

# Waitaha Hydro Joint Empanelment Hearing -

## Meeting Recording 1

13 February 2026, 11:49pm

3h 3m 28s

● **AJ Daniell** started transcription

VM

**Vicki Morrison-Shaw** 11:37

Kia ora mai tātou katoa.

So welcome everyone. It is 1:00. We've only got a short period. So what we're going to do is I'll get us started with a karakia, then we will take a bit of a role in terms of who's here and then I'll go through some introductory comments where we talk about the purpose of the session, what the session involves, what a session doesn't involve, some of the tikanga or protocols we're going to follow during the session, including about having cameras on or off and those sorts of things, some breaks and timing if we need them.

And then procedural matters that we'll address at the end. So we'll get underway with a karakia.

Tēnei te mauri ka piki ake ki te rangi e tū nei  
He mauri atua,  
he mauri tipua,  
he mauri tawhito  
Kia whiti, kia whiti ko te mātauranga  
Kia tau,  
Kia tau ko te māramatanga  
Whaia kia tata, puritia kia mau  
Haumi e, Hui e, Tāiki e!

Ka pai.

Now I've just received a message that Miss Bradley can't hear anything. Can everyone else hear me? Can I get a thumbs up?

**JH** **Jeremy Head** 12:46  
Thank you.

**JM** **John McLennan** 12:49  
OK.

**VM** **Vicki Morrison-Shaw** 12:57  
Apart. So I think the problem must be at your end, Miss Bradley. Perhaps your computer is on on mute.

Bye.

Great.

All right. So the karakia was just to clear the pathway. It's a karakia which talks about moving, embracing knowledge and moving to a high level of understanding, which is hopefully what we're seeking to achieve today.

In terms of people that are here, I'll just do a quick run through and perhaps if you could just unmute yourself and respond. That way we know who's here because I can't see you all on my one screen at the same time and then if I've missed anyone's name and there's somebody else here.

Please just let me know. All right. So we've got David Allen, legal counsel for West Power.

**DA** **David Allen** 14:03  
The order coat type.

**VM** **Vicki Morrison-Shaw** 14:04  
Go to David, Doctor Murray Hicks.

**MH** **Murray Hicks** 14:09  
Yes.

**VM** **Vicki Morrison-Shaw** 14:14  
Mr. Martin Doyle.

**MD** **Martin Doyle** 14:15  
Morning.

**VM** **Vicki Morrison-Shaw** 14:17  
Afternoon Kia ora, Doctor Dougal Clooney.

**MD** **Martin Doyle** 14:17  
Afternoon.

**DC** **Dougal Clunie** 14:23  
So.

**VM** **Vicki Morrison-Shaw** 14:24  
Mr. Jeremy Kent-Johnson.

**JK** **Jeremy Kent-Johnston** 14:29  
Kia ora.

**VM** **Vicki Morrison-Shaw** 14:30  
Right. And please do correct me if I get the titles wrong. If I've downgraded you from a doctor to a Mister, please let me know. But you know you're welcome to stay if I've upgraded you, Mr. Mason Jackson.

**JM** **John McLennan** 14:37  
Mhm.

**MJ** **Mason Jackson** 14:46  
Kia ora tatou

**VM** **Vicki Morrison-Shaw** 14:47  
Build up Doctor John McLennan.  
Build up Miss Shelley Mcmutry.

**SM** **Shelley McMurtrie** 14:57  
Kia ora

**VM** **Vicki Morrison-Shaw** 14:58  
Build up Miss Shona Bradley. Now I know she's here because she was having problems with her sound. Has that resolved?

**SB** **Shona Bradley** 15:06  
Yes, thank you. Good afternoon.

**VM** **Vicki Morrison-Shaw** 15:07  
Miss Marie Richardson.

**MR** **Marine Richarson** 15:13  
Kia ora tatou.

**VM** **Vicki Morrison-Shaw** 15:15  
Mr. Jason Melham.

**JM** **Jason Malham** 15:19  
Kia ora koutou.

**VM** **Vicki Morrison-Shaw** 15:21  
Mr. Jeremy Head.

**MR** **Marine Richarson** 15:23  
Uh, good afternoon.

**VM** **Vicki Morrison-Shaw** 15:26  
Kia ora and Miss Michelle Sidley.

**SS** **Shelly Sidley** 15:30  
Kia ora koutou

**VM Vicki Morrison-Shaw** 15:32

Like, uh, is there anyone else, um, from with power or doc that I have missed?

**RG Rodger Griffiths** 15:38

Yes, Kao ora.

**VM Vicki Morrison-Shaw** 15:38

Oh, Mr. Roger Griffiths.

Kia ora.

And nobody else. All right. And so I'm here with the panel. So there's myself, who is the chair. And then I've got Commissioners Crystal, Cousins, Markham and also Eldred.

Commissioner Eldred is still in transit but will be listening in, so for the moment the questioning will be led by Commissioner Cousins on those topics. In terms of the purpose of the session, it's really to enable us, the panel, to get a better understanding.

Of hydraulics, fish passage and fluvial geomorphology matters and the related effects on freshwater ecology and fear and the extent to which there's agreement and disagreement between the relevant experts in relation to those key into those areas.

The key areas of interest to the panel are whether there is sufficient information to determine the nature, type and scale of any likely effects, what information is required now at the consenting stage and what can be left to the detailed design. And whether and how any effects can be appropriately addressed. And that's why the first question in the question sheet that was circulated basically puts that up front because that question underpins basically all of the other questions that we're asking. We're very aware that our job is not to redesign or design the scheme and that we're here.

To consider and make determinations based on the information and evidence that's being put before us, and that includes any information that's provided or evidence that's provided through this joint empanelment hearing process. So what this process is?

It is a joint empanelment, so it's a form of hot tubbing of all of the relevant experts within these topic areas. So the panel is able to hear from all experts within the same

session and as a joint empanelment, it's a form of hearing.

But unlike standard hearings, there are no legal submissions. There's no opening or closing comments by parties. Experts in specific areas are questioned together on a topic basis rather than on a party basis, what the session is not.

It is not conferencing, so witnesses don't get to directly question each other. It's not a court hearing, so there's no cross-examination by legal counsel and witnesses do not have to get formally sworn in. But it is expected that all expert witnesses will still abide by their obligations as expert witnesses, including.

Communicating with other experts once questioning begins and any breaks that we have this afternoon.

In terms of the material that's provided and recording, so this session is being recorded. A transcript will be an AI transcript will be produced. The AI transcript should be available either later today, over the weekend or early Monday. The recording will take a couple more days and that will be uploaded.

as soon as it's available, but hopefully by Tuesday. The expert answers that are provided to the panel are regarded as oral evidence, um and we will be using the recording and transcript and preparing our decision, and it will also be used by those other experts.

Experts that are here in an observing capacity in terms of the further statements they have to produce.

In terms of the roles of participants, so the experts in the areas of hydraulics, fish passage, alluvial geomorphology, fresh water, ecology and feel will be the primary participants and they it'll be them that will be responding to the panel's questions. And that includes the panel's 2 peer review witnesses. In terms of if there are any West Power design specific questions, these will be directed to Mr. Griffiths and if there are any specific questions that stray into conditions then.

Mr. Jackson, I understand from West Power is here to assist with those and the panel also acknowledges and thanks the the applicant for the offer to refer to Mr. Jackson if we're not sure which witness to direct the question to.

Uh.

So other experts that are here in an observing capacity, they're not required to be here by us, so they are free to come and go as as they please. And legal counsel are also generally here in an observer capacity. But if there are any preliminary procedural matters, I'll ask for that before we get underway.

At the end, there are a few procedural matters that I do wish to raise with legal

counsel in terms of the follow on procedural steps, so we'll we'll cover that at the end. Outside of this, if something arises that legal counsel wish to address the panel on, they can make an oral application to do so.

How we'll run it. We have circulated the updated list of questions. We thank the West Power for providing a list of issues. We have basically used the four issue areas but reorganised them. So we'll be starting with intake, where scheme design, first passage, then sediment.

And then finally excavation and materials. We've organized all of our questions under those those topics and we've allocated one of the panel to basically lead the questioning on those topics.

The question will be read out for the record. It will just enable us to be able to find that when we're looking back in in the transcript or on the recording and looking for the answers for things, and then the relevant witness will be given an opportunity to answer that.

The if there is a a relevant doc expert in that area, noting that for the first topic at least it's it's Westpower and the peer review witnesses it will be.

The West Powers witness 1st and then the peer review. If there's no doc witness, if it's if there is a doc witness and a peer review comment on the issue, it'll be West power doc and then the peer review and if.

West Powers witness have any response to that. They get an opportunity right at the end. So we'll do that question by question. We are constrained for time, so please keep answers succinct. Stick to the question. Don't try and anticipate another question, just answer the question that's been put.

If you don't have anything you wish to add, just please indicate that and we'll move on. There is a lot of questions to get through in the time that we've been allocated. If in response to the questions that are put, the panel has additional questions, then you may see one of the.

Panel put their hand up and the person that's facilitating the questioning of that section will then allow that panel member, once the the comment has finished, to put an additional question.

Any witnesses who've completed their topic areas and aren't required for any further topic areas are free to leave or to remain as observers. In terms of timing and breaks, the session has been set down to to 5:00 PM.

We are conscious that there are a lot of questions and our preference is to run until we are finished. Hopefully we'll finish by 5, but if we do need to stay a little bit longer

than five, yeah.

If you have any issues with that, please, please let us know and then we'll try and accommodate. If we're running a bit behind time and you're right at the end, we can try and shuffle some questions forward if the session's still going at 3:00, which I imagine we will be.

We'll take a short 10 a minute break so that people can get up, have a stretch, grab a cup of coffee, whatever you need to do. And again, if we're still going around 4:30, 4:45, we'll take another brief little break if we're going, if it looks like we're going to run past 5:00 on any topic.

In terms of the tikanga and protocols applying following these introductions, if anyone who are not primary participants could turn their cameras off and just remain as a of observers, anyone that is.

One of the experts that's going to be questioned if they could please make sure your cameras stay on. Keep yourself everyone's debate be on mute unless a question is put to you if you wish to ask a question then or you've.

You couldn't hear a question. Please use the electronic hand raise tool and then we can come to you and and sort that out. If there's something urgent that arises and someone's in the middle of answering something, put your hand up, but also maybe pop it in the chat so that we can know. I don't know whether.

Suddenly come, something's come up and you need to urgently leave or something like that. That would be helpful. When you are asked a question, please speak slowly and clearly for the transcript. It is an AI transcript, so they might struggle with some of our our language.

If there's more than one person that's raised their hand at the at the same time, we'll work through them in order. So please, yeah, be patient. We will get to you. Please don't speak when someone else is speaking, just so it is easier for the panel to hear and also for the transcript to record.

If you need to screen share, please ask before doing so. Trying to minimize the time that we need to screen share simply because the panel can't be see as many of the the people on the call at the same time.

If you have prepared a statement or an expert report, please have a copy of that handy with you on your computer and of any equivalent. So if you have peer reviewed something, have a copy of the the report that you peer reviewed as well as your own report.

In case you get asked a question about it, and hopefully you will have all received a

copy in advance of the panel questions. We circulated an updated draft about 11:30 today, which is all colour coded, so your legal counsel should have that if you haven't received it yet.

Right now, before we get underway, does anyone have any questions about anything I've covered off here?

Right. And Mr. Allen, any preliminary procedural matters to raise?

**DA** **David Allen** 26:37

No, thank you.

**VM** **Vicki Morrison-Shaw** 26:38

Hi, Miss Bradley. Any preliminary procedural matters to raise from you?

26:42

No, thank you, ma'am.

**VM** **Vicki Morrison-Shaw** 26:45

Apply. All right, we will move on to the first topic, which is intake, wear and scheme design. And those questions will be led by Commissioner Cousins.

**TC** **Tony cussins** 27:02

Thank you. Going to the first question in our revised list, first question at question two is the information before us equivalent to preliminary design stage. In other words, being something beyond concept design but not yet at detailed design. I note in responses from the applicant that Mister Kent Johnstone had addressed that issue in some detail and supported by other experts for the applicant. I'll leave it to the applicant, but potentially Mr. Kent Johnstone could usefully lead on. That question and the and the subsequent question which we'll come to next question 2.

**JK** **Jeremy Kent-Johnston** 27:46

Certainly, thank you. In short, yes, the the application is equivalent to preliminary design stage, which is more than concept and prior to a detailed design phase.

**TC** **Tony cussins** 28:05

Was there any additional comments from the applicant before I ask both Doc and then Mr. Morgan to respond?

No.

**JK** **Jeremy Kent-Johnston** 28:19

There's nothing further from me except to say it's outlined in quite a bit of detail in my evidence.

**TC** **Tony cussins** 28:27

Yes, yes, Yep. Thank you for that. Yes, I noted that. Did any representation from Doc on that question?

**VM** **Vicki Morrison-Shaw** 28:37

There's no expert witness from Doc on this topic, so.

**TC** **Tony cussins** 28:39

OK. All right. Thank you, Mr. Morgan. I'll invite you now to respond to to that and you will have reviewed Mr. Kent Johnstone's evidence as well. So I'll ask you now to comment in response.

**PM** **Paul Morgan** 28:55

Yeah, I guess my main question if I can ask a question is just just checking that you know based on it being a preliminary design that.

That he sort of feels there's been sufficient modelling of things like sediment to to have comfort in the the current design and that that's what will be taken into detailed design.

