FLAG MEETING NOTES: 22 May 2015

Purpose:	Takaka Freshwater and Land Advisory Group (FLAG)– Meeting 10
Date:	22 May 2015
Time:	9.30am-3.00pm
Venue:	Takaka Fire Station
Present:	**FLAG members:** Graham Ball (GB) Greg Anderson (GA) Mirka Langford (MLa) Neil Murray (NM) Mike Newman (MN) Tony Reilly (TR) Mik Symmons (MS) Mike Newman (MN) Kirsty Joynt (KJ) Piers MacLaren (PM) Matt Rountree (MR) Margie Little (MLi- iwi representative on FLAG) Martine Bouillir (MB- council representative on FLAG) **Staff:** Mary-Anne Baker (MAB - Environmental Policy Planner) Lisa McGlinchey (LM -Environmental Policy Planner) Joseph Thomas (JT -Resource Scientist - Water & Special Projects) Trevor James (TJ- Resource Scientist – Water Quality & Aquatic Ecology) Glenn Stevens (GS - Resource Scientist - Water & Land) Rochelle Selby-Neal (RSN -Independent Facilitator) Andrew Fenemor (AF -Landcare Research) Julian Weir (JW – Aqualinc) Don Mead (DM) Mike Scarsbrook (MSc – Dairy NZ) Rick Pridmore (RP – Dairy NZ)
Apologies:	None
Notes taken by:	Lisa McGlinchey (supplemented by other staff)
Definitions and Abbreviations	FLAG = Freshwater and Land Advisory Group NPS-FM 2014 = National Policy Statement for Freshwater Management 2014 NOF= National Objectives Framework TRMP = Tasman Resource Management Plan (the Plan) TWMC = Takaka Water Management Catchments SOE = State of the Environment WCO = Water Conservation Order application for Te Waikoropupu Springs and recharge area AMA = Arthur Marble Aquifer TLA = Takaka Limestone Aquifer TUGA = Takaka Unconfined Gravel Aquifer
Note: records of discussion points have been grouped into similar topics and are not necessarily in the order discussed at the meeting.	
FLAG MEMBERS PLEASE NOTE: If you have any questions or need anything between meetings, then please contact Mary-Anne Baker by email: marya@tasman.govt.nz or by phone ddi 03 543 8486.	

Purpose of Meeting

- Increase understanding of land use effects on freshwater, including local nutrient trends and implications for freshwater values.
- Increase understanding of how the dairy industry approaches managing any impacts on freshwater.
- Discuss the impacts of different scenarios on freshwater flows and quality.

Welcome and Karakia

RSN welcomed the group and MLi lead the FLAG in the karakia.

Check in

No check-in topics raised by the group.

Session 1 – Land use effects on freshwater – nutrient management

Nutrient trends and limits for Te Waikoropupu Springs - group discussion on John Stark's report

Key points raised:

- *John Stark recommended macro-invertebrates are sampled annually, but add DRP and TP to the sampling at the main spring (already implemented). Some rationalisation of sites associated with biomonitoring of the NZKS farm down to sites immediately upstream and downstream of the discharge.*
- *The springs are a 'canary in the mine' as levels are starting to rise – it has been suggested to me that nitrogen could be coming from one particular farm – if this was the case then we wouldn't want to [place limits on all farms unnecessarily]*
- *Isn't the monitoring from the main springs and there are still nitrates measured there?*
  - *Yes for Council's 'State of the Environment' (SOE) monitoring programme, but there are mixtures of different sources within the main spring*
- *Where is the sampling for Fish Creek springs?*
  - *JT: The Fish Creek springs have only been sampled a few times in the past– only recently added to the regular SOE monitoring programme (TDC has 3 lots of sampling) – a specific location has been GPS'ed to ensure a consistent site – this site is a spring vent as we want to sample the spring not the river*
  - *Past efforts have focused on sampling the main spring where the waters have mixed*
- *Previously a local resident had concerns of damming of the start of Fish Creek for irrigation – but she struggled to get recognition of the issue from Council [post meeting note: this issue related to damage to a very small area of wetland and council's response was independently reviewed as appropriate].*
- *John Stark's report identifies that nitrogen is now hitting the ANZECC guideline value – and asks the question what is causing the increase in both N and P. The main spring seems to be one of our few opportunities to monitor deep aquifer water?*
  - *AF: we can monitor it by inference from other bores in the AMA eg Savage's and Sowman's bores – there is also the bore at the springs*
  - *JT: the marble is several hundred metres thick and the bores accessing this are just at the surface of the marble layer so they give an indication, but we don't know if this is representative of the deeper water in the aquifer. Chubb's bore is deeper, but still not into the deeper aquifer water.*
- *Is it still agreed that the water coming out at the main spring is about 14 years old – or has this changed?*
  - *Yes, it is about 12 years plus – but this is just an average – it is a mixture of young and old water (eg it could be a mix of 2 year and 140 year old water). Older water in the main spring, compared to the Fish Creek spring*
  - *The main spring also brings up sea water and we are not sure how this affects the springs ecosystem*

- *The different guidelines used were confusing – it is good to have a summary table [in John Stark's report] of why different guidelines are being used in different situations – I feel I understand this better now*
- *Te Waikoropupu Springs is a treasure and has the second clearest freshwater in the world – it will be important for us to consider setting appropriate limits to protect the special characteristics – regardless of what the guidelines say*
- *It is useful that we can quote John Stark's report, but we can't yet quote Don's*
    - *Don Mead: my short paper can be made publically available*

Te Waikoropupu Springs – impacts of land use on water quality (Don Mead)

Key Points:

