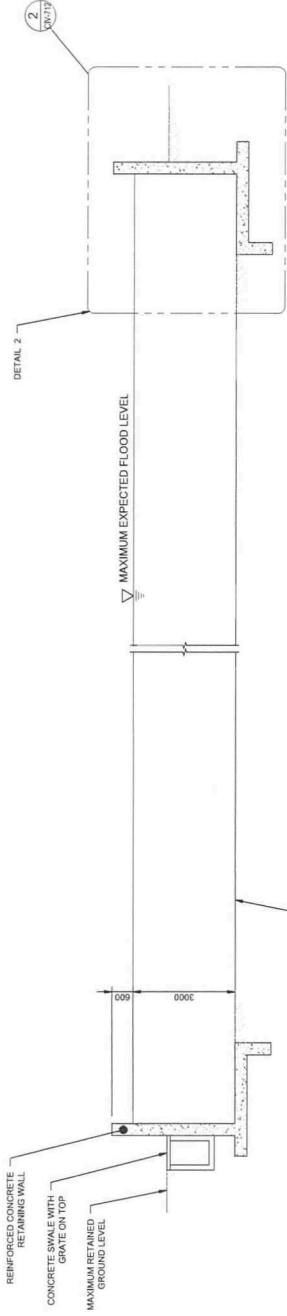


NOTE

DIMENSION UNIT IN MILLIMETERS

DESIGN CRITERIA

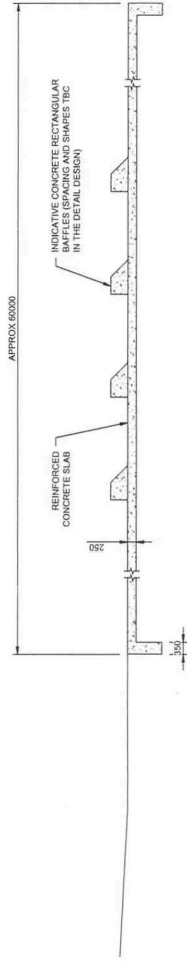
IMPORTANCE LEVEL 2
 DESIGN LIFE 50 YEARS
 ALLOWABLE DESIGN PRESSURE (ADP)
 ALLOWABLE BEARING CAPACITY (ABC) - 100kPa



S1 SECTION
 CIV-710 SCALE: 1:75(A1), 1:150(A3)



S2 SECTION
 CIV-710 SCALE: 1:75(A1), 1:150(A3)



S3 SECTION
 CIV-710 SCALE: 1:75(A1), 1:150(A3)



REVISION	AMOUNT	DATE
A	DEVELOPED CONCEPT DESIGN	A.S. 2025-11-21



WSP
 Nelson Office
 44-348 1099
 Private Bay 26
 New Zealand

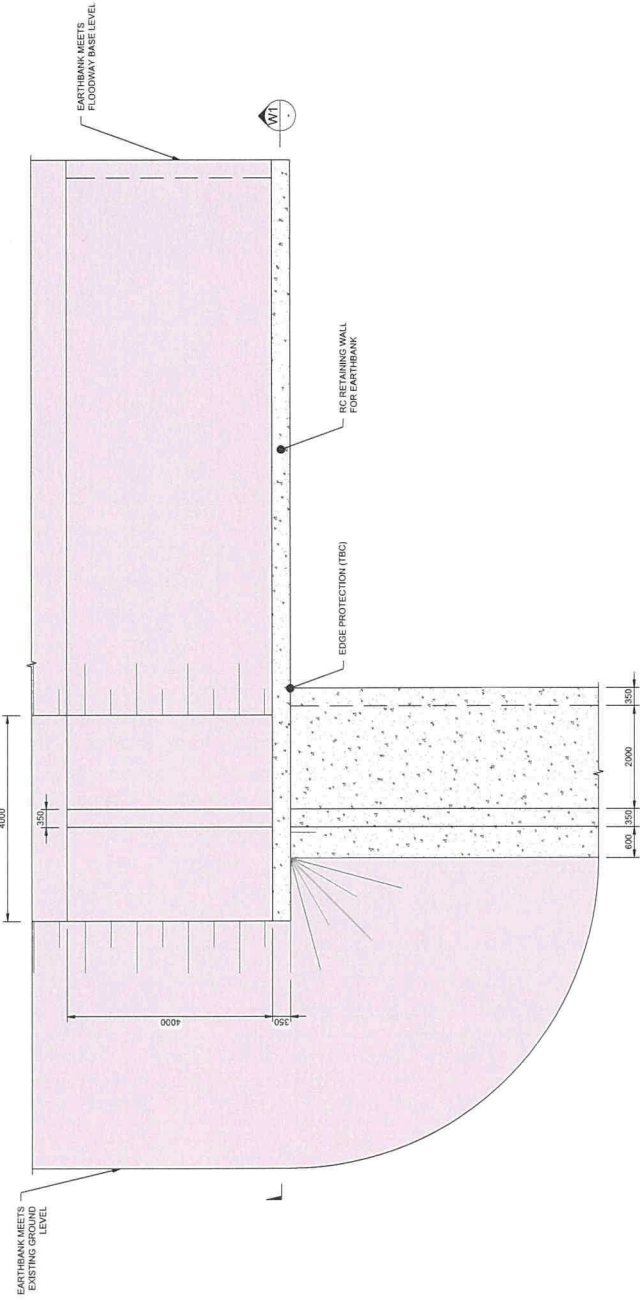
STRUCTURAL

DEVELOPED CONCEPT DESIGN

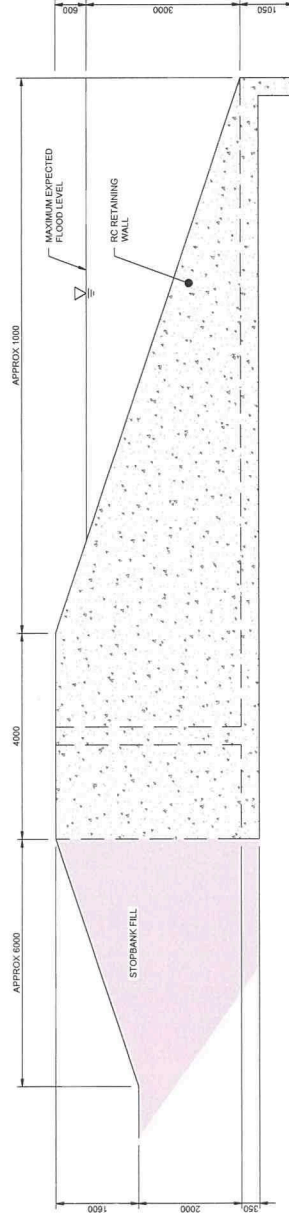
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1:75(A1), 1:150(A3)	N.LDSTONE	A.SOVERSBY	A1
DRAWN	N.LDSTONE	APPROVED DATE	
N.AJDEA		2025-11-21	
DRAWING CHECKED	DESIGN CHECKED		
N.LDSTONE	N.LDSTONE		

PROJECT
 HAWKE'S BAY REGIONAL COUNCIL
 WAIROA, HAWKE'S BAY
 WAIROA FLOOD MITIGATION PROJECT
 TITLE
 STRUCTURAL SECTIONS
 WSP PROJECT NO.
 2-14441-WSP-03-DR

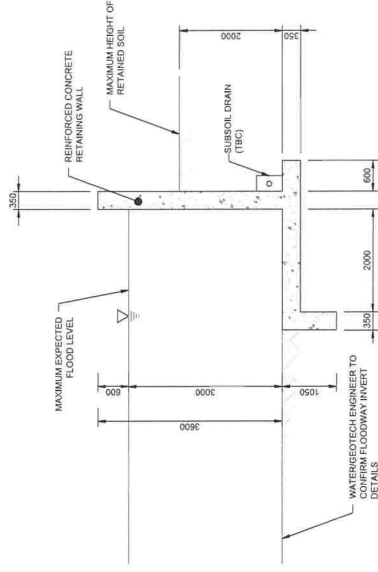
SHEET NO.
 CIV-711
 REVISION
 A



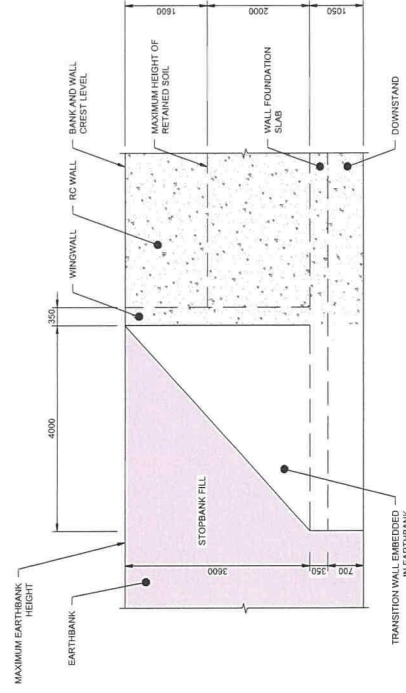
EARTH-BANK-WALL TRANSITION PLAN
SCALE: 1:50(A1): 1:100(A3)



(W1) EARTH-BANK-WALL TRANSITION SECTION
SCALE: 1:50(A1): 1:100(A3)



DETAIL 2
SCALE: 1:50(A1): 1:100(A3)



(W2) EARTH-BANK-WALL TRANSITION ELEVATION
SCALE: 1:50(A1): 1:100(A3)

NOTE

DIMENSION UNIT IN MILLIMETERS

DESIGN CRITERIA

IMPORTANCE LEVEL 2
DESIGN LIFE 50 YEARS
ALLOWABLE FLOOD LEVEL 9m
ALLOWABLE BEARING PRESSURE (SLS) > 100kPa



REVISION	AMENDMENT	APPROVED	DATE
A	DEVELOPED CONCEPT DESIGN	A.S.	2025-11-21



Nelson Office
44-43 Sall 1079
New Zealand

SCALES	ORIGINAL SIZE
1:50(A1): 1:100(A3)	A1

DESIGNED	APPROVED
NAUDEA NLIJSTONE	A.SOWERSBY

DRAWN	DESIGNED	APPROVED
NAUDEA	NLIJSTONE	A.SOWERSBY

DATE	APPROVED DATE
2025-11-21	2025-11-21

STRUCTURAL

DEVELOPED CONCEPT DESIGN

PROJECT: HAWKES BAY REGIONAL COUNCIL
Wairoa, Hawke's Bay
Wairoa Flood Mitigation Project
TITLE: RETAINING WALL DETAILS
WSP PROJECT NO: 2-14441-WSP-03-DR

SHEET NO: CIV-712
REVISION: A

Appendix B – Safety in Design Register

Ref	Date Identified	Project Stage and Element	Project Work Element	Identified Hazards	Hazard Owner	Existing Controls	Initial Risk Rating			How is hazard managed in design?		Document Reference	Residual Risk Rating			Residual Risk Owner	Risk Status	Additional Requirements / Comments
							Consequence	Likelihood	Risk Rating	Eliminated / Minimised Can I identify, reduce or control the risk so harm is unlikely or less serious?	Hierarchy of Control		Consequence	Likelihood	Risk Rating			
		Construction Maintenance Disposal/ Demolition	E.g. Specifics, work package, location (if required)	Identify health and safety hazards that may arise from the design and ensure there are no resulting risks to their health and safety. How could someone be injured during the life of this component? Can I influence this hazard through my design?	Contractor	Controls that are already in place without any design treatment. E.g. existing requirements	High	Critical	High	Eliminated / Minimised Can I identify, reduce or control the risk so harm is unlikely or less serious?	Where is Design treatment shown e.g. drawing number, specification etc.	High	Critical	High	Contractor	Open	For any hazards that have a residual risk other than 'Low', record what additional conditions (if any) the residual risk owner should be aware of to minimise the safety risk of those using the structure. Or if risk has been cancelled, justification for cancellation.	
15	25/07/2025	Construction	Work within the Floodplain	The safety hazard is: The contractor, plant and machinery gets trapped/managed or lost during a significant flood event. The potential consequence of this safety hazard is: Injury or death, debris and/or loss of property.	Contractor	NA	High	Critical	High	This is risk not managed via the design.	N/A	High	Critical	High	Contractor	Open	Residual Environmental Risk and H&S risk to be managed by the contractor's Construction Management Plan.	
16	25/07/2025	Construction	Temporary Traffic Management	The safety hazard is: The restriction of vehicle movement through the work site delaying emergency services. The potential consequence of this safety hazard is: The restriction work will cause delays to road users and emergency services due to lack of alternative access routes to private properties	Contractor	NA	High	Critical	High	This is risk not managed via the design.	N/A	High	Critical	High	Contractor	Open	The Contract shall manage and save the TTM requirements with WDC prior to commencing works. TTM to ensure a clear lane at all times or shall provide an alternative temporary access route.	
17	25/07/2025	Construction	Existing Sewer Pipe	The safety hazard is: The stop bank will cross a sewer line. Works could damage the pipeline. The potential consequence of this safety hazard is: Exposure of sewer or effluent, the contamination of the downstream environment.	Contractor	Sewer is underground.	High	Critical	High	The sewer pipe has been identified on the drawings and the proposed stopbank should not affect it.		High	Critical	High	Contractor	Open		
18	25/07/2025	Construction	Scour protection	The safety hazard is: Manual handling of RigRap and Reno Mattress The potential consequence of this safety hazard is: Workers injury.	Contractor	NA	High	Critical	High	Reno Mattress was proposed because of the lack of good-quality rock within the region. The extent of the Reno mattress was kept to the strict minimum.		High	Critical	High	Contractor	Open		
19	25/07/2025	Construction	Construction works on or near a road	The safety hazard is: Being struck by a vehicle The potential consequence of this safety hazard is: Death or serious injury	Contractor	NA	High	Critical	High	This is risk not managed via the design.		High	Critical	High	Contractor	Open	Risk to be managed through the contractor's TMP.	
20	30/07/2025	Operation	Roads	The safety hazard is: reduced line of sight because have to drive over the stopbank The potential consequence of this safety hazard is: Death or serious injury	Client / WDC	The road is flat and straight and this risk does not currently exist.	High	Critical	High	The design will be updated during the detailed design phase to improve the sight distance.		High	Critical	High	Client / WDC	Open	Risk to be discussed during the detailed design phase.	
21	31/07/2025	Operation	Roads	The safety hazard is: sight cones where the roads come over the stop banks with oversized vehicles encroaching the opposite lanes. Potential consequence of this safety hazard is: Death or serious injury	Client / WDC	The road is flat and straight and this risk does not currently exist.	High	Critical	High	The design will be updated during the detailed design phase to improve the alignment.		High	Critical	High	Client / WDC	Open	Risk to be discussed during the detailed design phase.	
22	31/07/2025	Operation	Floodway	The safety hazard is: People accessing the floodway during an event, or even outside of any rain event for recreational purposes. Potential consequence of this safety hazard is: Death or serious injury	Client / WDC	NA	High	Critical	High	The design will include a fence running along the toe of the floodway, with a road gate at each road intersection (x-3).	Engineering Controls	High	Critical	High	Client / WDC	Open	Risk to be discussed during the detailed design phase.	
23	31/07/2025	Operation	Floodway	The safety hazard is: People accessing the floodway for recreational purposes. To prevent this, the design will look at installing preventive measures to reduce the risk of people accessing the floodway. Potential consequence of this safety hazard is: Death or serious injury	Client / WDC	NA	High	Critical	High	To be reviewed during the detailed design phase.	Engineering Controls	High	Critical	High	Client / WDC	Open	Risk to be discussed during the detailed design phase.	
24	31/07/2025	Operation	Floodway	The safety hazard is: People's feeling trapped during a flood event, behind the floodway, with no emergency access available. Potential consequence of this safety hazard is: People's anxiety, lack of access to emergency services for a few hours.	Client / WDC	NA	High	Critical	High	To be reviewed during the detailed design phase. (When option is selected, other to be discussed - although these items are unlikely to be within the scope of this project).	Engineering Controls	High	Critical	High	Client / WDC	Open	Risk to be discussed during the detailed design phase.	

