Ministry for the Environment
Manatū Mō Te Taiao

Arotakenga Huringa Āhuarangi

TE ANGA MŌ TE WHAKAHAERE AROTAKENGA TŪRARU HURINGA ĀHUARANGI Ā-MOTU MŌ AOTEAROA

New Zealand Government

This document may be cited as: Ministry for the Environment. 2019. *Arotakenga Huringa Āhuarangi:* Te Anga mō te Whakahaere Arotakenga Tūraru Huringa Āhuarangi ā-Motu mō Aotearoa. Wellington: Ministry for the Environment.

Published in September 2019 by the
Ministry for the Environment
Manatū Mō Te Taiao
PO Box 10362, Wellington 6143, New Zealand

ISBN: 978-1-98-857941-2 (online)

Publication number: ME 1435

This document is available on the Ministry for the Environment website: www.mfe.govt.nz.

Ministry for the Environment
Manatū Mō Te Taiao

Making Aotearoa New Zealand
the most liveable place in the world

Ngā kōrero o roto – Contents

Ngā Tūtohinga – Tables

Ngā Āhua – Figures

Kupu takamua

E rongo ana a Aotearoa i ngā kino ka pā mai i te huringa āhuarangi i tēnei wā tonu, ka mutu, nā runga i ngā rukenga o mua, ka ngau tonu ēnei āpōpō atu, haere ake. Heoi anō, e āta herea ana te taupānga pāpātanga o te huringa ki tā tātou i mahi ai i tēnei wā ki te whakaheke i ngā rukenga. I te kore e whakapau kaha a te ao nui tonu ki te whakamauru i ngā rukenga i raro i te Whakaaetanga o Parihi, me āta arotake ngā tūraru mō ngā horopaki tino kino ka tūpono pā mai. Ka noho papa ko te katoa o Aotearoa i ngā huringa nei, ka mutu me āta whakaritenite e tātou te āhua o ā tātou uruparenga, ā tātou urutaunga, me haere kōtui hoki ki te whakaheke i ā tātou rukenga.

He hiranga te wāhi ki te kāwanatanga matua i ngā whakaritenga nei. Mana te tohu i te ahunga, e kaha ake ai te haumanutanga o ngāi Aotearoa, o te taiao, o ngā pūnaha hanganga me te ao ōhanga ki ngā pāpātanga o te huringa āhuarangi. Ko te wāhi ki te kāwanatanga matua mō te ahunga nei ko:

- te tāpae i te anga taha ture, taha kaupapa here
- te tāpae pārongo, kupu ārahi, hei tautoko i ngā kāwanatanga ā-rohe me ngā pakihi, ki te whakatau take urutau whai tikanga
- te whāngai pūtea ki ngā mahi rangahau me te whakaputa kōrero mō ngā pāpātanga o te huringa āhuarangi
- te noho takatū mai me te urupare ki ngā pūmate māori nunui ka pā.

I runga i te mōhio o te Kāwanatanga ki te hiranga nunui o te urutau ki te huringa āhuarangi, kua takoto i a ia he anga hautūtanga papai mō te urutautaunga, e whai ake nei ōna wāhanga:

- tētahi Arotakenga Tūraru Huringa Āhuarangi (NCCRA), kia mārama ake ai tātou ki ngā tūraru āhuarangi kei mua i te aroaro o a Aotearoa
- tētahi Mahere Urutaunga ā-Motu ka whakamārama i te ara ka whāia e te Kāwanatanga e kaha ake ai te manawaroa o Aotearoa ki ngā pāpātanga o te huringa āhuarangi
- te aroturuki me te pūrongorongo i te whakatinanatanga o te Mahere Urutaunga ā-Motu, e hua ai te haepapatanga.

Ko tā te puka nei he whakamārama i te anga me ngā tikanga ka whāia mō te NCCRA tuatahi, ka āwhina hoki tēnei ki te ārahi i ngā take tōmua hei whaiwhai ake i te Mahere Urutaunga ā-Motu ka puta i te kāwantanga matua ā-taihoa ake nei.

Ko te mātāpono kei te tūāpapa o te anga, e whatua atu ai Te Ao Māori me ngā mātāpono torotoro puta noa, e puta ai ko te mātauranga tukupū me ngā pūkenga whai tikanga mō te noho mārama ki ngā tūraru huringa āhuarangi. Ko tā te tukanga he whakatōpū i te pārongo taha pūtaiao, taha mātauranga whāiti, taha mātanga anō me te Mātauranga Māori, te mātauranga ā-rohe me tā rātou i wheako ai.

Ko te whāinga o te anga ko te tāpae arotakenga tūraru ka:

- whakapai ake i te pai o te hunga whakatau ki te whakatau i runga i te mātau, ahakoa te ngākaurua ki ngā āhuatanga e kore e taea te karo, i ōnā wā anō, ki tōna kaha me te kore e taea te whakaheke
- whakapai ake i te noho mārama a ētahi atu o te hunga whai wāhi ake me te atawhai, te tautoko i te hiahia mōhio o te iwi whānui mō te kounga o te tukanga whakatau (hei tauira, te tōkeke, te puata, te whai painga me te noho takatū).

Ko te arotahinga matua o te anga (waihoki o te NCCRA) ko ngā tūraru huringa āhuaranga ā-motu. E whai ana anō ki te kōrero mō ngā tūraru ā-rohe hiranga ka kawe i ngā take tōmua ā-motu me ngā tukanga pūtea, tae atu ki ngā tūraru ā-rohe mō ngā iwi (arā, te puta ake o te riha o te whenua āhua pārūrū, te mate me te ika tauhou ki Te Tai Tokerau, te hoki haere rānei o te pae hukarere me te awa kōpaka). Ka pākia hoki a Aotearoa e ngā kawenga o tāwāhi e ara ake ana i te kaupapa here huringa āhuarangi i ngā uruparenga rānei (hei tauira, te mākete inihua anō, ngā tohu o te mākete ōhanga mai i te hekenga o te haurehu kati mahana i te ao, te hekenga o te iwi nā runga i te huringa āhuarangi me te hangarau tauwhati ki te whakaheke rukenga), nō reira me urutau hoki ko te NCCRA me te Mahere Urutaunga ā-Motu ki ēnei kawenga i roto i te wā. Kāore e whakaaroaro te NCCRA tuatahi ki ngā tūraru tauwhiro, ki ngā matapaenga ōhangapori rānei, engari tērā ēnei ka whakaurua atu ki ngā putanga o āpōpō atu.

E whakaatu ana te anga ko te arotakenga kounga te momo arotakenga nui katoa o te arotakenga tuatahi ā-motu, ka whakaurua atu hoki te nui o te tūraru, te pārongo noho puare rānei i ngā wāhi ka taea, e hangore pai ai ki te whakatakoto i ngā momo pārongo e rua me te auau o tēnei. Ka uru atu ki ngā arotakenga kounga he kōrero mō ngā uaratanga me ngā wawata, te kounga o te mataora, te noho ora, me te tāpaenga tahi o te mātauranga o tēnā me tēnā mō ngā pāpātanga me ngā whakapaenga. Ka whakaaroarohia ngā hua me ngā tūraru e rokohanga, tē rokohanga rānei, me te aha, torowhānui ana te ara ka whāia ki te noho-ora o Aotearoa.

Mema o te Pae Mātanga

Anne Bardsley, The University of Auckland (Chair)
Acushla Sciascia, Māpuna Consultants
Rob Bell, National Institute of Water and Atmospheric Research
Wendy Saunders, GNS Science
Shaun Awatere, Manaaki Whenua – Landcare Research
Roger Fairclough, Neo Leaf Global
Bapon Fakhruddin, Tonkin and Taylor

Whakamihi

Tēnei te mihi a te rōpū ki ngā tāngata, ki ngā whakahaere me ngā pūtahi i tāpae whakaaro mai i te wā e whanaketia ana te anga nei, tae atu ki te hunga e whai ake nei.

Mātanga Kaiarotake

Will Symons, AECOM
Judy Lawrence, Victoria University of Wellington and PS Consulting Ltd
Daniel Hikuroa, The University of Auckland
James Hughes, Tonkin and Taylor
Simon Lambert, University of Saskatchewan

Tari o te kawanatanga matua

Te Puni Kōkiri
Department of the Prime Minister and Cabinet
Treasury – Te Tai Ōhanga
Te Manatū Waka – Ministry of Transport
Manatū mō te Taiao – Ministry for the Environment

Manatū Ahu Matua – Ministry for Primary Industries
Te Manatū Taonga – Ministry for Culture and Heritage
Te Papa Atawhai – Department of Conservation
Hīkina Whakatutuki – Ministry of Business, Innovation and Employment
Waka Kotahi – New Zealand Transport Agency
Te Ope Kātua o Aotearoa – New Zealand Defence Force
Te Arawhiti – The Office for Māori Crown Relations
Toitū te Whenua – Land Information New Zealand
Te Rākau Whakamarumaru – Ministry of Civil Defence and Emergency Management

Kāwanatanga ā-rohe

Te Pūtahi Matakōkiri – Local Government New Zealand
Te Kaunihera o Tāmaki Makaurau – Auckland Council
Otago Regional Council
Whakatāne District Council
Te Kaunihera ā-Rohe o Te Matau-a-Māui – Hawke's Bay Regional Council
Te Kaunihera o Te Tai Rāwhiti – Gisborne District Council
Te Kaunihera ā-Rohe o Te Taitokerau – Northland Regional Council
Te Kaunihera o Whakatū – Nelson City Council
Kaunihera Taiao ki Waitaha – Environment Canterbury
Horizons Regional Council

He tirohanga Māori

Karakia (recitation)

Ko Rangi
Ko Papa
Ka puta, ko Rongo
Ko Tānemahuta
Ko Tangaroa
Ko Tūmatauenga
Ko Haumiatiketike
Ko Tāwhirimātea
Tokona a Rangi ki runga
Ko Papa ki raro
Ka puta te ira tangata ki te whai ao ki te ao mārama
E rongo whakairi ake ki runga kia tīna, tīna!
Haumi e, hui e, tāiki e!

Ko tā te tirohanga Māori he whakamārama i te te tūhonotanga o te taiao me te tangata, ka mutu e rauwiri ana te hauora me te noho ora o ngā mea e rua. Hōhonu wheuri ana tō rāua hononga. E whakaatuhia ana te whakapapa i tō tātou taiao, e herea ana te tangata ki te wāhi mā roto i ngā hononga ki ngā tūpuna me ngā kāwai toto. Ko te oranga o te tangata kei te taiao māori, waihoki, ko te oranga o te taiao kei te manaaki a te tangata i te taiao; e haere ngātahi ana te taio me te tangata, mā tētahi e ora ai tētahi.

E kōrero ana te karakia nei mō te orokohangahanga mai o te ao, mō Ranginui (Matua o te Rangi) rāua ko Papatūānuku (Whaea o te Whenua) me ā rāua tamariki – ngā atua Māori. E tohu ana ngā atua nei i tēnā, i tēnā rohenga o tō tātou ao māori me te taiao, tae atu hoki ki te tangata. E tākina ana e te karakia nei te whakapapa o ēnei atua, ka tīmata ake i a Ranginui rāua ko Papatūānuku me tō rāua wehenga, i puta ai ko te ao mārama (te ao mārama me te māramatanga). Koinei te huarahi i whāia e kitea ai te ao mārama, e ahuahua ai te tangata i te whenua kura. Nō konei te hononga o te taiao me te tangata, he hononga e kore e taea te wehe. (Barlow and Wineti, 1991; Buck, 1950; Mead, 2016). Ko te hiranga o te karakia nei me ōna kōrero i te horopaki o te huringa āhuarangi ko te tohu i te hōhonu wheuri me te whanaungatanga i waenga i te taiao me te tangata. Nui whakahirahira ana te noho-ora me te hauora o te taiao me te tangata – me manaaki tētahi i tētahi e ora ai ko rāua tahi.

Ki te kore te tangata e manaaki i tōna taiao, ka kore te tangata e whai oranga

Me torowhānui tonu te ara e mārama ai ki ngā pāpātanga o te huringa āhuarangi ki te taiao me te tangata, e tautuhia ai ngā ara e urutau ai, e noho takatāu ai tātou ki ngā huringa, me panoni hoki tā tātou i mahi ai kia heke ai ngā pāpātanga. E takoto ana ki te anga nei te hiranga o te mātāpono ka noho hei wāhanga o te ara torowhānui ki te karu o te Te Ao Māori me tāna tirohanga. E mārama ai ki ngā hononga tūturu i waenga i te taiao me te tangata, kua whanaketia e mātou he huinga mātāpono (mātāpono ārahi me ētahi mātāpono whānui) e noho mai ai ngā kōrero mō te orokohanganga o te ao ki tētahi horopaki whai tikanga, e tohu ana anō i te hononga o te taiao me te tangata. Kei te tūāpapa ngā mātāpono nei o te anga katoa, tae atu ki te tukanga arotake tūraru.

Ngā mātāpono ārahi

Kei te tūāpapa o te anga e tāpaea ana i konei mō te Arotakenga Tūraru Huringa Āhuarangi – te Arotakenga Tūraru Huringa Āhuarangi o te Motu tuatahi – ko tētahi huinga mātāpono e hua ai te noho hiranga tonu o te whakaaro kia arotahi ki te taiao me te tangata ina whakaaroarohia, ina whakahaeretia te arotakenga tūraru.

E whakaaturia ana ngā mātāpono, ka noho nei hei āpitihanga ki ngā mātāpono o Te Tiriti o Waitangi, i te Pouaka 1. Kei tōna tūāpapa ko ngā mātāpono kei te *National Disaster Resilience Strategy* (NDRS) (Te Rākau Whakamarumaru /Ministry of Civil Defence and Emergency Management, 2019), me te tāpirihia atu o te ōhanga, e arahina nei e te Anga Paerewa Mataora (LSF) a Te Tai Ōhanga / Treasury (New Zealand Treasury, 2018). Ka matapakihia anō ngā mea e rua i te upoko A3.

Pouaka 1: Ngā Mātāpono Ārahi i Te Anga Arotakenga Tūraru Huringa Āhuarangi ā-Motu

Manaakitanga (Te manaaki tētahi i tētahi)

- Te kauanuanu me te manaaki i ētahi atu me te taiao.
- Te kawenga kia noho tōmua te noho ora me te hauora o ngā mea e rua.
- Te mōhio ki te hononga pū o te tangata me te taiao, tē wehea tētahi i tētahi.

Kaitiakitanga (Te toitūtanga heke iho i ngā reanga)

- Te rauhī me te tiaki i ā tātou taonga (rawa taiao).
- Te mātau ki te mauri o te taiao (hei tauira, te whakatangatahia o te tohu whenua me te rerenga wai).
- Te tiaki i te taiao mō ngā reanga o āpōpō atu.

Whanaungatanga (Te tūhonotanga me te whakawhanaungatanga)

- Te mōhio ki te haere kōtui a te Karauna–Māori i raro i Te Tiriti o Waitangi.
- Te torotoro, te kōrero tahi me te whakawhiti wheako.
- Te mahi ngātahi me te mahi tahi ki ngā marae, ngā hapū, ngā iwi me ngā hapori.

Ōhanga (Te tōnuitanga)

- Te whakamana i te tūtanga heke i ngā reanga.
- Te whakatairanga i te takuhe, i te pūmau me te whānui o ngā ara whai oranga.
- Te whai kia iti ngā pānga tarāwaho kino ki ā tātou taonga i ngā mahi ōhanga.

Rangatiratanga (Te hautūtanga me te mana motuhake)

- Te whakamana, te rauwiri me te whakatinana i Te Tiriti o Waitangi me ōna mātāpono.
- Te kauanuanu i ngā ariā o te mana whenua, te mana moana, te mana taiao.
- Kia arahina e ngā mātauranga pūtaiao, e te hītori, e te mātauranga ā-rohe me te mātauranga tuku iho.

Kia mahi ngātahi (Te torotoro me te whai wāhi atu)

- Ka whai wāhi atu ki te tukanga arotake tūraru ngā pūtahi ā-motu, ā-takiwā, ā-rohe, tae atu ki ngā māngai o ngāi Māori whānui, o ngai Māori, o te iwi me te hapū ka pākia e te arotakenga tūraru me ōna putanga.
- Ka whai huarahi te hunga tāpae whakaaro ki te arotakenga tūraru ki te tāpae whakaaro ki te whanaketanga o te Mahere Urutaunga ā-Motu (ka whakahaeretia he tukanga whakapāpā haere mō tēnei).
- Ka kimi whakaaro te tukanga whakapāpā i te hunga whai wāhi atu ki te whakarite i te āhua o tā rātou whai wāhi atu.

Kia āwhina (Te tautoko)

- Ka mōhiotia ngā hiahia me ngā pānga o te katoa ka whai wāhi ake, tae atu ki te hunga whakatau.
- Ka tukua atu ki te hunga whai wāhi ngā pārongo e tika ana mō te whai wāhi atu i runga i te whai tikanga, ka manaakitia ō rātou whakaaro, ka āta whakaaroarotia.
- Ka kōrerohia ngā putanga ki te hunga whai wāhi ake me te āhua o te kawea o ngā whakataunga e tā rātou e tāpae ai.

Wāhanga A: Te tuaroa, te horopaki me ngā tikanga mahi

Upoko A1: Kupu whakataki

A1.1 Te huringa āhuarangi me te āta whai mahi urutaunga

Ehara te huringa āhuarangi i te take mō āpōpō atu. Kua kitea kēhia ōna tukinga huri noa i te ao, (IPCC, 2013) ka mutu, ka haere tonu ēnei āhua i ngā ngahurutanga tau, ahakoa ngā rautaki whakamauru mātātoa ka whakahaeretia ki te whakaheke i ngā rukenga haurehu kati mahana. E pēnei ana nā ngā pānga takamuri o te mahana haere o te kōhauhau (whāia o te moana) i ngā haurehu ora roa i te kōhauhau i ngā mahi o mua, e haere tonu nei. Atu i tā tātou panoni i tā tātou i mahi ai ki te whakaheke rukenga, kia mārama tātou ki ngā papātanga o tēnei wā me āpōpō atu, kia pai ai tā tātou whakarite me pēhea te urutau ki ngā huringa o te taiao ka pā mai ahakoa pēhea. Kāore tēnei e whāiti mai ki ētahi mahi urutau motuhake, ka mahi anō tātou ki te whakapakari i tō tātou raukaha urutaunga me tō tātou manawaroa ki te whakaheke, ki te nekeneke, me te kimi oranga kē i ngā putanga o ngā huringa.

I waitohua e Aotearoa te Whakaaetanga Āhuarangi o Parihi o te 2015. E tono ana te Upoko 8 o te whakaaetanga kia āta whai ngā rōpū ki te:

> mōhio ki te hiranga o te kaupare, o te whakaheke me te aro atu ki ngā ngaronga me ngā tukinga ka haere tahi ki ngā kawenga kino o te huringa āhuarangi, tae atu ki te huarere tino kino me ērā ka āta pā mai, me te wāhi nui ki te whanaketanga matatū ki te whakaheke i te tūrarutanga o te ngaronga me te tukinga.

E tāpua ana anō i te Upoko 8 te hiahia kia noho mārama ake, kia kitea he ara whai tikanga mō ngā "āhuatanga ka pā e kore nei e hokia, e toitū ai ngā ngaronga me ngā tukinga", kia āta whakaarohia tētahi utu puretumu mō ngā ngaronga me ngā tukinga ka pā (UNFCCC, 2015).

I Aotearoa nei, he raraunga ā ētahi rāngai mō ngā papātanga o tēnei wā me ērā tērā ka pā. Kua whakaaroarotia hoki ētahi kōwhiringa urutau, engari kāore anō i whakahaeretia tētahi arotakenga ā-motu tukupū, kāore anō i whanaketia tētahi rautaki urutaunga ā-motu.

Ko tā te Pire Whakatikatika mō te Uruparenga Huringa Āhuarangi (Waro Kore) i tāpaea ki te Pāremata i te 8 o Haratua 2019 (te 'Pire Waro Kore') he whakarite i tētahi anga mō Aotearoa ki te whanake me te whakatinana i ētahi kaupapa here huringa āhuarangi e mārama ana, e pakari ana, me te tuku mana anō ki te whakahaere i tētahi Arotakenga Tūraru Huringa Āhuarangi ā-Motu (NCCRA) (Kāwanatanga o Aotearoa, 2019a). Hāunga ia tōna rangitahi, e para huarahi ana te Pire e āta whakaritea ai te whai i te urutaunga huringa āhuarangi ka takea mai I ngā taunakitanga papai katoa ka taea, i ngā pārongo papai me te arotakenga tūraru (tirohia te pouaka A1-1).

Pouaka A1-1: Urutaunga – ngā mahi whakapiki i te manawaroa o Aotearoa ki te huringa āhuarangi

Mā te mārama ki ngā tūraru me te whakarite i ngā mahi ka whāia ki te whakatika e āwhinatia ai a Aotearoa ki te ruruku i ngā mahi urutau whai tikanga. Ka tāpaea e te Pire nei tētahi anga e pakari ake ai ngā mahi urutaunga. Ka whāia tētahi arotakenga tūraru huringa āhuarangi ā motu, tētahi mahere urutaunga ā-motu, ētahi pūrongo kokenga auau mō te whakatinana i te mahere urutaunga ā-motu, me tētahi mana kohi-pārongo urutaunga.

Ka noho takatū tonu te arotakenga tūraru huringa āhuarangi ā-motu ki te whakapiki i te māramatanga me te tohu i ngā tūraru huringa āhuarangi tōmua kei mua i te aroaro o Aotearoa. Ka whakamārama te mahere urutaunga ā-motu i te ara ka whāia e te Kāwanatanga ki te whaiwhai haere i ngā tūraru kua miramirahia i te arotakenga tūraru huringa āhuarangi ā-motu.

Te Pire Whakatikatika mō te Uruparenga Huringa Āhuarangi (Waro Kore) (Kāwanatanga o Aotearoa, 2019a).

Me āta whai whakaaro te anga nei ki ngā huānga matua o te NCCRA e marohitia ana i te tekiona 5ZN (te whakarite i te arotakenga tūraru huringa āhuarangi ā-motu) o te Pire Waro Kore (Kāwanatanga o Aotearoa, 2019a):

…

(2) Ina whakaritea he arotakenga tūraru huringa āhuarangi, me āta whai whakaaro te Komihana ki ngā take e whai ake nei:

(a) ngā kawenga o te huringa āhuarangi ki te ao ōhanga, ki te pāpori, te hauora, te taiao, te taha hauropi me te ahurea:

(b) te tītaringa o ngā pāpātanga o te huringa āhuarangi ki te pāpori whānui, me te āta aro atu ki ngā rōpū me ngā rāngai noho whakaraerae:

(c) Ngā kawenga a Aotearoa i raro whakaaetanga ki te ao e hāngai ana:

(d) te āhua o te hāngaitanga me te hononga o te arotakenga ki ētahi atu arotakenga tūraru ā-motu e rite ana kua whakatakotohia e ngā hinonga kāwantanga matua:

(e) ngā ia huringa āhuarangi pae tawhiti:

(f) ētahi pārongo ka tāpaea iho e hua mai ana i ngā tono i raro i te tekiona 5ZV:[1]

(g) te kupu ārahi mō te pūtaiao me te mātauranga whāiti.

(3) Ka taea anō e te Komihana te whai whakaaro ki—

(a) ngā kōwhiringa ka ara ake mō te ōhanga o Aotearoa, mō te hapori whānui me te taiao ka hua mai i ngā kawenga o te huringa āhuarangi; me

(b) ētahi atu take e whakaaro ana ia e hāngai ana, e tika ana.

[1] Tekiona 5ZV: Ka taea e te Minita te tono whakahaere kia tāpae pārongo mō te urutaunga huringa āhuarangi.

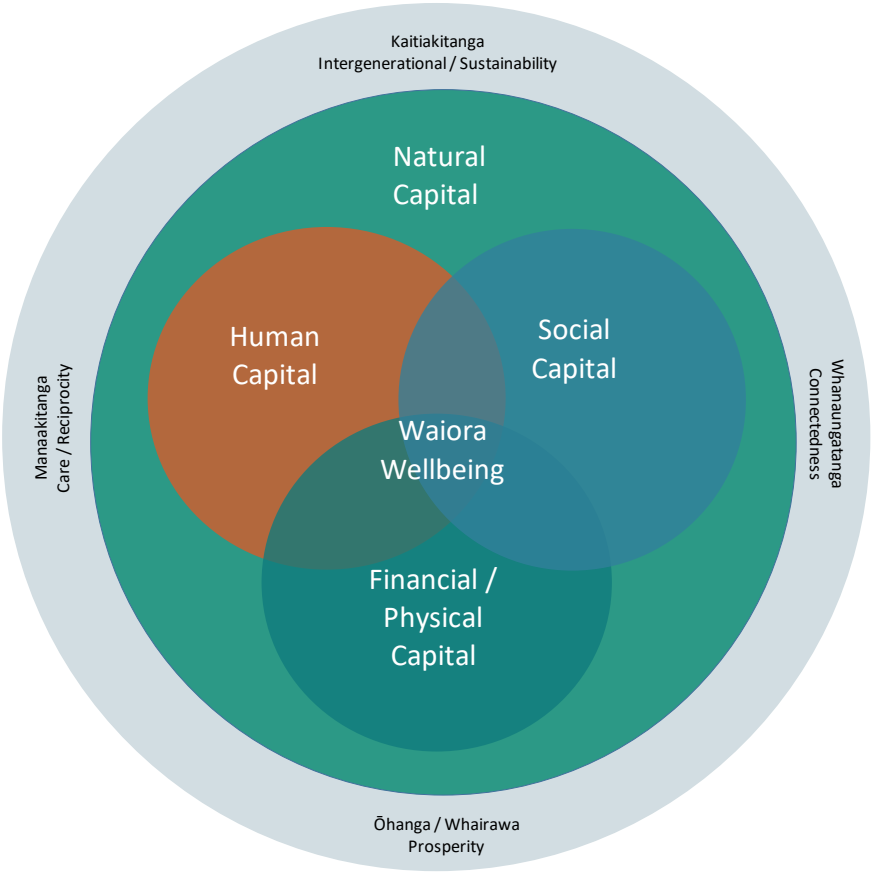
A1.2 Te arotake i ngā tūraru huringa āhuarangi mō Aotearoa

Hei uruparenga ki ngā whakahau kua kōrerohia ake nei, e whakamārama ana te puka nei i tētahi anga mō te NCCRA tuatahi mō Aotearoa.

E whakaatu ana te karakia (whārangi 11) i tētahi tirohanga Māori ki te ao me te arotahinga motuhake o Aotearoa hei ārahi i tā tātou i whakaaro ai, me te āhua o tā tātou whaiwhai ake i te huringa āhuarangi. E miramira ana i ngā hononga tūturu o te tangata ki te taiao māori me ngā reanga o mua atu, o muri mai. Waihoki ngā hononga o ngā pūnaha hauropi tētahi ki tētahi, o te hapori whānui anō ki ērā, tae atu ki te rerenga o ngā mahi ka mahia me ngā hua ka puta ki ngā takiwā whānui. E whakaatatia ana hoki ngā tūhonotanga nei i te Anga Paerewa Mataora (LSF) a Treasury mō te noho-ora, kei tōna pūtake ko ētahi manapou e whā – te ao māori, te tangata, te pāpori, te tahua me te kikokiko – ina hoki te anga kua marohitia, a 'He Ara Waiora' (tirohia te āhua A1-1):

> E tohu ana te waiora i te ariā whānui o te noho ora o te tangata, ka ahu mai i te wai, te toi o ngā mea ora katoa. Ko te tūāpapa o te noho ora kei te kaitiakitanga (te tiaki i ā tātou rauemi katoa), kei te manaakitanga (te manaaki i ētah atu), kei te ōhanga (te toitūtanga) me te whanaungatanga (te hononga tētahi ki tētahi) (O'Connell et al, 2018, p ii).

Āhua A1-1: Te Anga Paerewa Mataora (LSF) a Treasury mō te noho ora, me te anga o 'He Ara Waiora'



Nā: The New Zealand Treasury (O'Connell et al, 2018, p ii)

Ko tā te āhua A1-1 i whakaatu ai, e taiāwhio ana te manapou māori i ngā manapou katoa o te LSF. Ko tō tātou noho-ora kei te mauroa o te manapou māori, kei ngā 'ratonga' rānei a te pūnaha hauropi (Roberts et al 2015),[2] e tāpae ana i te rauemi, i te āhuarangi tūāmauru, e kai ana i te parakino, e kawe ana i te taiora, e tāpae ana i te painga ahurea me ētahi atu painga. Ko ēnei ratonga katoa e tautokohia ana e te pūnaha rauropi: te kararehe, te tipu me te moroiti kua uruatau ki, e paheko tahi ana anō i roto i te pūnaha rauropi. Kei roto anō te tangata i te pūnaha rauropi, e tohua ana tōna āhua e āna pāhekoheko taha ahurea, taha pāpori. E tautoko ana te LSF i te tirohanga Māori ki te ao i te mea e āta mātau ana ki ngā tūhonotanga i waenga i te tangata, i te manapou māori me ngā pūnaha rauropi. E tāpaea ana e ngā anga nei tētahi tīmatanga mō tā tātou whaiwhai ake i te huringa āhuarangi.

Ka whakatinanahia te LSF i roto i te horopaki o te kawea ake o ngā uaratanga pāpori, arā ngā mātāpono o te manaakitanga (te manaaki tētahi i tētahi), o te kaitiakitanga (te matatū heke iho i ngā reanga), te whanaungatanga (te tūhonotanga me te whakawhanaungatanga), te ōhanga (te toitūtanga), te mahi ngātahi (te torotoro me te whai wāhi atu) me te āwhina (tautoko). Ko tētahi atu mātāpono, uaratanga rānei, kua whakaurua atu hei whakaaroaro mā te NCCRA ko te rangatiratanga (te hautūtanga me te mana motuhake) (tirohia te tirohanga Māori, Pouaka 1, mō ētahi atu whakamāramatanga i roto i te horopaki o te huringa āhuarangi).

E tāpaea ana e Te Tiriti o Waitangi te mana kāwanatanga (mana whakahaere), me te āta tiaki tonu i te tino rangatiratanga o te Māori mō te āhua ki ā rātou rauemi māori, rauemi e rokohanga, rauemi ahurea. I raro i ngā kawenga o Te Tiriti o Waitangi e mana ana te noho kaitiaki a te Māori mō te manapou māori me ngā pūnaha rauropi, me te kawenga tuku iho ki te tiaki me te rauhī i te rauemi, i te taonga (rawa). Waihoki, me āta whakaaro anō te haere kōtui me te tuku rauemi ki a ngāi Māori, ki te iwi me te hapū hapū i roto i te tukanga whakatinana i te anga NCCRA. Mā roto i te tukanga nei, e mārama ake ai tātou ki ngā papātanga o te huringa āhuarangi o āpōpō atu ki te taonga Māori, ki ngā hapori me ngā uaratanga. Ko ētahi take pea hei wānanga ina whakaarohia te huringa āhuarangi me te taonga Māori, ko ēnei e whai ake nei (heoi, kāore e whāiti mai ki ēnei):

- he kaha ake te whakahirihiri o te ōhanga Māori ki te rauemi māori tēnā i ētahi atu wāhanga o te ao ōhanga, me te aha, ka kaha ake tāna rongo i ngā papātanga o te huringa āhuarangi me ngā kaupapa here (me te aha, ka nui ake ngā tūraru ki te pakihi Māori me te hiahia kia kitea he rongoā)
- he nui tonu ngā hapori Māori me ngā papa hiranga ki a ia kei te taha moana
- he papātanga tō te huringa āhuarangi pāhikahika ki ngā whānau hāhaka te utu oranga, me te noho pāhikahika anō o te whānau Māori ki tēnei karangatanga
- ngā kawenga a ngāi Māori ki ērā atu iwi o te Moana-nui-a-Kiwa ka pākia e te huringa āhuarangi.

Pērā anō i ngā mātāpono o Te Tiriti o Waitangi (te haere kōtui, te rauhī, te whai wāhi atu me te pito mata) (Te Mana Rauhī Taiao[3]) me te LSF, e arotahi ana te *National Disaster Resilience*

---

[2] Ko te ratonga punaha rauropi he tukanga e whai painga ai te tangata i ngā pūnaha rauropi, pērā i te hau takiwā mā, te wai māori me te rerenga o te hae ki te mahinga kai. E rite ana te wehea o ngā painga nei ki tētahi o ētahi momo e whā: te whakarato (arā, te kai, te kaka, te wai, te kora, te rauemi iranga); te whakariterite (arā, te kounga o te hau takiwā, te āhuarangi, te rerenga o te wai, te rerenga hae, te ārai horo whenua, te ārai i te riha me te mate); taha ahurea (arā, te taha wairua, te taha rerehua, te taha runaruna, te taha whai i te mātauranga); te taha tautoko (arā, te ahotakakame, te hanganga oneone, te kawenga taiora) (Roberts et al, 2015).

[3] Environmental Protection Authority. *He Whetū Mārama* https://www.epa.govt.nz/assets/Uploads/Documents/Te-Hautu/EPA-He-Whetu-Marama-English-poster.pdf

Strategy (NDRS) o nā tata nei ki ngā kaupapa manawaroa o te pāpori, te ahurea, te ōhanga, te taiao kua hangaia, te taiao māori, me te mana whakahaere, kei tōna tūāpapa ko te mātauranga, te raraunga me te arotakenga (Ministry of Civil Defence and Emergency Management, 2019). Ko ngā putanga e rapua ana ko te manawaroa o ngā kāinga, o ngā whānau; ngā pakihi me ngā whakahaere; ngā hapori me ngā hapū; ngā tāone nui, ngā rohe me ngā takiwā; me te whakakaha, te whakamana me te tautoko i te kāwanatanga. Mā ēnei kaupapa katoa e para huarahi e miramiratia ai ko te hononga me te mahi ngātahi e mārama ake ai ki ngā tūraru huringa āhuarangi mō te katoa o Aotearoa, me te tāpaea hoki o tētahi anga hiranga hei tūāpapa mō te the NCCRA.

E miramira ana ngā tūhonotanga kua huaina ake nei i te taupuhipuhi matatini o ngā pārongo e hiahiatia ana e mārama tukupū ai tātou ki te noho-ora mō Aotearoa, me ngā kawenga a te huringa āhuarangi ki tēnei. Kia mārama hoki tātou ki te noho tūraru o ngā taonga me ngā kawenga a te huringa āhuarangi ki a ngāi Māori me ngā uaratanga pāpori whānui, ki te āhua o tā rātou mahi, tā rātou noho. Waihoki, me āta mōhio tātou me pēhea tā tātou urutau ki te rauhī i aua uaratanga i runga i te kore e mōhio ka pēhea te āhua āpōpō atu. Me āta kōmitimiti ngā pārongo mai i tēnā, i tēnā puna, tae atu ki ngā mātauranga mō te ahupūngao koiora, mō te taha pāpori me te taha ōhanga, me te Mātauranga Māori hoki.

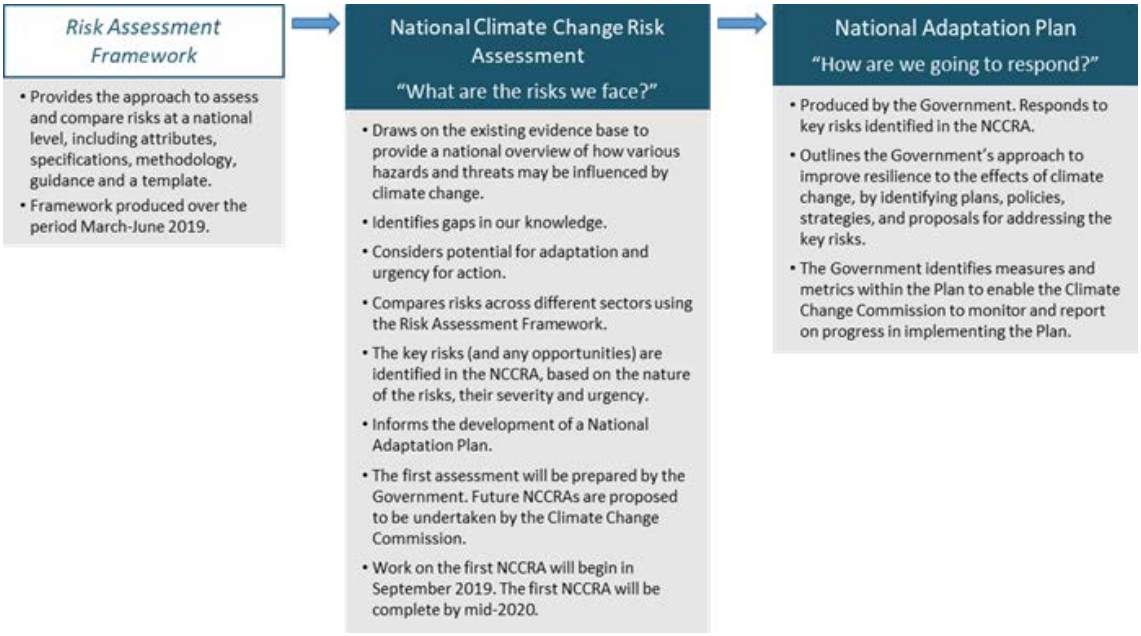
A1.3 Te whāinga a te anga Arotakenga Tūraru Huringa Āhuarangi ā-Motu

Ko te kaupae tuatahi e hangaia ai te NCCRA ko te whanake i tētahi anga arotake tūraru e taea ai ētahi momo tūraru te whakatairite ā-nahanaha nei i runga anō i te whai whakaaro ki ngā uaratanga o Aotearoa (e whakaatahia ana i te NDRS me te LSF; tirohia te tekiona A3.1) me ngā mātāpono (mātāpono ārahi) mō te anga (kei He tirohanga Māori, Pouaka 1). E tāpaea ana e te pūrongo nei taua anga me te kupu ārahi mō te whakahaere i te arotakenga tūraru e taea ai he tirohanga korahi ā-motu whānui mō ngā tūraru e hāngai ana ki te huringa āhuarangi ki Aotearoa o tēnei wā, o āpōpō atu, i raro horopaki huringa āhuarangi kē.