- *Don is a forest soils expert (retired from Lincoln University). He did his PhD in Florida which included a grounding in statistics. He has built on his knowledge of statistics during his investigations into water quality. His analysis uses the US Geological Survey methods*
- *Land use has changed in the Takaka valley from tall podocarp and beech forest which was cleared following European settlement for primarily sheep farming*
- *Farming has changed progressively to dairy farming and has intensified with time*
- *Clearing occurred on top of the marble mountains around 1900-1940 and subsequent erosion occurred.*
- *Clearing and burning of forest increases nitrate losses by up to 20 times*
- *We are dealing with a robust system – it will take perturbations and recover over time*
- *Mining also occurred in the catchment and the development of the Cobb dam in the 1950s was a major perturbation in the catchment system*
- *Dairy has changed over time with the introduction of milking machines, fertiliser and associated expansion of the local dairy factory*
- *In the lowland recharge area – dairy cow numbers have gone from approximately 400 in the 1910s, with a typical herd size of 10; to 6,700 cows by 2014, with typical herd size of 360 (2.8 cows/ha)*
- *Leaching losses – 2.8cows/ha on gravel soils in the Takaka Valley – OVERSEER often shows 80kg N/ha per year lost (compared to sheep/cattle farms of 15-20kgN/ha per year and indigenous forest of 0.5kg N/ha per year) This gives a N loss of 250t/year of nitrogen flowing in to the system.*
- *Water use in the recharge area: the volume of irrigated water used and total consented water use has increased over time*
- *Metered water use shows that irrigation occurs mid-Nov to mid- April with a peak usually in February – typically overall using only 40-80% of their consented allocated volume. Farmers use different percentages of their allowance. Those few that went over their allocated volume were fined.*
- *Nitrate levels in the main spring at Te Waikoropupu are increasing at a rate of 1.6% per year.*
- *Don has chosen not to knock out the high data points from the data set (which is different from the approach used by John Stark and staff), as he saw no reason to remove these as there was no knowledge of error occurring for these data points. This is considered to be a conservative approach to the statistics. Don has used non-parametric methods.*
- *Don's presentation included graphs of his analysis (refer copy available online)*
- *Earliest water sampling found in his review was done in 1970-71. This highlighted that the nitrate levels in the 1990s were lower than the 1970-71 results and Don believes this is due to improved farming practices. He also thought it could be from catchment recovery from the effects of Cobb dam etc or potentially from errors in analytical techniques at the time.*
- *Fish Creek springs has been analysed 7 times. Nitrate is significantly 20% higher than the main spring. This is thought to be due to the different mixing of shallow and*

deep aquifer waters. Don believes nitrates move preferentially in the shallower aquifer.

- *Phosphorus (P) is less clear – the soluble P is higher in the springs than in the rivers. During floods Total P can be high in the Takaka River at Kotinga.*
- *At the Harwoods site on the Takaka River – nitrates have been decreasing by 13% since 1999 – possibly due to the Cobb dam management*
- *At the Kotinga site on the Takaka River – the nitrate has remained stable (possibly due to the effect of farming elevating groundwater nitrates that flows into the river in the lower reaches)*
- *Water temperatures are recently interesting – in the main springs the temp was constant from 1970-71 (11.7°c), 1975-76 (11.7°c). A plot of the temperatures shows a more irregular data set after ~2004. Initially Don thought this could be due to monitoring error, however as the winter levels are stable across the data set and the same instrumentation was used for some of the data points before and after 2004 [GS: and the same instruments were used for other sites in Takaka that did not show increases], it suggests the increase invariability is real. Don believed this could be due to the irrigated water, as it is used during the dry warm weather when soil temperatures are high, but noted this was not an absolute proof and he was only theorising, but noted it also suggests the system is very sensitive.*
- *Periphyton and aquatic plants – there have been four studies on this in the main spring. There are several exotic weeds – latest invasion in 2005 and now covers 14% of spring. Watercress is N responsive and periodically weeded by DoC. John Stark suggests the springs are P limited and there has been no change to macro-invertebrates.*
- *Don suggested the FLAG use an adaptive management approach – set goals, select indicators and ideally these are locally based:*
    - *In karst systems, should ideally be from karst water although we don't have an un-impacted baseline data set for karst water.*
    - *Water clarity is very important and could be a good indicator. Could also continue to measure periphyton.*
    - *ANZECC guidelines are not designed for groundwater or karst systems.*
    - *Could use baseline level of nitrates in water above farming areas (about 0.01g/m3)*
    - *Recent estimates for this climate, geology and topography (0.06-/+0.03gm/3)*
    - *2012 guidelines for natural groundwater (up to 0.25gm^3)*
    - *National nitrate toxicity guidelines (ie NOF)*
    - *Refer Don's presentation for a graph of nitrate levels and guidelines (available online)*
- *Don is not wanting to advocate for a specific approach as this is the FLAG's job to determine*

The FLAG were worried about the lag effect – ie if we are measuring water as it was 10+ years earlier and holding existing farmers to account for historic issues – can you comment?
DM: I believe the nitrate moves preferentially in the shallow aquifer, so the lag effect would be shorter.

So how old are the changes we are seeing in terms of lag effect?
DM: Probably about a year. But we could still be seeing some nitrate coming through from when they originally cleared the forests – however what we are seeing now is most likely to be from current land uses.

Management of dairy farm impacts on freshwater – Dairy NZ perspective (Rick Pridmore)

Rick presented on: managing sustainability around NZ, nutrient limit setting processes being used, dairy industry support provided to farmers and environmental plans.