Appendix C – Project Risk Register

Project Risk Register	
Project Name: Waioa Floodway Design Phase	
Project Number: 2025/001	
Risk Assessment completed by: WSP & HBRC	

Revision	Date	Comment	Reviewed by
1	5/02/2025	Developed concept design issue	Phil Duncan (HBRC) and Petra Burns (WSP)
2	10/02/2025	Final design for the floodway	Gerrine Hansen (HBRC) and Petra Burns (WSP)
3	30/10/2025	Risk register review by Gerrine Hansen and Petra Burns	Gerrine Hansen (HBRC) and Petra Burns (WSP)
1.4	27/11/2025	Updated for concept design report Rev 3	Petra Burns (WSP) and Jean-Louis Dubois (WSP)

Risk Identifier	Date Rated / Updated	Risk Description	Risk Cause(s)	Risk Consequence(s)	Current Risk Level	Current Likelihood	Current Consequence	Current Risk	Planned Mitigation	Residual Risk Level	Residual Consequence	Residual Likelihood	Residual Risk	Mitigation Owner	Risk Owner
1	22/05/2025	Funding - Insufficient budget to complete the works	Project exceeds the budget agreed with central government. Delays are lower than actual cost. Central government withdraws funding.	HBRC covers shortfall. Project cancelled. Inability of affected properties to get insurance. No other obvious alignments for floodway.	High	Possible	Severe	Severe	Robust cost estimates during the design phase to help choosing the most cost effective solutions. Delays are regularly updated. Keep central government informed.	Medium	Moderate	Possible	Moderate	WSP	HBRC
2	30/10/2025	Land not available for alignment agreed in proposal letter dated 5 July 2025 (or alternative, but similar, alignment)	Landowners decline to make required land available (including when a Maori properties)	Project cancelled or extra costs in order to prevent risk of securing. Inability of affected properties to get insurance.	Critical	Likely	Severe	Severe	Discussions with landowners. Understanding concerns and mitigating where possible with the design. More alignment if possible.	High	Severe	Possible	Severe	HBRC	HBRC
3	22/05/2025	Programme or design doesn't meet expectations (for clients, crown, stakeholders and/or community)	Expectations are not adequately understood or cannot be economically met. Conflicting expectations cannot be met.	Crown dissatisfied with performance. Pressure to meet unrealistic programme results in compromised design and the project is delayed as discovered issues are addressed iteratively.	Critical	Likely	Severe	Severe	Set realistic programme at project outset. Identify items that can be completed early. Timely decisionmaking at critical hold points so project can progress. Monitor and update programme regularly. Regular community engagement with community.	Medium	Moderate	Possible	Moderate	WSP, HBRC and Crown	HBRC
4	30/10/2025	Cultural impact assessment results in design change	Cultural impact assessment carried out after design is complete (concept or detailed)	Unacceptable cultural impacts result in design changes. Delays to programme, extra costs, possible extra consenting work required. Reputational damage.	High	Likely	Moderate	Moderate	On a OIA, identify and avoid areas where possible. Engage cultural monitor during physical works. Proactive iwi, hapu and PSE engagement.	Medium	Moderate	Possible	Moderate	HBRC and Crown	HBRC
5	4/06/2025	Extra consents required	Early enabling works so site works can start earlier caused by time pressure to get started on site.	Extra costs and time to obtain resource consent through the usual process (not OIC), may result in no programme advantage.	Medium	Possible	Moderate	Moderate	Extension of OIC area. Consider consenting requirements when planning early enabling works, and only plan works that do not require a separate resource consent.	Low	Minor	Unlikely	Minor	HBRC	HBRC
6	5/06/2025	Onerous consent conditions	Lack of robust consent application preparation. Short notice of OIC means that onerous conditions could be imposed.	Construction costs are higher than budgeted in order to comply with more onerous consent conditions.	Medium	Possible	Moderate	Moderate	WSP to work closely with Strategy who are preparing the consent application. Regular progress meetings with Strategy.	Low	Minor	Unlikely	Minor	WSP	HBRC
7	22/05/2025	Large seismic event damaging the stopbanks	Liquefaction risks will be assessed during the design phase, but will likely be uneconomic to mitigate by means of design.	Failure during an earthquake will require some repairs.	Low	Rare	Severe	Severe	Describe the risks clearly. Accept the risk. Clearly define the design rain event at the project outset, and communicate this to stakeholders. Manage stakeholder and public expectations. Consider other mitigation options in any identified remaining high-risk areas. Assess the risk.	Low	Severe	Rare	Severe	WSP and HBRC	HBRC
8	22/05/2025	Project is completed successfully but flooding still occurs	Rain event higher than the design rain event.	Adverse publicity. Property damage.	High	Rare	Extreme	Extreme	Clearly define the design rain event at the project outset, and communicate this to stakeholders. Manage stakeholder and public expectations. Consider other mitigation options in any identified remaining high-risk areas. Assess the risk.	High	Extreme	Rare	Extreme	HBRC	HBRC
9	22/05/2025	Project is completed successfully but flooding still occurs	Bar at river mouth is not open at the time of the rain event.	Adverse publicity. Property damage.	High	Possible	Severe	Severe	River bar management plan has been developed and implemented.	Medium	Severe	Unlikely	Severe	HBRC	HBRC
10	22/05/2025	Critical design criteria not confirmed and/or changes are made to design criteria	Time pressure means project progresses before there is sufficient time to confirm criteria properly, resulting in it either not being confirmed, or not being considered thoroughly meaning changes are requested later.	Delays and extra cost due to re-work being required.	Medium	Possible	Moderate	Moderate	Identify critical design criteria early. Conservative assumptions. Hold design criteria for confirmation. Timely confirmation of design criteria in Design Philosophy Statement. Acknowledge that any future change in design criteria could cause significant extra cost and programme delays.	Medium	Moderate	Possible	Moderate	WSP and HBRC	HBRC
11	10/06/2025	Design complexity higher than anticipated while the design assumptions have not changed - physical works cost estimate too low	Design cost estimate poorly developed.	Extra programme and costs delays. Reputational damage.	Medium	Possible	Moderate	Moderate	WSP to monitor, and manage. Understanding likely cost impact of design events. Allow sufficient contingency at concept design to cover items that are not yet evident. Regular comms with WSP to keep them updated.	Medium	Moderate	Unlikely	Moderate	WSP	WTP
12	31/10/2025	Overengineering/Underengineering	Not enough time for full optimising or optimisation so may not end up with the most cost effective solution	Higher cost than otherwise, or not having a robust enough solution	High	Likely	Moderate	Moderate	Understand likely cost impact of design assumptions. Consider allowing extra programme if that may result in cost benefits. Undertake further design refinement.	Medium	Moderate	Possible	Moderate	HBRC	HBRC
13	22/05/2025	Archaeological discovery	Unexpected archaeological discoveries occur.	Delays and time-related costs.	Medium	Possible	Moderate	Moderate	Undertake proactive steps. Undertake Archaeological Assessment. Apply for Archaeological Authority if assessment recommends this. Write Archaeological Mgt Plan if required.	Low	Minor	Unlikely	Minor	WSP	HBRC
14	22/05/2025	Delayed construction start	Procurement delays	Project delivery is delayed	Medium	Possible	Moderate	Moderate	Early development of procurement plan. Streamlined procurement process.	Medium	Moderate	Unlikely	Moderate	HBRC	HBRC
15	5/06/2025	Programme delays (reviews or inputs by others)	Delays because waiting for other parties e.g. HBRC, peer reviewers, Crown if they are involved in design reviews etc.	Programme delays.	Medium	Possible	Moderate	Moderate	Procure any external reviewers (e.g. peer reviewers) early. Monitor programme and keep reviewers updated with any changes. Regular design workshops to update all parties.	Medium	Moderate	Unlikely	Moderate	HBRC and Crown	HBRC
16	30/10/2025	Delays while waiting for decisions	Delays because waiting for parties to make a decision	Programme delays.	Medium	Possible	Moderate	Moderate	Regular collaborative workshops with decisions made by the end of the workshop.	Low	Minor	Unlikely	Minor	HBRC and Crown	HBRC
17	25/07/2025	Ecological impact assessment not done before consent application (See also Risk 43 for Wildlife Act Permit specific risk)	Not enough time for a full ecological impact assessment; only desktop study has been undertaken	More onerous consent conditions. Delays to construction programme because Wildlife Act permits may be required - these will need field work before permits are issued. Time for Wildlife Act permits is currently at least 6 months.	Medium	Possible	Moderate	Moderate	Identify areas where physical works can be undertaken without impacting ecology. Identify whether Wildlife Act Authority is likely to be required ASAP. If so, early engagement with DOC. Site visit has been undertaken to check for lizards, bats and wetlands. Next steps to be confirmed.	Low	Minor	Unlikely	Minor	WSP and HBRC	HBRC
18	30/10/2025	Ongoing discussions and engagement required with Waioa District Council.	Lack of engagement early in the design with WDC.	Extra programme and costs delays. Damaged relationship	Medium	Possible	Moderate	Moderate	WSP to engage with WDC in partnership with HBRC and the Crown to engage and incorporate their comments into design steps as appropriate. WDC has indicated willingness to compromise on geometric design which will aid in the updated road alignments. Also made decisions on Alexandra Park.	Low	Minor	Unlikely	Minor	WSP	HBRC
19	10/06/2025	WSP staff planned for this project are not available for the duration of the project.	Resignation, other commitments.	Extra programme and costs delays.	Medium	Possible	Moderate	Moderate	WSP to monitor, and manage/secure resources as required as long as the skills are similar.	Low	Insignificant	Unlikely	Insignificant	WSP	WSP
20	30/10/2025	Stormwater on landslide of stopbanks may require extra space	Stopbank toe assumed to be along property boundary	Encroaching into private property for swales where required. This could cause issues with some landowners, especially those who do not want to sell land. Could have an easement instead.	Medium	Possible	Moderate	Moderate	Identify critical areas and assess whether stormwater system needs to be provided. Crossing floodway to allow swales for stormwater system (this could be difficult where the floodway is constrained). Consider stormwater easements where land cannot be acquired.	Low	Minor	Unlikely	Minor	WSP	HBRC

Risk Identifier	Date Rated / Updated	Risk Description	Risk Cause(s)	Risk Consequence(s)	Current Risk Likelihood	Current Risk Consequence	Current Risk Level	Planned Mitigation	Residual Risk Likelihood	Residual Risk Consequence	Residual Risk Level	Risk Status	Mitigation Owner	Risk Owner
21	17/07/2025	Undermining stopbanks	Not addressing stormwater issues on landslide (i.e. letting it pond)	Geotechnical impacts on stopbanks causing them to undermine and possibly fail	Unlikely	Severe	Medium	Address stormwater issues in the design	Unlikely	Minor	Low	Live-Treat	WSP	WSP
22	17/07/2025	Project is cancelled because hydraulic model predicts that floodway and stopbanks will not provide adequate protection for 1% AEP event	Hydraulic model peer review comments not closed out/hydraulic calibration not complete before developed concept design phase	Project is cancelled	Unlikely	Extreme	High	Accept This is almost certainly not going to eventuate based on discussion (closed out) Could also consider alternative level of service	Rare	Severe	Low	Closed	HBRC	HBRC
23	17/07/2025	Design, rework because assumptions turn out to be invalid	Previous to complete developed concept design and detailed design in a very short timeframe before all site investigations are completed, before hydraulic modelling is completed, before hydraulic model is calibrated, before landowner approval is secured, before CFD is carried out.	The concept design, and possibly the detailed design, is based on assumptions that turn out to be invalid, and the design is cancelled. Delayed construction.	Possible	Severe	High	Accept Mitigate for specific risks where possible/conservative design	Possible	Severe	High	Live-Parked	HBRC	HBRC
24	17/07/2025	Final hydraulic modelling, CFD analysis or other detailed design activity shows unacceptable erosion	Hydraulic model was not finalised at concept stage - so velocities might change. CFD cannot be carried out during concept design phase due to compressed programme.	Hydraulic modelling/CFD modelling results show that a lot more erosion protection than expected is required - adds programme and cost to the design.	Possible	Moderate	Medium	Allow for erosion protection in concept design. Allow for extra erosion protection in SOQ and cost estimate.	Possible	Minor	Medium	Live-Treat	WSP	HBRC
25	30/10/2025	Consequential flooding assessment submitted with consent application is inaccurate	CEA based on earlier iteration of 1CA alignment. There was not enough time to model the updated 1CA alignment (and the peer review/calculation was not completed)	CEA may not be completely accurate. It may show more or less flooding effects.	Possible	Minor	Medium	Accept. This might be a consent condition. Review the CEA during the design and we can adjust if there's a change) Updated CEA to be provided in NFF package at end of Nov 2025.	Unlikely	Minor	Low	Live-Parked	HBRC	HBRC
26	17/07/2025	Site testing and investigations are delayed or incomplete due to wet ground conditions	Wet conditions on site delay investigations, or result in incomplete investigations.	Delay in site data could delay the detailed design. (Does not delay the developed concept design because that is being prepared based on previous testing and assumptions)	Likely	Minor	Medium	Further testing could be part of the contractor's early works (e.g. compaction and sub-grade) Geotechnical site investigations were successfully undertaken so this risk doesn't apply to those investigations.	Likely	Minor	Medium	Closed	HBRC	HBRC
27	17/07/2025	River erosion more than expected	More extensive erosion works required than earlier anticipated - this could come from updated hydraulic modelling.	Extra design, higher construction cost, etc.	Possible	Severe	High	Erosion risk workshop has been held with HBRC to explain the risks. Conservative assumptions used in design. Flowway width set based keeping velocity to an acceptable value where possible. Concrete or other scour protection to be used in areas of high velocity.	Possible	Moderate	Medium	Live-Treat	WSP	HBRC
28	17/07/2025	Tenderer pricing inaccurate	Tendering on developed concept design drawings and typical details/cross sections. The detailed design will have including changes to typical details and cross sections.	Tenderers may price extra risk into their rates. Many variations requests for design changes after pricing.	Likely	Severe	Critical	Allow for variations during physical works contract Allow sufficient contingency in cost estimate Set up regular collaborative workshops HBRC/Contractor with variation values agreed at workshops (reduce administrative burden and build relationships). Accept this risk at the design stage.	Likely	Moderate	High	Live-Treat	HBRC	HBRC
29	17/07/2025	Floodway alignment changes during detailed design phase	Landowners decline to make required land available for detailed design alignment - change from concept design alignment.	Programme delay and extra costs	Possible	Severe	High	Accept Good consistent comms with landowners and addressing potential concerns.	Possible	Severe	High	Live-Treat	Crown	HBRC
30	17/07/2025	Negative flood impacts discovered during detailed design after consent granted	Consent application based on developed concept design, not on detailed design	Extra delay and costs LOS and project is cancelled	Possible	Severe	High	Acceptance of lower LOS. Compensating affected landowners for impacting.	Possible	Moderate	Medium	Live-Treat	HBRC	HBRC
31	17/07/2025	Resistance to changes required at Alexandra Park	Useable space will be significantly reduced. Slare park removed and not rebuilt elsewhere.	Impacted users are unhappy Negative publicity Time and cost to address users' concerns	Possible	Moderate	Medium	Engage with users early to discuss likely impacts and how their needs can be met within the new constraints. WSP has been engaged to undertake this work. This work has concluded, and WDC has now confirmed stopbank alignment in vicinity of Alexandra Park. WSP to provide updated final confirmation in between approach end of embankment and WDC wall on Churchill Ave.	Unlikely	Minor	Low	Live-Treat	WSP	HBRC
32	30/07/2025	Not enough cut from the floodway to build all the stopbanks	Different expectations about floodway cut and fill - there would be "above ground" cut from the river. Not all the cut can be used to build stopbanks because some of the material is unsuitable. Also, it is possible that there is not enough suitable material recovered to build the stopbanks.	Likely that the stopbanks could be built above ground - expectations not met. If not enough suitable cut material, a borrow site will need to be found - extra costs to supply this material.	Likely	Moderate	High	There is an understanding between all parties that the above ground option is possible. Geotechnical site investigations have been undertaken to understand what material is present on the site. Likely fill site for unsuitable material has been located. Possible borrow sites from HBRC land outside of the floodway. As soon as a contractor is procured, they will be invited to attend a constructability review was carried out for earlier options and findings have been incorporated.	Possible	Moderate	Medium	Live-Treat	WSP	HBRC
33	30/07/2025	The 1CA design has not had a constructability review	Only at concept design phase, very short timeframe imposed	No constructability inputs from a contractor yet - they may pick up some issues that would alter the design	Possible	Moderate	Medium	As soon as a contractor is procured, they will be invited to attend a constructability workshop. It is possible.	Unlikely	Moderate	Medium	Live-Treat	WSP	HBRC
34	30/10/2025	Dewatering not undertaken in time	Dewatering to lower the groundwater table must take place before construction. The Showgrounds (a key dewatering location) not available until after mid January (16 Jan) next year.	Delays to construction programme	Likely	Moderate	High	Discuss possible options with contractor esp regarding sequencing might not impact overall completion date. Negotiate earlier access to Showgrounds. Preferred contractor has explained construction techniques that don't require dewatering.	Likely	Minor	Medium	Live-Treat	WSP, HBRC and Crown	HBRC
35	30/07/2025	Unclear finance and asset split between HBRC and WDC.	Lack of adequate communication, record keeping and written agreements	Relationship breakdown Unexpected costs to either party	Possible	Moderate	Medium	HBRC to communicate clearly with WDC. Joint workshops to clarify roles and responsibilities. Prepares/updates/review MOU.	Unlikely	Moderate	Medium	Live-Treat	HBRC	HBRC
36	1/08/2025	Damage to stopbanks from water flowing through floodway	Damage to stopbanks from water flowing through floodway	Stopbanks undermined. Stopbank's overtop or scour during flood event	Possible	Severe	High	Consider this in the design of the road geometry. Incorporate lessons learned from post-Gabriele reviews.	Unlikely	Severe	Medium	Live-Treat	WSP	HBRC
37	5/08/2025	Cut material not suitable for forming stopbanks	Cut material sensitivity to moisture	Cut materials to be dried to optimum moisture content if required, worst case - cut material mixed with additives (impure material) to make it useable. If too cost prohibitive, the project would not be achieved within the budget.	Possible	Severe	High	Initial compaction trials have been undertaken. Undertake further compaction trials to confirm the likelihood of this risk. Lowering groundwater level to help dry the soils. Accept the residual risk.	Unlikely	Severe	Medium	Live-Parked	WSP and HBRC	HBRC
38	30/10/2025	Waihiere Road cannot cross the floodway due to physical constraints	Lack of available space	Cannot achieve appropriate road geometry and alignment.	Possible	Severe	High	Consider relaxing design parameters although unsure if this will work Consider the use of flood gates (although they could have seismic risk) Consider the unconnected end of Waihiere Road to Waihiere Road	Possible	Severe	High	Live-Treat	WSP	HBRC
39	30/10/2025	Different stages of design being used in time (e.g. resource consent application)	Spread of project. Some items are still being optioneered. Some items are still being detailed. Some items are still in the same documents	Confusion for those preparing/processing the consent application. Could result in onerous consent conditions.	Possible	Minor	Medium	Clear discussions with planner so that the application is as clear as possible. Provide updated package of all relevant documents for NFF (2 Nov) - provide this to Strategy also for consent application.	Possible	Insignificant	Low	Live-Treat	WSP, HBRC and Strategy	HBRC
40	8/09/2025	Risk of instability at terrace edge (Railway Road)	HBRC/landowner desire to run stopbank alignment along the natural terrace	Bank collapse. Need to setback the stopbank from the edge of the terrace, affecting the stopping land.	Possible	Moderate	Medium	Alignment is still being confirmed - will reassess risk once the alignment is clearer. Stopbank has been shortened so overall lower impact on the land.	Unlikely	Insignificant	Low	Live-Treat	WSP and HBRC	HBRC
41	17/09/2025	Risk of having to undertake CFD again - if concrete time (or similar) option is used below Waihiere Rd	Narrower floodway will increase the velocity of the water where it exits the floodway and mixes with the river	Extra time and cost required (Approx \$300k)	Possible	Minor	Medium	Monitor whether this is required and if it is, carry it out as soon as possible	Possible	Minor	Medium	Live-Treat	WSP	HBRC
42	31/10/2025	Risk of continued erosion at the floodway entrance (whether engineered solution is used or not)	Spillway entrance is at/near a sharp bend in the river where a lot of natural erosion has occurred	Do nothing option: consequences as this erosion will continue. Do something option: consequence could still be that erosion could continue, especially if there is a significant seismic event	Likely	Moderate	High	Accept the risk. Consider what repairs are acceptable to HBRC over the long-term, as this may be more cost effective than an expensive, hard engineered solution upfront.	Possible	Moderate	Medium	Live-Parked	HBRC	HBRC