Ko te whāinga a te arotakenga tūraru i ahu mai i te whakatinanatanga o te anga nei, ko te ārahi i te whanaketanga o tētahi Mahere Urutaunga ā-Motu ka whakaritea ina oti mai te NCCRA tuatahi (me ngā NCCRA ka whai iho). Ka urupare tēnei, ka tohu anō i ngā mahi urutau tōmua mō ngā tūraru matua e tautuhia ana i roto i te NCCRA, me te whakamārama anō i te ara ka whāia e te Kāwantanga ki te whakakaha ake i te manawaroa ki ngā pāpātanga o te huringa āhuarangi. E whakaatu ana te Āhua A1-2 i te tukanga e oti mai ai he mahere urutaunga ā-motu me te wāhi anō ki te anga NCCRA i roto i tēnei tukanga.

E hāngai ana te anga nei ki ngā huānga arotakenga tūraru e whakatinanahia ana ki te ao, engari e whai ana anō ki te miramira i te torotoronga (tae atu ki te whakahaere tukanga kohikohi kōrero tahi, hei tauira, ‘te awheawhe tūraru’) me ngā mātāpono o te anga. Me whai whakaaro ki ngā tukanga torotoro me te aromātaitanga i tēnā me tēnā kaupae.

Āhua A1-2: Te wāhi ki te anga Arotakenga Tūraru Huringa Āhuarangi ā-Motu (NCCRA) e taea ai te whanaketanga o te NCCRA me te Mahere Urutaunga ā-Motu ka whai ake



Upoko A2: Tikanga mahi mō te anga

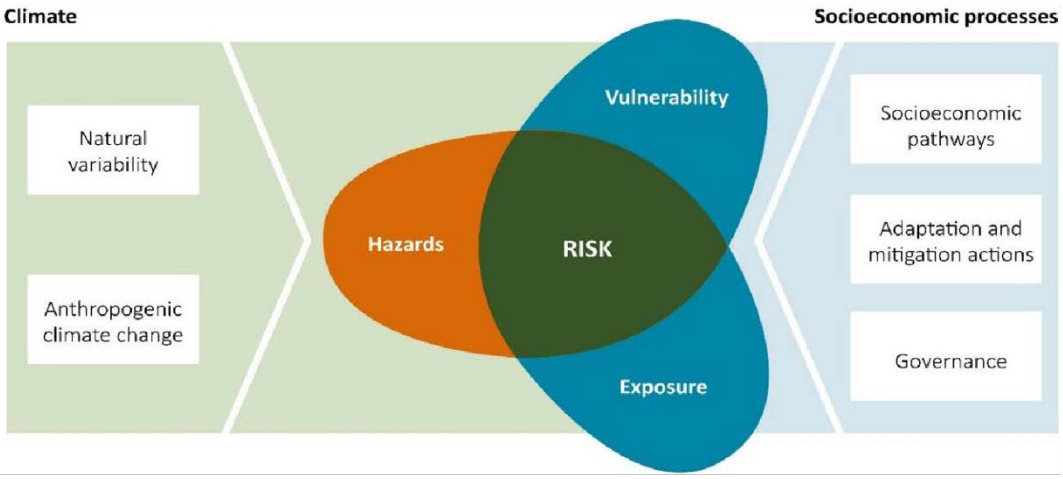
A2.1 Te whakahiato i te tūraru huringa āhuarangi

Ka kōrero te kupu 'tūraru' mō te ngaronga, mō te whiwhinga rānei o tētahi mea e uaratia ana, (te tangata, te rawa, te pūnaha rauropi, te taonga ahurea, te pūnaha hanganga, te aha atu) ka mutu e kīia ana ko te whakatōpūtanga o ngā hua o tētahi mahi, o tētahi āhuatanga, me te tūpono pā mai. E whai ana te arotakenga tūraru kia noho mārama ki te āhua o te tūraru me te tautuhi anō i te taumata o te tūraru, ka mutu ka whāia hei ārahi i ngā whakataunga me ngā mahi ka mahia ki te whakaheke tūraru, ki te whaiwhai rānei i ngā kōwhiringa e hāngai ana ki ēnei momo āhuatanga.

Heoi, ko tā te huringa āhuarangi he waihanga papātanga inaki, papātanga ka āta pā mai ina eke tētahi ia haere tonu (arā, te piki haere o te pae o te moana, te piki haere o te pāmahana o te kōhauhau, te waikawa haere o te moana, te aha atu) ki ōna anō paewae, ki tētahi pae rānei e kore e hokia, e pā ana ki tētahi pūnaha. Kāore ngā tūraru haere tahi e ahu tūturu mai i te āhuatanga kā pā, nō reira ka heke iho te whai hua o te whakatau tata i te tūponotanga pā mai o tētahi āhuatanga hei wāhanga matua o te tūraru. E kimi ana te taiao tūraru hurihuri kia kaha ake te aro atu ki ngā hua (ngā pātai 'he aha ka pā mai'? 'ka pēhea te kino o te pā mai?') tēnā i te whakatau tata i te tūpono pā mai ('he aha te tūponotanga pā mai?'). Hei tauira, kua tīmata kē te piki o te pae o te moana; hei aha te pātai mēnā ka 0.5 mita te piki ake, ko te wā kē e piki ai ki tērā taumata me ngā putanga o tēnei.

Nā rūnga i ēnei take, ka pai ake te whakahiato i te tūraru i te horopaki o te huringa āhuarangi mā te whakamahi i ngā huānga o te **pūmate**, te **noho puare** me te **noho whakaraerae**, mā te inakitanga e tautuhi te tūraru (tirohia te Āhua A2-1) (IPCC, 2014b). He kawenga te tūraru nō te pūmate āhuarangi (he *āhuatanga ka pā tūturu* mai, he *ia* rānei, pērā i te piki o te pae o te moana, te huringa rānei o te āhuarangi pekanga tau), te kaha o te noho puare o ngā mea e uaratia ana e tātou (te tangata, te rawa, te taonga) ki te pūmate me te noho whakaraerae ki ōna kawenga. E kawea ana te noho whakaraerae e ngā tukanga o te ōhangapori me te ahurea (tae atu ki te urutaunga me ngā mahi whakamauru me te mana whakahaere), ka whakapiki ake, ka whakaheke iho rānei i ngā **hua** (nō reira te tūraru) ka hua mai i te noho puare ki tētahi pūmate.

Āhua A2-1: Tauira o te pahekotanga i waenga i te pūnaha āhuarangi kikokiko, te noho puare, me te noho whakaraerae e puta ai te tūraru



Nā: Te Rōpū Mahi Mātauranga Whāiti mō te Urutaunga Huringa Āhuarangi (2017) (whakahounga o te IPCC 2014b)

Kia mōhio: E kawea ana te noho whakaraerae me te noho puare e te putanga piki tonu o ngā ara ōhangapori (te whanaketanga) me te āhua o te hapori whānui me te pahekotanga ki ngā pūmate hurihuri. Ka noho tonu ngā huringa o te pūnaha āhurangi (taha mauī) me ngā tukanga ōhangapori (taha katau) hei āinga matua mō te pūmate, te noho puare me te noho whakaraerae.

A2.2 Ngā waehanga o te tukanga arotake tūraru

Ka noho mai ngā mātāpono ki te tūāpapa o ngā kaupae arotake tūraru (kei te pouaka 1), hei ārahi i te āhua o te whakatinana i ngā kaupae o te tukanga arotakenga tūraru.

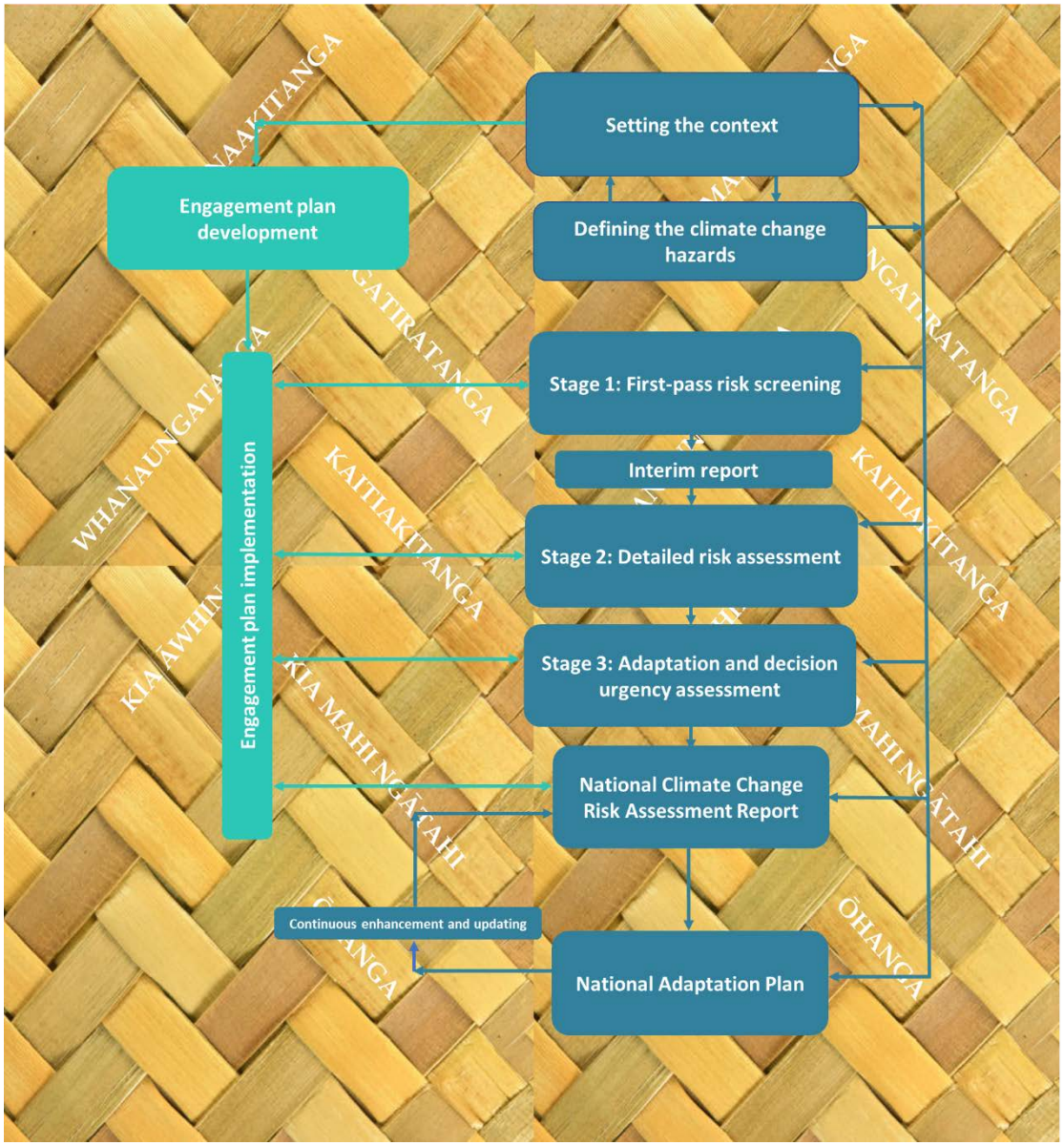
He wero nui ki te hunga whakatau te arotake tūraru i te whānuitanga atu o ngā takiwā i runga i te whai tikanga, ina koa ngā whakatau huringa āhuarangi e pūtahi ana ki ētahi atu takiwā kaupapa here. Me mātua mōhio mō ngā tūhonohonotanga o ngā tūraru huringa āhuarangi tonu me te rite tonu o te ara ake i te *pūhuinga* o ngā puna pūmate (arā, te waipuke ka ahu mai i te pikinga o te pae o te moana me te wai o te whenua me te kino o te ua) me ngā papātanga inaki ka kawekawe i te pūnaha me te rawa maha ki ōna kawenga matatini nei. Me āta whai whakaaro te arotakenga tūraru huringa āhuarangi ki ngā tūraru whakawhitiwhiti ka rere ki te pūnaha rauropi, ki ngā rawa kikokiko me ngā pūnaha hanganga, ki te ao ōhanga, me te pāpori (tae atu ki te hauora tangata, te noho haumaru me te noho ora, ki te ao ahurea me te tuakiri).

Ka whāia e te anga NCCRA ētahi tūāoma e toru ki te ārai, ki te tātari me te whakatairite tūraru i ngā takiwā me ngā rāngai mō te āhua ki te nui o te tūraru me te totoa o te urutaunga, hei ārahi i tētahi Mahere Urutaunga ā-Motu. Ka torotoro tonu i ia tūāōma. Ka whakaaro tonuhia te putanga rau o te arotakenga tūraru huringa āhuarangi i ngā tūāoma katoa nei.

Ka tīmata ake te arotakenga i te whakarite i te horopaki, arā, ki te tautuhi i te ‘huānga noho tūraru’ i te whānuitanga atu o ngā ‘takiwā uaratanga’. Kātahi ka arotakea ko ngā pūmate huringa āhuarangi ki ngā huānga nei, tuatahi ki tētahi tūāoma ārai taumata tiketike, ka āta arotake anō ai i ngā tūraru kua tautuhia kei te mātāriki-ki-te-tiketike ngā hua tērā ka pā. Kua whai ko te tapeke i tēnā, i tēnā, e tohua ai te totoatanga o te urutaunga mā te hunga whakatau. E mōhio ana hoki, ina whāia haeretia te arotakenga tūraru, me whai whakaaro tonu ki ngā take hohoko me ngā papātanga, arā, ina pākia tētahi huānga me te rere o ngā pānga ki ētahi atu huānga, ki ētahi atu rāngai rānei, kua whānui ake te tūraru, kua whakapipi rānei.

He whakamārama poto kei te Āhua A2-2 mō ngā wāhanga o te tukanga arotakenga tūraru (te anga), ka kōrerohia anō i ngā upoko ka whai iho. E whakamārama ana te upoko A3 i te ‘whakaritenga horopaki’, ka kōrero te upoko A4 mō ngā mātāpono torotoro (tae atu ki ngā taipitopito mō te whanake i te mahere torotoro kei upoko C1). Ko te tukanga mō te tautuhi I ngā pūmate huringa āhuarangi me ngā tūāoma arotakenga e toru, e whakamāramahia ana I ngā upoko mātauranga whāiti i te Wāhanga B. Kei ia tūāoma te whakatinanatanga o te mahere torotoro.

Āhua A2-2: Tirohanga whānui ki ngā tikanga mahi i te anga Arotakenga Tūraru Huringa Āhuarangi ā-Motu, me ngā tūāoma e toru ka whāia i te arotakenga



Kia mōhio: Kei te tūāpapa o ngā tikanga mahi ko ngā mātāpono (mātāpono ārahi) mō te anga.

Te whakarite i te horopaki (upoko A3)

Kō tā tēnei kaupae he whakarite i ngā whāinga whānui o te tukanga arotakenga me ētahi atu huānga horopaki, tae atu ki te:

- tohu i ngā uaratanga noho tūraru
- tohu i te hunga whai pānga me ngā hoa kōtui (ka kawea, e whakahaere ana i ngā tūraru?)
- tautuhi i ngā matapaenga huringa āhuarangi me ngā angawā mō te wāhanga pūmate o te tūraru
- whakarite paearu hei arotake i te papātanga, i te noho puare me te noho whakaraerae
- whakaū i te kaha o ngā taunakitanga paearu
- whakaū i te totoa o ngā paearu mō ngā whakatau urutaunga
- pou i te korahi o te arotakenga.

Te whanaketanga o te mahere torotoro (upoko A4 me te upoko C1)

Ka whanaketia tētahi mahere torotoro (i runga i te tikanga mahi papai me te noho mai ki tōna tūāpapa ngā tikanga matatika a te Royal Society of New Zealand) i te tūāoma whakarite horopaki me te noho mārama.

- Me āta whai tikanga papai ina torotoro ki a ngāi Māori (arā, Office for Māori Crown Relations (2018) *Guidelines for Engagement with Māori*), e whai wāhi atu ai tētahi e mātau ana, e whai wheako ana ki ngā mātāpono torotoro i a ngāi Māori.
- Me āta torotoro i tenā, i tēnā tūāoma o te tukanga arotake.
- Ka noho mai ko tā te mātanga kohi kōrero ki te pūtake o ngā tikanga kohi pārongo i tēnā, i tēnā rāngai. I te mea ka hua mai te putanga korokē i ngā haukumenga mātanga, e hira ana te āta whai i ngā i ngā tikanga kohi kōrero kua takoto, kia puata, kia ruarangi hoki te whakahaere i te whakaōritenga o tā ngā mātanga.

Te tautuhi i ngā pūmate huringa āhuarangi (upoko B1)

Ko tā tēnei kaupae he whanake i ngā kupu whakaahua mō ngā pūmate o tēnei wā (me ngā riakatanga mau tonu e hāngai ana ki te āhuarangi – tirohia te pouaka A2-1) kua kitea me te matapaenga o te huringa o te kaha me te auau mō ētahi angawā ki tua e rua me ētahi horopaki kē e rua mō ngā rukenga o te ao. Me whanake ngā pūmate mō ētahi rohenga āhuarangi e whitu e tohu ana i ngā mātauranga āhuarangi rohenga ā-motu whānui i Aotearoa. Ka uru atu ki ngā kaupae nei te:

- mātai i tētahi rārangi pūmate kua kōwhiria tōmuahia (tūtohi B1-1) me te whakaū koia nei ngā pūmate huringa āhuarangi matua (kawenga) ka papā ki ia takiwā uaratanga me ia rāngai
- te tiki atu, te whakarite matapaenga rānei o te kaha me te ahunga kē, ngā huringa rānei o te auau o te putanga ake o ia pūmate mō ētahi horopaki rukenga ao kē (RCP8.5 me te RCP4.5 – tirohia te tekiona A3.3), me ētahi angawā e rua mō tōna 30 tau nei, hei tauira, tētahi ngahurutanga tau i te takiwā ki te 2050 me ētahi tau 100 atu (i mua i te 2100) – tirohia te tekiona A3.3). Kia mōhio e tika ana kia arohaehaetia mō te 2150, kia miramirahia te piki haere tonu o ngā tūraru me te whai tonu i te ara auroa hei whakaaroaro ā-taihoa ake nei i te Mahere Urutaunga ā-Motu
- te whakaae ki te āhua o te huringa i tēnei wā o ngā pūmate nei (hei pae tīmata), te whakarite me te whakaae mō ngā huringa i roto i ngā pūmate mai i te mātauranga, te whakatauira, ngā matapaenga me ngā tukanga kohi kōrero
- te kawe whakamua i tētahi tūtohi whakarāpopotonga o ngā kupu whakaahua pūmate hei whakamahi i te tukanga arotakenga tūāoma-toru.

Pouaka A2-1: Te tautuhi pūmate

E tautuhia ana te 'Pūmate' hei tā te Rōpū ā-Kawanatanga mō te Huringa Āhuarangi (IPPC) i tautuhi ai, arā:

> ko tētahi āhuatanga kikokiko tērā ka puta māori noa nā te tangata rānei i puta ai, tētahi ia, he papātanga kikokiko rānei e mate ai te tangata, e whara ai, ētahi atu papātanga hauora rānei, tae atu ki te tukia, te ngaronga o te rawa, ki te pūnaha hanganga, ki te ara whai oranga, ki te tāpaenga ratonga, ki te pūnaha rauropi me te rauemi taiao (IPPC, 2012, pp 555–564).

I tēnei pūrongo, e tohu whānui ana te kupu pūmate kaua i ngā āhuatanga noa e pā ana ki te āhuarangi, (e mōhio whānuitia ana) engari ki ngā ia hurihuri, ki te āta pā mai rānei o ngā papātanga kikokiko (arā, te huri o te pāmahana o te raumati te heke rānei o te pH i te moana).

Arotakenga Tūāoma 1: Tirohanga tātaringa tūraru tuatahi (upoko B2)

He mahi papamahi taumata-tiketike tēnei tūāoma mā te mātanga. Ka arotakea ngā tūraru mō te angawā kua tohua i te upoko A3, e whakatairitea ai tēnei wā ki te matapaenga o te RCP8.5.

- **Kaupae 1: Te pou i te horopaki, te ārohi me ngā rōpū whai wāhi ake:**
  - te whakaū i ngā rōpū me ngā tukanga kohi kōrero mō ia takiwā uaratanga
  - te whakaū i ngā paearu ine kounga (kaha o ngā taunakitanga, ngā hua)
  - te tautuhi i te hiatotanga o ngā tūraru mai i ngā rohe āhuarangi o ngā rohenga ā-motu
- **Kaupae 2: Te tautuhi i ngā tūraru āhuarangi o tēnei wā** (mō tēnei wā, arā, ngā ngahurutanga tau e rua ka taha) mō ngā rāngai me ngā huānga kua tautuhia i te tūātaka whakarite horopaki. He whakautu tēnei i ngā pātai: 'He aha kā pā mai?', 'E pēhea ana te kaha o ngā kawenga ki te rawa, ki te taonga, ki te rāngai kua kawea kētia?'.
- **Kaupae 3: Te tātari tūraru** mō ngā papātanga ki tua o te huringa āhuarangi me ngā kōwhiringa mō ngā angawā kua tūtohua me ngā matapaenga huringa āhuarangi o te RCP8.5 anahe i tēnei tūāoma.
- **Kaupae 4: Te arotake tūraru** ki te tautuhi i te hiahiatia o te arotakenga tūraru whāiti te tūhuratanga rānei o ngā kōwhiringa. Te miramira i ngā āputa nui ka whakapau kaha ai ki ēnei āpōpō atu. Te aromātaitanga ki ngā paearu hua me te tautuhi i ngā tūraru e noho 'mātāriki' ana e 'tiketike' ana rānei hei kawe whakamua ki te tūāoma ka whai ake kia āta arotake whāitihia. Te whakatakoto pūrongo hukihuki e whakamārama ana i ngā kitenga taumata-tiketike mō ngā tūraru matua mai i te tātaringa o te Tūāoma 1.

Arotakenga Tūāoma 2: Arotakenga tūraru whāiti (upoko B3)

Mō ngā tūraru i tautuhia i te tātaringa tūraru o te Tūāoma 1 (upoko B2), te tātari me te aromātai i ngā tūraru ki tua me ngā kōwhiringa i runga i ngā matapaenga huringa āhuarangi e rua i kōwhiria me ngā angawā (upoko B1).

- **Kaupae 1: Te pou horopaki, te ārohinga me ngā rōpu ka whāi wāhi ake:**
  - te whakaū i te rārangi tūraru mai i te Tūāoma 1 hei āta torohē
  - te whakaū i ngā rōpū me ngā tukanga kohi kōrero i runga i ngā tūraru i tautuhia i te Tūāoma 1
  - **pūmate:** kia whakamahia ētahi atu puna me ētahi atu mātauranga, me tētahi hunga whai pānga ngaio me te torotoronga rangatira, e kohia ai he pārongo whāiti mō ngā pūmate i tautuhia e kawekawe ana i ngā huānga matua kua tautuhia e noho tūraru

ana me ngā huringa o ēnei kua matapaehia, tae atu ki te angawā roraha kua tāpirihia ki te 2150 mō ngā tūraru pūmate taha moana e pā ana ki te waipuke.

- **Kaupae 2: Arotakenga noho puare:** Te arotake i te noho puare o te rawa, te taonga, te rāngai i tēnei wā me ērā tērā ka noho puare āpōpō atu (ērā kua otī kē te tautuhi te noho puare, ka noho tūraru rānei i te Tūāoma 1 ngā mea e rua rānei)
- **Kaupae 3: Arotakenga noho whakaraerae:** Mō ngā rawa, ngā rāngai, ngā taonga kua tautuhia te kaha o te noho puare i te Tūāoma 2, arotakea te rauangi me te raukaha urutaunga whānui o te rawa, te taonga me te rāngai ki te pūmate, e tohua ai he inenga noho whakaraerae.
- **Kaupae 4: Arotakenga hua:** Mai i ngā otinga o te kaupae 2 me te kaupae 3, te aromātai i te pākaha o ngā hua i raro i ngā matapaenga me ngā angawā kua tūtohua mō te huringa āhuarangi (upoko B1). Whakaaroarohia ngā ritenga o te tūraru hohoko e kawe ana ētahi takiwā me ētahi rāngai.
- **Kaupae 5: Whakatau tapeke tūraru:** Tohua te kaha tūraru i runga i ngā hua i te korahi a-motu ka kawe whakamua ai ki te Tūāoma 3.

Arotakenga Tūāoma 3: Arotakenga urutaunga me te totoa o te whakatau (upoko B4)

I ngā tūraru o te Tūāoma 2, tātarihia te urutaunga o tēnei wā me te urutaunga kua whakaritea ki te miramira i ngā tūraru e oti ai he whakataunga urutau e totoa ana, hei ārahi i tētahi Mahere Urutaunga ā-Motu.

- **Kaupae 1: Arotake i te mahi urutau o tēnei wā me ērā kua whakaritea:** E eke ana ngā mahi nei ki te whakahaere i te tūraru e tupu tonu ana? Kei te pai anō te hangore e whakamāramatia ai ngā huringa ki tua kāore e mōhiotia ana?
- **Kaupae 2: Arotake i te totoa o te whakatau:**
  - whakaaroarohia ngā mahi ka roa e whāia ana i mua i te otinga
  - whakaaroarohia ngā wāhi e tōmuā ai te whāia e karohia ai te whai tonu i te ara auroa (tē taea te urutau) ngā hua kino rānei e kore e hokia
  - tautuhia ngā āputa rangahautanga e hāhaka ana te kaha o te taunakitanga mō ngā tūraru e kīia ana he tiketike e hōhonu ana rānei te warawara
  - tautuhia ngā āputa aroturuki.
- **Kaupae 3: Pūrongo mō ngā tūraru matua** i runga i te pākaha me te totoa mō ngā whakatau urutaunga me te whaiwhai ake, ka miramira ai i ngā wāhi e mahia ai ētahi atu mahi, e noho ana rānei hei take rāngahau tōmua.

Ka whakaotia te arotakenga tūraru āhuarangi nei mā te tātari i ngā raraunga me ngā mātākōrero me te kohi kōrero tahi ki ngā mātanga, ki a ngāi Māori, ki te iwi me te hapū, me te hunga whai pānga matua tae atu ki ngā tari kāwanatanga me ētahi atu kaitiaki o aua tūraru. Ka tāpaea he kupu ārahi mō te torotoro me te whakapā atu ki te hunga whai pānga, ki a ngāi Māori, ki te iwi, te hapu, te mātanga me ngā kaihautū urutaunga rāngai ki te kohi pārongo me te whakaraupapa i ngā tūraru e whakaaehia ana, me te aromātai anō i ngā tūraru matua hei whaiwhai ake.

Ka ārahi ngā otinga o te arotakenga tūraru i te Mahere Urutaunga ā-Motu. E whakaarohia ana kei te Komihana Huringa Āhuarangi te mana ki te aroturuki me te arotake i te Mahere Urutaunga ā-Motu.

Upoko A3: Te whakarite i te horopaki mō te Arotakenga Tūraru Huringa Āhuarangi ā-Motu

A3.1 Kupu whakataki

Ko te mahi tuatahi mō tētahi arotakenga tūraru ko te whakarite i te horopaki. Ka uru atu te pou whāinga, te tautuhi huānga matua e tūraru ana, te tautuhi i te hunga whai pānga, te tautuhi i ngā paearu e inea ai ngā tūraru, ka mutu, mō te wāhi ki ngā arotakenga tūraru huringa āhuarangi, te whakaahua i ngā horopaki āhurangi ka whakamahia.

Ko te whāinga a te NCCRA me te Mahere Urutaunga ā-Motu ka whai iho ko te whakamaru i te noho-ora o Aotearoa ki roto atu o āpōpō ahakoa te kore e mōhio mō ngā tūraru huringa āhuarangi kei mua i te aroaro. Ko te hua kē ia ko te rauhī me te whai kia manawaroa ake ngā uaratanga hiranga o te taiao, o te ahurea, me te pāpori, te taiao kua hangaia me te ao ōhanga.

E whakamārama ana ngā wāhanga e whai ake nei i ngā huānga mō te whakarite i te horopaki o te NCCRA.

A3.2 Te tautuhi i tā tātou i uara ai

E tautuhia ai ngā tūraru, me noho mārama tātou ki ngā mea ka noho papa: ko tā tātou i uara ai I hiahia ai ki te rauhī. Mō te NCCRA, me āta tautuhi ngā uaratanga o te motu, ngā taonga tērā ka noho tūraru i ngā papātanga kua kitea me ērā tērā ka pā i te huringa āhuarangi. Mō te whakahaerenga tūraru, e rite ana te kīia o ēnei he 'rawa', he huānga rānei e noho tūraru ana, engari kāore e whāiti mai ki ngā hanga kikokiko; ka uru atu anō ngā uaratanga e rokohanga me ērā tē rokohanga.

Ko te ara kua kōwhiria hei tautuhi i ngā huānga e noho tūraru ana mō te NCCRA tuatahi ka toro, ka hāngai hoki ki te LSF a Treasury, e tāpae ana i tētahi tikanga mō te whakaritérite tohu mō te noho-ora matatū heke i ngā reanga, me te NDRS, e āta tohu whāiti ana i ngā take tōmua me ngā whāinga mō te whakapakari ake i te manawaroa o Aotearoa ki te aituā.

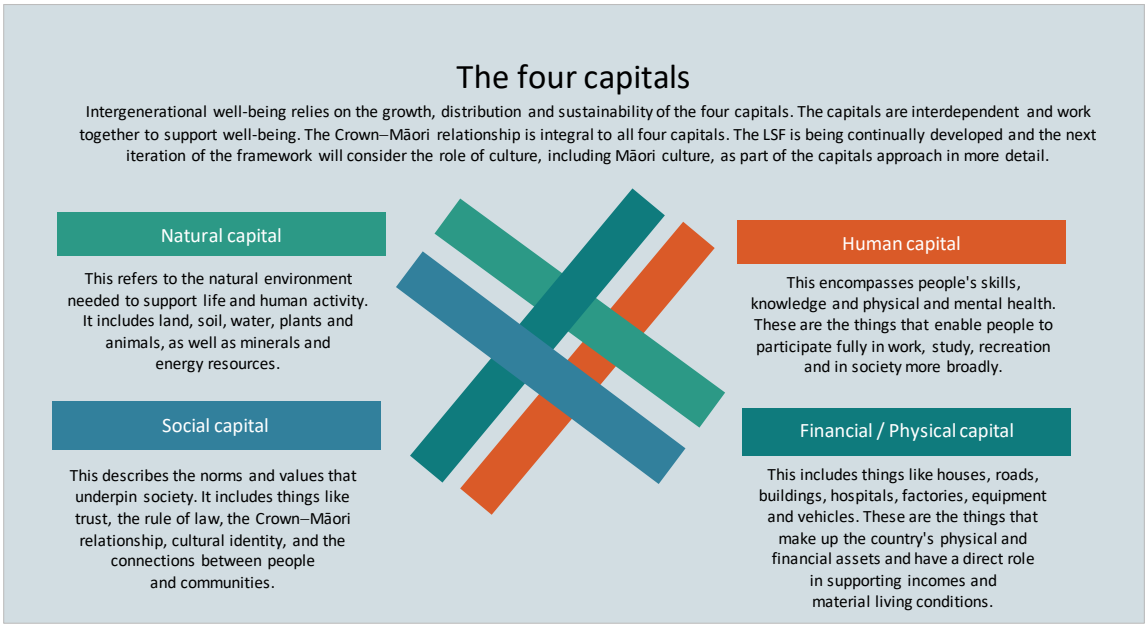
E tohu ana ngā manapou e whā o te LSF – manapou māori, manapou tangata, manapou pāpori, manapou tahua me te kikokiko – i ngā karangatanga whānui o ngā uaratanga me ngā rawa e puta ai te noho ora. Ka taea ēnei te whakahāngai i te taumata ki te tangata takitahi, ki te hapori, ki te motu whānui rānei. Waihoki, ko tā te NDRS he tohu karangatanga mō te huānga me te rawa (e kīia ana anō he manapou) ki raro i ētahi karangatanga whānui o te pāpori, te ahurea, te ōhanga, te taiao kua hangaia, te taiao māori, me te mana whakahaere. Ka tāpaea i konei he hanganga mō te anga NCCRA e noho mārama ai ki te tūraru mō te wāhi ki ngā 'takiwā uaratanga' – ngā rōpū mea e uaratia ana e te hapori whānui – e hāngai ana ki te NDRS me te LSF.

Kua kōrerohia nei i te upoko A1, ki tā te tirohanga Māori, ko te rauwiringa o te tangata me te taiao kei te tūāpapa o te noho-ora, koia nei kei te tūāpapa o ngā pahekotanga katoa, i te mea ko tō tātou oranga kei ngā rauemi māori. E noho matua mai ana anō te rauemi taiao ki ngā manapou katoa. Hei tauira, e whakahirihiri ana te manapou kikokiko ki te kaha o te taiao

māori (te mahinga whenua, te oneone, te wai, te taha moana) me te manapou tangata ki te manaaki i ēnei. E hira ana hoki te manapou māori ki te manapou ahurea me te manapou pāpori (te ahurea, te hapori), me te manapou tahua (arā, mō ngā ahumahi matua, te ao tāpoi, te mahi ika).

E whakaatu ana te Āhua A3-1 me te A3-2 i ngā manapou motuhake e whā o te LSF me ngā takiwā motuhake e ono (manapou) o te NDRS.

Āhua A3-1: Ngā manapou e whā o te Anga Paerewa Mataora



Nā: The New Zealand Treasury

Āhua A3-2: Anga mō te Rautaki Manawaroa ki te Maikiroa ā-Motu

Nā: Department of the Prime Minister and Cabinet, 2019

E whakamārama ana te tūtohi A3-1 i te inakitanga o ngā anga nei, me pēhea anō te hanga ariā me te arotake i ngā rāngai me ngā 'huānga noho tūraru' i te anga NCCRA. E pou ana anō me te whakamārama i ngā 'takiwā uaratanga mō te arotake tūraru, e noho hāngai nei ki ngā takiwā me ngā manapou o te NDRS. E whakamana ana ngā kupu whakaahua i te tūtohi A3-1 i te tūhonotanga o ngā takiwā nei me ā rātou papātanga ki ngā manapou o te LSF, kua miramirahia nei e ngā tohu tae kei te tūtohi.