**TC** **Tony cussins** 29:21

Certainly.

**VM** **Vicki Morrison-Shaw** 29:22

So just just in in that relation, sorry, if we could just answer the questions rather than asking questions. So yeah, from your perspective, based on what you've seen to date and based on the answer, Mr. Morgan, could you just provide your perspective on that rather than throwing another question through? Thank you.

**TC Tony cussins** 29:23  
Yeah, it's.

**PM Paul Morgan** 29:42  
Um, OK. No, that's that's fine. I'll leave. I'll leave that.

**TC Tony cussins** 29:48  
Before we move on to question two, I would comment on that, that we will come to further questions that address that more specifically. I will be able to direct those to Mr. Kent Johnstone and and Doctor Hicks a little further down.  
So moving to the next question then, just going back to my other screen.  
So question 3 asks, is preliminary design the stage normally required to understand the type, nature and level of effects?  
So I'll ask the applicant to respond to that first.

**JK Jeremy Kent-Johnston** 30:28  
There's no set hard and fast definitions of the various studies. We feel like this study is, compared to a typical application, far more advanced. The reasons for that are there was a lot of pre-existing information.  
There was a lot of optioneering, concept development, work with experts and the wider group that wasn't necessarily included in the application. However, a great deal of engineering work was done.  
And it's on that basis I can hand on heart say we feel very confident about where the project is and its ability to meet the requirements and also to have its effects assessed. Furthermore, there's.  
Detail that we feel you know using industry standard best practice will be developed in the detailed design stage which will ensure we meet all of the conditions.

**VM Vicki Morrison-Shaw** 31:32  
Sorry, just to jump in there, Mr. Kent Johnson, as you're giving your evidence as an expert witness, I need you to answer on your behalf rather than we. So I consider I those types of statements, please.

**JK Jeremy Kent-Johnston** 31:46

Understood. Thank you. Yes, I feel, I feel confident that this project in its current form is able to have its effects assessed and data and all of the other conditions.

Met once we're in the detail design phase and can work through those details and use advanced calculation techniques and and the like.

**TC** **Tony cussins** 32:15

And perhaps a supplementary on that, Mr. Kent Johnstone, you noted that that it's an that it is equivalent to an early feasibility class 4. Could you just perhaps expand on that for the benefit of the panel please?

**JK** **Jeremy Kent-Johnston** 32:33

Certainly the Class 4 references the AAC guidelines, which are useful because they're written for hydropower.

They outline a number of steps and pieces of work that one should do to reach that level of certainty. Whilst preliminary design and things may fit into a Class 5 by definition, we using a ACE as the reference I.

Using AAC as the reference would definitely be much more detailed than that. The feasibility band is rather large, 2 to 15% engineering development from memory and I've.

I believe that this is the range that we're in.

That that furthermore leads to the certainty that we have. I have on the on the design.

**TC** **Tony cussins** 33:32

OK. Thank you, Mr. Kent Johnson. I'll ask Mr. Morgan to respond on on that question, please.

**PM** **Paul Morgan** 33:47

Yeah, sorry, I I I probably, I've got more questions than being able to answer. Sorry, yeah.

Yeah, I guess if I start with what my my thoughts are, as I feel from the information that's been presented that I I don't see.

**TC** **Tony cussins** 34:03

2.

**PM** Paul Morgan 34:14

A lot of evidence around how coarse sediments going to be managed within the design. So that's I guess my my my question around concept versus preliminary design.

**TC** Tony cussins 34:30

So just to confirm that it's not a question that that's your expert opinion, Mr. Mullen, yeah.

**PM** Paul Morgan 34:35

Yep. Yeah.

That's just based on on the information that you know I've seen and and what's been presented.

**TC** Tony cussins 34:40

OK. Thank you.

OK. Pat, do you have any further comment just before we move on to the next question?

**JK** Jeremy Kent-Johnston 34:56

Nothing further than my evidence that I presented to the contrary.

**TC** Tony cussins 35:02

Thank you.

Did any of the commissioners have any further questions? We're sort of moving into another subject area slightly now. Is there any questions about that before we move on from fellow commissioners?

OK.

So question 4 is a little different. It relates to maintenance of residual flows or environmental flows and describe any circumstances in which the environmental flow would be diverted to the intake.

**JK** Jeremy Kent-Johnston 35:27

Sure.

**TC** **Tony Cussins** 35:40

And so that's first part of the question and then the second part, if so, what are the ecological effects of such a diversion? Obviously the second part is mute if there are no circumstances in which the the 3.5 cumics would be diverted. So I'll I'll pass that to the applicant.

To respond first.

**DC** **Dougal Clunie** 36:05

The simple answer to that question is there aren't any circumstances in which it would occur. So the minimum bypass of 3 1/2 cumics will always precedence overflow abstracted into the intake.

And the control system will ensure this. So if for any reason the monitored environmental flow drops below 3 1/2 cumics, station generation would be reduced until that 3 1/2 cumics is passed.

**TC** **Tony Cussins** 36:32

And that would that would also be the same in the event of any outages.

**DC** **Dougal Clunie** 36:40

Purchase.

**TC** **Tony Cussins** 36:42

Yeah. Thank you.

Mr. Morgan, are you aware of any circumstances to the contrary, or would you concur with the the applicant's response?

**PM** **Paul Morgan** 36:55

Yeah, I I can't see any obvious reasons why that would need to occur.

**TC** **Tony Cussins** 37:01

OK. Thank you.

Right. With that we'll we'll move on to the the next set of questions and question five. I imagine everyone has this in front of them, but I'll read it out in any case.

Mr. McMahon in paragraph two of his response notes that information related to the

development of the intake concept may have not been made clear in the application documentation. The question is what engineering scrutiny and technical inputs are being referred to in that paragraph?

And what were the key findings that support the concept design developed by Oz Hydro? So perhaps we'll pause there and just ask the applicant to respond to that question first.

**JK** **Jeremy Kent-Johnston** 37:53

Yes, thank you. Again, outlined in my evidence, there is some detail on on this, but in summary there was a significant amount of engineering involved in this process that ranged from.

A a comprehensive start where all the requirements from various subject matter experts were gathered. That led to an options assessment where we put on the table almost every option that one could think of.

We assessed those not only on the engineering merits but also on the multi criteria ability to meet the the multidisciplinary requirements that moved us into more.

Directed preliminary design phase, as it were. Whilst that was happening, there was ongoing reviews, almost continuous ongoing reviews commissioned either by Westpower themselves with independent experts such as Leyland, Brian Leyland and Jacobson There was also our own internal challenge process. Oz Hydro works with a network of experts and they were also involved in challenging our design.

The once, once we were, once I was happy and I say we representing Australian Hydro once, once we were happy, we were able to.

Move the design to A to a position that everyone could review it and and just make sure before we went into the application process that the the the effects were understood and requirements were met.

**TC** **Tony cussins** 39:48

What would you say the key, any key design changes occurred as a result of that process? Can you identify any specific key changes to the concept design?

**JK** **Jeremy Kent-Johnston** 40:03

Certainly the process was started entirely independently, where I had a lot of interaction with Mr. McCann. However, the initial designs were essentially blank slate. Eight. Once we were through that process, we realized that the design, the Oz Hydro

design reflected Ian's Mr. Mccann's design very closely, specifically.

We are levels 238 elevation is identical. The flows that we pass, the issues raised about gorge choking remain and limitations around our outlet structures.

Other similarities are D the requirement for a D sander to the question on differences we we've done it. We being Oz Hydro has done a lot of research on the best way to Orient.

An underground desander, especially with a very, very high Kiwi flathead water rise. And so that was resolved from largely speaking with international experts who have built and operated these types of.

Structures. So that's probably the largest difference is the improving the functionality of the desander. One other key difference actually is the introduction of a cut off flow, so we're not actually taking water.

One isn't taking water when the suspended sediment count in the river is concentration in the river is too high and that that's to prevent damage to the scheme and the need to remove undue amounts of sediment.

**TC** **Tony cussins** 42:05

Thank you. Yeah, I think you probably have touched on a number of the elements of the second question. You did identify that the issues around high sediment loads and the Morgan Gorge construction.

Choke effect and particularly in high flows. Have you got any further comment about that question and how that might have been reflected in design or do you think you've just covered that in your your previous response?

**JK** **Jeremy Kent-Johnston** 42:41

I believe it's largely covered in my previous response, but to just to recap quickly the the closure of the intake, the access tunnel protection under high water level rises and and these these features are.

New and revised to mitigate these these effects, largely high sediment loads and the Kiwi flat choking effect.

**TC** **Tony cussins** 43:09

Thank you. Could I ask Mr. Morgan whether you have any comment in regard to that response?

**PM Paul Morgan** 43:20

Yeah, in regards to Mr. McMahon's involvement, I guess the first thing I would say is I've worked with Mr. McMahon on a number of projects, including a number of the ones that he listed, West Coast ones and Marlborough ones.

And and so I certainly have a lot of respect and for his knowledge and skills and experience. So it's not a question of that, but a number of those schemes which he's listed and a few in particular.

That have actually disanders in that that the have had ongoing problems with coarse sediment causing problems at at those locations. So for example Branch is designed for 30 cumecs but never been able to get much more than about 22 cumecs through it because of.

Coarse sediment issues and another one that he talked about Clearedales also as an example has also had core sediment. So I guess my point is that even with very expert people like Ian, Mr. McCann.

These rivers are very challenging in terms of coarse sediment and the sanders are great at moving finer sediments, but at the the intake there can be issues. So again, I guess that's what what I perceive as as a concern around.

You know how that's going to be managed, the core, the core sediment part of the the intake both in front of the screen immediately in the start of the defender with the the systems in place that are going to be sufficient to to cope with that.

**TC Tony cussins** 45:00

Thank you. Thank you, Mr. Morgan. With that, we'll move on to question 6 and this relates to Mr. McCann's ongoing peer review role, which was outlined in evidence.

Were there any specific issues arising from that peer review of concept design decisions?

That were not resolved, so that's the key element.

**JK Jeremy Kent-Johnston** 45:23

Sorry.

**VM Vicki Morrison-Shaw** 45:25

Just before we move on to that, I see Mr. Alan has his hand up, Mr. Alan.

**TC** **Tony cussins** 45:31

Oh, I'm sorry, I couldn't. I couldn't see that on.

**DA** **David Allen** 45:31

Thank you.

That I'll be on a different screen probably. Um, Tony. Oh, sorry, um, panel member. Um, the the just there's been a couple of questions just regarding coarse sediment and through the desanda that Mister Morgan was just talking about.

It would be useful if, well, if the panel would find it useful. It would be useful taking Mr. Morgan's concerns and just asking either of Doctor Clooney or Doctor Hicks, who are sediment people here, whether they from on behalf of.

Westpower have the same concerns as Mr. Morgan? Or if not, why not?

But up to the panel, of course, just a suggestion, only because it's been raised, but it hasn't actually been answered before we move on to the next series of questions.

**VM** **Vicki Morrison-Shaw** 46:31

Yeah. Thank you, Miss. Mr. Allen. I did notice that we didn't actually give West Power a chance to respond to that to the Mr. Morgan's answer in that regard. So if West Power.

**DA** **David Allen** 46:43

Thank you.

**VM** **Vicki Morrison-Shaw** 46:46

the appropriate witness could please speak to that.

**DC** **Dougal Clunie** 46:53

Uh.

46:54

Thank you.

**TC** **Tony cussins** 46:56

Sorry.

**DC** **Dougal Clunie** 46:57

Yes, I I share Mr. Morgan's view that it is it is a challenging river. There are there are high sediment loads to be managed, but I do have a high level of confidence that the the final design will effectively manage these sediment loads.

That's the intake through the Dixander.

So I yeah, I believe the the necessary components are there in the preliminary design and there is a process going forward to.

Study these in in detail and refine for both the components and the the operation of the components.

To ensure that we we have a well worked management plan.

**TC** **Tony cussins** 47:42

Thank you, Doctor Clooney. Was there any further responses or inputs in regard to that question? If not, we'll move on to the next.

Um.

This relates specifically to the design of the sluice gate and it it it relates also to the performance of moving bed load and coarse sediment through the various flow conditions. So I'm wondering the the question poses what are the design features of the?

Sluice Gate in terms of its efficacy and all flow conditions to sluice sediment past the intake. Now I'm aware there's been quite a lot of evidence presented in regard to this, which is very helpful to the panel, but I'd just like to put that question to the applicant.

To touch on the main points in regard to the current concept design of the sluice gate, how it will be utilised in the various flow conditions and how that will then what could potentially be modified in detailed design after further modelling.

Could I put that question to the applicant please?

**DC** **Dougal Clunie** 49:05

Um.

Yeah, so, so thanks. And then on that the use of the sluice gate to sluice and flush sediments at different river conditions is further described in attachment C of evidence or my response that was provided this week.

To try to keep it 16, the sediments most effectively kept mobile or remobilized by

drawdown flushing with capacity of the gate is greater than the river inflow. So when the.

When the gates open, the water level can be drawn down, which increases the velocity and shear stress and the intake channel and keeps the sediment moving. So it's it's that particular operation.

Um.

Particularly potential in the rise, rise of floods, and particularly on the recession of floods that will be most effective at at passing.

That's some sediment clearing settled sediment.

Um.

In terms of design, particular is a key constraint at the site is the stroking effect of the gorge.

