To the Plan Change 29 commissioners ....

Good Morning -Tim Bayley here from 52 Domett St .. a twenty+year Nelson resident and retired engineer with a BE Civil from University of Canterbury

There are 4 main issues I want to cover with this hearing.

1. Noise control around State Highways.
2. Population numbers used in PC29.
3. Sunlight and daylight angles.
4. The Brook Flood Plane.

A. Noise control provisions for houses close to State Highways

It's a total cop-out to require people to have to hire noise control experts and install hush glass and specialty insulation to reduce noise effects next to any state highway in Nelson's urban areas.

It should be NZTA's responsibility to pave their roads in an appropriate quiet asphalt materials on any of their highways that are within the city limits, as they have done around Rocks road.

We should not let them off the hook, so that they can use inferior 3/5 Chip Seal that is noisy and does not last ...

If this zoning rule passes all residents will continue to suffer excessive noise and vibration from heavy traffic and cars from a roading surface that is not fit for purpose in a residential neighbourhood.

B. The Numbers?

Why are NCC Planners using population numbers that are way higher than are require by central government , which only requires the median of Statistics NZ.

So by 2048 we are having to intensify for an extra 7500 people. Why would we do that? Unless it better fits the planners objective! The planners are creating numbers out of thin air to suit the results they are hell bent on pushing onto their residents.

C. Sunlight and daylight angles

Jump online and look up Nelson NZ and it says it all ...

->#1 - The Welcome to Nelson sign



"Nelson is regularly ranked as the sunniest cities in New Zealand. Facts say it all, Nelson gets about 2,400 hours of sun per year, During my time in Nelson, I have seen more sun than probably ever in my life! Sun hits differently in Nelson; it's always there for you!"

Nelson prides itself as being the SUNSHINE CAPITAL of New Zealand ... It is the most dominant feature of any discussion about Nelson ... the temperate climate, mild winters with lots of sunshine.

Even the welcome sign to Nelson has always featured a sun.

So why do people choose to live in Nelson city?

Most homes are advertised as being "sunny aspect", "great view", "stunning location".

"Come to sunny Nelson ... the sunshine capital of New Zealand." they said.

So that is what we all did ... we came , we saw, we bought or we built and we created businesses and opportunities .... all within the existing zoning laws that respected everyone's rights to share one of the main features Nelson has to offer. **SUNSHINE** ...

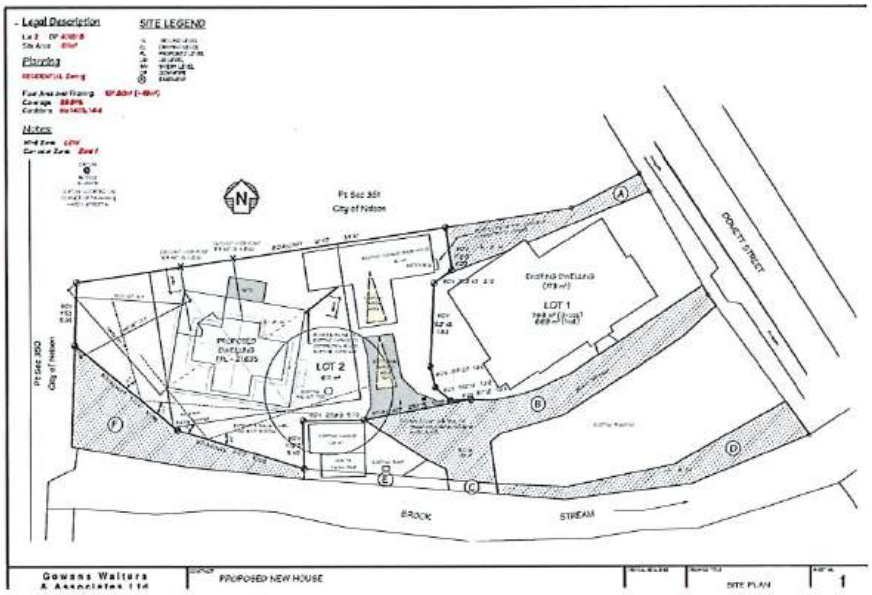
So why would ANYONE think it is a good idea to create intensification by infringing on the existing residents' amenity and access to winter sunshine. Used to heat their homes and create solar power. We are all told to be environmental aware so why isn't Plan 29.
The existing daylight angles work well for **everyone** to share what belongs to **no-one!** -

"SUNSHINE"

With good design and working with one's neighbours, we can easily create more density within existing urban areas without impacting on others existing amenities.
We did on our section and all well within the existing rules.

My wife and I were able to develop and intensify our section with a moderate "passive solar" cottage on the back of our section in central Nelson, using the existing planning rules, without infringing on any of our neighbours' right to sunshine including the fish in the Brook Stream!

->#2 Plan of #52 Domett St and its focus on the sun



We built a new 2 story house in 2009 that is just 6.5 m high to the peak of the roof without any compromise to our inside space …
So why is the new general residential at 8 m max height ?
And medium density max height set at 12 m ? .. both way too high.

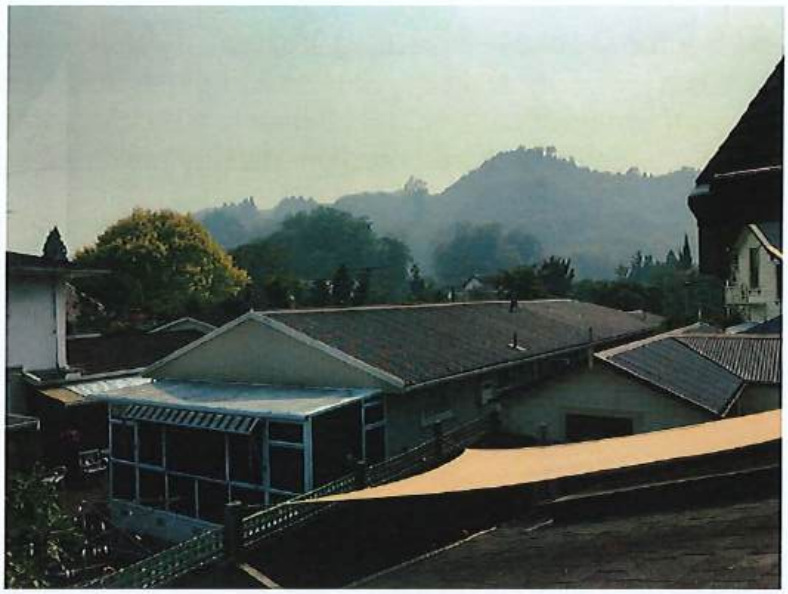
->#3 - #52 Domett as built in 2009

The developer vultures are already circling us, in the form of our northern neighbours, shown in picture #4 below.
It is a '60's cross lease that the present owners have just free-holded so the front tenant and her ex-developer boyfriend can buy it and they have offered first right of refusal to buy the back unit when the present owners decide to sell and move back Europe. Just waiting for Plan 29 to pass so they can build up 3 stories just 1 m from our northern boundary.



->#4 - the roof line of #50

Oh Joy Oh Joy ... any development under General or Medium density to our north will mean the loss of ALL our winter sun that at present provides 65% of our heat and solar power that was very costly to install.



->#5 - 52 Domett sunroom - designed for max solar gain



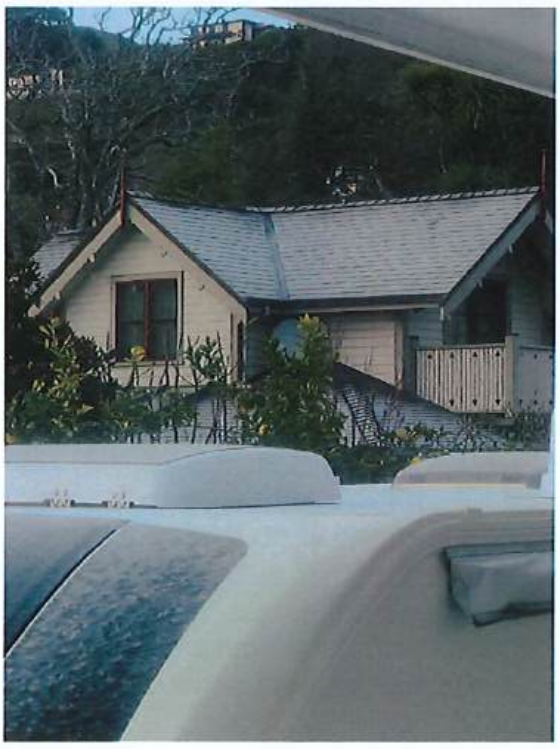
->#6 - a winter frost at 8 am

Here is an example from a recent frosty morning back in early August BUT by 11.30 the temp inside the sunroom is 35c and this heats the rest of the house via transom windows and a sliding doorway

->#7 - the solar gain in our sunroom

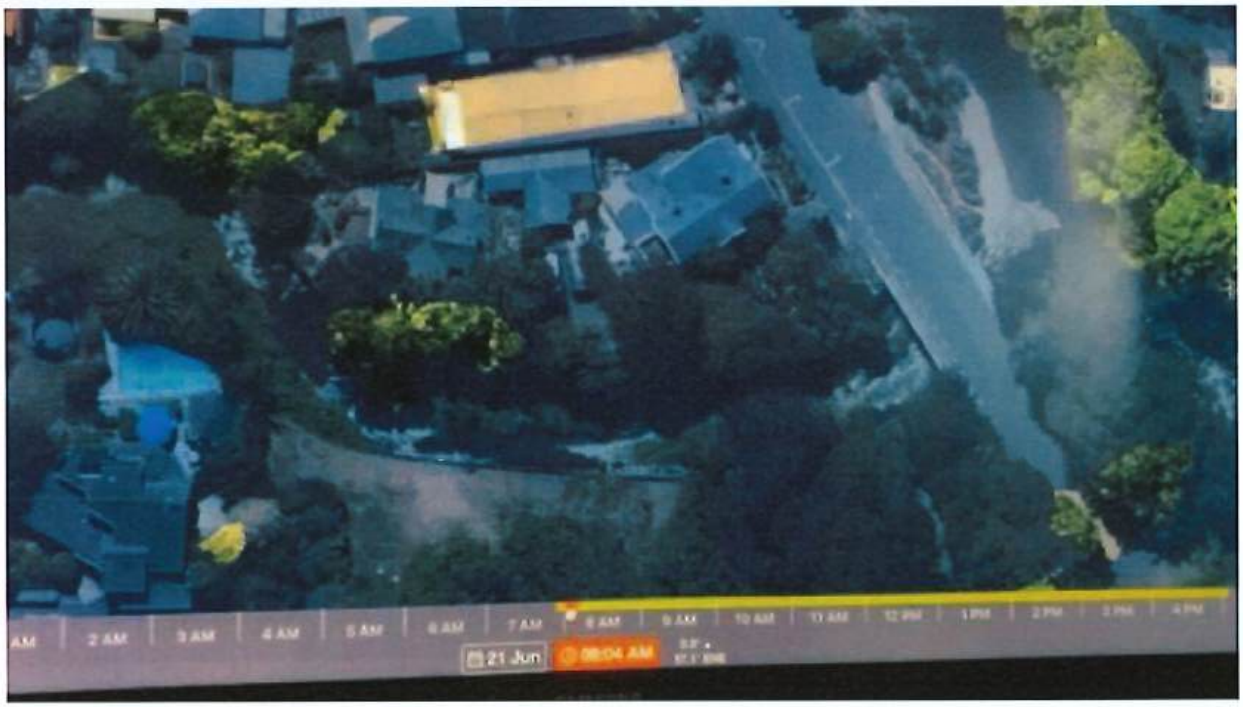
Our sunroom at 11.30 am on a sunny winter day





->#8 - 52 Domett Shading Video "Ask for video 8"

Here is a video showing the SHADING effects of a medium density 12 m high building on our northern boundary. NOTE : this only a building of the same footprint as the existing house… actually **Three** medium density buildings could be allowed under Plan29

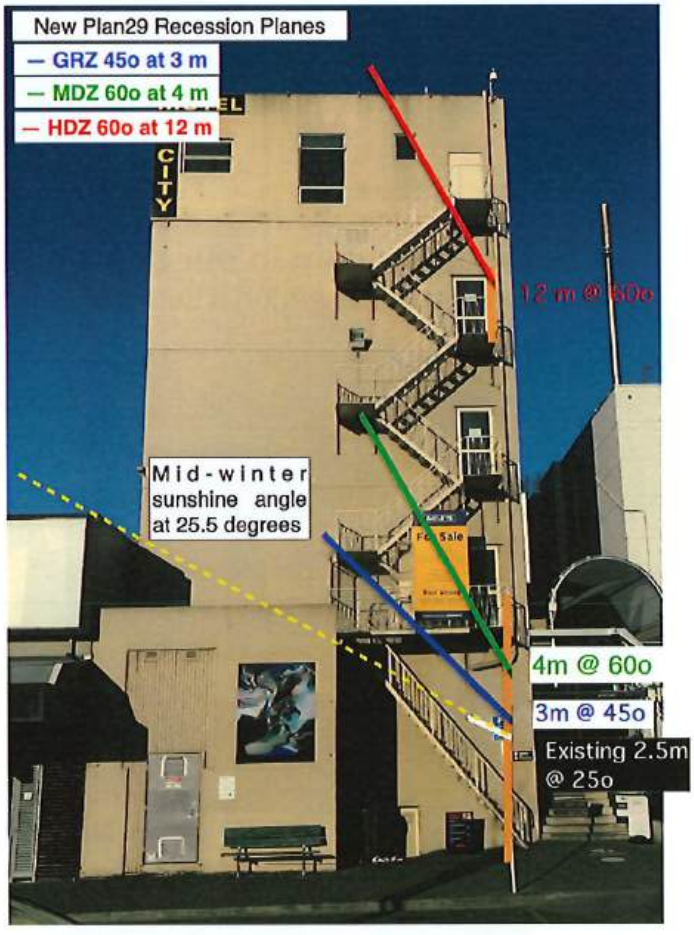


->#9 - The PC29 Daylight Angles

This picture of the Montgomery Sq m City Motel building give's you a great idea of the new Plan29 building heights and the proposed recession angles that will allow them, seriously infringing on existing neighbours light and privacy.

The only suitable place for this type of development, enabled by this proposed zoning, should only be in Greenfields or Brownfield areas where there is enough space so that it only effects those that choose to live in this development style.

Plan 29 is just LAZY PLANNING, that opens up the rules and allows developers Carte Blanche to do as they please. This will never be the best result for our Smart Little City... as money will always be the driver! And this will never produce the affordable housing … that councillors so crave.