Tūtohi A3-1: Takiwā uaratanga i takea mai i te Rautaki Manawaroa ki te Maikiroa ā-Motu (NDRS) me te Anga Paerewa Mataora (LSF) a Treasury

Takiwā uaratanga		Whakamārama
Tangata		E tautuhia ana te **manapou tangata** e te LSF ko ngā pūkenga, ngā mātauranga me te oranga taha kikokiko, taha hinengaro o te tangata. Ko ngā mea e rua o muri nei pea ngā mea ka kawea nuitia e te huringa āhuarangi, ka mutu tērā anō e raru ai te āhei ki te whai I te mātauranga me ngā whatunga mātauranga. E rarawhi ana te takiwā tangata i ngā huānga o te **taha pāpori** me te **taha ahurea** nō reira kāore ngā kaupapa nei i noho motuhake. E rauwiri ana te hauora tangata me tōna noho-ora ki te noho-ora o te **taiao māori**.
	Porihanga	Hei tā te LSF i tautuhi ai, e rarawhi ana te **manapou pāpori** i te takiwā **pāpori** me te takiwā **ahurea** o te NDRS, e whai pānga ana anō, e kawe ana anō i te **manapou tangata**. E tautuhi ana te LSF ko te manapou pāpori ko ngā tikanga māori noa, ko ngā tikanga tūroa me ngā whakahaere ka kawe i te noho tahi me te mahi tahi a te tangata me te rongo anō i tō rātou hononga (whakakotahitanga pāpori). Ka uru atu te ngākau pono, te tauutuutu, te tikanga ture, te tuakiri taha ahurea, taha hapori, ngā tikanga tuku iho me ngā tikanga ā-iwi. Waihoki, ka uru atu ki te NDRS te manapou pāpori, te hauora, te ao mātauranga, te oranga, te ture me te rauhītanga hei take matua mō te manawaroa pāpori. Kua tautuhia ko te uaratanga **ahurea**, ko te tuakiri me te mataora, te taonga tuku iho, te taonga me te Mātauranga Māori ngā take matua mō te manawaroa taha ahurea.
	Ahurea	Ko te tautuhinga whānui o te **ahurea** ko "taua toronga whānui matatini e uru atu ai te mātauranga, te whakapono, te toi, te matatika, te ture, te tikanga ahurea, me ētahi atu pūkenga, ritenga rānei ka ākona [e te tangata] i te noho mai ki te porihanga. He ahurea tō ngā tāngata katoa; kāore e whāiti mai ki ētahi karangatanga motuhake ki te pou tawhā matawhenua rānei. Katoa te ahurea tērā ka whakamārama kētia nō reira tērā ka huri kē i roto i te wā me te takiwā. He whakamārama ōkawa kē tō te '**oranga ahurea**' i ngā tikanga o te ao. I tēnei o ngā takiwā uaratanga, ka uru atu ki te 'oranga ahurea' te āhua o te āhei atu, te whai wāhi atu, te wheako, te pārekareka, te whanake me te tītari i tō rātou ahurea i roto i ō rātou hapori. Ka kīia te **ahurea tuku iho** ko 'ngā taonga tuku iho nō ngā tūpuna', tētahi āhuatanga o tō tātou ahurea ka taea te tango ake ka heke iho rānei mai i mua, e uaratia ana i tēnei wā me te hiahia kia tukua iho ki ngā reanga o āpōpō atu. Ka taea te ahurea tuku iho te wawae ki ētahi karangatanga matua e rua: te ahurea tuku iho e rokohanga, tē rokohanga rānei. Ka taea anō te kī he āhuatanga ahurea hoki tō te **taiao māori** tae atu ki ngā takotoranga whenua ahurea me ngā hanga kikokiko, ngā hanga koiora me ngā hanga matawhenua. Ka taea te tuakiri pāpori i te manapou māori pērā i te whenua, te maunga, te awa, te roto.
Taiao māori		E rarawhi ana te **mātāpono māori** i ngā āhuatanga katoa o te taiao māori noho manapou me ngā mahi a te tangata. Koia nei ētahi: • te whenua, te mahinga whenua me te oneone , • te wai māori • te pūnaha rauropi – te tipu me te kararehe • te taha moana me ngā pūnaha hauropi o te moana • Te Kura Taiao – ngā kura ora. E hira ana te rerenga rauropi (mō te riha me te mate) e pūmau ai te manapou māori. Kei te taiao māori te oranga o te **tangata** me ērā atu takiwā katoa.

Takiwā uaratanga	Whakamārama
Ōhanga	I roto i te NDRS, e hāngai ana te manawaroa ōhanga ki te manawaroa o te pakihi, o te ara whai oranga, o te whakahaerenga tahua (te pēke) me te rāngai inihua. E karangahia ana e te LSF te noho-ora mō te āhua ki te **manapou tahua**, engari e whakahirihiri ana te ao ōhanga ki te manapou **tangata** me te manapou **māori**.
Taiao kua hangaia	E rarawhi ana te **taiao kua hangaia** i te pūnaha hanganga, te rerenga waka, ngā momo whare, me ngā taone. Ko te tohu noho-ora o te LSF i tēnei takiwā ko te **manapou kikokiko**.

A3.3 Te tautuhi i ngā huānga matua, ngā hoa kōtui me te hunga whai pānga

Ka taea te whakamahi te anga e whakamāramahia ana i te tūtohi A3-1 ki te tautuhi hūanga noho tūraru, tae atu ki ngā rāngai (arā, ngā ahumahi matua te pūnaha hanganga rānei) me ngā rāngai whāiti (arā, te ahuwhenua, te pūnaha pūngao) tae atu ki ngā rawa e rokohanga, tē rokohanga, me ngā taonga (arā, ngā mea pērā i te noho-ora o te hapori me ngā rawa ahurea).

Ko tā tēnei tukanga he:

- whakamahi i te anga takiwā uaratanga ki te tautuhi i ngā rāngai, ngā pūnaha, ngā taonga me ngā rawa ('huānga') e noho tūraru ana i ia takiwā, i runga i te mōhio ka whakawhiti takiwā, ka mutu ko ngā papātanga ki tētahi tērā ka pā ki ētahi atu o taua takiwā anō, i ētahi atu takiwā rānei. Me āta whakaaro ngā manapou e whā katoa (LSF) i roto i ngā takiwā e ono (NDRS) e hua ai te kapinga o ngā wāhi uara matua mō Aotearoa.
- tautuhi i ngā tari matua, ngā hoa kōtui, te hunga whai pānga me ngā whakahaere e whai wāhi atu ana ki te whakahaere tūraru i ngā rāngai, ngā pūnaha, ngā taonga me ngā rawa nei. Mai i te tirohanga mana whakahaere ā-motu, he manatū, he tari kāwanatanga ēnei, me ngā iwi me ngā rōpū Māori, tae atu ki ngā hunga whai pānga e whai uara motuhake ana ki tētahi huānga noho tūraru kua tautuhia. Me torotoro ngā kāhui nei i roto i te tukanga tautuhi rawa e noho tūraru ana (tirohia ngā upoko A4 me te C1).

E rārangi mai ana he tauira i te Tutohi A3-2 ka taea te whakamahi hei tauira ki te tautuhi huānga tērā ka noho tūraru mā roto i tētahi tukanga torotoro hei tātari i roto i te NCCRA. Kia mōhio hoki kāore i pau katoa mai ngā hunga whai pānga ki te rārangi, tērā hoki ka rerekē I roto i te wā. Me āta ārohi whānui i te wā o te tūāoma mahere torotoronga. Tērā pea ka whakamahinetia anō e te kaiarotake o te NCCRA (ara, ka tāpirihia, ka whakarerekētia ngā rāngai whāiti). Tērā anō hoki ka whakarerekētia ēnei hei whakamahi mā ngā tari rohenga ā motu.

Tūtohi A3-2: Rāngai me ngā huānga tērā ka noho tūraru, hei tā ngā takiwā kei te Rautaki Manawaroa ki te Maikiroa ā-Motu

Takiwā uaratanga		Rāngai, rawa, taonga (huānga noho tūraru)	Tari, hoa kōtui, te hunga whai pānga
Tangata	Porihanga	Noho-ora o te hapori, whakakotahitanga pāpori me te toko i te ora: • hapori taone • hapori taiwhenua • hapori taha moana	MSD, local councils, SOLGM, LGNZ, MPI, Federated Farmers
		Hauora	MOH, ngā DHB, ngā PHO
		Mātauranga	MOE, TEC

Takiwā uaratanga	Rāngai, rawa, taonga (huānga noho tūraru)	Tari, hoa kōtui, te hunga whai pānga
	Hākinakina, mahi pārekareka	MCH, DOC
Ahurea	Ahurea tuku iho: • papa whaipara tangata • whare taonga, toi, papa whakaari	MCH, MPP… ētahi atu DOC
	Ahurea Māori, tikanga Māori, mātāpono Māori	TPK, iwi, rōpū-Māori, Iwi Chairs Forum, Māori Women's Welfare League, New Zealand Māori Council, Māori Climate Change Commission
	Taonga ahurea	TPK, iwi, pan-Māori, DOC
Taiao māori	He Kura Taiao – Taonga ora	TPK, iwi, pan-Māori, DOC, Iwi Chairs Forum, Māori Women's Welfare League, New Zealand Māori Council, Office of the Māori Climate Commissioner
	Wai māori	MfE, MPI, DOC, regional councils, PCE
	Pūnaha hauropi o te taha moana, te ngutuawa, te moana	MfE, MPI, DOC, regional councils, EPA, Hauraki Gulf Forum, PCE
	Haumaru koiora – te noho haumaru i te riha me te mate	MPI
	Mahinga whenua	LINZ, LGNZ, regional councils, local authorities, DOC, MPI, MfE, PCE
	Kanorau koiora	MfE, MPI, DOC, regional councils, PCE
Ōhanga	Ahumahi matua: • Mahi ika • Ngā mahi ahumoana • Ahungahere • Ahuwhenua • Mahinga kai, mahinga wāina	MPI MPI, DOC, MfE, Aquaculture New Zealand MPI, DOC, MfE MPI, DOC, MfE, Beef + Lamb New Zealand, Dairy NZ, Horticulture New Zealand, New Zealand Winegrowers
	Ao tāpoi	MBIE, DOC, Tourism New Zealand
	Hangarau me te pakihi	MBIE
	Whakatipu rawa – Hinonga Māori	TPK, iwi, pan-Māori, Iwi Chairs Forum, Māori Women's Welfare League, New Zealand Māori Council, Māori Climate Change Commission, FOMA, Te Tumu Paeroa
	Inihua me te pēke	Treasury, New Zealand Insurance Council, banks
Taiao kua hangaia	Pūnaha hanganga me te whakaratonga	Local councils, specific sector organisations, New Zealand Lifelines Council, Infrastructure Commission, Treasury, SOLGM, LGNZ, Engineering New Zealand
	• Wai	Water New Zealand, MOH, MfE, DIA
	• Pūngao	MBIE, Electricity Authority, Transpower, lines companies, electricity generators, GIC, Refining

Takiwā uaratanga	Rāngai, rawa, taonga (huānga noho tūraru)	Tari, hoa kōtui, te hunga whai pānga
		New Zealand, EECA, Commerce Commission
	• Rerenga Waka	MOT, New Zealand Transport Agency, KiwiRail, CAA, lifeline utility airports, lifeline utility ports
	• Hangarau tuku pārongo me te whakapāpā haere	MBIE, Vodafone, Spark, 2degrees
	• Whakahaerenga para	WasteMINZ, MfE
	• Ngā momo whare	MBIE, BRANZ, Housing New Zealand, local councils, MHUD, Engineering New Zealand
	Ngā taone	Local councils, MHUD
	Te Whare Āhuru He Oranga Tāngata – Kāinga haumaru, tangata hauora	Housing New Zealand, MBIE, TPK, iwi, pan-Māori, Iwi Chairs Forum, Māori Women's Welfare League, New Zealand Māori Council, Office of the Māori Climate Commissioner, Te Aranga
Mana whakahaere	Pūmate māori	MCDEM, MfE, regional council special interest group on natural hazards, regional and local councils, DOC (coastal)
	Kaupapa waonga	MOD, NZDF
	Whakamaru i te motu me te ture	DPMC, MOD, MOJ, NSS, MFAT
	Hoa kōtui Tiriti	Māori–Crown relations, MOJ, iwi, pan-Māori, Iwi Chairs Forum, Māori Women's Welfare League, New Zealand Māori Council, Office of the Māori Climate Commissioner, DOC
	Tahua	Treasury, Reserve Bank of New Zealand, Office of the Auditor-General

Kia mōhio: Me arotake ngā takiwā me ngā huānga nei ki ngā papātanga ki ngā manapou noho-ora e whā o te LSF. Kāore i tautuhia ngā tari, ngā hoa kōtui me ngā hunga whai pānga katoa, ka mutu he ārahi noa tā ērā kua whakarārangitia. Mā te kaiarotake e whakariterite ngā huānga nei. Tirohia ngā whakapotonga mō ngā ingoa tūturu o ngā tari, ngā hoa kōtui me ngā hunga whai pānga.

A3.4 Kōwhiringa o ngā angawā me ngā matapaenga huringa āhuarangi hei arotake tūraru

Te whiriwhiringa o ngā angawā

Ka whakaaroarotia e te anga NCCRA ētahi angawā e toru mō te arotake tūraru (me ngā kōwhiringa) mai i te huringa āhuarangi. Ka whakaaroarohia he angawā tuawhā i ngā arotakenga Tūāoma 2 mō ngā tūraru pūmate taha moana ka ara ake i te piki tonu o te pae o te moana.

1. **Tēnei wā (te 10–20 tau ka taha)**, e hira ana te wehe i ngā papātanga o te huringa āhuarangi e haere ana i tēnei wā hei pae tīmata mō te whakaaroaro i te totoatanga o ngā tūraru tiketike kua tautuhia i roto i te tukanga arotakenga tūāoma-toru. I kīia te kimi

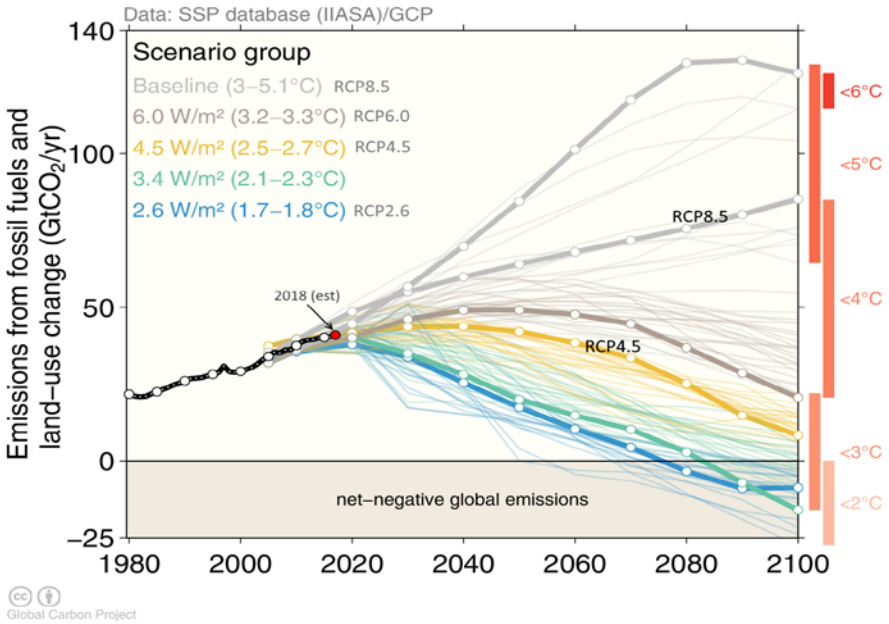
tautoko mō te āhua o tēnei wā he kahanga o te NCCRA tuarua i Peretānia (Warren et al, 2018). He whai tikanga anō tēnei pae tīmata mō te tukanga torotoro, te tikanga kohi kōrero i mua i te whakaaroaro ki ngā papātanga o āpōpō atu.

2. **Toru tekau tau**, kei te takiwā ki te 2050 (te ngāhurutanga tau 2040–2050 rānei). Ka kapi i konei ngā hurihanga ki tua o ngā mahere pae tawhiti a ngā kaunihera, ka mutu ko te 30 tau te angawā whakatakoto mahere rautaki pūnaha hanganga a ngā kāwanatanga ā-rohe (Local Government Act 2002, s101B) me ā rātou mahere whakahaere rawa. E hāngai ana anō tēnei ki te roa ake o te wā mō te whakaaetanga rauemi kua whakamanahia (ki te 35 tau), e pai ake ai te miramira i ngā tūraru āhuarangi ā taua wā.
3. **I mua i te 2100 (kei tōna 60–80 tau)**, taka mai ki tēnei wā, koia nei te wā e tohua whānuitia ana hei wā e matapae whāitihia ai te huringa āhuarangi (mā tēnei angawā e taea ai te matapae mō ētahi tāupenga āhuarangi whānui hei whakamahi me te kore e mate ki te matapae). Kei te pai te roa o te 2080–2100, ahakoa te tika mō ētahi whakataunga kia 100 tau neke atu te angawā, inā rā, ko te whāinga matua o te arotakenga huringa āhuarangi ko te tohu i ngā mahi tōmua hei whaiwhai ake mō ngā tūraru tiketike i runga I te whakatairiterite.
4. Mō ngā **tūraru taha moana** e pā ana ki te piki o te pae o te moana, me arohaehae anō ngā tūraru tae atu ki te **2150** i te arotakenga Tūāoma 2, inā rā: i) ko te mana ki te arotake I ngā tūraru taha moana (tae atu ki te huringa āhuarangi) kia toro "ki te 100 tau neke atu" kua noho kē mai ki te *New Zealand Coastal Policy Statement 2010* (Department of Conservation, 2010); ii) e wātea ana tētahi huinga matapaenga mō Aotearoa motuhake mō te piki o te pae o te moana tae noa ki te 2150 i te Kupu Ārahi mō te Pūmate Taha Moana me te Huringa Āhuarangi (Ministry for the Environment, 2017, p 105, āhua 27), ka mutu iii) kua takoto kē mai i te taumata ā-motu he taipitopito kōrero mō te noho puare o ngā wāhi taha moana ki te tūraru waipuke taha moana ki te 3 mita (Parliamentary Commissioner for the Environment, 2015; Paulik et al, 2019; LGNZ, 2019). He mahara tonu, he whai whakaaro tonu ngā iwi me ngā hapū ki te tirohanga pae tawhiti neke atu i te 100 tau mō te taha moana me ngā papātanga o te piki tonu o te pae o te moana ki ā rātou taonga me ngā papa ahurea. Mā te whakaaroaro ki te angawā o te 2150 e miramira ngā take o te aukatinga me te whai tonu i te ara auroa tērā ka ara ake i ngā mahi e whakaarotia ana i te Tūāoma 3.

Kōwhiringa o ngā matapaenga huringa āhuarangi

Ko ngā matapaenga huringa āhuarangi e tūtohia ana i te anga NCCRA i ahu mai i ētahi arawhiu haurehu kati mahana kukū e whā (ngā RCP) i whakamahia e te Rōpū Tari Kāwanatanga mō te Huringa Āhuarangi (IPCC) i tana Pūrongo Arotakenga tuarima (2013–2014) (IPCC, 2014a). E tohu ana, e whakaahua ana ngā RCP i ētahi huringa āhuarangi whāiti o āpōpō atu tērā ka pā (āhua A3-3) hei whaiwhai ake i ngā arotakenga. E tohu whānui ana ngā RCP torutoru nei i ētahi horopaki e pā ana ki te āinga hihinga, te mahana haere rānei mō ia mita pūrua o te Nuku (Watts/m^2) mai i te āhua o te ao ahumahi o mua atu i te 1750. E komokomihia ana ki ngā ara rukenga a te RCP te rerekē o te whakamahi i te whenua, ngā matapaenga taupori me ngā rerekētanga taha pāpori, taha ōhanga tērā pā ki te ao whānui.

Āhua A3-3: Te rerenga o ngā ara rukenga waro hāora-rua o te ao mō te (CO_2) i te koranehe me te huri o te whakamahi i te whenua me te matapaenga pāmahana o te ao i mua i te 2100



Nā: Whakahounga mai i te Hōtaka Waro o te Ao: www.globalcarbonproject.org/carbonbudget/18/presentation.htm (Slide 40)

Kia mōhio: Ko ngā tohu arawhiu kati mahana kukū (ngā RCP) i whakamahia e te IPCC e whakamāramahia ana i te pātohu, ko ngā RCP e rua i kōwhiria mō te NCCRA e whakamāramahia ana i te kauwhata. E whakaatu ana te rārangi pango i te ia o ngā rukenga waru hāora-rua o te ao ki te 2018. GCP = Hōtaka Waro o te Ao; $GtCO_2/yr$ = ngā piriona tone waro hāora-rua i te tau; IIASA = International Institute for Applied Systems Analysis; SSP = shared socioeconomic pathways; W/m^2 = Watts mō ia mita pūrua.

Ko ngā matapaenga RCP e rua i kōwhiria mō te arotakenga tūraru whānui, me ngā tau waenga (e 50-ōrautanga) matapaenga o te toharite pikinga o te pāmahana ā-tau ina whakatairitea ki te paetīmata o te 1986–2005 (Ministry for the Environment, 2018; tūtohi 5 me te 6, pp 38–39), ko te:

- **RCP 4.5** – me te rerenga o ngā matapaenga pāmahana ā-tau i te whānuitanga atu o Aotearoa o te 0.7–0.9 waeine Celsius i mua i te 2031–2050 me te 1.3–1.4 waeine Celsius I mua i te 2081–2100
- **RCP 8.5** – me te rerenga o ngā matapaenga pāmahana ā-tau i te whānuitanga atu o Aotearoa o te of 0.9–1.1 waeine Celsius i mua i te 2031–2050 me te 2.8–3.1 waeine Celsius i mua i te 2081–2100.

Mō te tūāoma tātari tūraru tuatahi (Tūāoma 1, upoko B2), ko te matapaenga RCP8.5 tiketike noa e hiahiatia ana, ko te whāinga kē hoki o te tātaringa ko te whakatairite me te whakatau I ngā tūraru matua hei tātari i te wā o te arotakenga tūraru whāiti. Ka heke iho hoki te whakapaunga kaha e taea ai te aromātai ngā papātanga whānui tonu me te kaha o te pānga, I raro i tētahi horopaki tiketike kotahi o ngā rukenga o te ao i te auau o te pānga i tēnei wā. Heoi anō, e whakahaua ana kia whakmahia ētahi matapaenga huringa āhuarangi e rua mō te tūāoma arotake tūraru whāiti (Tūāoma 2, upoko B3) ki te kōpani i te warawara ki ngā ara whiu o āpōpō atu o ngā rukenga hauarehu kati mahana o te ao (āhua A3-3) me ngā uruparenga āhuarangi e hāngai ana.

A3.5 Te Turaru me te paearu totoa

Ka rere mai ngā paearu whakatau i te whāinga o te NCCRA, arā, ki te ārahi i te whanaketanga o te Mahere Urutaunga ā-Motu (tirohia te tekiona A1.3). Ko te tikanga o tēnei ko te arotahi ki ngā tūraru i te taumata ki te motu me tētahi arotakenga e taea ai e te kāwanatanga matua te tohu mahi tōmua e nui atu ai te whai painga ki te motu nui tonu.

Ka inea ngā tūraru i runga i te pākaha me te nunui o ngā putanga, te kaha o te taunakitanga mō ngā whakatau tata o te pānga o tētahi āhuatanga (pūmate), ngā paewae rānei e whakawhitihia ana (ngā riakatanga me ngā ia) mō te āhua ki ngā matapaenga huringa āhuarangi kua kōwhiria mō ngā angawā kua kōwhiria (tirohia te tekiona A3.4 me te upoko B1), me te totoa o te whakataunga mō te urutaunga e whaia haeretia ai ngā tūraru tino hiranga.

Koia nei ētahi o ngā paearu kōwhiri tūraru:

- te kaha o ngā taunakitanga mō te whakaahua i te pūmate, me te hoatu tapeke tūraru (tirohia te tūtohi C2-1 i te upoko C2)
- te nunui o ngā putanga (te noho puare me te noho whakaraerae) i te whānuitanga atu o ngā manapou e whā o te LSF (tirohia te tūtohi C2-2 i te upoko C2)
- te totoatanga o ngā whakataunga (upoko B4).

Mō ia huānga me ia rawa, ka inea te tūraru i runga i te paheko i ngā tapae putanga mō ia manapou LSF ka kawekawea. Me mōhio hoki kāore te NCCRA tuatahi e komokomo i ngā matapaenga ōhangapori ki roto i te whakaraupapatanga o te nui me te pākaha o te putanga. Ka whakamahia pea tēnei i ngā putanga o āpōpō atu o te anga, e komokomohia ai ngā tikanga ki te arotake i te kawenga o ngā huringa ōhangapori (kāore e āta mōhiotia ana).

Ka kōrero tonu te anga mō ngā mahi urutau o tēnei wā me ērā kua whakaritea me te pānga o ngā kaupapa here a te kāwanatanga, āna mahi rānei o tēnei wā ki te kawe i te taumata tūraru.

A3.6 Te korahi o te arotakenga

He arotakenga ā-motu whānui te NCCRA o ngā tūraru huringa āhuarangi. Ko tētahi wero o te arotakenga ā-motu ko te āhua o te whaiwhai ake i ngā uruparenga matawhenua kē me ngā taumata rerekē o te noho puare ki ngā riakatanga āhuarangi e kore ai e waimeha ngā inenga ina whakahiatotia ki tētahi korahi ā-motu. Tērā pea ka mahue ētahi papātanga hira ka kawe i ētahi o ngā rohe anahe (arā, te ahumahi matua, te ao tāpoi, te pūnaha hanganga rānei o ngā taone matua) ka hua mai rānei i ngā auautanga rerekē o ngā āhuatanga pūmate tino kino i te korahi ki te rohe engari ka whai pānga tonu ki te whakahiatotanga o ngā papātanga.

E whakaaroarohia ai ngā huringa e pā ana ki te āhuarangi ka whakaputa kē ōna papātanga i ngā rohenga matawhenua, ka whakahaeretia te arotakenga ki ngā rohe o ngā rohenga ā-motu e ono e whakamahia ana e te National Institute of Water and Atmospheric Research (NIWA) mō te arotake tirohanga āhurangi pekanga tau (NIWA, 2019a), me tētahi atu rohenga mō Wharekauri. E whakamāramahia ana ngā rohe i upoko B1.1. Ka kīia ngā tūraru e whakaarohia ana he tiketike, he tino kino i ngā korahi ā-rohe he tūrarutanga ā-motu. Waihoki, ina tohua te tūraru he mātāriki he tiketike rānei i ētahi rohe, ka kīia anō he tūrarutanga ā-motu. Ka kitea ngā kōrero whāiti mō ngā tikanga mahi mō tēnei arotakenga i upoko A2 me te Wāhanga B. Ko ngā pārongo mō te whakamahi i te anga i tēnā, i tēnā korahi kei te upoko C5.

Upoko A4: Torotoronga arotake tūraru

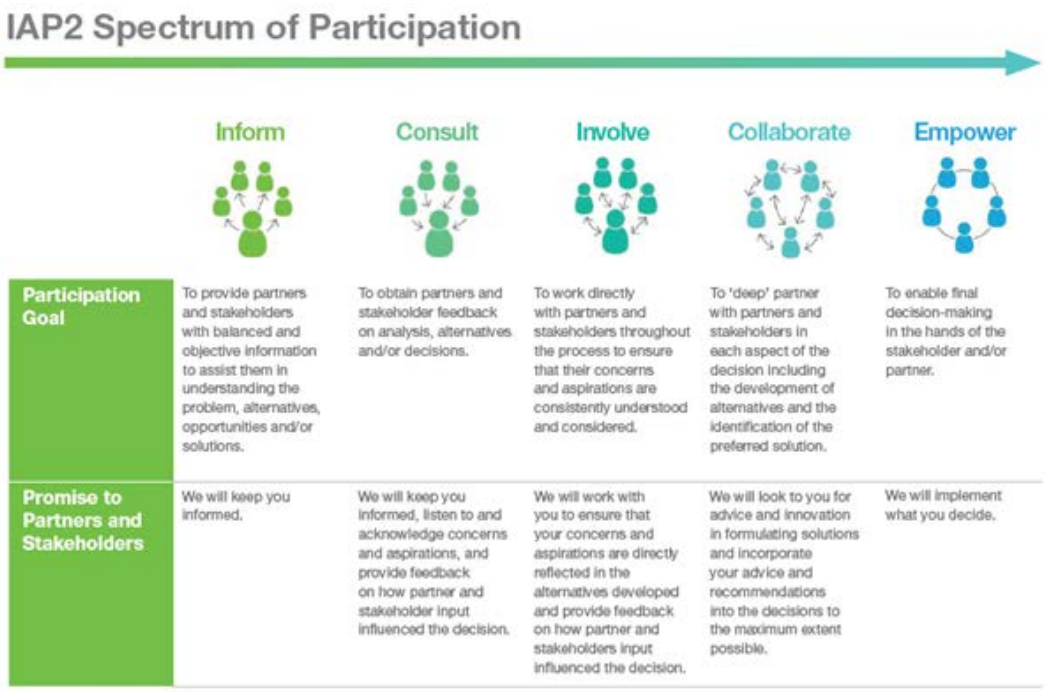
A4.1 Whakaaroarotanga whānui

He wāhanga hira te torotoronga i te anga arotakenga huringa āhuarangi nei. Me haere tēnei mahi i ia tūāoma o te tukanga whakahaere tūraru ki ngā whakahaere Māori whānui me te hunga whai pānga o te motu, o waho atu hoki. Ko ngā mahi torotoro me ngā kōpanatanga mō ia tūāoma, mō te whanake i tētahi rautaki torotoro ki te whakatakoto i te NCCRA me te whakatinana anō, e whakamāramahia ana i te upoko C1, he whakamaharatanga hoki kei te mutunga o ia upoko tūāoma arotakenga (ngā upoko B2, B3 me te B4).

I tēnei anga, e tautuhi ana te 'hunga whai pānga' i te tangata takitahi, i te rōpū tāngata, i te whakahaere, i te hinonga tōrangapū rānei e whai pānga ana ki te putanga o tētahi whakatau ki te papātanga o tētahi kaupapa here, o tētahi hōtaka, o tētahi whakaaro rānei. Ka taea anō te whakamahi te kupu 'hapori', e tautuhi nei i te tangata takitahi, i te rōpū tāngata, i te hunga whai pānga, i ngā rōpū whai whakaaro ake me ngā rōpū kirirarau. He wāhi matawhenua pea te hapori (hapori wāhi), he hapori whakaaro tahi (hapori mahi) he hapori rānei e tūhono ana e rite ana te tuakiri (pērā i te ahunga mahi). E kōrero ana te 'hoa kōtui' mō te torotoro motuhake ki a ngāi Māori, ki te iwi me te hapū, e whakaahua ana i ngā mātāpono haere kōtui o Te Tiriti o Waitangi.

Mō tēnei arotakenga tūraru, me torotoro haere tonu e whai whakaaro ai ki ia tūāoma o te tukanga arotakenga. Tērā ka hiahiatia ētahi tikanga me ētahi momo torotoronga maha i tēnā me tēnā tūāoma o te tukanga, tērā anō hoki ka hiahiatia tētahi tūāwhiorangi mahi torotoronga (arā, te ārahi, te kōrero tahi, te uru atu, te mahi tahi, e whakaaturia nei i te āhua A4-1). Kāore he tuku āheinga he 'whakamanatanga' rānei e hiahiatia ana i te mea kāore he whakatau urutaunga o roto i te arotakenga tūraru e āta tuku mana ana.

Āhua A4-1: Whakahounga o te tūāwhiorangi whai wāhitanga kei te International Association of Public Participation (IAP2)



Nā: International Association of Public Participation www.iap2.org

He tukanga ka āta whakaritea te torotoronga i runga i te whai kia mahi tahi ki ngā whakahaere, ki ngā hoa kōtui, ki te hunga whai pānga me ngā hapori ki te tārai i ngā whakataunga, i ngā mahi ka mahia e hāngai ana ki tētahi raruraru, tētahi kōwhiringa ki te putanga rānei. Kāore te katoa o te hunga whai whakaaro atu ka hiahia whai wāhi atu ki te tukanga arotakenga tūraru; ko ētahi ka hiahia kia rite tonu te tae atu o te kōrero hou, ko ētahi atu ka hiahia ruku atu ki te kaupapa. He rahi ngā puna kupu ārahi e taea ana mō te mātāpono torotoro, mō te tukanga me te hoahoatanga, tae atu ki te Kupu Ārahi mō te Huringa Āhuarangi me te Pūmate Taha Moana (Ministry for the Environment, 2017); te International Association of Public Participation (IAP2); Standards Australia/New Zealand (2010) me te Commonwealth Scientific and Industrial Research Organisation (Gardner et al, 2009).

A4.2 Whakaaro motuhake mō te torotoro i a ngāi Māori

Ina whakaritea ngā tikanga torotoro ki a ngāi Māori, ki te iwi me te hapū, e tika ana kia whai whakaaro tātou ki te raukaha me ngā pūkenga o te hunga ka torotorohia, pērā i ō rātou pūmanawa, te mātauranga, ngā take tōmua e taupatupatu ana, ngā rauemi me te wā e hiahiatia ana e whai tikanga ai ngā uruparenga ki tā tātou inoi kia whai wāhi mai rātou (Waikato Regioinal Council, 2017). Ina whakahaeretia te NCCRA, me āta whakamahi ngā tikanga kua poua mō te torotoro i a ngāi Māori (arā, te Office for Māori Crown Relations (2018) *Guidelines for engagement with Māori*), ka mutu me whai wāhi atu ki te tukanga tētahi tangata whai mātauranga, whai wheako ki ngā mātāpono me ngā tikanga torotoro i a ngāi Māori.

E hira ana te whai tikanga o te torotoro i a ngāi Māori e pai ake ai te kounga o ngā putanga, e ea anō ai hoki te haere kōtui a ngāi Māori–Crown. Mā konei e taea ai e koe te kohi pārongo, te kohi whakaaro me te uruparenga i taua wāhi tonu, e kaha ake ai te whai mana o ngā putanga. He tāpaenga tō te torotoro tika i a ngāi Māori ki te whanake kōwhiringa kaupapa here whai painga, ki te āwhina i ngā tari ki te tāpae kupu ārahi ruarangi ki ngā Minita, ki te whakatutuki putanga pai ake. Ko te tukanga torotoro pono a te Kāwanatanga ki a ngāi Māori ko te (Office for Māori Crown Relations, 2018):

- whakamana i tō rātou rangatiratanga me tō rātou tūnga hei hoa kōtui i raro i te Te Tiriti o Waitangi
- whakamana i te tāpaenga hira o te Mātauranga Māori ki te rongoā i ngā raruraru kaupapa here me ngā raru whakatinana i tētahi mahi
- whakaae he rauemi, he pūkenga o ngāi Māori hei tāpae ake
- whaakae ka kawea pāhikahikatia a ngāi Māori e ētahi o ngā take nō reira ka pai ake mēnā ka riro mā ngāi Māori tonu e whanake rongoā.

Ko te tikanga o te torotoro ko te hanga hononga whai tikanga; ka nui te hiranga o tēnei ki a ngāi Māori. Ina taea me kōrero ā-waea atu, me kōrero kanohi ki te kanohi rānei, hei aha te tuku īmēra atu.

Tērā tonu e whāiti ai te raukaha o ngā whakahaere a ngāi Māori, a te iwi me te hapū mō te torotoronga me ētahi atu take tōmua ka noho taupatupatu. E manawa popore ana ngā rōpū Māori ki te urupare me te whakautu i ngā tono a ngā tari huhua. Tērā tonu hoki kāore a ngāi Māori, te māngai rānei o te iwi, o te hapū e utua mō te wā e whakapaua ana, kāore i nui ā rātou rauemi, ka mutu he rahi ngā kaimahi e mahi tūao ana, e mahi harangote ana rānei. Me mātua whai wāhi atu ngā whakahaere me ngā māngai ki te whakariterite i ngā tikanga torotoro, kia takoto ai ko tētahi tukanga e tāea ana te whakatutuki, e rite ana, e hāngai ana ki ngā rōpū e rua. Koia nei ētahi mea hei whakaaroaro ake:

- te tirotiro mēnā he mahere tā te iwi, te hapū, tā te whakahaere Māori rānei mō te whakahaere i te taiao i te huringa āhuarangi rānei. Mēnā āe, tirohia ngā whakahau o roto i mua i te torotoro atu, kei noho mai hoki he tikanga torotoro e paingia ana, he utu rānei e pā ana ki tēnei, he take kua tautuhia he take tōmua rānei e pā ana ki te huringa āhuarangi. Ka taea pea e ngā mahere nei te ārahi te whanaketanga o te rautaki torotoro.
- te tirotiro ki te wāhi mō ngā mahi torotoro me ngā wāhi pai ki a ngāi Māori (arā, ki te marae, mā wai tēnei e whakarite, hei tauira, mā te mātanga hāpai, mā te māngai Māori rānei o te iwi o te hapū). Me mātua mōhio koe mō ngā tikanga motuhake mō taua marae
- te hua kua uru atu ki ngā whakaritenga pūtea ngā utu mō te hui, mō te wā ka pau i a ngāi Māori, i te iwi, i te hapū rānei, me ngā mahi tautoko taha ahurea
- te hua e pai ana te angawā kua whakaritea mō te torotoronga ki ngā rōpū e rua
- i mua i e kohinga o te mātauranga Māori mō te arotakenga tūraru nei, kia āta kōrerotia, kia āta whakaaetia te taumata o te tūpono āritarita, o te rauhī, o te tuku whānui, te whakamahinga me te 'rangatiratanga' ki te hunga tāpae mātauranga.

Ina torotorohia a ngāi Māori i te taumata ā-motu, e tūtohu ana mātou kia whakaarohia e te kaiarotake tūraru, hei mahi tuatahi, tētahi tukanga e toroa ai a ngāi Māori e noho māngai ana mō ētahi o ngā takiwā me ngā kaupapa (arā, te taiao kua hangaia, te taha tangata (te pāpori, te ahurea me te mana whakahaere), te taiao māori me te ōhanga). Ka taka mai ki raro i ngā rōpū ā-motu me ngā rōpū ā-Māori whānui ēnei e whai ake nei: te Iwi Chairs Forum (Pou Taiao Committee); te New Zealand Māori Council; te New Zealand Māori Women's Welfare League; te Office of the Māori Climate Commission; me te National Māori Climate Network. Ka pai ake te hunga Māori tautōhito ki te torotoro haere e whai whatunga tūhonotanga kua roa e tū ana kia angitu ai te torotoro ki ēnei whakahaere.