Risk Identifier	Date Rated / Updated	Risk Description	Risk Cause(s)	Risk Consequence(s)	Current Likelihood	Current Risk Consequence	Current Risk Level	Planned Mitigation	Residual Likelihood	Residual Risk Consequence	Residual Risk Level	Risk Status	Mitigation Owner	Risk Owner
43	7/10/2025	Wildlife Act permit requirement for lizards could cause delay to construction programme	Wildlife Act permit is required for lizards.	Lizard management plan and Wildlife Act permit need to be given early submission approval. Under the OTC, DoC work will require extra time and cost. If DoC does not approve the permit, more time and cost will be required to re-apply.	Likely	Moderate	High	Identify the area impacted by the Lizard Management Plan. Write the LMP and apply for the Wildlife Act permit ASAP. Undertake works in unaffected areas first if the Wildlife Act permit hasn't been approved yet.	Possible	Moderate	Medium	Live-Treat	WSP	HBRCC
43	29/10/2025	HBRCC Engineering team do not accept lower Freeboard departure	Freeboard optimised following WSP analysis (memo dated 21 Oct 2025). Shows that freeboard could be lowered in places to 400 mm (Freeboard could be increased to 410 mm and 550 mm)	Lower freeboard (therefore slightly) lower stopbanks - less fill. HBRCC Engineering team would need to accept this change in freeboard. This would result in increased construction costs.	Possible	Moderate	Medium	Get to discuss with HBRCC engineering team and keep them updated. Seek departure.	Possible	Moderate	Medium	Live-Treat	HBRCC	HBRCC
44	29/10/2025	Flood gates option used for NIFF deliverable package but there's a risk that they turn out to be unsuitable	HBRCC decision to proceed with flood gate option on Wairere Road, but no time for full optioneering.	Could have seismic issues; the gates could be very expensive to undertake providing access to neighbouring properties will be difficult so could also be very expensive. Flood gates could turn out to be unfeasible for technical reasons. Delayed construction - worst case pushes construction into another construction season. Cost implications for (incomplete project). Possible reputational damage.	Possible	Severe	High	Once the NIFF deadline has passed, get onto the detailed design of the flood gates ASAP to determine whether this risk is likely to eventuate. Allow some contingency in the NIFF stage cost estimate.	Possible	Moderate	Medium	Live-Treat	WSP	HBRCC
45	30/10/2025	Inclement weather conditions delaying construction	Inclement weather	Cost implications for (incomplete project). Possible reputational damage.	Possible	Severe	High	Timely delivery of requirements for contractors. Contractor has ability to resource up during the construction season. Appropriate sequencing of works.	Possible	Moderate	Medium	Live-Treat	WSP, HBRCC and contractor	HBRCC
46	27/11/2025	Erosion of the towside riverbank following installation of the floodway	Increased water velocity on the towside of the river	Erosion/slumping of the riverbank. Could impact on private land. Cost and delays. Possible reputational damage.	Possible	Severe	High	Set back the towside stopbank from the river as far as achievable. Consider the use of sheetpiles or timber walls if needed. Consider further modelling (scour based modelling and/or sediment transport modelling) to better understand the risk when floodway activated. Likelihood reduced because assumption that stopbank will be offset further from the river during detailed design.	Unlikely	Minor	Low	Live-Treat	WSP and HBRCC	HBRCC
47	27/11/2025	Avulsion risk	Erosion on (overbank) (at the floodway inlet) causing the river to change its main bed alignment to the floodway	The river chooses the floodway as its main channel	Unlikely	Extreme	High	Stabilise the floodway inlet to reduce risk of further regression and erosion. Additional scour protection at inlet. Concrete entry sill.	Rare	Extreme	High	Live-Treat	WSP and HBRCC	HBRCC
48	27/11/2025	Gradual riverbed modifications over time that could change the erosion risk along stopbank 3	Change in velocities at floodway outlet	Could modify risk 46 assessment	Almost certain		#N/A	Consequences unknown. Cannot assess this risk. Suggested mitigation as for risk 46. Consider further analysis to better understand the risk (scour based modelling and/or sediment transport modelling).	Almost certain		#N/A	Live-Parked		HBRCC
49							#N/A				#N/A			
50							#N/A				#N/A			

Appendix D – Cost Estimate Report



WAIROA FLOOD ALLEVIATION
DEVELOPED CONCEPT DESIGN

02 December 2025

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CONTACT

DETAIL	DESCRIPTION
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DOCUMENT STATUS	NAME	DATE
PREPARED BY	Julian Broughan	02.12.25
REVIEWED BY	Luke Donnelly	02.12.25
E-SIGNATURE APPROVED	Luke Donnelly	02.12.25

REVISION NO.	REVISION DATE	DRAFT.FINAL
00	20.11.25	DRAFT
01	20.11.25	DRAFT
02	02.12.25	FINAL

1 INTRODUCTION

WT Infrastructure (WT) has been engaged by WSP to prepare a developed concept design estimate for the Wairoa Flood Alleviation Project.

This report outlines our approach and outcomes for the project estimate. Please note that we previously developed a Schedule of Quantities (SOQ) for the bulk earthworks only, which has since been used to appoint the preferred tenderer for the project moving forward assuming its approval.

We have relied upon the following documents when preparing this estimate:

- WSP Drawing Pack – Issued for Tender Drawings – Wairoa Floodway Project – dated 06/08/2025.
- Multiple high-level sketches provided by WSP to update items such as roading, drainage, outlets structures, scour protection, retaining walls etc.
- Earthworks volumes provided by WSP for the floodway and stopbanks.
- Building / Dwelling / Shed demolition list provided by HBRC.
- WSP/HBRC provided risk register

2 FINANCIAL SUMMARY

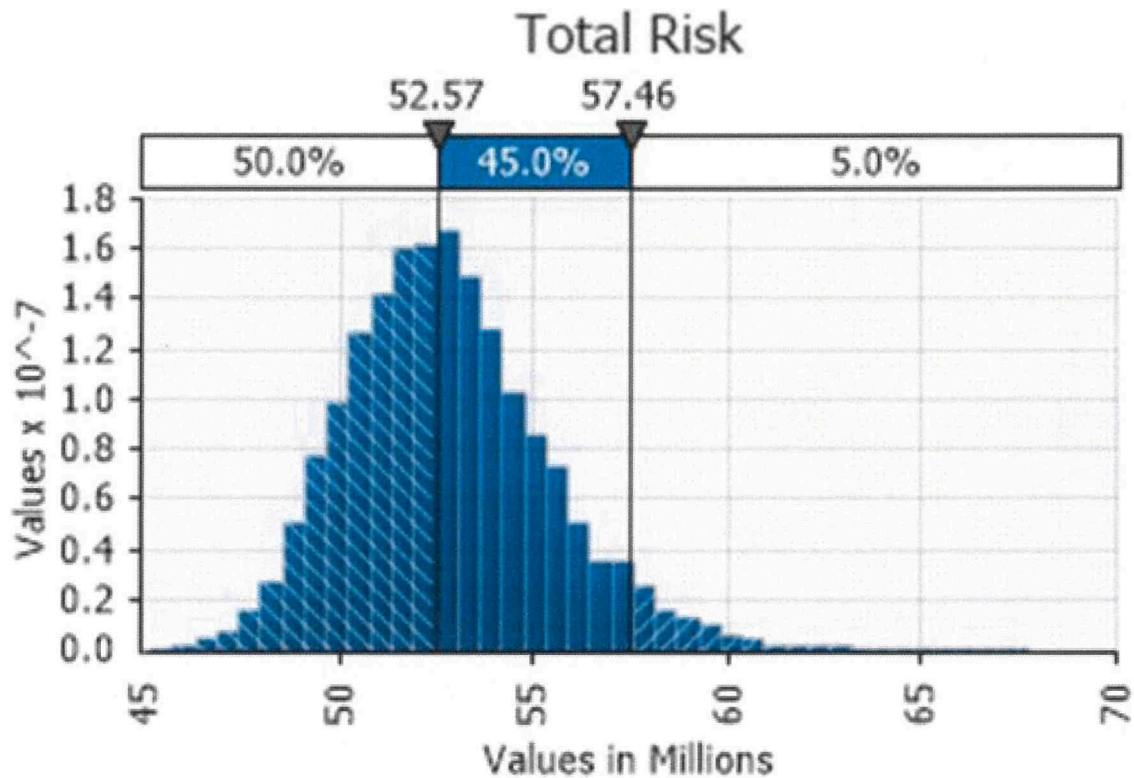
The below table provides a summary of the estimated project cost.

ITEM	DESCRIPTION	TOTAL
A	TOTAL PROPERTY COST	Excluded
B	TOTAL PROJECT DEVELOPMENT	Excluded
C	TOTAL PRE-IMPLEMENTATION	Excluded
D	TOTAL IMPLEMENTATION PHASE	44,410,649
E	PROJECT BASE ESTIMATE	44,410,649
F	CONTINGENCY (P50)	8,454,000
G	PROJECT EXPECTED ESTIMATE	52,864,649
H	FUNDING RISK CONTINGENCY (P95)	5,012,000
I	95th PERCENTILE PROJECT ESTIMATE	57,876,649

We have assumed several construction details and have made several assumptions and allowances throughout the estimate. Please refer to the full estimate breakdown under the Appendices and our list of clarifications and exclusions under section 4 of this report.

3 RISK AND CONTINGENCY

We have utilized the Wairoa Risk Register provided by WSP to develop a Quantitative Risk Analysis (QRA). We developed 3-point estimates for each risk and generally relied upon the likelihoods scores within the risk register. We have included a copy of the risk register in Appendix B along with the output report from the QRA. The distribution and contingency allowances for Wairoa is shown below:



These values have been back calculated as percentages and applied uniformly across the elemental estimate. The P50 contingency for this project is approximately 18.38% representing the value we expect to be within 50% of the time. The P95 contingency is 11.01%; representing the value we expect to be in 95% of the time. When accumulated with the P50 allowance, the total effective contingency at P95 is 29.39%.

4 ASSUMPTIONS, CLARIFICATIONS AND EXCLUSIONS

4.1 GENERAL ASSUMPTIONS, EXCLUSIONS AND CLARIFICATIONS

- Onsite Overheads have been included at 15%.
- Offsite Overheads have been included at 13%.
- Contingency has been developed through a QRA process utilising the risk register provided by WSP. This has given us a P50 contingency value of 18.38% and a P95 contingency value of 11.01%. Combined this is 29.31%. Note that WT has included an extra risk for soft ground remediation works which was not included in the original provided risk register.
- The implementation fees for the project have been provided by HBRC. These have been hard typed into our summary page.
- We have received multiple high-level sketches / mark ups from WSP to quantity and price items such as drainage, roading, retaining walls, outlets, scour protection etc. It is understood that these will be provided in more detail as the project progresses into detailed design.
- Some construction details have been assumed. We have built up our rates using knowledge from similar projects.
- Where applicable, we have utilised the preferred contractors' rates. These relate primarily to earthworks only.
- Programme duration has been assumed to be 12 months. It is understood that this would be run over 2 x earthworks seasons.
- We have made provisions for approximately 1500m of temporary cut of drains, which we will be utilised during the bulk earthworks of the floodway.
- Pole plating allowance have been included as per the previous estimate update.
- Allowances have been made for mobilisation and demobilisation of key plant and equipment.
- Allowances have been included for temporary roadways to both Ruataniwha and Waihirere Road. These have been included as per marked up sketch by WSP, which covers 3 separate temporary road stages.
- Allowance has been made for temporary haul road for carting. This is approximately 1500m long.
- A provisional allowance of 6000m of fencing has been assumed to be removed.
- An allowance of \$128k has been included to demolish the existing skatepark.
- Allowances have been made for removal of all vegetation including grass, low shrubs, and trees. The exact extent of these is unknown at this stage.
- An allowance of 2 months has been included for an arborist to clear existing trees. It is understood that this may not be required and potentially could be done cheaper by the main contractor.
- Allowance for demolition of existing residential houses, sheds and small dwellings has been included as per HBRC information. This has given us a value of \$305k.
- A high-level quote from Elliott Calendar for relocation of the existing Ski Club has been included at \$285k.
- It has been assumed that all extra over cut material not required for filling of stopbanks, will be removed to the disposal site located to the northwest of the floodway. This volume is approximately 150,000m³.
- WSP Volumes have been used for all areas relating to areas, cut and fill volumes.
- It has been assumed that site won material will be used for the construction of all stopbanks.
- Reno mattresses rock supply has been sourced from Saddle Lime Quarry with trucking of the material sourced from ACM in Napier. The area of this has been included as per WSP sketch.
- Allowance for testing have been assumed for each stopbank.
- We have made an allowance for 160m of Terramesh MSE wall on Stopbank 3.
- An allowance of approximately 50,000 m² of TRM Enkamat has been included as per WSP sketch. Supply of this product has been from Geofabrics.
- The floodway outlet has been included as per WSP sketch. This is a 100m x 60m x .25m thick reinforced concrete slab. It also has a 1m high thickening to the perimeter.

