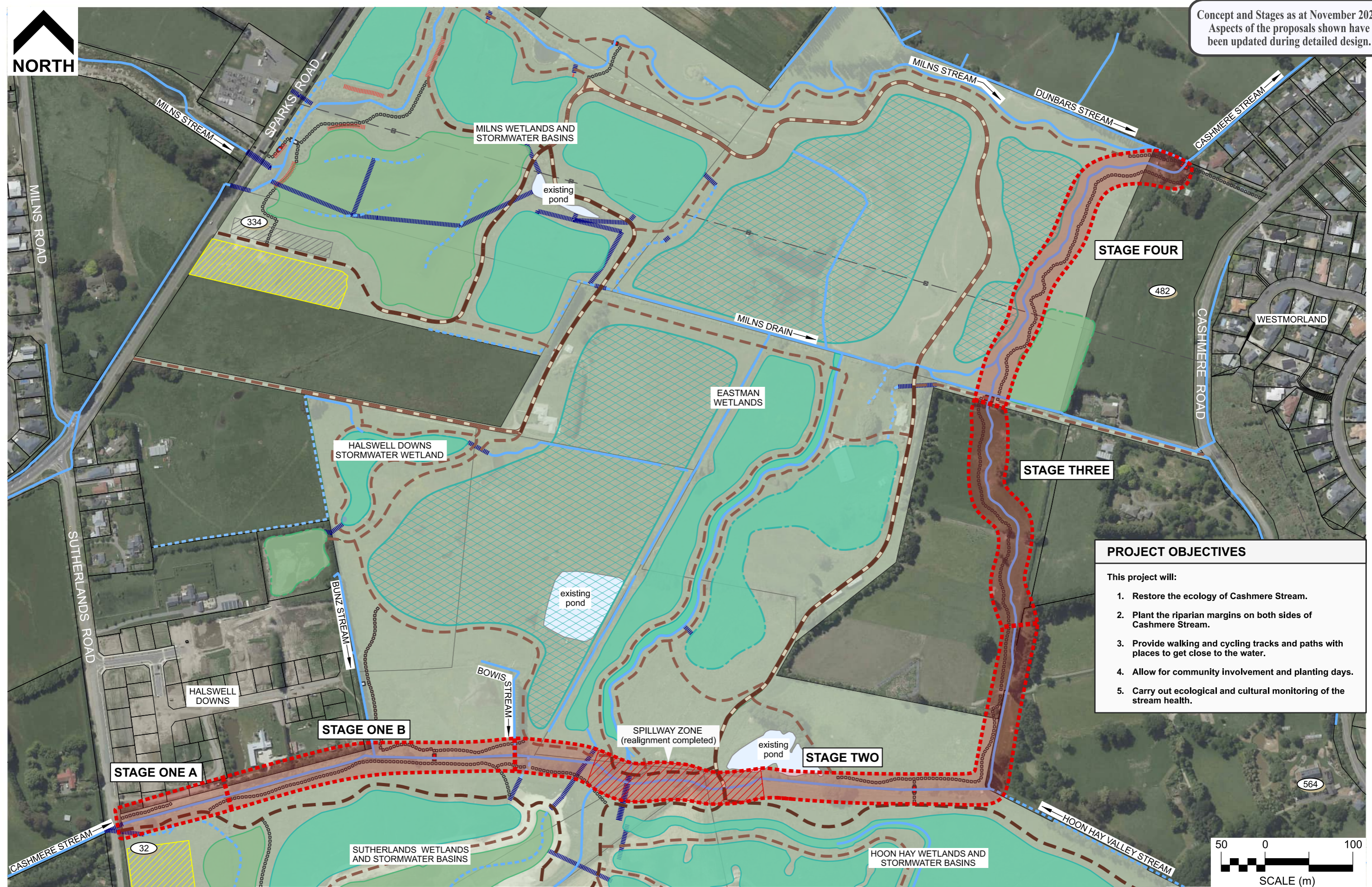


Concept and Stages as at November 2021.
Aspects of the proposals shown have been updated during detailed design.



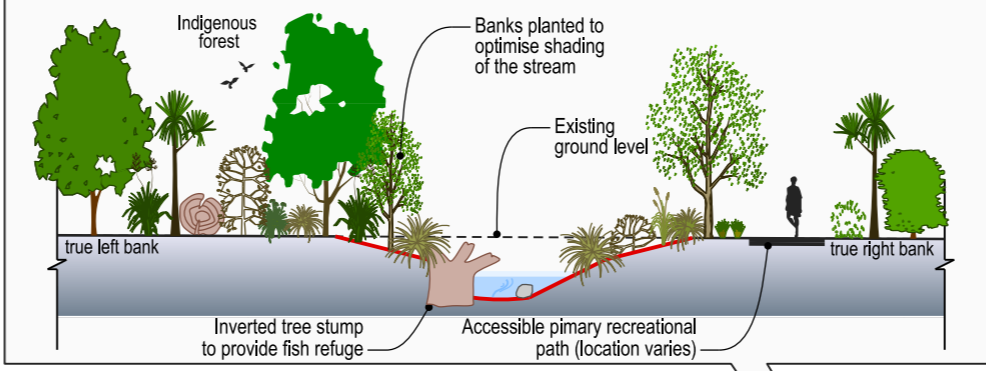
- PROJECT OBJECTIVES**
- This project will:
1. Restore the ecology of Cashmere Stream.
 2. Plant the riparian margins on both sides of Cashmere Stream.
 3. Provide walking and cycling tracks and paths with places to get close to the water.
 4. Allow for community involvement and planting days.
 5. Carry out ecological and cultural monitoring of the stream health.

