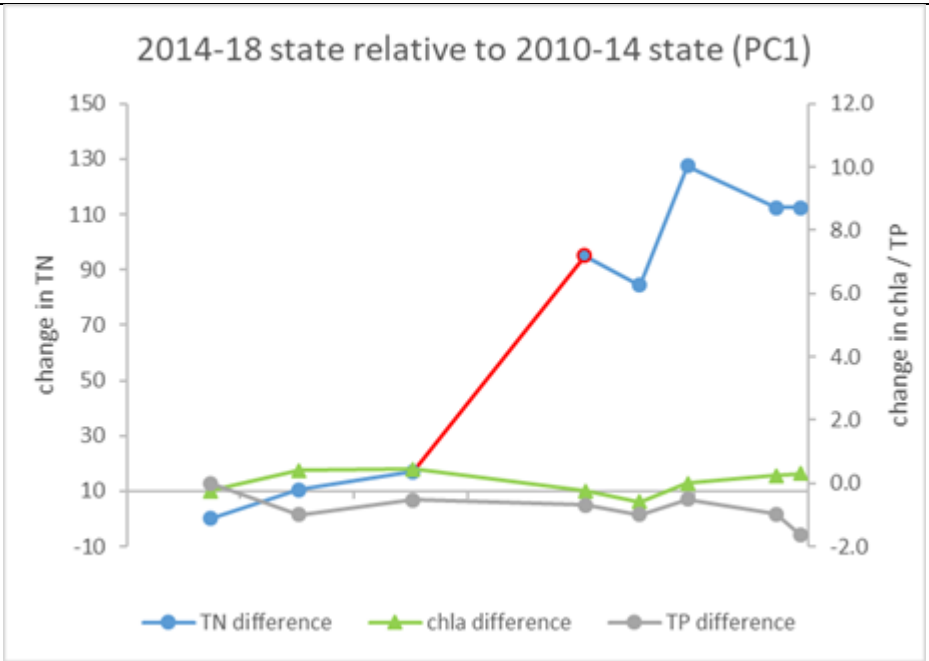
T3.11-1 JWS Run Sheet – Attributes etc

In the Table below please indicated whether you agree with the paper (Y); disagree with parts or whole (N); not applicable to your area of expertise (N/A); and provide brief comments on any area of disagreement so that Vicki can capture these in the JWS (bullets only please). This will form the basis for our record in the JWS so represents your considered expert opinion. Please fill out electronically so that Vicki can cut-and-paste. [**Note: not all papers received yet – This form due back ~~7~~ 14 June**)

Name: Craig Depree

Attribute paper	Agree	Agree in part	Disagree	N/A	Comment / Qualifier
Nutrients		**Agree in part**			**Section 3) Nitrate toxicity** I support the nitrate and ammonia toxicity attribute values proposed in Table 1 of the document. This will avoid the problematic issues arising from current 'band testing' which results in several examples of much larger improvements having to be made in catchments where the water quality (and hence impacts) are less. For example, if current C band for nitrate toxicity, need as little as 8% reduction in nitrate, but if B band, this reduction can be >50%. **Section 4) Waikato mainstem long-term thresholds (Approaches 1 & 2)** Numerous studies and analyses have indicated that TP is the main predictor of chla in the mainstem river. This have been further supported in the 4-year period since the 2010-14 PC1 'current state' with TN increasing in the river (largely between Waipapa and Narrows), but TP, Chla and visual clarity either remaining the same or improving (refer to figure below).