->#10 - Reasonable General Density

It is possible to build townhouse units that don't destroy neighbours' sunshine...
For example these out on Main Rd Stoke which are only just over 6 m tall and are built on the northern side of the section with a 5 or 6 m driveway to their southern neighbours.



->#11 - Medium Density

The medium density examples here should only be on Greenfield or Brownfield developments where they only affect themselves and people have a choice if they want to live in them.
Do we really want to look like Christchurch , Wellington or Auckland?



->#12 - General Density



This planning bylaw puts the FOX in charge of the hen house ... in fact it allows the FOX to design the rules that the hen house is built to .... then has the FOX checking the application to build new hen houses .... something is very wrong here ....

Do we want Nelson to look like this? We don't think so.

->#13



->#14



In Summary

Sunlight and daylight angles

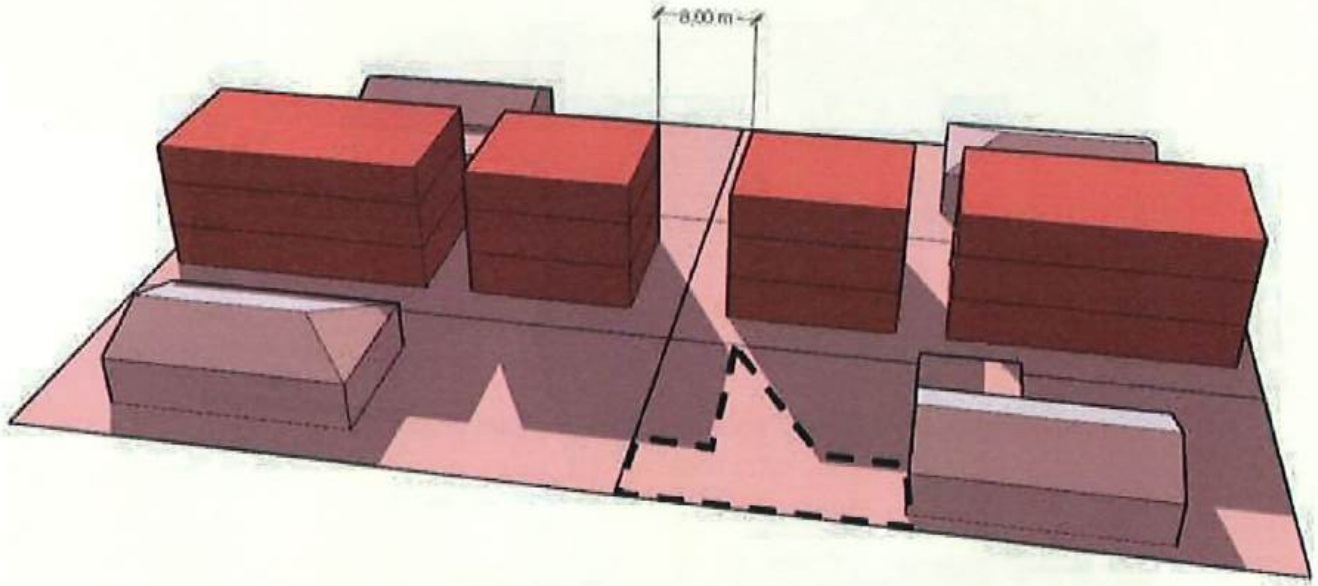
In summary, sunlight is part of the Nelson's DNA. It's what makes Nelson, Nelson. It belongs to all of us and nothing should be adopted by Council that reduces any resident's access their sunlight. The proposed changes to building heights and recession angles would fundamentally and permanently change the special nature of our city. It's possible to achieve the Council's goal of intensification by targeted methods rather than the broad brush approach as incorporated into PC29.

I now ask that you look at Page 61- S42A Report - Residential & Subdivision by NCC Planner C Barker of the example from expert Cam Wallace of B&A associates of a modification to improve sunshine into southern neighbours back yards ...
(page 23 I think as his document is not numbered)

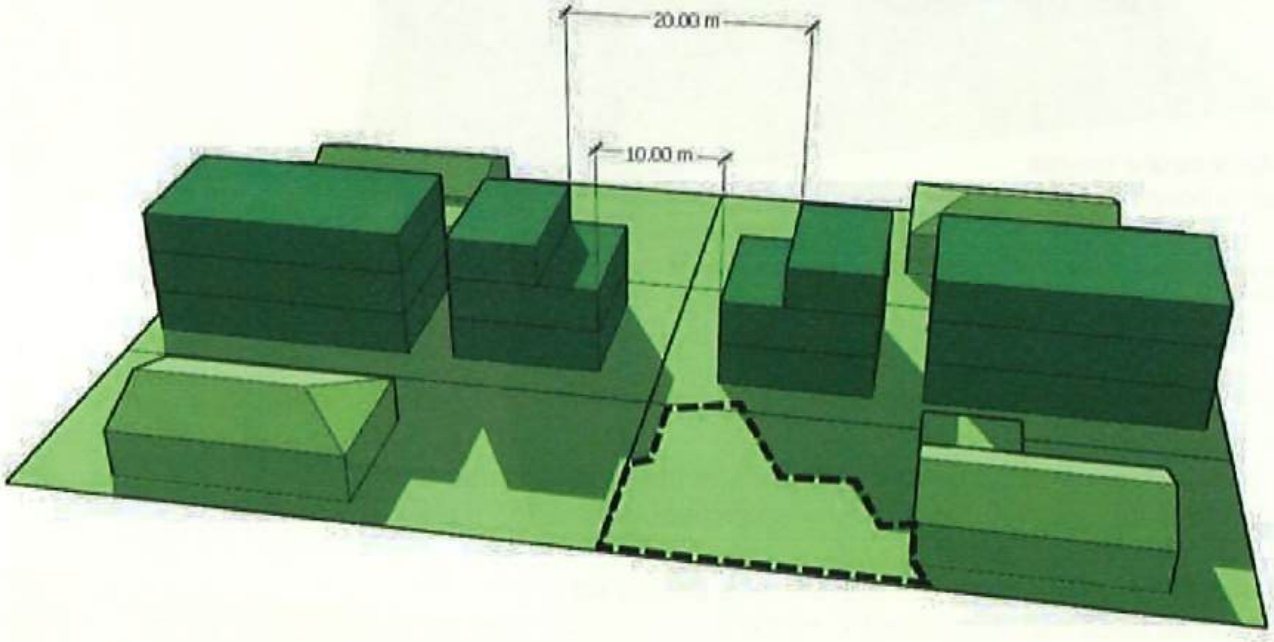
->#15 - This is the big compromise to give us more sun.

All looks good - but is it really ?

Theoretical building bulk as notified (shading 9am at 22/09)



Theoretical building bulk as amended (shading 9am at 22/09)



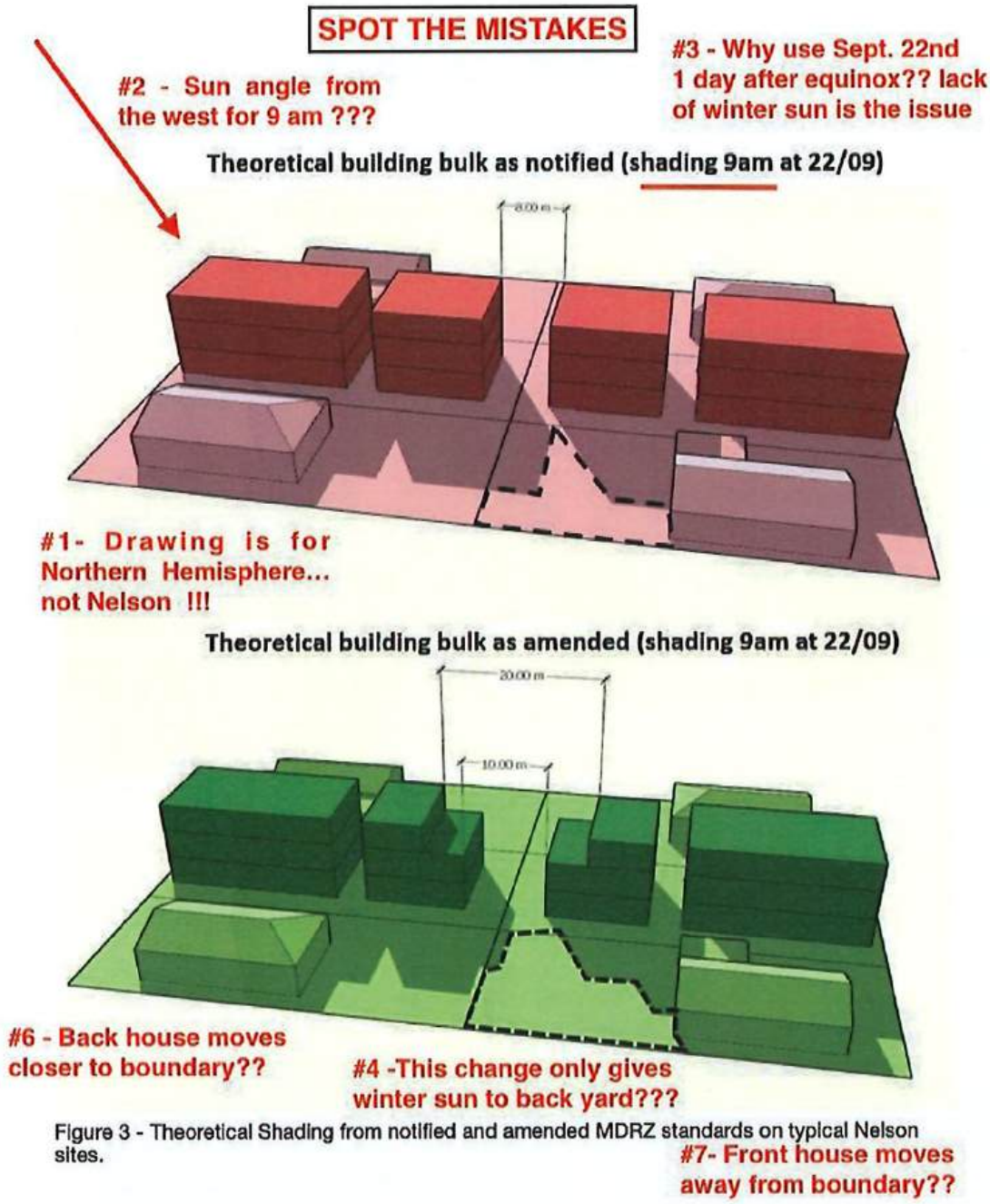


Figure 3 - Theoretical Shading from notified and amended MDRZ standards on typical Nelson sites.

There are a total of 6 errors or deliberate deceptions in this drawing

- The sun angle is from the west at 9 am ??
- So this drawing is actually from England - ie the Northern hemisphere !!
- Why use Sept 22nd - 1 day after the spring equinox ... the 6 darkest months of the year are already past!
- This change only gives extra sun to ones back yard.
  - Who uses their back yard in winter?
- The existing back house has somehow moved closer to southern boundary ??
- The existing front house has somehow moved away from the southern boundary ?? If this is an example of the quality of the expert witnesses then just what else is incorrect in these reports?

D. The Brook Flood Plane

In my original submission I did a pretty comprehensive Flood Plan for the lower Brook but all that showed up in the Planners' SUMMARY OF DECISIONS REQUESTED was this little note: so sort of you will not have seen this report (included in your packet)

"Refer to the original submission section 13 for more detail, including the detail in the submission addendum labelled The Brook Flood Model - as Per Plan Change 29 - 5th October 2023 by Tim Bayley."

I would like to draw the Hearing's attention to a serious anomaly with the **Flood Hazard Maps** for the Brook Stream as prepared by Tonkins & Taylor that is used in the overlays for Plan Change 29.

And to further S42A report by

Sue Robb - Natural Hazards Section 9.8.1 - pages 60 to 62

and the corresponding evidence of

Damian Velluppillai - pages 7 to 9 in his evidence he states

#25- "Modelling indicates that at the peak of the design 1% AEP flow event, and accounting for high tailwater conditions (water level) in the Maitai River, flow velocity is likely to be much higher than 1 m/s, in the order of 3-4 m/s. I have cross-checked this modelled flow velocity using a second 2d model (developed using TUFLOW software) based on similar flows in the Brook/Waimarama Stream and Maitai River. Unlike a 1d flood model, a 2d flood model explicitly allows for the 2d interaction of flows at the confluence, including eddy effects, superelevation at bends, and bend losses. The 2d model confirms that peak flow velocities ***are likely in the order of 3-4 m/s,*** *and therefore that the flow capacity at the Domett Street bridge is likely greater than Mr. Bayley assumes."*

->#17 - the predicted flood levels for both rivers are shown below

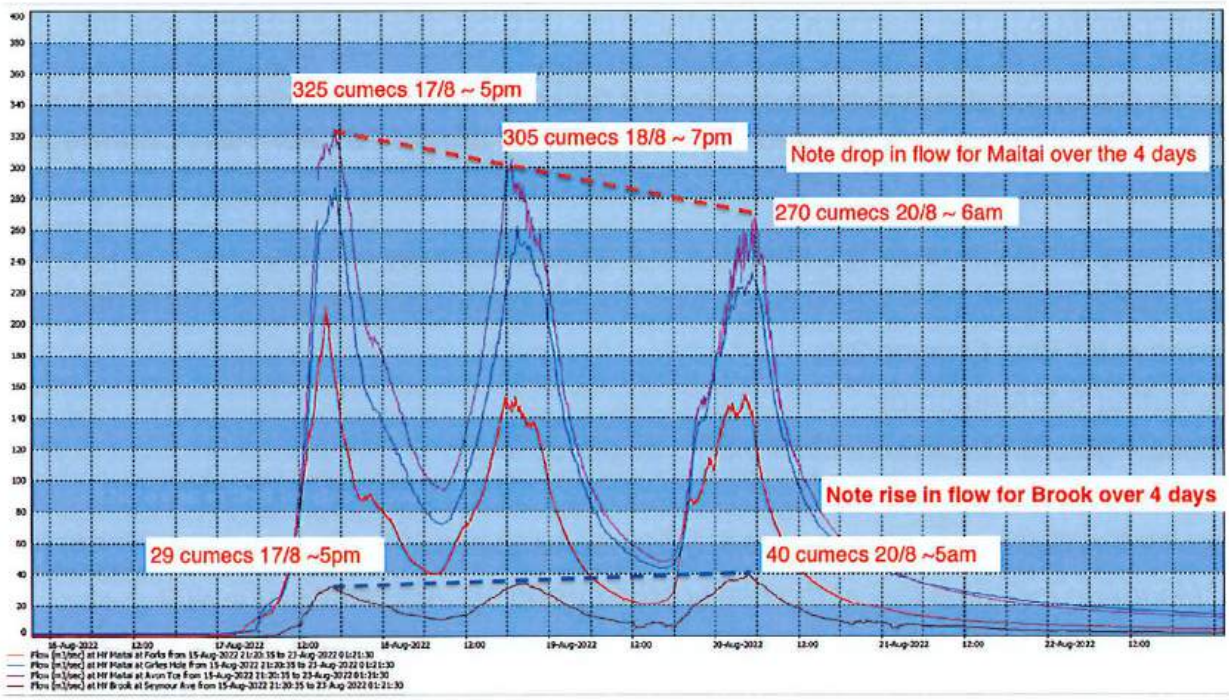
Maitai River at Avon Tce.