Key Points:

- *Rick Pridmore has a background in lake/stream water quality and ecology. He helped build NIWA in 1992 – he was the Research Director for 12-15 years, then became chief executive. Then he retired and was subsequently hired by Dairy NZ – looking after sustainability aspects. He has been advising organisations on sustainability. Rick was also one of NZs first catchment modellers*
- *Previously the dairy industry used to go to court a lot, but have since changed their approach and now Dairy NZ is looking to be open and working in partnership with industry and councils to achieve sustainable outcomes*
- *The thing we have messed up in NZ [freshwater management] is forgetting how to set a limit. When the NZ fisheries quota was set up – we selected a number that was 80% less than the point where effects are bad for the population – a precautionary approach. We need to do the same for water quality.*
- *As we get near the 80% line [for allocation of the resource] we need to slow growth using adaptive management and stop growth when it reaches an appropriate point.*
- *This approach has been used in Canterbury – using orange and red zones – the orange zone is within the 80% line, the red is up to the target line (100%).*
- *So far we have been growing without having the 80% line being set – and we are having to reduce growth to meet the limits needed to obtain the desired water quality.*
- *How do we fix this problem without destroying the livelihoods of those affected? We don't have to reach the target immediately – we set the vision and we may need 100 years to reach it.*
- *We have not refurbished/rehabilitated many water bodies – we have set limits to save lakes, but not fully restored one. The cost of restoring is much higher than preventing degradation in the first place. Lake Rotorua is one of the first examples of attempted restoration.*
- *"Rotting from the bottom" is a "tragedy of the commons" situation – water bodies deteriorate as everyone is doing their own thing and we are not working together to protect the water body. This also occurs with businesses too. We put so much pressure on the primary produces in the system, they go broke first and then this flows up in the business chain. It is not in anyone's benefit to pass the 80% level, as in the long term businesses will fail.*
- *Collaborative processes are a more robust system as the targets set are harder to change than those set by Councils only. Every collaborative process is different.*
- *Under the Streams Accord dairy farmers have been fencing off streams – so far about 94% of farms have the whole length of streams fenced – but this has not resolved the nitrogen issue, as this is largely from the urine from cows.*
- *The impact of fertiliser on groundwater is minimal – it is when the cows eat the extra grass grown by the fertiliser that the problem arises as the concentration of the urine patches is well above the assimilating capacity of the soil.*
- *DairyNZ is doing a lot of work with the Horizon's OnePlan [one of the first regional plans to introduce widespread rules on nitrate loss allocation] – how do we achieve a 15% reduction in nitrate losses without any loss of production? Currently, we are gaining 7% - 15% improvements while maintaining production and profitability. However, this usually requires reasonable skill on the part of the farmer.*
- *The skills on farm have been diminishing - farmers struggle with the necessary changes.*
- *If you want to make the same amount of profit and production – we focus on pasture management – using the nitrogen fertiliser at the right time of the year in the right*

way. In most cases the issue is farmer skill. Often issues result as cows have insufficient feed and as a result have poor body condition, then fertiliser is used.

- *DairyNZ uses a three step process:*
  - *1. We teach farmers effective grazing of paddocks which uses home grown feed first – so profitability goes up*
  - *2. We improve reproductive performance (the fewer replacements the better)*
  - *3. We lower nitrogen inputs – which reduces their profitability and production back to their original levels, but with a 15% reduction in nitrate losses.*
- *Outputs are: fewer, but potentially larger cows; high pasture utilisation; better reproduction performance; and lower nitrogen losses.*
- *The aim of all farmers in a low payout year is reducing the production costs to below $4/kgMS. This can be done by the process outlined above.*
- *You can also build off-paddock solutions – eg concrete hard-stand pads –if cows are put on a pad twice a day for four hours – nitrogen footprint potentially reduced by 30%.*
- *Barns are also an option, however these need to be built for the right reasons. Barns in NZ cost more than those oversees – $1-1.5Millon each (overseas can be 1/3 of this). This changes the economy of the farm with the need for more returns to cover the cost of the barn. From the increased production required, the amount of waste is subsequently increased and while not as bad as urine on soil, the amount of waste can increase with associated cost or potential contaminant loss so much so as to cancel out the gains made from the barn.*
- *The best farmers are the ones that enjoy <u>how</u> they are farming – farmers therefore need to farm the way they enjoy farming – these people will put the extra effort in to achieve their goals.*
- *Pollution Abatement Curves are now being used by DairyNZ to assess the economic impact of various environmental policy options. The method can be carried out on representative farms and extrapolated for the freshwater management unit or zone.*

We have Te Waikoropupu Springs and we need to protect it from degradation.
RP: With Te Waikoropupu Springs you will need to make sure your 80% limit is well set [to protect the characteristics you value].

Are lower stocking rates the solution to the nitrate issue?
RP: Not entirely. The typical stocking rate in Canterbury is 4.5-5. Rick's own farm is 2.8. Farmers want to meet any targets on water quality, but soon they will also have to meet targets for greenhouse gases. If all you cared about was grazing paddocks well, the best stocking rate is around 5. This keeps grazing at the optimal rate to promote grass growth, however urine patches increase greatly. A stocking rate of 2.1 will result in poorer paddock quality if farmers don't know what they are doing. A stocking rate of around 3.2 is a moderately challenging rate to achieve.

So fertiliser is not really the issue, and lower stocking rates won't solve things - so what is the solution?
RP: We lower our N use to create less feed, so that the lower stocking rate can still effectively graze the paddocks. When you set tough limits, high stocked farms will struggle to meet the limits without adding aspects like hard stands.

We are not here to tell farmers how to manage their farms – we are here to set the limits.
MAB: Yes, but we need to consider how the limits we set will affect farmers and on farm management.

Management of dairy farm impacts on freshwater – Dairy NZ perspective (Mike Scarsbrook)

Mike Scarsbrook presented on DairyNZ's experiences with water quality and dairy intensification links and his analysis of the Takaka water data.