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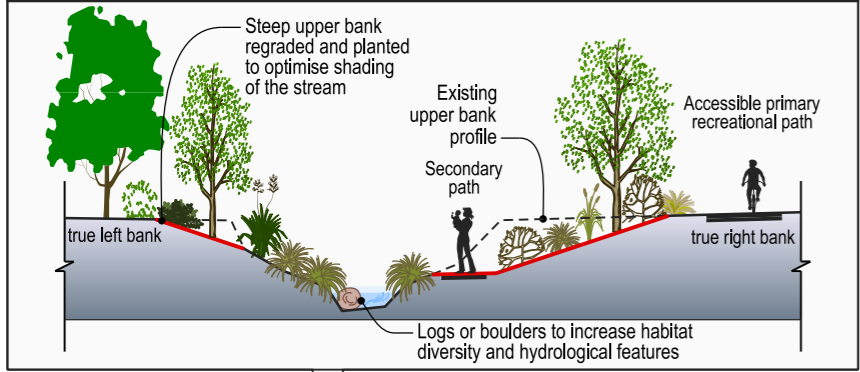
STAGE 3 and 4 PROPOSALS:

- realign and enhance channel
- provide diverse instream habitat with natural hydrological features
- increase riparian buffer and terrestrial habitats
- provide recreational paths with views and access to water



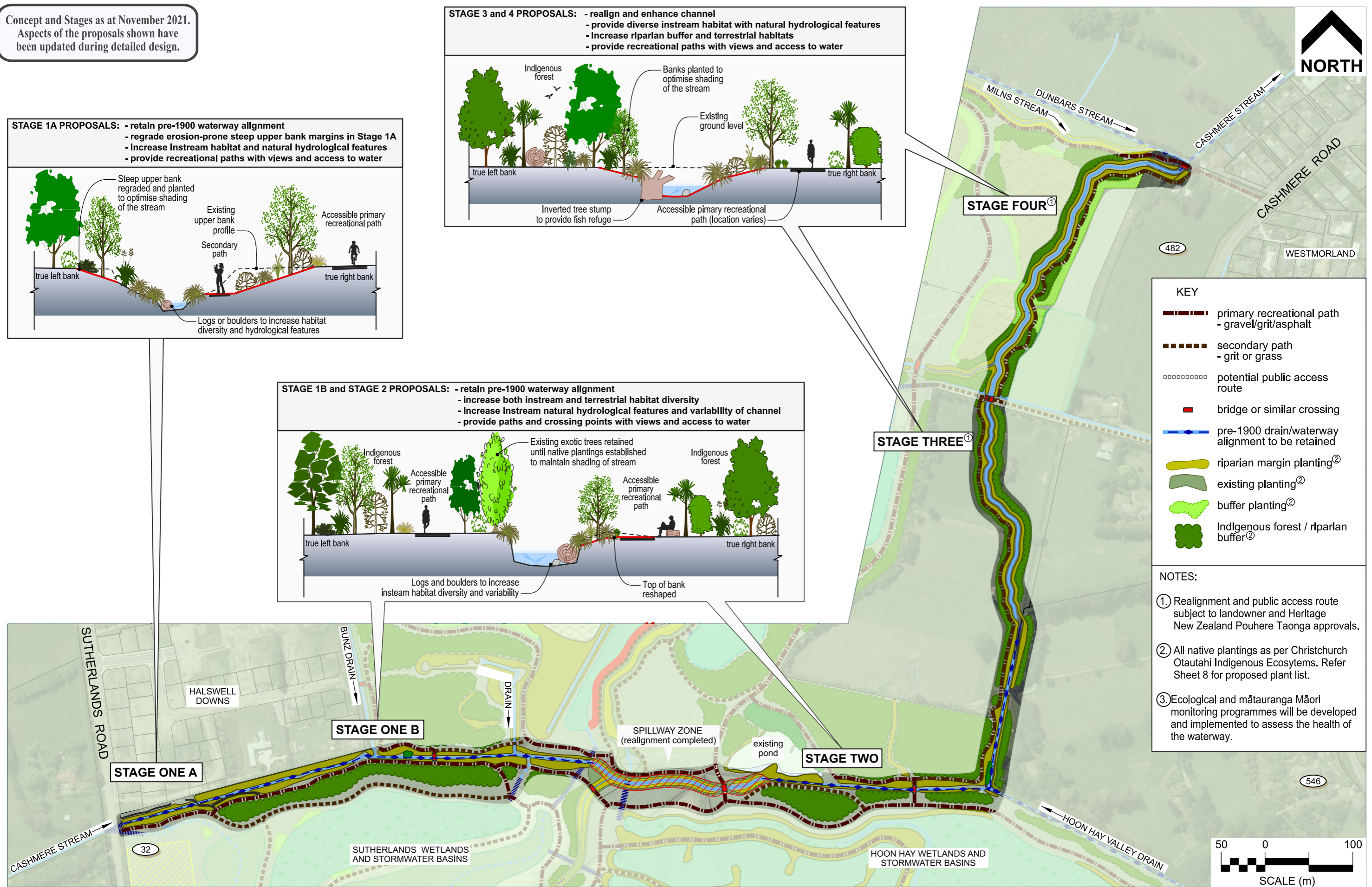
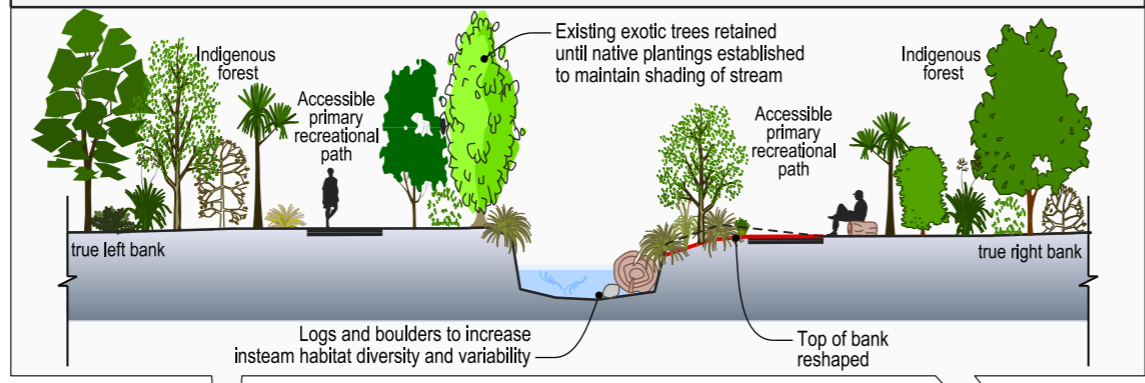
STAGE 1A PROPOSALS:

- retain pre-1900 waterway alignment
- regrade erosion-prone steep upper bank margins in Stage 1A
- increase instream habitat and natural hydrological features
- provide recreational paths with views and access to water



STAGE 1B and STAGE 2 PROPOSALS:

- retain pre-1900 waterway alignment
- increase both instream and terrestrial habitat diversity
- increase instream natural hydrological features and variability of channel
- provide paths and crossing points with views and access to water



KEY

- primary recreational path - gravel/grit/asphalt
- secondary path - grit or grass
- potential public access route
- bridge or similar crossing
- pre-1900 drain/waterway alignment to be retained
- riparian margin planting²
- existing planting²
- buffer planting²
- indigenous forest / riparian buffer²

NOTES:

1. Realignment and public access route subject to landowner and Heritage New Zealand Pouhere Taonga approvals.
2. All native plantings as per Christchurch Otautahi Indigenous Ecosystems. Refer Sheet 8 for proposed plant list.
3. Ecological and mātauranga Māori monitoring programmes will be developed and implemented to assess the health of the waterway.

Concept and Stages as at November 2021.
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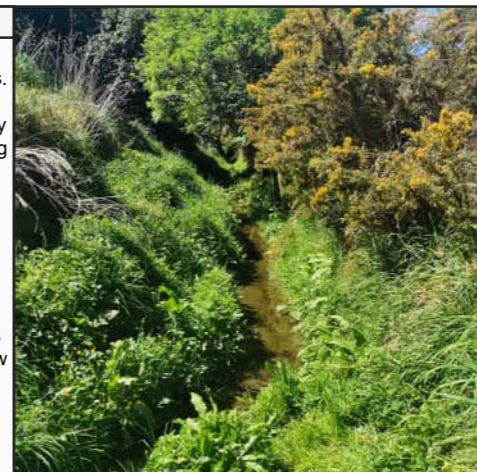
- A. Culvert Outlet at Sutherlands Road**
1. Retain and enhance the existing pool by:
 - removing weed species at culvert and pool margins;
 - replace existing fence at road;
 - keep the surrounding steep banks and plant to shade pond;
 - provide location to view pool.
 2. Investigate options to keep the perched culvert to exclude brown trout upstream but still allow access for native fish.