Scenario	Location	Peak discharge (m^3/s)
5% AEP storm, Present day	**Maitai 13900**	276
2% AEP storm, Present day	**Maitai 13900**	348
1% AEP storm, Present day	**Maitai 13900**	401
1% AEP storm, RCP 8.5M climate change scenario to 2130	**Maitai 13900**	568

Brook Stream at Seymour Tce.

Scenario	Flow at Seymour Tce gauge site (Ch4009, model version MaiBkYk_202103v016) m^3/s
Present day 5% AEP (20 year)	43
Present day 2% AEP (50 year)	56
Present day 1% AEP (100 year)	67
2130 RCP8.5M 1% AEP (future 100 year)	**97**

->#18 The flood gauge readings for the August '22 event



This graph from NCC's flow stations on the Maitai and the Brook shows the relative flows of the rivers over the 4 days of the big flood event in August '22.

You can see here that the Maitai was at it's max on the Wednesday afternoon around 5pm but the Brook did not peak till Saturday morning at 5 am.

We can clearly show in the following videos that the actual flow was approx 1 m/sec or slightly less when the Maitai was running at it's "high tailwater conditions" of 325 cumecs (ie a 50 year event) but the Brook was only running at a 15 year event level ...of ~30 cumecs - in the pictures below the river is running at 2.5 m/s above Nile St....

->#19 Flood level Intake Nile St ->#20 Inflow at Nile St culvert "Ask for video 20"





->#21 Out flow at the Nile St culvert- "Ask for video 21"



Nile St culvert outflow - running just under 30 cumecs at around 5 pm Wed. 17/8/22

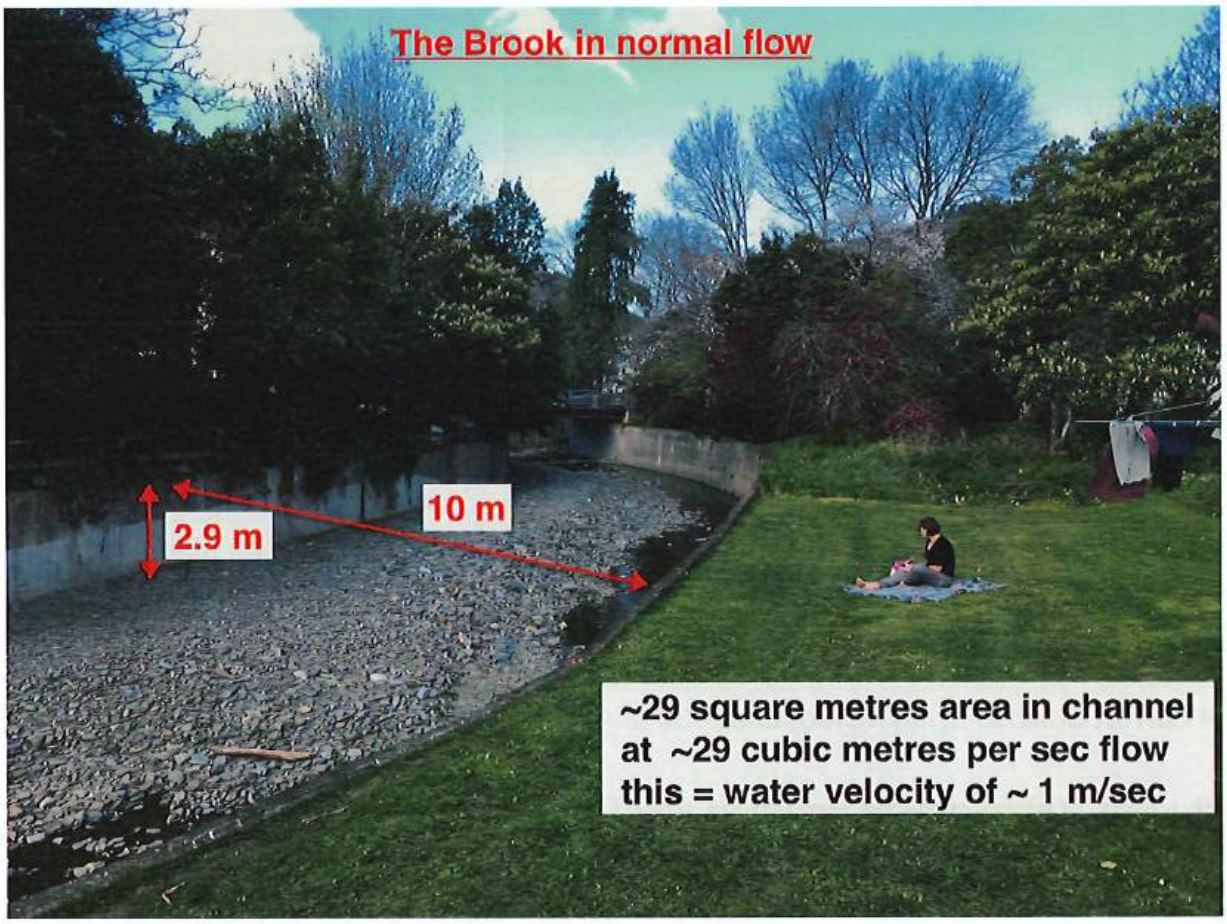
->#22 - But 100 m downstream at #52 Domett - "Ask for video 22"



The Brook is almost stopped by the Maitai blocking it's exit under the Domett St bridge

Flow < 30 cumecs at 5 pm 17/8 - **Running in 29 sq m channel so flow is just 1 m/s -**

->#23 - The Brook in normal flow



The size of the channel and the flow of just under 30 cubic metres a second confirms that the flow rate here was ~ 1 m/s

->#24 - Driveway of 52/51 Domett St "Ask for video 24"



Around 4.30 on the 17/8/22 the Brook breached the wall into the driveway of #51/52 Domett St due to the Maitai high flood level blocking its outflow ..

->#25 - A freeze frame of the video above

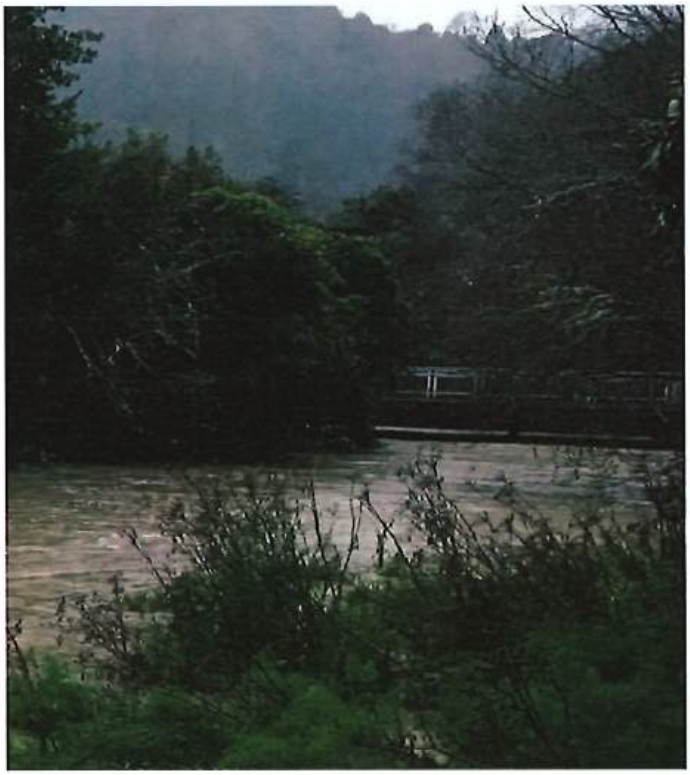


The flow at 5.15 seconds, can be measured by going frame by frame, as the camera shows water passing the posts on the channel wall … these posts at exactly 2 m apart and the water takes 2.15 seconds to go this distance …= a flow of **JUST UNDER 1 M/S**

->#26 The flow or lack of -(from 155 Nile St back lawn)

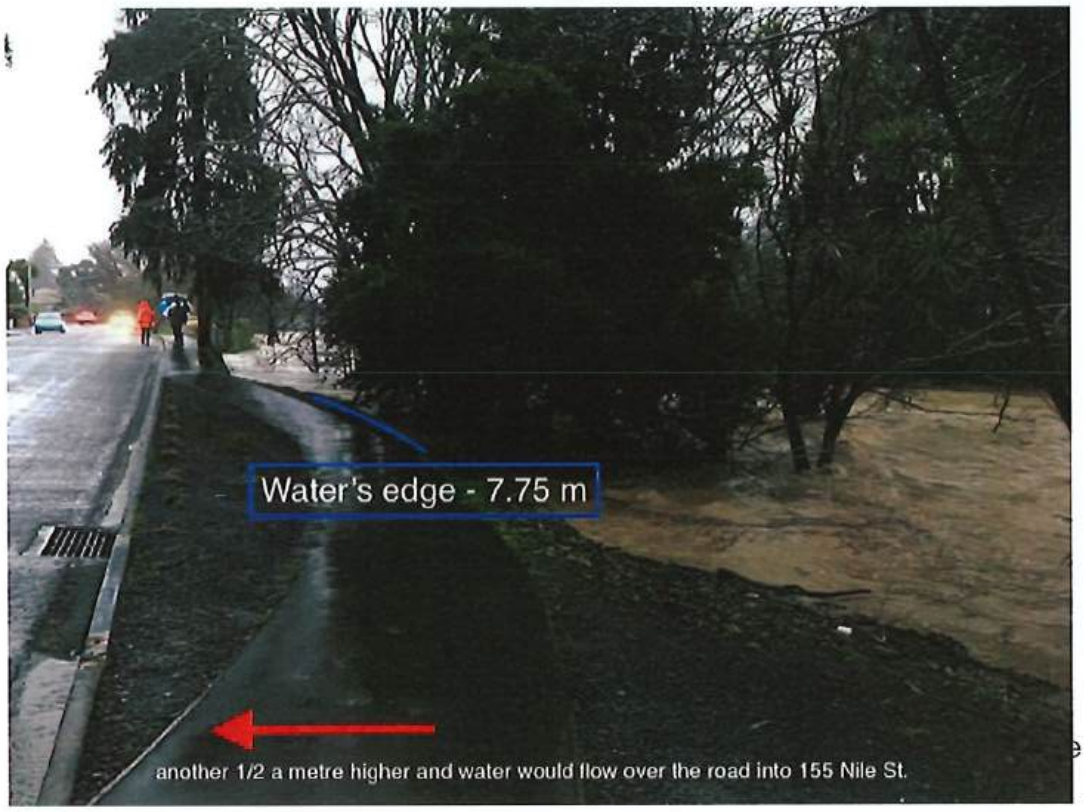


->#27 - The lack of clearance under the Domett St bridge

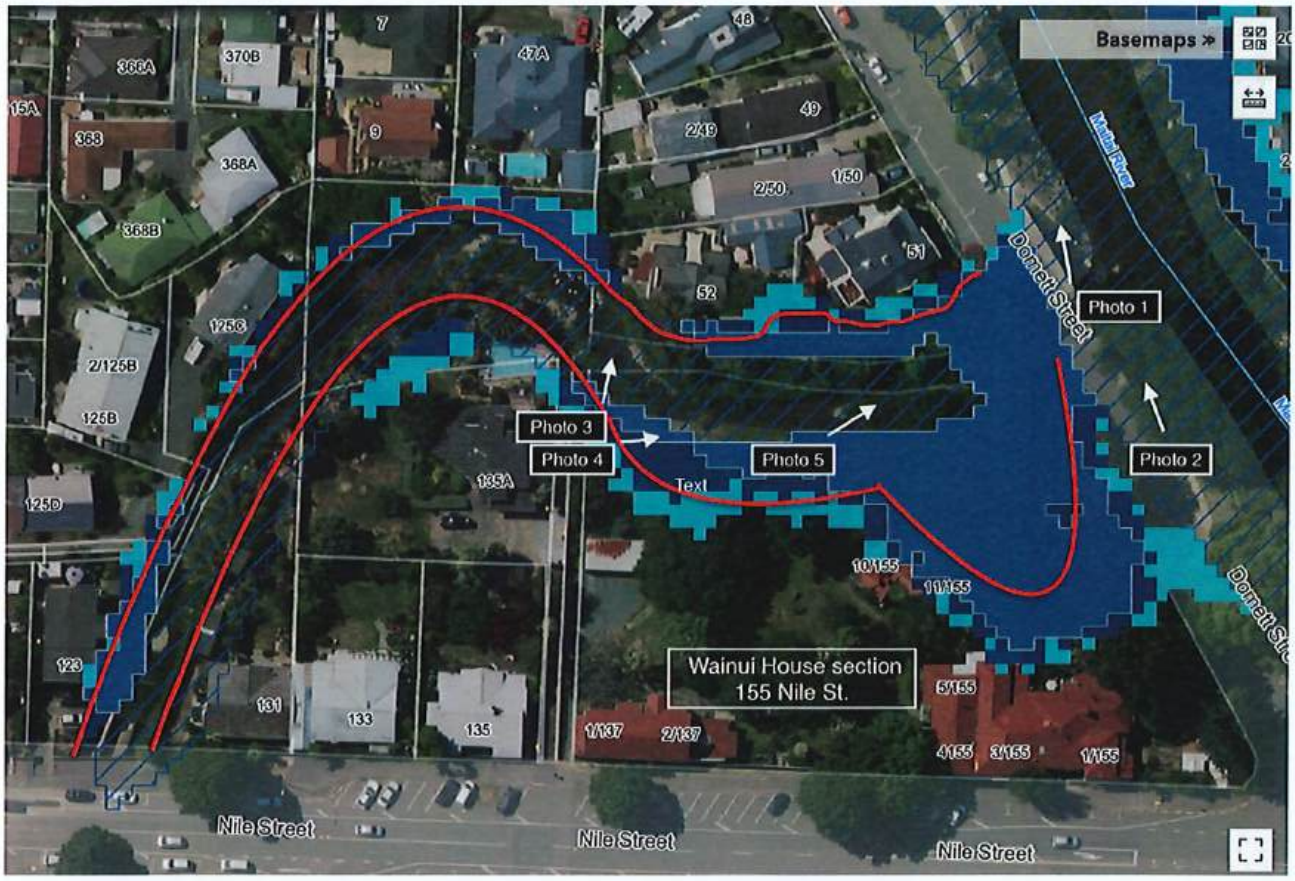


When the Maitai is in any kind of flood level above 300 cubic metres a sec, there is no way that the Brook Stream can't flow out into the Maitai at any significant flow rate above this level of **30 to 35 cumecs** .. maybe 40 ? But a 100 cumecs not a chance !
so we are missing 60 cubic metres of flood water per second .....
..... that's 3600 VW Beetles a MINUTE! ....