Key Points:

- *Mike has been with Dairy NZ for 7 years – prior to that NIWA for 13 years. Has worked in Takaka previously on a groundwater ecology research project ~10 yrs ago.*
- *Mike manages the environment program of work for Dairy NZ. Identifying problems and solutions including policy and implementation on-farm to achieve outcomes and following this up with robust monitoring to identify achievement of objectives*
- *It is important to focus on the values and be able to effectively define the problem*
- *Eg in Hurunui district there has been a ~4000% increase in intensive dairy farming. State of environment indicators are showing a doubling of nitrate concentrations in the Hurunui River, but macro-invertebrates have shown no significant change from reference sites. This raises the question of whether the increase in nitrogen is a problem for ecosystem health.*
- *DairyNZ have looked at a number of case studies of practice across NZ. Seen a big increase in dairying in some areas. Over the last ten years particularly seen an increase in nitrate, but not seeing an increasing level in other contaminants, including sediment, E.coli and Phosphorus.*
- *With the Clean Streams Accord and improved riparian management etc we are not seeing the increase in these other contaminants, but N is still increasing.*
- *Mike had also looked at the nitrate data for Te Waikoropupu Springs and agreed there is a significant increasing trend at the springs. However the levels in the Takaka River at Kotinga have not increased. If there was a lot of intensification in the catchment, we would expect to see an increase in nitrates in the river waters - although there may be local conditions affecting this.*
    - *DM: I believe this is due to the reducing N levels coming in from the upper catchment (above the Harwoods site) - better quality water is flowing into the upper parts [which is masking the effect of the downstream land use]*
    - *JW: are the reductions at Harwoods of comparable levels? [post meeting note: JW: the data shows nitrate concentrations at Harwoods were slightly elevated from about 1998-2002, but drop off after then and have remained low since.]*
    - *[post meeting note AF: Kotinga flow is dominated by uncontaminated Waingaro water at low flows]*
- *There is evidence of a step change in the data around 2008-09. Possibly due to land use changes or laboratory methods. This is something that needs to be looked at further as this drives the statistically significant trend in Nitrates.*
    - *JT: GNS are sceptical of the data analysis from the early monitoring, but we have no way of going back to review these.*
- *The data suggests there are some questions that need to be asked – if the step change is due to the land use changes, are the N levels at Te Waikoropupu springs a problem for ecology? [Stark report shows 'not yet'. However, aesthetics are also important. If there is an increase in undesirable biological growth (periphyton) then this will concern many members of the community].*

Are you able to determine an effect of increasing nitrate in the springs river from any effect from the salmon farm?

TJ - There is no observed effect from the salmon farm immediately downstream of their discharge. However, we don't know the nitrate concentration in this discharge -this could be sampled.

But the nitrate increases could be a problem for water clarity in Te Waikoropupu springs.

Yes, it could [in particular due to increase in phytoplankton and zooplankton and dissolved organic carbon from increased periphyton].
There has been no recent sampling of water clarity in the springs as it is expensive (requires divers, mirrors, permits etc).

How land use change affects nitrate levels in Takaka Catchments (Julian Weir)

Key Points:

- *Julian Weir is a specialist groundwater modeller with Aqualinc*
- *Julian presented a table summarising the estimated Nitrate loads going into the system – the numbers are approximate and up for debate. The table includes typical leaching rates for the various land uses – it estimates an input of 433t N per year.*
- *Looking at outputs of N in the catchment – estimated 376t/yr from surface water, and 155t/year for groundwater – a total of 531t/yr going out.*
- *The outputs do not match the inputs, which indicates something is wrong with the numbers, but they are in the same ball park. This suggests little de-nitrification is occurring in the system – which is consistent with a karst catchment.*
- *The scenario modelling comparing the current irrigation area with double the irrigation area suggests the following changes in nitrate [all concentrations below are in g/m^3]:*
  - *For groundwater:*
    - *From 0.5 to 0.6 in the Takaka Unconfined Gravel Aquifer (TUGA) and Arthur Marble Aquifer (AMA) (0.1 increase),*
    - *From 2.15 to 2.85 in the Takaka Limestone Aquifer (TLA) (0.7 increase)*
  - *For surface water:*
    - *From 0.3 to 0.5 at Te Waikoropupu Springs (0.2 increase)*
    - *From 0.0 to 0.5 in Takaka River at Kotinga (0.5 increase)*
    - *From 0.7 to 1.2 in Motupipi River (0.5 increase)*
- *A topic for discussion is what effects we would see – for example on the Te Waikoropupu Springs - with these levels of increases.*

Have increased numbers of cows been included in the scenarios?
Yes, as the irrigated area has increased, the cow numbers have been increased, but the stocking rate has been kept the same.

Panel Discussion – managing land use impacts on freshwater quality

Panel discussion and Q&A session with panel of Don, Rick, Mike, Julian and Andrew.

Questions and answers:
JT: Don – you talked about the temperature in the Te Waikoropupu Springs – we are told we are getting warmer summers – are we seeing a thermal mass effect in the groundwater temperatures? [ie. an overall increase in groundwater temperature due to climate change effects]. The amount of irrigation water coming through the system is small – how can we possibly tie the temperature changes to irrigation?
DM: If you look at the water temperature in the shallow bores it is stable. As are the winter values in the main springs. We don't have monthly data, so we will need to consider how representative this is.
Water in shallow bores is higher than in Te Waikoropupu Springs due to higher soil temperatures. The shallow bore water is about 14 degrees, the springs water is about 11 degrees.
When there are low flows in the springs we have more shallow water than deeper water contributing to the springs.

MN: You can get dramatic thermoclines in groundwater – the warmer water does not blend into the larger mass, but stays at the top.

TR: You are assuming farmers are irrigating in excess of soil capacity and this is not the case.
DM: I think this is because the winter rains flush this through, but I can't prove it.

AF: I'd suggest we put a temperature probe in the springs to look at the variability [to see if it is real or not].
TJ: Yes, this is possible.
[post meeting note: GS & JT - If we did have temperature sondes in the main spring and fish creek, as well as local shallow bores and deep bores – water temperature is unlikely to help define the relative contributions of shallow and deep water flowing to the different springs]

Action: *Staff to consider the possibility/value of putting a temperature probe (sonde) in the springs.*

We are talking about efficiency of irrigation – with more, but efficient irrigation – does this actually result in increased N leaching?
RP: If you create more grass, and your cows are free ranging – then you will create more nitrogen and have more nitrogen leaching – this could be managed by combining efficient irrigation with a stand-off pad.