So that's something that that chokes the the tail water off this gate, which is at a lower level. It chokes at at a lower discharge. So the gate can only potentially pass flows up to around 60 cumics.

And can get to get size for that maximum practical discharge capacity considering stroking so.

Was this negligible benefit to be gained by by larger gates or Morgan for example so.

Um.

Yeah, so so detail modeling to come.

Will be used to refine the shaping of that intake channel to to encourage those paths. It will be used to to refine the exact size that get to this. Currently we have a 3 1/2 meter wide so escape.

It may become four meters wide, for example, if the flow conditions or the hydraulic conditions and such that would be would be beneficial for flushing.

And yes, I've talked about flushing, which is is is the key or the most most useful mechanism to to pass sediment, which is only available in certain flow conditions.

In higher flows that designs get level to remain fully open through the peaks of big floods and this whole whole system is submerged, in which case it passes a reduced flow, so in the order of maybe 10 or 20 cumics which will keep the.

Keep the immediate space in front of the gate clear and but won't have that time.

Power to pull more sediment through from upstream if it starts to a grade.

And.

And the design also allows for the gate to be used partially open, so it can be open.

It can be sluicing settled gravels locally at at lower flow conditions whilst the station remains online and generating.

**TC** **Tony cussins** 52:12

Can I ask Doctor Clooney here? I noticed the the gate sill is set at elevation 231 metres. How critical is that and could that change through detailed design? There is a reason for asking, which we may come back to later in in management of bed load and how that is intended to be operationally managed, but is is that elevation set or could that change?

**DC** **Dougal Clunie** 52:45

Yeah, I mean it could change potentially it. It has to be set lower than the the intake, the lowest level of the intake screens, which currently I think is set.

**TC** **Tony cussins** 52:51

Yes.

**DC** **Dougal Clunie** 52:55

One meter higher than that, so so both of those elevations could change slightly. The the screens screen elevation could be set slightly higher to give us a bit more space and move the so potentially could be moved slightly.

**TC** **Tony cussins** 53:11

OK. Thank you. Mr. Morgan, do you have any comment in response or? From your perspective.

**PM** **Paul Morgan** 53:23

No, the the the information that Doctor Clooney's presented, I think does, yeah, provide for, yeah, a very good system for keeping that area of the of the of the weird. There of sediment as he says up to a certain size flood and then obviously there's the potential for it to be overcome I guess in in certain floods but but for yeah up to reasonable size flows that that it will be.

A good system for keeping it clear as far as I can see.

**TC** **Tony cussins** 53:59

Does that suggest that you have a concern above the the design flood the the 50 to 60 cumics that Doctor Clooney's talked about it being the optimal operational range?

**PM Paul Morgan** 54:11

Yeah, I think he he's mentioned that it you know once it's once it's greater than that then obviously the flows through the sluice once it's there's going to be backwater effects and stuff. So it's going to drop significantly. So velocities and all that will will drop and therefore the ability to to move.

Material, plus the fact that those larger floods, you're going to actually get larger, you know, rocks and stuff coming down that, yeah, that that obviously is a risk that that that will be deposited and yeah, not be able to be cleared through.

Just as loose gating would require physical works to to to clear. I guess that it's just an unknown exactly, you know how much that's going to be or how at what point that becomes a problem.

**TC Tony cussins** 55:00

OK. Thank you, Mr. Morgan. Yeah, that that issue of mechanical intervention we'll be coming back to a little bit later in in further questions.

So with that moving on to question 8, do the floods referred to by Mr. McMahon accord with Oz Hydro's 2D modelling? I I don't know if you're aware of the detail he went into about the flood effects and what what was observed.

Observed during a a significant flood having over topped the the walkway. My question here is about whether that observation accords with Ozhydro's 2D modeling downstream modeling and was it an opportunity to.

Validate that modeling.

**DC Dougal Clunie** 55:58

Um.

No is probably the the the quick answer the so the the downstream flow modelling report concentrated on modelling flow off flows during the operational regime and that didn't didn't model flood flows through the gorge.

**TC Tony cussins** 56:16

Would would it be correct to say that that the conclusions from the evidence from the applicant is that the weir is in those high flows, particularly mean annual flood

and above, is not going to be significantly different to what's observed in natural flow?

**DC** **Dougal Clunie** 56:38

That's exactly right. It's so.

**TC** **Tony cussins** 56:40

Yeah. So would the would the modelling not be indicative of post operation conditions?

**DC** **Dougal Clunie** 56:51

Yes, for the the particular modelling that you're talking about there I think is the the modelling of flows within the gorge which which obviously don't look at at water levels above the above the weir there has been.

**TC** **Tony cussins** 56:58

Yes.

I was, sorry to be clear, I was referring to those observations within the gorge.

**DC** **Dougal Clunie** 57:13

OK, so so no, the we will have no effect on flood levels within the gorge.

**TC** **Tony cussins** 57:18

Yeah.

All right. Thank you, Mr. Morgan.

Any comment?

**PM** **Paul Morgan** 57:27

Nothing. No, nothing to add.

**TC** **Tony cussins** 57:30

OK. Thank you.

So I have to keep flipping back. I've got a single screen here, so um.

So at question 9 in paragraph 11, but this again is Miss McMahon's. I I was just seeking clarification on the actual implications of this statement here. Doctor

Clooney, would you respond to this or?

Um, have you seen that question or should I read that out?

**VM** **Vicki Morrison-Shaw** 58:07

Could you just read it for the record, Commissioner Cousins?

**PM** **Paul Morgan** 58:07

Yeah.

**TC** **Tony cussins** 58:09

Sure. Oh, sure. Yes, I will. In paragraph 11 of his response, Mr. McMahon notes that an abnormally high flood rise from the Morgan Gorge choke, which moves the hydraulic conditions from near critical flow at low to medium flows to subcritical submergent.

High flows and the question from the panel was what are the implications of this in terms of effects?

**DC** **Dougal Clunie** 58:41

Right. So I guess the point out I'm not I'm a designer rather than the fix. This is an expert and I might call on Doctor Hicks to to add to my answer, but the primary effects on sediment transport on Kiwi flat for the.

Sediment transport is as as that gorgeous choked and the water level rises in high floods, the sediment transport essentially stalls and so coarse sediments will be deposited for the upstream end of Kiwi Flat and in larger floods all the sand that's in suspension will be dropped out and deposited extensively across Kiwi Flat.

Which is evidenced by the sandbars on site.

And yeah, so there's deposited sediments are then sort of scaled out and reworked, transported down towards the the head works as the flow recedes and the and the water level drops.

**TC** **Tony cussins** 59:36

Thank you, Doctor Hicks. Would you like to add to Doctor Clooney's response there?

**MH** **Murray Hicks** 59:45

Yes, thank you. So I certainly agree with Doctor Clooney. He summed it up very well.

The I get a expanded account of the effect of the choking on the transfer of bed material.

The on the lower part of heavy flat and into the gorge and the the intake structure itself will have no impact of any significance at all on the choking phenomenon. So in that context the the effects of that on that.

Transfer will be no.

**TC** **Tony cussins** 1:00:29

Is so Doctor Tannicliff, would you like to?

Do.

Provide any response in regard to what you're heard from Doctor Clooney and Doctor Hicks.

**JT** **Jon Tunncliffe** 1:00:41

Well, just to say that it's clearly a complex interplay between it will take several years to to fill the the elevated, you know, upstream of the sill.

So it'll be important to understand the how the grain size is going to, you know those dynamics will will shift over time and it seems like the kind of modelling that would be helpful to understand how this is going to impact the.

The overall morphology of the system there, there's a a management regime that will need to be developed. I think to understand the how that channel is going to evolve over time, we we can see it's shifted quite a bit since the.

1950s imagery and there's there's been quite a a channel does move around and so we'll want to understand how that that impacts the modern or the proposed sediment management regime with machinery and mechanical.

Movement of the sediment.

**TC** **Tony cussins** 1:01:53

Yeah. Thank you, Doctor Tunncliffe. Just noting here that we will be coming back to some of those sediment management issues later in the agenda. Is there any final response from the applicant just before we move on on that point?

**DC** **Dougal Clunie** 1:02:12

On the stage for me now.

**TC** **Tony cussins** 1:02:12

OK. Thank you. Thank you.

So to question 10 then and this relates to and CFD modelling comes up a number of times and it's reliance in further phases of design, but at question 10.

We we so in paragraph 10 again to Mr. Kent Johnstone, you've noted that CFD modelling will be undertaken in reference design stage.

My question, and I'm wondering if you this is a broad question, but I'm wondering if you could focus your response specifically on some of the issues that Mister Morgan has raised around uncertainties for.

Concept design versus detailed design. So I'm wondering if you could comment on how the CFD modelling will be undertaken, but focused very particularly on on Mr. Morgan's concerns that he's raised in his.

In his review report.

**JK** **Jeremy Kent-Johnston** 1:03:26

Certainly been aware, but.

**TC** **Tony cussins** 1:03:27

Thank you.

**JK** **Jeremy Kent-Johnston** 1:03:31

See if it wasn't explicit in the questions, but earlier, but there has been a significant hydraulic modelling of Kiwi flat in the head works in in what we refer as 2D2D is missing.

A certain component which shows how the flow rotates and this is very important for this intake. The way to understand that is CFD because it adds the third dimension, so directly answering Mr. Morgan's concern.

CFD in the first instance will allow us to understand the flow regime and that will require us trialling different approach geometries of the intake until we land on one that encourages sedimentation to the left.

And Clearwater to the right and sediment to be focused where our sluice skaters.

That's that's a primary goal of that work. Other goals of the CFD work are to understand the efficacy of the D sander.

The erosion that we may suffer in the power station? No, that's not not exactly the

question.

And it also will help us to understand what type of suspended sediment concentrations are we going to have at the screen and at the left bank and what the appropriate cut off flow would be.

Cut off low meaning when do we stop generating because of high sediment?

**TC** **Tony cussins** 1:05:12

Thank you, Mr. Mr. Morgan.

**PM** **Paul Morgan** 1:05:18

Not a lot to add other than, yeah, CFD is obviously an important tool for assessing that in combination with the work that's done around 2D modelling, also sediment modelling to understand, yeah, the the the CFD will I guess give it more.

Thorough picture of of where there's likely to be sediment carried to, etcetera, and where there's risk of scour, etcetera. So yeah, it makes sense to me that that's what they're proposing to do.

**TC** **Tony cussins** 1:05:46

So I guess a supplementary question on that, Mr. Morgan, would be, are there still uncertainties in your mind about when that CFD modelling will be undertaken in terms of?

The panel understanding effects for this application.

**PM** **Paul Morgan** 1:06:07

Yeah, I guess the the concern is that the the work that's been done to date has has given some of that information, but yeah, obviously more detailed analysis is is is has the potential to highlight.

Things that you know will need to change to to to be able to manage what that shows in terms of, you know, the risks in terms of where where sediment etcetera is going to deposit.

**TC** **Tony cussins** 1:06:38

And could that uncertainty in your professional opinion be addressed through conditions?

And I'm referring here specifically to prescription of relevant conditions.

**PM Paul Morgan** 1:06:52

Yeah.

Yeah.

Not sure cause it's really it's almost really part of the design process that you know it's a reality of the design process that you as as you move through and do more detail that you you you're gonna find um some issues that maybe weren't.

**TC Tony cussins** 1:07:12

It.

**PM Paul Morgan** 1:07:17

Didn't weren't highlighted with more simple approaches to analysis, which you then have to come up with solutions to to to manage those issues. So it's it's quite hard to put that into conditions because it's a, you know, there's a lot of uncertainty about what.

You know what you're gonna find until you do it.

**TC Tony cussins** 1:07:36

Yes, any response from the applicant just.

**VM Vicki Morrison-Shaw** 1:07:41

Just before we go there, Commissioner Crystal's got his hand up.

**TC Tony cussins** 1:07:44

Oh, thank you.

**DC Dean Chrystal** 1:07:47

Thank you. I just question for Mr. Keith Johnson. You mentioned erosion around the power station. Can you just explain what you mean by that?

**JK Jeremy Kent-Johnston** 1:07:56

I was referring specifically to erosion of the turbine runner, the stainless steel runner. Hard sediments can wear it out. In fact, any power station on most sediment later

rivers suffers some erosion. It's about balancing.  
That.

**DC** **Dean Chrystal** 1:08:16  
OK.

**JK** **Jeremy Kent-Johnston** 1:08:16  
Which is why I made the comment that it's not specifically directed to Mr. Morgan's concerns. It was a sundry.  
There was a there was a question there about um.

**VM** **Vicki Morrison-Shaw** 1:08:29  
OK.

**JK** **Jeremy Kent-Johnston** 1:08:35  
About, you know, uncertainty into the future phase. We're mitigating that by allowing a lot of flexibility in the design in general.  
To allow us, Mr. Clooney alluded to gate sizing, there's channel approach options, gate arrangements, there's even different gate types. So it's that flexibility that gives me the confidence that.  
The detailed design phase will ensure that this project works as intended.

**TC** **Tony cussins** 1:09:14  
Thank you. I think that's a useful segue into the next question, which probably is for you, Mr. Kent Johnstone as well. So I'll just read that out.  
In paragraph five of your evidence, you confirmed that further work was completed to ensure your confidence, my confidence in your statement and being able to achieve the the detailed design that is consistent with the concept scheme design drawings.  
And the environmental outcomes sought by Westpower, what's the nature and extent of that further work? And I know you've touched on some elements of this, but is there anything to add that to emphasize?