->#28 -The flood level of the Maitai at 325 cumecs ... at 5.15 pm Wed 17th '22



->#29 -The Plan 29 flood Plain for the lower Brook - the red line shows the



extent of the actual Brook flooding which was just a 15 year event but it almost covers the whole area projected by NCC engineers and their consultants for **the big 100 year event** that is 3 x's this volume !!

The only way this volume of water,, that Damian talks about could flow down the channel in the lower Brook is if the Maitai was TOTALLY EMPTY ....

E. The Missing Flood Plain in Plan29

In late 2023, after all Submissions had closed, it came to our attention that Kainga Ora had been required to get a special flood report by Tonkin and Taylor because of possible flooding of its 107 Nile St site by the Brook from this Nile St culvert .. this report was started in 2022 by T&T and given to KO several months before Plan 29 was even announced **but there was no mention of it** in any of the Plan 29 information.

We requested a copy and this finally came to light in February of this year .

It clearly shows that the Brook will overflow Nile St and flood Tasman St and the houses on both side once the flow gets to around the high 60's of cubic metres per second.

As you can see below we were told we can't use this as it is "site specific" and can only be used by KO a Flood Plan is a flood plan and water does not care what report it is used inUsing the information we got, in image #30, we have worked out that the water velocity at the Nile St culvert was ~2.5 m/sec ... and from picture #19 the flood water was 1.4 m below the underside of the concrete ... so through some basic hydraulics, one

->#30 The Brook culvert dimensions just upstream of Nile St



can work out the flow when the flood waters just reach the underside of the culvert entrance … this number is ~3 m/s … and at 3 m/s the volume of water passing during a flood of this level would be the total area x's 3 which is 22.8 x 3 = 68.4 cumecs …. which is exactly what T&T predicted as shown below from their report … for once, they might actually have it right ? https://www.omnicalculator.com/physics/open-channel-flow

->#31 - Modelled Flooding at Brook St Culvert on Niles St



Damian Velluppillai from T&T writes in his expert witness statement :

26. Mr. Bayley refers to a flood assessment report prepared by T+T in 2023 for Kāinga Ora, for their resource consent application to develop a property at 107 Nile Street. He notes that the modelled flooding presented in that report is significantly different (more

extensive out-of-channel flooding in the lower Brook/Waimarama floodplain) than what has been used for the PC29 flood overlay.

27. I consider it inappropriate to compare the flood mapping used to set minimum development levels for a specific property, with the flood mapping prepared by Council to identify potential flooding issues at a catchment scale. A site-specific flooding assessment may include more detailed survey and local features not able to be represented in a larger model and may also adopt a more risk-averse approach to setting development levels"

So we are told we can't use this information ... I don't think that flood waters take any notice who or what the flood report was done for...

So below you can see our estimation as to what the actual flood plain for the lower Brook might look like when the Maitai is at a 45 year or better flood. And this does not include the part of the Brook that will now be flowing over Nile and Tasman St

And yet this was the very reason that the area north of Hardy St has been totally removed from Plan 29 ... as should these 2 blocks.....

So the two blocks from Nile to Hardy and Domett to Alton should also be removed from Plan29 as they have now been shown to be flood prone.

I hate the say the word .... BUT I think actual observation and video of the two rivers interactions in a major August '22 flood event "TRUMPS" any 1, 2 or 3D modelling !

->#32 - The predicted Brook Flood Plain - 100 year event



The Brook Flood Plane

In summary, I am hugely concerned about the data and analysis being used to support the flood planes built into PC29 and urge you to engage a consultant who understands the complexity of the intersection of these two rivers. As I believe I have demonstrated in my testimony and submission, the adoption of the flood plane presented by the planners is likely to have severe repercussions in flooding areas that are being proposed for three or even six story buildings. This requires much deeper and more transparent analysis.

Conclusion

The present government has removed most of the mandatory requirements for PC29 brought in by the previous government. So Nelson is not required to do this, and the statistics the planners have used for justification are flawed. While Nelson will obviously grow, there truly is no need to plan for the dramatic increases suggested by the planners.

If intensification is desired, it should take place in targeted areas where larger buildings will not affect the quality of life of residents, current and future. Existing recession angles should stay except for larger sites.

PC29 will result in neighbour being pitted against neighbour. That is wrong!
PC29 gives developers an "as of right" to do whatever they want on a section, without consultation or appeal. That is wrong!
PC29 will lead to us all living in fear of the bulldozers showing up on a Monday morning. That is wrong!

We want to live in a collegial community, where we all get along. PC29 will turn neighbour against neighbour. It will generate hate and hostility. It is bad planning law. There is a better way and I urge you to step back and create a plan for Nelson's growth that thoughtfully considers the rights of our citizens, now and in the future.

Why would we want to live with this fear ...

This past year has been the most stressful in my whole life ...

It has taken at least 5 year off my life ....

I WANT IT BACK !!!

We don't want to live like this ... Yours Tim Bayley - 52 Domett St

The Brook Flood Model

- as Per Plan Change 29 - 5th October 2023 by Tim Bayley

I would like to draw the council's attention to a serious anomaly with the Flood Hazard Maps for the Brook Stream as prepared by Tonkins & Taylor that is used in the overlays for Plan Change 29.

As a resident of Domett Street, being along side both the Maitai River and the Brook Stream, for the past 26 years we have observed these waterways closely in both drought and flood conditions.
The biggest of these weather events being 17th to 20th August 2022.
During this flood the Brook Stream came over the wall at the back of our property, 52 Domett Street, three times.
To set the scene of what happened over the 3 + days of the big flood back in August of 22
Over the next 4 pages we have included a series of pictures of the rivers normally and in full flood on the Wednesday the 17/8/22 in the late afternoon.
Our house, below, sits on the last bend in the Brook Stream before it exits under the Domett St bridge into the Maitai River.





#1A - The Maitai River from Domett St bridge - looking downstream - normal flow



#1B - The Maitai River from Domett St bridge looking downstream - FULL FLOOD



#2A - The Maitai River just upstream of Domett St bridge - normal flow



#2B The Maitai River just upstream of Domett St bridge - in FULL FLOOD -17/8/22



#3A - Brook Stream - from 155 Nile toward 52 Domett St - normal flow



#3B- Brook Stream - from 155 Nile toward 52 Domett St - in FULL FLOOD -17/8/22

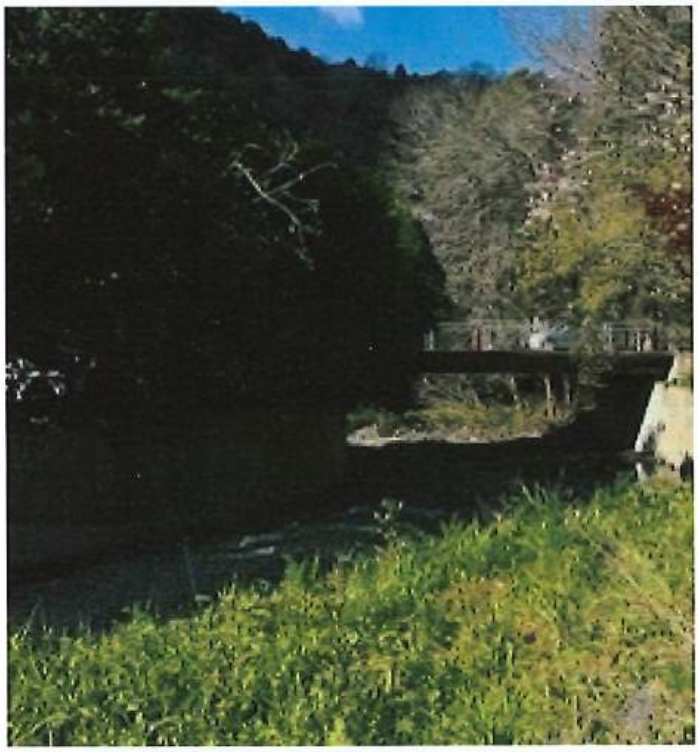


#4A - Brook Stream - looking down to Domett St bridge - normal flow

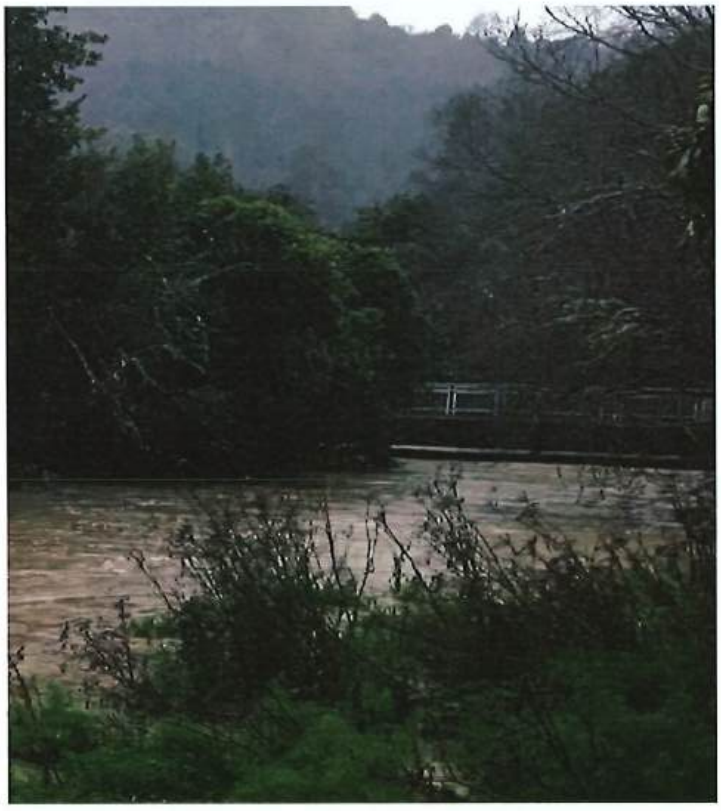


#4B - Brook Stream - looking down to Domett St bridge - in FULL FLOOD -17/8/22

As you can see in this picture the Brook Stream is flowing over the edge of the concrete channel and into the grounds of Wainui House at 155 Nile St.
At this time the Brook Stream was flowing at **30** cumecs and the Maitai River was running at it's biggest volume in the last 40+ years at **330** cumecs at Avon Terrace (- some 300 cumecs just above it's junction with the Brook) - see the cross-section of the river page 11



#5A - Brook Stream - close up of the Brook showing the normal opening under the Domett St bridge around 15m W x 3 m H



#5B - Brook Stream - close up of the flood running under the Domett St bridge - with only around 15 cm of clearance . The height of the underside of the bridge is just under 8 m from Nelson datum.

Due to the extreme level of the Maitai River, the Brook Stream, as it exits at the Domett St bridge, was almost at full capacity, as shown in the photo #5 on page 6 above, with just 15 or so centimetres of clearance left under it. The Brook had slowed to almost a crawl due to the back pressure from the flooded Maitai .

The Brook was at a 30 cumecs of flow at this time....

the normal size of the main channel is 2.9 m deep x 12 m wide = ~35 m2 in area ...

so the speed of the Brook with this flow is just under 1 m/sec ...

Quite slow, - So with this flow or bigger in the Maitai River, the Brook Stream has a very restricted outflow under the Domett St bridge of just around **30 to 35 cubic metres per second. It can't take any more capacity ...**

But the predicted flows for the big 1% 100 year 2130 flood are estimated, by Tonkin & Taylor in their flood plain modelling, as **568** cumecs for the Maitai River and **97** cumecs for the Brook Stream respectively as shown on the two tables below.

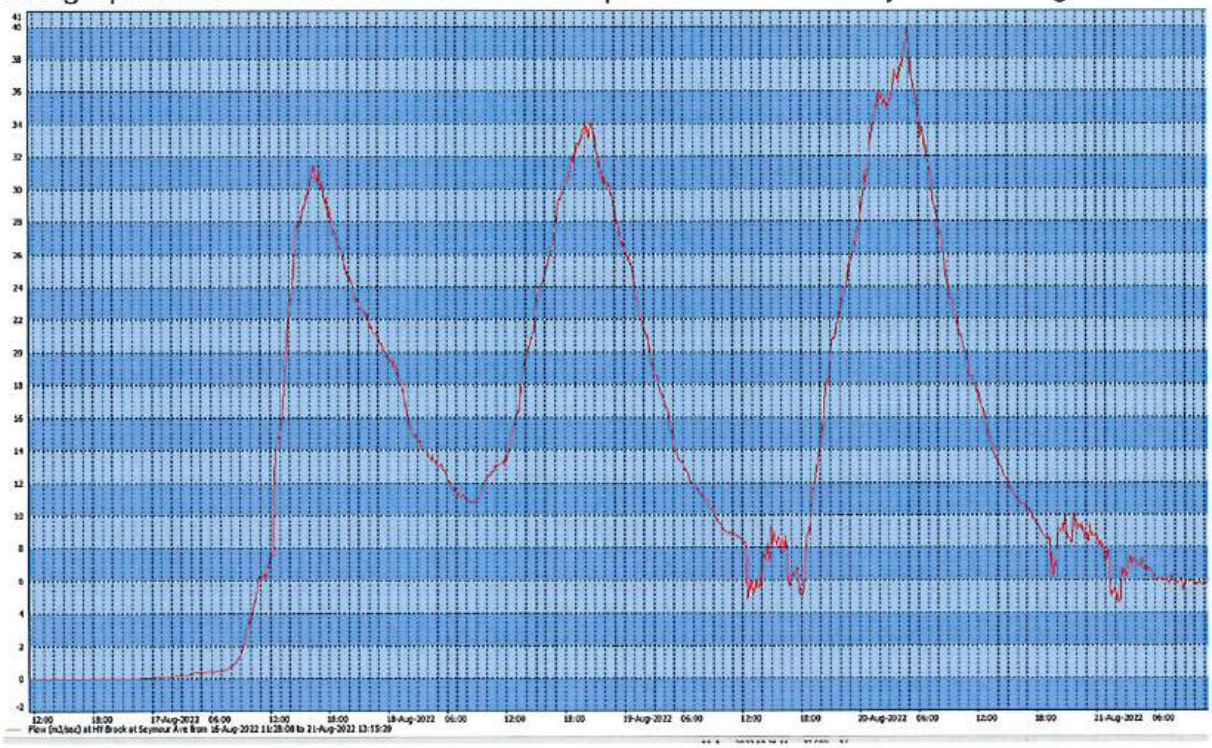
Predicted river flows:
Maitai River at Avon Tce.