- The concrete sill inlet structure has been assumed to be 220m x 11m x 0.5m as per WSP sketch.
- It has been assumed that 25% of the new road surface and the concrete inlet and outlet structures will require soft ground remediation using 300mm AP65 with geotextile wrapping.
- An allowance of \$50k has been included for disposal of contaminated hotspots.
- It has been assumed that the swale drain is 2.5m thick and .8m deep. It has been assumed this will have a rock/aggregate backfill with a perforated pipe. The total length of these has been included as per WSP information.
- An allowance has been included for concrete swale drain. This has been assumed to be insitu concrete with a FRP grate covering.
- Floodway drainage has been included as per the Awakeri Drainage Limited Quote. This has been adjusted to \$500k as per instruction from HBRC.
- It has been assumed that a 300mm culvert and headwall is required at each property access ramp.
- An allowance for a 600mm culvert and headwall has been assumed at 100m intervals across the roadway where applicable.
- An allowance for 20 HDPE 300mm flap gates has been made for all existing culverts on the town side.
- An allowance of 500m of subsoil drainage has been made as per WSP instruction. Another 693 m of subsoil drain has also been included to run along the lengths of the new retaining wall structures.
- Aggregate and concrete supply has been included as per conversations with QRS.
- Pavements for Ruataniwha Road and Waihirere Road have been included as per WSP sketch. Typical section 5 pavement refers to the road which lies outside of the floodway channel and is not required to be cement stabilised. Typical section 6 pavement refers to the section of road which lies within the floodway and is required to be cement stabilised.
- An allowance has been made for AP65 aggregate and chipseal to form ramps for property access.
- Provision has been included for a 27m x 5m x .25m reinforced concrete boat ramp.
- An allowance has been made to form access ramps for both the Ski Club and Adventure Wairoa.
- An allowance has been made to redirect or lower existing water mains where it has been affected by stopbanks and floodways.
- Retaining walls have been included as per WSP documentation and sketches. These have all been priced as insitu reinforced concrete.
- Allowances have been included for signage and road marking.
- An allowance of 606m has been included to underground existing services across the floodway channel. This includes power, communications and water only.
- An allowance has been included to hydroseed floodway base channel.
- Allowance has been included to hydroseed embankment sides on the stopbanks
- It has been assumed that a 5m width each side of the construction zone will be required to be tidied up using hydroseed.
- Waterforce has provided costing to supply and install the 12m x 3.5m steel floodgates. This is a high-level quote due to minimal information and is subject to change.
- We have included an extra over allowance for forming a concrete channel and thickening the retaining wall to each gate location. We have also made allowance for trenching and cabling to connect the gate units to power.
- An allowance has been included to reinstate new farm fencing. The exact allowances of this is unknown but we have assumed the full length of all of the stopbanks as a starting point.
- Traffic Management allowances have been built up on the assumption of proposed crew and equipment for 52 weeks only.
- An allowance of \$10k has been included to relocate the existing flying fox. The exact cost of this is unknown.
- An allowance of \$1million has been included for a new skatepark as per instruction from HBRC.

4.2 EXCLUSIONS

- GST.
- Project Development Fees.
- Pre-Implementation Fees.
- Legal or marketing costs.
- Escalation.
- Operational costs/downtime due to operations.
- Removal of large / unforeseen ground objects.
- Contaminated waste disposal.
- Land and Property Acquisition costs.
- Sunk Costs.
- Geotechnical Investigations.
- Imported Fill material to stopbank formation.
- Management costs associated with Implementation phase.



APPENDIX A

Estimate Breakdown

Project Name: Wairoa Flood Alleviation

Item	Description	Base Estimate	Contingency	Funding Risk Contingency
A	Property Purchase and Compensation Costs	Excl	Excl	Excl
	Property Owner Accommodation Works	Excl	Excl	Excl
	Property Consultancy Fees	Excl	Excl	Excl
	Total Property Cost	Excl	Excl	Excl
B	Project Development Phase			
	- Consultancy Fees	Excl	Excl	Excl
	- Management Costs	Excl	Excl	Excl
	Total Project Development	Excl	Excl	Excl
C	Pre-implementation Phase			
	- Consultancy Fees	Excl	Excl	Excl
	- Management Costs	Excl	Excl	Excl
	- Geotechnical Investigation	Excl	Excl	Excl
	Total Pre-implementation	Excl	Excl	Excl
D	Implementation Phase			
	Implementation Fees			
	- Consultancy Fees	2,260,000	678,000	339,000
	- Waka Kotahi Managed Costs (Form G)	Excl	Excl	Excl
	- Consent Monitoring	260,000	78,000	39,000
	Sub Total Base Implementation Fees	2,520,000	756,000	378,000
	Physical Works			
	1 Environmental Compliance	1,415,935	260,000	156,000
	2 Earthworks	17,549,649	3,225,000	1,933,000
	3 Ground Improvements	296,147	54,000	33,000
	4 Drainage	2,150,711	395,000	237,000
	5 Pavement and Surfacing	1,816,131	334,000	200,000
	6 Bridges	0	0	-
	7 Retaining Walls	4,448,095	817,000	490,000
	8 Traffic Services	45,428	8,000	5,000
	9 Utility Services	521,160	96,000	57,000
	10 Landscaping	2,180,858	401,000	240,000
	11 Traffic Management	801,860	147,000	88,000
	12 Extraordinary Construction Costs	1,010,000	186,000	132,000
	13 Contractor's Onsite Overheads	4,835,396	889,000	532,000
14 Offsite Overheads and Profit	4,819,278	886,000	531,000	
Sub Total Base Physical works	41,890,649	7,698,000	4,634,000	
	Total for Implementation Phase	44,410,649	8,454,000	5,012,000
E	Project Base Estimate (A+C+D)	44,410,649		
	Project Base Estimate (rounded)	44,500,000		
ESC	Escalation	Excl	Excl	Excl
F	Contingency (Assessed/Analysed)	(A+C+D)	8,454,000	
G	Project Expected Estimate	(E+F)	52,864,649	
	Project Expected Estimate (rounded)		52,900,000	
	Total Property Cost Expected Estimate		Excluded	
	Project Development Phase Expected Estimate		Excluded	
	Pre-implementation Phase Expected Estimate		Excluded	
	Implementation Phase Expected Estimate		52,864,649	
H	Funding Risk Contingency (Assessed/Analysed)		(A+C+D)	5,012,000
I	95th percentile Project Estimate		(G+H)	57,876,649
	95th percentile Project Estimate (rounded)			57,900,000
	Total Property Cost 95th percentile Estimate		Excluded	
	Project Development Phase 95th percentile Estimate		Excluded	
	Pre-implementation Phase 95th percentile Estimate		Excluded	
	Implementation Phase 95th percentile Estimate			57,876,649
Date of Estimate	4Q2025			
Estimate prepared by	Julian Broughan			
Estimate internal peer review by	Luke Donnelly			
Estimate external peer review by	n/a			
Estimate accepted by Waka Kotahi project manager	n/a			

WAIROA FLOOD ALLEVIATION

DEVELOPED CONCEPT DESIGN ESTIMATE

November 2025



Item	Description	Quantity	Unit	Rate	Total (\$)
1.00	Environmental Compliance				1,415,935
	<u>Dust Suppression</u>				
1.01	Allowance for water trucks	12	month	47,667	572,000
1.02	Silt Fences	4,234	m	25	105,850
1.03	Allowance for movement of silt fences to suit staging	1	item	60,000	60,000
	<u>SW Management</u>				
1.04	Allowance for cut off drains	1	LS	78,735	78,735
1.05	Retention Pond	1,500	m3	70	105,000
1.06	Ongoing management of sediment pond during duration of works	12	months	5,000	60,000
	<u>Pole Planting</u>				
1.07	Allowance to reinforce lower banks using willow pole plating to improve scour resistance	43,435	m2	10	434,350
2.00	Earthworks				17,549,649
	Temporary Works				
	<u>Mobilisation and Demobilisation</u>				
2.01	Mobilisation and Demobilisation of key plant and equipment	1	item	35,000	35,000
	<u>Temporary Road Ways</u>				
2.02	Allowance for temporary public roads during construction	1	item	1,080,721	1,080,721
	<u>Haul Roads</u>				
2.03	Allowance for forming haul roads including maintenance and removal upon completion	1	item	458,550	458,550
	Demolition and Site Clearance				
	<u>General</u>				
2.04	Sawcut existing roadway	28	m	15	420
2.05	Breakout existing roadway and dispose off-site	11,340	m2	25	283,500
2.06	Demolish existing farm fence and dispose off-site	6,000	m	20	120,000
2.07	Removal of existing power pole along existing roadways	15	no	5,000	75,000
2.08	Remove vegetation and dispose off site (grass, low shrubs, small trees)	252,018	m2	5	1,260,090
2.09	Remove vegetation and dispose off site (medium / large trees) using an arborist	1	item	360,000	360,000
2.10	Breakout and dispose off existing concrete skatepark	1,600	m2	80	128,000
	<u>Buildings</u>				
2.11	Demolish existing sheds / small dwellings / residential housing	1	item	305,000	305,000
2.12	Relocate Ski Club back into Reserve	1	item	285,000	285,000
	Earthworks				
	Stockpile Site				
2.12	Allowance for preparation of stockpile site including works during construction	202,135	m2	6	1,168,451

WAIROA FLOOD ALLEVIATION

DEVELOPED CONCEPT DESIGN ESTIMATE

November 2025



Item	Description	Quantity	Unit	Rate	Total (\$)
Floodway					
<u>Topsoil Strip</u>					
2.13	Strip topsoil to stockpile - 300mm thick assumed	60,501	m3	16	957,731
2.14	Respread topsoil from stockpile upon completion (300mm thick)	60,501	m3	15	877,265
<u>Bulk Earthworks</u>					
2.15	Cut to stockpile material for stopbank construction	71,762	m3	8	594,189
2.16	Cart key material to disposal site	150,110	m3	13	1,936,419
<u>Reinforcement to Slipway</u>					
2.17	Reno Mattress including rock	420	m2	90	37,636
Stopbank 1					
<u>Topsoil Strip</u>					
2.18	Strip topsoil to stockpile - 300mm thick assumed	5,360	m3	15	77,720
2.19	Respread topsoil from stockpile upon completion (300mm thick)	5,360	m3	15	78,417
<u>Bulk Earthworks</u>					
2.20	Cart key material to disposal site (200mm thick)	3,573	m3	13	46,092
<u>Stopbank Formation</u>					
2.21	Form Stopbank using site won material	22,901	m3	14	316,034
2.22	Testing	208	no	200	41,600
Stopbank 2					
<u>Topsoil Strip</u>					
2.23	Strip topsoil to stockpile - 300mm thick assumed	6,629	m3	15	96,121
2.24	Respread topsoil from stockpile upon completion (300mm thick)	6,629	m3	9	56,877
<u>Bulk Earthworks</u>					
2.25	Cart key material to disposal site using Moxy (200mm thick)	4,419	m3	13	57,005
<u>Stopbank Formation</u>					
2.26	Form Stopbank using site won material	34,468	m3	15	526,671
2.27	Testing	186	no	200	37,200
Stopbank 3					
<u>Topsoil Strip</u>					
2.28	Strip topsoil to stockpile - 300mm thick assumed	3,118	m3	32	100,649
2.29	Respread topsoil from stockpile upon completion (300mm thick)	3,118	m3	38	118,733
<u>Bulk Earthworks</u>					
2.30	Cart key material to disposal site using Road Trucks (200mm thick)	2,079	m3	22	45,530
2.31	Cart from stockpile to site across river using Road Trucks	14,393	m3	22	313,767
<u>Stopbank Formation</u>					
2.32	Form Stopbank using site won material	14,393	m3	44	633,292
2.33	Allowance for terramesh wall	240	m2	1,113	267,060

WAIROA FLOOD ALLEVIATION
DEVELOPED CONCEPT DESIGN ESTIMATE
November 2025



Item	Description	Quantity	Unit	Rate	Total (\$)
2.34	Testing	124	no	200	24,800
	Floodway Outlet				
2.35	Turf Reinforcement Mat (TRM) Enkamat 7018 (Geofabrics)	49,975	m2	20	978,195
2.36	Concrete Slab - 100m x 60m x .25m	6,284	m2	347	2,179,438
2.37	Rectangular Concrete Baffles	64	no	1,850	118,400
	Floodway Sill				
2.38	Concrete Sill - 220m x 11m x .5m	2,420	m2	609	1,473,076
3.00	Ground Improvements				296,147
3.01	EO rate for disposal of contaminated materials		m3	500	Excluded
3.02	Allowance for disposal of contaminated hot spots	1	item	50,000	50,000
3.03	Allowance for soft ground remediation (assumed 25% of road and outlet area); assume 300mm undercut with AP65 backfill	1,552	m3	159	246,147
4.00	Drainage				2,150,711
	<u>Swale Drainage</u>				
4.01	Allowance for swale drain (assumed 2.5m wide x .8m deep) to stopbank 1	800	m	367	293,760
4.02	Allowance for swale drain (assumed 2.5m wide x .8m deep) to stopbank 2	400	m	367	146,880
4.03	Allowance for swale drain (assumed 2.5m wide x .8m deep) to stopbank 3	700	m	367	257,040
	<u>Concrete Swale</u>				
4.04	Concrete Swale	274	m	1,383	379,492
	<u>Floodway Drainage</u>				
4.05	Awakeri Drainage Limited Quote	1	LS	500,000	500,000
	<u>Culverts</u>				
4.06	DN300 culvert	90	m	600	54,000
4.07	DN600 culvert	108	m	1,200	129,600
	<u>Headwall</u>				
4.08	DN300 Headwall	36	no	2,500	90,000
4.09	DN600 Headwall	15	no	4,250	63,750
	<u>Flap Gates</u>				
4.10	Allowance for 300mm flap gate to existing culverts	20	no	4,650	93,000
	<u>Subsoil Drainage</u>				
4.11	Allowance for subsoil drainage to stopbanks	500	m	120	60,000
4.12	Allowance for perforated subsoil drainage pipe including surrounds to base of retaining wall	693	m	120	83,189
5.00	Pavement and Surfacing				1,816,131
	Carriageway - Ruataniwha Road				
	<u>Pavement - Typical Section 5</u>				
5.01	Subgrade preparation	4,736	m2	3	11,840

WAIROA FLOOD ALLEVIATION

DEVELOPED CONCEPT DESIGN ESTIMATE

November 2025



Item	Description	Quantity	Unit	Rate	Total (\$)
5.02	Construction Platform; Lean Mix Concrete 8-10MPa; 200mm thick	948	m3	275	260,700
5.03	Subbase; GAP65: 210mm thick	995	m3	130	129,350
5.04	Basecourse; M4 AP40; 100mm thick	474	m3	150	71,100
5.05	Surface course: 2 Coat Chipseal	4,736	m2	15	71,040
5.06	Allowance to tie in to existing surfaces	15	m	150	2,250
<u>Pavement - Typical Section 6 (Cement Stabilised)</u>					
5.07	Subgrade preparation	4,392	m2	3	10,980
5.08	Construction Platform; Lean Mix Concrete 8-10MPa; 200mm thick	879	m3	275	241,725
5.09	Subbase; GAP65 5% Cement Stabilised: 180mm thick	791	m3	210	166,110
5.10	Basecourse; M4 AP40 1.5% Cement Stabilised; 100mm thick	440	m3	230	101,200
5.11	Surface course: 2 Coat Chipseal	4,392	m2	15	65,880
Carriageway - Waihirere Road					
<u>Pavement - Typical Section 5</u>					
5.12	Subgrade preparation	1,859	m2	3	4,648
5.13	Construction Platform; Lean Mix Concrete 8-10MPa; 200mm thick	372	m3	275	102,300
5.14	Subbase; GAP65: 170mm thick	316	m3	130	41,080
5.15	Basecourse; M4 AP40; 100mm thick	186	m3	150	27,900
5.16	Surface course: 2 Coat Chipseal	1,859	m2	15	27,885
	Allowance to tie in to existing surfaces	14	m	150	2,100
<u>Pavement - Typical Section 6 (Cement Stabilised)</u>					
5.17	Subgrade preparation	981	m2	3	2,453
5.18	Construction Platform; Lean Mix Concrete 8-10MPa; 200mm thick	197	m3	275	54,175
5.19	Subbase; GAP65 5% Cement Stabilised: 170mm thick	167	m3	210	35,070
5.20	Basecourse; M4 AP40 1.5% Cement Stabilised; 100mm thick	99	m3	230	22,770
5.21	Surface course: 2 Coat Chipseal	981	m2	15	14,715
Property Ramps					
5.22	Allowance for property ramp access	18	no	2,125	38,250
Boat Ramp					
5.23	Allowance for concrete boat ramp; 27m long x 5m wide x 250mm thick	1	no	46,918	46,918
5.24	Allowance for ski club access ramp	1	no	161,174	161,174
5.25	Allowance for adventure wairoa access ramp	1	no	102,520	102,520
6.00	Bridges				-
	N/A				
7.00	Retaining Walls				4,448,095
	<u>Retaining Walls</u>				
7.01	Reinforced concrete retaining wall to outlet; 3600mm high x 350mm wide including foundation	693	m	6,151	4,264,290
7.02	Reinforced concrete retaining wall to earthbank-wall transition; 3600mm high x 350mm wide including foundation	15	m	12,419	183,805