**JK** **Jeremy Kent-Johnston** 1:09:46  
Yes.

**TC** **Tony cussins** 1:09:57

That exercise that provides that level of confidence to you.

**JK** **Jeremy Kent-Johnston** 1:10:04

Uh, certainly. Um. Is the panel looking for specific examples? Um.

**TC** **Tony cussins** 1:10:13

We were interested in relevant analogous schemes that would have provided that level of confidence, so certainly on that aspect, but just what what elements of that exercise had given you the confidence that the concept design would be able to achieve be achieved through the subsequent.

**JK** **Jeremy Kent-Johnston** 1:10:40

Understood.

Well, primarily, you know, starting, starting the process off the a great deal of literature search was done. We literally started with textbook methods.

Avery sediment control at intakes. Things like this once we have.

Again, we meaning Oz Hydro, once options was on the table, we were able to talk to global experts about these things. Tom Jacobson from Cetacon specifically has a lot of.

Very relevant, relevant experience around the world and extremely high sediment rivers in in Nepal, North India, Himachal Pradesh.

British Columbia or even Forrest Kerr is a good example, and those were researched to understand the effectiveness of these. Then there was the challenge process.

We.

Always maintain, you know, a transparent, open feedback there. So and we're we're certainly not afraid to have our designs challenged and I I at least to a better design.

The fact that we put a very large amount of options on the table and assess them in detail, it is large is a huge driver of my confidence.

The combination of assessing plethora of options, plus expert review and transparent discussion about any concerns. Those are the aspects that really drive my confidence in this design.

**TC** **Tony cussins** 1:12:40

Thank you. Thank you, Mr. Ken Johnston. Mr. Morgan, do you have any comment on that particular question?

**PM Paul Morgan** 1:12:49

Yeah, probably it's, it's sort of slightly goes on a little bit of a tangent, but it does relate to the process and that is that you know the the majority of the design process that's been undertaken and and it does follow standard practice and that.

Is that, you know, it's very easy to just focus on the physical properties of water and sediment because they're quite, you know, very challenging at this site. And I guess that's where I've raised other issues about integration of other.

Sort of needs like issues about protection of fish and leaving that really to the ecologist as to how much of a concern it is for that. But but traditionally a lot of structures like this that we've built over the last 100 plus years is is focused on physical properties of water and not on.

Protecting, you know, things like environmental considerations, particularly fish. So I guess that's what my concern is through this process is, you know, how much that has been thought about or if there is opportunity to think about that more going forward.

In the design process.

**TC Tony cussins** 1:14:06

Thank you. Any response to that, Mr. Kent Johnston, before we move to the next question?

**JK Jeremy Kent-Johnston** 1:14:13

It is worth adding one more thing. Throughout this process there's been multiple workshops and sessions with the entire team of experts, but those experts I mean on the call today and involved with the project from visual to.

Fish to sediment, for example, you know there were there was a lot of interaction workshops in Christchurch to go through all those. So every everybody's had a chance to input into the design and.

That led to iteration and and that led to the development of the preliminary design. So that's just a useful addition.

**TC Tony cussins** 1:15:00

Thank you. Thank you. We'll move now to question 12, which reads in a statement of 10th of February, Mr. Griffiths outlines the challenge process undertaken by the applicant to determine the concept design presented in the application.

The question from the panel is there, is there any further information that could be provided about that challenge process that that could assist the panel in its decision making?

**RG** **Rodger Griffiths** 1:15:33

Happy to answer that. The short answer is is is no. We think you have the information that you can use as provided by myself and the evidence of the experts you've heard. However, just to.

Put a bit of flesh on that. From the client perspective, this is a preliminary design. It's more than a concept and the fact that it has survived the challenge, the challenge is and still continues to exist and it's basically the same form gives me real confidence as a.

Client and I can talk to my board and assure them that we are comfortable with the the design where it sits, it's been challenged, it's survived.

It's perhaps a bit unfortunate that we've used this term concept design when it's really as you've picked up more than a concept, and I can assure you a lot of engineering work has gone in the background by Mr. Kent Johnstone and others. And I'm I'm very comfortable with that and the the challenges that have resulted in the the, I guess the standard of the design that we have. It is a bit unfortunate perhaps too that we didn't provide more detailed information. It would have been challenging for Mr. Morgan with the initial information maybe to form views.

Without having a lot of the additional information we've now provided. But in future, should we ever do it again, we would probably provide more of that engineering background information upfront just to give the panel, I guess, more.

To work with to see what we've we've been doing, but just a final point to reiterate what Mr. Kent Johnston said, we really need to maintain flexibility during the detailed design process so that we can achieve the outcomes that that we need to and and really that's the purpose for us.

I guess sent the design as it is and telling you a bit about how we plan to move forward.

**TC** **Tony cussins** 1:17:39

Well, thank you, Mr. Griffith. I think that's a useful segue into the last question actually. So that question was specifically for the applicant for yourself, but the next one it goes to, I just need to go back to my list.

Um.

Yes. So at question 13, and this is to to Mr. Morgan, in relation to your technical review report, can you please comment on the applicant's responses provided 10th of February? To what extent are your concerns in relation to design addressed?

Both the level of hydraulic modeling supporting the design and the selected concept design. So I'll put that to Mr. Morgan and then give the applicant the opportunity to respond to that.

**PM** Paul Morgan 1:18:31

Yeah, sort of carries on quite well from Rod Mr. Griffiths response. And you know, one of the first things I said reading the application documents is that I said I'd I'd be more comfortable if I saw names like Ian McCann involved, you know, in the development of the design not.

Knowing that he actually was. So he was the first name I mentioned as somebody who would give me more comfort about the process that's gone on, having worked with him a lot as well. Yes, I think that's really the key issue is that the, you know what what my review was based on was was quite limited and it wasn't actually clear.

What a lot of processes were. So the the information that's now been provided, particularly from the 10th of February, it has filled in a number of those gaps and concerns and it has highlighted that there has actually been.

A lot more engineering, you know, analysis and work undertaken in in the development, which based on what was presented earlier, looked very much like an early concept with that work to be done.

I I still am left with, you know, probably my main concern around this engineering side is still how you know is the impact of core sediment. Because as I said, I've worked on a number of the projects that Mister McCann mentioned that he's also been involved with and have been involved in the operation since.

And there's almost a consistent pattern that one of the the consistent problems of those existing intakes relates to coarse sediment management and some of that, you know, there's very good engineering designs that we put in, but that's still remains and.

The Waitaha River is a pretty scary river from a from a sediment point of view. You

know that's you you'd be doing well to find a a scary one. Really. There's not too many. So yeah, so that that is my main concern and I think that that should definitely be a a big focus of.

What works to come to to not just from an effects oint of view, but obviously for West Powell's own sanity and maintaining an intake.

**TC** **Tony cussins** 1:20:55

Thank you, Mr. Morgan. Just before we finish off this section, I'll just hand back to the applicant. Would you like to provide a response in regard to Mr. Morgan's comments there before we close out?

**JK** **Jeremy Kent-Johnston** 1:21:11

Not for me.

**TC** **Tony cussins** 1:21:15

OK. All right. Look, with that, I'll hand back to the chair. I think that's that section done. Thank you very much for your inputs.

**VM** **Vicki Morrison-Shaw** 1:21:26

Thank you, Commissioner Cousins for leading that. So we'll now move on to the second issue, which is fish passage and freshwater ecology. And the questioning on this will be led by Commissioner Markham reading out the questions and then directing them first to Westpower and then if there are.

Relevant dock witnesses here, the dock witness to respond and to the extent they relate to technical first passage, also to the peer reviewer, Mr. Morgan, before going back to the applicant over to you, Commissioner Markham.

**JM** **Josh Markham** 1:22:06

Yeah, thank you. Yeah, majority of these questions will be directed at Miss Murtree as as the fresh water expert for Westpower. So if we just start with question 14.

Is what consideration has been given to the design of the energy dissipation structures at the intakes for reducing the risk of harm to fish and maintain fish passage and integrated into the design.

And when answering this question, I'm happy for you to sort of give a high level

summary of the the whole intake structure and screening of the intake structure, not only the energy dissipation structures of it.

**SM** **Shelley McMurtrie** 1:22:54

Kia ora. Thanks, Commissioner Markham. I'm actually going to hand over to Doctor Clooney for this first one, so I will mute myself.

**DC** **Dougal Clunie** 1:23:05

Thanks. So, so, so Mr. Pit you want to give me me to give a a bit of an introduction on energy dissipation to sort of set the things that energy dissipation over the head works has been considered in the preliminary zone structures for for both engineering erosion considerations.

And to ensure the ecological needs are met. But to put it in context, the energy dissipation needs are relatively minor. So if I refer to to figure one of my written response this week, the energy across the headwork structure is.

At a maximum at low flows, it is only five, 5 1/2 meters approximately.

And that reduces. It seems water starts to spill over the weir that the water level difference between the two reduces.

Such that when when the flows are at 150 cubics or higher, there's no energy dispersion at all over the structure.

With that, Mr. Kitch, I can hand it back to you to explain any.

Ecological. Thanks.

**SM** **Shelley McMurtrie** 1:24:14

Thanks, Doctor Clooney. Yeah, so in in any of the work that is done around the fish passage of the intake structure is based on the principles of maintaining the existing level of Kawari passage into Kiwi Flat and retaining and exclusion of trout.

In relation to I think Section 5 of my response was kind of looking at and talking to the fact that in relation to downstream passage, what we're referring to there are kawaro that are in the Kiwi flat area and so their downstream movement is limited to that larval.

Stage during flood events, so that sort of post hatching as they are inundated from the riparian zone where they've been, where the eggs have been laid and so during those events the flow will be over the weir and that flow over the weir will increase.

They will then move through the incredibly turbulent conditions that that exists

within.

And the gorge. So any inclusion and discussion around design criterias for structures such as these need to take into account following the conditions that have been set out in the draft that it is continuing to meet the obligation of maintaining that.

Kawari passage into Kiwi flat, keeping trout out as well as the visual features as well. Correct.

**JM** **Josh Markham** 1:25:45

So just probably asking another question on this question is Miss Mercury, do you see any risk of of Kuaro on their upstream migration coming up over the weir structure and and getting impinged on the energy dissipation structures?

The and late.

And if so, no, if no, why?

**SM** **Shelley McMurtrie** 1:26:12

So at this stage, there are no energy dissipation structures that have been included in the design. Doctor Clooney can confirm that statement if I have that incorrect, yeah.

**DC** **Dougal Clunie** 1:26:33

Sorry for me the yeah, I mean the energy dispersion is essentially the water falling over the weir and and impacting on the downstream place of the weir in the in the rocks below.

**JM** **Josh Markham** 1:26:50

OK. Before we move on to the next, Mr. Morgan, do you have anything further to add on this question?

**PM** **Paul Morgan** 1:27:01

Oh, I guess just on your last comment, Commissioner Markham, I think what you were probably referring to is, is there a risk with upstream fish passage over the structure that then that those fish could be entrained into.

Spill flows, I guess, yeah, which which I think is a obviously a consideration of how you design the the fish pass to avoid those problems.

Yeah. So I guess if it's, it just needs to be part of the the design process to ensure

that that isn't an issue, which will depend on where the the fish passes and what the, yeah, what the different flow conditions are when those fish might be moving.

**JM** **Josh Markham** 1:27:59

Miss McMurtree, anything else to add to that in terms of?

**VM** **Vicki Morrison-Shaw** 1:28:05

Just before we return to Miss McMurtree, I note Mr. Allen's got his hand up and we also need to give Miss Richardson from DOC an opportunity to respond on freshwater matters. Mr. Allen.

**JM** **Josh Markham** 1:28:08

Uh.

**DA** **David Allen** 1:28:18

Just very briefly, we've gone round here. There are no energy dissipation structures proposed. Full stop.

**VM** **Vicki Morrison-Shaw** 1:28:30

Thank you for that clarification, Mr. Allen. Was that all you wanted to speak to? Thank you. All right. Back to you, Commissioner Markham.

**DA** **David Allen** 1:28:36

Yes, thank you.

**JM** **Josh Markham** 1:28:44

Yeah. So is have you just going back to before we go over to Doc, Mr. Mutri, is there any further comment to make based on what Mr. Morgan has said?

In terms of the the the detailed design being needing to accommodate and and allow for the quaro not being re entrained back into the sluice gate or into that area once coming up the fish ladder.

**SM** **Shelley McMurtrie** 1:29:18

Look, just to say that the current design for the fish passage structure itself is flexible. There's flexibility in the design of that. There's flexibility in the location of that, which

should allow the design process as it proceeds through to be able to meet the obligations of the consent conditions.

In relation to kawari and fish passage and keeping trout out.

**JM** **Josh Markham** 1:29:51

OK. Thank you. Miss Richardson, do you have any comment to make on that on that question and what you've heard before we move on?

**MR** **Marine Richarson** 1:29:59

Um, sure. Um.

Concerning so I I would split the risk to fish passage into two the downstream risk for larvae being entrained over the weir and I think Miss McMurtry addressed it pretty well in her description of how the larvae behave.

In the water colon in her evidence and then the risk of fish passageway upstream for juvenile corridor as far as I understand the the current design the.

Fish pass for upstream migrants is is a fish ramp style passage I would have.