Scenario	Location	Peak discharge (m^3/s)
5% AEP storm, Present day	**Maitai 13900**	276
2% AEP storm, Present day	**Maitai 13900**	348
1% AEP storm, Present day	**Maitai 13900**	401
1% AEP storm, RCP 8.5M climate change scenario to 2130	**Maitai 13900**	**568**

Brook Stream at Seymour Tce.

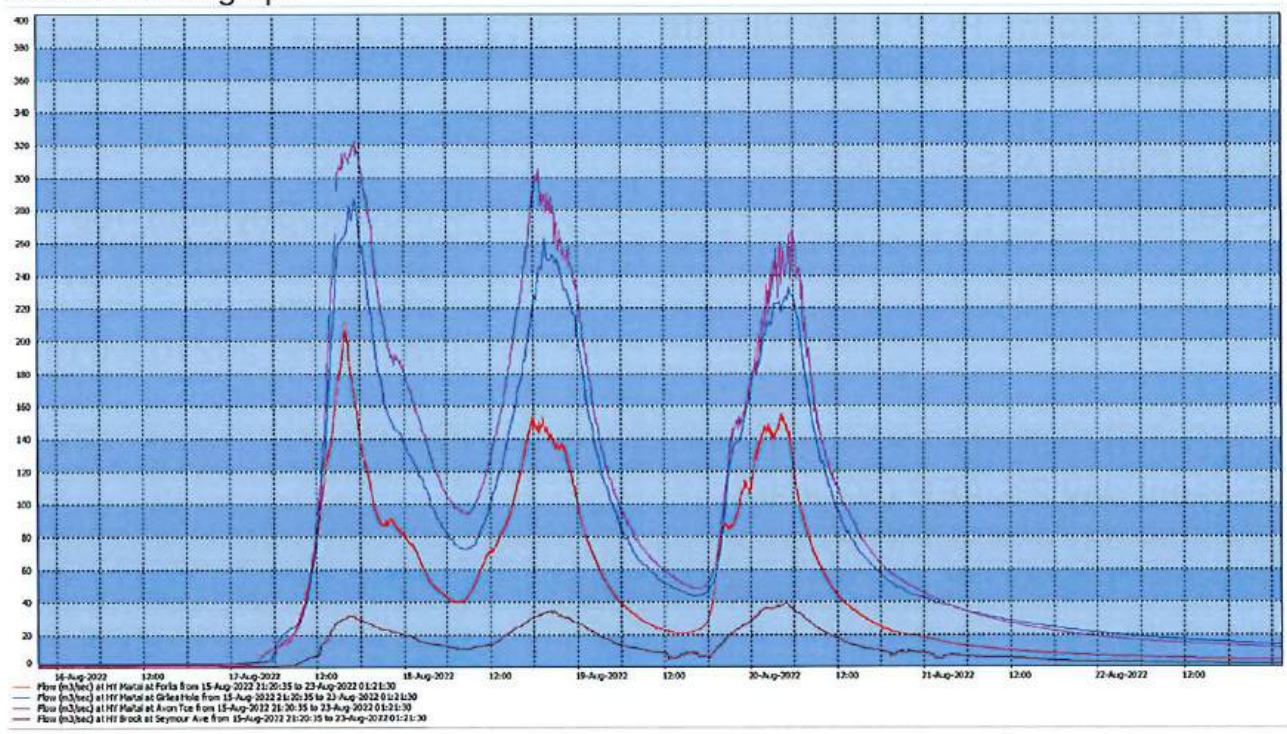
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Present day 5% AEP (20 year)	43
Present day 2% AEP (50 year)	56
Present day 1% AEP (100 year)	67
2130 RCP8.5M 1% AEP (future 100 year)	**97**

The graph below shows the Brook Stream peeks over the 3 days of the August event



This clearly show that the Brook Stream was only running at **30 cumecs** (just a ~10 year event) at around 4.30pm when the Maitai River was running at **330 cumecs** (so ~300 cumecs just above the Domett St bridge.) (which was an almost 50 year event ie 2%)

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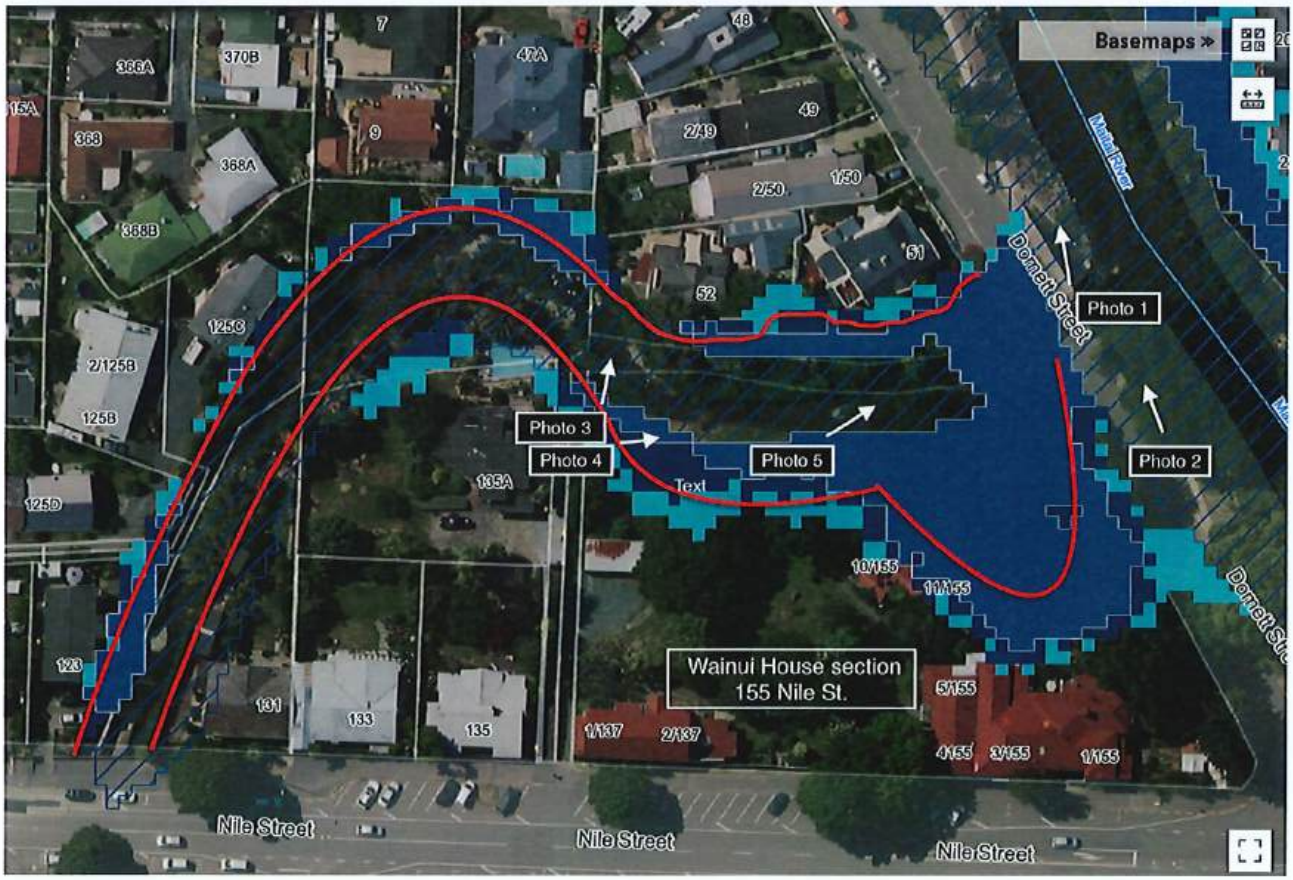


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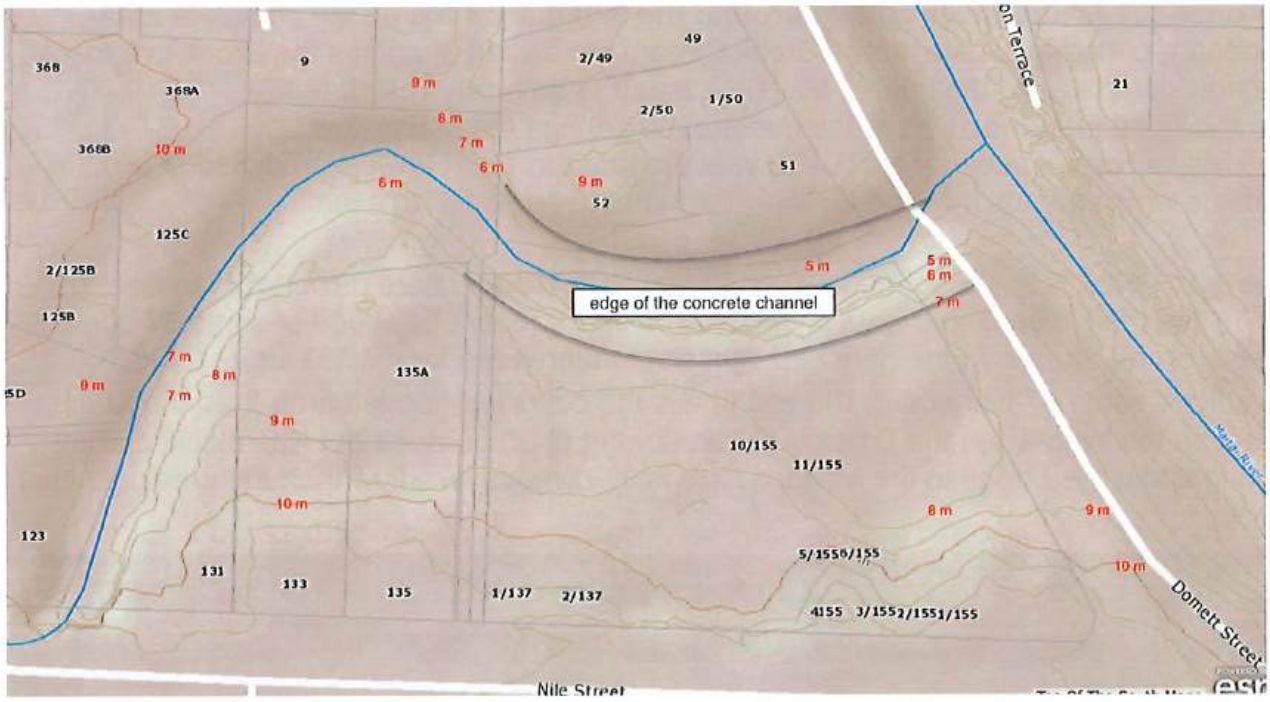
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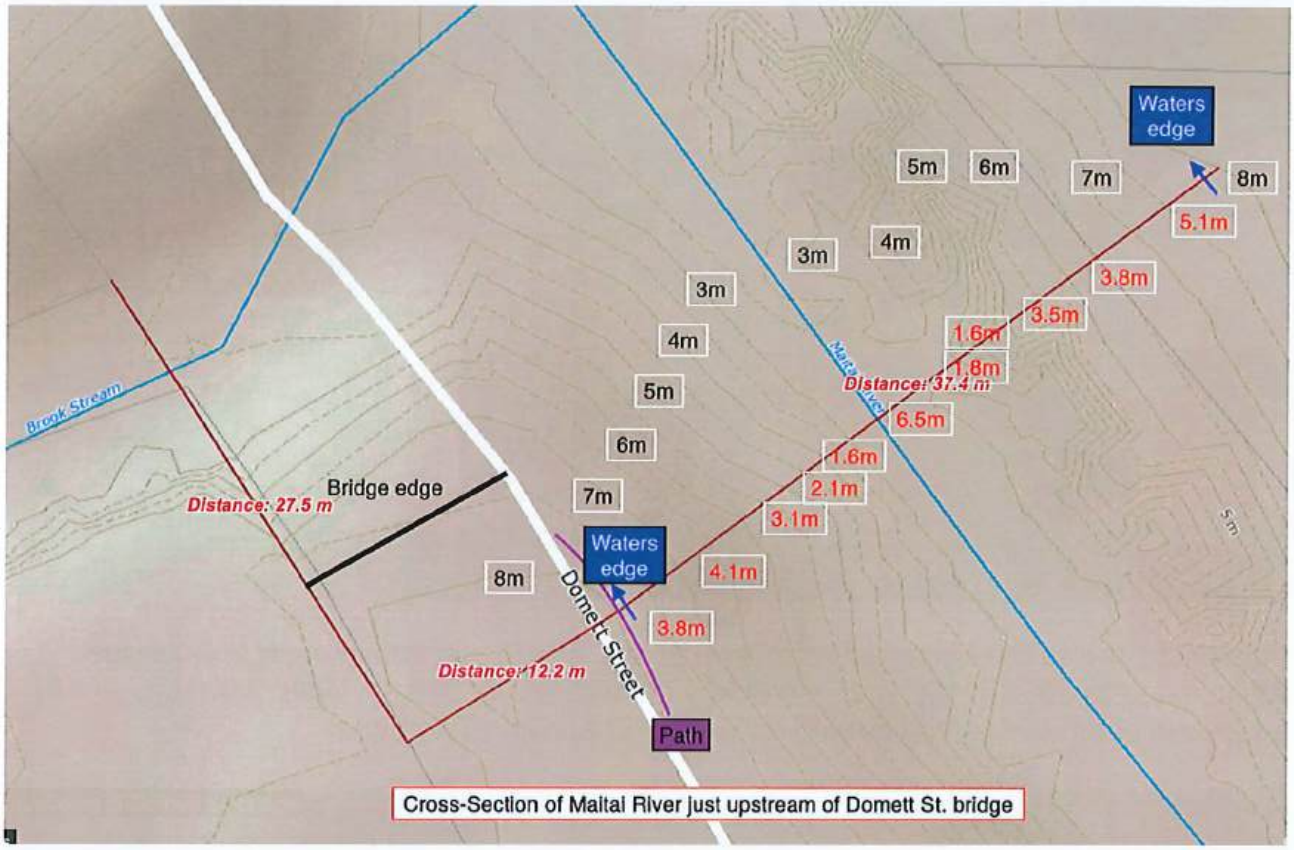
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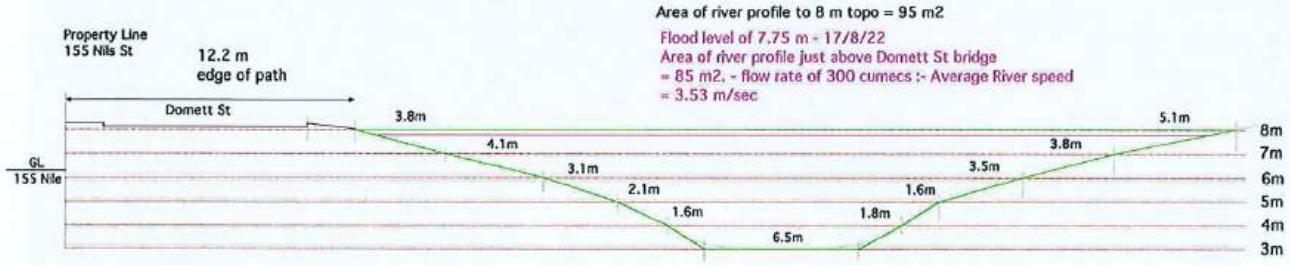
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The flood level on the 17th August last year, at 330 cumecs, was at the 7.75 m level which is just 15 cm below the underside of the Domett St bridge. (see picture #2B)