MLa: In Takaka, Fonterra records show irrigated dairy farms have a 0.4 higher stocking rate and an additional 9kg/ha N loss (estimated from OVERSEER) than non irrigated farms.

Would stocking rate be considered high if a farm had a more sensitive soil type?
RP: Yes- it can also be affected by how heavy or light the animals are. Smaller animals on sensitive soil will eat less and so will generate less waste and have lower leaching levels.

What are the panels thoughts on the toxic effects of nitrate?
MS: John Stark's report shows for the highest level of protection you want to keep levels below 1g/m^3. The springs are currently at half of this level.
Most waterways in NZ are about 0.25 g/m^3. Toxicity is not an issue, but more of an issue is the growth of plants and algae and the flow-on effects of this on ecology.
JT: this is correct, we now have further information on the impact of water hardness on toxicity which further reduces the local toxicity of nitrate.
RP: we would never have to manage a river in NZ for nitrate toxicity.

There is some concern on using OVERSEER as a management approach for setting limits. What other methods might we look at?
RP: OVERSEER was originally created as a farm guidance tool – and it is excellent for this and we need effects based tools to implement the RMA. However it is a spreadsheet model, not a dynamic model - we are seeing a lot of changes with each version of OVERSEER. We need to test it for 6 months before accepting each version. Is the model correct? – for looking at irrigation changes this is trying to make a spreadsheet model into a dynamic model and this is not possible. We can use it for generating inputs, to then put into a dynamic model. "All nitrogen is not created equal" - you can say if you use autumn fertiliser it is bad – but it leaves the system when there are flood flows and goes out to sea. OVERSEER does not take into account N losses from unlined ponds – which leach at a summer time when the nitrates cause problems.
DM: OVERSEER is very rough.

From 1970's to 1990's the Total N load reduced and you said this was due to better farming practices, but over the same time the number of cows doubled – how do you explain this?
DM: I'm only guessing on this, but I think this is due to improvements, such as not having cows in rivers, and stopping dumping things down the tomos.

The comparison doesn't seem to add up.

Point source and nutrient bursts are exacerbated by karst systems.

I'm interested in the springs, the sea and the aquaculture industry and tourism pressures. There are a lot of complex issues here – how do we ensure we do a good job?
JW: Yes, it is a really complex picture. In terms of the modelling – if you change the land use we can estimate the outputs and then look at what the effects are from these changes.

Regarding the estuary and bay – when you get to the estuary we worry about the total mass that reaches those points, rather than specific levels in the rivers. For example low concentration, but high volume river waters can still result in problems in the estuary, however the mixing from incoming sea water can also influence things.

> ***Nothing is monitored for any of these and we also have the prospect of mining occurring which could affect water quality...***
> *Once you have your limits set, this can control these activities.*

So how do we work with farmers to change practices to achieve best outcomes when some farmers don't have the water they need and the aquifers are at capacity?
RP/MS: Through sustainable environment plans farmers have been voluntarily reducing N use. For Nitrates 0-40%, and an average of 10% reductions have been achieved and for Phosphorus 0-60% and an average of 18% reductions have been achieved – we were also looking at E.coli and sediment.

We need to be able to help the farmers achieve the outcomes, not just tell them a limit they need to achieve.
We need to appreciate how much a farmer can do to reach the limits and the costs. Are these numbers an issue in Golden Bay?
We don't know until we know what the target (100%) and 80% limits are. Farmers from our voluntary programs reached reductions of 7 – 10%.
But is this enough?

RP: We know with the Southern Oscillation Index (SOI) we can get large fluctuations in river flows. We see the SOI quickly in rivers, but this can take longer to be seen in groundwater – one question I have is - is the step change seen in the data due to potential changes from the SOI and resulting surface water flows?

MS: John Stark's report is very useful to the FLAG and it should use his expertise.

RP: I've been involved in 11 collaborative process and they have always got there!

DM: when we talk about the springs, we are talking about the whole aquifer – we need to manage the whole aquifer, not just what to the tourists see. We don't know a lot about some aspects - like stygofauna.

Session 2 – Flows and nutrient modelling – informing limit setting

Flow and nutrient modelling (Julian Weir and Andrew Fenemor)

Julian and Andrew gave a presentation outlining the preliminary results of modelling of specific scenarios on the ground and surface waters in the Takaka Valley.

Key Points:

- *When thinking about Te Waikoropupu and Motupipi River we need to consider what is relevant for setting limits and what is not.*
- *One model has been setup for each of the three different aquifer systems (AMA, TLA, TUGA) (refer presentation available online for spread of sites).*

- *We obtained a good correlation between the actual measured and modelled groundwater levels for the aquifers and river flow sites.*
- *There is a large variability in groundwater levels in the AMA, but the town aquifer (TUGA) is relatively stable.*
- *Fish Creek goes dry occasionally, but the main spring does not.*
- *Motupipi River flow measurements can be affected by weeds.*
- *Pupu Main Spring flow has been synthesised by TDC. Payne's Ford flows in the Takaka River have also been synthesised (by Aqualinc), and there is a less good fit between modelled data and those synthetic flows.*
- *The model has been calibrated using a status quo scenario which accommodates current land use and irrigated areas (2,226ha).*
- *The following results are preliminary.*

Scenario 1 - No Consumptive Use

This is not a 'natural use' scenario as it keeps existing land use, stopbanks, Cobb dam etc. – it represents a 'what if all the consumptive use stops' situation. Compared to the status quo (calibration) scenario, Scenario 1 provides us with a picture of how the groundwater system is affected by existing use.