Little concern actually of Quaro being re-entrained over the weir just because they would access the upstream face of the the upstream start side of the weir where.

Flows are not as fast and they would Orient themselves in a way that would like make them, have them proceed where the flow is not as heavy. So I think there would be little risk.

Of them just being swept back downstream.

As for larvae, they tend to behave at best like passive particles, just going with the water. And if I understand again the concept correctly, the weir has a slope of one by one, which is.

Not conducive to like direct impact that it wouldn't drop like that wouldn't be like a a sheer drop for them, which might mitigate the risks as well.

Thank you.

**JM** **Josh Markham** 1:32:05

OK. Thank you very much. We'll move on to question 15. Oh.

**VM** **Vicki Morrison-Shaw** 1:32:10

Oh, sorry, Commissioner Malcolm, just before we do, just offering Miss Mcmurtry an opportunity to respond to anything she's heard.

**JM** Josh Markham 1:32:16

Oh.

**SM** Shelley McMurtrie 1:32:21

Thank you, Commissioner Morrison Shaw. Appreciate that and I have nothing else to add on in general agreement with what Miss Richardson said as well. Kia ora.

**JM** Josh Markham 1:32:37

OK, thank you. So moving to question 15, if the course of sediment accumulates or blocks the intake for a period of time, what impact does this have on fish passage?  
Miss McMootry.

**SM** Shelley McMurtrie 1:32:55

So this has been primarily covered in section 13 of my response, so that's a response dated the 10th of February. So as stated there, it's my opinion that this will not significantly impact on fish passage.

Kawaro live in an incredibly dynamic environment where bed movement and sediment accumulation is a normal event. So as I said, I did not see this as having a significant impact.

**JM** Josh Markham 1:33:30

Mr. Morgan, do you have anything else to add?

**PM** Paul Morgan 1:33:35

Yeah, sorry, I was just trying to understand if what the question's asking about in terms of what's gonna block.

So it's not talking about blocking the environmental flow release.

**JM** Josh Markham 1:33:49

No, but.

**PM** Paul Morgan 1:33:50

So that just means blocking the flow into the hydropower intake.

Is that what it's meaning?

**JM** **Josh Markham** 1:34:00

Yeah, well that's that's I guess that's how how you read it. But it could pose another question as well as what we've heard from Doctor Clooney is terms of how the sluice gate works and the build up of sediment on the.

On the opposite side of the stream, does that build up or or change of of sediment dynamics or core sediment dynamics there change the the flow over the the fish pass or would it block the flow to the fish pass?

So.

**PM** **Paul Morgan** 1:34:36

It's sort of hard to know for sure because as Miss McMurtry indicated that there may be some flexibility to where that is going to be located. So I guess that will just have to be a consideration of.

**JM** **Josh Markham** 1:34:48

Mm.

**PM** **Paul Morgan** 1:34:51

You know a scenario like that is as to where the you know where the the fish pass is proposed to be and whether it would be an issue or not.

**JM** **Josh Markham** 1:35:03

OK. Mr. Mutri, have you got anything else to add based on the further commentary I provided in terms of the build build up of the sediment in front of the fish pass?

**SM** **Shelley McMurtrie** 1:35:16

No, I think what Mr. Morgan said is reflective of that. I'll constantly move on.

**JM** **Josh Markham** 1:35:22

OK, Miss Richardson, do you have anything else to add from a department's perspective?

**MR** **Marine Richarson** 1:35:30

No, I think it's contingent on the final design, but yeah, I don't think Quadro would have a particular problem with sediment accumulation.

**JM** **Josh Markham** 1:35:42

Mm.

OK. If there's no objection, we can move on to point or question 16.

So Miss Murtree refers to fish passage at the where intake structure as a significant adverse effect. How can the panel be confident that this significant adverse effect is able to be adequately addressed through the detailed design phase so that effects are mitigated to less than minor?

As Miss Murtree has described them.

**SM** **Shelley McMurtrie** 1:36:24

Thank you. So just to clarify that rating of significant adverse effect that is presented in table two of the freshwater ecology report that relates to the potential effect without any mitigation measures in place.

Table 2 and section 20.7 of the Freshwater Ecology report outlines the recommended mitigation that would be needed to reduce that level of impact to a less than minor level. And those as we know, focus on the design of that Kawaro passage structure and monitoring.

To act as a tool for ongoing maintenance and management approach. So just reflecting back as per section four of my response, I am confident that it should be possible to design and build a structure that will allow for the ongoing access of quail into Kiwi flat and the ongoing.

Exclusion of trout, you know, within the context of this environment.

**JM** **Josh Markham** 1:37:34

OK. Thank you. Just for the benefit of others, I'll just, I will hand over to Mr. Morgan to see if there's any further comment on that.

**PM** **Paul Morgan** 1:37:45

My my comment would be that some of the information that has been presented and there's kind of been mentioned about the climbing abilities quail, which I think is definitely not in doubt and there are lots of examples where they've.

Achieved amazing feats at natural structures like waterfalls and stuff. The the concern

really with this scenario is that the proposal is to put a weir across a river and to have a very discreet, you know, for for significant periods of time to have a very discreet location for flows.

To be occurring. So to me that's a concern that has to be addressed and the design is the fact that it's not a natural state that's being presented through this design and so therefore the complexity of flow that normally occurs through some quite challenging structures.

To move over doesn't exist. There will be discrete points of flow, etc. So that becomes a key element in ensuring that the design accounts for that because as with any fish pass.

It's not just the fish pass, it's actually getting the fish started as a key part of that that you need to to to be sure that your design is going to create a a system where the fish can find the point to start because the reality is quieter once they find that starting point.

You know, you could almost do a vertical face and if it's the right materials and it was wet enough that they will be able to get over the structure. So I guess that was that was one of my.

Points, I guess in terms of the concerns was that ensuring that that's, yeah, not forgotten, that just building a past that, you know, and there's lots of examples of fish passes being built on weirs and dams which don't work. And it's not because there's a problem with the fish pass, it's a problem with.

The fish finding the start of it. So to me, you can't just put it anywhere. You have to go through that process of thinking about where the flow is. And in this case it is going to change depending on whether it's just a release from the environmental flow or whether there's spilling occurring. So that will also change the patterns of. Of conditions that the koara are going to face.

Hello.

 **Josh Markham** 1:40:06

Thanks, Mr. Morgan. I think, I think we're sort of reaching into question 17 now as well. But before we do that, just in terms of the significance assessment, Miss Richardson, have you got anything further to add to round out questions 16 before going to 17 and touching on further comments?

The Mr. Morgan mate.

**MR** **Marine Richarson** 1:40:29

Sure. Thank you. Just making a note that I have not visited the site, so I'm just providing commentary on general principles and my knowledge of the of the fish and of fish passage in general.

Currently, the site would be considered a natural velocity barrier. Overall, the gorge has high, high speed, high water velocities that the fish need to navigate, and that kind of explains why only Karuk is able.

**JM** **Josh Markham** 1:41:05

Mhm.

**MR** **Marine Richarson** 1:41:05

To navigate that, the way they navigate it is not by swimming against the current, but by finding the path of least resistance. And so the question of which flows are attracted are attracting the fish and their.

Orientation towards the fish bass is a legitimate one. It might not be. I don't think it would go as Mr. Morgan raised towards the the the outlet.

Pass just because it would be too much, too much like water velocity would be too important, but the fish might try to Orient in in areas where the velocities would be lower and.

Positioning the pass in in this sort of lines of least resistance of that pathway of least resistance for the fish would be would be key.

And I think that was my point. Yeah. Thank you.

**JM** **Josh Markham** 1:42:16

Yeah, thank you, Miss Richardson. We've got a hand up from Commissioner Crystal.

**DC** **Dean Chrystal** 1:42:26

Thank you. Miss Mcurtry, I just want to ask you just around conditions around this. Would you expect as an ecologist to be involved in the design of that fish pass?

**SM** **Shelley McMurtrie** 1:42:42

So what the current draft condition specifies that the design of it needs to involve a multidisciplinary team. So there needs to be an ecologist that has a knowledge and

understanding of of the fish that we're talking about as well as the unique environment that this structure is going to be placed within as well as. Engineers that are familiar with these types of things as well, which I think so those conditions are reflected by Mr. Morgan's comment around the fact that these designs need to include both ecologists and engineers that are familiar with fish passage structures. So that condition there is.

Condition that requires that this is not a single specialist design. This is a this is a design that involves a range of of people and to sort of add a little bit more to what was said earlier by Miss Richardson, you know there is it is the morphological and. Behavioural traits that Kawari have that we can use for or that can be used for the design of the structure. There is some research that's come out in recent years that has actually been focused on the on Kawari, which gives a lot more information available to how they are responding to those small.

Changes and conditions through which they're swimming. And so you know, with the combination of those two things, with the flexibility and where that fish passage structure can be located, I think all help to, you know, increase that general confidence and the reason why it was originally put on the site on the other. Side of the river from where the environmental flow and intake and everything else is, is to get it away from that more forced velocity, turbulent kind of environment on the basis of those behaviours. But yeah, I from from the perspective of someone who you know has been working.

In freshwater ecology for 25 years, I look at this system and the current design that sits there and the flexibility within that design and the condition requirements that have been proposed and the conditions also set in the freshwater environmental management plan and that gives me.

A lot of confidence that a solution can be found. I've possibly gone on a little bit beyond what you're asking, but so I'll stop there because it looks like you're going to ask another question.

**DC** **Dean Chrystal** 1:45:07

Well, there was a subsequent question. Is this is this a? Is this something that you would get peer reviewed?

**SM** **Shelley McMurtrie** 1:45:15

Uh, yeah. I think it's actually one of the conditions is that this is to be, um, also

reviewed by Doc as well. Um. So this is something that, yeah, would be looked at externally through that process.

**DC** **Dean Chrystal** 1:45:28

Thank you.

**JM** **Josh Markham** 1:45:32

Thank you for that. If there's no objection, we'll move on to question 17. I think we've touched on this question a little bit, but just want to hand that back to Miss Murtree to just get a little bit of further.

Give us a little bit of further information in terms of that detailed design process and what changes you could envision making to the weir structure, but also to the tail race structure and to promote.

Upstream um passage for cryo.

**SM** **Shelley McMurtrie** 1:46:17

So I think, I think we have touched on a lot of that already in the in the response to the questions just before this and I certainly don't want to circumvent that full detailed design process that's yet to come for this fish passage structure that will involve many heads.

To work through that design process. So you know, I'm so like I say, I'm not wanting to circumvent that by saying what those design details or design changes could or would be.

What I fall back on and what gives me comfort is that there are conditions there that set those requirements and that ensure that this is designed not just from an engineering point of view, not just from an ecology point of view, but across the board from everything.

That there is an involvement in doc and in in that process as well and that there is also you know monitoring to go on as part that's been recommended as part of the management plan. So I do sound like a broken record, but that's probably.

Because there is a bit of a bleed in between these questions, it's probably a similar answer to the to the previous ones.

**JM** **Josh Markham** 1:47:35

Yeah. So if I ask sort of a follow up question on that, you're you're confident that there's that that that that the detailed design can address everything.

**SM** **Shelley McMurtrie** 1:47:48

Yes, I am. Based on the context of this environment and and and I'll I'll sort of talk about this a little bit more you know as we move through to some of the later questions. But putting this system into context, you know this is not a benign environment. We're not going from a.

**JM** **Josh Markham** 1:47:57

Hmm.

**SM** **Shelley McMurtrie** 1:48:06

Happy environment for for fish of any kind, including Kawaro to inhabit and to move through into Kiwi flat. We've got an incredibly highly disturbed system that has some of, you know, a free three of 26, which I think goes to a 23.6 with the with the scheme in place, it's one of the highest rainfalls.

In the country, it's actually quite a distance inland and there are a lot of tributary waterways that Kawari moving upstream have an opportunity to move into, including the Kakapatahi, which is a very large catchment that comes off right at the start of the system. So there are a lot of factors that.

That creates a very inhospitable environment up here. The Kawari that are getting through is, you know, a small representation of what the potential number of recruits are down at the, you know, at the sea as they're moving back through that system. So it's actually setting this into context of the environment that it's.

**JM** **Josh Markham** 1:49:02

Mhm.

**SM** **Shelley McMurtrie** 1:49:04

This is not putting a 10 metre high wear across a nice flowing gentle environment that that kawari can get through in their sleep. The animals, the individuals that are getting up there have actually journeyed through some incredible conditions to get to that point. So on that.

Yes, I do think that there is a way that this can be designed.

**JM** **Josh Markham** 1:49:35

Just given others opportunity, Mr. Morgan, is there anything else to add before we move on to the next question?

**PM** **Paul Morgan** 1:49:44

Yes, sort of in response to the current question, but it does start to apologies migrate into the next question as well. I guess what I guess one of the concerns I have is that you know we've had it clearly stated that you know what's being presented as a preliminary design.

For for this, for the for these structures. But yet there's, you know, I'm not seeing even even very high level concepts about how some of these issues around fish are going to be managed the things around the tail race entrainment into the.

And the intake, the fish passes a little bit, but basically for some of those issues which have been highlighted as concerns, there is indication that they're going to be addressed during detailed design. My concern is we'll.

You know, why is there not at least a high level concept of how those things are going to be, those effects are going to be mitigated given that we're told this is a preliminary design?

**JM** **Josh Markham** 1:50:49

Just handing it back across to Miss Murtree.