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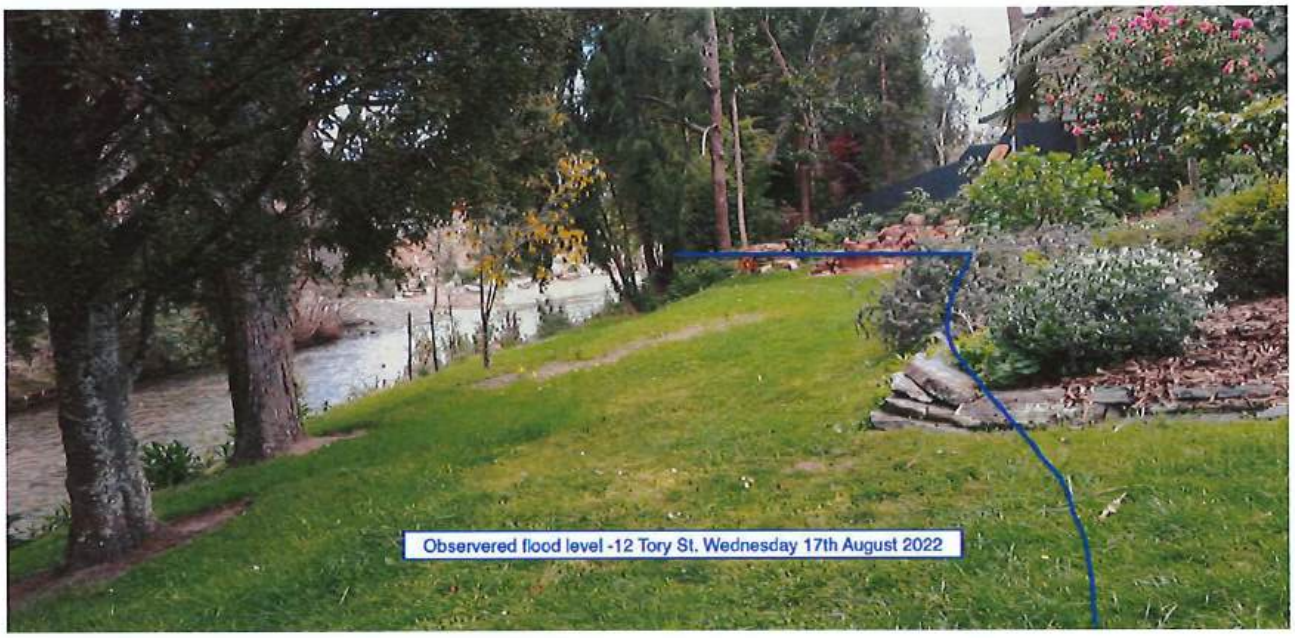


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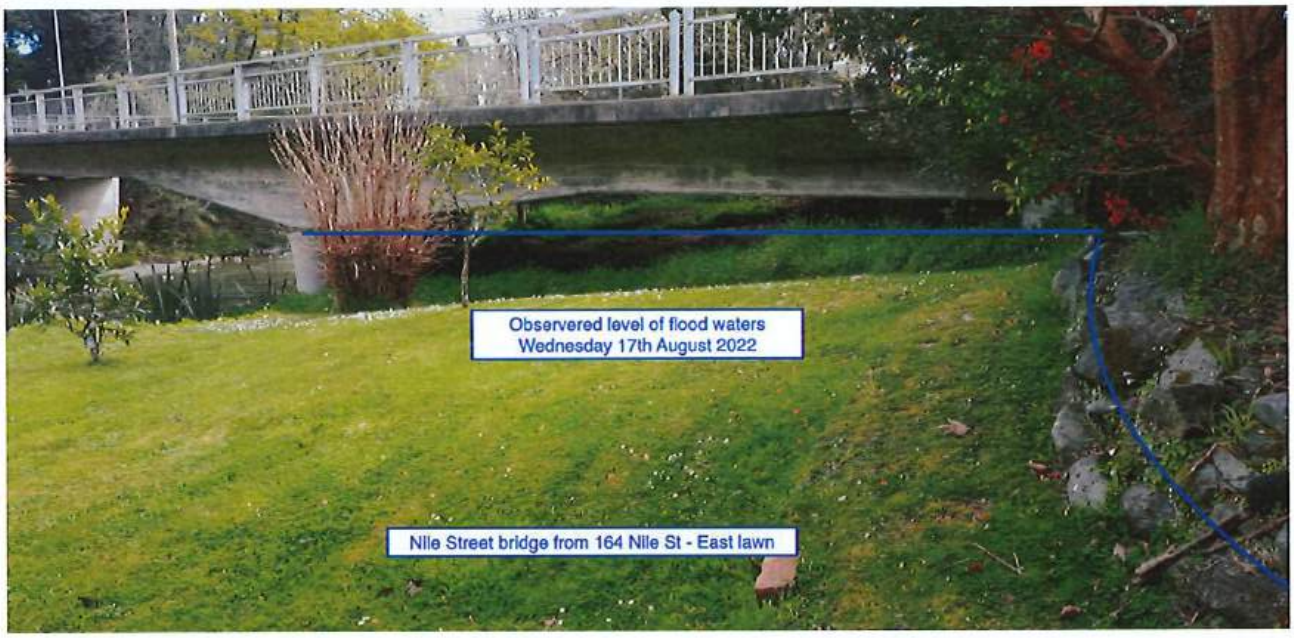
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The photo below shows the observed level of the floodwaters on the 17th August 2022 at 12 Tory St which is directly across the river on the end of the cross-section on page 7. Around 3/4's of a meter higher and the water would have been flowing around the house and out onto Tory St.



This photo shows the observed flood level at 164 Nile St just above the Nile St bridge . An increase to the 1 in 100 flow rate of 401 cumecs would see the water flowing over the lower end of the bridge and flowing down Nile St and into Tory street



The below picture slows the predicted extent of flooding with the Brook running at 50 year or above event when the Maitai is also running at 50 year and above event.



There are some other major issues:

1. Is that during a flood, of this nature and duration, the channel that the Brook flows along fills with gravel just after the last bend by our house at 52 Domett St … so goes from a "clean" max area of 35 sq metres to just 20 sq metres thus further restricting the flow …This means with the Domett St. bridge blocked by the Maitai River in full flood … the channel upstream of the bridge will only have capacity for some 20 to 25 cumecs of flow, further compounding the issues.

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Entrance ~ 20 m2



Exit ~ 40 m2 in 3 channels



The Brook Flood Model

- as Per Plan Change 29 - 5th October 2023 by Tim Bayley

I would like to draw the council's attention to a serious anomaly with the Flood Hazard Maps for the Brook Stream as prepared by Tonkins & Taylor that is used in the overlays for Plan Change 29.

As a resident of Domett Street, being along side both the Maitai River and the Brook Stream, for the past 26 years we have observed these waterways closely in both drought and flood conditions.
The biggest of these weather events being 17th to 20th August 2022.
During this flood the Brook Stream came over the wall at the back of our property, 52 Domett Street, three times.
To set the scene of what happened over the 3 + days of the big flood back in August of 22
Over the next 4 pages we have included a series of pictures of the rivers normally and in full flood on the Wednesday the 17/8/22 in the late afternoon.
Our house, below, sits on the last bend in the Brook Stream before it exits under the Domett St bridge into the Maitai River.





#1A - The Maitai River from Domett St bridge - looking downstream - normal flow



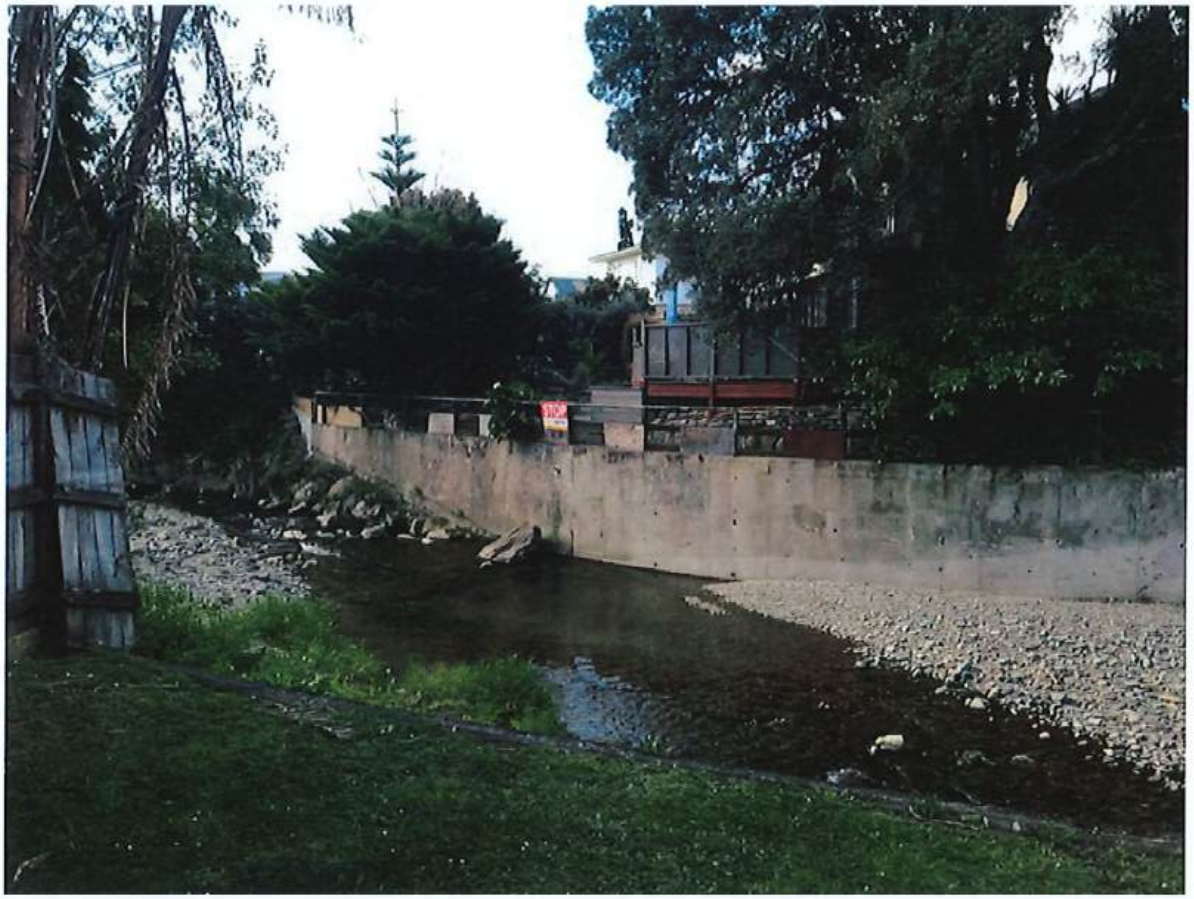
#1B - The Maitai River from Domett St bridge looking downstream - FULL FLOOD



#2A - The Maitai River just upstream of Domett St bridge - normal flow



#2B The Maitai River just upstream of Domett St bridge - in FULL FLOOD -17/8/22



#3A - Brook Stream - from 155 Nile toward 52 Domett St - normal flow



#3B- Brook Stream - from 155 Nile toward 52 Domett St - in FULL FLOOD -17/8/22

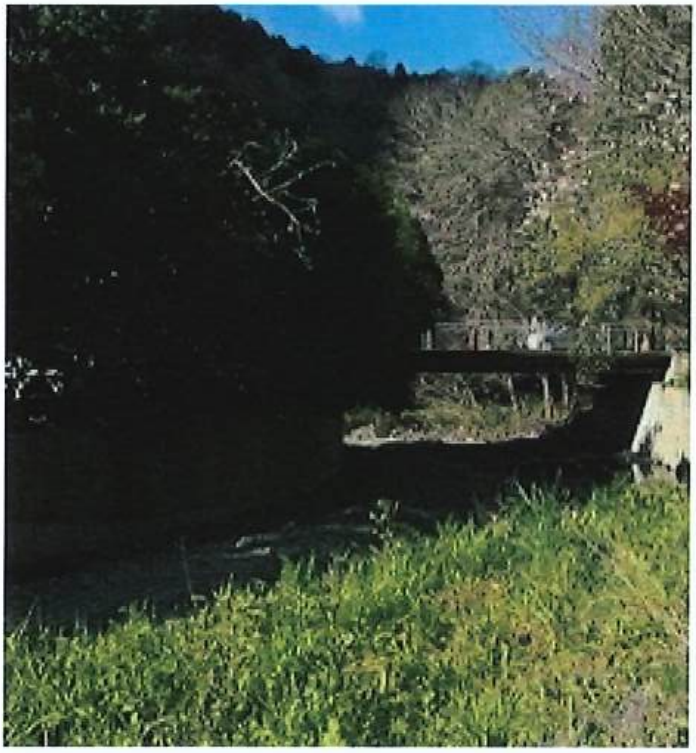


#4A - Brook Stream - looking down to Domett St bridge - normal flow



#4B - Brook Stream - looking down to Domett St bridge - in FULL FLOOD -17/8/22

As you can see in this picture the Brook Stream is flowing over the edge of the concrete channel and into the grounds of Wainui House at 155 Nile St.
At this time the Brook Stream was flowing at **30** cumecs and the Maitai River was running at it's biggest volume in the last 40+ years at **330** cumecs at Avon Terrace (- some 300 cumecs just above it's junction with the Brook) - see the cross-section of the river page 11



#5A - Brook Stream - close up of the Brook showing the normal opening under the Domett St bridge around 15m W x 3 m H



#5B - Brook Stream - close up of the flood running under the Domett St bridge - with only around 15 cm of clearance . The height of the underside of the bridge is just under 8 m from Nelson datum.