WAIROA FLOOD ALLEVIATION

DEVELOPED CONCEPT DESIGN ESTIMATE

November 2025



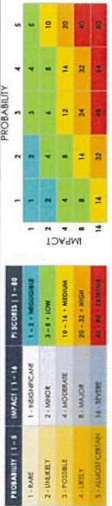
Item	Description	Quantity	Unit	Rate	Total (\$)
8.00	Traffic Services				45,428
	<u>Linemarking</u>				
8.01	Allowance for linemarking	1	item	24,337	24,337
	<u>Signage</u>				
8.02	Allowance for signage	1	item	21,092	21,092
9.00	Utility Services				521,160
	<u>Shared Utilities Trench</u>				
9.01	Allowance for shared utilities trench	606	m	300	181,800
	<u>Power</u>				
9.02	Allowance to underground existing overhead power	606	m	270	163,620
	<u>Communications</u>				
9.03	Allowance to underground existing fibre	606	m	140	84,840
	<u>Water</u>				
9.04	Allowance to lower existing watermain below floodway	606	m	150	90,900
10.00	Landscaping and Urban Design				2,180,858
	<u>Soft Landscaping</u>				
10.01	Hydroseed to base of floodway	201,668	m2	1	100,834
10.02	Hydro seed to embankment	50,350	m2	1	25,175
10.03	Allowance for reinstatement to embankment perimeter	13,545	m2	1	6,773
	<u>Hard Landscaping</u>				
10.04	12m long x 3.5m high steel floodgate complete	2	no	949,943	1,899,886
10.05	Allowance for new farm fencing	4,234	m	35	148,190
11.00	Traffic Management				801,860
11.01	Traffic Management Allowance	1	item	801,860	801,860
12.00	Extra Ordinary Costs				1,010,000
12.01	Allowance to relocate existing flying fox	1	item	10,000	10,000
12.02	Allowance for new concrete skatepark	1	item	1,000,000	1,000,000
				Sub-total	32,235,975
13.00	Contractor's Onsite Overheads	32,235,975	%	0.15	4,835,396
14.00	Contractor's Offsite Overheads & Profit	37,071,371	%	0.13	4,819,278
				Construction Total	41,890,649



APPENDIX B

Risk Register and QRA

Project Risk Register
 Wairoa Floodway Design Phase
 Project Name:
 Project Number:
 Risk Assessment completed by: WSP & HBRC



Risk Identifier	Date Rated/Updated	Risk Description	Risk Cause(s)	Risk Consequence(s)	Current Likelihood	Current Consequence	Current Risk Level	Planned Mitigation	Residual Risk Likelihood	Residual Risk Consequence	Residual Risk Level	Risk Status	Mitigation Owner	Risk Owner
1	22/05/2025	Funding - insufficient budget to complete the works	Project exceeds the budget agreed with central government. Initial estimates are lower than actual cost. Central government withdraws funding.	HBRC covers shortfall. Project cancelled. Adverse publicity. Inability of affected properties to get insurance. No other obvious alignments for floodway. Project cancelled or extra costs in order to prevent risk of scouring. Adverse publicity. Inability of affected properties to get insurance.	Possible	Severe	High	Robust cost estimates during the design phase to help choosing the most cost effective solutions. Cost estimates to be regularly updated. Keep central government informed.	Possible	Moderate	Medium	Live-Treat	WSP	HBRC
2	30/10/2025	Land not available for alignment, agreed in proposal letter dated 9 July 2025 (or alternative, but similar, alignment)	Landowners decline to make required land available (including whenua Maori properties)	Project cancelled or extra costs in order to prevent risk of scouring. Adverse publicity. Inability of affected properties to get insurance.	Likely	Severe	Unacceptable	Discussions with landowners. Understanding concerns and mitigating where possible with the design. More alignment if possible.	Possible	Severe	High	Live-Treat	HBRC	HBRC
3	22/05/2025	Programme or design doesn't meet expectations (for client, crown, stakeholders and/or community)	Expectations are not adequately understood or cannot be met. Conflicting expectations cannot be met.	Adverse publicity. Crown dissatisfied with performance. Pressure to meet unrealistic programme results in compromised design and the project is delayed as discovered issues are addressed on the fly.	Likely	Severe	Unacceptable	Set realistic programme at project outset. Identify items that can be completed early. Timely decision-making at critical hold points so project can progress. Monitor and update programme regularly. Regular comms and engagement with community.	Possible	Moderate	Medium	Live-Treat	WSP, HBRC and Crown	HBRC
4	30/10/2025	Cultural impact assessment results in design change	Cultural impact assessment carried out, after design is complete (concept or detailed)	Unacceptable cultural impacts result in design changes - delayed programme, extra costs, possible extra consenting work required. Reputational damage.	Likely	Moderate	High	CIA to be completed as soon as possible. Once CIA available, appropriate design to protect areas where possible. Engage cultural monitor during physical works. Proactive whi, hapa and PSC engagement.	Possible	Moderate	Medium	Live-Treat	HBRC and Crown	HBRC
5	4/06/2025	Extra consents required	Early enabling works so site works can start earlier caused by time pressure to 'get started on site'	Extra consents and time to obtain resource consent through the local process (not OIC), may result in no programme advantage.	Possible	Moderate	Medium	Cession of OIC area. Arrangements when planning early enabling works, and only plan works that do not require a separate resource consent.	Unlikely	Minor	Low	Live-Treat	HBRC	HBRC
6	5/06/2025	Onerous consent conditions	Lack of robust consent application preparation. Short timeframe for consent under OIC means that onerous conditions could be imposed	Construction costs are higher than budgeted in order to comply with more onerous consent conditions.	Possible	Moderate	Medium	WSP to work closely with Strategy who are preparing the consent application. Strategy to check level of detail in assessment reports. Regular progress meetings with Strategy.	Unlikely	Minor	Low	Live-Treat	WSP	HBRC
7	22/05/2025	Large seismic event damaging the stopbanks	Liquefaction risks will be assessed during the design phase, but will likely be uneconomic to mitigate by means of design.	Failure during an earthquake will require some repairs.	Rare	Severe	Low	Describe the risks clearly. Insurance. Accept the risk. Confirm design criteria with HBRC (importance Levels etc)	Rare	Severe	Low	Live Parked	WSP and HBRC	HBRC
8	22/05/2025	Project is completed successfully but flooding still occurs	Rain event higher than the design rain event.	Adverse publicity. Property damage. Injury.	Rare	Extreme	High	Clearly define the design rain event at the project outset, and communicate this to stakeholders and public expectations. Monitor other mitigation options in any identified remaining high-risk areas. Freeboard, secondary flow paths etc. Accept the risk.	Rare	Extreme	High	Live Parked	HBRC	HBRC
9	22/05/2025	Project is completed successfully but flooding still occurs	Bar at river mouth is not open at the time of the rain event.	Adverse publicity. Property damage. Injury.	Possible	Severe	High	River bar management plan has been developed and implemented	Unlikely	Severe	Medium	Live Parked	HBRC	HBRC
10	22/05/2025	Critical design criteria not confirmed and/or changes are made to design criteria	Time pressure means project progresses before there is sufficient time to confirm criteria properly, resulting in it either not being confirmed, or not being considered thoroughly meaning changes are requested later.	Delays and extra cost due to re-work being required	Possible	Moderate	Medium	Identify critical design criteria early. Conservative assumptions. Hold workshops to discuss. Design criteria in Design Philosophy Statement. Acknowledge that any changes to design criteria could cause significant extra cost and programme delays.	Possible	Moderate	Medium	Live-Treat	WSP and HBRC	HBRC
11	10/06/2025	Design complexity higher than anticipated while the design assumptions have not changed - physical works cost estimate too low	Design cost estimate poorly developed	Extra programme and costs delays. Reputational damage.	Possible	Moderate	Medium	WSP to monitor, and manage. Understanding likely cost impact of design assumptions. Allow sufficient contingency at concept design to cover items that are not yet evident. Regular comms with WTP to keep them updated.	Unlikely	Moderate	Medium	Live-Treat	WSP	WTP
12	31/10/2025	Overengineering/Underengineering	Not enough time for full optioneering or optimisation so may not end up with the most cost effective solution	Higher cost than otherwise, or not having a robust enough solution	Likely	Moderate	High	Understand likely cost impact of design assumptions. Consider allowing extra programme if that may result in cost benefits. Accept. Undertake further design refinement.	Possible	Moderate	Medium	Live-Treat	HBRC	HBRC
13	22/05/2025	Archaeological discovery	Unexpected archaeological discoveries occur.	Delays and time-related costs.	Possible	Moderate	Medium	Undertake proactive steps: Undertake Archaeological Assessment. Apply for Archaeological Authority if assessment recommends this. Undertake Archaeological Protocol in place.	Unlikely	Minor	Low	Live-Treat	WSP	HBRC
14	22/05/2025	Delayed construction start	Procurement delays	Project delivery is delayed	Possible	Moderate	Medium	Timely delivery of design documents. Early development of procurement plan. Streamlined procurement process.	Unlikely	Moderate	Medium	Closed	HBRC	HBRC
15	5/06/2025	Programme delays (reviews or inputs by others)	Delays because waiting for other parties e.g. HBRC, peer reviewers, Crown if they are involved in design reviews etc.	Programme delays.	Possible	Moderate	Medium	Procure any external reviewers (e.g. peer reviewers) early. Early engagement and clear programme communicated. Monitor programme and keep reviewers updated with any changes. Regular design workshops to update all parties.	Unlikely	Moderate	Medium	Live-Treat	WSP, HBRC and Crown	HBRC
16	30/10/2025	Delays while waiting for decisions	Delays because waiting for parties to make a decision	Programme delays.	Possible	Moderate	Medium	Regular collaborative workshops with decisions made by the end of the workshop.	Unlikely	Minor	Low	Live-Treat	HBRC and Crown	HBRC
17	25/07/2025	Ecological impact assessment not done before consent application	Not enough time for a full ecological impact assessment; only desktop study has been undertaken	More onerous consent conditions. Delays to construction programme because Wildlife Act permits may be required - these will need final work before permits can be issued. Delays to resource consent time for Wildlife Act permits is currently at least 6 months.	Possible	Moderate	Medium	Identify areas where physical works can be undertaken without impacting early engagement with Wildlife Act Authority is likely to be required ASAP. If so, early engagement with DOC. Site visit has been undertaken to check for lizards, bats and wetlands. Next steps to be confirmed.	Unlikely	Minor	Low	Live-Treat	WSP and HBRC	HBRC