**SM** **Shelley McMurtrie** 1:50:55

Yeah. So the the scheme, the intake structure itself is a preliminary design, the fish passage structure is a concept.

So it is not at the same level. It is the drawing for that fish piece of structure is not a preliminary design, it's a concept design.

**JM** **Josh Markham** 1:51:23

Mr. Bulgan.

**PM** **Paul Morgan** 1:51:26

Yeah, I I guess you know that and I did sort of indicate that there there is some indication of what the fish passes, but things like the management of the risks

associated with the upstream fish passage that the tail race is going to present or entrainment I guess.

I guess into the intake, which is.

I guess that what I guess what I'm asking is, you know there is no even concept so far presented as to how those issues are going to be addressed. They've been highlighted as issues by the the applicant and indicated that there will be. They'll be addressed in detailed design, but there is actually no concept of how they are going to be addressed.

1:52:06

Mm.

**VM Vicki Morrison-Shaw** 1:52:10

So just to clarify, that's your view. And if Miss Mcurtry wants to respond to that, she can. But we're not having questions directed directly put from witness to witness.

**JM Josh Markham** 1:52:20

Hmm.

**SM Shelley McMurtrie** 1:52:29

Uh, yeah, I'm happy to to move on on that basis.

**JM Josh Markham** 1:52:34

OK, and I note that Miss Richardson's had to move to another room due to power running out of her laptop, so she's not here to pass over to so.

Oh, now she is.

Hello, can you hear us? Perfect.

**MR Marine Richarson** 1:52:58

Hello. Hello. Sorry, apologies about that.

**JM Josh Markham** 1:53:01

No problem, no problem. Miss Richardson, just get before you're moving on to the next question, do you have anything else to add to to the comments that you've heard?

**MR** **Marine Richarson** 1:53:12

I missed the the last couple of minutes, sorry.

**JM** **Josh Markham** 1:53:19

OK. The discussion was at a high level just between the difference, the concept, difference between concepts and detailed design and whether there's enough confidence that there's a that the detailed design can answer some of these questions that we're we're asking in regards to.

Upstream fish passage not only on the weir but also the tail race system.

**MR** **Marine Richarson** 1:53:44

OK, thank you. So I I think the the concept itself captures the idea that different expertise must be brought in at the final design stage.

Which I support and and essentially the the sound principles for best practice have been captured at the concept design. So I don't really have a concern if they are maintained and applied that that the final design.

Will not address potential issues for fish passage.

**JM** **Josh Markham** 1:54:28

OK. Thank you for that. And we'll move on to the next question, which is question 18.

So what mitigation options can be included in the design to manage the approach and sweeping velocities keep fish and debris out of the tunnel?

Mcmurry.

**SM** **Shelley McMurtrie** 1:54:53

Thanks. So just to clarify what we're referring to here, the fish in this instance are Kaware larvae that are around about 7 mils long. They've recently hatched and they're being washed downstream during a flooded flood event post that inundation hatching.

So they'll be passively pushed along with the flood flow and Miss Richardson sort of referred to that earlier in in the discussions earlier on. So this is also covered with a bit more detail in Section 7A, Section 5D and Section 8.

A to B of my response. So what that means is that the project isn't trying to keep them out of the intake because they will be present at times of flood flow and they

will be passing over the weir as well.

So in terms of any additional detail in relation to that sweeping velocity and in relation to the debris into the tunnel, I'll pass it over to Doctor Clooney.

**DC** **Dougal Clunie** 1:56:06

OK, thanks. So just just on the select of keeping debris out of the tunnel. So the preliminary design includes these intake bath screens with a spacing of 30 to 40 millimetres to stop any any large debris getting through.

It's not intended to provide a continuous.

Flashing flow past those screens.

So there there will be a.

Will be a sweeping flow past as when the sluice gate is operated.

And in large flood events, because everything's submerged, the sluice gate is wide open and any debris, the majority of debris passing over the weir, but any debris around those screens will be swept, swept through the open sluice gate.

**JM** **Josh Markham** 1:56:58

Thank you, Mr. Doctor Clooney, for for that. Just just sort of making another comment, Miss Mutri, about what you said in terms of putting into context of downstream migration of of the larvae form of kawaro.

Would you go as far as putting a percentage of what you think the percentage of juvenile larvae would go down the tunnel and be lost and what percentage would go over the where and?

And down the system.

**SM** **Shelley McMurtrie** 1:57:38

What I've said in the freshwater ecology report that given that they are passive passengers in the water, that you could make the assumption that the proportion that the larvae are proportional to the flow. So if you have 5% of the flow going through the intake, then you could assume that 5%.

Of the larvae are going through the intake just as a rough back of the hand style calculation in relation to when they are in those flood events that and you know and I know a lot of you are aware of the.

Spawning behaviour of Kuare, but they are reliant on they'll spawn in that inundated vegetation when the water levels have risen up and then that water level will drop

down and those eggs need to remain moist and not be eaten by rats and mice. Mice until they are inundated again and it's actually the movement of the water. They need physical agitation to to elicit a hatch hatch response. So eggs that haven't had that agitation will will not hatch out.

So as the flow increases through Kiwi Flat, the proportion of flow that's going through the intake decreases in relation to the proportion of flow that's actually continuing to go down down into Morgan Gorge.

So on that basis, whatever those proportions of flow are may be proportional to where the larvae are going. Have I answered your question? Sorry.

**JM** **Josh Markham** 1:59:23

Yes, yeah, you have. Thank you for that. Just giving others opportunity. Mr. Morgan, do you have anything else to add to that question?

**PM** **Paul Morgan** 1:59:35

No, I I agree that that's the most likely scenario that it will best be proportional to the flows given that they are not, they're not strong swim swimmers or that they're pretty passive. So therefore they're just going to follow where the flow goes.

**JM** **Josh Markham** 1:59:41

M.

**PM** **Paul Morgan** 1:59:52

That's, yeah, that's probably up for me.

**JM** **Josh Markham** 1:59:55

OK, Miss Richardson, anything to add comment?

**MR** **Marine Richarson** 1:59:58

Yes, thank you. Not to cast doubt on Cuaro's ability to thrive in that environment, but I don't know that we have any data on the larval production ability of the species above.

In that environment, as was mentioned earlier, it is a challenging environment. So in the main stem in difficult conditions, I don't expect spawning to to be thriving.

Really. And that potentially would impact level production. So just keeping this in mind. Another point I thought I'd raise again, not to cast out on the fish, but.

**JM** **Josh Markham** 2:00:29  
Hmm.

**MR** **Marine Richarson** 2:00:46  
Those early stages for these types of species are are prone to a lot of mortality, so larval mortality until the white bait stage. This is where the week is called essentially. So having this background natural mortality.  
Is also something to take into consideration. To me, it's not a deal breaker to have a proportion of larvae been led into the intake.  
Because, well, they might survive, but also that that might be just added at the background mortality, added to the background mortality. Thank you.

**JM** **Josh Markham** 2:01:33  
OK. Thank you for that.  
If there's no objections, no other hands up, we can go to the next question.  
Right, I take silence as a let's go. So question 19, what implications does a side intake rather than a stream bed intake have for the location and performance of the fish pass on the true left of the intake?  
I think we've sort of answered this question through others, but I'm happy to hand over to Miss Mcurtry just to provide any further explanation to that.

**SM** **Shelley McMurtrie** 2:02:12  
Look, look, I I think that we've we've spent some time sort of discussing this on. I'm comfortable to move on unless there is a specific question within that that that panel would like answered.

**JM** **Josh Markham** 2:02:29  
I'm happy with with that being an outcome and just before we do move on, I'd like to just check in with Mr. Morgan and Miss Richardson if they're OK with that as well.

**PM** **Paul Morgan** 2:02:42  
I'll go first. Yeah, I mean the I I don't actually think the the the difference between

those two types of intakes has a significant effect cause it's cause quite a climbing species. So one one.

**JM** **Josh Markham** 2:02:57  
Mm.

**PM** **Paul Morgan** 2:02:59  
If if it was a different type of fish that that that require a different sort of fish pass, then I think that would be quite, quite important. It's more really the relationship between where flows are and yeah, what those flows are and all those sorts of things. Is probably more important, which isn't directly related to the the type of intake.

**JM** **Josh Markham** 2:03:23  
Miss Richardson.

**MR** **Marine Richarson** 2:03:26  
I don't have any further comment. Thank you.

**JM** **Josh Markham** 2:03:28  
OK. Thank you very much. So moving on to question 20, how will subsequent fish passenger effectiveness monitoring and fish population monitoring results influence a scheme that's already been constructed and is an operation?  
That's Mutri.

**SM** **Shelley McMurtrie** 2:03:51  
You know, so again, just to re reiterate, you know, whilst I'm confident that fish passage for Kuaro can be effective within the context of of the environment and the population that we're talking about the fresh water.  
Ecology management plan, I think it was section 7.3 C does provide for the modification of the fish pasture structure if needed as a result of the monitoring. So the monitoring that has been proposed is looking at recruitment into Kiwi flat and comparing that to recruitment.  
Downstream. So to give some context around that, that was one of the reasons for the concept design, having that fish passage structure separate to the sluice gate and the environmental flow structure on the other side of the channel to better facilitate

future potential modifications.

Without directly impacting on those more substantive structures.

**JM** **Josh Markham** 2:04:55

Yeah, before moving to others, if I could just ask another question is would there be a?

Would there be an outcome that that any modifications to the fish pass wouldn't result in in better monitoring results?

**SM** **Shelley McMurtrie** 2:05:18

I'm sorry, Commissioner Markham, can you repeat that? I I didn't quite understand it.

**JM** **Josh Markham** 2:05:19

Well, yeah, so so just explain my thinking a little bit further. If the if the monitoring shows that there's an issue with recruitment, then you go to modification of the fish pass, would would the fish pass be able to be modified enough?

To result in a in recruitment, getting up in the in the population of Kawairo up in the tributaries above Morgan Gorge increasing.

**SM** **Shelley McMurtrie** 2:05:54

I think we've got to be careful that we're not not talking about increasing populations. If if that comment was around increasing what's currently there, you know this is a and again I think when we get down to question 25 as an opportunity for me to have a little to talk a little bit.

**JM** **Josh Markham** 2:06:02

Um.

**SM** **Shelley McMurtrie** 2:06:14

More about the context that that that this population is in and what are the other overarching factors that are actually influencing this population. So the so, so all of those factors come into play in this scenario. There are probably more.

**JM** **Josh Markham** 2:06:16

Mm.

**SM** **Shelley McMurtrie** 2:06:34

Factors outside of the influence of the scheme that can impact on Kawaro recruitment and survival, particularly into a system that is most likely a sink population rather than a source population. So the I suppose the in my mind I would break I I I'd.

This question down into two, there's the, you know, feedback from the engineers from a constructability point of view. You know what's the what's the ability to go back in and modify a structure once it has been built. And obviously there's a lot of modification of fish passage structures that go.

Goes on, you know, for small and large scale systems, but it's in my mind that question was more around is it possible to in this environment to go back in and and once a structure is built, is it actually possible to go and modify it?

Um, yeah.

**JM** **Josh Markham** 2:07:32

Great and is up.

**SM** **Shelley McMurtrie** 2:07:34

So I'll hand over to either Jeremy or Dougal, I guess, to comment on that from an engineering perspective.

**JK** **Jeremy Kent-Johnston** 2:07:42

I might, I might just say quickly here that the the fish passage here, the flows that are dealt with for Kuado are very small and the structure deals with very small flows and for that reason it's very easy to modify this if it was like a salmon pass.

Which has a lot more water going through. It's a different story, but this is a climbing fish and it's a small amount of water in the in the scheme of the project.

**JM** **Josh Markham** 2:08:06

Mhm.

OK. I I do take the point that this is going to be further discussed further down. So I'm happy with that as well. But before we do move on, just passing it over to Mr. Morgan and Mr. Richardson for any further comment before we move on, Mr. Morgan.

**PM** Paul Morgan 2:08:40

I think as long as the consent conditions, it sounds like you know we'll we'll deal with this issue. I think it's important that.

**JM** Josh Markham 2:09:03

Mm.

**PM** Paul Morgan 2:09:03

Therefore, if there's, you know, it could be that the intake structure is not the problem. If there is problems with fish passage that it could be more than, you know, the number of fish being impacted by the tail race, for example, then that would need to consider what modifications are needed there to to improve that and in terms of the agree with what.

Mr. Kent Johnson said that you know the the flows here are very small that you need for a climbing fish. The concern more is that the, you know, it's it's the relationship with the the whole hydraulic system in terms of where flows are, you know, at different.

Types of scenarios of of release and you know I guess that that's where the potential limitations on what might be able to be changed given as Mcurtry had highlighted that these these made main or major structures like sluice and.

Other things obviously are much more difficult to to change once they're built, and then you are having to effectively, if there's an issue with your past, trying to find a better place to put it within the limitations of what the the structure already has.

Which again is why you know it's it's good that there's flexibility, but there needs to be consideration of of all the different scenarios of flows that and and what that might mean in terms of what how much flexibility you actually do have to to change things.

And and probably highlighting again, I think it's not going to be the actual structure itself. I don't think that's going to be the problem. It's it's going to be more about you know whether the quaro are getting to the start of the the structure will be will be the issue. So it may not be the changes that the structure that's needed, it may actually be changes.

In terms of the the downstream components, in terms of where where water's sitting.

