimming with an afternoon pool temperature of 22 - 23°. That's warmer than the air temperature most days. We are confidently expecting to swim 5-6 months of the year.