Scenario 1 Modelled effects include:

- ***General groundwater levels:*** *Regional changes in groundwater levels from existing use (0.1-0.6 m) are smaller than natural variations in groundwater levels (up to 10s of meters in parts of the AMA). Local effects (e.g. draw down of the water table caused by local pumping between neighbouring bores) needs to be managed, and may be larger than regional effects.*
- ***AMA (Pupu Springs system):*** *Existing pumping is predicted to affect regional groundwater levels by 0.1-0.2 m during dry periods.*
- ***TLA (Limestone from east Takaka towards Clifton):*** *Due to its confined nature, existing pumping results in relatively larger changes in groundwater levels (up to 0.6 m), compared to effects in the AMA system.*
- ***TUGA (River gravel aquifer underlying Takaka town):*** *This system is unconfined, and therefore the effects on groundwater levels from existing pumping are relatively small (~0.1 m).*
- ***River flows:*** *Existing pumping reduces river flows. 7-day Mean Annual Low Flow in Pupu Main Spring is estimated to be reduced by approximately 140 l/s as a result of existing pumping in Takaka Valley. Similarly, Motupipi River reduces by approximately 30 l/s and Paynes Ford by 10 l/s. Existing takes have very little effect on the number of dry days the Takaka River experiences. Takaka River above Paynes Ford is expected to go dry at times, even when no water is consumed.*

Scenario 2 – Double Irrigated Area

This looks at a doubling of the irrigated area to ~4,653ha (551ha on waiting list, plus a worst case scenario of 1,876ha potentially irrigated as estimated by Mirka Langford and Corrigan Sowman). This estimate assumes these areas have no problems accessing the water required (e.g. may require deep drilling), no cost constraints, and all users wanting to irrigate, with water taken from the same water bodies as at present and in the same ways. This represents a potential maximum for comparison purposes.

Julian provided the FLAG with copies of the potentially irrigated land map used in scenario 2 [note: the unshaded valley areas not included in the potential irrigated area are life-style blocks]

Scenario 2 modelled effects include:

- ***AMA:*** *If irrigation is doubled, the reduction in low groundwater levels in the AMA system is expected to increase from 0.1-0.2 m under the status quo to 0.3-0.4 m during dry periods. Again, this is much smaller than the natural variation in levels.*
- ***TLA:*** *If irrigated area is doubled, groundwater levels are expected to fall an additional 1 m in this aquifer.*
- ***TUGA****: This aquifer is the shallowest layer and is the first to receive recharge from the land surface. Additional irrigation that is sourced from rivers results in additional drainage without the lowering effect of groundwater pumping Hence, in some areas, the TUGA aquifer is predicted to rise higher than existing. This benefit is small (0.2-0.3 m).*
- ***River flows:*** *Doubling the irrigated area is predicted to reduce Pupu Main Spring 7-day MALF by an additional 180 l/s, Motupipi by an additional 40 l/s and Paynes Ford by an additional 30 l/s. Fish Creek is predicted to go dry occasionally (approximately five times a year on average compare with two days per year existing), and the number of days that Paynes Ford goes dry is predicted to increase by approximately 25%.*

Scenario 3 – All irrigation is sourced from groundwater

This has the same land uses, but looks at what the effects would be if all water is taken from groundwater, with no restrictions. Currently 75% is taken from surface water and 25% from groundwater.

Scenario 3 modelled effects include:

- ***General groundwater levels:*** *Surface water sourced irrigation introduces additional leakage of water (recharge) into the groundwater system which, in part, offsets the effects of groundwater pumping. When irrigation is sourced fully from groundwater alone, then this benefit is removed and groundwater levels are lower, even though the irrigated area remains unchanged.*
- ***AMA:*** *If all existing irrigation is sourced from groundwater, groundwater levels in the AMA system are predicted to reduce by 0.1-0.2 m below existing levels.*
- ***TLA:*** *Full groundwater-source irrigation is predicted to lower TLA groundwater levels by 1-2 m.*
- ***TUGA:*** *Groundwater levels in this aquifer are predicted to lower by 0.2-0.3 m if all irrigation was to be sourced from groundwater.*
- ***River flows:*** *Similar to groundwater levels, river flows are predicted to drop if all irrigation is sourced from groundwater. 7-day MALF for Pupu Main Spring is estimated to reduce by 300 l/s, Motupipi River by 110 l/s (half the flow) and Paynes Ford by 30 l/s (1/3 of the flow). Both Fish Creek and Motupipi River are expected to go dry on occasions, and the number of days that Paynes Ford goes dry increases (compared to Status Quo).*

Scenario 4 – Effects of the Cobb Dam

This scenario looks at what impacts the Cobb Dam has on the system by looking at the situation as if it did not exist. For this scenario, the flow in the Takaka River at Harwoods has been modified to estimate a natural flow. [post meeting clarification: note this scenario is not suggesting a removal of the dam as an option, but looking to quantify the current benefits of the dam – the easiest way of doing this is to model the system without the dam and compare it to the existing situation with the dam].

Scenario 4 modelled effects include:

- *Overall, the Cobb Dam has a significant benefit on low flows and groundwater levels. This is because it stores water during high flows (that would otherwise flow off shore), and then releases this water during drier periods. AMA low groundwater levels are predicted to be 0.6-0.9 m higher as a result of the dam, TLA 0.2 m higher and TUGA 0.5-0.8 m higher.*

- *Correspondingly, the 7-day MALF for Pupu Main Spring is estimated to be approximately 790 l/s higher and Motupipi River 250 l/s higher as a result of the dam. Paynes Ford 7-day MALF is expected to be dry if it were not for the dam. The number of dry days at Paynes Ford more than doubles when the effects of the dam are removed from the model.*

Scenario 5 – Effects of the Waingaro River

This scenario looks at the sensitivity of the groundwater system to recharge from the Waingaro River by setting this to zero.