**JM** **Josh Markham** 2:11:04

Uh, Miss Richardson, do you have any anything for the date?

**MR** **Marine Richarson** 2:11:07

Yeah, I had interpreted some of the question a bit differently because to me monitoring was also around ensuring that there was no trout incursion as as low likelihood likelihood it is for the species to come up, but with. Lower flows downstream of the weir that might be able to get there. So I thought monitoring couldn't could include like just ensuring that there is no no passage for some minutes. Upstream.

**JM** **Josh Markham** 2:11:44

Miss McMurtry, do you have anything further to add to both what you've heard from Mr. Morgan and Mr. Richardson?

**SM** **Shelley McMurtrie** 2:11:52

Yeah, absolutely. So there is, yes. So part of the monitoring is to also identify whether or not trout are getting up into Kiwi Flat. And I have also in my response talked about, I think it was section 11.

**JM** **Josh Markham** 2:12:02

Mhm.

**SM** **Shelley McMurtrie** 2:12:11

Of my response the relating to the potential for trout to use the abstraction reach or to access into Kiwi flat. So I'll take it as read that people have have have seen that and and read the information that's in there.

It's a very low just to clarify for the purposes of this conversation, my conclusion around the potential for trout to either get through the Morgan Gorge or up over the weir or through the environmental flow gate or the sluice gate.

Is very low. In fact, the conditions for trout within Waitaha River itself is very, you know, inhospitable. And for both trout and eels, the temperature matter in particular, as well as the low food supply would mean that this environment is even more

challenging.

With the changes that occur with at lower temperatures for those fish.

**JM** **Josh Markham** 2:13:20

Perfect. Thank you. If there's no objection or no other hands up, we can move to question 21.

**VM** **Vicki Morrison-Shaw** 2:13:27

We'll just move to question twenty-one and then we'll have a ten-minute break following question twenty-one and then resume.

**JM** **Josh Markham** 2:13:35

Fantastic. Yep. These freshwater questions are a bit of a marathon, aren't they? Yeah. So moving to question 21, what are the consequences if monitoring shows fish passage is not working as intended? I think. I think we have covered this slightly, but I will hand over to Miss McMurtry to provide. Wide any further information.

**SM** **Shelley McMurtrie** 2:13:57

Thanks, Commissioner Mark. I might, yeah, look, I'm in agreement. I feel that we've covered this off in relation to question 20, but I also will be referring to this in a bigger context in relation to answering question.

25 that's the new 25, not the old 25. So if there's general sort of comfort from the the panel and Mr. Morgan and Miss Richardson, I I would be comfortable to to. Finish that off through answering question 25.

**JM** **Josh Markham** 2:14:36

Is that OK with uh both M Mr. Morgan and Miss Richardson? Yep.

**MR** **Marine Richarson** 2:14:42

Yes, thank you.

**JM** **Josh Markham** 2:14:45

OK. Thank you very much. Yeah. And I'll hand over to Madam Chair before we go on a break.

**VM Vicki Morrison-Shaw** 2:14:51

So we're making quite good progress. We're sort of close to halfway through. We'll have a 10 minute break, have a stretch, get get us something to drink. If everyone could be back online with their cameras on by quarter past, we'll resume bang on quarter past and continue with the fresh.

Water ecology questions. We've only got another five of those to go and then we'll move on to the sediment topic. So thank you everyone and we'll see you again at quarter past.

Bye looks like.

They're all back.

Other than Mr. Morgan, we'll just Mr. Morgan, are you back yet?

In more seconds.

Alright.

We will get underway again. I'll hand back over to Commissioner Markham and we will start again at Question 22.

**JM Josh Markham** 2:26:14

Thank you. So starting with question 22, Miss Mcurmury states that Kiwi flat reach is an important to the Kawaro fishery as trout are unable to access the area. In what contents is that important?

And why is it important ecologically?

**SM Shelley McMurtrie** 2:26:39

So I consider it to be important ecologically from the context that trout aren't present, and trout are recognised to impact through both direct predation and indirect competition for resources on galaxis species, including kawari.

However, it is not as important from the point of view of being a significant Kawari population compared to other rivers on the West Coast, and that's primarily reflected in section 18.3, I think it's B&C of the Freshwater Ecology report.

Which refers to Kawaro presence and trout absence in Kiwi Flat to the assigning of a medium significance value with higher significance values actually related to the stable tributary downstream of Morgan Gorge.

I can also touch further on the ecological context of this Kawari population, but that is covered once again in that in that answer to question 25. So I'll I'll leave it at that

for the moment.

And see what the general comment is.

**JM** **Josh Markham** 2:27:54

Before we hand over, you make you make reference to the tributary just down from Morgan Gorge being higher significance for the Kawaro population. What's your opinion on the tributaries above Morgan Gorge? their significance for the koiri population. Is it the same level as the Kiwi flat reach or are they higher?

**SM** **Shelley McMurtrie** 2:28:22

I apologise, I may have not made that entirely clear. This higher significant values related to the stable tributary downstream was not in relation to Kawaro specifically, although they were present there, it was in relation to the significant invertebrate values and.

The rarity of that habitat being a a seepage spring fed system. So I may have muddied the waters in relation to sort of mixing those two things together, but the section 183B and C refer to.

A a medium significance value for Kawaru and Kiwi Flat. So I was just making the comparison that it didn't achieve a high a high value like some like that stable trip did for different reasons downstream of Moorland Gorge.

**JM** **Josh Markham** 2:29:06

Hmm.

**SM** **Shelley McMurtrie** 2:29:12

Forge.

**JM** **Josh Markham** 2:29:14

OK. Thank you for that further explanation. Just handing over to Mr. Morgan and Mr. Richardson, is there anything further to add to to to that those comments?

**PM** **Paul Morgan** 2:29:29

No, not for me.

**MR** **Marine Richarson** 2:29:39

Yes, thank you. I actually noted that since the species is at risk declining, any population that is safe would be an important population, however, in terms of. Quantity of fish. I don't have the data to claim that this population is like a super important stronghold for the species at large, so it's.

It's uh.

I suppose I agree with Miss Mcurtry around the significance based on the fact that there aren't any salmonids that have incurred that have penetrated in these fish population.

However, from a more global perspective, it's it's not a significant population stronghold in it's potentially not a population stronghold in my view.

Thank you.

**JM** **Josh Markham** 2:30:53

OK, um, notice that, um, Commissioner, uh, Crystal's got his hand up.

**DC** **Dean Chrystal** 2:30:59

Yeah, um, Miss McMoochy, just wonder if with a reduced flow in the gorge, could more fish get up the gorge and the population does become significant?

**SM** **Shelley McMurtrie** 2:31:15

I do refer to that, and I apologise. I know I did refer to it in my response document where I talk about the fact that the current that I don't.

Feel that there will be that the residual flow in of itself will create conditions that make it, you know, more amenable for fish to get up through there and up into Kiwi flat. I think the comparison that I made that at the moment they need to navigate through.

**JM** **Josh Markham** 2:31:41

No.

**SM** **Shelley McMurtrie** 2:31:49

Turbulent flows through Morgan Gorge and a significant velocity barrier to to get into Kiwi Flat with the scheme in place. At times they will have less turbulent and and

lower flows through Morgan Gorge, but there will be the passage structure and to negotiate so.

Mind I don't. Yeah, these things probably even themselves out. And again, I'll refer to this through my answers to question 25 in terms of the level of attrition that is going on by the time they get up there, the numbers of Kawaro actually in the system at the start of.

The project area of influence. Those numbers are probably reasonably low anyway, and yeah.

Have I answered your question?

**DC** **Dean Chrystal** 2:32:41

Uh, you sort of. I guess the low flow in the in the gorge is less than the current low flow. So it's actually at a level below what is currently experienced at low flow time. So I think we're down to 3.5 cubics compared with four something or other is the the lowest flow at the moment.

So I I guess it it's just really in response to what Miss Richardson has said in terms of this isolation group and if if you if you've got a flow which is less than the current lowest flow, is there a then a potential that that you do get an increase in the population I it becomes potentially a positive.

Of effect, I suppose above Morgan Gorge because you've got this much lower flow which allows potentially allows more Karo to to get up the river and then up and over the ladder and and that population increases.

**SM** **Shelley McMurtrie** 2:33:40

Oh, sorry, I didn't mute myself. It is a possibility. I I would say that that is a possibility. The IFIM modelling indicated that there wouldn't be a significant increase in weightable usable area through the abstraction reach for Kawaro.  
The.

But as you say, if and the food resources and the disturbance regime through the main stem will remain pretty much as it is now, you know, as we've talked about, the free three goes from 26 to 23.6.

So the overarching disturbance regime and low food basal sources, food sources will remain the same. So those will probably put in, you know, in check some.

Massive increases in any fish still inhabiting the main stem, but it is not outside of the realms of possibility that it could help at those times of residual flow for Kuaro to

move through and get up to that passive structure and up and over.  
And that would be a nice thing.

**DC** **Dean Chrystal** 2:34:59

Is that would that form part of your monitoring?

You would you would you would detect that with the monitoring that you're proposing?

**SM** **Shelley McMurtrie** 2:35:10

So the monitoring that has been proposed is looking at a a backy design and looking at recruitment. So it's population monitoring, looking at whether new recruits, juveniles moving into the population in Kiwi flat in comparison to the population structure.

Or, you know, size of individuals and recruitment of individuals into tributaries downstream of Morgan Gorge to try and take into account the other natural statistic things that will be going on that will be influencing, you know, the recruitment of Kawari into the system.

System.

**DC** **Dean Chrystal** 2:35:51

OK. Thank you.

**JM** **Josh Markham** 2:35:58

OK, fantastic. I don't have anything else to any other comments on on that. So I'm happy to move along as long as there's no one else.

OK, so moving on to question 23 is sort of covered this little bit. With the reduced flows in Morgan Gorge, is it possible for eel could more easily make their way up to the weir? If so, can the species be stopped from traversing the fish?

letter and what would that look like?

Miss.

**SM** **Shelley McMurtrie** 2:36:34

Thank you. I do not believe that Eels would be able to access Kiwi flat for the reasons given in section 6A to C of my response. Very briefly because I don't want to take up people's time given that it's 330, but the there are some significant.

This environment of the Waitaha River is pretty inhospitable for eels and all the fish surveys that we did, we caught one in the main stem. Temperatures remain below 12 degrees. In fact the median is around.

5 degrees and the food supply in terms of the invertebrate densities within the main stem is very low in comparison to and the tributaries and elsewhere. So it is my opinion that even with an with the reduced flow with the residual.

Or throw through the abstraction reach. I do not believe that that is sufficient to make this an environment that is suitable for eels and their swimming and their activity is closely linked to temperature. So below 11 and 12 degrees they do go into a form of high.

Nation and are less active, so there is further expansion on that in my response.

**JM** Josh Markham 2:38:00

OK. Thank you for that. Mr. Morgan and Mr. Richardson, any further comments to make on that?

**PM** Paul Morgan 2:38:08

Yeah, probably the second part of your question, I think.

Cause I've been involved in a lot of um designing a species, species barriers in various parts of the world. Um, I don't believe that if uh eel got to the uh where that you'd be able to design a.

A fish pass that worked for Quaro and didn't work for for eel. I think there's, you know, there's too many similarities in terms of what their needs are in terms of a pass. So that part of it I think would be very difficult to differentiate. So I'm not commenting on Miss Mcurmury's comments about the likelihood of them getting there if I think if they did get there, they, yeah.

I don't see a way that you could easily exclude, um, just the all.

**JM** Josh Markham 2:38:57

Yeah. And before going to Mr. Richardson, Mr. Mcurmury, can can you just clarify that is that the intent of the detailed design to exclude eel on the fish pass or not?

OK.

**SM** Shelley McMurtrie 2:39:19

But the primary focus is to 1st and foremost exclude trout. The question around tuna

has also been is there a chance that they would get through as it currently is? And so I think the bigger question is around.

If El or Tuna were to get into Kiwi flat, what is the implication of that on the population? I, you know, agree with Mr. Morgan in relation to a structural point of view of trying to create a passive structure for Kawari that excludes.

Tunna. Um, but you've we've got to put into that equation, um, the temperatures that these fish are operating at and the extremely low numbers of of tuna that are in the system. Um.

Because that is the context of the environment that we're working within. But I think also it is about what happens, you know we we can cover off the what if and and the answer to the next question.

**JM** Josh Markham 2:40:27

OK. Thank you for that. Miss Richardson, have you got anything further to add?

**MR** Marine Richarson 2:40:33

Yeah, I concur with both previous statements. There are historically no low numbers of tuna found in the catchment based on public data.

The physical barrier would not be hard to negotiate for an eel. They they are better climbers in Kuaro really, but there are limitations in terms of ecological.

**JM** Josh Markham 2:40:54

H.

**MR** Marine Richarson 2:41:03

Uh requirements.

From what I understand, but happy to to to expand at question 24.

**JM** Josh Markham 2:41:15

OK. All right. Thank you. Eager to get to question 24 now. So if I if I don't hear from anyone else, we'll go straight to question 24. So if eels can't be stopped and in the event they do colonize above Morgan Gorge, what impact would?

What they have on the ecology of Kiwi flat, in particular the unique habitat currently provided for Kawaro.

Must move my tree.



**Shelley McMurtrie** 2:41:45

So I think it's worthwhile just going through briefly what I had put in section 60 of my response around in a scenario where.