Tērā pea ka whāiti mai ētahi tūraru huringa āhurangi ki ētahi wāhi motuhake, pērā i te kaha ake o te tauraki i ngā wāhi ki te rāwhiti, nō reira e tūtohi ana kia torotoroa te tangata whenua (ngā whakahaere kua whakamanahia e ngāi Māori, e te iwi, e te hapū) i ngā wāhi motuhake e noho tūraru ana. Kia pūruahia te kōrero, ka pai ake te tautōhitotanga e hāngai ana e whai whatunga tūhonotanga kua roa e tū ana kia angitu ai te torotoro ki ēnei whakahaere. Me whai whakaaro hoki ki te tika o ngā rauemi mō te tukanga torotoro, hei tauira, kia utua te wā me ngā haerenga a ngā māngai o te iwi, o te hapū, te koha me ngā kaiārahi taha ahurea, ki te hiahiatia.

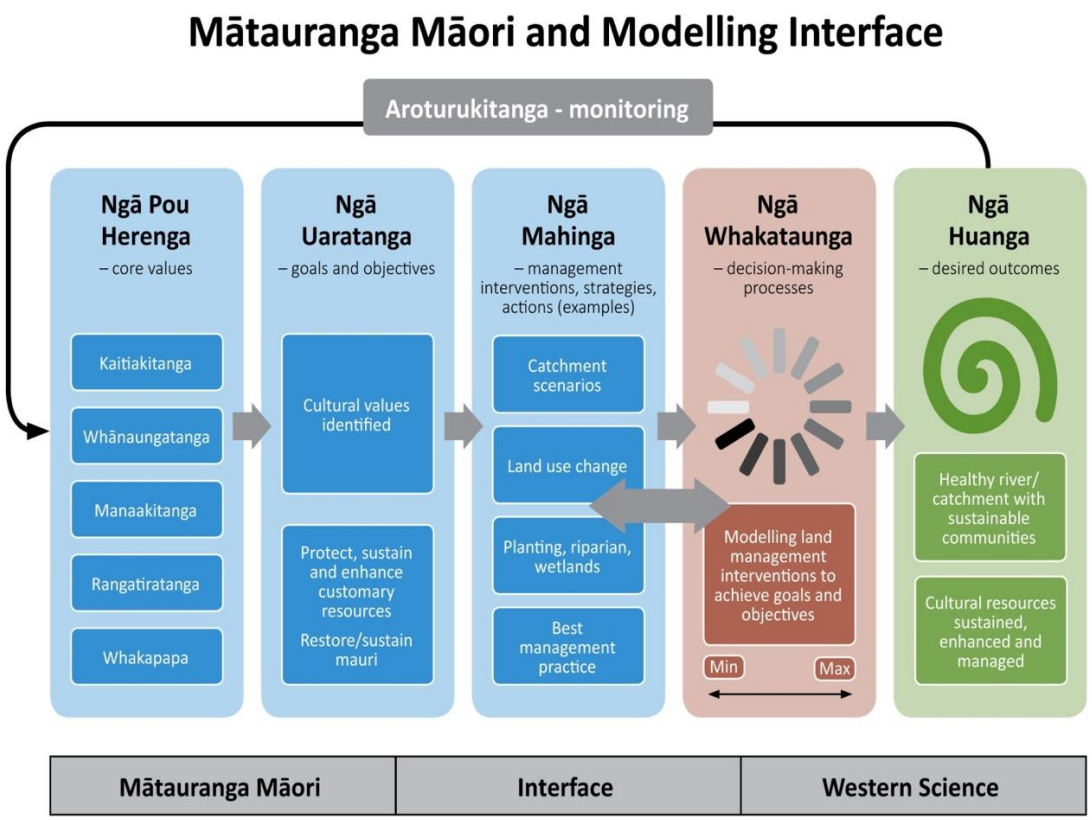
E takoto mai ana ngā aratohu mō te whanake me te mahere torotoro i te upoko C1.

A4.3 Te whakaaroaro ki te Mātauranga Māori i te tukanga arotake tūraru

Mō te roanga atu o ngā tūāoma arotake tūraru, ka taea te whakahaere ngā tukanga mahi ngātahi mō te tautuhi tūraru ki a ngāi Māori, ki te iwi me te hapū ki te taonga me te rawa motuhake i te whānuitanga atu o ngā takiwā e uaratia ana o te anga nei. E whakaatu ana te Āhua A4-2 me pēhea te whakamahi i te arotakenga ine i te nui me te Mātauranga Māori e puāwai ai he horopaki whakahaere whenua me te whakamaurutanga e tutuki ai ngā putanga me ngā whāinga e wawatatia ana e te iwi e te hapū mō ā rātou rawa ahurea me ā rātou taonga. I te tauira o te āhua A4-2, e whakamahia ana te aroturukitanga taha ahurea, taha pūtaiao ki te mataara i ngā ia e whai atu ana, e tawhiti kē atu ana rānei i ngā whāinga e wawatatia ana. I whakamahia tēnei tauira e Harmsworth et al (2014) i ngā whenua rerenga wai o te Manawatū me Kaipara me te haere tonu o te whakamahine me te whakahounga mā roto i te 'whakaūnga o te ariā' me te whakamahinga o ngā taputapu whakatauira whenua rerenga wai, pērā i te

tātaringa mokowā, te tauira a te Catchment Land Use for Environmental Sustainability (CLUES) (NIWA, 2019a) me te SedNetNZ (Dymond and Basher, 2019) ki te whanake horopaki whakamauru mō ngā para kei te wai māori, pērā i te waipara, i te hauota, i te pūtūtaewhetū me te tukumate. He āwhina kei te ara nei mō te ārahi i ngā whakataunga whakahaere tūraru e pai ake ai ngā rautaki whakahaere tūraru, e matatū ai, e rauhītia ai ngā uaratanga ahurea me te kaha ake o te whai wāhi atu a te iwi me te hapū ki te urutaunga huringa āhuarangi.

Āhua A4-2: Te tauira ki ngā wawata me ngā putanga ki a ngāi Māori aspirations and outcomes



Nā: Harmsworth et al, 2014

Wāhanga B: Upoko Mātauranga Whāiti

Upoko B1: Te tautuhi i ngā pūmate hurihuri mō te arotakenga tūraru

B1.1 Defining hazards

Chapter A3 described the conceptual basis for defining values, assets and systems that may be at risk from exposure to climate-related hazards and the selection of climate change projections and timeframes to consider.

This chapter defines sub-national climate zones. It outlines the process for developing descriptors to represent the climate-related hazards for different emission scenarios and timeframes as input to the climate change risk assessment stages. The 'hazard component' of risk (left-hand part of figure A2-1 in chapter A2) can be related to either:

- a worsening of natural hazard events (magnitude, persistence and changing frequency with time), conventionally seen as a 'hazard' (eg, more intense short-duration rainfall)
- a gradual onset 'stressor' or **'**trend' (eg, change in seasonal rainfall patterns or receding snowlines, decreasing ocean pH or international climate-related influences).

The term 'hazard' is used in this framework to describe the component or driver of the 'increased or accelerated' risks arising from climate change. This follows IPCC terminology, with the term 'hazard' referring to hazards, stressors and trends. This step's main task is to develop concise 'descriptors' of the main hazards. These should include the magnitude of change and/or change in frequency of occurrence by around 2050 (30 years) and 2100 (60–80 years), plus 2150 for coastal hazard risks only, for two climate projections and variations in geographical influence across defined sub-national climate zones (figure B1-1).

A useful starting point for assessing future risk is to appraise the present situation of climate change effects, but remembering that future effects may accelerate, rendering past trends and occurrences as an unreliable guide to the future.

Defining hazard components is not intended to be extensive or time consuming but should develop a concise narrative of the expected hazard range, gleaned from current information and expert knowledge. This can then inform the risk assessments as to the nature of changes (relative to present-day) over the relevant timeframes.

Managing the heightened risks caused by climate change requires:

- an understanding of the climate hazards that will exacerbate climate-sensitive risks imposed on the domain elements and systems being assessed
- identifying thresholds (where available) for emerging climate-related hazards. These thresholds relate to, when agreed (through elicitation), future objectives associated with a domain element or sector that would no longer be met (eg, a rise of X degrees Celsius in mean air temperature could render a type of horticulture or viticulture unviable; or an X metre sea-level rise could lead to a significant national exposure of buildings and infrastructure).

This framework presents a suite of key hazards (table B1-2) that are most likely to contribute to substantial climate-related risks, driven by primary and secondary climate variables that

contribute to the hazard, to be input into the risk assessment as the hazard component. In most cases, the degree of change in the variables and, hence, the change in the hazard through time, can be informed by:

1. the assessor applying recommended climate change projections for climate variables (or the hazards themselves, if available) at national and sub-national scales directly from available credible information sources or previous assessments and reports using those projections (see section C4 for information sources)
2. expert elicitation processes involving recognised researchers, practitioners, climate and policy analysts in local and central government, and Māori experts to determine or confirm the relevant suite of hazards and their descriptors for each value domain or sector.

To keep this task manageable, it is envisaged the assessor will compile descriptors for the suite of hazards (based on the set list), in conjunction with researchers and practitioners with climate and hazard expertise in the relevant sub-domain or sector.

In addition, at the start of the elicitation or risk workshops for the first-pass risk screening (assessment Stage 1), it would be pertinent to confirm the suite of hazards are the main ones to consider, or if any are missing, for the specific domain element or sector and across all sub-national climate zones.

B1.1 Sub-national climate zones

For the national-scale risk assessment, it is recommended hazards are developed for seven climate zones to represent broad sub-national climatologies that may show significant differences in climate change impacts. Figure B1-1 shows the sub-national climate zones.

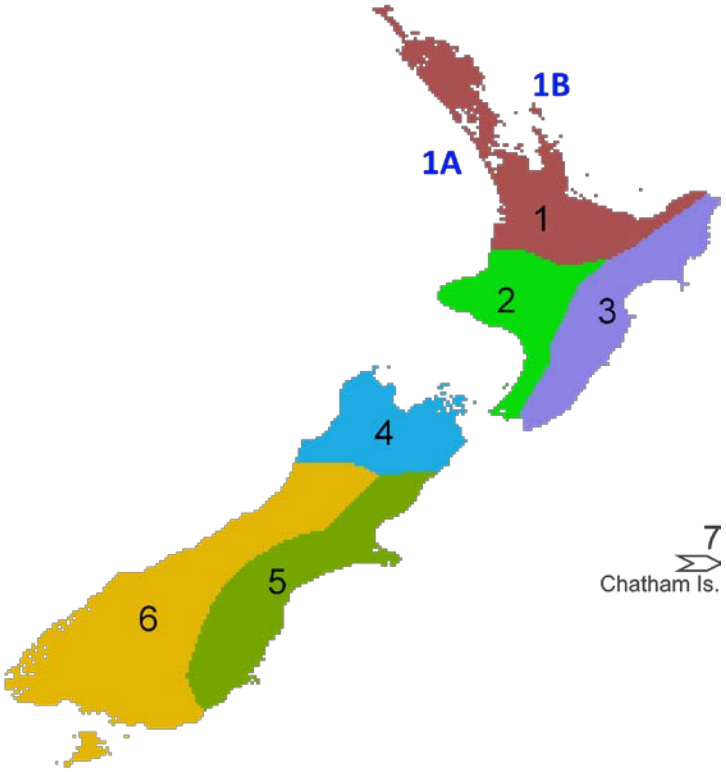
Within each risk assessment stage, the risks identified will need to be aggregated to the national scale, while still retaining those risks that might be rated high in one or two climate zones that have significant national impact (see chapters B2 and B3).

The extent of the sub-national climate zones is defined as follows.

1. **Region 1:** Upper North Island (Te Ika ā Māui) – extends to Mōkau on the west coast and Lottin Point (Wakatiri) in eastern Bay of Plenty, and covers the northern part of Lake Taupō. For assessing climate impacts on coastal and marine activities or elements, split the west coast and Tasman Sea (zone 1A) from the east coast, Pacific Ocean and Hauraki Gulf (zone 1B). Includes the regions of Northland, Auckland, Waikato and Bay of Plenty.
2. **Region 2:** Western lower North Island (Te Ika ā Māui) – covers Taranaki to Wellington (Te Whanga-nui-a-Tara) and includes National Park and southern Lake Taupō. Includes the regions of Taranaki, Manawatū–Whanganui (Horizons) and Wellington.
3. **Region 3:** Eastern lower North Island (Te Ika ā Māui) extends from Hicks Bay (Wharekahika) to Palliser Bay (Te Waha o te Ika ā Māui) and back to the Ruahine and Kaweka ranges. Includes Gisborne, Hawke's Bay and the Wairarapa catchment of Wellington.
4. **Region 4:** Northern South Island (Te Wai Pounamu) – covers Marlborough (from Kaikōura north), Nelson (Whakatū) and around to Punakaiki on the West Coast. Includes Tasman, Nelson, Marlborough and Buller District.
5. **Region 5:** Eastern South Island (Te Wai Pounamu) from Kaikōura to Owaka (South Otago) and includes Central Otago and the MacKenzie Basin including Lakes Tekapo to Ōhau to the east of the Southern Alps. Includes the West Coast, inland Otago and Southland.

6. **Region 6:** Western and southern South Island (Te Wai Pounamu) – covers the West Coast, Fiordland, Southland and Stewart Island (Te Punga o Te Waka ā Māui) and includes the Southern Alps and southern lakes. Includes Canterbury and Otago.
7. **Region 7**: Chatham Islands (Wharekauri – Rēkohu) and Pitt Island (Rangiauria –Rangiaotea) at longitude 183–184°E.

Figure B1-1: Spatial coverage of the sub-national climate zones based on broad zones of rainfall climatologies



Note: The spatial coverage of the sub-national climate zones are based on broad zones of rainfall climatologies that NIWA uses for seasonal forecasting (Kidson and Renwick, 2002). An additional seventh zone has been added for the Chatham Islands. Coastal and marine climate change risks should consider separately the west (1A) and east (1B) coasts in zone 1, due to their different ocean and climate conditions.

B1.2 Method for determining climate hazards

The hazard component of risk (figure A2-1) comprises both changing hazard profiles and gradual onset trends or shifts through time, driven by single or multiple climate variables (eg, heating and associated changes). The steps for defining the hazard component are outlined in figure B1–2, which shows how various primary and secondary climate variables combine to cause the climate-related hazards. These hazards can be examined in the risk assessment stages for all value domains and associated sectors.

Changes or trends in climate-related variables at the sub-national scale (seven climate zones; figure B1-1) should be determined from recommended climate change projections (see section B1.3), where available, or from credible information sources (examples in chapter C4) and/or elicitation processes. To reduce the workload at the first-pass risk screening stage (Stage 1, chapter B2) and to focus on the higher emerging risks, only hazards for the higher projection RCP8.5 are needed initially. Those higher risks transferred to the detailed risk assessment stage

should then be further examined using hazards derived from both RCP4.5 and RCP8.5 projections in Stage 2 (chapter B3).

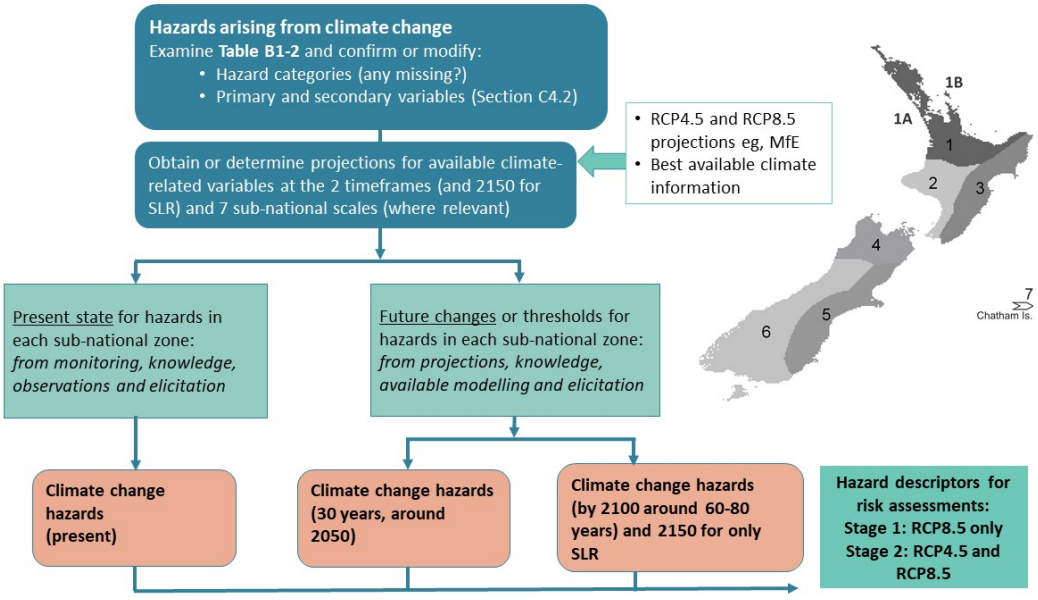
Hazard descriptors should be developed for the present day (eg, past one-to-two decades) to appraise the climate-related changes presently being experienced, then at two selected future timeframes, plus by 2150 for coastal hazard risks only (section A3.3).

The aim is to determine a credible suite of hazard descriptors applicable to the seven sub-national climate zones (or generically across Aotearoa New Zealand, eg, sea-level rise) to populate the hazard component for the risk assessments in chapters B2 and B3.

The assessor can augment the derivation of the suite of hazards and their descriptors through expert input. This can include how changes in primary and secondary climate variables influence changes in the hazard over time (from the present day), including changes in magnitude (severity), persistence and changing frequency with time. Hazard descriptors should also be confirmed at the outset of the first-pass risk screening stage during risk elicitation or workshops for each sector.

If the magnitudes and uncertainties or changes in climate hazards are largely unknown (ie, strength of evidence is low), this aspect should be carried into the risk assessment stages and noted as a gap and, hence, a potential research priority, particularly if the potential risk is perceived to be moderate or high (chapter B4).

Figure B1-2: Steps in translating climate change variables to hazards in each sub-national climate zone, applicable to specified timeframes for two climate change projections



Note: The starting point in the elicitation and engagement processes is the list of suggested hazards in table B1-1. The outputs are the descriptors of hazards due to climate change that input to the risk assessment stages (chapters B2 and B3). Inset map shows the sub-national climate zones (figure B1-1), with zones 1A and 1B applying to marine and coastal risks in northern Aotearoa New Zealand. MfE = Ministry for the Environment; SLR = sea-level rise.

Table B1-1 provides an exemplar for recording the hazard descriptors for transferring to the risk assessments, with a useful starting point being table 1 in the 2018 Climate Change Projections for New Zealand (Ministry for the Environment, 2018).

Table B1-1: Example table for recording descriptors of the present state and future changes of hazards (including stressors and trends) for the two projections RCP4.5 (moderate emissions mitigation) and RCP8.5 (continuing high global emissions)

Hazard	Recent and past effects or changes	Projected changes by ~2050 (30 years) *Direction and magnitude of change*	Projected changes by ~2100 (60–80 years) *Direction and magnitude of change*
Rising mean temperature: air and water	Average air temperature has increased by 1.0°C over the past 100 years. The five warmest years since 1909 are: 2016, 2018, 1998, 1999 and 2013 (0.84–0.72°C above 1981–2010 average) (MfE, Stats NZ and NIWA 7-station series) River and lake temperatures have risen by ... Sea-surface temperatures have risen by …. over period … with Tasman Sea marine heatwaves in the previous two summers	**RCP4.5**: ensemble average increase for period **2031–50**, eg, zones 1, 4, 5 and 6 (+ 0.9°C, + 0.9°C, + 0.7–0.8°C) (MfE, 2018) Freshwater temperatures for likely to rise by … Sea-surface temperatures likely to rise by ... ?	**RCP4.5**: ensemble average increase for period **2081–2100**, eg, zones 1, 4, 5 and 6 (+1.4°C, +1.4°C, +1.3–1.4°C) (MfE, 2018) Freshwater temperatures for likely to rise by … Sea-surface temperatures likely to rise by ... ?
		RCP8.5: ensemble average increase for period **2031–50**, eg, zones 1, 4, 5 and 6 (+ 1.1°C, + 1.0°C, + 0.9–1.0°C) (MfE, 2018) Rivers, lakes, sea-surface temperatures will rise by ... ?	**RCP8.5**: ensemble average increase for period **2081–2100**, eg, zones 1, 4, 5 and 6 (+ 3.1°C, + 3.0°C, + 2.8–3.0°C) (MfE, 2018) Rivers, lakes, sea-surface temperatures will rise by ... ?
Climate sub-national zones affected	All	All (slightly smaller increase in south)	All (slightly smaller increase in south)
Reduced snow cover and glaciers	Total ice volume of the Southern Alps for the small and medium glaciers has decreased by 33% from 1977–2018 (Salinger et al, 2019). Snow pack or snowlines have changed by ...	**RCP4.5**:	**RCP4.5**:
		RCP8.5:	**RCP8.5**: Snow days per year reduce by 30 days or more by 2090 (MfE, 2018). By 2120, …
Climate sub-national zones affected	2, 4, 6	2 (Central Plateau), 4, 6	2 (Central Plateau), 4, 6
Hazard X		RCP4.5:	RCP4.5
		RCP8.5:	RCP8.5:
Climate sub-national zones affected			

Note: The baseline (zero) for Ministry for the Environment (2018) and IPCC projections is the average over 1986–2005. MfE = Ministry for the Environment; NIWA = National Institute of Water and Atmospheric Research; Stats NZ = Statistics New Zealand.

B1.3 Climate-related changes: Defining hazards

Based on the expected climate changes for Aotearoa New Zealand, table B1-2 provides the key categories (17) of hazards (which may be events or trends and stressors, or a mix of both) arising from climate change that are most likely to result in substantial risks to the nation's wellbeing (ie, Treasury's Living Standard Framework as outlined in chapter A3). The second and third columns outline the associated primary and secondary climate change variables that contribute to each of the hazards. A 'long list' of these climate-related variables is available in chapter C4 (table C4-1), if amendments to table B1-2 are necessary.

The risk screening assessment (chapter B2) provides an initial appraisal of whether these hazards pose a threat (and how significant), are minor or not applicable for the climate sensitive elements of each value domain and associated sectors. Other compound hazards (combinations of the listed hazards) could also pose a risk for a particular sector and could be added at the initial step (figure B1-2).

Table B1-2: Key categories (17) of hazards (blue shading) arising from climate change most likely to result in substantial risks to include in the NCCRA (this is not an exhaustive list)

Hazard (arising from climate change)	Primary climate-related variables	Secondary climate-related variables
Higher mean temperatures: air and water	• Higher day and night temperatures • Higher mean water (freshwater and marine) temperatures	• More heatwaves and warm spells • Fewer frosts or cold days
Heatwaves: increasing persistence, frequency and magnitude	• Higher day and night temperatures • Increase in persistence of maximum daily temperatures above 25°C	• Changes in seasonal winds • Humidity changes from changes in cloudiness
More and longer dry spells and drought	• Low seasonal rainfall • Change in seasonal wind patterns • Interannual variability (eg, ENSO)	• Higher day and night temperatures
Changes in climate seasonality with longer summers and shorter winters	• Fewer frosts or cold days • Higher day and night temperatures • Changes in seasonal rainfall	• Changes in seasonal wind
Increasing **fire–weather** conditions: harsher, prolonged season	• Low seasonal rainfall • Change in seasonal wind patterns • Increase in persistence of maximum daily temperatures above 25°C • Humidity changes from changes in cloudiness	• Higher day and night temperatures • Interannual variability (eg, ENSO)
Increased **storminess and extreme winds**	• Increase in storminess (frequency, intensity) including tropical cyclones • Changes in extreme wind speed	• Changes in wind seasonality • Interannual variability (eg, ENSO) • Increase in convective weather events (tornadoes, lightning)

Hazard (arising from climate change)	Primary climate-related variables	Secondary climate-related variables
Change in **mean annual rainfall**	• Higher or lower mean annual rainfall in sub-national climate zones • Changes in seasonal winds	• Humidity changes from changes in cloudiness
Reducing **snow and ice cover**	• Higher day and night temperatures • Changes in rainfall seasonality • Change in seasonal wind patterns • Receding snowline • Reduced snow and glacier cover • Earlier snow melt	• Increase in avalanches • Interannual variability (eg, ENSO)
Increasing **hail** severity or frequency	• Increase in hail severity or frequency • Increase in convective weather events (tornadoes, lightning)	• Humidity changes from changes in cloudiness
River and pluvial flooding: changes in frequency and magnitude in rural and urban areas	• Changes in extremes: high intensity and persistence of rainfall • Increase in hail severity or frequency • Interannual variability (eg, ENSO) • Increased storminess and wind • Relative sea-level rise (including land movement) • Rising groundwater from sea-level rise	• Humidity changes from changes in cloudiness • Changes in rainfall seasonality • Change in seasonal wind patterns • More and longer dry spells and droughts (antecedent conditions)
Coastal and estuarine flooding: increasing persistence, frequency and magnitude	• Relative sea-level rise (including land movement) • Change in tidal range or increased water depth • Permanent increase in spring high-tide inundation • Rising groundwater from sea-level rise • Changes in extremes: high intensity and persistence of rainfall • Increase in storminess (frequency, intensity) including tropical cyclones	• Changes in waves and swell • Changes in extreme wind speed • Changes in sedimentation (estuaries and harbours)
Sea-level rise and salinity stresses on brackish and aquifer systems and coastal lowland rivers	• Relative sea-level rise (including land movement) • Permanent and episodic (low river flow) saline intrusion • Low seasonal rainfall • Rising groundwater from sea-level rise • Permanent increase in spring high-tide inundation	• Changes in sedimentation (estuaries and harbours) • Interannual variability (eg, ENSO)
Increasing **coastal erosion:** cliffs and beaches	• Relative sea-level rise (including land movement) • Changes in waves and swell	• Rising groundwater from sea-level rise • Changes in rainfall seasonality

Hazard (arising from climate change)	Primary climate-related variables	Secondary climate-related variables
	• Changes in extreme rainfall: high intensity and persistence • Changes in sedimentation from catchment run-off • Increased storminess and extreme winds • Interannual variability (eg, ENSO)	• Change in seasonal wind patterns
Increasing **landslides and soil erosion**	• Changes in extreme rainfall: high intensity and persistence • Changes in rainfall seasonality • More and longer dry spells and droughts (antecedent conditions)	• Interannual variability (eg, ENSO)
Marine heatwaves: more persistent high summer sea temperatures	• Higher mean ocean temperatures • Increase in persistence of maximum daily temperatures, eg, above 25°C • Change in seasonal wind patterns • Ocean circulation changes	• Interannual variability (eg, ENSO) • Changes in waves and swell
Ocean chemistry changes: nutrient cycling and pH changes	• Changes in ocean nutrient cycling – upwelling and carbon • Ocean acidification (pH decreasing) • Higher mean surface-water temperatures • Change in seasonal wind patterns	• Ocean circulation changes • Interannual variability (eg, ENSO)
International influences from climate change and greenhouse gas mitigation preferences	• Immigration • Markets (pricing, preferences) • Pacific Island countries (disaster responses, development)	
Other?	• • •	• • •

Note: This is not an exhaustive list. The second and third columns outline the associated primary and secondary climate change variables that contribute to each of the hazards, which should be confirmed before developing the 'hazard component' descriptors at the recommended timeframes and projections (extra space is provided in the table). The long-list of variables is in chapter C4.2 (table C4-1). ENSO = 2–4 year El Niño–Southern Oscillation.

B1.4 Guidance on alignment of information with Representative Concentration Pathway projections and timeframes

Figure B1-3 gives an outline of approaches for mapping information, where possible, to align consistently with the recommended RCP4.5 and RCP8.5 projections for Aotearoa New Zealand at the recommended timeframes: present day; 30 years (around 2050); by 2100; and for sea-level rise and coastal flooding impacts only, by 2150 during Stage 2. An initial list of information sources and tools is given in chapter C2.

Types of information on climate change projections include the following.

a) Projections of the core group of primary climate variables that contribute to the key hazards. These are available for RCP4.5 and RCP8.5 projections, particularly temperature, rainfall, drought, wind and sea-level rise. The main sources for these primary variables are the Climate Change Projections for New Zealand (Ministry for the Environment, 2018), the Coastal Hazards and Climate Change Guidance (for sea-level rise to 2150) (Ministry for the Environment, 2017), the Australasian IPCC chapter from Working Group II to the IPCC's Fifth Assessment Report (Reisinger et al, 2014), and various papers and reports.

b) Information derived from analysis of increments in climate change variables.

   For example, high-intensity rainfall increases for various event durations (one hour to three days) are available in the High Intensity Rainfall Design System (HIRDS) version 4 (or the Climate Change Projections for New Zealand report (Ministry for the Environment, 2018)) for 1 degree Celsius increments in rising air temperature or coastal risk exposure nationally in terms of 0.1 metre increments in sea-level rise (eg, Parliamentary Commissioner for the Environment, 2015; Paulik et al, 2019).

   For the recommended timeframes, determine the magnitude of the relevant climate hazard or contributing climate variables from the RCP4.5 and RCP8.5 projections (see point a above) and interpolate the available magnitude and frequency in the information sources or tools from the nearest increments. For example, if the temperature were to rise by 2.8 degrees Celsius in 100 years for the RCP8.5 projection, then the high-intensity rainfall increase can be interpolated from the increases for 2 degrees Celsius and 3 degrees Celsius in the HIRDS tool.

c) Past reports or journal papers may have previously assessed climate change effects with past scenarios from the IPCC Special Report on Emission Scenarios (SRES) that were used in the third and fourth IPCC Assessment Reports. These scenarios are now superseded by the RCP projections.

   In this case, map the equivalent SRES scenarios to RCP4.5 and RCP8.5 projections:

   - equivalent to RCP8.5 – use an average of A1FI (highest scenario) and A1B SRES scenarios for 30 years and by 2100
   - equivalent to RCP4.5 – use the B1 SRES scenarios for 30 years and by 2100 (Ministry for the Environment, 2017, appendix C).

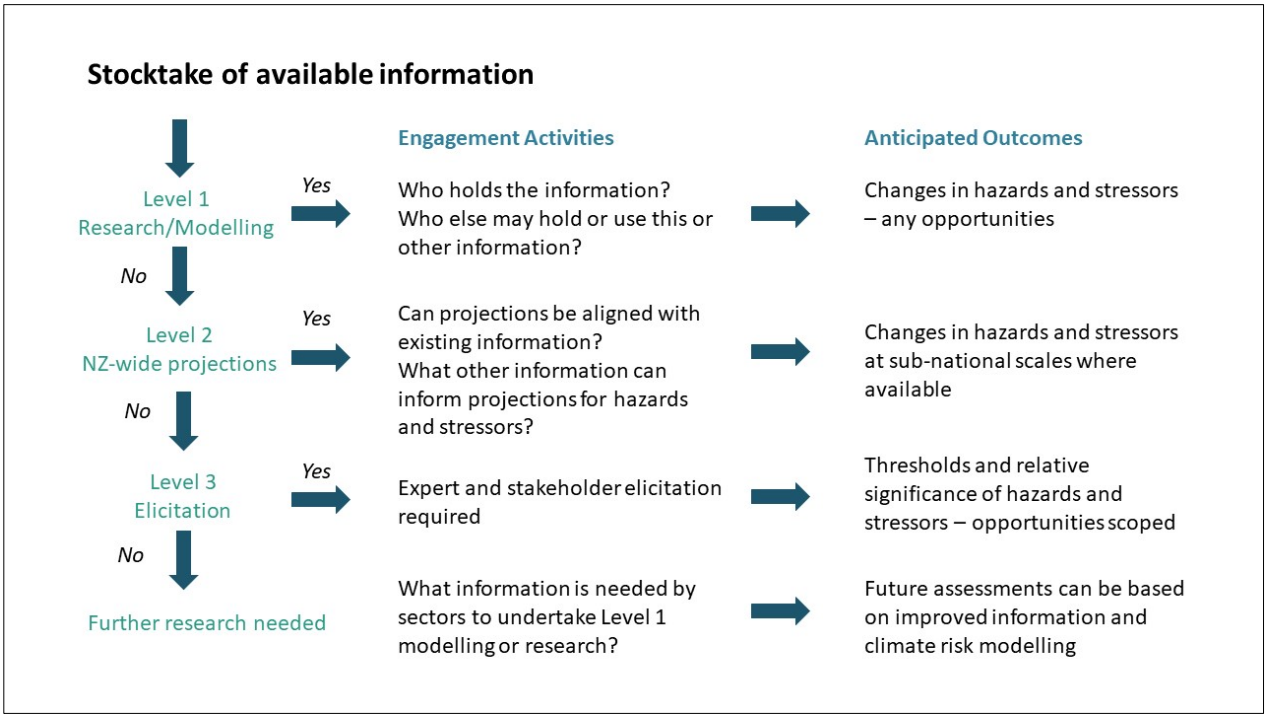
d) Expert or Mātauranga Māori findings from stakeholder elicitation processes that may be able to express the hazard in terms of potential thresholds, where agreed future objectives or levels of service may no longer be met.

   Such mixed quantitative–qualitative information on thresholds should be aligned or mapped to the recommended RCPs and timeframes by the assessor, where possible. (For example: a) a regional aquaculture activity may not be viable once the mean summer sea temperature is 1 degree Celsius higher, or b) a sea-level rise threshold is agreed when more than [X] number of buildings nationally are at risk of more frequent flooding from available risk exposure assessments). From these deliberations, the assessor should align such thresholds with the recommended projections, where possible (eg, timing for the emergence of the threshold under different projections). This then provides consistency when assessing and evaluating the risks.

e) Where information on the changes in climate is unclear (has not emerged), little known or is unlikely to be significant in terms of exposure or vulnerability.

In this case, the findings can be transferred from the risk screening stage (Stage 1, chapter B2) and assessed to see if further action or research is needed in Stage 3 (chapter B4) when evaluating the urgency rating.

Figure B1-3: Mapping for producing mixed quantitative and qualitative information and knowledge on hazards and risk exposure for consistency and relativity between risks



Upoko B2: Arotakenga Tūāoma 1: Tirohanga tātaringa tūraru tuatahi

B2.1 Scope and purpose for first-pass risk screening

Once the context of the climate change risk assessment has been set (by identifying the important assets, taonga and elements at risk (chapter A3)), and descriptors identified for the climate change hazards to which these elements may be exposed and vulnerable (chapter B1), the next step is assessing how and where these components interact, to identify the risks. This assessment starts with a first-pass screening stage. The purpose is to provide a transparent process that encompasses a broad exploration of climate change risks to identify those that require a more detailed risk assessment (chapter B3).

First-pass climate change risk screening is primarily a qualitative process that can be co-produced without detailed data to develop a preliminary understanding of the extent and relativity of climate change risks to a value domain, sector or at the regional or local level (CoastAdapt, 2016). It helps users assess the broad risk spectrum qualitatively using existing and available information, and through elicitation processes or risk workshops and engagement with expert and sector adaptation leaders, and Mātauranga Māori in the context of values (chapter A3) and agreed objectives or thresholds of change.

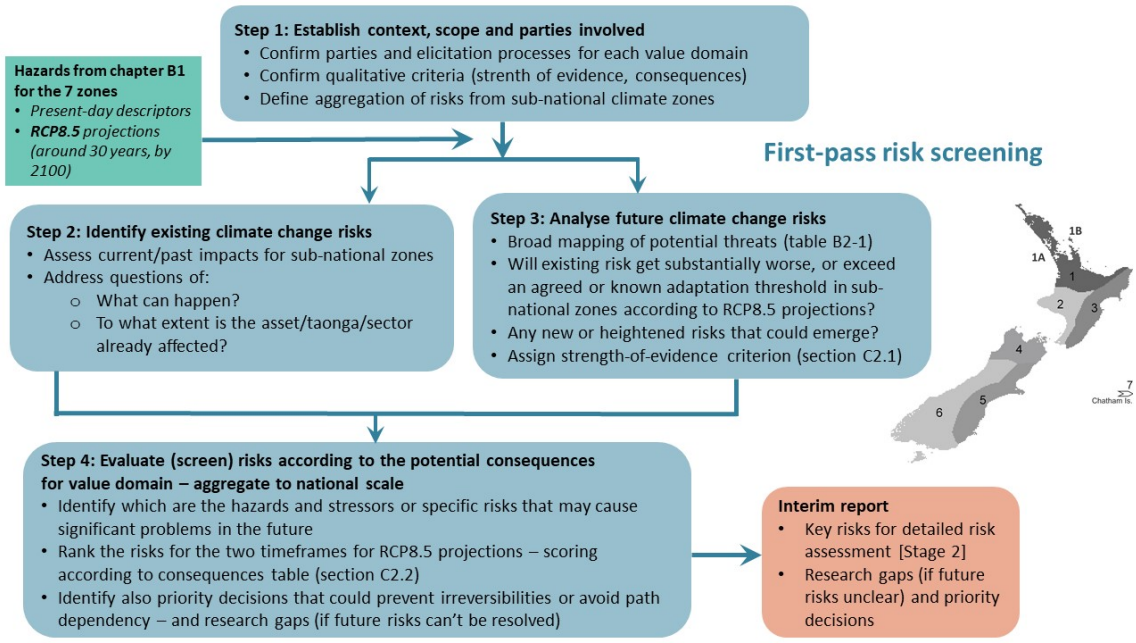
Acknowledging the primarily qualitative nature of information gathered, this stage still requires grounding by canvassing the present day risk exposure and appraising future risks arising from the hazards based on the higher RCP8.5 climate projections and two future timeframes (chapter B1). A first-pass screening process should not be relied on to make initial or early adaptation decisions, but the actual process and engagement is an important step for overlaying values, objectives and potential threats from climate change. It is also important for identifying opportunities arising from a warmer climate, quick wins for adaptation or research gaps that can be picked up in Stage 3 (chapter B4).