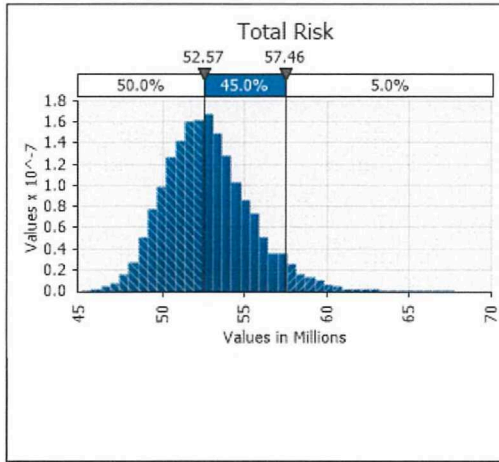
Risk Identifier	Date Raised / Updated	Risk Description	Risk Cause(s)	Risk Consequence(s)	Current Risk Likelihood	Current Risk Consequence	Current Risk Level	Planned Mitigation	Residual Risk Likelihood	Residual Risk Consequence	Residual Risk Level	Risks status	Mitigation Owner	Risk Owner
18	30/10/2025	Ongoing discussions and engagement required with Waioira District Council	Lack of engagement early in the design with WDC	Extra programme and costs delays. Damaged relationship	Possible	Moderate	Medium	WSP to engage with WDC in partnership with HBRC and the Crown to engage in meetings and workshops as appropriate. WDC has indicated willingness to compromise on geometric design which will aid in the updated road alignments. Also made decisions on Alexandra Park.	Unlikely	Minor	Low	Live-Treat	WSP	HBRC
19	10/06/2025	WSP's staff planned for this project are not available for the duration of the project.	Resignation, other commitments	Extra programme and costs delays.	Possible	Moderate	Medium	Identify critical areas and assess whether stormwater system needs to be provided. Prioritising floodway to allow space for stormwater system (this could be difficult where the floodway is constrained). Consider stormwater easements where land cannot be acquired.	Unlikely	Insignificant	Low	Live-Treat	WSP	WSP
20	30/10/2025	Stormwater on landside of stopbanks may require extra space	Stopbank toe assumed to be along property boundary	Encroaching into private property for swales where required. This could cause issues with some landowners, especially those who do not want to sell land. Could have an easement instead	Possible	Moderate	Medium	Provide extra space for stormwater system (this could be difficult where the floodway is constrained). Consider stormwater easements where land cannot be acquired.	Unlikely	Minor	Low	Live-Treat	WSP	HBRC
21	17/07/2025	Undermining stopbanks	Not addressing stormwater issues on landside (i.e. letting it pond)	Geotechnical impacts on stopbanks causing them to undermine and possibly fail	Unlikely	Severe	Medium	Address stormwater issues in the design	Unlikely	Minor	Low	Live-Treat	WSP	WSP
22	17/07/2025	Project is cancelled because hydraulic model predicts that floodway and stopbanks will not provide adequate protection for 1% AEP event.	Hydraulic model peer review comments not closed out/hydraulic model calibration not complete before developer concept design phase	Project is cancelled	Unlikely	Extreme	High	Accept (Note: This is almost certainly not going to eventuate based on discussion 31/07 - risk can be closed once peer review is closed out) Could also consider alternative level of service	Rare	Severe	Low	Closed	HBRC	HBRC
23	17/07/2025	Design rework because assumptions turn out to be invalid	Pressure to complete developed concept design and detailed design in a very short timeframe before all site investigations are completed, before hydraulic modelling is completed, before hydraulic model is calibrated, before landowner approval is secured, before CFD is carried out.	The concept design, and possibly the detailed design, is based on assumptions that turn out to be invalid, and the design needs significant rework. Extended design programme and extra costs. Delayed construction.	Possible	Severe	High	Accept Mitigate for specific risks where possible/conservative design	Possible	Severe	High	Live-Parked	HBRC	HBRC
24	17/07/2025	Final hydraulic modelling, CFD analysis or other detailed design activity shows unacceptable erosion	Hydraulic model was not finalised at concept design stage so velocities might change. CFD cannot be carried out during concept design phase due to compressed programme.	Hydraulic modelling/CFD modelling results show that a lot more erosion protection than expected is required - adds programme and cost to the design.	Possible	Moderate	Medium	Allow for erosion protection in concept design. Allow for extra erosion protection in SQO and cost estimate.	Possible	Minor	Medium	Live-Treat	WSP	HBRC
25	30/10/2025	Consequential flooding assessment submitted with consent application is inaccurate	CFA based on earlier iteration of 1C+ alignment. There was not enough time to model the updated 1C+ alignment (and the peer review/calibration was not complete)	CFA may not be completely accurate. It may show more or less flooding effects.	Possible	Minor	Medium	Accept This might be a consent condition (Can be checked during detailed design and we can advise if there's a change) Updated CFA to be provided in NIF package at end of Nov 2025.	Unlikely	Minor	Low	Live-Parked	HBRC	HBRC
26	17/07/2025	Site testing and investigations are delayed or incomplete due to wet ground conditions	Wet conditions on site delay investigations, or result in incomplete investigations.	Delay in site data could delay the detailed design. Does not delay the developed concept design because that is being prepared based on previous testing and assumptions.	Likely	Minor	Medium	Further testing could be part of the contractor's early works (e.g. compaction trials) Geotechnical site investigations were successfully undertaken so this risk doesn't apply to those investigations.	Likely	Minor	Medium	Closed	HBRC	HBRC
27	17/07/2025	River erosion more than expected	More extensive erosion works required than earlier anticipated - this could come from updated hydraulic modelling	Extra design, higher construction cost etc	Possible	Severe	High	Erosion risk workshop has been held with HBRC to explain the risks. Conservative assumptions used in design. Velocity width set based on keeping velocity to an acceptable value where possible. Concrete or other scour protection to be used in areas of high velocity.	Possible	Moderate	Medium	Live-Treat	WSP	HBRC
28	17/07/2025	Tenderer pricing inaccurate	Tendering on developed concept design drawings and typical details/cross sections. The detailed design will have changes, including changes to typical details and cross sections.	Tenders may price extra risk into their rates. Many variations requests for design changes after pricing	Likely	Severe	High	Allow for variations during physical works contract. Allow sufficient contingency in cost estimate. Set up regular collaborative workshops HBRC/Contractor with variation values agreed at workshops (reduce administrative burden and build relationships). Accept this risk at the design stage.	Likely	Moderate	High	Live-Treat	HBRC	HBRC
29	17/07/2025	Floodway alignment changes during detailed design phase	Landowners decline to make required land available for detailed design alignment - change from concept design not on detailed design	Programme delay and extra costs	Possible	Severe	High	Accept Good consistent comms with landowners and addressing potential concerns. Compensating affected landowners for impacting.	Possible	Severe	High	Live-Treat	Crown	HBRC
30	17/07/2025	Negative flood impacts discovered during detailed design after consent granted	Consent application based on developed concept design, not on detailed design	Extra delay and costs. Worst case finding that floodway does not meet the required LOS and project is cancelled	Possible	Severe	High	Accept lower LOS. Compensating affected landowners for impacting.	Possible	Moderate	Medium	Live-Treat	HBRC	HBRC
31	17/07/2025	Resistance to changes required at Alexandra Park	Usable space will be significantly reduced. Skate park removed and not rebuilt elsewhere.	Impacted users are unhappy. Negative publicity. Time and cost to address users' concerns	Possible	Moderate	Medium	Engage with users early to discuss likely impacts and how their needs can be met within the new constraints. WSP has been engaged to undertake this work. This work has concluded, and WDC has now confirmed stopbank alignment in most of Alexandra Park. WSP to provide updated layout for final confirmation between upstream end of campground and MSE wall on Church Ave.	Unlikely	Minor	Low	Live-Treat	WSP	HBRC
32	30/07/2025	Not enough cut from the floodway to build all the stopbanks	Different expectations about floodway cut and fill - there is more ground between Wahieru Road and the river. Not all the cut can be used to build stopbanks because some of the material is unsuitable. Also, it is possible that there is not enough suitable material recovered to build the stopbanks.	Unlikely that the stopbanks could be built above ground - expectations not met. If not enough suitable cut material, a borrow site will need to be found - extra costs to supply this material.	Likely	Moderate	High	There is an understanding between all parties that the above ground option is preferred. Geotechnical site investigations have been undertaken to understand what material is present on the site. Likely fill site for unsuitable material has been located. Possible borrow sites from HBRC land outside of the floodway. Convey the findings of the concept design to stakeholders.	Possible	Moderate	Medium	Live-Treat	WSP	HBRC
33	30/07/2025	The 1C+ design has not had a constructability review	Only at concept design phase, very short timeframe imposed	No constructability inputs from a contractor yet - they may pick up some issues that would alter the design	Possible	Moderate	Medium	Constructability review was carried out for earlier options and findings have been incorporated. As soon as a contractor is procured, they will be invited to attend a constructability workshop.	Unlikely	Moderate	Medium	Live-Treat	WSP	HBRC
34	30/10/2025	Dewatering to lower the groundwater table must take place before construction. The Showgrounds (a key dewatering location) not available until after mid-January (15 Jan) next year	Dewatering to lower the groundwater table must take place before construction. The Showgrounds (a key dewatering location) not available until after mid-January (15 Jan) next year	Delays to construction programme	Likely	Moderate	High	Understand the dewatering options that are possible. Discuss possible options with contractor esp regarding sequencing might not impact overall completion date. Negotiate earlier access to Showgrounds. Preferred contractor has explained construction techniques that don't necessarily need dewatering.	Likely	Minor	Medium	Live-Treat	WSP, HBRC and Crown	HBRC
35	30/07/2025	Unclear finance and asset split between HBRC and WDC.	Lack of adequate communication, record keeping and written agreements	Relationship breakdown. Unexpected costs to either party	Possible	Moderate	Medium	HBRC to communicate clearly with WDC. Joint workshops to clarify roles and responsibilities. Prepare/Update/review MOU.	Unlikely	Moderate	Medium	Live-Treat	HBRC	HBRC
36	1/08/2025	Damage to stopbanks from water flowing through floodway	Road "ramps" directing the flow up onto the stopbank	Stopbanks undermined. Stopbank's overtop or scour during flood event	Possible	Severe	High	Consider this in the design of the road geometry. Incorporate lessons learned from post-Cabreille reviews.	Unlikely	Severe	Medium	Live-Treat	WSP	HBRC

Risk Identifier	Date Raised / Updated	Risk Description	Risk Cause(s)	Risk Consequence(s)	Current Risk Likelihood	Current Risk Consequence	Current Risk Level	Planned Mitigation	Residual Risk Likelihood	Residual Risk Consequence	Residual Risk Level	Risk status	Mitigation Owner	Risk Owner
37	5/08/2025	Cut material not suitable for forming stopbanks	Cut material sensitivity to moisture	Cut materials to be dried to optimum moisture content. If (imported material) to make it useable. If too cost prohibitive, the project would not be achieved within the budget.	Possible	Severe	High	Initial compaction trials have been undertaken. Undertake further compaction trials to confirm the likelihood of this risk. Lowering groundwater level to help dry the soils. Accept the residual risk.	Unlikely	Severe	Medium	Live-Parked	WSP and HBRC	HBRC
38	30/10/2025	Wahiere Road cannot cross the roadway due to physical constraints	Lack of available space	Cannot achieve appropriate road geometry and alignment.	Possible	Severe	High	Consider relaxing design parameters (although unsure if this will work. Consider the use of flood gates (although they could have seismic risk) Connect the disconnected end of Wahiere Road to Ruataniwha Road	Possible	Severe	High	Live-Treat	WSP	HBRC
39	30/10/2025	Different stages of design being used in documents that are being submitted at the same time (e.g. resource consent application documents)	Speed of project. Some items are still being optioneered. Floodway alignment has been modified. Some things have changed from the concept design drawings, but they are the latest drawings that are available.	Confusion for those preparing/processing the consent application. Could result in onerous consent conditions.	Possible	Minor	Medium	Clear discussions with planner so that the application is as clear as possible provide this to Strategy also for consent application.	Possible	Insignificant	Low	Live-Treat	WSP, HBRC and HBRC Strategy	HBRC
40	8/09/2025	Risk of instability at terrace edge (Railway Road)	HBRC/handowner desire to run stopbank alignment along the natural terrace.	Bank collapse. Need to setback the stopbank from the edge of the terrace, affecting the cropping land.	Possible	Moderate	Medium	Alignment is still being confirmed - will reassess risk once the alignment is clearer. Stopbank has been shortened so overall lower impact on the land.	Unlikely	Insignificant	Low	Live-Treat	WSP and HBRC	HBRC
41	17/09/2025	Risk of having to undertake CFD again if concrete flume (or similar) option is used below Wahiere Rd	Narrower roadway will increase the velocity of the water where it exits the roadway and mixes with the river	Extra time and cost required (approx \$30K?)	Possible	Minor	Medium	Monitor whether this is required and if it is, carry it out as soon as possible Accept.	Possible	Minor	Medium	Live-Treat	WSP	HBRC
42	3/10/2025	Risk of continued erosion at the floodway entrance (whether engineered solution is used or not)	Spillway entrance is at/near a sharp bend in the river where a lot of natural erosion has occurred	Do nothing option-consequence is that erosion will continue. Testing option-consequence could still be that erosion could continue, especially if there is a significant seismic event	Likely	Moderate	High	Accept the risk. Consider what repairs are acceptable to HBRC over the long term, as this may be more cost effective than an expensive, hard engineered solution upfront.	Possible	Moderate	Medium	Live-Parked	HBRC	HBRC
43	7/10/2025	Wildlife Act Permit requirement for lizards could cause delay to construction programme	Wildlife Act permit is required for lizards.	Lizard management plan and Wildlife Act permit need to be written and submitted to DOC for approval. Under the OIC, DOC must respond within 20 working days. Undertaking this work will require extra time and cost. If DoC does not approve the permit, more time and cost will be required to re-apply.	Likely	Moderate	High	Identify the area impacted by the Lizard Management Plan. Write the LMP and apply for the Wildlife Act permit ASAP. Undertake works in unaffected areas first if the Wildlife Act permit hasn't been approved yet.	Possible	Moderate	Medium	Live-Treat	WSP	HBRC
44	29/10/2025	HBRC Engineering team do not accept lower freeboard departure	Freeboard optimised following WSP analysis (memo dated 21 Oct 2025). Shows that freeboard could be lowered in most locations below 600 mm (freeboard could be between 410 mm and 550 mm)	Lower freeboard therefore (slightly) lower stopbanks - less HBRC Engineering team would need to accept this change in design criteria. If they don't accept the departure, there will be re-work costs (design) and associated delays, and (slightly) increased construction costs.	Possible	Moderate	Medium	GH to discuss with HBRC engineering team and keep them updated. Seek departure.	Possible	Moderate	Medium	Live-Treat	HBRC	HBRC
45	29/10/2025	Flood gates option used for NIFF deliverable package but there's a risk that they turn out to be unsuitable	HBRC decision to proceed with flood gate option on Wahiere Road, but no time for full optioneering	Could have seismic issues; the gates could be very expensive once the structural design and mechanical design has been undertaken, providing access to very expensive. Flood gates could turn out to be unfeasible for technical reasons.	Possible	Severe	High	Once the NIFF deadline has passed, get onto the detailed design of the flood gates ASAP to determine whether this risk is likely to eventuate. Allow some contingency in the NIFF stage cost estimate.	Possible	Moderate	Medium	Live-Treat	WSP	HBRC
46	30/10/2025	Inclement weather conditions delaying construction	Inclement weather	Delayed construction - worst case pushes construction into another construction season. Further flood risk (for incomplete project) Possible reputational damage.	Possible	Severe	High	Timely delivery of requirements for contractors. Contractor has ability to resource up during the construction season. Contractor to identify and be prepared for weather-critical activities. Appropriate sequencing of works.	Possible	Moderate	Medium	Live-Treat	WSP, HBRC and contractor	HBRC
47	WT added this	Soft Ground Remediation	Poor ground conditions encountered onsite	Failed ground, time and cost impacts.	Likely	Moderate	High	Soft Ground Allowances	Likely	Moderate	High			

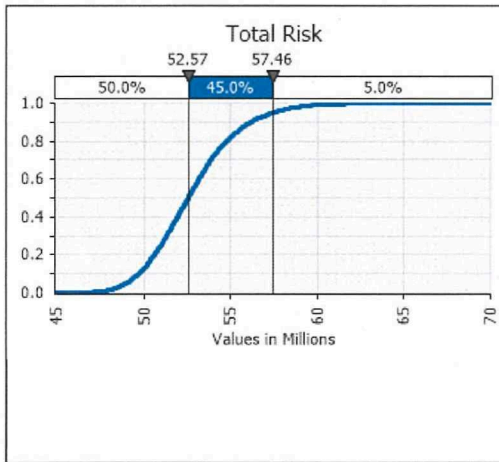


WAIROA FLOOD DEFENCE PROJECT - UPDATED CONCEPT QRA

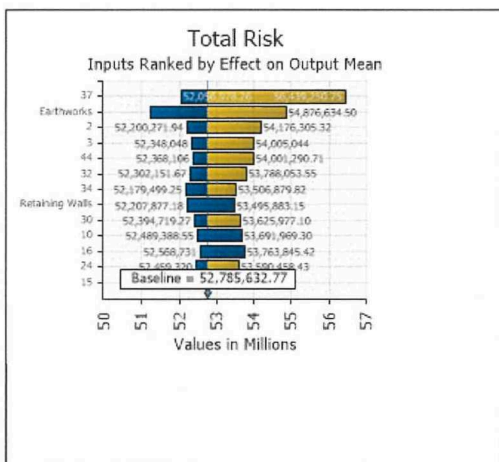
Report: Compact Output Report
 Performed By: Luke Donnelly
 Date: Thursday, 20 November 2025



Summary Statistics	
Statistic	Value
Minimum	45,191,676.40
Maximum	67,718,587.64
Mean	52,785,632.77
Std. Deviation	2,581,667.64
Variance	6.665E+012
Skewness	0.5993
Kurtosis	3.7723
Median	52,571,692.88
Mode	52,597,229
Left X	52,571,692.88
Left P	50%
Right X	57,462,277.15
Right P	95%

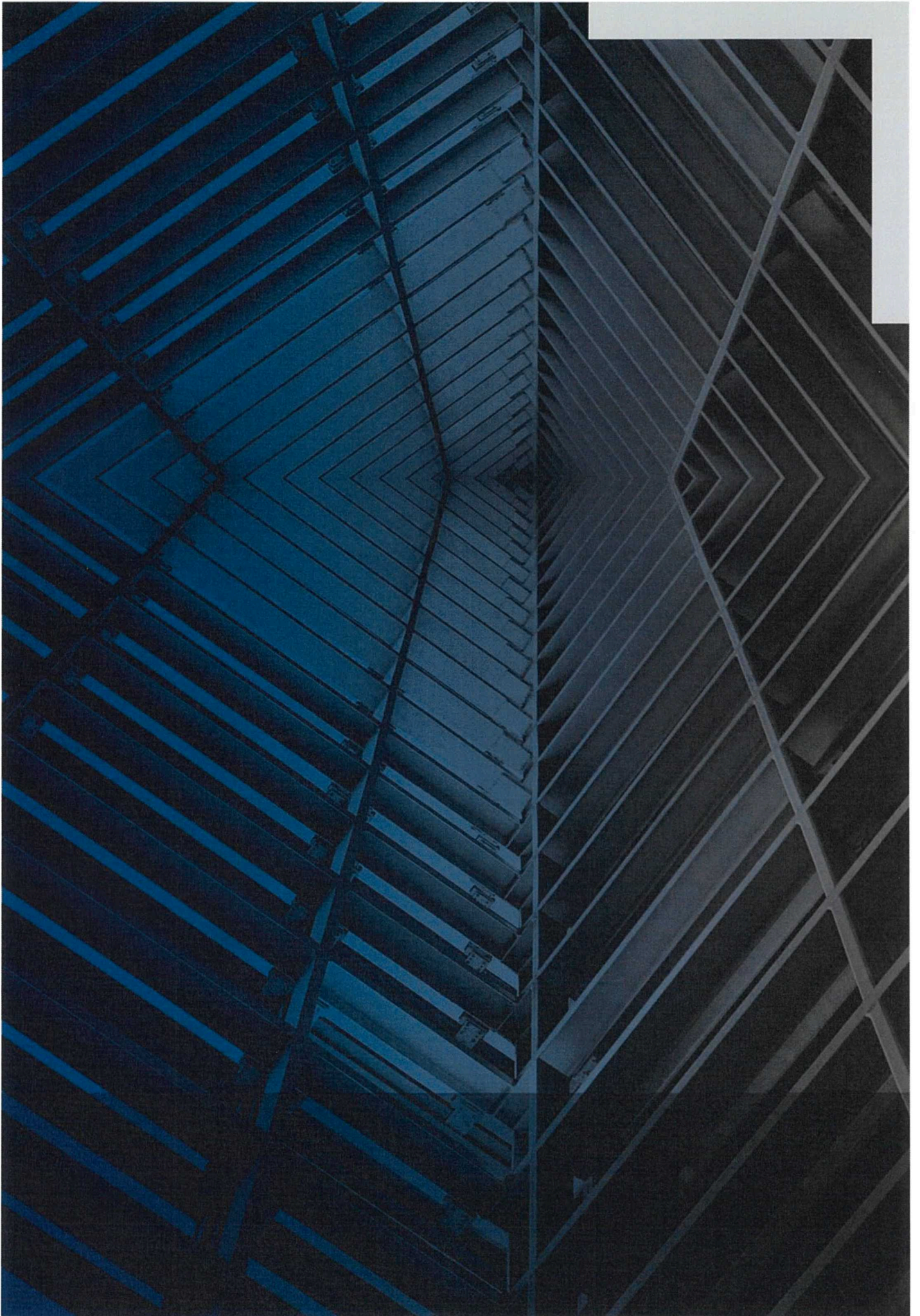


Percentiles	
Percentile	Value
1%	47,728,069.64
2.5%	48,416,251.29
5%	48,983,737.35
10%	49,676,403.84
20%	50,590,614.21
25%	50,980,164.37
50%	52,571,692.88
75%	54,290,948.27
80%	54,798,931.14
90%	56,165,539.87
95%	57,462,277.15
97.5%	58,498,921.43
99%	59,871,489.68