Due to the extreme level of the Maitai River, the Brook Stream, as it exits at the Domett St bridge, was almost at full capacity, as shown in the photo #5 on page 6 above, with just 15 or so centimetres of clearance left under it. The Brook had slowed to almost a crawl due to the back pressure from the flooded Maitai .

The Brook was at a 30 cumecs of flow at this time....

the normal size of the main channel is 2.9 m deep x 12 m wide = ~35 m2 in area ...

so the speed of the Brook with this flow is just under 1 m/sec ...

Quite slow, - So with this flow or bigger in the Maitai River, the Brook Stream has a very restricted outflow under the Domett St bridge of just around **30 to 35 cubic metres per second. It can't take any more capacity ...**

But the predicted flows for the big 1% 100 year 2130 flood are estimated, by Tonkin & Taylor in their flood plain modelling, as **568** cumecs for the Maitai River and **97** cumecs for the Brook Stream respectively as shown on the two tables below.

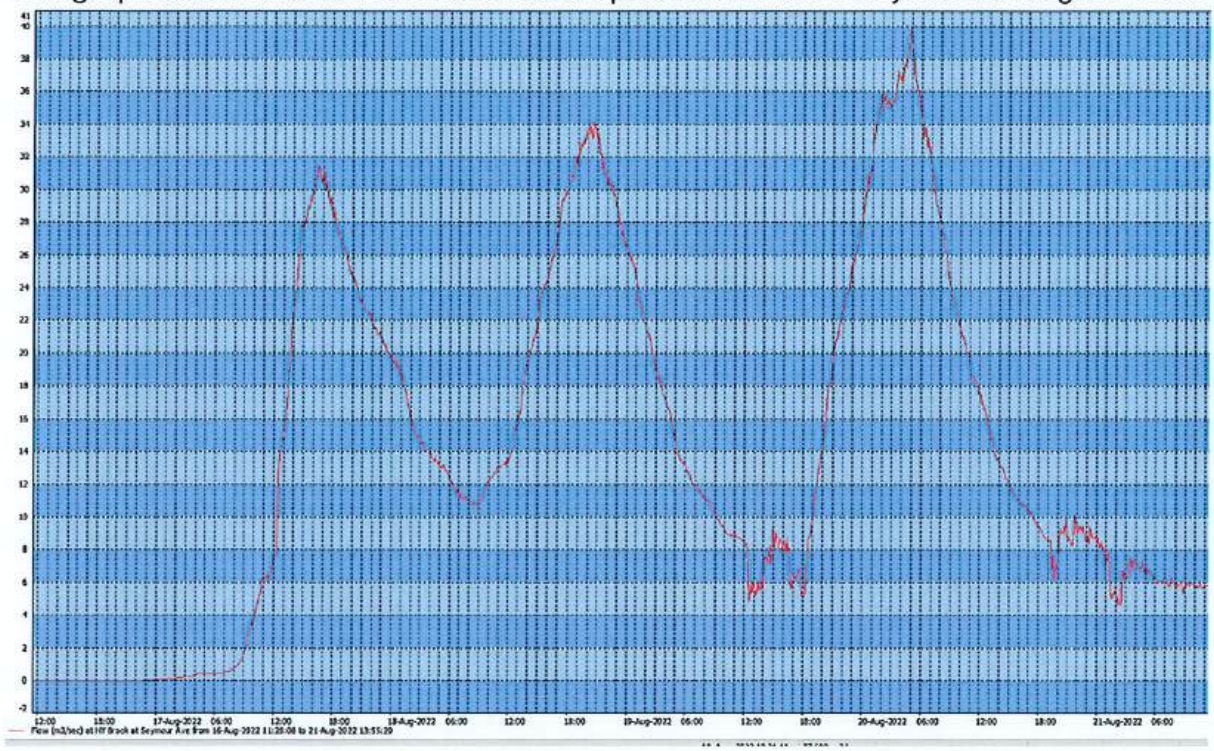
Predicted river flows:
Maitai River at Avon Tce.

Scenario	Location	Peak discharge (m^3/s)
5% AEP storm, Present day	**Maitai 13900**	276
2% AEP storm, Present day	**Maitai 13900**	348
1% AEP storm, Present day	**Maitai 13900**	401
1% AEP storm, RCP 8.5M climate change scenario to 2130	**Maitai 13900**	**568**

Brook Stream at Seymour Tce.

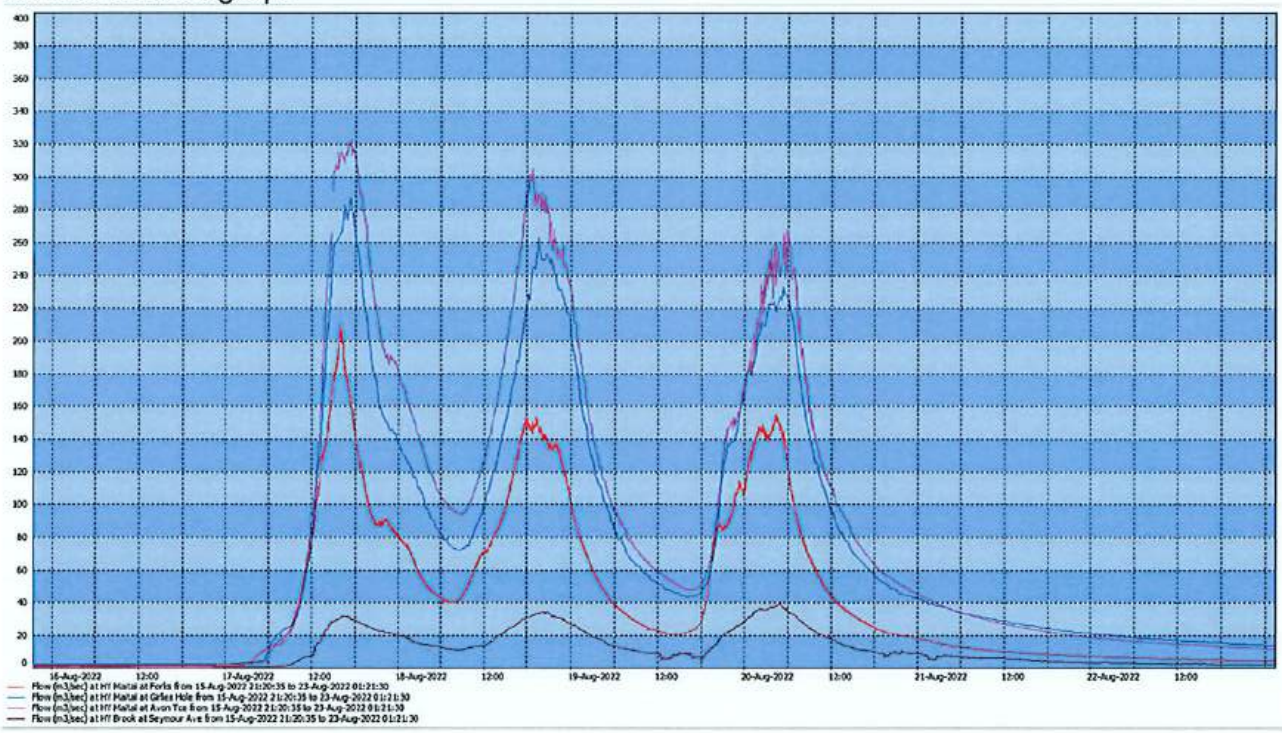
Scenario	Flow at Seymour Tce gauge site (Ch4009, model version MaiBkYk_202103v016) m^3/s
Present day 5% AEP (20 year)	43
Present day 2% AEP (50 year)	56
Present day 1% AEP (100 year)	67
2130 RCP8.5M 1% AEP (future 100 year)	**97**

The graph below shows the Brook Stream peeks over the 3 days of the August event



This clearly show that the Brook Stream was only running at **30 cumecs** (just a ~10 year event) at around 4.30pm when the Maitai River was running at **330 cumecs** (so ~300 cumecs just above the Domett St bridge.) (which was an almost 50 year event ie 2%)

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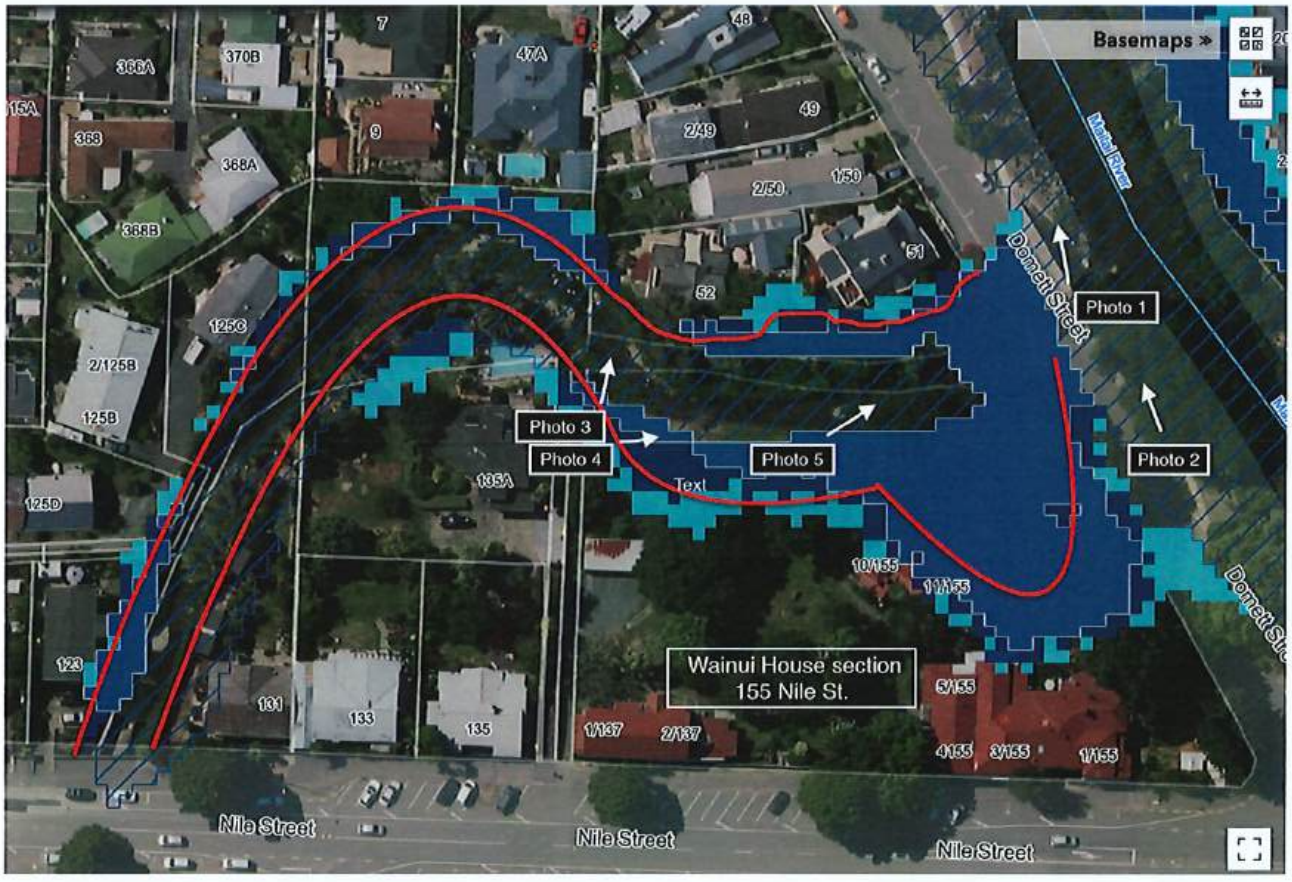