To start the process, ensure all key partners and stakeholders have been identified for engagement purposes and participation in the elicitation or risk workshop process, to co-produce the first-pass risk screening. This stage will:

- provide participants with a rapid starting point for understanding broader climate change impacts and implications
- leverage existing national, regional or local information and expert knowledge. This includes accessing and identifying Māori aspirations and values along with mātauranga ā iwi/hapū (iwi and hapū knowledge) and hītori (histories)
- shortlist potential future climate risks (or exposure, if risk is not well described) from the broad categories of potential hazards (table B1-1) for the relevant value domain, decision area or system to be assessed in detail in Stage 2.

Figure B2-1 outlines the process for the Stage 1 first-pass risk screening.

Figure B2-1: Stage 1 first-pass risk screening process



B2.2 Method for the first-pass risk screening

The four steps and various prompts covering the first-pass risk screening are outlined below (adapted from CoastAdapt, 2016).

- **Step 1: Establish the context and define the scope and parties involved in the first-pass screening for each value domain or sector**
  - Set objectives and scope of the domain or sector risk screening and allotted time period.
  - Confirm and set up the elicitation (risk workshops) and engagement processes (see section A4).
  - Confirm the applicability of the qualitative criteria (domain or sectoral consequence criteria and strength of evidence) for which risks are carried forward into the detailed risk assessment.
  - Reconfirm that hazard descriptors from chapter B1 together cover the main hazard component for the value domain or sector – noting that only RCP8.5 projections out to 2100 are used for this risk screening stage.
  - Define how the spatial scale (for the sub-national climate zones) of the first-pass assessment is handled, to aggregate to national-scale risk ratings.
- **Step 2: Identify the existing climate risks (both past and present day)**
  - Using hazards from table B1-2, complete table B1-1 on the impacts observed for the present day or recent past, assess the broad impacts on sectors and elements across the value domains. Include any available records or accounts of trends or changes in climate or weather-related hazards in recent times, relative to the past.
- **Step 3: Analyse future climate change risks for the RCP8.5 projections out to 2100 and rate the evidence base**

- Using hazards from table B1-2, complete table B1-1 for the RCP8.5 projections for the recommended timeframes (around 30 years and by 2100). Then explore the degree of climate change impacts on the climate-sensitive elements or activities for the relevant value domain or sector using available information and co-production through elicitation processes. This can be undertaken using a precursory mapping exercise (as shown in table B2-1) to map the potential threats or where the impact of the hazard is minor, neutral or not applicable.
- Can any existing risk get substantially worse, or exceed an agreed or known adaptation threshold, under the projected climate change?
- Could any new or heightened risks emerge under the future projected change?
- How confident are we in the pedigree or strength of the initial evidence collated (information, knowledge from elicitation) for assessing the risk in this screening process? Apply a strength-of-evidence rating from table C2-1 (chapter C2).

- **Step 4: Evaluate (screen) risks according to the potential consequences to determine need for a detailed risk assessment for the more at-risk elements or activities**
  - Identify which hazards or specific risks (if well described or known) may cause problems in the future for the value domain or sector.
  - Rank the risks for the two timeframes, applicable to RCP8.5 projections, by scoring according to the five-level risk-rating scale from the consequences table (table C2-2, chapter C2) for the relevant value domain. Outline and document how the national-scale risk rating has been aggregated from the sub-national climate zones (eg, if any sub-national zone score is high, then a national score is high, or if there are two, three or more medium ratings, then the national rating may be set to high and so on). Note: for marine or coastal activities or sectors, use sub-national climate zones 1A and 1B separately instead of just zone 1 (upper North Island).
  - Are opportunities available for beneficial effects arising from climate change that could prompt transformational change with low regrets?

Following these steps, select the high risks, and any moderate risks with associated high uncertainty (eg, strength of initial evidence is low to medium, or it is unknown how the sector may adapt or cope), to transfer through the detailed risk assessment stage (chapter B3). The four-step process for the first-pass screening is not necessarily a linear progression. Previous steps may need to be revisited if new information or knowledge arises or earlier findings need readjusting to establish a consistent set of priority risks.

B2.3 Guidance on the screening steps

Guidance on Step 1: Establish the context and scope, set up engagement processes

Step 1 has several components.

Understand the scope and purpose of the exercise. This should be established at the start of any level of risk assessment to clarify what is included or excluded in the assessment. Guidance on the context and underpinning values for the NCCRA is discussed in chapter A3.

Develop an engagement plan. Involve parties who should be part of the first-pass risk assessment in co-producing value domain or sector risk priorities to be further evaluated in

the detailed risk assessment. The levels of engagement and methods should be defined (see chapter A4 and chapter C1).

Define the qualitative criteria. At the outset, define the criteria used to decide which risks are carried forward to the detailed risk assessment. This may be by consensus, a majority, via review of a reference group, or significant consistent evidence for indicators, such as potential national impact, maximum number of risks for each domain or sector, or whether the risks are amenable to being addressed in a National Adaptation Plan.

Define how the spatial scale of the first-pass screening assessment is handled. The NCCRA assessment is primarily intended to be applied nationally to feed into the National Adaptation Plan (chapter A1). It also needs to identify significant regional-scale risks that would be of major concern to central and local government, industry, services, infrastructure providers, business and the insurance and banking sector.

Incorporate the recommended timeframes to consider (chapter B1) covering present-day changes or trends (and the recent past) in Step 2. In Step 3, use the 30-year (around 2050) and 2100 timeframes (leaving the additional long-term appraisal for coastal flood risk to 2150 to be undertaken in Stage 2).

Incorporate the RCP8.5 climate change projection from chapter B1 (the completed table B1-1). Include this where possible, to provide a consistent grounding for deliberations and establish relative priorities. An example is that participants in the risk screening could be given summary factsheets (derived from table B1-1) outlining the main categories of climate change effects nationally and regionally. The effects could include temperature rise, rainfall intensity, sea-level rise, pH change and rainfall, wind and drought patterns, and so on, for the relevant projection at the two future timeframes. It would also be useful to include increments of change and by decade for these climate change effects for the relevant projection, to align thresholds that emerge from elicitation processes.

Example: if nationally a threshold sea-level rise of say around 0.3 metres was deemed to lead to a significant loss of estuarine wetlands and salt marsh environments, tables like table 10 (decadal increments) and table 11 (0.1 metre sea-level rise increments) in the Coastal Hazards and Climate Change Guidance would indicate this would occur around 2050 for RCP8.5 (or earlier, if polar ice sheet response was greater than expected using a higher RCP8.5 H^+ sea-level scenario) (Ministry for the Environment, 2017).

The types of information and sources of climate change projections are outlined in chapter C4.

Guidance on Step 2: Identify the existing climate risks

Table B1-1 (chapter B1), once completed, should outline a range of hazards exacerbated by climate change (look-up list in table B1-2). The same hazard set can be used as a starting point for identifying and reviewing recent or past changes or trends of these hazards for the 'present day' situational analysis. Many of the listed hazards that were induced by changes to the climate and oceans may not yet have emerged, but several changes in extremes (eg, flooding, intense rainfall) or seasonal changes in temperature or precipitation (eg, droughts) have become evident in recent decades.

At this step, **identify any records**, **accounts**, **reports or other sources** (see chapter C4) that discuss trends or changes in climate or weather-related hazards (eg, drought occurrence or

persistence, flooding) in recent times (one-to-two decades) relative to the past.[4] Elicitation with experts (climate scientists, social scientists, Māori experts and so on) and stakeholders, including and especially those who could be considered 'custodians' of the risk, will be required at this stage and could be combined with Step 3 engagement requirements.

For a national assessment, these experts and knowledgeable practitioners would first be identified by mapping the sectors or elements at risk (described in chapter A3) against the climate drivers and impact chains (the 'hazards', described in chapter B1). This would be done according to the scope of the risk assessment (ie, regional or local assessments may use different criteria to decide on sectors or elements to be screened).

Expert elicitation will include relevant representatives such as:

- pan-Māori organisations
- researchers (ie, Crown research institutes, universities, private research companies)
- policy analysts (ie, climate, hazard, risk and climate policy) in central and local government (including quasi-government organisations and state-owned enterprises)
- practitioners (ie, planners, engineers, economists, social, cultural) with experience in climate matters
- professional bodies (ie, Society of Local Government Managers, Engineering New Zealand, New Zealand Planning Institute, New Zealand Sustainability Council) and representatives well versed in climate change issues.

Guidance on Step 3: Identify future climate change risks and opportunities

Once the source of your climate change projection data or information for the recommended timeframes is finalised (completed table B1-1), start exploring the degree of climate change impacts that will affect the relevant value domain. Sector or domain climate impact scenarios may already have been developed and analysed that would be useful to introduce to the first-pass screening assessment. These could be, for example, the pastoral sector scenarios in various SLMACC (Sustainable Land Management and Climate Change) research or review reports collated and assessed by the Ministry for Primary Industries (2019).

Some national-scale risk exposure assessments have been completed, especially for coastal areas affected by sea-level rise and associated hazards (Bell et al, 2016; LGNZ, 2019; Parliamentary Commissioner for the Environment, 2015; Paulik et al, 2019; Tait, 2019). These provide a regional and aggregated national-scale analysis of the exposure to sea-level rise and coastal flooding, and a high-level assessment for riverine flood plains (Paulik et al, 2019).

Questions to ask during this stage of the assessment follow.

Can any existing risk get worse under projected climate changes?

Qualitative understanding of the change in direction (increase, decrease or no change) of future climate hazards, as well as other risk-related information (eg, erodibility of the coastline

[4] Note: a useful starting reference on the attribution of the influence of climate change on recent flood and rainfall events and droughts over the past decade can be found in Frame et al (2018b). Another helpful reference on changes in severe weather is Bell (2018a, 2018b).

or catchment soils), should provide a qualitative understanding of how existing risks, identified in Step 2, may change in future at the nominated timeframes.

As an example, with projected sea-level rise, those parts of the coast nationally that have previously experienced coastal flooding or erosion-related problems, or that exhibit a tidal signal in groundwater levels (existing risk), will clearly face increasing risks from these hazards in future.

Could any new risks emerge under the future projected changes?

Just because an area has no previous record of a particular hazard, this is not a guarantee it will not happen in future. The assessor should consider whether the qualitative change of a hazard in future could give rise to risk that has not yet been realised (CoastAdapt, 2016). As an example, prolonged summer heatwaves may not be an issue in some coastal urban areas, like Auckland at present, but with rapid urbanisation, combined with growth in the aged population and a rise in average temperature, the health risk to people living in these areas may increase in future heatwaves. Another example could be as sea-level increases, the increased extent of semi-permanent, high-tide inundation or coastal flooding could create new challenges. For example, large tracts of coastline in Aotearoa New Zealand have not yet experienced these impacts but, with ongoing rising seas, it will only be a matter of time before such risks emerge.

List any possible future damage, losses or declines in services or primary production against each of the relevant hazards (CoastAdapt, 2016). This will help identify assets, areas, activities, environments, cultural taonga or communities that may be exposed to future climate-related hazards. In the coastal situation, the coastal risk-exposure reports above would give an indication of the emergence of those risks in different coastal regions of New Zealand, for example, number of buildings and roads exposed at different sea-level rise increments.

How confident are we in the strength of the evidence base (information, knowledge, from elicitation) for assessing the risk?

Some rating of the strength of evidence is important before evaluating the risk in Step 4 (especially if the rating is low). It is also important for transparent communication of decisions when selecting a category for action in chapter B4 (that may eventually be part of the National Adaptation Plan) or for taking the uncertain risk through to the detailed risk assessment stage. If little is known, but a climate change effect is perceived as a threat, then that risk could be a candidate for assigning it to a 'Research Priority' action (see chapter B4). It could also be analysed in the detailed risk assessment (chapter B3), if information on exposure and vulnerability can be determined through expert and stakeholder elicitation. A suggested score card of the confidence in 'strength of evidence' is shown in table C2-1 in chapter C2.

Precursory mapping of climate change threats and opportunities

In Step 3, precursory mapping of a value domain or sector's elements (where specific climate risks are known at the sector level) to the generic list of climate change hazards (table B1-2, chapter B1) will be a useful preliminary step to identify which elements could be exposed to a hazard, or are neutral (ie, not relevant or impact on that element is minor or unlikely).

Such an exercise provides a wider landscape of the impacts and can be a useful starting point for engaging with stakeholders, Māori, iwi, hāpu, sector leaders and experts on the relevancy of hazards and their potential impacts.

Table B2-1 shows an example that encapsulates this precursory mapping.

Table B2-1: Example template for precursory mapping of climate change threats and opportunities

Theme or sector: Transport sector																				
	Climate-related hazards (broad suite)																			
Map climate-related hazards that pose main threats to the value domain or sector (leave blank if neutral or N/A)	Higher mean temperatures: air and water	Heatwaves	Dry spells and drought	Changes in climate seasonality	Fire weather (harsher, prolonged season)	Storminess and extreme winds	Mean annual rainfall	Reducing snow/ice cover	Hail	River & pluvial flooding	Coastal & estuarine flooding	SLR & salinity stresses	Coastal erosion	Landslides and soil erosion	Marine heatwaves	Ocean chemistry changes	International influences	Others?
Elements or activities exposed																		
Element 1		■	■		■					■	■							
Element 2	■			■								■	■	■			■	
...		■		■		■	■		■									
....	■	■	■	■	■										■			■
...		■				■					■		■				■	
Activity X		■		■		■	■	■	■									
Activity Y											■							
Activity Z	■	■		■	■													
...																		
...																		
...																		

Note: This example template provides for precursory mapping of potential threats (from hazards) for each element of a value domain or sector, or where the climate change effect is not likely to be significant or relevant to that domain or sector (blank cell). SLR = sea-level rise.

This template example, which maps climate change effects (hazards) to elements of a value domain or sector, can be updated throughout the risk assessment and engagement processes (as new information is revealed), and to provide an overview of where the risks potentially lie from climate change. The relevant climate change threats for each element of a value domain or sector can then be taken through to the first-pass climate change risk screening (Step 4).

Guidance on Step 4: Analyse risks and evaluate priorities for detailed risk assessment or exploration of opportunities

Identify hazards or specific risks that may cause problems in the future

Through structured engagement and elicitation processes that address Step 2 and Step 3 questions, work through risk screening summary sheets for the elements in each value domain or sector for the key hazards identified in the precursory mapping in Step 3. An example sheet is shown in table B2-2.

The threat or opportunity would be derived from a template such as table B2-1, the strength of evidence from table B2-2, and codes used to indicate the different types of evidence (data, knowledge, reports, existing risk assessments and so on).

Defining consistent criteria across all value domains is difficult for the initial risk rating in the short term (30 years) and long term (100-plus years), given the variety of activities and elements. However, an initial step the assessment team should explore when undertaking the facilitated elicitation process ('risk workshop') for a sector or domain is co-producing qualitative descriptors of what would constitute a low, medium or high risk for the sector, to produce reasonable relativity between risks. It is important in elicitation or workshop processes to revisit the risk-screening scoring after the first round, to apply a relativity lens and ensure consistency. It is also helpful to consider input from an external review of the outputs, before proceeding to the detailed risk assessment (chapter B3).

From this first-pass risk assessment and the completed risk screening summary templates, several climate impacts can be identified for further analysis in the detailed risk assessment using criteria defined in Step 1.

Are there opportunities (beneficial effects) arising from climate change that could be explored within a National Adaptation Plan?

Collate the credible opportunities for beneficial effects (eg, reduced or negligible frost days) which could arise from a warmer climate for the relevant value domain or sector (and any potential side-effects or indirect implications) and that could be transferred to the evaluation of risks and opportunities in chapter B4 (because these types of opportunities do not readily fit the risk assessment framework in chapter B3).

Table B2-2 shows an example template for Step 4 that could be used to record findings from the risk screening process.

Table B2-2: Example template of how the climate related risks for key elements or activities in a value domain or sector can be assessed in the first-pass screening process

Exemplar: Stage 1 Risk Screening				Example content only – for illustrating the method							
Value Domain: Economy				Sector: Primary Industries			Element: Aquaculture and marine farming				
Climate-related hazard [table B1-2]	Significant present-day impacts	Significant impact by ~2050 [RCP8.5]	Significant impact by 2100 [RCP8.5]	Main impacts for RCP8.5: due to changes in magnitude, frequency or trends (by ~2050 and 2100)	Key implications for the element or sector	Strength of evidence (1 to 4) [tableC2-1]	Current or planned adaptation under way [Short-term fix or adaptive/long-term?]	Well-beings affected?	Sub-national climate zones exposed (1–7)	Initial national risk rating: ~2050 [Consequences table C2-2]	Initial national risk rating: by 2100 [Consequences table C2-2]
River and pluvial flooding (high intensity rainfall)	?	●	●	Reduced harvest times due to *E. coli* – increases by x% by …	Loss in production time		Smart monitoring systems, catchment plans	**Economic**, Environ., Cultural	1 – 6	Moderate	Moderate
Ocean chemistry changes (pH and nutrients)	–	●	●	Shell condition degenerates (pH expected to decrease to X); Nutrients expected to …	Viability of production?			"	all	Minor	Moderate
Marine heatwaves	?	●	●	Affects spat larvae and feeding, salmon condition … Marine heatwaves will become common by …	Viability of production?			"	1A, 1B, 4	Moderate	Major
Etc											

Note: The table uses incomplete examples for the aquaculture and marine farming sector; these do not contain verified information but simply show the method. Table C2-1 lists the strength of evidence criteria and table C2-2 the criteria for consequences, which are used in the risk screening stage for initially rating the risks mapped in a template, such as figure B2-1.

Produce interim report at the end of Step 4 on preliminary risk screening assessment findings including potential opportunities arising from climate change

Rather than producing one report at the end of the NCCRA, it is recommended the Stage 1 screening exercise results are communicated in an interim report at the end of Step 4 for the general public.

Step 4 requires expert judgements to be validated because opinions gathered may not be able to be fully justified if data and information are scarce. Additional engagement activities at this point should include verifying the first screening findings with those people engaged, to ensure the findings reflect the actual risks.

Engagement activities	Prompts
Verifying Stage 1 outcomes	• Were all those with expert knowledge or information engaged in the process? • Do the results reflect perceived and actual risks? • Are there any perverse outcomes? • Are assessment attributes weighted for regional context, that is, population, impact? If so, why and how? • Send first screening results back to engaged stakeholders for their verification of outcome. • Does the engagement strategy need to be revised and updated?

Upoko B3: Arotakenga Tūāoma 2: Taipitopito arotakenga tūraru

B3.1 Detailed risk assessment scope and purpose

The purpose of the detailed risk assessment is to refine our knowledge about risks rated as of potential concern in the first-pass screening (chapter B2). This process helps to identify key risks to be considered in the development of a National Adaptation Plan. The assessment will require an engagement plan, including expert elicitation, as discussed in chapters A4 and C1.

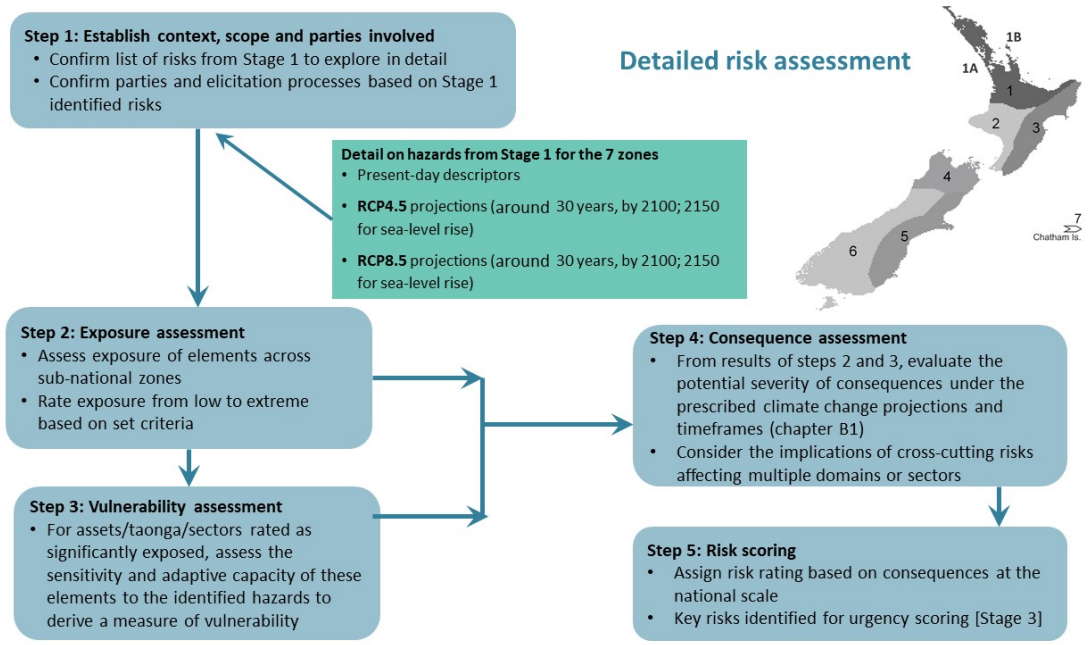
Following the first-pass assessment, a number of elements will have been identified as being at moderate or high risk due to changes in climate-related hazards associated with the RCP8.5 projection. The Stage 2 assessment will further examine the extent of exposure of the assets, sectors and taonga, and their vulnerability to the identified climate-related hazards. This helps determine the potential severity of consequences under both RCP4.5 and RCP8.5 projections, at all three recommended timeframes (chapter B1), plus out to 2150 for only coastal flood risks associated with sea-level rise (chapter B1). The latter extension highlights this long-run risk (for which risk exposure information is available out to 2150), to ensure short-term actions or long-term options that address adaptation are sufficiently flexible and adaptive to avoid locking in pathway dependency.

As summarised in chapter A2, the NCCRA framework is based on the hazard–exposure–vulnerability framing of climate change risks from the IPCC Working Group II Fifth Assessment Report (IPCC, 2014a). Risk results from the interactions of climate-related hazards (chapter B1) with exposure and vulnerability to those hazards from the changing climate. Vulnerability relates to how sensitive the elements are to changes in the climate, as well as their adaptive capacity (the ability to cope with the impacts and/or rate of change). In the detailed risk assessment, risk is rated in terms of consequences (impacts) resulting from these interactions.

Like the first-pass assessment, the detailed assessment assesses risks across the seven designated sub-regional climate zones (chapter B1) and aggregates the consequence scores to determine a national-level risk rating.

The Stage 2 detailed risk assessment process is shown in figure B3-1.

Figure B3-1: Stage 2 detailed climate-change risk assessment



B3.2 Method for detailed risk assessment

As shown in figure B3-1, this assessment stage involves five steps, as discussed below.

- **Step 1: Establish the context and define the scope and parties involved**

  Based on results of Stage 1, including further detail on hazards:

  – reconfirm the list of risks from Stage 1 to explore in detail (chapter B2)

  – confirm the parties and the elicitation (risk workshops) and engagement processes based on Stage 1 identified risks (see chapter A4 and chapter C1)

  – gather detail on hazards from Stage 1 for RCP4.5 and RCP8.5 projections and the recommended timeframes (around 30 years, by 2100, and for sea-level rise in relation to coastal flooding, out to 2150) across the seven sub-regional climate zones (from the updated and completed table B1-1, chapter B1).

- **Step 2: Exposure assessment**

  – Define elements at risk by value domain or sector (chapter A3) for the priority risks from the screening assessment (chapter B2), by sourcing relevant data and knowledge on elements from databases. For example, these databases include Census, sector databases, New Zealand Landcover Database, Land Information New Zealand NZ Building Outlines, RiskScape asset and buildings databases, environment and conservation classifications, tourism hotspots, marine habitats and fisheries environment classifications.[5]

  – Quantify the value (in monetary terms, if possible) of the defined assets, taonga, environments and people exposed to the identified climate hazards.

[5] LRIS Portal (2019) LCDB v 4.1 Land Cover Database version 4.1, Mainland New Zealand, https://lris.scinfo.org.nz/layer/48423-lcdb-v41-land-cover-database-version-41-mainland-new-zealand/; Statistics New Zealand 2018 Census www.stats.govt.nz/2018-census/; NZ Building Outlines https://data.linz.govt.nz/layer/101290-nz-building-outlines/; RiskScape: https://riskscape.org.nz/.

- Assess the elements at the temporal and spatial scales of exposure (where quantifiable for the seven sub-national climate zones) for current and specified future timeframes (chapter A3 and chapter B1) for the two recommended projections (RCP4.5 and RCP8.5).
- Record the exposure quantitatively or qualitatively in geospatial maps or tabular form, and apply ratings on a four-level scale from low to extreme exposure across the sub-national climate zones using table B3-1. Except where the asset values are easily quantifiable in objective terms, it will be necessary to engage with key stakeholders, experts and sector adaptation leaders in an elicitation process to define thresholds for the key elements exposure that constitute a risk.

- **Step 3: Vulnerability assessment**
  - Through an elicitation process with key stakeholders, experts and sector adaptation leaders, decide on appropriate data and information, indicators or qualitative descriptors for the vulnerability assessment. This information should cover **sensitivity** and **adaptive capacity** relating to the elements or activities at risk in a value domain or sector.
  - Assess data and information for each value domain or sector across the seven sub-national climate zones and record a qualitative ranking using the four-level scale, from low to extreme, shown in table B3-2.
- **Step 4: Consequence assessment**
  - Confirm the criteria of relevance for assessing consequences for each value domain or sector. Chapter C2 (table C2-2) gives an example of consequence indicators for five impact levels across the NCCRA value domains.
  - Engage experts and knowledgeable practitioners to evaluate the consequences based on the agreed criteria, considering the ratings for exposure and vulnerability.
  - Where multiple consequences criteria are scored for each value domain or sector, use an agreed weighting or normalisation method to determine an aggregate score.
- **Step 5: Risk scoring**
  - Prepare a workbook for scoring risks by domain or sector. Risks will be rated based on the consequences score, aggregated across the sub-national climate zones (using criteria prepared for the aggregation of risk scores to the national scale eg, Step 1, section B2.2). Only risks falling under consequence categories of moderate to extreme from Step 4 need to be scrutinised further in Stage 3.
  - Assess strength of evidence and uncertainty using the strength of evidence criteria outlined in chapter C2, table C2-1.
  - Identify key risks. Following assessment of strength of evidence levels, prepare a summary tabulation by domain or sector, as shown in table B3-5.

B3.3 Guidance on the assessment steps

Guidance on Step 1: Context and hazards

The context for Stage 2 flows from the results of Stage 1. Engagement is again required to gather and analyse information, following similar methods with stakeholders, agencies and partners as identified in Stage 1. Guidance is provided in chapter C1.

Hazards

Chapter B1 describes several hazard categories based on primary and secondary climate variables, such as changes in temperature, precipitation, storms, and changes to coasts and oceans (see table B1-2). The first-pass risk screening (Stage 1, chapter B2) should have identified priority hazards for each value domain or sector, including changes to these hazards for the RCP8.5 projection (eg, changes in climate seasonality), considered over the three timeframes (present day, around 30 years, and by 2100).

For the detailed risk assessment, further available information, publications and data should be sourced to better resolve the exposure and vulnerability components across the sub-national climate zones for risks rated moderate to high in Stage 1. Combined expert elicitation may be needed to provide more specific and detailed information on hazards, exposure, vulnerability and impacts. This should be undertaken with the aim of better defining the exposure, sensitivity and coping capacity of each sector.

Results from this engagement then need to be reconciled between sectors (see chapter C1) into the vulnerability rating scale (table B3-1).

This could involve in-depth discussions with research providers, local and central government agencies, Māori, iwi, hāpu and other stakeholders to source data and information to better define exposure, sensitivity and coping capacity. This can be supported by literature reviews of relevant New Zealand and international reports and publications.

Guidance on Step 2: Exposure assessment

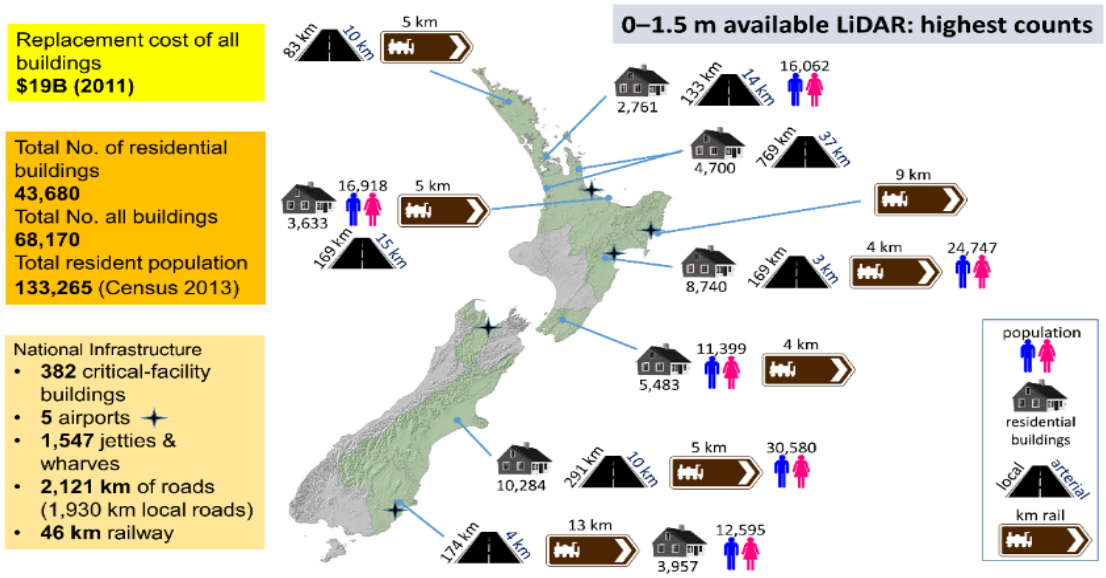
Exposure is defined as:

> The presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected by natural hazards and climate change (see Glossary).

Elements (eg, people, buildings, infrastructure, environments, primary production and critical facilities) are exposed to climate change hazards if they are spatially located within an area affected by a climate-related hazard. Exposure is assessed using the projections (eg, Ministry for the Environment (2018) maps of climate projections) or other available hazard-exposure layers (eg, coastal flooding with sea-level rise).

Figure B3-2 shows a coastal example of a national exposure assessment for sea-level rise.

Figure B3-2: Example of a national-scale exposure analysis of physical assets and people in coastal areas potentially affected by a sea-level rise of 1.5 metres



Source: Bell et al, 2015; Ministry for the Environment, 2017

Note: LiDAR = Light Detection and Ranging.

The degree of exposure can be expressed by absolute numbers, densities or proportions of the elements at risk (eg, people, buildings, infrastructure, and the economy) that are exposed. The extent of exposure is measured spatially (eg, a map of the hazard overlying the elements present or tabulated lists) and temporally (the three timeframes, plus 2150 for coastal flooding exposure) to determine this aspect of risk.

In most cases, the extent and numbers defining the exposure will increase with time for any given climate change projection. Besides the change in hazard over time (projections), which alters the extent or location of exposure, the temporal component of exposure can also relate to the assets' lifespan (eg, could be short-life assets), or changes to the asset base over time (eg, more buildings or infrastructure in the hazard area, or a growing population such that, over time, more people are exposed).

Exposure data can therefore be spatial and temporal. The 'quality' of spatial resolution will be influenced by the availability of trustworthy data, the total available human resources and the time spent on the assessment. National-scale exposure analysis may need to be tailored to the broad regional (sub-national scale) enumeration of elements exposed to different hazards. For example, drier summers or autumns in the east from North Otago to East Cape for zones 3, 4 and 5 (figure B1-1) may affect dairying, so a broad estimate of the exposure could be the area (hectares) of dairying land in those regions (and also aggregated to national scale) likely to be exposed to drier conditions.

Rate exposure on a four-point scale, from low to extreme, as indicated in table B3-1. Any elements that have a 'low' exposure rating at this step should not be carried through to the next step (vulnerability assessment).

Table B3-1: Exposure rating scale

Description of exposure level	Definition
Extreme	>75% of sector or element is exposed to the hazard
High	50–75% of sector or element is exposed to the hazard
Moderate	25–50% of sector or element is exposed to the hazard
Low	5–25% of sector or element is exposed to the hazard

Guidance on Step 3: Vulnerability assessment

The IPCC's Fifth Assessment Report (AR5) describes vulnerability as encompassing "a variety of concepts and elements, including sensitivity or susceptibility to harm or damage, and lack of capacity to cope and adapt (adaptive capacity)" (IPCC, 2014a, p 128). Vulnerability is derived from the interplay of sensitivity and adaptive capacity. It contributes directly to the impact or consequences of a hazard on the exposed objects.

Sensitivity

Sensitivity as a concept, defines the degree to which an exposed object, species, system, sector, taonga or community could be affected by a specific climate-related hazard. Sensitivity may include physical attributes of a system (eg, building material of houses, type of soil on agriculture fields, temperature or frost tolerance of a type of horticulture or viticulture), and social, economic and cultural attributes (eg, age structure, income structure). Examples of sensitivity and their connection to exposed elements are described in box B3-1.

Box B3-1: Examples of sensitivity of elements to climate change hazards

Examples of sensitivity include:

- characteristics of an exposed population, such as age, which contribute to a predisposition to be more sensitive to heatwaves
- incomes of households or businesses (eg, lack of access to insurance leads to higher sensitivity to hazards)
- quality and durability of building materials or the condition of assets, infrastructure or services (eg, aged or poorly maintained assets have a higher sensitivity)
- infrastructure network redundancy (eg, are there alternative road routes, how sensitive is the electricity network to exposed sub-stations)
- aquaculture and marine farming, which are particularly sensitive to sea temperatures and nutrient availability
- tolerance of sub-alpine habitats and species to changing snow lines and rising mean temperatures.

Adaptive capacity

The Climate Change Adaptation Technical Working Group's Stocktake Report (2017, p 98) defined **adaptive capacity** as:

> The resources available for adaptation to climate change and variability or other related stresses, as well as the ability of a system to use these resources effectively in pursuit of adaptation.

However, adaptive capacity goes beyond having the necessary resources at hand. It also reflects the willingness and capability to convert those resources into effective adaptive action (Cinner et al, 2018). Examples of adaptive capacity characteristics are described in box B3-2.

Box B3-2: Adaptive capacity characteristics

Examples of adaptive capacity characteristics include:

- appropriate emergency response capacity to respond to more frequent hazard events or stressors, such as drought, pest and disease invasions, heatwaves, epidemics from vector-borne diseases
- business continuity plans and strategies to reduce risk and minimise disruption
- capacity and resources to upgrade or change critical infrastructure and utilities (eg, respond to electricity demand in hotter summers, reroute coastal roads, upgrade bridges, shift primary–industry processing plants)
- capacity and willingness of communities, businesses and the primary sector to accept reducing levels of service (eg, stormwater, maintaining road access, wastewater systems, flood protection in transition to a more transformative situation)
- resources and capability of local government to address climate change impacts and implications
- access to insurance and hence bank finance (private and public assets)
- capacity and resources available to switch to alternative types of activities or production (eg, capacity of fishing quota system to respond to changes in geographical distribution of fish stocks), different tourism activities (eg, loss of glaciers), changing types of horticulture or aquaculture.

Determining vulnerability ratings

Quantitative vulnerability assessments are complex and not yet well developed in Aotearoa New Zealand.[6] The main challenge is understanding how sensitivity and adaptive capacity will evolve in the future, as New Zealand faces increasing risks and social-economic adjustments from climate change and policy responses to mitigating greenhouse gas emissions. Therefore, the first iteration of the NCCRA will only involve a high-level qualitative assessment, allowing further narratives to be introduced and appraised in future iterations. The first assessment will not involve the use of different future scenarios, such as the Shared Socioeconomic Pathways (SSPs) (Frame et al, 2018a).

[6] A current research topic in the Resilience to Nature's Challenges and Deep South Science Challenges (see https://resiliencechallenge.nz and www.deepsouthchallenge.co.nz, for further information).

The vulnerability of Māori populations and taonga needs to be discussed in detail with local iwi or hapū. Each value domain in this framework has a kaupapa Māori component to it: Culture – Ahurea Māori/Tikanga Māori/Māori culture; natural environment – He Kura Taiao/Living treasures; economy – Whakatipu Rawa/Māori enterprise, built infrastructure – Te Whare Āhuru He Oranga Tāngata/Safe homes, healthy people; and governance–Te Tiriti o Waitangi partnerships. Through an elicitation process with key stakeholders and partners, such as the Iwi Chairs Forum, Māori Women's Welfare League, New Zealand Māori Council and Office of the Māori Climate Commissioner, decide on appropriate data and information, indicators or qualitative descriptors for the vulnerability assessment that covers both sensitivity and adaptive capacity with regard to the elements or activities at risk. This should be done specifically for the kaupapa Māori components for each value domain or sector.

The elicitation process should produce a 'qualitative' ranking of vulnerability from low to extreme, based on the descriptions and definitions in table B3-2.