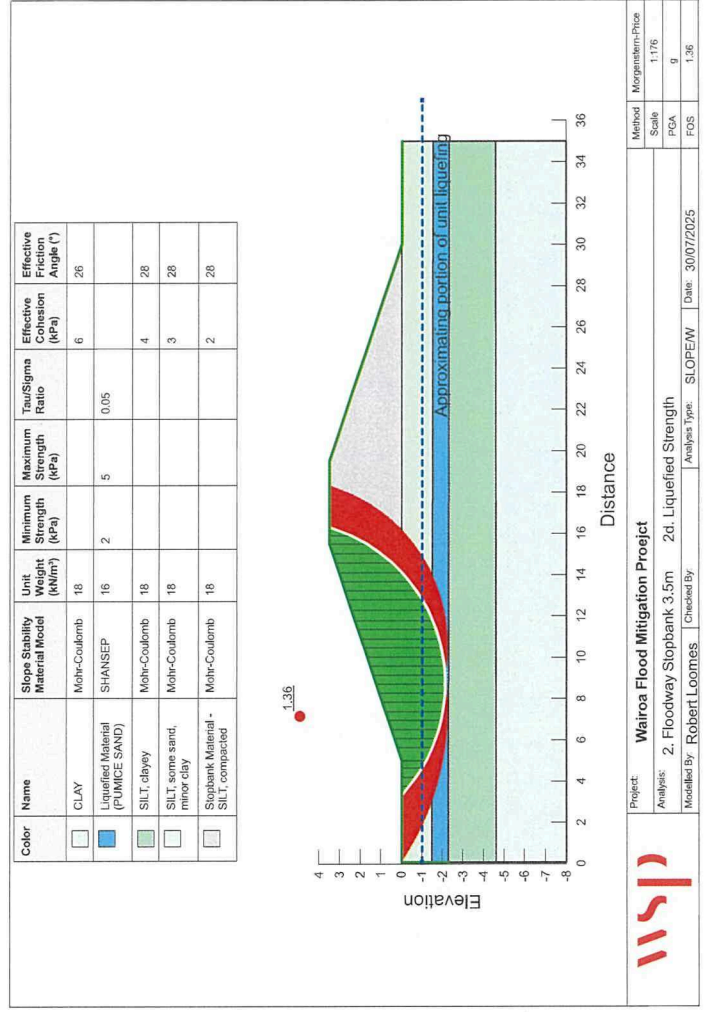
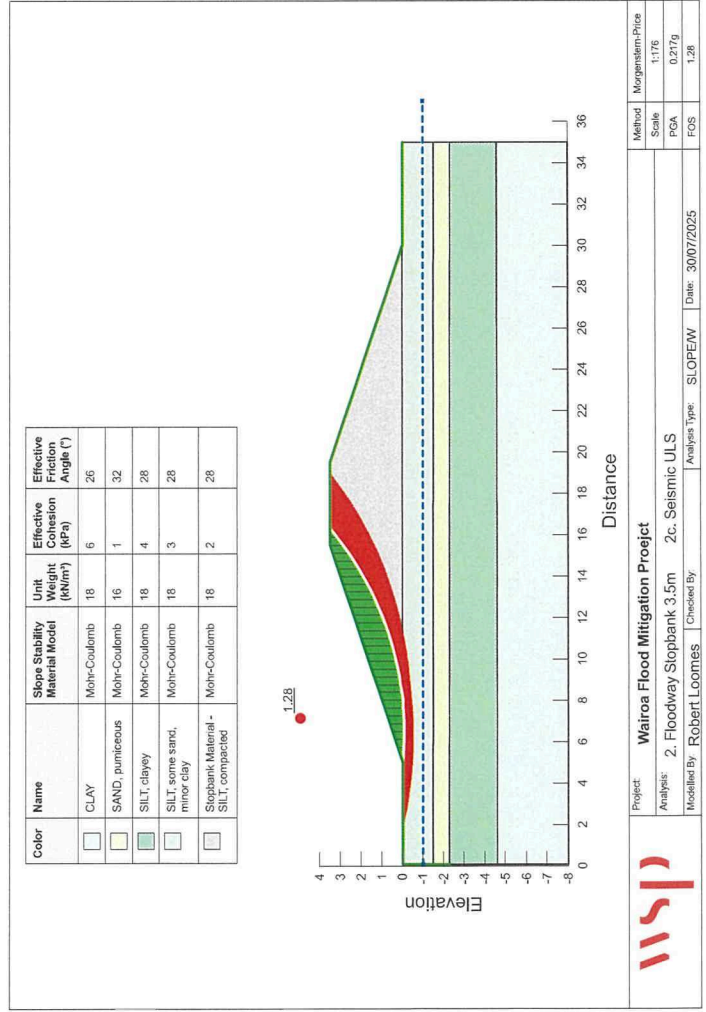
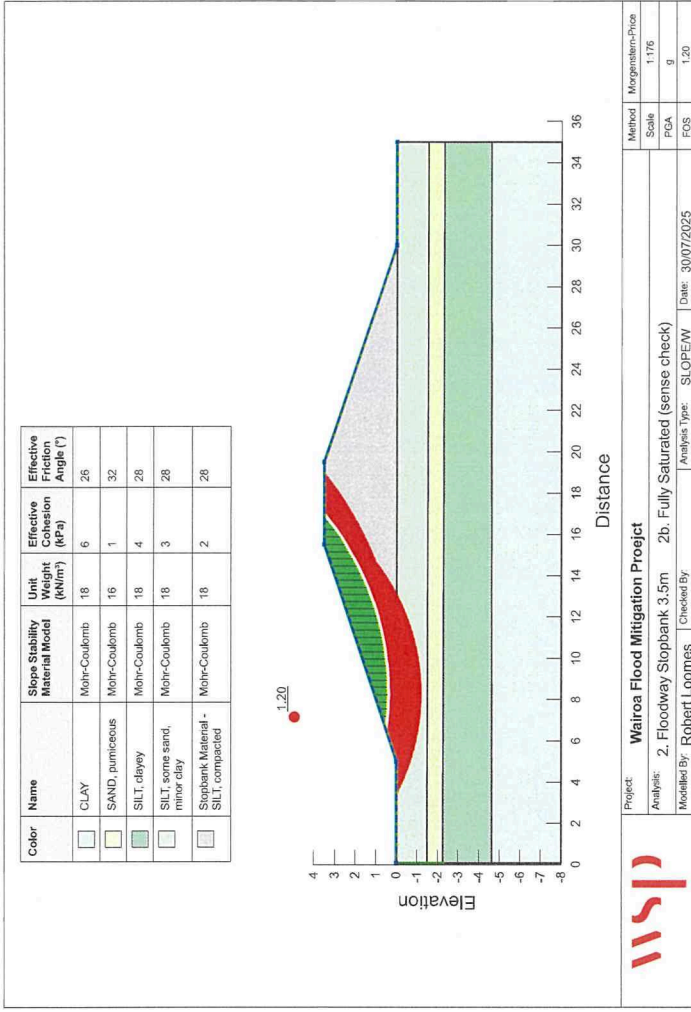
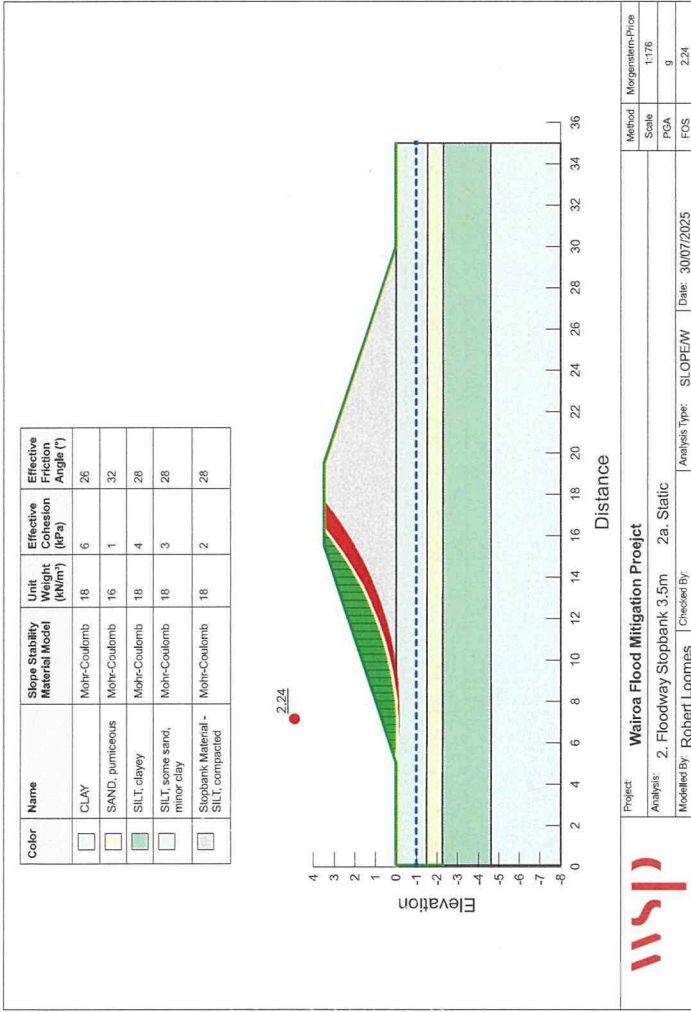
Change in Output			
Rank	Name	Lower	Upper
1	37	52,056,978.26	56,439,250.75
2	Earthworks	51,242,200.23	54,876,634.50
3	2	52,200,271.94	54,176,305.32
4	3	52,348,048	54,005,044
5	44	52,368,106	54,001,290.71
6	32	52,302,151.67	53,788,053.55
7	34	52,179,499.25	53,506,879.82
8	Retaining Walls	52,207,877.18	53,495,883.15
9	30	52,394,719.27	53,625,977.10
10	10	52,489,388.55	53,691,969.30
11	16	52,568,731	53,763,845.42
12	24	52,459,320	53,590,458.43
13	15	52,583,567.09	53,692,772

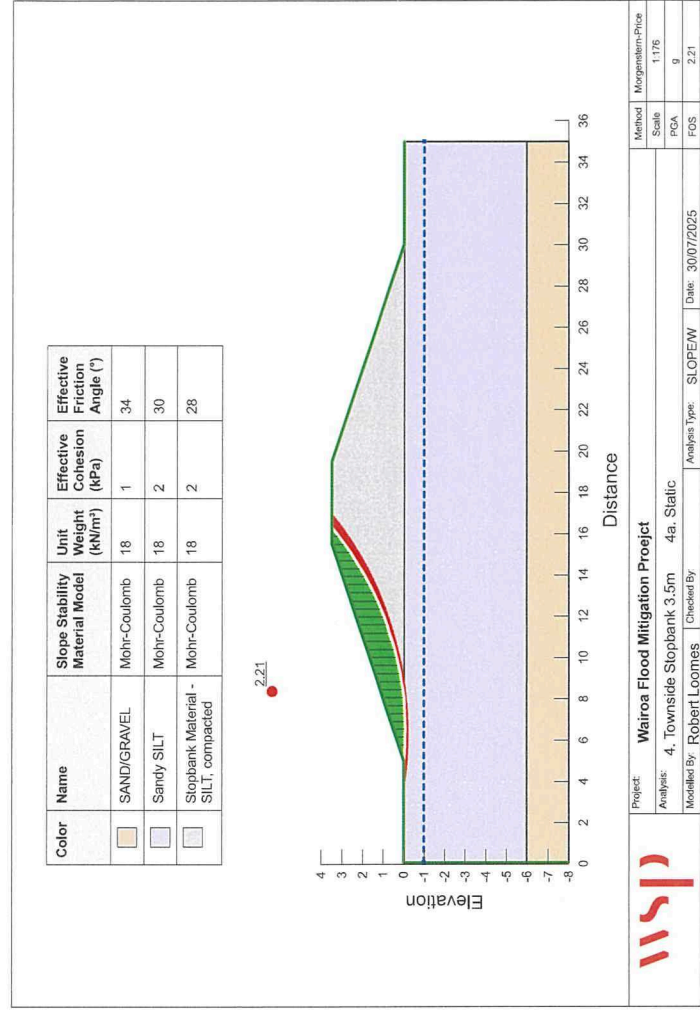
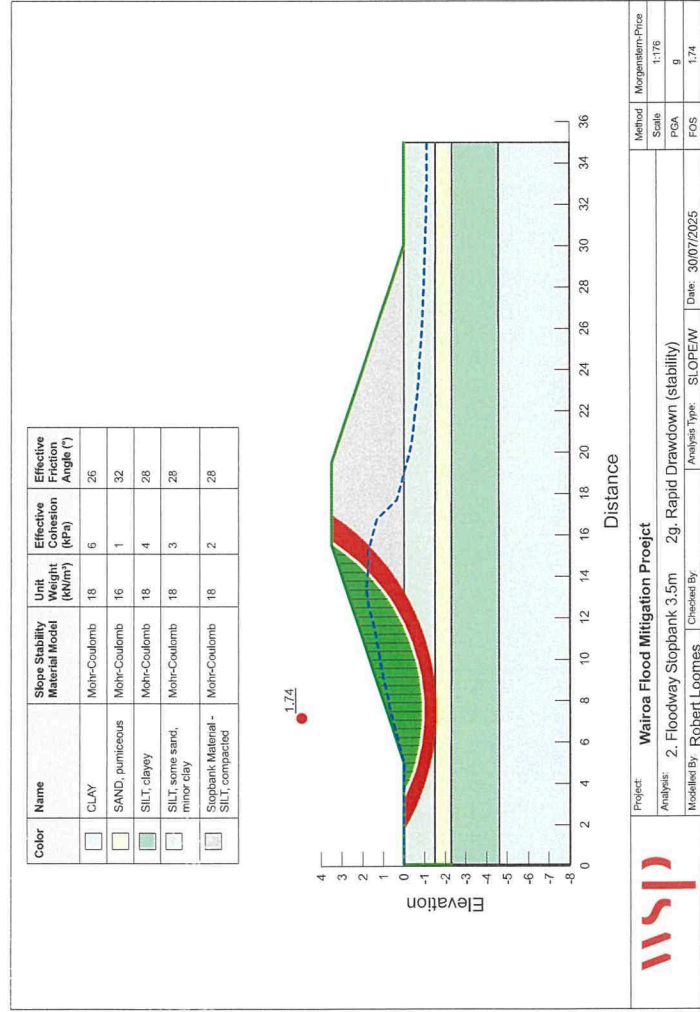
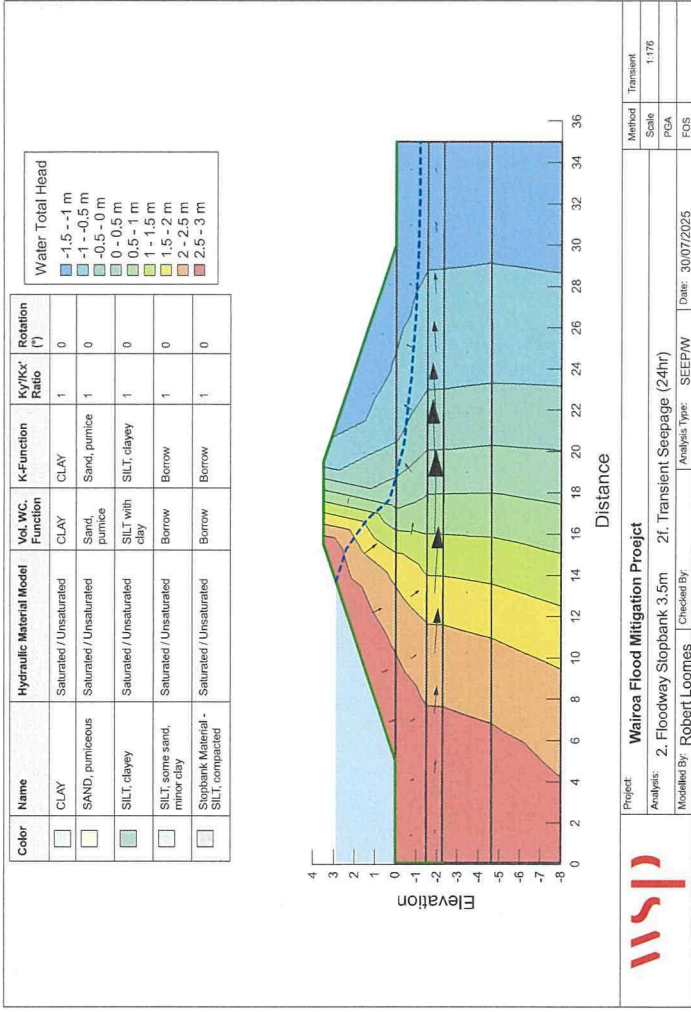
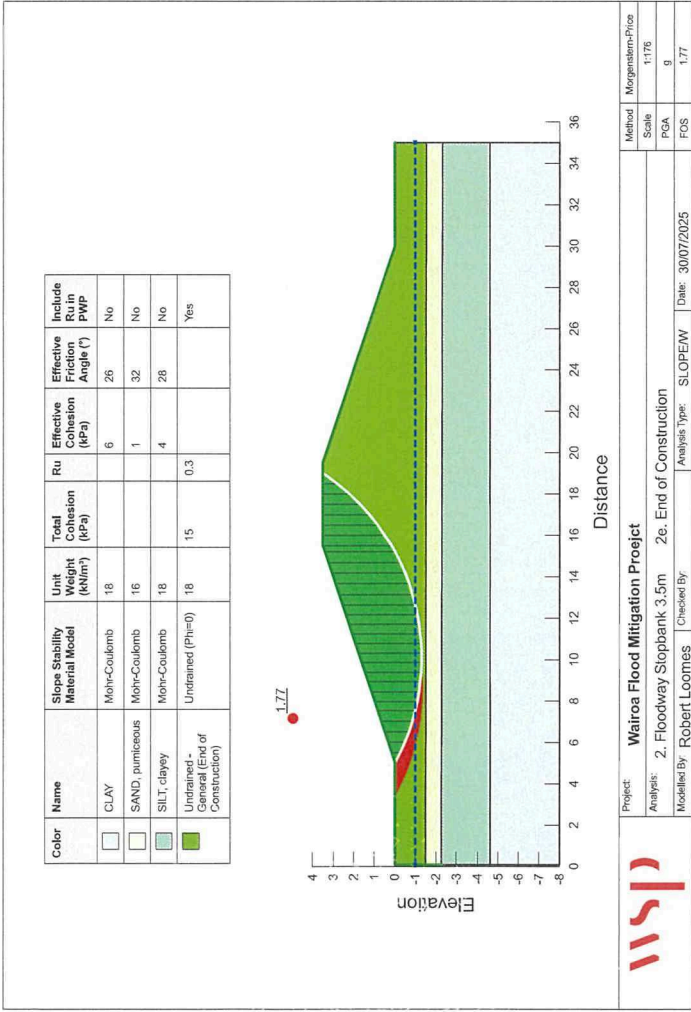
Base Estimate	44,410,649		
P50	52,571,693	8,161,043	18.38%
P95	57,462,277	4,890,584	11.01%