Scenario 5 modelled effects include:

- *The Waingaro River recharge adds to groundwater levels by 0.4-0.8 m for the AMA, 0.2 m for the TLA and 0.7-0.8 m for the TUGA.*

- *Waingaro River recharge has next to no effect on the Motupipi River. It does, however, contribute approximately 380 l/s to Pupu Main spring and 60 l/s to Paynes Ford 7-day MALFs. It also assists to reduce the number of dry days in the Takaka River at Paynes Ford because of the higher groundwater levels mentioned above.*

Questions arising from presentation:

When the AMA drops in water level - is there just a head of air on top?
Yes.

So we have only just got into the surface of this aquifer?
JT: Yes - the deepest bore is the Chubb bore at 150m deep, but there is probably 200-300 metres of aquifer below this.
JT: There is so much water flow, we can hardly see the pumping effects of the Chubb bore.
AF: The Arthur Marble aquifer is more akin to a large subterranean lake [with a tangle of cave tubes feeding in and out of it].

Can we also look at a scenario of using the Cobb Dam to provide irrigation water?
MAB: Yes we could do this, but it would require a further discussion between Trustpower and the irrigators.
MLi: I think we should be looking at this.

How does the irrigation raise groundwater levels – isn't this only when inefficient irrigation occurs?
No. some irrigation will always pass right through the soil. We can minimise inefficient irrigation, but in practice we can't eliminate it.

JT: Is the model misleading? – if you have a really long dry summer the bottom separations get bigger - it won't reflect the longer term issues for drier years.
JW: Only two years are shown on the graph, but the model runs for much longer and we have numbers for 5 and 10 year low flows.

So it doesn't seem to take much to affect the limestone aquifer?
Yes.

Where is the Payne's Ford monitoring site? There appears to be dry days shown on the graph, but it does not dry up at the bridge.
The water we see there is groundwater coming to the surface, not surface water coming down the river. The site is just up from the bridge at the bottom of the drying reach.

In the Motupipi River columm (in the river flows table) - which groundwater was considered in the scenario 3?

Both the karst and gravel aquifers were model inputs.

Is there a time lag?
Yes, in the order of days for water level response [much longer for transport of contaminants].

How does the current limit of 500L/s and current water use, relate toflow at the springs?
The allocation is not all currently being used, also some of the water is coming from storage. Removing all the irrigation seems to have only a small effect on flows at Te Waikoropupu Springs.

Most of the region is managed with a one in ten year drought for an allocation limit.
The current limit is an interim number – it is not associated with a specific water body.
So this could change with further investigation.

JT: Why do you need to synthesise data for sites TDC have data for?
JW: We are using the data TDC have provided to us.
Action: JT to liaise with JW to ensure the correct data is available [done – correct data used].

How much are these modelling outputs assumption or reality?
It is a bit of both. It is using real data to predict what might happen under the scenarios. You will get localised effects of neighbouring bores drawing down, but the model is looking at this at a regional level and effects at a regional level, not localised effects.

If a neighbouring bore to the fire station pumped as much as they could – would we see an effect?
JT: No - only immediately around the bore. However, if there were several bores pumping we might see more widespread effect. This will also not tell us things like salt water intrusion effects.

In the long term scenario, if the Takaka River bed level keeps dropping what impact will this have on the town groundwater levels?
It will drop the groundwater level over time. [Based on what happens in the Motueka Plains], a drop in the river bed of 0.5m drop would result in a 0.3m drop in aquifer level.

Action: AF to return at next meeting with WaterWheel outputs.

Modelling Review – group discussion on modelling

The FLAG had a group discussion on the modelling to date – with three key questions put to members:

- *Do you have confidence in the modelling?*
- *Any further refinement needed?*
- *Any further scenarios you want to consider?*

Do you have confidence in the modelling?

With the quality aspects – how do we calibrate the model?
The flow modelling creates the water quality outputs by including the loads – it is coarse.

If we want more data we would need to spend more money – but are there specific data or data confidence (+/-) conversations we need to have to consider uncertainty? We don't understand the plumbing within the groundwater – if Don Mead's assumptions are correct - that shallow water lag times are only a year – this will be very different than if there is more mixing.
JT: the numbers don't yet make sense.

Any further refinement needed?

The nitrate in and out numbers – these seem to need further work?
Yes, nitrate loads into and out of the system should match better.

The numbers used for the indigenous forest area are very different between Julian Weir's and Don Mead's summaries – could we get an indication by doing tests in the upper Cobb or Waingaro before it reaches the lower areas?
Yes, we already have some upper catchment data that we can use.

Any further scenarios you want to consider?

How the Cobb would affect the system if it was used to supplement irrigation.
It is a question of whether we do this, or if this should be a discussion between Trustpower and irrigators group – as they need to determine if it is workable before we could look at it.

We want to make sure we don't create expectations by doing the modelling first. The detail of this modelling is beyond what's being done at present.

This could replace the 'No Cobb Dam' scenario.

Group discussion on Cobb Dam scenario:
Outcome of discussion: *staff to look at modelling a scenario with Cobb Dam supplementing irrigation in the future.*

The modelling is based on nitrate concentrations in low flows. Are nitrate losses during flood events going to be looked at?
JT: We should have some data on this for when we looked at the Fonterra flood flow discharge consent to the Takaka River.

The nitrates from scrubland seemed quite low – when this could be a lot of gorse?
Possibly, yes.

Action: If anyone has changes to the projected irrigated areas mapped by Corrigan and Mirka, please provide these to Julian Weir.

Managing flows and nitrates in Takaka Catchments (group discussion)
The FLAG members reflected on what they had learned today and shared their thoughts on management of flows and nutrients and implications for limit setting.