Table B3-2: Vulnerability rating scale

Description of vulnerability	Definitions
Extreme	Extremely likely to be adversely affected, because the element or asset is highly sensitive to a given hazard and has a low capacity to adapt.
High	Highly likely to be adversely affected, because the element or asset is highly sensitive to a given hazard and has a low capacity to adapt.
Moderate	Moderately likely to be adversely affected, because the element or asset is moderately sensitive to a given hazard and has a low or moderate capacity to adapt.
Low	Low likelihood of being adversely affected, because the element or asset has low sensitivity to a given hazard and has a high capacity to adapt.

Outcomes of the vulnerability assessments need to be reconciled according to sector and expert agreement categories, to ensure biases are not averaged. The same members and assessors of the engagement project team should meet to assess the responses, rather than this being done separately or by several people independently of each other. Once each expert group has been coded, the assessor(s) can reconcile the various groups according to their level of agreement. An example of how this reconciliation process could proceed is given in chapter C1.

Guidance on Step 4: Consequence assessment

Consequence is an important component of assessing risk. A higher consequence from a hazard significantly exacerbated by climate change (eg, more frequent coastal flooding or a seasonal shift in rainfall) will naturally lead to a higher risk rating. The level of exposure and vulnerability of a sector or element will influence the consequences and affect severity.

The development of consistent consequence tables is critical for comparing consequences across a range of outcome types. This will need expert consultation and elicitation. Chapter C2 (table C2-2) sets out the proposed consequence table for the NCCRA. The example criteria in table C2-2 represent only broad consequence measures that may need further detailed articulation across the various sectors. This requires an expert group representing different disciplines and domains to work together to align consequence levels across the domains.

The severity of consequences also relates to the importance of a particular asset, taonga, sector, environment or service provision or function. This will vary based on differing values

and worldviews that may be held, Te Tiriti o Waitangi principles, statutory requirements and standards, and the balance of consequences across the four LSF wellbeing capitals (rather than just monetisation of the consequences, such as at-risk building replacement costs). For example, in a built environment or economic context, a hospital within a floodplain will be rated as more important (higher consequence and impact) than a residential house, due to the potential social, economic and health consequences that would result if it were adversely affected. In an environmental context, certain taonga species may be deemed of higher cultural consequence (importance) than others. For community-based elements, consequence is likely to be more difficult to assess.

A single risk event or episode can generate many consequences that can have both positive and negative effects across the four LSF capitals and impact multiple value domains and sectors. Initial consequences can escalate through cascading and cumulative effects, but ongoing stressors can also lead to cumulative effects. Examples are described in box B3-3.

Box B3-3: Examples of cascading and cross-cutting risks and consequences

Cascading effects, also known as knock-on effects, tend to be associated with events where a primary threat is followed by a dynamic sequence of secondary hazards. For example, earthquakes or floods can not only heavily damage roads and compromise other critical infrastructure or services, such as electricity grids, potable water supply, but also disrupt tourism operations and supply-chain logistics. The cascading effect of heatwaves or drought could also trigger wildfires, which could be exacerbated by a lack of water supply and inaccessible roads, causing trickle-down impacts and consequences on other value domains, unless planned for.

Similarly, an ongoing rise in groundwater levels as a result of sea-level rise will lead to dampness and mould issues in housing, foundation and road instabilities and increase liquefaction potential, thereby affecting multiple domains and sectors in a cascading and cumulative manner.

Evaluating cross-cutting risks and issues

In undertaking the risk assessment, cross-cutting risks and issues will arise from two main directions:

1. those being revealed during assessment of discrete domains and sub-domains
2. others at the domain or sub-domain level that are considered relatively low risk but have the potential, cumulatively across several domains, to present significant risk across multiple sub-national zones.

For those in the first category, it is likely judgement calls can be made in terms of materiality and potential consequence. Where minor, they can likely be ignored, but if otherwise, they need to be reported along with other risks. These may need further assessment alongside assessment in other domains.

Those in the second category will be more difficult to identify. During the engagement process, specific attention should be paid to identifying potential cross-cutting risks that may be relatively minor under individual domains or sub-domains but that cumulatively may pose significant risks. Again, these need to be reported on, particularly to enable active ongoing monitoring and evaluation.

Cross-cutting risks and issues of material significance are to be separately reported on, to enable consideration relative to all domains. An example of where cross-cutting issues are separately reported is the *Thirty Year New Zealand Infrastructure Plan 2015* (The Treasury, 2015).

Guidance on Step 5: Risk scoring

A **risk score** is conventionally derived by combining the probability (or likelihood) of an adverse event with the magnitude of the expected consequences. To address the evolving impacts of climate change, risk is better defined as the interplay between hazards, exposure and vulnerability, as discussed in chapter A2. Risk assessments that consider risks from ongoing climate change must consider the changing characteristics and intensity of the considered hazard and the set of receptors exposed to it.

The probability aspect of a climate-related hazard impacting on receptors is better reframed for climate change risk by assessing consequences at different junctures (present and two future timeframes, plus by 2150 for coastal flooding risk) and across different climate projections (two for this framework). The assessment should consider:

1. adaptation thresholds for consequences (eg, number of floods in a decade, increment of sea-level rise, a seasonal temperature threshold) when objectives for safety, wellbeing, economic returns or system performance can no longer be met, and the timeframes for when these thresholds will eventuate for different projections
2. high consequence (life safety) hazards (eg, landslides and debris flows) generated by high intensity events (ie, rainfall), the frequency of which will increase over time. These require proactive risk reduction interventions in the short term rather than continuing to respond to consequences post-event.

Risk should also, ideally, consider evolving social-economic scenarios for different futures (eg, how primary production, land use, business and societies might operate under different degrees of climate change and commitments to greenhouse gas emissions). For the first NCCRA, in absence of a well-developed suite of national scenarios (other than the broad New Zealand shared socio-economic pathways – CCII report (Tait et al, 2016)), assessments will need to be limited to narratives developed through elicitation processes or adopting domain or sector scenarios that have already been applied and assessed. The vulnerability of the receptors exposed to the climate hazard then determines the consequences and impact severity.

Assemble a workbook by value domain or sector. To complete the risk assessment to this point, a workbook, such as in table B3-3, could be used to assemble and present the components of the risk scoring, as well as the final risk score. Other approaches may be chosen, but transparent decision-making must be maintained in assembling the components and to enable easy transition to the next stage of reporting (chapter B4), which is important for informing the development of the National Adaptation Plan.

- A workbook should be developed for each value domain or sector, where key climate-related hazards and their exposure and sensitivity will be defined first.
- Climate risk and opportunity will be identified based on the elicitation and workshop process. Opportunities that will result from climate changes could be captured separately and transferred to Stage 3, so they can be documented clearly within the final NCCRA report.

- Based on the hazard, exposure, vulnerability and consequences guidance (section B3.1 to B3.3), scoring should be completed, ranking from insignificant to extreme.
- In some cases, the consequence component may not be able to be meaningfully assessed or differentiated for a particular risk or risk area. In this instance, the risk will be based on the assessment of exposure and vulnerability only.

Table B3-3: Sample workbook

Sample Worksheet

Value Domain or sector: Agriculture — Example content only - for illustrating the method

Key climate hazards: (remove those not applicable)

Key sensitivities: Water, seasonality, temperature, sea-level rise

Climate hazard	Climate effects	Implications (including opportunities)	Exposure						Vulnerability						Consequences (risks)						Extent of risk (climate zones)
			Present	~30 yrs	by 2100 RCP4.5	by 2100 RCP8.5	by 2150 (SLR) RCP4.5	by 2150 (SLR) RCP8.5	Present	~30 yrs	by 2100 RCP4.5	by 2100 RCP8.5	by 2150 (SLR) RCP4.5	by 2150 (SLR) RCP8.5	Present	~30 yrs	by 2100 RCP4.5	by 2100 RCP8.5	by 2150 (SLR) RCP4.5	by 2150 (SLR) RCP8.5	
Change in mean annual rainfall	Decreasing rainfall in some climate zones … Western areas projections are for higher annual rainfall.	Decreasing precipitation with consequently less water for growth and irrigation. Wetter western areas may promote more growth – but more waterlogging?	Low	Moderate	Moderate	Major	–	–	Low	Low	Moderate	Major	–	–	Minor	Minor	Moderate	Major	–	–	Drier in north and east of North Island, and east of South Island (climate zones: 1, 3, 4, 5). Wetter in western regions (climate zones: 2, 6)
Higher mean temperatures	Warmer climate with decreasing frosts …	Changes in optimal regions for cropping and grasses. Potentially higher growth rates where adequate water.	Low	Moderate	Major	Extreme	–	–	Low	Moderate	Moderate	Major	–	–	Insignificant	Moderate	Major	Major	–	–	Agricultural regions throughout New Zealand including Chatham Islands (all climate zones 1–7)
Coastal and estuarine flooding	Lowland river and coastal areas subject to more frequent flooding including higher groundwater, …	Drainage increasingly difficult or expensive, low-lying coastal rural land less productive and more hazardous, … Also compound hazard from salinization.	Low	Moderate	Major	Major	Major	Extreme	Major	Major	Extreme	Extreme	Extreme	Extreme	Minor	Moderate	Major	Extreme	Extreme	Extreme	Areas around coasts, estuaries and lowland rivers of relatively flat low-lying land (all climate zones)
Continue below			Low	Low	Moderate	Moderate	–	–	Low	Major	Major	Major	–	–	Insignificant	Minor	Major	Major	–	–	

Instructions:
In the cells type rating and colur will be automatic

Rating options:

Exposure:	Vulnerability:	Consequences (Risks)
– Not assessed	– Not assessed	– Not assessed
Low	Low	Insignificant
Moderate	Moderate	Minor
Major	Major	Moderate
Extreme	Extreme	Major
		Extreme

The consequences score is derived based on consideration of the hazard, exposure and vulnerability as described in Step 4 above (see also table C2.2 for a description of a five-level scale from 'insignificant' to 'extreme'). At this stage, the risk assessment score will be taken as the consequence score. It is anticipated that risks will be assessed via a workshop approach, with input from various stakeholders and specialists.

Only risks falling under the categories of moderate, major or extreme as in the timescales in table B3-4 need to be scrutinised further.

Table B3-4: Ratings and timescales for risks requiring further assessment

Risks requiring further assessment			
		100-plus years	
Present	30 years	RCP4.5	RCP8.5
Moderate	Moderate		
High	High	High	
Extreme	Extreme	Extreme	Extreme

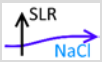
Assess strength of evidence and uncertainty

A certain pedigree of literature and information is needed to develop a robust summary of observed or projected impacts on sectors, particularly those associated with uncertain variables that support the scenarios and timeframes used. The strength of evidence criteria outlined in table C2-1 in chapter C2 provide guidance that includes demonstrated consensus in any elicitation process, including with Mātauranga Maori experts. If the strength of evidence rating is low or weak, but the risk is perceived to be relatively high, then recommendations for any key research, information or monitoring gaps should be transferred to Stage 3.

Identify key risks

As shown in table B3-5, a summary tabulation by domain or sector should be prepared following assessment of the strength of evidence. An Excel spreadsheet has been developed to expedite this reporting and incorporates automatic colour coding to entered ratings.

Table B3-5: Summary table for domain or sector (example)

Value Domain or sector:	**Agriculture** Example content only – for illustrating the method												
Key climate hazards: *(remove those not applicable)*	 Higher mean temperature	 Heat waves	 Dry spells and drought	 Changes in seasonality	 Increased fire weather	 Storminess and winds	 Change in mean rainfall	 Landslide and soil erosion	 Increas-ing hail severity	 River and pluvial flooding	 Coastal and estuarine flooding	 SLR and salinity stresses	
Key climate sensitivities:	Water, seasonality, temperature, sea-level rise												
Climate hazard	**Climate effects**	**Implications (including opportunities)**	**Risk rating** *(based on consequences table C2-2)*								**Strength of evidence**	**Current adaptation**	
			Present	~30 yrs	by 2100		by 2150 (SLR only)						
					RCP4.5	RCP8.5	RCP4.5	RCP8.5					
Change in mean annual rainfall	Decreasing rainfall in some climate zones ...	Reduced water for growth and irrgation ...	Insignificant	Minor	Moderate	Major	–	–			Low	Low	
Higher mean temperatures	Warmer climate with decreasing frosts ...	Changes in optimal regions for cropping/grasses. Potentially higher growth rates where adequate water ...	Minor	Moderate	Major	Extreme	–	–			Medium	Low	
Coastal and estuarine flooding	Lowland river and coastal areas subject to more frequent flooding incl. higher groundwater, ...	Drainage increasingly difficult, low-lying coastal rural land less productive and more hazardous, ... Also compound hazard from salinization	Minor	Moderate	Major	Extreme	Extreme	Extreme			High	Medium	
Continue below ...			Minor	Minor	Moderate	Moderate	–	–			Very high	Medium	

The resulting risk scoring results should be made available for the expert participants to review, verify and suggest modifications if needed. This ensures that any perverse or bias outcomes are identified and reassessed if required.

Engagement activities	Prompts
Verifying Stage 2 outcomes	• Were all those with expert knowledge or information engaged in the process? • Do the results reflect perceived or actual risks? • Are there any perverse outcomes? • Send results back to engaged stakeholders for their verification of outcome. • Does the engagement strategy need to be revised and updated?

Upoko B4: Arotakenga Tūāoma 3: Te urutaunga me te arotake whakataunga totoa

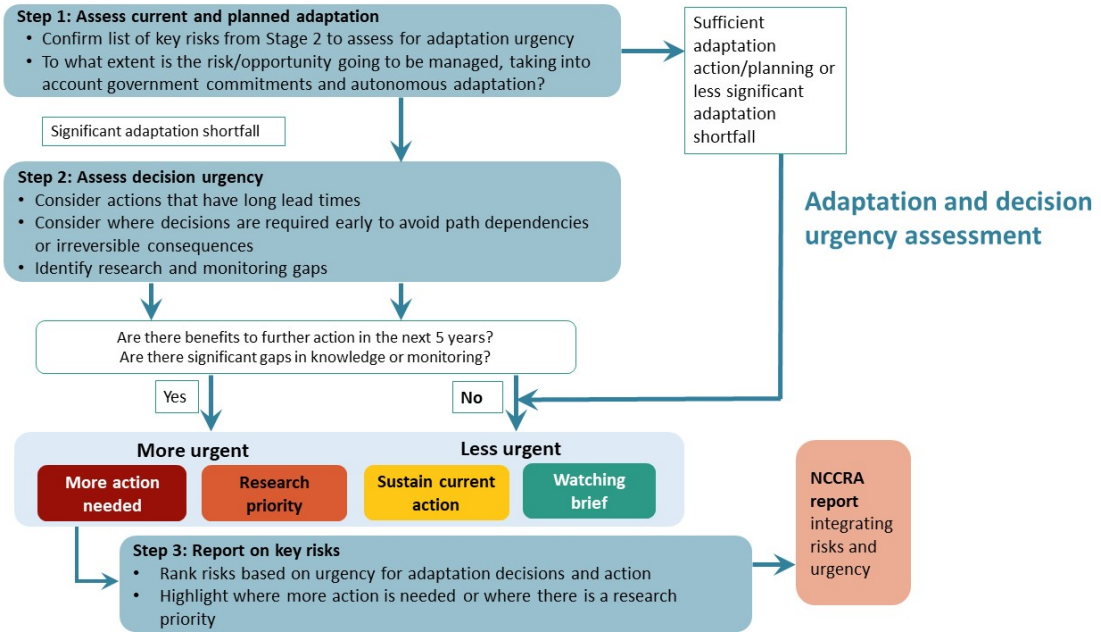
B4.1 Scope and purpose of adaptation and decision urgency assessment

The main objective of undertaking the NCCRA using this framework is to highlight key risks that will help inform development of a National Adaptation Plan. It is important, therefore, that the outputs from the NCCRA are targeted towards this purpose.

To achieve this, a third assessment stage is recommended to assess current and planned adaptation strategies and actions to identify where gaps exist and quick decisions need to be made to prevent maladaptive path dependencies or irreversible consequences. This stage should also highlight opportunities where early action can reap benefits from changing climatic circumstances. The framework uses the urgency ratings from the 2017 UK Climate Change Risk Assessment (Committee on Climate Change, 2017) to signal the need for adaptation decision-making, and the IPCC AR5 reporting frameworks have been adapted for New Zealand purposes (IPCC, 2014b). Figure B4-1 shows the process for Stage 3.

All risks through to this stage either will have been rated as key risks, based on potential future impacts across a range of wellbeing indicators, or be perceived as potentially high but more evidence is needed. It will be the role of those developing the subsequent National Adaptation Plan to decide on the priorities, particularly because these may coincide with government policy and budgeting cycles. The intention is to enable the NCCRA to deliver fairly clear messages across sectors in terms of key risks that need action.

Figure B4-1: Stage 3 process for assessment of adaptation and decision urgency



B4.2 Method for adaptation and decision urgency assessment

Taking the key risks from Stage 2, analyse the current and planned adaptation to highlight risks for which adaptation decisions need to be made most urgently, to inform a National Adaptation Plan.

- **Step 1: Assess current and planned adaptation**
  - Confirm list of key risks from Stage 2 and involve stakeholders, partners and agencies to canvass plans and activities to manage the identified risks.
- **Step 2: Assess decision urgency**
  - Are current actions sufficient to manage the evolving risk? Identify actions that limit future adaptations (ie, may result in lock-in of current practice or vulnerability).
  - Consider where early action is needed to avoid current pathway dependency (maladaptation) or irreversible negative consequences.
  - Consider decisions and actions that have long lead times for implementation.
  - Consider decisions that have long life spans (eg, infrastructure).
  - Identify research gaps where strength of evidence is low or there is deep uncertainty.
  - Identify monitoring gaps.
- **Step 3: Report on key risks based on urgency for adaptation decisions and action**
  - Highlight where further action is needed or there is a research priority.
  - Use an integrated reporting template to show risk scores and impact of adaptation.
  - Include where early action is critical, to take advantage of opportunities.

B4.3 Guidance on the assessment steps

Guidance on Step 1: Assess current and planned adaptation

Once you have identified major risks for potential consequences (based on the exposure and vulnerability of the sector, system or asset), review current adaptations, regulations and policies to identify gaps where more action is needed or current actions need modifying. This is the starting point for assessing the urgency of decision-making around future adaptation actions.

Different types of adaptation activities need to be considered when determining the current level of adaptation, as shown in box B4-1. Stakeholder, partner and agency engagement should be used to tease out all types of activities to compile a full picture of adaptation strategies for the key risks.

Box B4-1: Types of adaptation

- **Anticipatory adaptation** – Adaptation that takes place before impacts of climate change are observed. Also referred to as proactive adaptation.
- **Autonomous adaptation** – Adaptation that does not constitute a conscious response to climatic stimuli but is triggered by ecological changes in natural systems and by market or welfare changes in human systems. Also referred to as spontaneous adaptation.
- **Planned adaptation** – Adaptation that is the result of a deliberate policy decision, based on an awareness that conditions have changed or are about to change and that action is required to return to, maintain or achieve a desired state.
- **Private adaptation** – Adaptation that is initiated and implemented by individuals, households or private companies. Private adaptation is usually in the actor's rational self-interest.
- **Public adaptation** – Adaptation that is initiated and implemented by governments at all levels. Public adaptation is usually directed at collective needs.
- **Reactive adaptation** – Adaptation that takes place after impacts of climate change have been observed.

Source: IPCC, 2001.

Assess whether any risk management or adaptation strategies or actions are already in place or under development. If past or present changes in climate-related hazards or risk have been identified for the relevant value domain or sector, then consider whether any risk management or adaptation strategies are in place (or under development) to tackle this rising or emergent risk. This step should only be a high-level assessment of activities that may influence the level of risk for the sector or element.

After gathering information on current actions and plans in Step 1, a follow-on consideration is whether these strategies or actions are sufficient to reduce risk by asking if they are:

- short-term fixes to buy time or lock in future path dependencies – therefore, the risks (or residual risks, eg, higher sea wall could be breached) are still present and need to be assessed in the NCCRA
- long-term options or transformational changes in practices or responses, with inherent adaptive flexibility and, therefore, only require 'ongoing monitoring' or a 'watching brief' to ensure maladaptation or unintended impacts have not occurred.

Integrating adaptation into climate change planning and decision-making will include both incremental and transformational adjustments. It is important to consider that the time horizons for risk often differ from those required for adaptation planning. For example, a risk such as rising groundwater levels may not manifest itself for several decades, but the timeframes related to land use planning processes mean adaptations now may reduce consequences and impact severity in future.

Guidance on Step 2: Assess decision urgency

Adaptation actions or options will require considerable lead times not only to develop a plan but to implement it (eg, managed relocation from very low-lying coastal or flood plain areas may take decades to achieve). If an important risk looks to be emerging in the medium-to-long term (30-plus years), but requires long lead times for implementation or effectiveness of an

adaptation strategy, then this could be rated as more urgent than a decision on another risk where adaptation does not require such a lead time, even if it may emerge sooner.

The assessment should consider where delays may increase long-term costs or reduce expected benefits. This can happen particularly in the case of slow-onset trends, which can grow steadily but imperceptibly until they reach a tipping point.

Engagement with stakeholders in a series of 'positive enquiry' questions can elicit information on options and barriers. Such questions could include the following.

- **Would action have early, robust benefits?**

  This could lead to identified 'no-regret' or 'low-regret' actions that help build future resilience.

- **Do decisions have long lead times?**

  Adaptations with long lead times may require action sooner.

- **Is there potential for lock-in?**

  This point serves to show that, in some instances, avoiding actions can maintain options and be more effective in the longer term. This includes areas where decisions today could 'lock-in' vulnerability of assets or communities for a long time. Fast-tracking of adaptation may be desirable if a wrong decision today will make us more vulnerable in the future and if those effects are costly to reverse. Several strategic decisions potentially fall into this category, including those on long-term infrastructure (eg, the location of new ports, airports, roads), land-use planning and the management of development trends, such as regional water demand.

Prompts for engagement on assessing current and planned adaptation are shown below.

Engagement activities	Prompts
Assessing current and planned adaptation	• What adaptation measures and policies is your agency currently undertaking or planning for climate change? • What adaptive measures could be taken in the future? • Are there any new policy initiatives that need to be implemented? • What are the implications of any actions to the different sectors and Māori? • What is the impact on sectors of waiting or not waiting on actions? • How will your agency monitor the effectiveness of climate change policies? • Is there a process for changing policies if they are deemed ineffective? • Do any regions require a national all-of-government approach? • What are the priority issues? To whom? • Where are the gaps in knowledge?

Urgency categories for decision-making

From the engagement process, the major risks are ranked and rated in terms of urgency for action. Judgement of urgency is based on available evidence about:

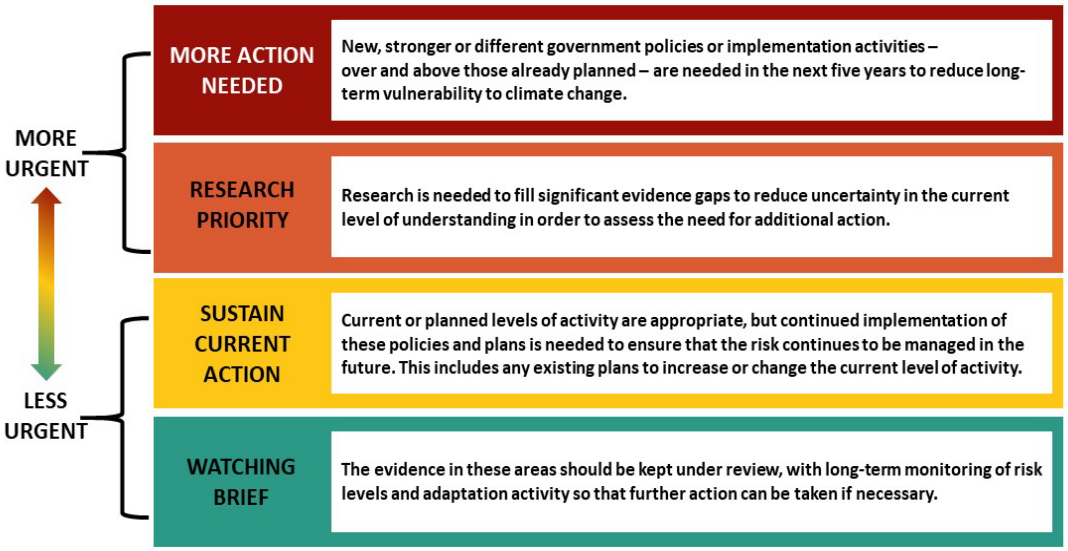
- the opportunity for intervention or early adaptation
- the difficulty of adaptation
- the lead time for adaptation

- existing or expected socio-economic trends
- the flexibility of the system in terms of the ability to change decisions in the future that are made today.

Typical risk management language refers to levels of risk, that is, high, medium, low; or acceptable, tolerable, intolerable. To avoid confusion and provide a measure that relates directly to 'adaptation decision making', the NCCRA framework adopts the UK Climate Change Risk Assessment urgency categories. This provides clear signals about the urgency of decisions and actions (Committee on Climate Change, 2017). In this approach, less urgent categories are designated as either 'watching brief' (where risks should be monitored and reviewed) or 'sustain current action' (where current or planned actions need to be carried out). The more urgent categories are designated 'research priority' (where risks are potentially high but significant evidence gaps exist and/or little is known about adaptation) and 'more action needed' for risks where stronger change in adaptation planning and activity is urgently required to reduce the impacts (consequences).

Figure B4-2 lists definitions for the urgency categories.

Figure B4-2: Urgency categories for adaptation action on key risks



Source: Based on the Climate Change Risk Assessment urgency categories (Committee on Climate Change, 2017)

The overall assessment considers uncertainties about the levels of future climate change, exposure and vulnerability identified in chapter B3. Specific tailored engagement may be required with those agencies where further urgency is required for adaptation, to ensure no actions have been missed in the previous step and it is within their mandate to action the urgency rating that is applied. This should address whether any other planned adaptation activities have been missed.

Guidance on Step 3: Report on key risks

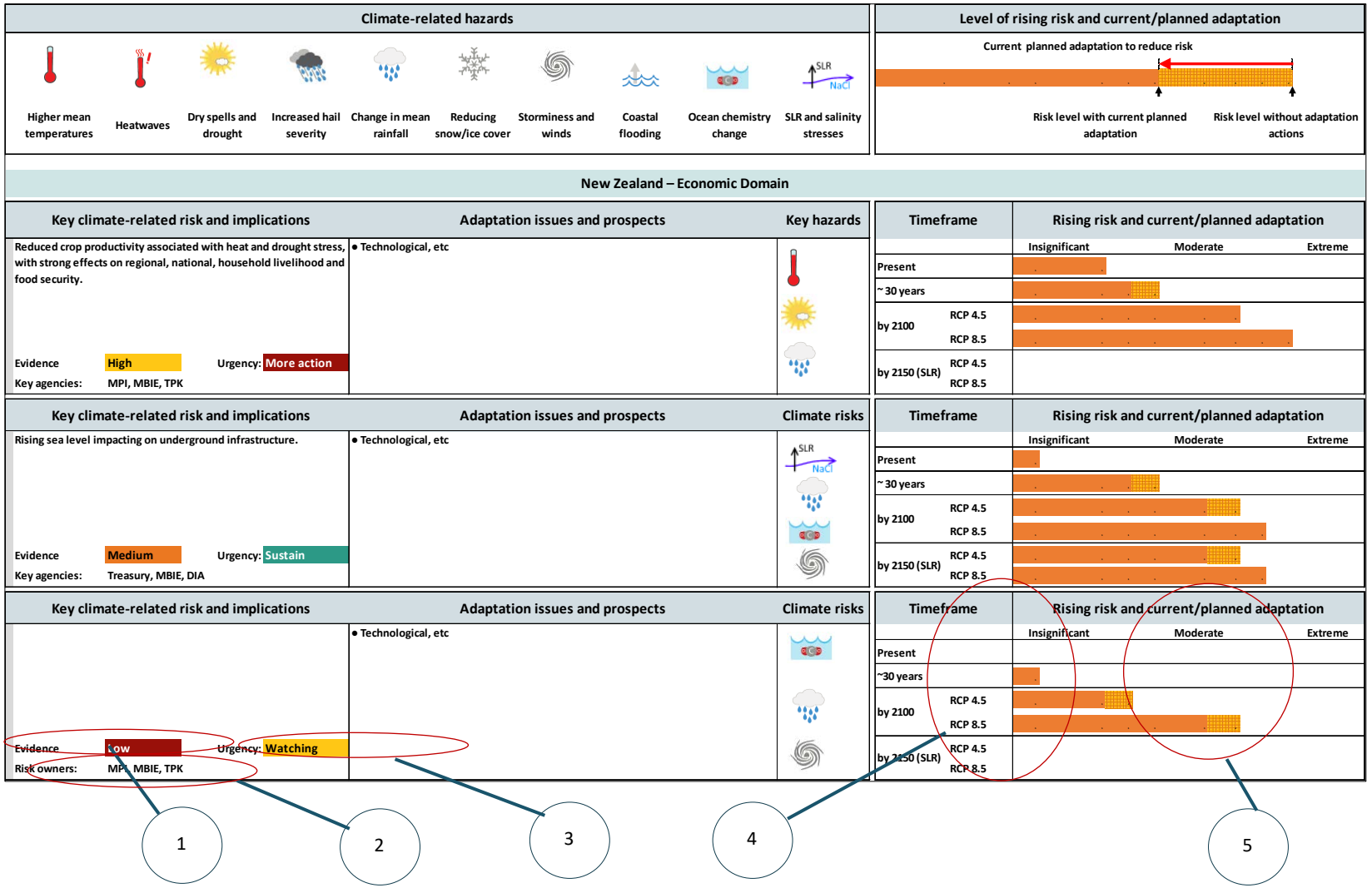
Integrated reporting for policy-makers and others

The IPCC AR5 developed a climate adaptation reporting framework targeted at policy-makers but that is useful for many other users (IPCC, 2014b). This is considered to be particularly

applicable to Aotearoa New Zealand and for the purpose of informing development of the National Adaptation Plan. It helps focus on the key risks that need attention in the National Adaptation Plan and should also help manage trade-offs and monitoring. Enhancements to the IPCC approach include adding confidence levels, urgency ratings and custodians of risk.

This format can be used to present risks in terms of urgency for each value domain as well as subsets. Guidance is provided below on the content and methods to be applied. The content in table B4-1 is indicative only and represents no level of analysis or assessment.

Table B4-1: Integrated reporting



Guidance on the reporting template

1. The strength of evidence is directly sourced from outputs of the Stage 2 detailed risk assessment (chapter B3, table B3-5). Options are low, medium and high.
2. Key agencies are those parties that have been identified to date with responsibilities related to the risk. Where known or anticipated, the lead custodian is highlighted.
3. The urgency rating is directly derived from qualitative assessment (chapter B4). Options are: more action (for More Action Needed), research (for Research Priority), sustain (for Sustain Current Action) and watching (for Watching Brief).
4. The timeframes are as discussed in chapter A3 and chapter B1.
5. The total risk level (orange plus hatched yellow) is the level as derived from the Detailed Assessment (chapter B3). The hatched yellow represents the largely qualitative assessment of potential for adaptation (chapter B4).

An Excel spreadsheet has been developed to expedite this reporting and incorporates automatic colour coding across points 1, 3, 4 and 5.

Wāhanga C: Kōrero āpiti

Upoko C1: Te whanake mahere torotoro

Any engagement process will follow accepted good practice, for example, the International Association of Public Participation process of design, methods and evaluation.[7] At the outset of planning the risk assessment process, and while starting to understand the context of the assessment, an engagement plan should be developed that reflects the process shown in table C1-1. This plan will guide the engagement process, to ensure project outcomes are met.

It is expected that, while different forms of engagement will be required (as described in chapter A4 and shown in figure A4-1), expert elicitation will be the main method for extracting information from the different sectors. This formal procedure is used for obtaining and combining expert judgements, and is often used when existing information cannot be easily provided, agreed upon or accessed. Because expert biases can result in perverse outcomes, it is important structured elicitation protocols are followed, and the reconciliation across experts is carried out in a transparent and robust manner (see table C1-1 for an example of how this can be done).

The engagement strategy is a living document and you should update it as the project progresses. For example, once engagement begins, if you identify more stakeholders (eg, experts, pan-Māori representatives) add them to the engagement strategy. There should be a regular cycle of engagement planning, implementing the plan, monitoring and reflecting on the outcomes against objectives and plan review. As well as ensuring the engagement plan is meeting its objectives, this review cycle also provides for the 'monitor and review' part of the risk assessment process. To inform the development of the strategy, the activities in table C1-1 should be undertaken.

Table C1-1: Engagement activities required to develop the engagement plan

Engagement activities	Prompts
Understand context	• What are the international, national and regional influences? • What political debate is occurring? • How important is the project to New Zealand? • Where does the need to make a decision come from? • What is the policy approach to engagement from the Ministry for the Environment? • What are the key drivers for engagement? • How is climate change affecting New Zealand now, in 30 and 100 years' time? • What overlaps or cross-cutting themes are emerging for climate change adaptation? • How will the engagement outcomes be used to inform the risk assessment? • Is there any potential cross-over with any other engagement processes occurring around the same time? • Is the Government currently engaging with this group on any other matters? • Has the Government engaged recently on this issue or with the same audience, and what was the result? • What other activities might be occurring within Māori communities that may affect your process? • Is there an opportunity to coordinate with other engagement processes occurring? • How can this opportunity for involvement and meaningful engagement be maximised?

[7] International Association of Public Participation (IAP2) for good practice engagement guidance and templates: www.iap2.org.

Engagement activities	Prompts
Scope the project	• Provide a clear statement of why this project and engagement is being undertaken • What is the understanding of the focus of the engagement? • What is the reason for the engagement? Why now? Why is it a priority? • What is the outcome of the project, that is, what influence will it have? • What are the limitations of the scope, and what is out of scope? • What are the absolute requirements to achieve the outcome? • What are the key messages? • How will information be gathered, stored, accessed, used?
Understand people	• Who should be in the engagement team? – What skills do they bring? – Are team members IAP2 certified? – Do they have experience and knowledge of effective Māori engagement? • What type of interest should people have in this project? For example, IAP2 Orbit of Public Participation? – Who needs to be aware but not actively involved? – Who will be watching the process who the consultant may not be aware of? – Who will need to review the outcome? – Will advisors be required to the project team? – Who has interest and knowledge so their direct involvement is required? – Who are the decision-makers in the final outcome?
Set purpose	• What is the purpose of the engagement? • What engagement goals can be set so that progress can be monitored and milestones are achieved?

Note: IAP2 = International Association of Public Participation.

When establishing timeframes, you should consider the capacity of your partners and stakeholders to participate effectively in your engagement process, and timeframes should remain as flexible as possible to allow for unexpected situations. In particular, for Māori, negotiating sufficient time to consider the kaupapa and response should be agreed together; it is important to go to Māori with initial thinking and proposals rather than a fully formed or fixed view (Ministry for the Environment, 2018).

Some engagement processes will need to include full disclosure on how information gathered will be used, stored, accessed; privacy requirements and longevity (ie, they will be undertaken according to ethical principles). This is particularly important for citizen or stakeholder surveys, hui, structured interviews and any mātauranga Māori that is collected. Any ethical considerations should be included in the engagement plan. The Royal Society of New Zealand provides a code of ethics which should be followed throughout the risk assessment process.

Example of how to reconcile different sector expert elicitation outcomes

The elicitation process could involve scenarios based on the consequence table that experts associate a timeframe to (eg, present; 30 years; 100 years). This is then reconciled by the assessor. An example is given in figure C1-1, based on three levels of risk; however, this could be adapted to different levels of risk, such as extreme, high, medium, low). The number of percentage categories are important to ensure averages are not used, because averages will bias the outcome.

Figure C1-1: An example of coded responses for expert elicitation on consequences and timeliness

A	90% or more described this as acceptable or tolerable and the percentage who found it only tolerable was 10% or less.
A-	70% or more found this acceptable. Those who found it tolerable was no more than 25%.
A/T	70% or more found this acceptable or tolerable with the majority finding it acceptable. 50/50 is where percentage of respondents were even for both acceptable and tolerable.
T/A	70% or more found this acceptable or tolerable with the majority finding it tolerable.
T	Majority find this tolerable – those who find acceptable or intolerable differs by 4% or less.
T/I	70% or more found this tolerable or intolerable with the majority finding it tolerable.
I/T	70% or more found this tolerable or intolerable with the majority finding it intolerable.
I-	More than 70% found this intolerable and less than 10% found it acceptable.
I	89% or more found this intolerable or tolerable the % of who found it tolerable was 10% or less.
?	This indicates the presence of a significant minority contrary voice of 20% or more.

Source: Kilvington and Saunders (2015)

To reconcile the elicitation activities from five different groups, the process below could be followed (refer to Kilvington and Saunders (2015) for the full process) to compile one recommended set of thresholds:

1. insert all 100 per cent scores
2. insert all remaining scores and colours
3. make judgement calls where majorities from each information stream align; leave blank where there are inconsistent majorities requiring considered judgement
4. make considered judgement for outlier areas – relying on knowledge about how numbers were determined and weight of opinion, as well as consistency and workability of final outcome.