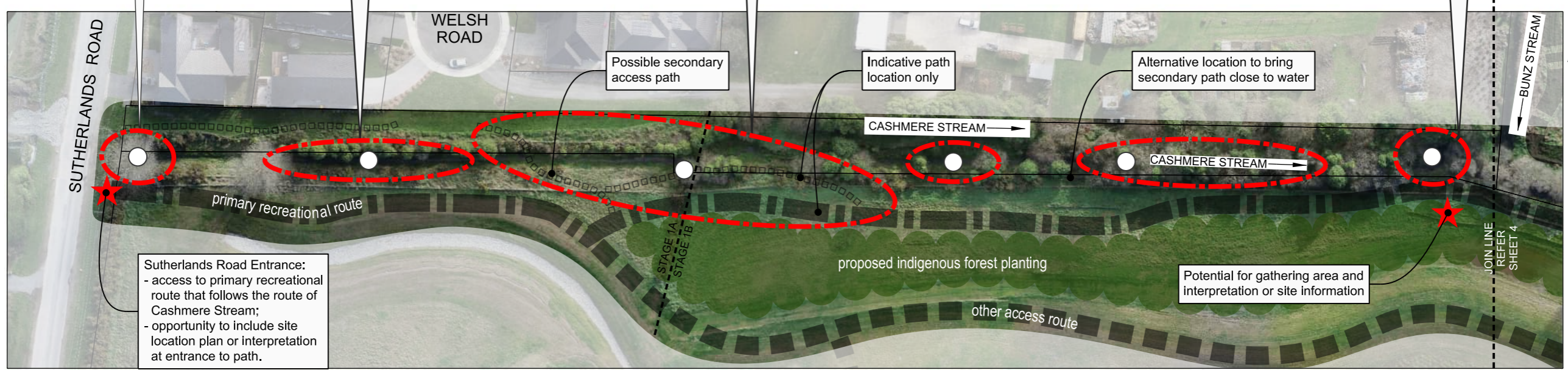
- B. Straight Stretches of Channel**
1. Regrade any erosion prone steep upper banks and remove pest weed species.
 2. Increase instream habitat diversity by using boulders and secured branches or logs to add variability to stream flow and meanders to channel.
 3. Replant both banks with riparian margin plants including shade trees.



- C. Channel SE of Welsh Road**
1. Regrade erosion prone steep upper banks and remove pest weed species.
 2. Investigate option to form a secondary path down and along the bank to bring people closer to the water.
 3. Protect and enhance the existing natural meanders and flood plain within the channel.
 4. Increase instream habitat diversity by using boulders and secured branches or logs to add variability to stream flow and meanders to channel.
 5. Replant both banks with riparian margin plants including shade trees.



- D. Spring In Cashmere Stream**
1. Protect the existing spring in the stream:
 - ensure no loss to existing shade canopy with removal of weed species;
 - avoid excavation and minimise any earthworks within 20m of spring.
 2. Provide an opportunity to view the spring safely from the southern bank.
 3. Potential location for site information or interpretation along with an informal seating or gathering area near the path.



- Control and removal of pest weeds**
1. Woody weeds species including gorse, elderberry, willow and invasive non-local native species (e.g. hybrid hoheria) will be removed. Stumps will be left unless bank reshaping is occurring.
 2. All other invasive waterway weeds species such as yellow flag iris will be removed.



- Proposed Riparian Planting**
1. Both banks of Cashmere Stream will be planted to maximise shading of the waterway. Sedges will be planted at the margin to overhang the water with a mix of shrubs and trees further up the bank.
 2. Regraded banks will be planted with small grade native plants to minimise further ground disturbance. Larger grade plants and specimen trees will be included in un-disturbed areas.
 3. Refer Sheet 8 for the proposed plant list.



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E. Existing Mature Exotic Trees

1. Initially retain mature trees near locations with possible springs or deep pools with the aim to remove all pest tree species once native plantings established.
2. Pest tree species (such as poplar and willow) will be managed to prevent further spread. They may be poisoned and left in situ and /or trimmed to facilitate replanting and access to stream.



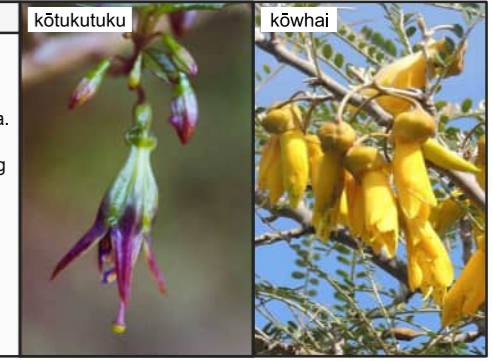
F. Uniform Stretches of Channel

1. Retain existing soft sides of the channel and use natural materials, securely placed to add variability and create meanders in the stream flow.
2. A range of features including rock vanes, boulders and cobble clusters will be used to add instream habitat diversity.
3. Timber overhangs, logs or other woody debris will be incorporated to add shade or habitat refuges.
4. Remove pest weed species and reshape the top of bank to remove any excess spoil from previous channel clearances.
5. Plant both banks with riparian margin plants, optimising shade planting on the northern bank.