Key Discussion Points:

- *Need to consider what our modelling tells us regarding our limit requirements, eg:*
  - *Should there be a limit on the AMA?*
  - *Should there be a limit on the Te Waikoropupu spring flow?*
  - *Should there be a limit on the N levels in the springs?*

Is a half a metre drop [in groundwater level] significant? – I am hoping the WaterWheel will show this – will it?
AF: We will still need to have some discussions about local detail, as the WaterWheel is looking at a catchment level scale.

Can you set a limit – for example the nitrate limit from the ANZECC - and then determine the impact on the uses?
Yes we can, but it is through our modelling, not necessarily the WaterWheel doing this.

Is it worth looking at the low flow levels and comparing these with the ANZECC guidelines etc. To determine what the implications of the modelling results are in terms of effects?

We have the information, it might not be ideal, but we need to make decisions and use precautionary approaches where necessary.

For FLAG members - if you are getting a clear sense of what is going on – then it would be good to send these around to the group.
Action: FLAG members to send around summaries they feel would be beneficial to others understanding of the issues.

It would be nice to know more about the salt water intrusion issue.

How far along are we to achieving good farming practice in Takaka?
There will always be new good practice technologies to adopt.

Session 3 – UPDATES

- Attribute feedback requested – none received to date
  RSN: Do we take no response to the request for feedback on the attributes table as a go ahead?
  FLAG: Yes.
- Mik updated the Golden Bay Community Board - the GBCB were interested - there was a small number of people in the public forum.
- Media release went out. Forwarded to Golden Bay Weekly and through Martine's email network.
- Chris Hickey (NIWA) report on hardness and toxicity of N received by staff
- Website hits for public consultation page good so far – one feedback received to date outlining local water quality issues
- AF: A survey is being conducted as part of Values Monitoring and Outcomes project - one of the social researches has a survey that collaborative participants can do at the start, middle and end of collaborative processes. It would be helpful to the research if the FLAG members could do the 15min survey. Results won't identify individuals and we will report back to FLAG.
  RSN: Are FLAG members happy to receive the link to the survey?
  FLAG: Yes, members happy to do survey.

Action: AF to send FLAG members link to collaborative participants survey [sent 9 June]
Action: FLAG members to complete collaborative participants survey when link received.

Water Conservation Order update

MAB: I have not yet been successful with the WCO applicants to get a meeting date agreed.

MLi has discussed this with the applicants, but Andrew Yuill keen to get the application progressed. Andrew is collecting the further information requested by MfE. MLi has not seen the latest version of the application to know where things are at.

MLi: I'm hoping the FLAG process will proceed fast enough to stay ahead of the WCO process.
Action: MAB to ring Andrew Yuill about the WCO process.

What is the problem with letting the WCO progress alongside the FLAG process?

- It is a totally different process to the FLAG process that will focus on limits for Waikoropupu Springs – understanding what limits are being sought could be a requirement in the further information request of the applicants.
- There is also concern that the WCO process would interfere with all the work the FLAG are now doing or over turn the community process and the outcomes the community selects as part of the FLAG process.
- Once the WCO application is accepted it must be notified and opened for public submission – the FLAG will no doubt feel the need to make a submission and will have to spend time on this instead of the FLAG work.
- Once the application is accepted, the council staff will also be asked by MfE to provide information and data, which will take them away from support work for the FLAG.
- The Minister wants to know where, what and how. The current application acknowledges the protection of the springs, but doesn't talk about what it wants in order to achieve the protection of the springs (eg the limits etc in the AMA).
- If the iwi are happy with the FLAG process they won't need the WCO.
- If the WCO is accepted for notification – it will be out of FLAG hands and the process will be driven by Wellington rather than the local community.

What is the usual time frame for notification?
It depends - as the Minister has asked for more information first before the application is formally accepted.

Session 4 – Project management

Future meeting dates:

Some discussion had on future meetings dates. Meeting dates confirmed as:

- 26 June meeting (implementation methods, WaterWheel)
- 24 July (modelling review for limit setting) – AF away, Julian Weir to attend?
- 21 August
- Possible September date of 25 Sept *[this is the Friday before the September school holidays begin]*

<End of meeting>

Action Points – Council Staff/Facilitator/Advisor

No.	What	Who
1.	Staff to consider the possibility/value of putting a temperature probe (sonde) in the springs.	TJ
2.	JT to liaise with JW to ensure the correct data is available.	JT
3.	AF to return at next meeting with WaterWheel outputs.	AF
4.	AF to send FLAG members link to collaborative participants survey	AF
5.	MAB to ring Andrew Yuill about the WCO process.	MAB

Action Points – FLAG members

No.	What	Who
6.	If anyone has changes to the projected irrigated areas mapped by Corrigan and Mirka, please provide these to Julian Weir.	ALL
7.	FLAG members to send around summaries they feel would be beneficial to others understanding of the issues.	ALL
8.	FLAG members to complete collaborative participants survey when link received from Andrew Fenemor.	ALL

Action Points – FLAG Sub-groups

No.	What	Who
9.	none	

Scheduled FLAG and FLAG Subgroup meetings

Date	Friday 26 June 2015 (FLAG Meeting 11)
Time	9.30am -3pm
Venue	Takaka Fire Station
Agenda Items	Implementation methods

Date	Friday 24 July 2015 (FLAG Meeting 12)
Time	9.30am -3pm
Venue	Takaka Fire Station
Agenda Items	Modelling review and limit setting

Date	Friday 21 August 2015 (FLAG Meeting 13)
Time	9.30am -3pm
Venue	Takaka Fire Station
Agenda Items	

Information and resource documents identified during meeting

Date	Title	Author/Source
	None	

**Key documents available electronically will be added to the online PDF document bibliography.*

Issues or topics identified during meeting for future consideration

Topic/Issue Description	Requester
none	

**Issues or topics unable to be addressed at the meeting, but requiring future consideration will be recorded in the Takaka FLAG 'Information Eddy'.*