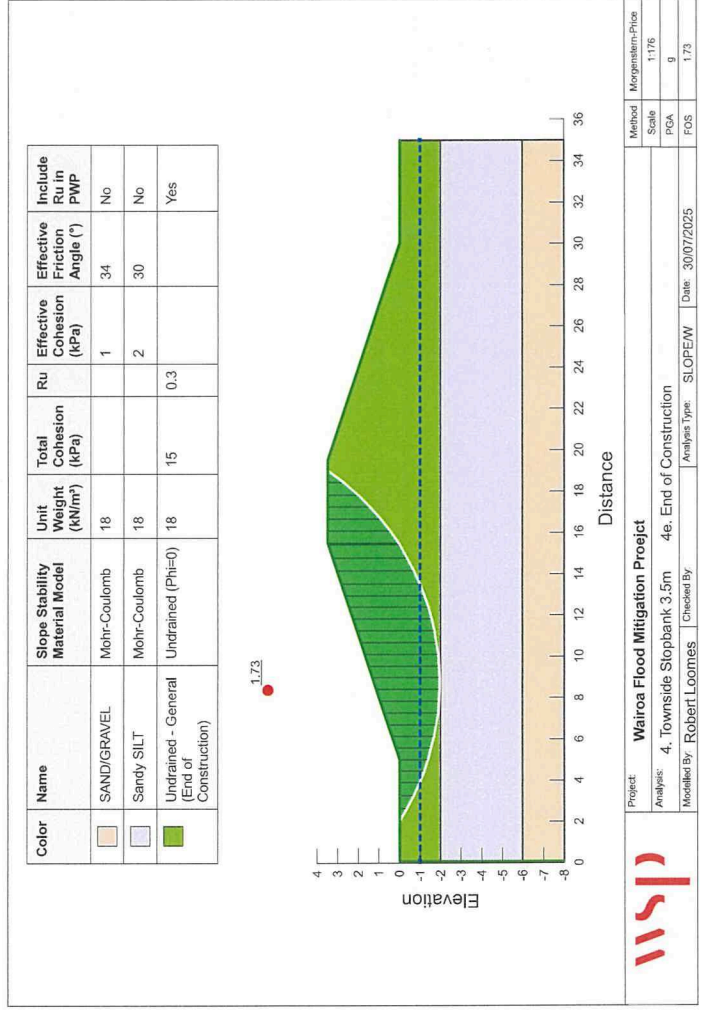
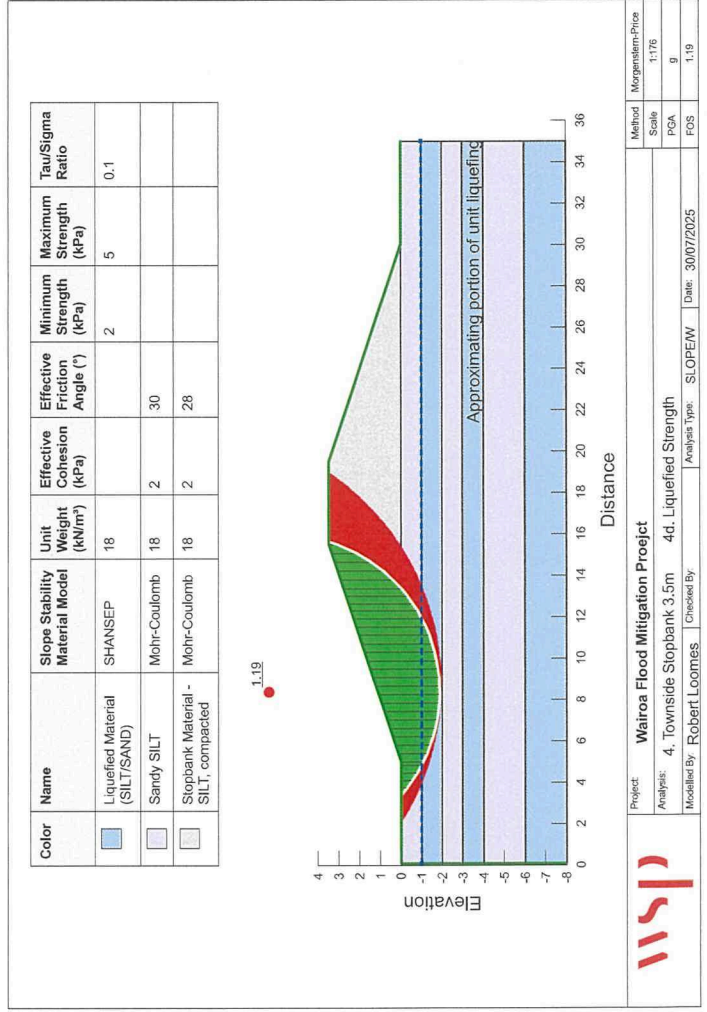
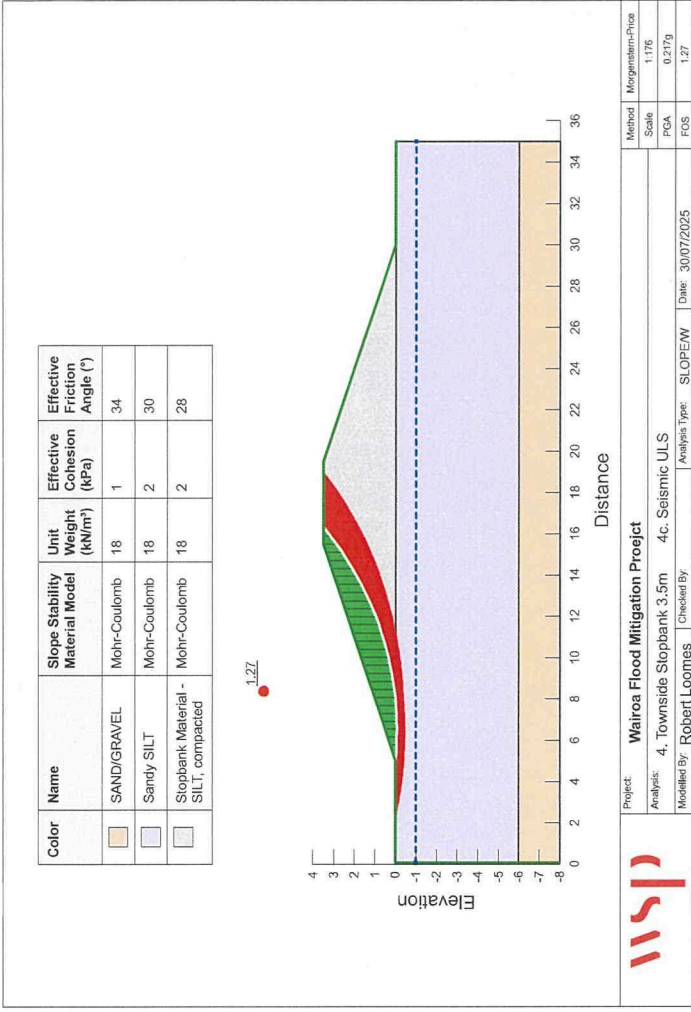
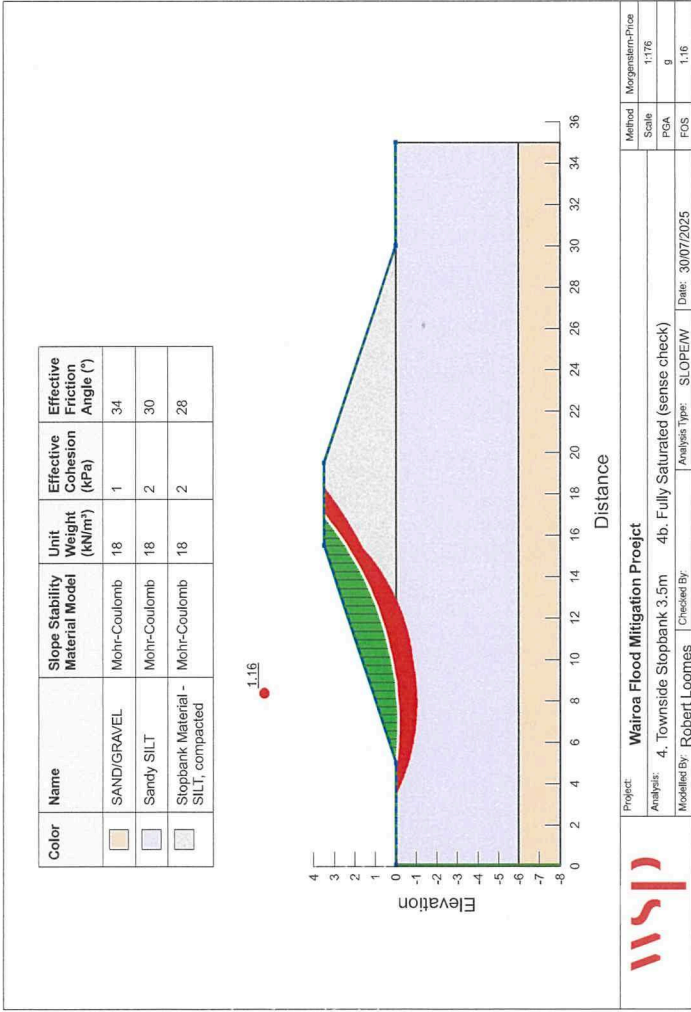


Appendix E – Preliminary Geological Section (Floodway)

Appendix F – Stability & Seepage Model Outputs









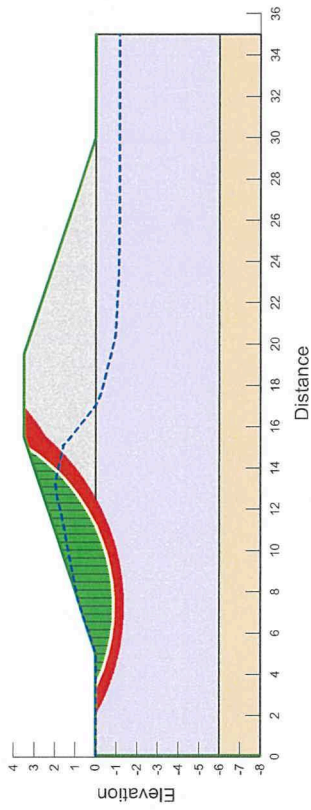
Project: **Wairoa Flood Mitigation Project**

Analysis: 4. Townside Stopbank 3.5m
 Modelled By: Robert Loomes
 Checked By: Robert Loomes
 Date: 30/07/2025
 Analysis Type: SLOPEW

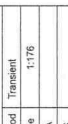
Method	Morgenstern-Price
Scale	1:176
PGA	g
FOS	1.56

Color	Name	Slope Stability Material Model	Unit Weight (kN/m ³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	SAND/GRAVEL	Mohr-Coulomb	18	1	34
	Sandy SILT	Mohr-Coulomb	18	2	30
	Stopbank Material - SILT, compacted	Mohr-Coulomb	18	2	28

1.56



Distance



Project: **Wairoa Flood Mitigation Project**

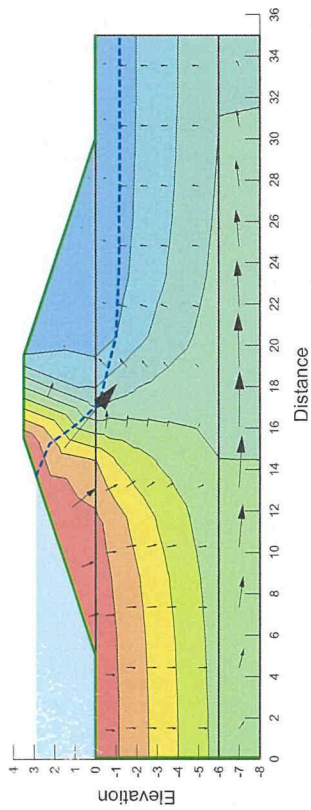
Analysis: 4f. Transient Seepage (24hr)
 Modelled By: Robert Loomes
 Checked By: Robert Loomes
 Date: 30/07/2025
 Analysis Type: SEEPW

Method	Transient
Scale	1:176
PGA	
FOS	

Water Table Head

	-1.5 ~ -1 m
	-1 ~ -0.5 m
	-0.5 ~ 0 m
	0 ~ 0.5 m
	0.5 ~ 1 m
	1 ~ 1.5 m
	1.5 ~ 2 m
	2 ~ 2.5 m
	2.5 ~ 3 m

Color	Name	Hydraulic Material Model	Vol. WC. Function	k-Function	Ky/Kz Ratio	Rotation (°)
	SAND/GRAVEL	Saturated / Unsaturated	SAND/GRAVEL	SAND/GRAVEL	1	0
	Sandy SILT	Saturated / Unsaturated	Sandy SILT	Borrow	1	0
	Stopbank Material - SILT, compacted	Saturated / Unsaturated	Borrow	Borrow	1	0



Distance