Mahinga Kai Gathering Areas

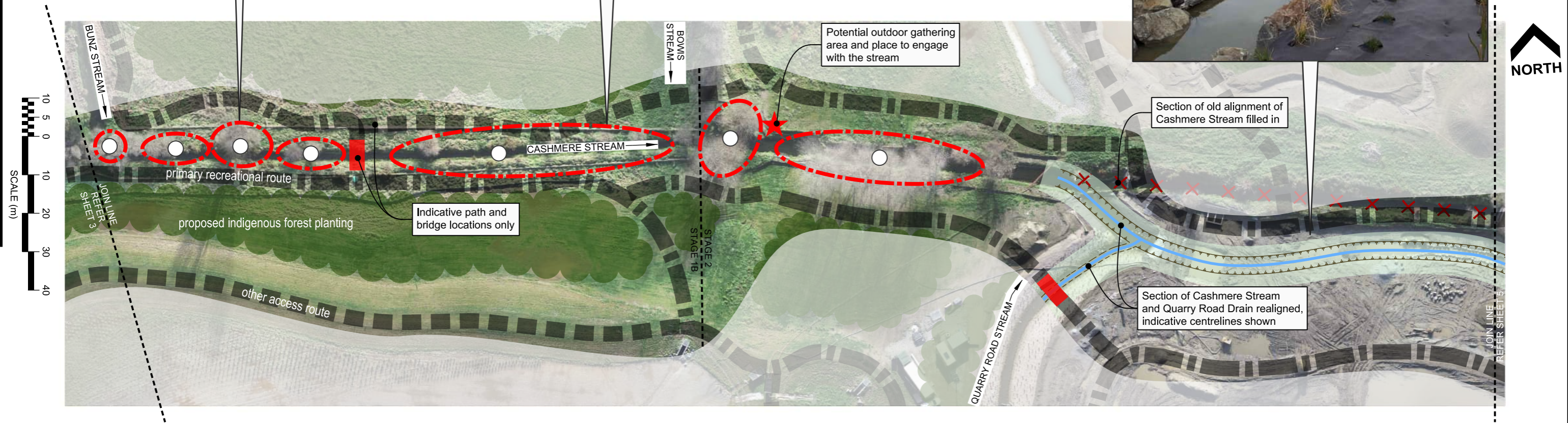
1. The ecological restoration of the habitats of Cashmere Stream and its surrounds, supports the ongoing customary use of natural resources - native flora and fauna.
2. Traditional knowledge and food gathering practises can be shared between generations of mana whenua both now and into the future.



Completed Realignment of Spillway Zone (with rock armouring)



Concept and Stages as at November 2021. Aspects of the proposals shown have been updated during detailed design.



Recreational Access Routes

1. Primary recreational routes will have a minimum path width of 2.4m. Some routes will be combined with service vehicle access routes and will be wider.
2. All primary recreational routes will have formal crossing points such as bridges, boardwalks or culverts. Secondary paths may utilise informal crossings.
3. Path surfaces will vary, typically they will be grit or gravel with some sections of asphalt, bark or grass.



Proposed Riparian Planting

1. Both banks of Cashmere Stream will be planted with riparian margin plants, with shading optimised on the northern bank.
2. Any regraded banks will be planted with smaller grade native plants to minimise further ground disturbance. Larger grade plants and specimen trees will be included in un-disturbed areas.
3. Refer Sheet 8 for the proposed plant list.



Existing Wai Kōura Habitat

1. Aquatic ecological surveys have found wai kōura burrows in the stream banks downstream of the confluence with Hoon Hay Valley Drain.
2. Sections of the bank where burrows are present will be protected and any instream enhancements will avoid disturbance of these areas.



wai kōura burrows

G. Straight Stretches with Exotic Trees

1. In these locations exotic trees (mostly pest species) contribute important habitat features including:
 - poplar buttress overhang;
 - instream willow roots add diversity to stream flows;
 - woody debris from fallen branches.
2. Stage removal and replacement of these trees. Remove any failed trees that are a risk to public initially. Further removal to occur once native plantings established and/or alternative instream habitat provided.



poplar buttress

willow roots

Concept and Stages as at November 2021. Aspects of the proposals shown have been updated during detailed design.

Existing Pond

1. As space is limited there is no primary recreational route proposed along the northern bank of Cashmere Stream adjacent the pond.
2. Planting of the pond margin adjacent the stream will be carried out with stream enhancements works.
3. Enhancement and planting of the rest of the pond will be under a separate project.



E. Existing Mature Exotic Trees

1. Initially retain mature trees near locations with possible springs or deep pools with the aim to remove all pest tree species once native plantings established.
2. Pest tree species (such as poplar and willow) will be managed to prevent further spread. They may be poisoned and left in situ and /or trimmed to facilitate replanting and access to stream.



trout in pool

F. Uniform Stretches of Channel

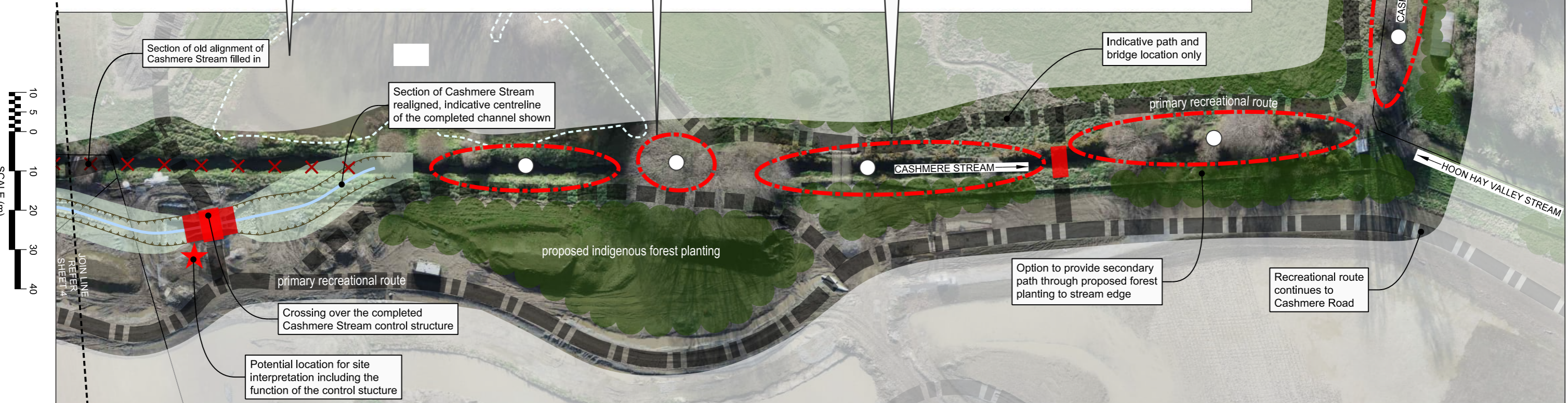
1. Retain existing soft sides of the channel and use natural materials, securely placed to add variability and create meanders in the stream flow.
2. A range of features including rock vanes, boulders and cobble clusters will be used to add instream habitat diversity.
3. Timber overhangs, logs or other woody debris will be incorporated to add shade or habitat refuges.
4. Remove pest weed species and reshape the top of bank to remove any excess spoil from previous channel clearances.
5. Plant both banks with riparian margin plants, optimising shade planting on the northern bank.