Tuna were able to get into Kiwi flat. What is the implication of that? Um, my opinion remains that the tuna numbers in the Waitaha are very low and so any individuals that were able to overcome the significant temperature.

Issues where the water temperature is below 7 degrees for 53% of the year. It remains below and this is based on daily water temperature readings over 2 years. Water temperature remained below 12 degrees for all but one day.

So it sits below 11 degrees for 97% of the year and below 7 degrees for 53% of the year. So there is a significant physiological constraint for Tuna in this system they. Remain inactive for extended periods of time when that temperature sits below 11 or 12 degrees. So notwithstanding the other limitations of habitat suitability, low food resources, not a temperature system that is good for them.

Were they to get into Kiwi flat somehow, then the impact on the Kawaro population I don't believe would be significant because one, the numbers are going to be very low to cohabitation of tuna and Kawaro.

And the predation of tuna on Kawaro is certainly part of the natural ecosystem. You know, Kawaro are part of that white bait run. They are considered to be a marine subsidy for high trophic level fish such as tuna. Also the distribution and abundance of Kawaro has been negatively.

Correlated with trout, but not with eels. So the collapse of those kawari populations, primarily lake dwelling, they they have only been linked to the introduction of trout or smelt. So and then on top of that the ability so once.

If eels are in there in the Kiwi area, they still need to successfully predate on the kawari or out compete them for resources and again that becomes a temperature dependent question and we have the.

Issue of temperature. So in addition to the daily temperature recordings for two years in Kiwi Flat that I've got for the main stem that I've gone over, we did have some spot temperatures for water temperature in the tributaries during September and the average temperature of those tributaries at that time was 9.4 degrees, so I. I do not believe that the tributaries would have a significantly different temperature regime to the to the main stem, and I'll I'll close it there and invite responses.

**JM** Josh Markham 2:44:56

Thank you, Mr. Morgan, and then we'll go to Miss Richardson.

**PM** Paul Morgan 2:45:01

Yeah, no, I don't have anything to add to that.

**JM** Josh Markham 2:45:03

OK.

**MR** Marine Richarson 2:45:10

So I'll I'll go then. So I I will agree with Miss McCrotry's statements. There are limitations of temperature. So long fin eels in particular are very plastic, very adaptable.

**JM** Josh Markham 2:45:10

Thank you.

**MR** Marine Richarson 2:45:28

So like a wide range of habitats, assuming that conditions over time evolve with climate change, better more suitable temperatures occur in the in the flat and they managed to access the area or the oat stray eel managed to to access the. Area there might be predation, but I personally don't think it would be a massive issue just because codon eels have evolved together, so there would be behavioral. And ecological defenses from Quaro. So that there it would be, I would be hard pressed to to foresee a wiping out of the Quaro population because of because of eels noting as well that if predation is a concern there is.

There are known instances of cannibalism within part of populations as well. So it's as Miss McMurtry said, it's part of the natural processes for this population. I would be more worried about salmonids.

**JM** Josh Markham 2:46:34

Hmm.  
Yeah.

**MR** **Marine Richarson** 2:46:39

Thank you.

**JM** **Josh Markham** 2:46:42

OK. Thank you for those responses. And I think if there's no further comments on that, we can move to the next question.

So the next question, question 25, quite a large question and I note that there's quite a few things pointing to this question that have been alluded to before. So what are the cumulative, sorry about the word long-term effects of the proposed scheme on the quarry population in the upper catchment?

After restrictions to upstream fish passage, tower race deterring a proportion of the upstream migration and potential ineffectiveness, full or partial of the fish pass and mortality.

Which we've discussed before, being proportional of the downstream migration being entrained into the tunnel, have been taken into account.

**SM** **Shelley McMurtrie** 2:47:40

So yeah, firstly, I appreciate that I have referred to this question and subsequent answer in a number of the previous ones. A lot of this is just wanting to put things into context in terms of the this particular environment and to recognise that this is certainly not a benign.

**JM** **Josh Markham** 2:47:44

Yeah.

**SM** **Shelley McMurtrie** 2:48:00

A benign system or a benign environment I think I referred to earlier. It has some of the highest rainfalls and some of the highest flood disturbed systems in the country. The project area on the Whitehour main stem is some distance inland. It's about 20 kilometres to the tower range.

Itself.

And between the sea where the white bait are moving in from to that location, there are many tributary waterways downstream that incoming Kawaro will migrate into.

So what that means is that there will be fewer recruits actually coming into the

project area itself.

I do discuss in section 4G and 5D of my response more detail around those existing unfavourable conditions in the Waitaha and through Morgan Gorge in particular, but ultimately the system creates a very big challenge.

For kawaro survival, and that is for kawari moving in and kawaro larvae getting washed out. What that means is that the Kiwi flat kawari population would already, in my opinion, be reliant on an influx of recruits from other source populations.

Meaning that this is a sink population rather than a source population. When looking at the Kawaro meta population, I would expect therefore that the population at Kiwi Flat is more likely to be affected by those cumulative factors outside of the realm of influence of the project than it would be.

By the project alone. Adding to that, Kawari have a low natal fidelity, so that means that they don't necessarily return to their birth stream. And because of that, we also need to look at the wider Kawari fishery in general.

In Section 4G of my response, I do refer to the density of Kawari in Kiwi Flat and compare that based on records available in the freshwater fish database across the country. So we've got a density of Kawari in Kiwi Flat that is roughly half that of the of the national average.

So we've got 4.4 Kawari per 100 metres squared and Kiwi flat versus 9.6 per 100 metres squared on a nationwide basis. And the Kiwi flat populations in terms of density is slightly lower than other West Coast rivers.

So that means that they do not necessarily represent a significant portion of the fishery. So on that basis, I do not believe that there will be any observable change in the Kawari fishery overall as a result of the project.

I will finish there. I'm happy to go through what those other external factors are that influence that that would be influencing the population. But I think I will wait for the responses I think before jumping into that, if that's OK.

**JM** **Josh Markham** 2:51:09

OK. Thank you. Um, Mr. Morgan.

**PM** **Paul Morgan** 2:51:14

I guess my comment looking at the flow duration curve, you know the what's proposed here is is a significant change. You know it's the the flow duration curve shows in terms of what the flows are through Morgan Gorge and also the.

The, I guess the implications around tail race flows. So to me, although a lot of those things that Miss Mitri has said, you know, have have the basis from surveys that the reality is there is quite a big change here. So I think there is.

Definitely the potential for some effects on the population based on that change and as was highlighted by Commissioner Crystal, I think that the proposed environmental flow will basically flatline.

The river for, you know, close to 66% of the time. So you know, therefore again that that has significant.

You know, potential for for change. The other thing I guess and and it's been highlighted to me from another project that I've been working on just in the last week where we were at a site where the EDNA has shown that there's only one species of fish.

And we were told that there's been almost 20 years since anybody last found one of those fish in this catchment and the applicant undertook many, many surveys and Doc has undertaken many, many surveys and we went to site and.

On the day that we went there with planners and engineers and ecologists, we saw hundreds and hundreds of these fish. So to me it kind of highlighted that, you know, there is always a concern about when you're trying to work out population numbers. In terms of surveys and particularly of rivers that you know, you have to account for the fact that there is quite a lot of uncertainty and what we understand about the populations and so I guess I would have some caution and.

Yeah, how, how, you know how you then relate that to to the value. And I think it also relates to a comment from Miss Richardson that you know because of the.

The status of of Quaro in terms of their you know at risk. Therefore you know there was an argument to say well you know the the populations are important, you know possibly no matter how small they are and particularly the natural environment. So I guess that's all my my comments is that.

Going back to the flow duration curve, you know what's proposed here is significantly different and so therefore I feel it must carry some risks of of of effects and that has to be, yeah, considered through, you know, what's done to try and mitigate.

You know that that risk in terms of a very big change in the hydrology of the river.



**Josh Markham** 2:54:16

Yeah. Thank you, Mr. Morgan. And I I just before going to Miss Richardson, I I want

to give Miss McMurtry an opportunity to answer that. But also just to add to it slightly as well as sort of as we've gone through these questions, we sort of built up a bit of a picture.

Of this quarry population but being quite quite low and being a sink and answering the question to Mr. Morgan be great to get clarify from you whether you think that this population is at a tipping point and whether likely this proposal going forward would tip a tip the population.

Nation into not existing above Morgan Gorge.

Miss.

**SM** **Shelley McMurtrie** 2:55:03

Thank you, Commissioner Mark Markham. Thank you for letting me answer first because my memory wouldn't. I wouldn't be able to retain the comments from Mr. Morgan before going to Miss Richardson. So I think there's a couple of things there to talk about one.

Relates to the conversation around the residual flow. So there was a lot of work and done in relation to the IFI modelling and the the freshwater ecology report that sort of dealt with the predictions relating to the residual flow.

And the key aspect to consider there is is the the effect of stream disturbance as a primary factor regulating stream systems where those systems are highly disturbed. So in those types of systems that we have such as the Waitaha.

The primary factor regulating those communities is actually the disturbance regime. Ultimately, those flood prone systems are influenced most by the intensity and frequency of those disturbances, and they far outweigh other biotic interactions, including.

Predation, competition and food supply. This river system is one of the lowest in in terms of the comparison of the nutrient status. It's it's coming out as one of the at the very, very low end of of nutrients. There is agreement that there is a.

No chance or very, very low chance that with the residual flows that algae will be have an opportunity to proliferate because there isn't the food supply there for that to happen and the resetting of that system with that free three of 23.6.

Bearing in mind that a free three of 15 is considered to be a highly disturbed system and we're at 23.6, that will ultimately dictate how the system responds to that residual flow.

I've actually forgotten what the rest of that response was. Mr. Morgan, I do

apologise. Would you be able to brief me on the rest of your statement so that I could finish that off?

**PM** **Paul Morgan** 2:57:33

All right. Sorry, just trying to find my mute button. I mean that was kind of the main issue was the the change to the the hydrology in terms of the fluctuation curve. The the other issue I just, I guess I just reiterated something that Miss Richton had highlighted that.

Yeah, sometimes the, yeah, if you just base it purely on numbers that you can maybe come up with some values around a population, but just the fact that they exist is has a value in in itself and that's not just an environmental, that's also a cultural.

Perspective as well. So yeah, that I get and that's what I was relaying to. But also just I guess reiterating that you know and I understand the challenges that you face in terms of even trying to understand population numbers and river systems is quite challenging and particularly in the river like the Waitaha would.

You know be you know like like any river is you know there is a limitation to what surveys can can provide. They they they obviously give a a good indication and we do have you DNA and stuff like that which really sometimes helps to fill in the gaps. I was just kind of highlighting that that it's.

Yeah, there's there's always some uncertainty around populations and and my experience from just this site just last week is that obviously when people do surveys has a big effect on what they what they actually find and believe because at that site there was very strong evidence that there was very few fish.

But just from a site visit last week, that's kind of really questioned 20 years of data of of people saying there's there's very few fish there.

**SM** **Shelley McMurtrie** 2:59:18

Thank you, Paul. I, Mr. Morgan, I appreciate going back over that so that I can sort of respond to that as well. Yeah, look, I'm, you know, I I'm in agreement in relation to, you know, when you sample, how you sample, what you sample does have an influence on on what you find.

I think one of the unusual things about this project is that there is a very, you know, comprehensive data set, both for invertebrates and for fish. It was surveyed over 2 years for fish at different times of the year and then it was supplemented with quite a wide scale eDNA sample.

Sampling programme with that technology becoming available in in more recent years. So there's probably been a greater level of sampling undertaken than what would usually be undertaken for this and it has given us a valuable insight into what is going on in the system.

I think also in relation to looking at the population dynamics and and how you you know with the difficulties around establishing population size etcetera, one needs to add.

The layers of information on top of each other and and do a sense check in terms of is what we are what we are seeing reflecting making sense to to to what we see in that environment and so the numbers of fish that the current density of of fish that we've had out of.

days, the comparison of densities within the main stem versus the tributaries um reflect and the fish that are present up in Kiwi Flat being Kawaro does reflect the other information that that we have, the temperature, the the flow ratio.

the disturbance regime. I mean, these things are adding up rather than not making sense of recognizing I'm probably getting to the end of my cogent sort of words here, but I think we need to I have confidence that the information that we're we're finding is is

Not conflicting each other. So the pattern that we're seeing emerge here is making sense from the point of view of what we're seeing. So I have some level of confidence in in those statements that I've made in relation to.

This population most likely being a sink rather than a source, and that those densities of fish in there are, you know, certainly lower than what they are in other areas of the country and similar, slightly lower, but similar to what is being seen, you know, on average across other systems.

Systems. So whilst it's not full population sort of studies, you know the value in a huge data set is to look at those sort of patterns emerging. I'm I'm going to close it there I think and and.

Let Miss Richardson respond. I'm happy to talk about that further, but I will put myself on mute for the moment.

**JM** Josh Markham 3:02:34

Thank you, Mr. Richardson.

**MR** Marine Richarson 3:02:38

Thank you. Trying to to weave those threads together and adding another one. One of the key things around managing a species like quaro is that there are.

The the existence of a population at a site is not a closed system. Recruitment actually is is a really important factor to take into account.

With a species like cuaro, worst case, worst case scenario, the population upstream of the barrier disappears. It does not mean that it's gone forever because it might be seeded by.

Juveniles from other catchments. Best case scenario population above the weir improves and more adults produce larvae that might contribute to the big pool.