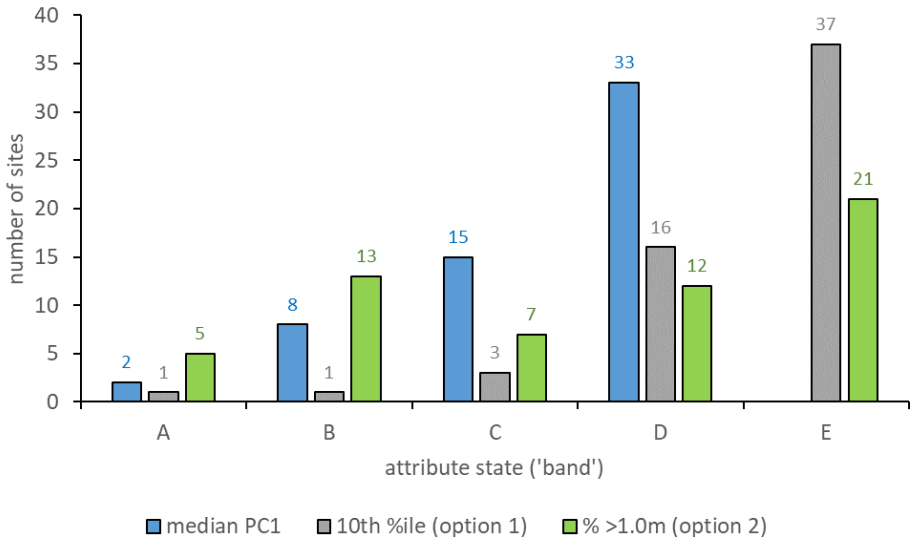
					 Accordingly, **I support Approach 2C for setting TP targets** that correspond to the community expectation of a target of 5 mg/m^3 of median chla along the length of the river. Accepting that it is recognised both from a science perspective and community perceptions/expectation; it is essential to manage both P and N - indeed, some studies have indicated that at times (ie summer) that some parts of the river, maximum chla may be N-limited. **I do not support the N thresholds proposed in 2C**, but rather support the TN thresholds proposed in 1B or 1C. The difference between these being whether Lake Ohakuri is regarded as 'seasonally stratified' or 'polymictic', which dictates an NPS-FM TN threshold target of 160 mg/m^3 or 300 mg/m^3, respectively. This has implications for management, as the former indicates the lake is 'over allocated' and the latter suggests it is not (as current state is c. 210 mg/m^3). I am comfortable supporting TN targets from Approach 1C based on the

					following inclusions: 1) Table 3.11.1 has additional line (or replacement of Narrows) estimate water quality at Karapiro. Water quality at Narrows more closely represents water quality exiting the upper FMU, than water quality in the middle FMU. This is important given that increases in TN (using contemporary state - ie 2014-2018) are occurring between Waipapa and Narrows (oresumably Pokaiwhenua catchment is a major contributor), and these inputs are being 'registered' (or accounted) in the middle FMU site at the Narrows. Not having a Karapiro site means that the last site in the upper FMU assessed for 'compliance' against targets is Waipapa, which is 80km upstream. Without including Karapiro, Approach 1C and 2C indicated the upper FMU is not over-allocated with respect to nutrients. Including Karapiro site will explicitly define the upper FMU as being over-allocated with respect to both TN and TP. 2) That Lake Ohakuri is defined as not being seasonally stratified. It would also to reassuring to get additional information/monitoring on the eutrophic status of the Whirinaki Arm - as not indicating Ohakuri as over-allocated, lessens (in my opinion) the ability to address over-allocation in area contributing to this degraded (eutrophic) arm of Ohakuri. 3) Short term-targets for mainstem (based on 10% progress towards the 80-y target) will need to be recalculated based on new recommended targets (if adopted). For contaminants such as nitrogen that have increased markedly at selected sites since PC1 current state (2010-14), short-term targets should also factor in these increases, if the intention is to set these short-term targets at 10% progress towards long-term goals (note without changing TN thresholds, in the lower FMU, short-term targets now represent >50% progress towards 80y targets). ~~Support the science rationale behind approach 2C. Logical to set TN and TP to achieve desired outcomes in Chlorophyll a, where there is robust evidence to do so. There is a strong body of evidence indicating P is more important than N in controlling Chlorophyll a along the mainstem of the Waikato river. Also support the rationale of more clearly defining the impacts associated with~~

					~~inputs from the riverine lakes (e.g. Waikare).~~ **Waikato mainstem and tributary short-term thresholds (Approach 3)** These approaches are outline in Table 4 for mainstem sites and Table 6 for subcatchment tributaries. I have confidence in the work underpinning them, and that my understanding is that the load reduction from implementing the policy mix (in Doole et al. 2016) have resulted in complementary numbers. While these numbers are very useful, I am not convinced that they should be used to set short-term (10y) interim targets. The reason is that the CSG defined short-term targets as being 10% of the journey to 80 year targets. We know from the modelling of Doole et al (2016) that contaminants at almost all sites exceed the interim 10% progress targets. Thus the reality is that PC1 mitigation are likely to achieve greater than 10% progress towards 80y targets. For example, counting the 53 subcatchments in table 6 – reductions in TN and TP, from the mitigation scenarios are 623 and 89 t/y, respectively. Based on reductions required at Tuakau (1854 t TN/y and 257 t TP/y), **the progress towards the 80 year targets is 34% for TN and 35% for TP** – hence both are significant greater than 10% progress required in the 10 years of PC1. This needs to be taken into account if they are used as interim /short-term targets – as they represent progress towards the long-term targets (based on Tuakau) that is around 3x greater than that required in the duration of PC1. Because even if they are not met, it is likely that progress >10% has still be made, hence things would still be on-track for meeting 80-y targets. **Approach 4** **Do not support**. Overly simplistic and not based on Waikato data. Data based on macroinvertebrates / fish / and periphyton (mainly the former) – based on large national datasets. It is generally accepted (by scientists, including lead author of the study that derived the thresholds – i.e. Dr. Death) that nutrients effects on macroinvertebrates at subtoxic concentrations are most likely