existing channel

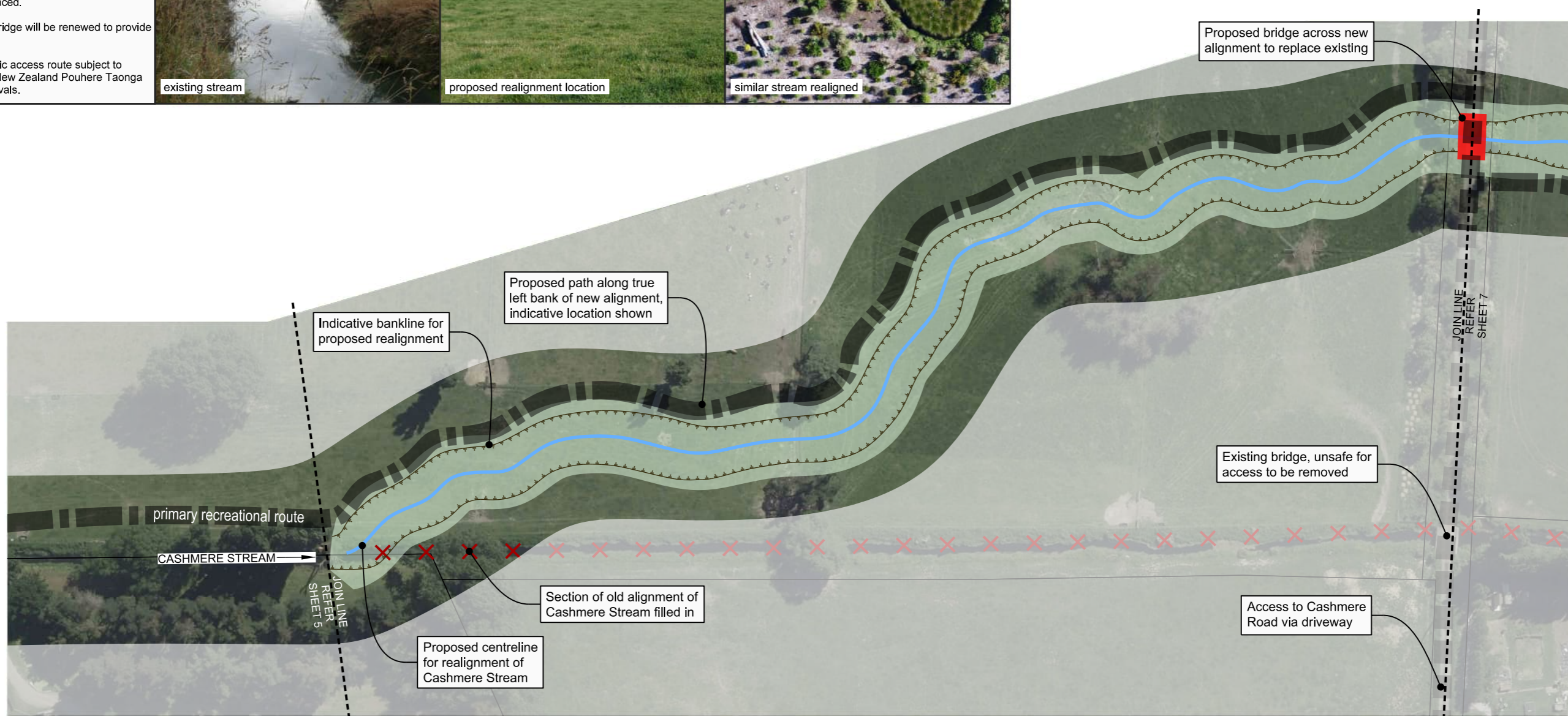
The enhanced waterway corridor will be fenced on private property

Property boundary, recreational route on private property through this section



Concept and Stages as at November 2021.
Aspects of the proposals shown have been updated during detailed design.

- Realignment at 586 Cashmere Road**
1. Realign Cashmere Stream with a natural meandering channel. This will provide opportunities for a greater range of habitats than enhancement of the straight channel alone can provide such as:
 - floodplains and/or back waters;
 - increased mix of pools and run habitats.
 2. Realignment will allow a wider riparian buffer to be planted with natives plants. The total width of the realigned waterway corridor will be approx. 30m and this corridor will be fenced.
 3. The existing access bridge will be renewed to provide a safe crossing.
 4. Realignment and public access route subject to landowner, Heritage New Zealand Pouhere Taonga and consenting approvals.