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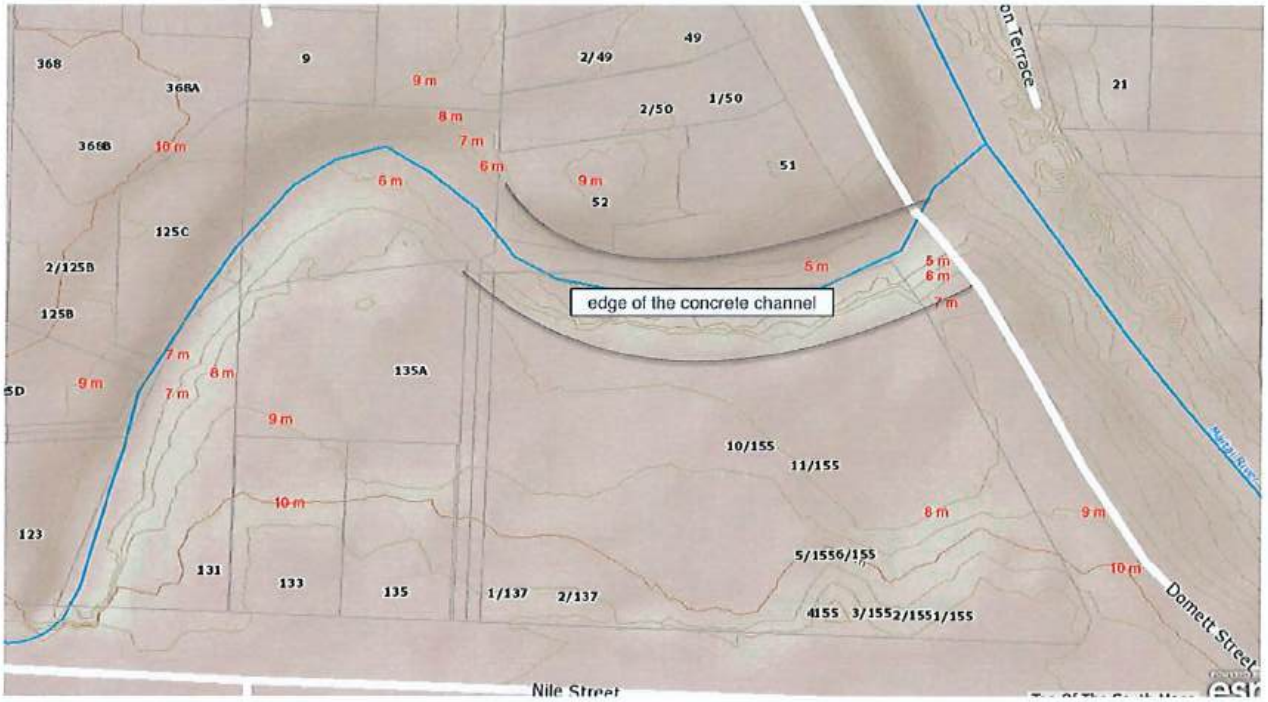
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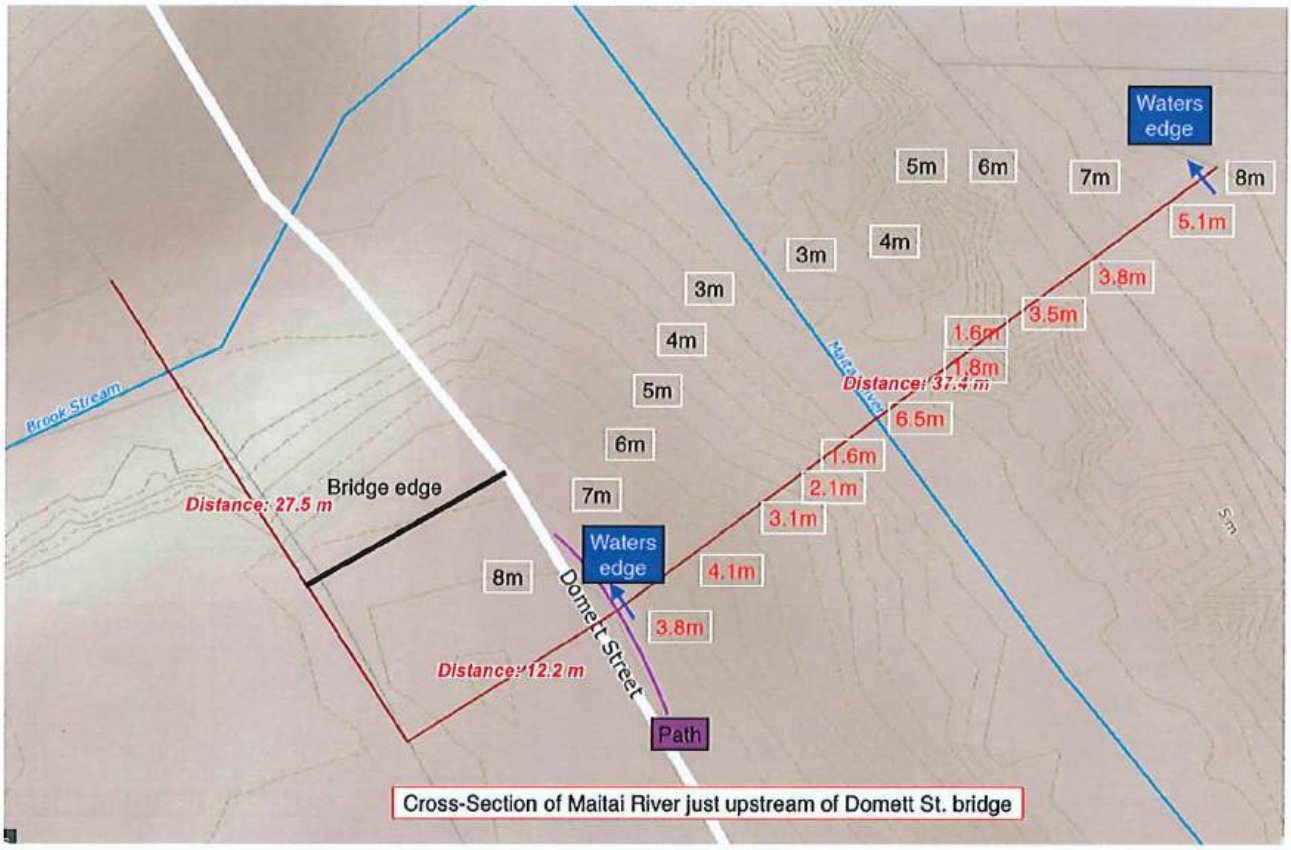
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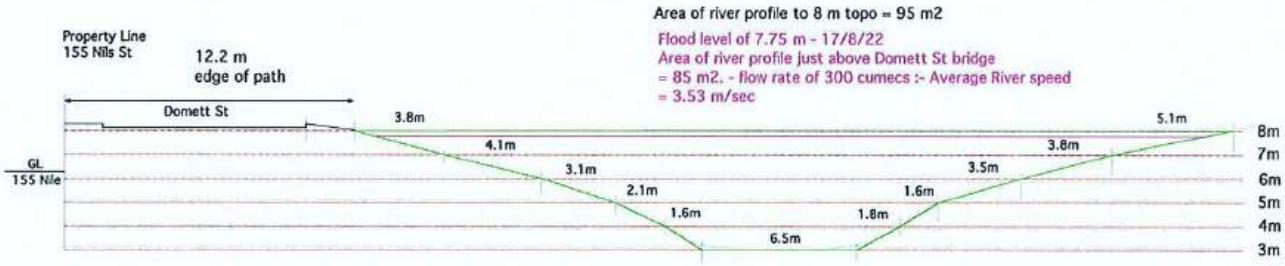
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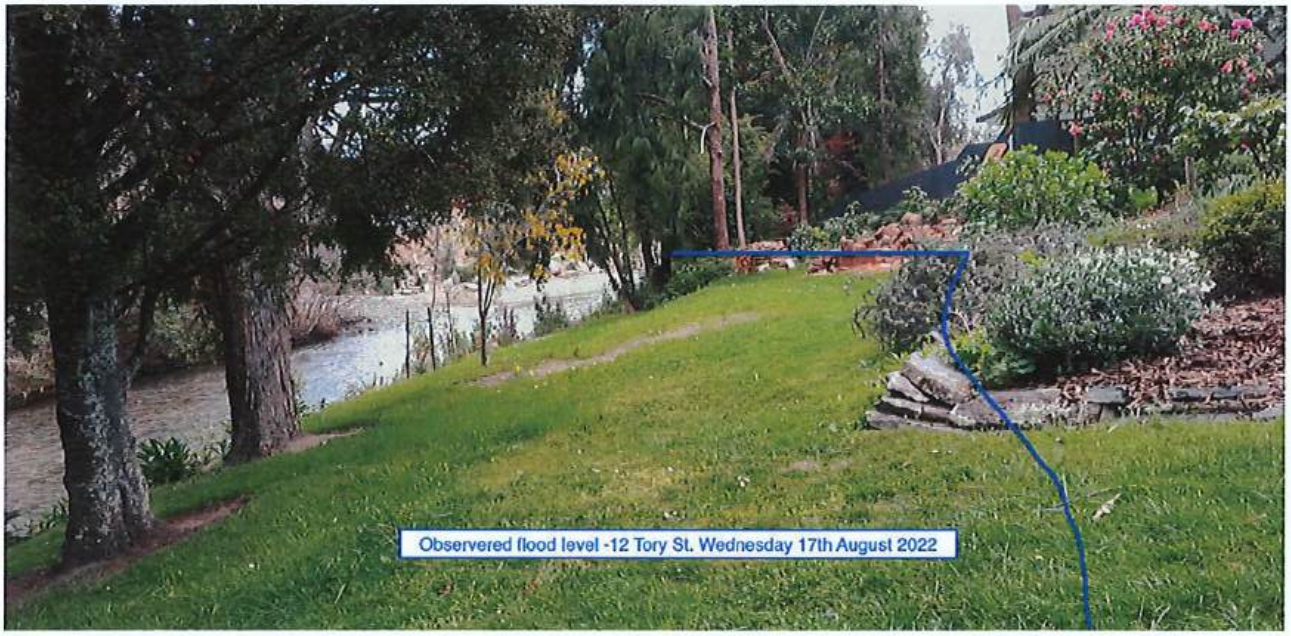


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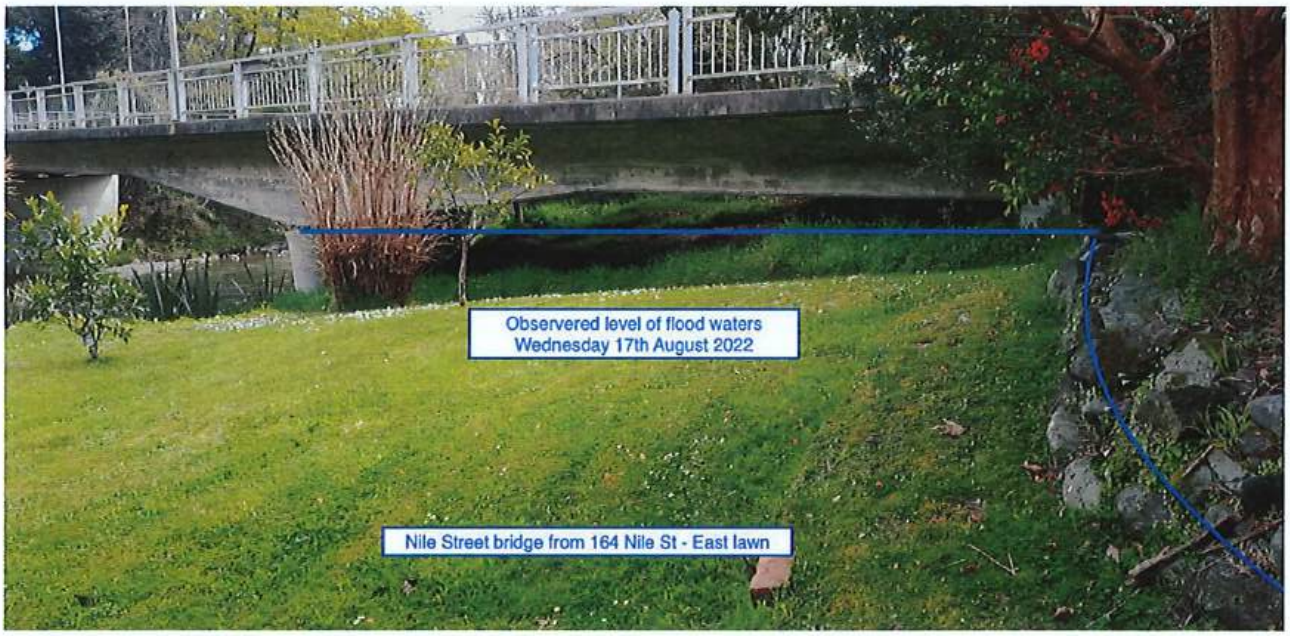
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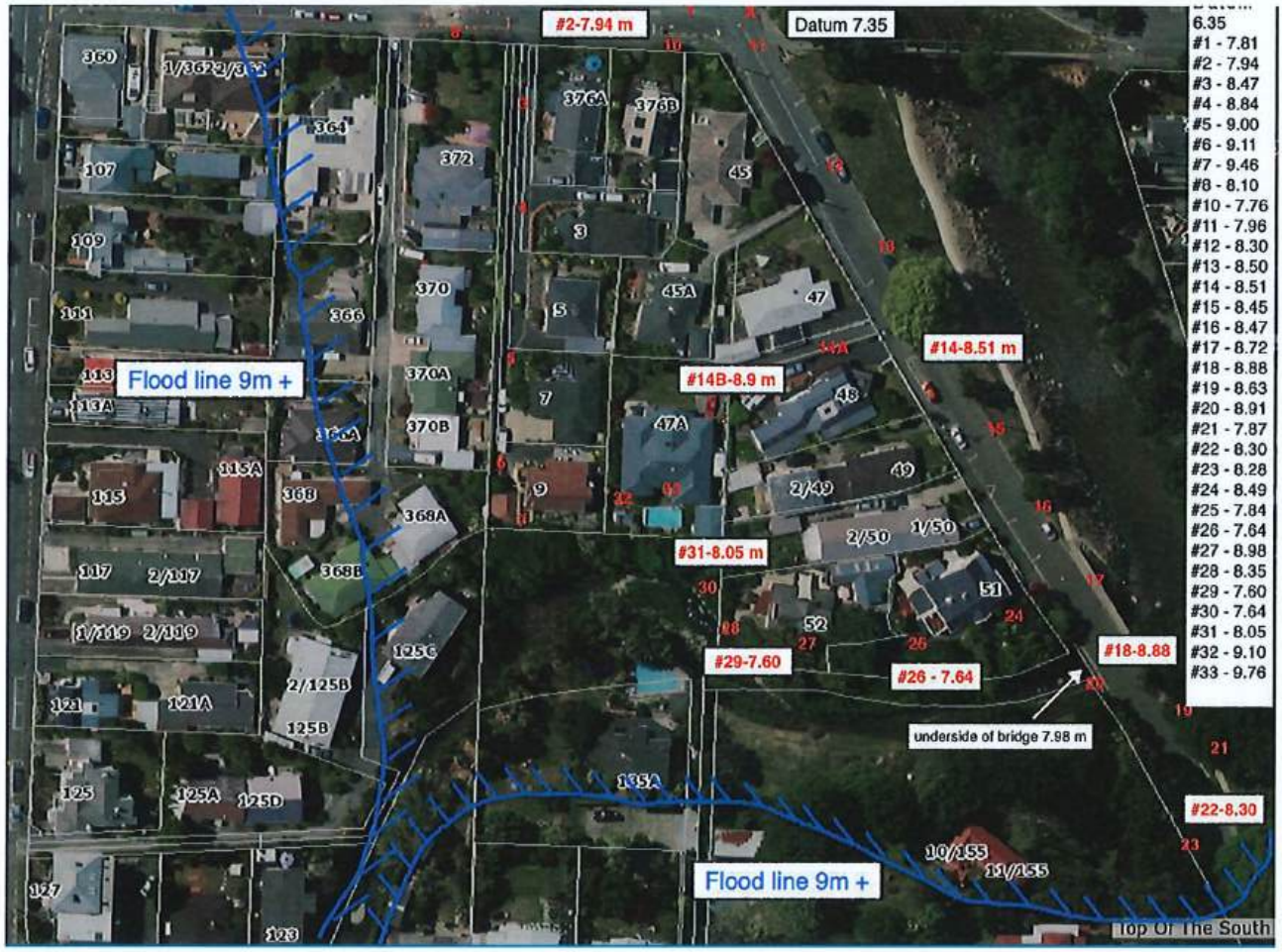
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Entrance ~ 20 m2



Exit ~ 40 m2 in 3 channels