					mediated by periphyton. Accordingly, what is the relevance of these numbers in streams that are hard-bottomed but do not 'express' nuisance periphyton growths, or the large proportion of streams in the Waikato that are soft-bottomed, and hence cannot support periphyton proliferations. Additionally, the method proposed ignores the process implemented by the CSG which looks at current state and sets targets to improve on that current state. This Approach just assigns a single target regardless of current state and catchment landuse. Highly problematic and idealistic. **Approach 5** Not supported, as very simplistic, and I do not even know the origins of the data. Worse than Approach 4, and suffers from the same issue around implementation – ie one size fits all, which seems inconsistent with the CSG approach of improving everywhere from current state etc. These proposed target are based on periphyton, which doesn't occur everywhere, and there are a huge number of factor that control its biomass (flood frequency, substrate, shade and nutrients) – hence very simplistic, and flawed approach. I support having at least a periphyton narrative attribute to make sure where periphyton proliferations occur, there is a mechanism for these to be monitored/identified and steps put in place to mitigate.
E.coli	**Agree**				**I support implementing the E.coli attribute as per the NPS-FM (amended 2017).** ~~Needs recommendation for faecal coliform attribute relative to shellfish gathering.~~ **I do not support recreational shellfish gathering water quality guidelines for pathogens to be applied in PC1**, as see are based on estuarine/marine water environments (i.e. MoH/MfE 2003, which states median faecal coliforms should not exceed 14 per 100ml and not more than 10% of samples should exceed 43 per 100ml. I would recommend sampling of riverine shellfish and determination of *E.coli* in flesh (i.e. NSFSA 2006, not to exceed 230 E.coli per 100g flesh and not more than 10% of samples must exceed 700 E.coli per 100g), and then attempting to relate shellfish flesh bacteria levels to known water quality E.coli measure/metrics - this may allow derivation of meaningful water quality targets to protect shellfish harvesting.

					~~Do~~ I do **not support subset of measures or flow modification to grade sites, as this is inconsistent with the NPS-FM (2017) *E.coli* attribute for human safety.**
Deposited sediment			**Disagree**		~~Needs to be developed further. Support monitoring requirement with action when breaching bottom line - I was lead on initial sediment thresholds project for MfE , and several aspects of the attribute as proposed were unworkable as an attribute table (in my opinion). I would consider supporting a bottom-line type narrative attribute statement (i.e. similar to policy CB3 in NPS-FM for macroinvertebrates) – but I am concerned that this is based on assessments relative to natural reference state, and these are dependent on national models with large uncertainties.~~ ~~Potentially~~ I potentially support a bottom-line based 'CB3' type statement, but there are significant issues around monitoring that need to be resolved. As with macroinvertebrates and periphyton, these are monitored annually, whereas temporal variation requires at least 2 years of monthly monitoring data (based on proposed national attributes for sediment, Phase 2 report for MfE). I was lead on initial sediment thresholds project for MfE , and several aspects of the attribute as proposed were unworkable as an attribute table (in my opinion). I would consider supporting a bottom-line type narrative attribute statement (i.e. similar to policy CB3 in NPS-FM for macroinvertebrates) – but I am concerned that this is based on assessments relative to natural reference state, and these are dependent on national models with large uncertainties.
Clarity	**Agree**				**I support alternative 2** - i.e.attribute based on % compliance with 1 m visual clarity. PC1 attribute for clarity is based on perception of water to recreate (which sites work based on water quality scientist perception). Cited work actually showed that clarity is a relatively minor aspect determining public's perception of swimming – more driven by environment, access, safety (currents etc). These studies showed that the critical area of clarity was between 0.7 and 1.2 m and that above this range there is a rapidly diminishing improvement of swimming perception and clarity. Hence thresholds such as 1.6 and 3 m simply do not relate to, or define conditions of safe swimming. **For example, what**