When opinion diverges between the groups, judgement is required on which direction to take. Factors that need to be considered include the strength of opinion expressed by each contributing group, the overall trend towards risk acceptability, and emphasis on either consequence or likelihood.

Upoko C2: Paearu arotakenga tūraru

C2.1 Strength of evidence criteria

Table C2-1 provides a metric to rate the strength of evidence, including expert consensus (and therefore level of confidence), for use in the risk screening and detailed risk assessment stages.

Table C2-1: Strength of evidence indicators

Measure	Evidence	Information	Methods	Consensus
1 – Low	Inconclusive evidence for impacts	Limited information, extrapolations, poor documentation	Not tested	Disagreement or lack of consensus among subject matter experts. No views expressed and shared by Mātauranga Māori experts
2 – Medium	Suggestive evidence for impacts	A few sources of information, incomplete models, minor documentation	Emerging	Competing consensus among subject matter experts. Few views expressed and shared by Mātauranga Māori experts
3 – High	Moderate evidence for impacts	Several sources of information, partial models, some documentation	Varying	Moderate consensus among subject matter experts. Some views expressed and shared by Mātauranga Māori experts
4 – Very high	Strong evidence for impacts	Multiple sources of information, established models, well documented	Accepted	Strong consensus among subject matter experts. Multiple views expressed and shared by Mātauranga Māori experts

C2.2 Consequence rating criteria

Table C2-2 provides indicative metrics for rating the severity of consequences against the LSF capitals and across the framework's six value domains. The metrics generally do not reflect event-based consequences but focus on impacts resulting from changes in climate-related hazards.

Table C2-2: Consequence rating criteria

Value domain		Consequence level (national scale aggregated from the seven sub-national climate zones)				
		Insignificant No significant change in impact nationally that can be handled through business as usual processes or some local or regional impacts with no specialised management required	**Minor** Some minor impacts at the national scale that could be addressed through local or regional management and adaptation processes	**Moderate** Significant impacts at the national scale of interest to national agencies to address adaptation, or a major impact for 1–2 sub-national climate zones	**Major** Major impacts at the national scale of high interest to national agencies to quickly address adaptation, or an extreme impact for 1 sub-national climate zone	**Extreme** Extreme impacts at the national scale (or even in a few sub-national climate zones) of heightened interest to national agencies to urgently address adaptation. May be of interest to international partners or financial or insurance institutions
Human	**Society**	No discernible changes in damage, casualties or displacement of households from weather-related events. Small increase in demand nationally for welfare, education and community services after events, including prolonged drought or heatwaves. Full access to essential consumer products (apart from expected major events). Individuals generally feel attached to their communities and trust and cooperation is high. Most people satisfied or very satisfied with life in New Zealand, despite the	Growing number of people affected by more frequent weather-related events and sea-level rise in different pockets around Aotearoa New Zealand, but the slight increase in injuries and illness (and even a few climate-related fatalities) can still be managed through existing health and emergency management plans. Less than 100 additional displaced households during more frequent weather-related events, with local or regional housing agencies managing within existing resources. Despite increasing number of events, including persistent drought and heatwaves, welfare services can still be	Significant number of people (hundreds) and communities affected by more frequent weather-related events and sea-level rise around Aotearoa New Zealand, with the noticeable increases in injuries, casualties (tens of more people than expected over time), illness and heat stress, which may challenge existing health and emergency management responses. May require additional support from outside the region and national agencies. Significant number of people affected (and more frequently) with hundreds more displaced households during events exacerbated by climate change.	High number of people (thousands) and communities affected by more frequent weather-related events and sea-level rise around Aotearoa New Zealand, with large increases in injuries, casualties (tens to hundreds more people than expected over time), illness and heat stress, which strongly challenge existing health and emergency management responses. Will require strong support from outside the region and national agencies. Significant number of people affected (and more frequently) with thousands more displaced households during events exacerbated by climate change.	Large number of people (tens of thousands) and communities affected by more frequent weather-related events and sea-level rise around Aotearoa New Zealand, with steep increases in injuries, casualties (hundreds more people than expected over time), illness and heat stress, which may overwhelm existing health and emergency management responses. Will require strong ongoing support from national agencies. Significant number of people affected (and more frequently) with tens of thousands more displaced households during events exacerbated by climate change.

Value domain	Consequence level (national scale aggregated from the seven sub-national climate zones)				
	Insignificant No significant change in impact nationally that can be handled through business as usual processes or some local or regional impacts with no specialised management required	**Minor** Some minor impacts at the national scale that could be addressed through local or regional management and adaptation processes	**Moderate** Significant impacts at the national scale of interest to national agencies to address adaptation, or a major impact for 1–2 sub-national climate zones	**Major** Major impacts at the national scale of high interest to national agencies to quickly address adaptation, or an extreme impact for 1 sub-national climate zone	**Extreme** Extreme impacts at the national scale (or even in a few sub-national climate zones) of heightened interest to national agencies to urgently address adaptation. May be of interest to international partners or financial or insurance institutions
	climate-related changes, and can see the opportunities. The wellbeing of whānau is minimally affected. The overall wellbeing of rural or urban communities is minimally affected (including support industries and primary production). Climate-related changes are well inside the 'coping range'.	managed through existing local or regional services. Isolated and short-term disruption to education, employment and community services. Minor increase in short-term disruption to accessing essential consumer products. The wellbeing of whānau within some communities increasingly becomes negatively affected. The overall wellbeing of rural or urban communities is somewhat affected and more often (including support industries and primary production). Climate-related changes remain inside the 'coping range', but can be stretched during more frequent 'nuisance' weather	Welfare services in response to hazard events and stressors (eg, drought, heatwaves) require more substantial regional and occasional national coordination than previously. Multiple short- to-medium term disruption to education, business and community services. Pockets of individuals are distrustful or disengaged. Multiple short-term disruptions to access to essential consumer products. The wellbeing of hapū and iwi within some regions or across some sub-national climate zones is significantly affected. The overall wellbeing of rural or urban communities is	Special welfare funds become available (eg, mayoral relief). Widespread short-to-medium term disruption to education, business and community services. Distrust or disengagement evident across multiple communities throughout Aotearoa New Zealand. Widespread short-to-long term disruption to essential consumer products. The wellbeing of hapū and iwi within most regions or sub-national climate zones is majorly affected. The overall wellbeing of rural or urban communities is majorly affected across most sub-national climate zones and more often (including support industries,	Additional national welfare funding mechanisms needed. Widespread longer-term disruption to education, business and community services. Widespread distrust or disengagement nationally. Widespread medium-to-long term disruption to essential consumer products – otherwise make changes to infrastructure services, community locations or local or regional economic activities. The wellbeing of hapū and iwi within most regions or sub-national climate zones is seriously affected. The overall wellbeing of rural or urban communities is seriously affected across most sub-national climate zones and more often

Value domain	Consequence level (national scale aggregated from the seven sub-national climate zones)				
	Insignificant No significant change in impact nationally that can be handled through business as usual processes or some local or regional impacts with no specialised management required	**Minor** Some minor impacts at the national scale that could be addressed through local or regional management and adaptation processes	**Moderate** Significant impacts at the national scale of interest to national agencies to address adaptation, or a major impact for 1–2 sub-national climate zones	**Major** Major impacts at the national scale of high interest to national agencies to quickly address adaptation, or an extreme impact for 1 sub-national climate zone	**Extreme** Extreme impacts at the national scale (or even in a few sub-national climate zones) of heightened interest to national agencies to urgently address adaptation. May be of interest to international partners or financial or insurance institutions
		events from flooding, especially in coastal areas. Access to climate-related insurance and mortgages declines in some local pockets.	significantly affected across some sub-national climate zones and more often (including support industries, lifelines and utility services and primary production) – with some communities permanently affected from changes in primary production, tourism or rising sea levels. Climate-related changes begin to challenge the 'coping range', and more frequent 'nuisance' weather events (flooding, especially in coastal areas) will, for some communities and areas, exceed 'coping capacity'. Access to climate-related insurance and mortgages declines in some localities, especially low-lying coastal areas.	lifelines and utility services and primary production), with a significant number of communities permanently affected from changes in primary production, tourism or rising sea levels. Climate-related changes challenge the 'coping range', and more frequent 'nuisance' weather events (flooding, especially in coastal areas) will, for some communities and areas, exceed local 'coping capacity'. Access to climate-related insurance and mortgages declines for a significant number of communities (or suburbs) across Aotearoa New Zealand, especially low-lying coastal areas.	(including support industries, lifelines and utility services and primary production), with a high number of communities permanently affected by changes in primary production, tourism or rising sea levels. Climate-related changes exceed the 'coping range' for many communities or a primary or secondary industry, and more frequent 'nuisance' weather events (flooding, especially in coastal areas) will, for a significant number of communities and areas, exceed both local and regional 'coping capacity'. Access to climate-related insurance and mortgages declines for many communities or suburbs across Aotearoa New Zealand, especially low-lying coastal areas.

Value domain	Consequence level (national scale aggregated from the seven sub-national climate zones)				
	Insignificant No significant change in impact nationally that can be handled through business as usual processes or some local or regional impacts with no specialised management required	**Minor** Some minor impacts at the national scale that could be addressed through local or regional management and adaptation processes	**Moderate** Significant impacts at the national scale of interest to national agencies to address adaptation, or a major impact for 1–2 sub-national climate zones	**Major** Major impacts at the national scale of high interest to national agencies to quickly address adaptation, or an extreme impact for 1 sub-national climate zone	**Extreme** Extreme impacts at the national scale (or even in a few sub-national climate zones) of heightened interest to national agencies to urgently address adaptation. May be of interest to international partners or financial or insurance institutions
Culture	No impact	Little impact on the ability of people to participate and/or express their cultural identity. Temporary minor damage to cultural values, identity, heritage and knowledge.	Most people have the ability to participate in cultural life and express their cultural identity, but some pockets of dissatisfaction. Some decline in status and condition of sites of national cultural significance, loss of cultural values, identity, heritage and knowledge.	Many people unable to participate in cultural life and/or express their cultural identity. Large pockets of dissatisfaction. Major decline in status and condition of sites of national cultural significance. Significant loss of cultural capital, cultural values, identity, heritage and knowledge.	Most people unable to access or participate in cultural life and/or express their cultural identity. Permanent loss of cultural capital, cultural values, identity, heritage and knowledge. Irreversible decline in status and condition of sites of national cultural significance.
Natural environment	Negligible impact or very short-term event-driven, reversible effects. Difficult to isolate the trend for any climate-change influence from other natural, climatic and human factors (very low signal to noise ratio).	Temporary localised or minor regional decline in land, water, air, soil, ocean quality or habitats and landscape attributable to climate change. Short-term temporary loss or minor decline in quality and status of designated sites attributable to climate change.	Sustained local and regional impacts on taonga species, habitats and landscapes across some sub-national climate zones. Sustained localised or regional impacts on quality and status of environmental protected sites or marine protected areas of national importance.	Widespread degradation of air quality, water quality, soils, and marine environments across most sub-national climate zones. Medium-term loss of biodiversity after more frequent or persistent events (eg, droughts, marine heatwaves, floods) and increasing pressure of more permanent loss of biodiversity.	Permanent degradation of air quality, water quality, soils and marine environments nationally. Permanent loss of biodiversity. Permanent, widespread loss of significant natural areas or taonga species. Substantial loss of climate-sensitive environments (eg, salt

Value domain	Consequence level (national scale aggregated from the seven sub-national climate zones)				
	Insignificant No significant change in impact nationally that can be handled through business as usual processes or some local or regional impacts with no specialised management required	**Minor** Some minor impacts at the national scale that could be addressed through local or regional management and adaptation processes	**Moderate** Significant impacts at the national scale of interest to national agencies to address adaptation, or a major impact for 1–2 sub-national climate zones	**Major** Major impacts at the national scale of high interest to national agencies to quickly address adaptation, or an extreme impact for 1 sub-national climate zone	**Extreme** Extreme impacts at the national scale (or even in a few sub-national climate zones) of heightened interest to national agencies to urgently address adaptation. May be of interest to international partners or financial or insurance institutions
		Temporary short-term loss or minor decline in quality and status of taonga species. Ability to detect minor evolving trends from climate-change influences over the background of other natural, climatic and human factors (low signal to noise ratio).	Sustained localised impacts on ecosystem services and water, air and soil quality. Sustained localised impacts on recreation, aesthetics, bio-chemistry or biodiversity attributable to climate change. Emergence of geographical shifts of species to maintain preferences for climate tolerance, eg, fisheries, mangroves, tuna? Ability to detect trends of stronger effects or decline or increase from climate-change influences over the background of other natural, climatic and human factors (moderate signal to noise ratio). Moderate cross-sector consequences from	Loss of significant natural areas or taonga species. Increasing decline or loss of climate-sensitive environments (eg, salt marsh, coastal lakes, sub-alpine ecosystems). Noticeable geographical shifts of species to maintain preferences for climate tolerance eg, fisheries, mangroves, tuna? Ability to detect trends of deleterious effects or decline or increase from climate-change influences over the background of other natural, climatic and human factors (high signal to noise ratio). Major cross-sector consequences from environmental change (eg, primary sector, tourism, ecosystem services, Māori businesses, governance).	marsh, coastal lakes, sub-alpine ecosystems). Strong geographical shifts of species to maintain preferences for climate tolerance eg, fisheries, mangroves, tuna? Obvious trends of major effects or decline or increase from climate-change influences over the background of other natural, climatic and human factors (high signal to noise ratio). Substantial cross-sector consequences from environmental change (eg, primary sector, tourism, ecosystem services, Māori businesses, governance).

Value domain	Consequence level (national scale aggregated from the seven sub-national climate zones)				
	Insignificant No significant change in impact nationally that can be handled through business as usual processes or some local or regional impacts with no specialised management required	**Minor** Some minor impacts at the national scale that could be addressed through local or regional management and adaptation processes	**Moderate** Significant impacts at the national scale of interest to national agencies to address adaptation, or a major impact for 1–2 sub-national climate zones	**Major** Major impacts at the national scale of high interest to national agencies to quickly address adaptation, or an extreme impact for 1 sub-national climate zone	**Extreme** Extreme impacts at the national scale (or even in a few sub-national climate zones) of heightened interest to national agencies to urgently address adaptation. May be of interest to international partners or financial or insurance institutions
			environmental change (eg, primary sector, tourism, ecosystem services, Māori businesses, governance).		
Economy	No impact; less than 1% of gross domestic product (GDP).	A small number of individuals are affected with minimal financial losses. Short-term business disruption and/or minimal impact on profitability. Short-term increases in local and central government costs. Short-term loss of output for a key economic sector. Limited disruption to employment. Total financial losses 1–2% of GDP. A small number of livestock lost with minimal financial losses.	Many individuals with significant financial losses. Medium-term business disruption and/or moderate impact on profitability. Medium term increase in local and central government costs, minimal loss of assets. Medium-term loss of output for a key economic sector. Temporary reduction in employment. Total financial losses 2–3% of GDP. Many stock losses with significant financial losses.	Significant number of people affected, with large financial losses. Long-term business disruption and/or significant impact on profitability. Long-term increases in local and central government costs, some loss of assets. Long-term loss of output for a key economic sector. Medium- to long-term reduction in employment. Total financial losses 3–4% of GDP. Significant number of livestock losses, with large financial losses.	Whole-of-community impacts with large financial losses. Permanent loss of business output and / or widespread business failure. Long-term costs for local/central government increases, and significant loss of assets. Closure of key economic sector(s). Widespread job losses. Total financial losses >4% of Gross Regional Product. Whole-of-livestock sector with large financial losses.

Value domain	Consequence level (national scale aggregated from the seven sub-national climate zones)				
	Insignificant No significant change in impact nationally that can be handled through business as usual processes or some local or regional impacts with no specialised management required	**Minor** Some minor impacts at the national scale that could be addressed through local or regional management and adaptation processes	**Moderate** Significant impacts at the national scale of interest to national agencies to address adaptation, or a major impact for 1–2 sub-national climate zones	**Major** Major impacts at the national scale of high interest to national agencies to quickly address adaptation, or an extreme impact for 1 sub-national climate zone	**Extreme** Extreme impacts at the national scale (or even in a few sub-national climate zones) of heightened interest to national agencies to urgently address adaptation. May be of interest to international partners or financial or insurance institutions
Built environment	Minor or insignificant infrastructure disruption at local level (business as usual). Negligible damage to residential dwellings, commercial, government, and non-commercial buildings. Negligible damage to Māori cultural assets, such as marae, urupā, wāhi tapu and wāhi taonga.	Isolated and short-term infrastructure service disruption. No permanent damage. Some minor restoration work required. Early renewal of infrastructure by 10–20%. Need for new or modified ancillary equipment. Between 1–50 residential homes require assessment, 1–10 commercial buildings require assessment, 1–10 government and non-commercial buildings require assessment. Planning for future relocation required. Damage to 11–25% of Māori cultural assets, such as marae, urupā, wāhi tapu and wāhi taonga.	Multiple short-term infrastructure service disruptions. Damage recoverable by maintenance and minor repair. Early renewal of infrastructure by 21–50%. Damage to 51–250 residential dwellings requires assessment. Most easily reparable, majority covered by insurance, but some specialised relief and financial assistance required. Some require immediate relocation. Between 11–100 commercial buildings require assessment, 11–100 government and non-commercial buildings require assessment. Some require temporary relocation	Widespread short-to-medium term infrastructure service disruptions. Extensive infrastructure damage requiring major repair. Major loss of infrastructure service. Early renewal of infrastructure by 51–90%. Damage to 251–1000 residential dwellings requires assessment. Widespread structural damage mostly reparable, but significant numbers need to be immediately relocated. Costs exceed insured value. Between 101–500 commercial buildings require assessment, 101–500 government and non-commercial buildings require	Widespread, long-term service disruption. Significant permanent damage and/or complete loss of the infrastructure and the infrastructure service. Loss of infrastructure support and translocation of service to other sites. Early renewal of infrastructure by more than 90%. More than 1000 residential dwellings require assessments for immediate relocation. More than 500 commercial buildings require assessment, more than 500 government and non-commercial buildings require assessment for permanent relocation options. Extensive structural damage in multiple regions and cities. Costs significantly exceed insured value.

Value domain	Consequence level (national scale aggregated from the seven sub-national climate zones)				
	Insignificant No significant change in impact nationally that can be handled through business as usual processes or some local or regional impacts with no specialised management required	**Minor** Some minor impacts at the national scale that could be addressed through local or regional management and adaptation processes	**Moderate** Significant impacts at the national scale of interest to national agencies to address adaptation, or a major impact for 1–2 sub-national climate zones	**Major** Major impacts at the national scale of high interest to national agencies to quickly address adaptation, or an extreme impact for 1 sub-national climate zone	**Extreme** Extreme impacts at the national scale (or even in a few sub-national climate zones) of heightened interest to national agencies to urgently address adaptation. May be of interest to international partners or financial or insurance institutions
			Damage to 26–50% of Māori cultural assets, such as marae, urupā, wāhi tapu and wāhi taonga.	assessment. Many need to be permanently relocated. Damage to 51–75% of Māori cultural assets, such as marae, urupā, wāhi tapu and wāhi taonga.	Damage to more than 75% of Māori cultural assets, such as marae, urupā, wāhi tapu and wāhi taonga.
Governance	No impact or some low-level inconsequential impacts. Business as usual disruption to non-essential local level governance.	Some minor impacts at the local level. Disruption to some local level governance and decision-making functions (eg, temporary limited access to local facilities). Some negative impacts on perceived reputation. Minimal effects to Te Tiriti o Waitangi rights.	Moderate localised impacts on decision-making functions. Limited access or damage to district facilities requiring temporary relocation, which has minor impacts on service delivery. Moderate impacts on perceived reputation that will require specialised management to restore. Some Te Tiriti o Waitangi rights are temporarily eroded or damaged.	Major multi-functional, multi-regional impacts on decision-making functions. Limited access or damage to regional facilities, requiring long-term or permanent relocation, which has moderate impacts on service delivery. Major impacts on perceived reputation that will require significant resources and time to mitigate. Major erosion or damage to Te Tiriti o Waitangi rights.	Limited access or damage to facilities, which has major impacts on service delivery at all levels of government. Significant disruption to the functioning of government at the national level. Significant impacts on perceived reputation that will result in permanent or near permanent damage. Te Tiriti o Waitangi rights are lost.

Upoko C3: Pūnga mō te kōwhiri matapaenga me te whakahāngai matapaenga ki ngā angawā

The rationale for recommending the two climate-change projections (RCP4.5 and RCP8.5) is as follows (adapted from Ministry for the Environment, 2017).

- Because of the uncertainty about future changes in climate, it is necessary to examine a range of climate projections that reflect future states. Using more than one scenario, rather than a single 'best' or 'worst' estimate, also avoids estimates of risks being invalidated as new information or projections becomes available.
- A range of projections enables the rate of increase in risk to be explored for different sectors and themes, to better determine the emergence of thresholds for critical impacts in a changing risk environment, and to examine non-linear responses.
- Projections selected for the NCCRA adopt the internationally accepted representative concentration pathways (RCPs) used by the IPCC in its global assessment reports.
- Although it is desirable to use a wide range of scenarios, especially for detailed risk assessments at the local and regional level to inform adaptation pathways, in practice, two projections should be manageable for the detailed risk assessment and one projection (RCP8.5) for the risk screening.
- Given the deep uncertainty around ongoing sea-level rise (eg, polar ice sheet tipping points) and the relative maturity of recent coastal risk assessments, a higher scenario could also be considered for the assessment of coastal climate-related hazards in Stage 2 where information and data are available. This higher scenario could use the upper H^+ sea-level rise scenario from the Coastal Hazards and Climate Change Guidance (Ministry for the Environment, 2017). This may highlight future risks for long-lived assets or infrastructure and new coastal developments.

At present, detailed projections are mostly available until 2100 only (eg, IPCC Fifth Assessment Reports (IPCC 2013; 2014b) and Ministry for the Environment (2018) projections). However, a longer view is necessary, given we are close to 2020. Until detailed projections are extended, initial risk assessments should apply extrapolation of projections based on the rate of change later this century for RCP4.5 and RCP8.5.

Projections for sea-level rise are already available out to 2150 for Aotearoa New Zealand in the Coastal Hazards and Climate Change Guidance (Ministry for the Environment, 2017). For coastal areas of known ongoing subsidence (eg, lower North Island, urban deltas, Hauraki Plains), it is also recommended to add an appropriate average trend for vertical land movement to determine the relative sea-level rise for each sub-national zone. Land movement rates can be sourced from the Coastal Hazards and Climate Change Guidance (Ministry for the Environment, 2017), or use updated trends currently being analysed in the NZSeaRise research programme (Richard Levy, Victoria University of Wellington and GNS Science, pers. comm).

Upoko C4: Puna pārongo mō ngā tāupenga me ngā pāpātanga huringa āhuarangi

Realistically, the first NCCRA can only assess **existing and available** data and knowledge on climate-change impacts. It will, in many cases, comprise mostly qualitative information on the components of risk (hazard, exposure and vulnerability). It is also recognised that, in developing the framework, the level of information about climate-related hazards will vary considerably across the value domains and sectors and is especially pertinent for cross-cutting or cascading impacts. Therefore, it is important to develop processes, where possible, that synthesise quantitative hazard or exposure information and data.This will ensure sufficient flexibility to handle both types of information (qualitative and quantitative) in a consistent manner. Use of mixed methods also deals more widely with uncertainty in future climate change by exploring possible impacts and implications through elicitation for various future narratives (projections and social–economic scenarios).

At present, some of the information on hazards may not be specifically tied to the RCP projections. General guidance is given in section B1.4 on how to align existing information, or findings from engagement processes and risk workshops, which is not specifically tied to relevant RCP projections, with the two projections (RCP4.5 and RCP8.5) recommended for the framework.

Potential hazards exist where the effect of climate change is not clearly prescribed, largely unknown or not available from New Zealand climate projections, for example, ocean nutrient-cycle and air quality changes. In these situations, action, such as a research gap or assigning a watching brief (chapter B4), can be determined if stakeholders in a value domain or sector recognise potential adverse vulnerabilities, for example, an activity or wellbeing that is sensitive to the specific hazard (or climate variable).

The assessor will need to assemble relevant information and datasets that are currently available or accessible (rather than develop new information or model simulations). Information and observations can be broadly accessed from the types of sources discussed below. This ensures wider coverage of potential impacts on Aotearoa New Zealand than what may necessarily be used in rigorous scientific assessments, such as IPCC assessment reports, provided they are credible or reputable sources (and cited in all cases, for transparency and legitimacy).

C4.1 Sources and databases

Potential sources of information and datasets (not exhaustive):

- published and reviewed reports, such as local and central government, Crown research institutes, sector groups, universities, National Science Challenges (eg, Deep South, Sustainable Seas, Our Land and Water), international (eg, Organisation for Economic Co-operation and Development)
- Ministry for the Environment Climate Projections (2018) developed by NIWA: www.mfe.govt.nz/publications/climate-change/climate-change-projections-new-zealand

- Ministry for the Environment Guidance for Local Government on Preparing for Climate Change (no date): www.mfe.govt.nz/climate-change/climate-change-guidance/guidance-local-government-preparing-climate-change
- climate change impacts or design tools, for example, High Intensity Rainfall Design System (HIRDS version 3): https://hirds.niwa.co.nz/ as summarised by Ministry for the Environment (2018)
- Urban Impacts Toolbox: www.niwa.co.nz/climate/urban-impacts-toolbox
- Climate Change Impacts and Implications reports: https://ccii.org.nz/
- Droughts and extreme winds under climate change (NIWA report for Ministry for Primary Industries): www.niwa.co.nz/climate/research-projects/risk-of-drought-and-extreme-winds-under-climate-change
- Ministry for the Environment State of the Environment assessment reports and Statistics New Zealand and Ministry for the Environment reported environment domain statistics,[8] for example, waves, coastal sea-level rise, mean temperature trend
- information provided by lifeline utilities and local councils under the reporting power of the Zero Carbon Bill
- Census (2013, 2018) for population data
- published journal papers focused on the New Zealand climate (but some international papers may be relevant or scalable)
- IPCC special reports and assessments. The Australasian chapter of IPCC Working Group II assessment reports have specific climate information relevant to New Zealand (IPCC, 2014b): www.ipcc.ch/report/ar5/wg2/
- structured elicitation processes, such as risk workshops (to be defined in the engagement plan for the risk assessment stages),[9] led by experts (researchers, Māori experts and practitioners) engaging with sector adaptation leaders, iwi and hapū organisation representatives and key stakeholders
- engaging with Māori advisory groups (national, pan-regional, iwi and hapū)
- iwi and hapū environmental management plans
- iwi and hapū climate change plans and strategies.

Different levels of information gathering on hazards and opportunities can also be used.

- Engage with relevant research institutions to source data and information on climate change hazards for RCP4.5 and RCP8.5 projections at the recommended timeframes, if not available in the Climate Change Projections for New Zealand (Ministry for the Environment, 2018) – usually derived from climate–ocean models.
- For present-day climate-related impacts – engage with regional, unitary and district councils through Local Government New Zealand, central government (eg, Ministry of Civil Defence and Emergency Management) and the Insurance Council of New Zealand. Also

---

[8] For the marine domain see New Zealand's Environmental Reporting Series Environmental Indicators: Marine: http://archive.stats.govt.nz/browse_for_stats/environment/environmental-reporting-series/environmental-indicators/Home/Marine.aspx (other domains are also accessible from this URL).

[9] For example, facilitated risk workshops at the inception of major infrastructure projects are often convened with multiple parties and disciplines to co-produce a risk assessment and rank the critical risks to the project.

consult the report for Treasury on the attribution of climate change to recent rainfall and drought events (Frame et al, 2018b).

- Literature reviews focused on present and future impacts for New Zealand – engage first with researchers who often have undertaken these reviews and sometimes published them, for example, Rouse et al (2017) for coastal adaptation.
- Structured elicitation processes with multiple parties and disciplines relevant for the value domain or sector, particularly for those hazards where definitive quantitative projections are not available.

Attention should be given to ensuring that, as new information sources are identified, the 'non-exhaustive list' above is updated.

C4.2 Climate change variables contributing to hazards

A 'long list' of climate-related variables used for a suggested suite of climate-related hazards and evolving stressors is shown in table C4-1, if amendments or additions are necessary to the hazards in table B1-2.

Table C4-1: Categories of climate change and associated effects (climate variables) considered in formulating hazards arising from climate change in table B1-2

Categories of climate change	Climate change variables (effects)
Rising temperatures	• Higher day and night temperatures • More heatwaves and warm spells • Fewer frosts or cold days • Changes in seasonality • Interannual variability (eg, ENSO) • Freshwater and estuaries: higher mean temperatures • Marine and coastal waters: higher mean temperatures • Marine and coastal waters: heatwaves
Rainfall and hail	• Higher or lower mean annual rainfall in sub-national climate zones • Changes in rainfall seasonality • Interannual variability (eg, ENSO) • Changes in extreme rainfall: high intensity and persistence • Floods (fluvial and pluvial) • Increase in hail severity or frequency • Rain-induced landslides • Changes in sedimentation from catchment runoff
Dryness and drought	• Increase in dry spells • Higher drought frequency and persistence • Fire weather (harsher, prolonged season) • Changes in seasonality • Interannual variability (eg, ENSO) • Low river flows and lake levels
Storminess and wind	• Changes in mean wind speed and direction • Changes in wind seasonality • Interannual variability (eg, ENSO) • Changes in extreme wind speed

Categories of climate change	Climate change variables (effects)
	• Increase in convective weather events (tornadoes, lightning) • Increase in storminess (frequency, intensity) including tropical cyclones
Snow and ice	• Receding snowline • Reduced snow and glacier cover • Earlier snow melt • Increase in avalanches
Coastal change: sea-level rise, waves, ocean circulation and carbon dioxide uptake	• Relative sea-level rise (including land movement) • Change in tidal range or increased water depth • Permanent increase in spring high-tide inundation • Permanent and episodic saline intrusion • Rising groundwater from sea-level rise • Changes in waves and swell • More frequent coastal flooding (storm-tide, waves) • Coastal and cliff erosion • Changes in sedimentation (estuaries and harbours)
Ocean changes	• Changes in ocean nutrient cycling – upwelling and carbon • Ocean acidification (pH decreasing) • Ocean circulation changes
Others	• Air quality changes • Carbon dioxide increase (plants) – but consider other countering effects • Humidity changes from changes in cloudiness • International climate-related influences, eg, immigration, markets

Note: This list should be checked for any other aspects to consider when determining the hazards in chapter B1. ENSO = 2–4 year El Niño–Southern Oscillation, but could include the longer 20–30 year Interdecadal Pacific Oscillation.

Upoko C5: Te whakamahi i te anga i ētahi korahi kē

The risk assessment methodology described in the framework is flexible to support regional and local or sectoral risk assessment. Assessments undertaken at different scales would involve different information requirements, as outlined in table C5-1.

Table C5-1: Levels of climate change risk assessment showing the information needed at different scales, from national to district and local assessments

Three scales of climate change risk assessment	Attributes	Links with
National and sub-national-scale climate change risk assessment	Informs government agencies, ministers, sector groups, pan-Māori, iwi and hapū organisations by providing a systematic examination of the additional risks from climate change on New Zealand	• National Adaptation Plan • Living Standards Framework • National Disaster Resilience Strategy • National policy statements • MBIE research strategies • Sector national plans • Conservation management plans • National infrastructure plans • National security risk management • Pan-Māori strategies
	Uses New Zealand-wide climate projections and exposure mapping, and assesses risks to domains and sectors	
	Aggregation of risks up to a national or sub-national level	
	Detail: focus on highest national-level risks (short and long term) to inform the National Adaptation Plan (mandatory under proposed Zero Carbon Bill)	
Regional and catchment scale climate change risk assessment	Informs regional and unitary councils, infrastructure and natural resource managers, district health officials, iwi, hapū and other stakeholders by providing a systematic examination of the additional risks of climate change on a region	• Long term plan (regional) – 10 year • Infrastructure strategy (regional) – 30 year • Regional plans (including coastal) • Regional policy statements • CDEM group plans; lifelines • Iwi and hapū management plans • Growth and development strategies
	Uses downscaled climate projections, regional hazard and exposure modelling, and vulnerability analysis to assess risks to regional domains or sectors and catchments	

Three scales of climate change risk assessment	Attributes	Links with
	Regional-level view, aggregation of risks up to a regional level and disaggregate down from the national scale	
	Detail: focus on regional risks to inform region-wide plans, catchment management and climate change strategies	
District and city scale climate change risk assessment	Informs district and city councils, infrastructure and natural resource managers, public health officials, iwi, hapū, whānau and other stakeholders by providing a systematic examination of the additional risks of climate change on districts and cities and local communities and marae	• District plans • Long-term plan (district) – 10 year • Infrastructure strategy (district) –30 year • Iwi and hapū management plans • Iwi and hapū climate change strategies • Housing (Building Act 2004 and Special Housing Areas) • Spatial and structure planning • Growth and development strategies
	Uses downscaled climate projections, district and city hazard and exposure modelling, and suburb or town vulnerability analysis to assess risks	
	District and local community view, risks resolved at a district and local level, eg, to communities, district plans, structure plans and services	
	Detail: focus on local or city-wide risks to inform adaptation plans for communities and assets and district and city climate change strategies	

Note: CDEM = Civil Defence Emergency Management; MBIE = Ministry for Business, Innovation and Employment.

Local governments are at the front line in dealing with the impacts of climate change. They have a role in ensuring that regional and local circumstances are adequately considered in the overall adaptation response.

They need to:

- manage risks, to and impacts on, public assets owned and managed by local government and local government-owned entities
- manage risks to and impacts on local government service delivery
- ensure local planning and development regulations are consistent with central government adaptation approaches
- facilitate building resilience and adaptive capacity in the local community (eg, providing information about relevant climate change risks)
- involve local communities directly in efforts to facilitate effective change.

How will this framework help risk management in local government or other agencies? Can iwi and hapū use the framework for place-based risk assessment?

- They can carry out a risk assessment using this framework, but apply local 'elements' to the value domains in chapter A3, to inform decisions on sectors to assess at Stage 1.
- It is anticipated all the steps mapped out in this framework can be followed at the local government, iwi and hapū levels. The content and considerations will be more localised, and it is likely greater quantitative detail will be available. As at the national level, lack of quantitative detail should not delay undertaking a localised risk assessment and developing an adaptation plan.
- At the national level, the direction of risk assessment, of necessity, needs to be targeted more at policy and fiscal settings. At the localised level, the risk assessment can be targeted towards more specific localised actions.
- As expressed in the framework, the process of expert elicitation and engagement are important components in undertaking a risk assessment.
- It is anticipated that risk assessments at the local level will contribute to national level risk assessment and vice versa, so that, over time, the iterations will present substantial benefits to all. Where cross-cutting risks are involved, learnings at the local level are expected to provide valuable information at the national level.

Local risk assessments should consider:

- priority geographical areas (eg, coastal regions, areas of social deprivation)
- priority sectors or departments
- the data currently available.

Kuputaka me ngā whakapotonga

Kuputaka

Kupu	Whakamārama
Urutaunga	Tētahi rautaki uruparenga e noho takatū ai, e ātetehia ai ngā papātanga e kore e taea (kāore rānei e taea ana) te karo i raro i ētahi horopaki rerekē o te huringa āhuarangi (IPCC, 2014b). Te tukanga o te nekeneke ki tētahi huringa āhuarangi me ōna kawenga tūturu, ki tētahi rānei e whakaponohia ana ka pā mai. I ngā pūnaha tangata, e kimi ana te urutaunga ki te whakamāmā ki te karo rānei i te mate, i te apo painga rānei i ngā ara whai painga. I ētahi pūnaha māori, tērā pea ka huawaeretia e te wawaonga tangata te nekeneke ki te huringa āhuarangi me ōna kawenga e whakaponohia ana ka pā mai (IPCC, 2014b). Kei tētahi o ngā karangatanga nei te urutaunga: • huringa iti – ētahi mahi ko te whāinga matua ko te tiaki tonu i te uho me te pono o tētahi pūnaha, tukanga rānei ki tētahi korahi kua tohua • huringa nui – ētahi mahi ka panoni i ngā āhuatanga tūturu o tētahi pūnaha e uruparetia ai te āhuarangi me ōna kawenga.
Pae urutaunga	Ngā āhuatanga, te pae, te whakatutukinga mahi, te taumata whakarato rānei ka ekea ina kore e tutuki ngā whāinga kua whakaaetia (arā, te matatū o te hauora, o te noho haumaru, o te ōhanga o te taiao rānei) e mate ai te āta whakatinana ara urutaunga kē e eke ai ki taua pae. Kia mōhio: i ōna wā ko te 'pae tē hokia' ka whakamahia, ina koa mō ngā taiao, engari ka whāiti kē mai tēnei whakaaro ki te huringa e kore e taea te hokia e kore rānei e taea te whakahoki mai anō.
Raukaha urutaunga	Ngā rauemi e wātea ana mō te urutau ki te huringa āhuarangi me te taurangi ki ētahi atu riakatanga ka pā rānei, me te āhei o tētahi pūnaha ki te whakamahi pai i ngā rauemi nei e whāia ai te urutaunga. (Brooks and Adger, 2005). He āhua rerekē anō i te 'rokohanga urutaunga', ko te kaha tūturu kē tēnei ki te kawe ake, ki te ātete i te huringa (i ōna wā ka kīia ko te 'urutaunga motuhake'). Ko te 'raukaha urutaunga' e arotahi kē ana ki ngā tauārai me ngā āhuatanga para huarahi (tae atu ki te rauemi) e taea ai te urutaunga te whakatinana. Ka taea e te hapori, te hapū, te iwi te whakaatu te rokohanga urutaunga engari tērā pea ka iti te raukaha urutaunga nā runga tonu I ngā āhuatanga e pā ana ki te kore e ōrite o te āhei atu ki te rauemi I Aotearoa nei. He tauārai nui tonu pea tēnei ki ngā rōpū o te hapori, o te hapū me te iwi e pai ake ai ngā putanga urutaunga ki ō rātou hapori.
Rawa	'Ngā hanga e uaratia ana' tērā ka noho puare, ka noho whakaraerae rānei ki tētahi pūmate ki tētahi tūraru rānei. Te hanga e uaratia ana taha kikokiko, taha taiao, taha ahurea, taha tahua, taha ōhanga ka whai uara e rokohanga, uara māori, uara taha wairua (tirohia te **Taonga**).