- New Stream Profile**
1. The new alignment will have natural banks that incorporate woody debris, logs and stumps or root wads to help shade and provide habitat.
 2. The new channel will be lined with gravels and rocks and boulders will be included for habitat features.
 3. Rock or boulder edging of the bank will only be used where ground conditions require bank armouring.

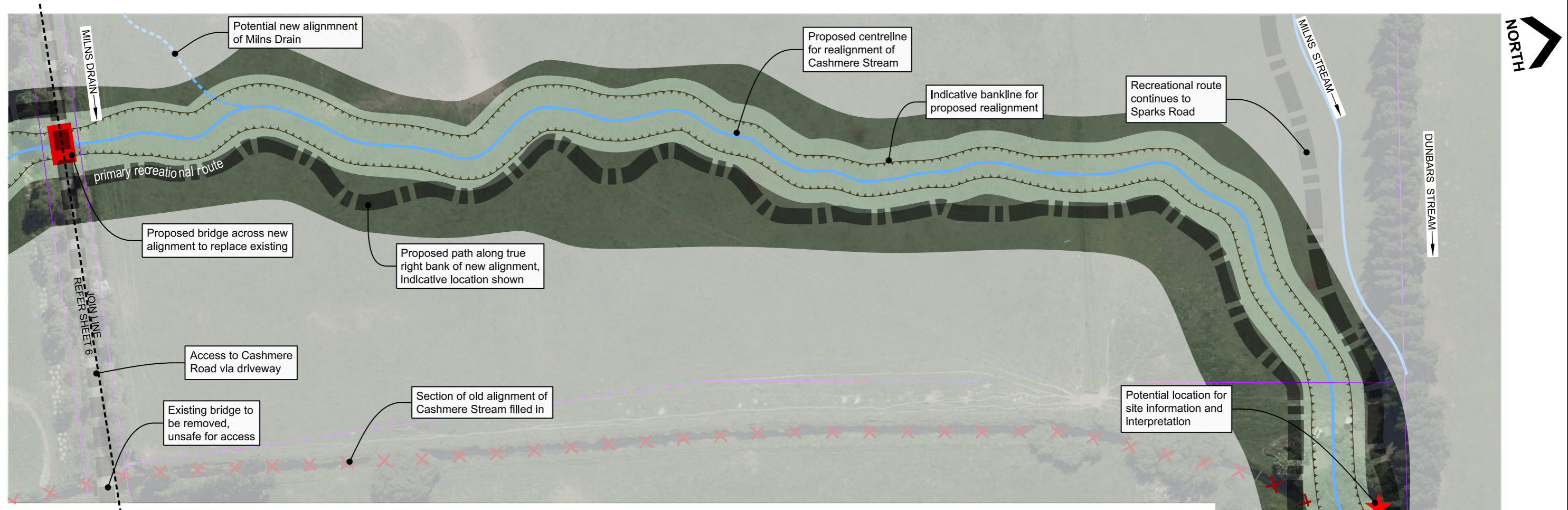


- Proposed Riparian Planting**
1. Riparian margin plants will be planted down the bank to the typical water level.
 2. Both sides of the waterway will be planted to provide shade and create a forest corridor and buffer from the surrounding farm land.
 3. Refer Sheet 8 for the proposed plant list.



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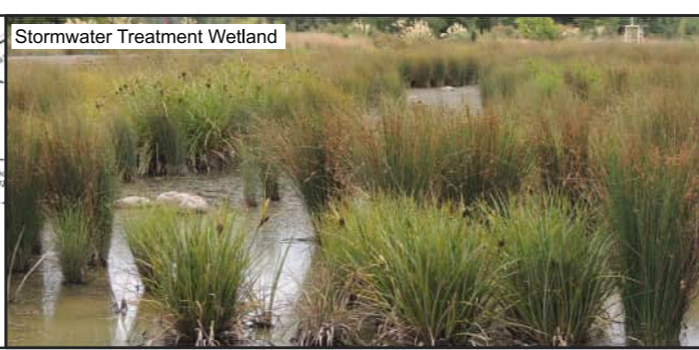
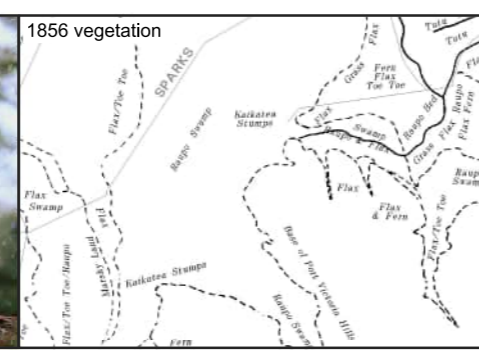
Stage 4 Proposed Realignment

1. Realign Cashmere Stream with a natural meandering channel. This will provide opportunities for a greater range of habitats than enhancement of the straight channel alone can provide such as:
 - floodplains and/or back waters;
 - increased mix of pools and run habitats.
2. Realignment will allow a wider riparian buffer to be planted with natives plants. The total width of the realigned waterway corridor will be 30m.
3. The existing access bridge will be renewed to provide a safe crossing.
4. Realignment and public access route subject to landowner, Heritage New Zealand Pouhere Taonga and consenting approvals.