					does 'eminently suitable for swimming' mean to the general public regarding safe to swim/recreate? In contrast, Canadian has defined minimum clearness distances in water, and these translate in NZ black disc measurement of 1m. **Thus a more informative and less arbitrary basis for an attribute is the % a water body meets or exceeds this define safe swimming clarity value.** **A value of 1m is supported by Waikato perception studies at locations in the upper and middle FMU (Karapiro and Wellington Street Beach) showed 90-95% as public surveyed perceived it as swimmable (and did swim) – these sites had clarity measurements of around 0.9m.** Comparison of PC1, Alternative 1 and **recommended Alternative 2** shown below (2010-14 data - ie PC1 current state) 
TSS				**NA**	
DO		**Agree in part**			I do not support the attribute table in the document, I disagree with the having a mean DO measure (which is not present in the current NPS-FM DO attribute that applies downstream of point source discharge).

					I do support the recommendation to use a bottom line DO narrative type objective (analogous to policy CB3 NPS-FM type statement). I also recommend that if 1-day minima measures are used, this should be assessed from a DO record that is at least long enough to assess the 7-day minimum measure. This is do avoid compliance being assessed from a single 24 hour deployment of DO instrument (which is unsatisfactory).
Invertebrate Communities			**disagree**		Accept that macroinvertebrates is important, but conceptually have problems with aspect of proposed attribute. These include: • Use of QMCI as measure, without adequate explanation of why results vary so much compared to the more national recognised MCI measure. For example, the proportion of sites graded as 'poor' are 2 to 5 times greater when assessed using QMCI compared with MCI. The choice of metric and nature of attribute obviously has considerable implications for mitigations in PC1 – which I am uncomfortable with • I refer to MfE website for review of these 2 measures - https://www.mfe.govt.nz/publications/about-us/user-guide-macroinvertebrate-community-index/appendix-2-use-mci-qmci-and-sqmci • Complete mis-alignment of macroinvertebrate and water quality monitoring sites – hence don't have water quality data to respond to decreasing / impoverished macroinvertebrate communities at a site that could be very distant/remote from a subcatchment water quality monitoring site. • Uncertainties around hard-bottom vs soft-bottom scoring that makes up the regional data. It is my understanding that Waikato data apparently doesn't need to have correction for hard vs soft-bottom, despite this being a requirement in Auckland and Northland. If Waikato is dominated by soft-bottom streams, and soft-bottom streams naturally have less diverse/more impoverished (or 'pollution tolerant') communities, then how does this impact on regional/catchment results – is this contributing to the huge variation between QMCI and MCI assessments

Field Cod

					I support a general narrative state around bottom-line and MCI, as per policy CB3 in NPS-FM.
Macrophyte nuisance	**Agree**				**Agree, in that I do not support macrophyte as an attribute**. Needs further development at national and regional scale.
Periphyton		**Agree in part**			**I support recommendation (2)** stating we should adopt the NOF bottom line of 200 mg/m^2 chla in all hard-bottomed rivers and streams in the Waikato/Waipa catchment (i.e. CD3-type statement as per NPS-FM). Addition comments include: • Periphyton monitoring requires monthly monitoring, periphyton monitoring currently carried out at REM site annually – hence have same problem as macroinvertebrates in that were periphyton is monitored is not where water quality is monitored • Need to measure periphyton at water quality sites (although not many are apparently wadeable), or to increase monitoring to monthly at selected REM (regional ecological monitoring sites). Presumably this will require some aspects of prioritisation outline in recommendation (1).
Fish Communities			**Disagree**		**I do not support the Fish IBI attribute** for the following reasons:~~.~~ • for reasons articulated by other experts (i.e. Ausseil/Scarsbrook) – in particular that the single largest driver of fish communities in NZ is physical habitat quality (in-stream and riparian habitat) and accessibility (e.g. barriers to fish migration); and sediment (suspended and deposited) can influence fish recruitment and habitat quality; however, direct quantitative relationships between fish community health and suspended or deposited sediment are not available; • I note that in the Ruamahanga Whaitua plan, fish are included as **narrative objectives** – not numeric attributes/objectives • Whilst statistically significant, correlations between nutrients and fish communities are not causative ~~Fish QIBI relatively poor at discriminating stressor effects in Waikato. Fish index is heavily influenced by barriers to access and this limits its utility as a WQ indicator. I don't agree that we know what to do to manage for QIBI at a~~