Kupu	Whakamārama
Huringa āhuarangi	E kōrero ana te huringa āhuaranga mō te huri o te āhua o te āhuarangi e taea ana te tautuhi (arā, mā te whakahaere whakamātautau tatauranga) i runga i ngā rerekētanga, ngā ia rānei i te toharite me te tāupenga o ōna āhuatanga, ēnei mea e rua rānei, ka mutu ka mau tonu mō tētahi wā roa, arā, mō te ngāhurutanga tau, mō te rau tau. Ka uru atu anō ki te huringa āhuarangi ngā tukanga āhuarangi māori ā-motu, ngā āinga āhuarangi rānei o waho, pērā i ngā tāupenga i te huringa o te rā, te hū o te maunga me ngā huringa kawenga tangata i te hanganga o te kōhauhau i te rerekē rānei o te whakamahi i te whenua (whakahounga mai i te IPCC, 2013, annex III).
Matapaenga āhuarangi	Ko te matapaenga āhuarangi ko te uruparenga ka whakaaturia e te pūnaha āhuarangi ki tētahi horopaki o ngā rukenga o āpōpō atu, te kukū rānei o te haurehu kati mahana me ngā rehu matūriki, ka ahu whānui mai i te tauira āhuarangi. He rerekē anō te matapaenga āhuarangi i te whakakitenga āhuarangi nā runga i te whakawhirinaki ki te horopaki rukenga-kukūtanga-āinga hihinga-āinga ka whakamahia, waihoki e takea mai ana i te kōrero e whakaponohia ana, hei tauira, te whanaketanga ki tua o te ōhangapori, o te hangarau te rerekē rānei o te whakamahinga i te whenua tērā pea ka ea (adapted from IPCC, 2013, annex III).
Hapori	Ko te hapori he wāhi matawhenua pea (hapori wāhi), he hapori whakaaro tahi (hapori mahi) he hapori rānei e tūhono ana e rite ana te tuakiri (pērā i te ahunga mahi).
Pūhuinga o te pūmate me te riakatanga	Te pūhui o te puta o ētahi pūmate me ētahi riakatanga maha (arā, te whakapipinga pūmate) ka tino kaha ake ki tua i te ekenga ki te pae urutaunga, hei tauira, mō te taha moana e hāhaka ana te takoto, te whāia atu o te pekanga tau e tohe tonu ai te ua (nui te wai ki te whenua, heke iho te kaha o te whenua ki te pupuri i te wai) e tētahi āwhā taha moana ka hē atu i te pikinga o te pae o te moana me te hē kē atu i te karawhiu anō o te ua, puta ana ko te papātanga o te pūhuinga waipuke.
Whakamanawatanga	Te ine i te kounga o te pono o tētahi kitenga, i runga i te momo, te rahi, te kounga me te auau o ngā taunakitanga (arā, te raraunga, te mārama ki te ara mahi, te ariā, te tauira, te pai o te whakatau) me te kaha o te whakaaetia.
Hua	Te putanga o tētahi āhuatanga tērā ka hua mai i te pūmate. Ka taea te whakapuaki ā-tau (arā, te waeine o te tukinga o te ngaronga rānei, te wā o te tauwhatinga, te uara ā-moni o te papātanga o te pānga rānei ki te taiao), tōna tataunga nei ā-karangatanga (arā, te tiketike, te mātāriki, te hāhaka o te papātanga) ā-kounga rānei (te whakaahuatanga o ngā papātanga). E kīia ana anō ko te putanga o tētahi āhuatanga ka kawe i ngā whāinga (ISO/IEC 27000:2014 (ISO, 2014) me te AS/ISO 31000:2009 (Standards New Zealand/Standards Australia, 2009).
Raukaha ātete	Te kaha o te tangata, o te whakahaere, o te pokapū, o te pūnaha, i runga i te whakamahi i te pūmanawa, te uaratanga, te whakapono, te rauemi me ngā kōwhiringa ki te whaiwhai haere, ki te whakahaere me te where i te āhuatanga kino, i te tūraru, i te maikiroa i roto i te wā poto, te wā mātāriki rānei. E taea ai ngā āhuatanga nei te ātete me noho mai te rauemi, te whakahaerenga papai, i te wā noa, i te wā hoki e pā mai ai te aituā me te āhutanga kōwaro. He tāpaenga kei te raukaha ātete e heke ai te tūraru aituā (Secretary-General United Nations, 2016).

Kupu	Whakamārama
Āinga	Tētahi mea ka panoni i tētahi pūnaha. Tērā pea ka wā poto te āinga engari ka roa tonu ōna kawenga. Ko ngā huringa o te pūnaha āhuarangi me ngā tukanga ōhangapori, tae atu ki te urutaunga me te whakamaurutanga, he āinga ēnei o te pūmate, o te noho puare me te noho whakaraerae. Nō reira ka ahu mai te āinga i te āhuarangi, kaua rānei i te āhuarangi.
Rukenga	Te waihanga me te ruke atu i tētahi hanga tērā pea he āinga hihinga tōna (arā, te kai me te tuku pūngao hihi) kei te kōhauhau (arā, te haurehu kati mahana, te rehu matūriki).
Noho puare	Te noho mai o te tangata, o te ara whai oranga, te momo, te pūnaha hauropi rānei, ngā mahi a te taiao, te ratonga, te rauemi me te pūnaha hanganga, te noho mai rānei o te rawa taha ōhanga, taha pāpori, taha ahurea rānei tērā pea ka pākia kinohia e te pūmate māori me te huringa āhuarangi. Te rahi, te mātotoru, te uara rānei o te tangata, o te rawa, te ratonga me ētahi atu mea e uaratia ana (taonga) e noho mai ana ki tētahi wāhi ka noho papa ki tētahi pūmate, ki ētahi pūmate rānei (arā, o roto i tētahi rohenga pūmate), tērā anō ka rongo i te ngaronga i te mate.
Auautanga	Te rahi, te auau rānei o te putanga o te pūmate, i roto i tētahi wā kua tohua.
Pūmate	Te pānga kikokiko mai o tētahi āhuatanga māori noa nā te tangata rānei i pā mai ai, te ia, te papātanga kikokiko rānei tērā e mate ai te tangata, e whara ai, ētahi atu papātanga rānei, tae atu ki te tūkinotanga, te ngaronga rānei o te rawa, o te pūnaha hanganga, o te ara whai oranga, te tāpaenga ratonga, me te rauemi taiao. Ko te tino tikanga o te pūmate ko te āhuatanga kikokiko ko te ia rānei ka pā mai i te āhuarangi me ōna papātanga kikokiko rānei (IPCC, 2014b). Tētahi āhuatanga kōwaro (haora ki te marama) ka kawea, ka kē atu rānei i te huringa āhuarangi, ka mutu tērā pea he pahekotanga o ētahi take huringa āhuarangi.
Papātanga	Te kawenga ki te pūnaha māori noa ki te pūnaha tangata, ki ngā mea e rua rānei. E tino whakamahia ana te kupu papātanga ki te kōrero mō ngā kawenga ki te pūnaha māori me te pūnaha tangata o te āhuarangi tino kino, o tētahi atu āhuatanga me te huringa āhuarangi. E kōrero whānui ana te papātanga mō ngā kawenga ki te tangata, ki te ara whai oranga, ki te hauora, ki te pūnaha hauropi, ki te ao ōhanga, ki te porihanga, ki te ahurea, te ratonga me te pūnaha hanganga nā runga i te pāhekoheko o te huringa āhuarangi o te āhuatanga āhuarangi mōrearea rānei ka pā mai i roto i tētahi angawā motuhake me te noho whakaraerae o tētahi pāpori, o tētahi pūnaha e noho puare ana ki ēnei. Kia mōhio: ka kīia anō te hua ka puta, te putanga he papātanga.
Rōpū Tari Kāwanatanga mō te Huringa Āhuarangi (IPPC)	He rōpū tāngata pūtaiao, he rōpū nō ngā tari kāwantanga kei raro i te maru o te United Nations.
Hīrangi	Mō Aotearoa, e tautuhia ana te hīrangi i runga i te maha o ngā rā piri tata e neke atu ai te pāmahana i te 25 waeine Celsius.

Kupu	Whakamārama
Kaitiaki	Te tangata, te hunga ka tiaki, ka rauhī, ka taurima i tētahi hanga Ka kīia te tukanga me ngā tikanga o te rauhī me te tiaki i te taiao ko te kaitiakitanga
Kaupapa Māori	He maha ngā whakamāramatanga mō tēnei me ngā horopaki e whakamahia ai. E hua ai te kore e mahue o tētahi ki waho, e tāpaea ana i konei ōna whakamārama whānui: • Te ara ka whāia e ngāi Māori, te take kōrero a ngāi Māori, ngā tikanga ka kawea ake e ngāi Māori, te whakahaere Māori, te kaupapa Māori, te mātāpono Māori, te ariā Māori – he whakaakoranga mātauranga e komokomo ana i ngā pūkenga, ngā waiaro me ngā uaratanga a te porihanga Māori.
Uaratanga me ngā mātāpono Māori	Ka takea mai te uaratanga Māori i te pūnaha whakapono tuku iho mō te tirohanga ki Te Ao Māori. Ka taea te tautuhi ko ngā āhuatanga e mātau ai, e wheako ai, e whakamāoritia ai e ngāi Māori tō rātou taiao. Koia nei kei te tūāpapa o ngā matatika me ngā mātāpono Māori.
Mātauranga Māori	He horopaki motuhake te Mātauranga Māori nā ngāi Māori, i takea mai i Aotearoa. He maha ōna rerenga, ōna whakamārama mō tā te Māori i whakapono ai, mō āna ariā mātauranga, mō ngā uaratanga me te mātauranga o nehe heke iho ki te ao hou. Ka taea te Mātauranga Māori te tautuhi ko te mātauranga, ko te mōhiotanga me te māramatanga ki ngā mea katoa o te ao tukupū ka kitea, tē kitea rānei.
Whakamaurutanga	Te wawaonga a te tangata ki te whakaheke i ngā puna ki te whakapiki rānei i ngā putunga haurehu kati mahana (IPCC, 2014a, annex II).
Ōhanga	Te toitūtanga, te ōhanga
Te ara whiu haurehu kati mahana kukū (RCP)	He tohu kohinga horopaki ki tua o te tāpiringa āinga hihinga i te mata o te Nuku tae noa ki te 2100 (ki te Watts mō ia mitarau pūrua), koia nei te tapeke panonitanga i te tauritenga i waenga i te hihinga kōmaru e ahu mai ana me te pūngao e ahu atu ana ka rere anō ki te kōhauhau. Ka taea te kī ake he ara whiu haurehu kati mahana kukū tēnā me tēnā RCP (ehara i te rukenga) i kawea ake e te IPCC mō tana Pūrongo Arotakenga Tuarima (AR5) i te 2014 (IPCC, 2014b). Tirohia hoki te āpitihanga C.2 i te *Coastal Hazards and Climate Change: Guidance for Local Government* (Ministry for the Environment, 2017).
Mahuetanga tūraru	Te tūraru ka mahue iho (tērā anō ka piki haere tonu) kāore e whakahaeretia ana, i muri o te whakatinanatanga o ngā mahi whakahaere tūraru me ngā kaupapa here urutaunga e urutau ai ki te huringa āhuarangi me ngā pūmate e auau ana te puta ake, ka mutu me turuki tonu ngā uruparenga whawhati tata me ngā āpitihanga raukaha urutau me tirotiro rānei ngā tepe ki te urutaunga. Me āta whakaōrite e ngā wawaonga kaupapa here me ngā mahere urutaunga ngā huringa tūraru ka mahue iho ki te tirohanga (hurihuri) a te pāpori o te tūraru ka manawanuitia. (Whakahounga mai i te SFDRR, 2015 and Adger et al, 2018).
Manawaroa	Te raukaha o ngā pūnaha taha pāpori, taha ōhanga, taha taiao ki te ātete i te āhuatanga mōrearea, i te ia, i te ueuenga i runga i te urupare, te whakariterite anō e mau tonu ai tāna mahi tūturu, tōna tuakiritanga me tōna hanga, me te mau tonu anō o te raukaha mō te urutaunga, te akoako me te huringa kē (IPCC, 2014a).

Kupu	Whakamārama
Tūraru	Te hua tērā ka puta e pākia ai tētahi mea e uaratia ana me te kore e mōhiotia o te putanga, e arohia atu ai te rerenga whānui o ngā hanga e uaratia ana. He rite tonu te tohua o te tūraru ko te tūponotanga pā o tētahi āhuatanga pūmate o tētahi ia rānei me te whakarea i ēnei ki ngā papātanga ki te puta ake ēnei āhuatanga, ēnei ia. Ka hua mai te tūraru i te pāhekoheko o te noho whakaraerae, o te noho puare me te pūmate. E whāia ai ngā papātanga hurihuri o te huringa āhuarangi, ka pai ake te tautuhi i te tūraru ko te rerenga ngātahi i waenga i te pūmate, i te noho puare me te noho whakaraerae (IPCC, 2014a, WGII). Ka hangaia e te huringa āhuarangi te tūraru inaki i ngā pūnaha kikokiko, i te pūnaha hauropi, me te pāpori, me te rite tonu o te tūhonohono o ēnei e pā mai ai ngā āhuatanga i ōna wā e kore ai e unuhia, e paingia te neke atu i te pae e whakaaetia ana, e paingia ana i ētahi korahi maha (Adger et al, 2018).
Arotakenga tūraru	Te tukanga whānui o te ine i te kounga, te ine i te rahi, ngā mea e rua rānei, o te tautuhi tūraru, o te tātaringa me te aromātaitanga tūraru, me te maha o ngā wāhi hou atu mō te whakapāpā, te torotoro, te aroturuki me te arotake (AS/NZS ISO 31000:2009: Risk Management (Standards New Zealand/Standards Australia, 2009).
Riakatanga (āhuarangi)	Te tohe tonu o tētahi āhuatanga āhuarangi (arā, te rerekē o te āhua o te heke o te ua i te pekanga tau) te taupānga rānei o te rerekētanga, te ia rānei o ngā tāupenga āhuarangi, pērā i te toharite, te kaha, te rerenga rānei (arā, te piki tonu o te toharite o te pāmahana o te moana, te waikawa rānei) ka pā mai i roto i te wā (arā, i ētahi tau, e ētahi ngahurutanga tau, i ētahi rautau), me te hira o ngā kawenga ki te pūnaha e noho puare ana, e piki ake ai te noho whakaraerae ki te huringa āhuarangi.
Pūnaha	Tētahi huinga hanga e mahi ngātahi ana hei wāhanga o tētahi whatunga tūhonohono o tētahi hanga matatini, ngā mea e rua rānei.
Taonga Māori	Te hanga e rokohanga, tē rokohanga rānei e noho kahurangi ana, e noho kura ana i te ahurea Māori. E whai ake nei te āhua o te titiro ki te taonga Māori: • **māori** (te taiao – te taiao māori pērā i te whenua, te ngahere, te awa, te maunga me te moana • **tangata** (te whānau, te hapū, te iwi), te taha wairua (te mauri e mauri ora ai tētahi mea) • **pāpori** (te Mātauranga Māori, te heke iho o te mātauranga i ngā reanga) • **tahua** (te uara taha tahua o te rawa tae atu ki ngā pānga whenua) • **rawa hanganga** (ngā momo whare tae atu ki te marae, ngā haumitanga ōhanga me te kāinga tūmataiti).
Te Ao Maori	Te ao o ngāi Māori
Tino rangatiratanga	Te mana ariki, te mana rangatira, te mana motuhake

Kupu	Whakamārama
Warawara	Te kore e noho mai o ngā mātauranga katoa ka hua mai i te korekore o te pārongo, i te taupatupatu rānei ki ngā mea e mōhiotia ana, e taea ana rānei te mōhiotia. Tērā pea ka maha ngā momo puna, mai i te raraunga kāore i tino tika, i tino pono, ki te ariā, te kupu kōrero e rangirua ana te tautuhia, e warawara ana rānei ngā matapaenga whanonga tangata.
Noho whakaraerae	Te noho raraka kia kawea kinohia. Ka rarawhi te noho whakaraerae I ētahi ariā me ētahi huānga maha tonu, tae atu ki te tere rongo, te noho tuwhera rānei ki te mate ki te tūkinotanga, me te korekore o te raukaha ki te ātete atu me te urutau (raukaha urutaunga) (IPCC, 2014a). He whānui ake te arotake i te noho whakaraerae tēnā i te arotakenga tūraru noa mā te whakauru atu i ngā putanga autaki me ngā putanga tē rokohanga ki ngā manapou e whā o te Anga Paerewa Mataora me te whakaaroaro ki te rokohanga urutaunga me te raukaha urutaunga (arā, tērā pea ka noho rauhanga, ka hiahia urutau te hapori, te whānau me te iwi, engari tērā e korekore ai te rauemi, te āheinga inihua, te mana me te raukaha ki te urutau).

Abbreviations

BRANZ	Building Research Association New Zealand
CAA	Civil Aviation Authority
CCATWG	Climate Change Adaptation Technical Working Group
CLUES	Catchment Land Use for Environmental Sustainability model
CO_2	Carbon dioxide
DHB	District health board
DOC	Department of Conservation
DIA	Department of Internal Affairs
DPMC	Department of the Prime Minister and Cabinet
EECA	Energy Efficiency and Conservation Authority
ENSO	El Niño–Southern Oscillation
EPA	Environmental Protection Authority
FOMA	Federation of Māori Authorities
GCP	Global Carbon Project
GIC	Gas Industry Company
Gt	Gigatonne
HIRDS	High Intensity Rainfall Design System
IAP2	International Association of Public Participation
IASA	International Institute for Applied Systems Analysis
IPCC	Intergovernmental Panel on Climate Change
LGNZ	Local Government New Zealand
LiDAR	Light Detection and Ranging
LINZ	Land Information New Zealand
LSF	Living Standards Framework
MBIE	Ministry of Business, Innovation and Employment
MCDEM	Ministry of Civil Defence and Emergency Management
MCH	Ministry for Culture and Heritage
MFAT	Ministry of Foreign Affairs and Trade
MfE	Ministry for the Environment
MHUD	Ministry of Housing and Urban Development

MOD	Ministry of Defence
MOE	Ministry of Education
MOH	Ministry of Health
MOJ	Ministry of Justice
MOT	Ministry of Transport
MPI	Ministry for Primary Industries
MPP	Ministry for Pacific Peoples
MSD	Ministry of Social Development
NCCRA	National Climate Change Risk Assessment
NDRS	National Disaster Resilience Strategy
NIWA	National Institute of Water and Atmospheric Research
NSS	New Southern Sky
NZDF	New Zealand Defence Force
PCE	Parliamentary Commissioner for the Environment
PHO	Primary health organisation
RCPs	Representative concentration pathways
SHA	Special Housing Area
SOLGM	Society of Local Government Managers
SRES	Special Report on Emission Scenarios
SSP	Shared socio-economic pathways
TEC	Tertiary Education Commission
TPK	Te Puni Kōkiri
W/m^2	Watts per square metre

Ngā Tohutoro – References

Adger WN, Brown I, Surminski S. 2018. Advances in risk assessment for climate change adaptation policy. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 376(2121). https://doi.org/10.1098/rsta.2018.0106

Barlow C, Wineti E. 1991. *Tikanga Whakaaro: Key Concepts in Māori Culture.* Oxford University Press.

Bell RG, Paulik R, Wadhwa S. 2016. Coastal hazard and climate-change risk exposure in New Zealand: Comparing regions and urban areas. In: *Proceedings of International Federation of Surveyors (FIG) Working Week 2016,* Recovery from Disaster, Christchurch, New Zealand, 2–6 May. Retrieved from www.fig.net/resources/proceedings/fig_proceedings/fig2016/papers/ts02i/TS02I_bell_paulik_et_al_8102.pdf (19 July 2019).

Bell RG. 2018a. *Impacts of Severe-Weather: Chasing Resilience for NZ*. Presentation on behalf of NIWA's Climate, Atmosphere and Hazards Centre. Retrieved from www.parliament.nz/en/pb/sc/submissions-and-advice/document/52SCED_EVI_77773_1767/niwa-supp-1 (19 July 2019).

Bell RG. 2018b. Impacts of Severe Weather: Chasing Resilience for NZ – Submission to the Economic Development, Science and Innovation Select Committee, Parliament. Hamilton: NIWA. Retrieved from www.parliament.nz/en/pb/sc/submissions-and-advice/document/52SCED_EVI_77773_1765/niwa (19 July 2019).

Bell RG, Bell R, Wadwha, S. 2015. *National and Regional Risk Exposure in Low-Lying Coastal Areas: Areal Extent, Population, Buildings and Infrastructure.* Prepared for the Parliamentary Commissioner for the Environment by the National Institute of Water and Atmospheric Research Ltd. Retrieved from www.pce.parliament.nz/media/1384/national-and-regional-risk-exposure-in-low-lying-coastal-areas-niwa-2015.pdf (19 July 2019).

Brooks N, Adger, WN. 2005. Assessing and enhancing adaptive capacity. In: I Burton, B Lim (eds) Adaptation Policy Frameworks for Climate Change: Developing Strategies, Policies and Measures, United Nations Development Programme. Cambridge: Cambridge University Press.

Buck PH. 1950. *The Coming of the Māori*. Wellington: Māori Purposes Fund Board.

Cinner JE, Adger, WN, Allison EH, Barnes ML, Brown K, Cohen PJ, Gelcich S, Hicks CC, Hughes TP, Lau J, Marshall NA, Morrison TH. 2018. Building adaptive capacity to climate change in tropical coastal communities. *Nature Climate Change* 8(2): 117–123.

Climate Change Adaptation Technical Working Group. 2017. *Adapting to Climate Change in New Zealand: Stocktake Report from the Climate Change Adaptation Technical Working Group.* Wellington: Climate Change Adaptation Technical Working Group. Retrieved from www.mfe.govt.nz/sites/default/files/media/Climate%20Change/adapting-to-climate-change-stocktake-tag-report.pdf (19 July 2019).

CoastAdapt. 2016. *Guidance on Undertaking a First-Pass Risk Screening.* Gold Coast: National Climate Change Adaptation Research Facility. Retrieved from https://coastadapt.com.au/sites/default/files/factsheets/T3M4_1_1st_pass_risk_assessment_0.pdf (19 July 2019).

Committee on Climate Change. 2017. *UK Climate Change Risk Assessment 2017: Synthesis Report: Priorities for the Next Five Years.* London: Committee on Climate Change. Retrieved from www.theccc.org.uk/wp-content/uploads/2016/07/UK-CCRA-2017-Synthesis-Report-Committee-on-Climate-Change.pdf (19 July 2019).

Department of Conservation. 2010. *New Zealand Coastal Policy Statement 2010*. Wellington, Department of Conservation.

Dymond J, Basher, l. 2019. SedNetNZ: A new model to predict land management effects on erosion and sediment yield. *Soil Horizons Newsletter* 21(September). Retrieved from www.landcareresearch.co.nz/publications/newsletters/soil/issue-21/sednetnz (19 July 2019).

Environmental Protection Authority. No date. *He Whetū Mārama.* Poster. Wellington: Environmental Protection Authority. Retrieved from www.epa.govt.nz/assets/Uploads/Documents/Te-Hautu/EPA-He-Whetu-Marama-English-poster.pdf (19 July 2019).

Frame B, Lawrence, J, Ausseil A-G, Reisinger A, Daigneault A. 2018a. Adapting global shared socio-economic pathways for national and local scenarios. *Climate Risk Management* 21: 39–51.

Frame D, Rosier S, Carey-Smith T, Harrington L, Dean S, Noy I. 2018b. *Estimating Financial Costs of Climate Change in New Zealand: An Estimate of Climate Change-Related Weather Event Costs.* Wellington: The Treasury / Te Tai Ōhanga. Retrieved from https://treasury.govt.nz/publications/commissioned-report/estimating-financial-costs-climate-change-nz (19 July 2019).

Gardner J, Dowd A-M, Mason C, Ashworth P. 2009. *A Framework for Stakeholder Engagement on Climate Adaptation*. Climate Adaptation Flagship working paper no 3. Canberra: CSIRO (Commonwealth Scientific and Industrial Research Organisation). Retrieved from www.csiro.au/resources/CAF-working-papers.html (19 July 2019).

Harmsworth GR, Awatere S, Procter J. 2014. Meeting water quality and quantity standards to sustain cultural values. In: *21st Century Watershed Technology Conference and Workshop Improving Water Quality and the Environment Conference Proceedings*, 3–6 November 2014, American Society of Agricultural and Biological Engineers, University of Waikato. 10.13140/2.1.3507.8086.

IPCC. 2001. Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Houghton JT, Ding Y, Griggs DJ, Noguer M, van der Linden PJ, Dai X, Maskell K, Johnson CA (eds). Cambridge, UK: Cambridge University Press. Retrieved from www.ipcc.ch/report/ar3/wg1/ (19 July 2019).

IPCC. 2012. Glossary of terms. In Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation: A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change (IPCC). CB Field, V Barros, TF Stocker, D Qin, DJ Dokken, KL Ebi, MD Mastrandrea, KJ Mach, G-K Plattner, SK Allen, M Tignor and PM Midgley (eds). Cambridge, UK, and New York, NY, USA: Cambridge University Press. pp 555–564.

IPCC. 2013. Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Stocker TF, Qin D, Plattner G-K, Tignor M, Allen SK, Boschung J, Nauels A, Xia Y, Bex V, Midgley PM (eds). Cambridge, UK: Cambridge University Press. Retrieved from www.ipcc.ch/report/ar5/wg1/ (19 July 2019).

IPCC. 2014a. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Pachauri RK, Meyer LA (eds). Geneva: Intergovernmental Panel on Climate Change.

IPCC. Oppenheimer M, Campos M, Warren R, Birkmann J, Luber G, O'Neill B, Takahashi K. 2014b. Emergent risks and key vulnerabilities. In *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* CB Field, VR Barros, DJ Dokken, KJ Mach, MD Mastrandrea, TE Bilir, M Chatterjee, KL Ebi, YO Estrada, RC Genova, B Girma, ES Kissel, AN Levy, S MacCracken, PR Mastrandrea, LL White (eds). Cambridge, UK: Cambridge University Press. Chapter 19, pp 1,039–1,099. Retrieved from www.ipcc.ch/report/ar5/wg2/ (19 July 2019).

ISO. 2014. ISO/IEC 27000:2014: Information Technology – Security Techniques – Information Security Management Systems – Overview and Vocabulary. Geneva: International Organization for Standardisation.

Kidson JW, Renwick JA. 2002. Patterns of convection in the tropical Pacific and their influence on New Zealand weather. *International Journal of Climatology* 22: 151–174.

Kilvington M, Saunders WSA. 2015. *"I can live with this". The Bay of Plenty Regional Council Public Engagement on Acceptable Risk.* GNS Science Miscellaneous Series 86. Wellington: GNS Science.

Land Information New Zealand. 2019. *LINZ Data Service: NZ Building Outlines.* Retrieved from https://data.linz.govt.nz/layer/101290-nz-building-outlines/ (19 July 2019).

LGNZ. 2019. *Vulnerable: The Quantum of Local Government Infrastructure Exposed to Sea Level Rise.* Wellington: LGNZ. Retrieved from www.lgnz.co.nz/our-work/publications/vulnerable-the-quantum-of-local-government-infrastructure-exposed-to-sea-level-rise (19 July 2019).

LRIS Portal. 2019. *LCDB v4.1: Land Cover Database, version 4.1, Mainland New Zealand.* Retrieved from https://lris.scinfo.org.nz/layer/48423-lcdb-v41-land-cover-database-version-41-mainland-new-zealand/ (23 June 2019).

Mead HM. 2016. *Tikanga Māori: Living by Māori Values.* Revised edition. Wellington: Huia Publishers.

Ministry for Primary Industries. 2019. *Sustainable Land Management and Climate Change Research Programme*. Retrieved from www.mpi.govt.nz/funding-and-programmes/farming/sustainable-land-management-and-climate-change-research-programme/ (19 July 2019).

Ministry for the Environment. 2018. Climate Change Projections for New Zealand: Atmospheric Projections Based on Simulations Undertaken for the IPCC 5th Assessment. 2nd edition. Wellington: Ministry for the Environment. Retrieved from www.mfe.govt.nz/sites/default/files/media/Climate%20Change/Climate-change-projections-2nd-edition-final.pdf (19 July 2019).

Ministry for the Environment. 2017. *Coastal Hazards and Climate Change: Guidance for Local Government.* Wellington: Ministry for the Environment. Retrieved from www.mfe.govt.nz/publications/climate-change/coastal-hazards-and-climate-change-guidance-local-government (19 July 2019).

Ministry for the Environment. No date. *Guidance for Local Government on Preparing for Climate Change.* Retrieved from www.mfe.govt.nz/climate-change/climate-change-guidance/guidance-local-government-preparing-climate-change (19 July 2019).

Ministry for the Environment, Statistics New Zealand. No date. *New Zealand's Environmental Reporting Series Environmental Indicators: Marine.* Retrieved from http://archive.stats.govt.nz/browse_for_stats/environment/environmental-reporting-series/environmental-indicators/Home/Marine.aspx (19 July 2019).

Ministry of Civil Defence and Emergency Management. 2019. *National Disaster Resilience Strategy: Rautaki ā-Motu Manawaroa Aituā.* Wellington: Ministry of Civil Defence and Emergency Management. Retrieved from www.civildefence.govt.nz/assets/Uploads/publications/National-Disaster-Resilience-Strategy/National-Disaster-Resilience-Strategy-10-April-2019.pdf (19 July 2019).

New Zealand Government. 2019. *Climate Change Response (Zero Carbon) Amendment Bill* 136-1. Retrieved from www.legislation.govt.nz/bill/government/2019/0136/latest/d6806171e2.html?search=sw_096be8ed81873608_adaptation_25_se&p=1&sr=0 (19 July 2019).

NIWA. 2019a. *CLUES: Catchment Land Use for Environmental Sustainability Model.* Retrieved from www.niwa.co.nz/freshwater-and-estuaries/our-services/catchment-modelling/clues-catchment-land-use-for-environmental-sustainability-model (19 July 2019).

NIWA. 2019b. *Seasonal Climate Outlook June–August 2019*. Retrieved from www.niwa.co.nz/climate/seasonal-climate-outlook/seasonal-climate-outlook-june-august-2019 (19 July 2019).

NIWA. 2016. *Risk of Droughts and Extreme Winds under Climate Change*. Retrieved from www.niwa.co.nz/climate/research-projects/risk-of-drought-and-extreme-winds-under-climate-change (30 July 2019).

O'Connell E, Greenaway T, Moeke T, McKeeking S. 2018. He Ara Waiora: A Pathway Towards Wellbeing – Exploring Te Ao Māori Perspectives on the Living Standards Framework for the Tax Working Group. New Zealand Treasury Discussion Paper 18/11. Wellington: Treasury. Retrieved from https://treasury.govt.nz/sites/default/files/2018-09/dp18-11.pdf (19 July 2019).

Office for Māori Crown Relations / Te Arawhti. 2018. *Guidelines for Engagement with Māori.* Wellington: Office for Māori Crown Relations / Te Arawhti. Retrieved from https://tearawhiti.govt.nz/assets/Maori-Crown-Relations-Roopu/6b46d994f8/Engagement-Guidelines-1-Oct-18.pdf (19 July 2019).

Parliamentary Commissioner for the Environment. 2015. *Preparing New Zealand for Rising Seas: Certainty and Uncertainty.* Wellington: Parliamentary Commissioner for the Environment. Retrieved from www.pce.parliament.nz/publications/preparing-new-zealand-for-rising-seas-certainty-and-uncertainty (19 July 2019).

Paulik R, Stephens SA, Wadhwa S, Bell RG, Popovich B, Robinson B. 2019. *Coastal Flooding Exposure under Future Sea-Level Rise for New Zealand.* NIWA Client Report 2019119WN prepared for the Deep South Science Challenge.

Reisinger, A, Kitching RL, Chiew F, Hughes L, Newton PCD, Schuster SS, Tait A, Whetton P. 2014. Australasia. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. VR Barros, CB Field, DJ Dokken, MD Mastrandrea, KJ Mach, TE Bilir, M Chatterjee, KL Ebi, YO Estrada, RC Genova, B Girma, ES Kissel, AN Levy, S MacCracken, PR Mastrandrea, LL White (eds). Chapter 25, pp 1371–1438. Cambridge, UK: Cambridge University Press. Retrieved from www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-Chap25_FINAL.pdf (19 July 2019).

Roberts L, Brower A, Kerr G, Lambert S, McWilliam W, Moore K, Quinn J, Simmons D, Thrush S, Townsend M, Blaschke P, Costanza R, Cullen R, Hughey K, Wratten S. 2015. *The Nature of Wellbeing: How Nature's Ecosystem Services Contribute to the Wellbeing of New Zealand and New Zealanders.* Wellington: Department of Conservation. Retrieved from www.doc.govt.nz/Documents/science-and-technical/sap258entire.pdf (19 July 2019).

Rouse HLB, Lundquist C, Blackett P, Hicks MD, King D-N. 2017. Coastal adaptation to climate change in Aotearoa–New Zealand. Review article. *New Zealand Journal of Marine & Freshwater Research* 51(2): 183–222.

Salinger MJ, Fitzharris BB, Chinn T. 2019. Atmospheric circulation and ice volume changes for the small and medium glaciers of NZ's Southern Alps mountain range 1977–2018. *International Journal of Climatology*. 10.1002/joc.6072.

Secretary-General United Nations. 2016. Report of the Open-Ended Intergovernmental Expert Working Group on Indicators and Terminology Relating to Disaster Risk Reduction. Seventy-first session, agenda item 19(c), 1 December. Retrieved from www.unisdr.org/we/inform/publications/51748 (19 July 2019).

SFDRR. 2015. *Sendai Framework for Disaster Risk Reduction 2015–2030.* UN Office for Disaster Risk Reduction. Retrieved from www.unisdr.org/we/inform/publications/43291 (8 August 2019).

Standards Australia/Standards New Zealand. 2010. *HB327:2010: Communicating and Consulting about Risk.* Sydney: Standards Australia.

Standards New Zealand, Standards Australia. 2009. *AS/NZS ISO 31000:2009: Risk Management – Principles and guidelines*. Sydney and Wellington: Standards Australia and Standards New Zealand.

Tait A. 2019. *Risk-Exposure Assessment of Department of Conservation (DOC) Coastal Locations to Flooding from the Sea.* Science for Conservation report 332. Wellington: Department of Conservation. Retrieved from www.doc.govt.nz/globalassets/documents/science-and-technical/sfc332entire.pdf (19 July 2019).

Tait A, Rutledge DT, Frame B, Frame D, Lawrence J, McBride G, Overton J, Reisinger A. 2016. Climate Changes, Impacts and Implications for New Zealand to 2100: Synthesis Report – Overall CCII Project. MBIE contract C01X1225. Retrieved from https://ccii.org.nz/app/uploads/2017/07/Overall-CCII-Project-synthesis-report1.pdf (19 July 2019).

The Treasury. 2015. *The Thirty Year New Zealand Infrastructure Plan 2015.* Wellington: The Treasury. https://treasury.govt.nz/sites/default/files/2018-03/nip-aug15.pdf (19 July 2019).

The Treasury. 2018. *Our Living Standards Framework.* Retrieved from https://treasury.govt.nz/information-and-services/nz-economy/living-standards/our-living-standards-framework (19 July 2019).

UNFCCC. 2015. *Adoption of the Paris Agreement. COP21.* Paris: United Nations Framework Convention on Climate Change. Retrieved from https://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf (19 July 2019).

Waikato Regional Council. 2017. *Māori Engagement Framework He Ritenga Mahitahi: A Guidance for Waikato Regional Council Staff*. Hamilton: Waikato Regional Council.

Warren R, Wilby R, Brown K, Watkiss P, Betts R, Murphy J, Lowe J. 2018. Advancing national climate change risk assessment to deliver national adaptation plans. *Philosophical Transactions of Royal Society A: Mathematical, Physical and Engineering Sciences* 376(2121). http://doi.org/10.1098/rsta.2017.0295.