					~~regional or FMU scale.~~
Riparian			**Disagree**		**Strongly disagree with this attribute** – it seems like it is a proxy for landuse cover, and hence doesn't make sense. Specific comment below: • I don't even really understand how the two attributes work in practice i.e. unclear to me whether both apply and how this works? • For example, if rural catchment and landowners achieved >80% riparian buffers (A band) , but if these were <5m average , then it would be 'D" band ? • Additionally, the first table has issues around dual measures (average vs minimum) , and inconsistent definitions of D band relative to the bottom line • **Length of riparian / or stock exclusion best dealt with via rules / FEPs (not attribute for Table 3.11.1)**
Lakes			**Disagree**		**I do not support alternative FMU delineation**. **I support retaining the lake attribute table currently in PC1** for the following reasons: • Very little technical data/justification provided (except for table presented as part of Dr. Phillips' block 1 evidence) • My understanding that the cited work supporting the proposed delineation of lake FMUs (Ozkundacki, 2015), is incomplete and unreviewed • Lakes are tricky and will most likely require major landuse changes; ie wont get there with FEPs / good practice etc • Meaningful lake management in PC1, in my opinion, requires the development of subcatchment management plans for all lakes (as per policy 14) ~~This is based on an incomplete and unreviewd piece of work by WRC. Should be referred to as (pers. Comm.), not Ozkundakci (2015). And also no technical information was submitted to the expert group for review.~~ ~~**I support retaining the lake attribute table currently in PC1.**~~

Whangamarino		**Agree in part**			**~~Support~~ I support the monitoring of Pungarehu channel and the recommendations to change FMU** Conceptually I support the need to limit nutrients in wetlands, and this requires a reduction, but I have not seen any scientific information to support the application of lake-based NOF TN and TP values to protection of a wetland, where there a number of issues outlined below: • Part of the evidence provided in Table 2 shows slightly elevated TP and elevated TN in Whangamarino wetland soils relative to national wetland averages (swamp type). I don't have an appreciation for the relationship between nutrient concentrations in river water column, and wetland soil, and I am told that improvement in these aspects is looking at 500 year time scales. • Whangamarino is part of Waikato River flood scheme , although infrequent , what contribution to surface soil nutrients does episodic inundation of Waikato river (as part of flood scheme)? That is, can remediation be achieve if this wetland is subject to large amounts of nutrient enriched sediment as part of flood detention scheme? • What is the connectivity of Whangamarino river the adjacent wetlands – ie under baseflow conditions , does surface water move into wetland, or does this only occur during higher flows ? What is the relative importance of nutrient enrichment occurring under median/baseflow events vs high flow events resulting in more substantive inundation? Hence what is the relevance of thresholds based on median TN and TP concentrations? • Nutrients at island block road is hugely influenced by inputs via channel from a supertrophic lake (Waikere), hence setting a nutrient limit in Whangamarino river at island block road will require successful restoration of lake waikere? The important management goal should therefore focus on lake waikere restoration, not setting nutrient limit at island block road? The world lacks examples of lakes being returned from such flipped, extremely eutrophic states – in the case of Waikere,

					it is part of a flood detention scheme for Waikato river and has been lower by 1m , hence restoration would likely be difficult while it is still used as flood infrastructure (well is my understanding). • My general view is that like lakes, Whangamarino wetland, needs a detailed subcatchment management plan which will be developed as part of PC1 (ie. Policy 14 and 15)
Temperature			**Disagree (with attachment 14 – Dr. Canning)**		**Disagree with temperature being an attribute** in PC1 (i.e. as proposed in attachment 14 of the JWS). I agree with the assessment by Dr. Cox (attached 15), which recommends temperature is not included as an attribute.
Toxicants / Pesticides			**Disagree**		**I ~~Disagree~~ disagree with Toxicants/pesticides attributes (taken from ANZECC guidelines) being ~~an attribute in~~incorporated into PC1.** • although I am not a policy person, presumably PC1 (or perhaps via regional policy statement?) could refer to need to comply with toxicants as per set out in the ANZECC guidelines. • generally only issue re point source discharge consents ~~Support narrative approach based on ANZECC Guidelines risk assessment framework, but don't support inclusion in PC1 (would change entire scope of PC1 from four contaminants to "all" contaminants).~~