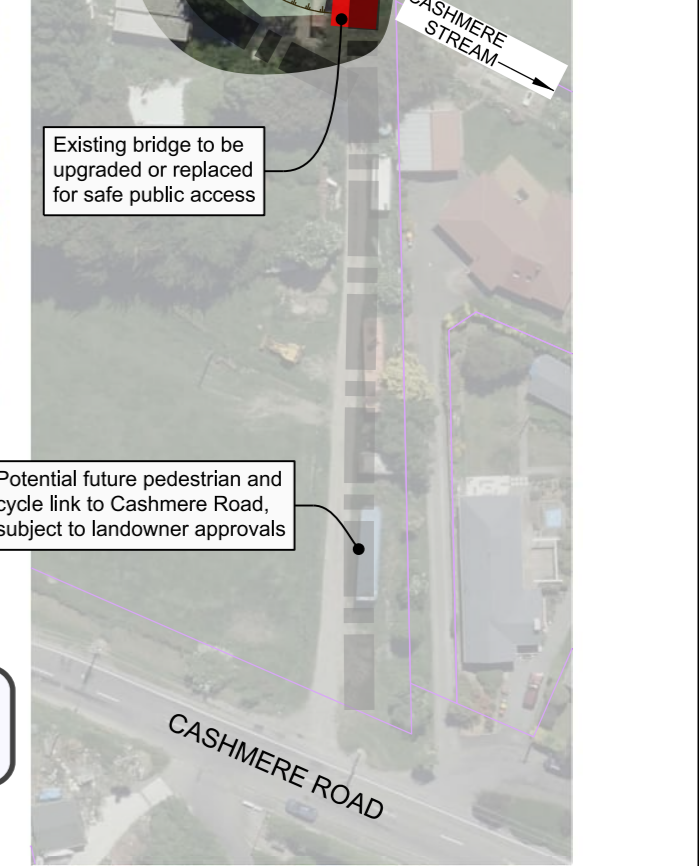


Interpretation and Site Information

1. Site information including maps and interpretation will be provided at appropriate locations along Cashmere Stream.
2. Interpretation will cover a range of topics relating to Cashmere Stream including:
 - Tangata whenua values;
 - heritage and history of the site;
 - ecological habitats;
 - stormwater management.






Concept and Stages as at November 2021. Aspects of the proposals shown have been updated during detailed design.



PROPOSED PLANT LIST FOR CASHMERE STREAM ENHANCEMENT

NOTES:
 1. It is estimated that a minimum of 60,980 plants will be planted over the four stages of this project. The proposed plant list has been compiled as a comprehensive list for all four stages of the project, with not all species being used in every stage of the project. There are a number of niche species included that will only be used in the right situation.
 2. This proposed plant list is informed by the Christchurch Otautahi Indigenous Ecosystems Plants Lists:
 a) Plants listed are primarily from the 'Wet Plains - Kahikatea' list based on the underlying soils;
 b) Plants listed are not exclusive to this list, with plants included to match soils modified from nearby construction.

KEY:
 **R - Riparian Margin:** - streamside plants including groundcovers, understorey and canopy species.
 **F - Indigenous Forest:** - forest plants including groundcovers, understorey and canopy species.
 **B - Buffer Planting:** - groundcovers and mid-storey species.

B	F	R	BOTANICAL NAME	COMMON NAME	NOTES
			Anemanthele lessoniana	wind grass	
			Alectryon excelsus	tītoki	sheltered site only
			Aristolelia serrata	makomako / wineberry	
			Astelia fragrans	kakaha / bush flax	
			Austroderia richardii	toetoe	
			Carex buechananii	Buchanans sedge	At Risk-Declining species, not commonly available
			Carex flagellifera	mānia / Glen Murray tussock	
			Carex gaudichaudiana	Gaudichaud's sedge	
			Carex geminata	rautahi / cutty grass	
			Carex maorica	Maori sedge	
			Carex secta	pūkio	
			Carex solandri	forest sedge	
			Carex tenuiculmis	slender wine sedge	At Risk-Declining species, not commonly available
			Carex virgata	pūkio	
			Carpodetus serratus	putaputaweta / marbleleaf	
			Coprosma areolata	thin-leaved coprosma	sheltered site
			Coprosma crassifolia	thick-leaved mikimiki	
			Coprosma linariifolia	mikimiki / yellow wood	
			Coprosma lucida	karamū	
			Coprosma propinqua	mikimiki	
			Coprosma rhamnoides	mikimiki	
			Coprosma robusta	karamū	
			Coprosma rotundifolia	round leaf coprosma	sheltered site
			Coprosma rubra	mikimiki	
			Coprosma virescens	mikimiki	At Risk-Declining species
			Cordyline australis	ti kōuka / cabbage tree	
			Cyperus ustulatus	upokotangata / umbrella sedge	
			Dacrycarpus dacrydioides	kahikatea	
			Deschampsia caespitosa	tufted hair grass	At Risk-Declining species, not commonly available
			Dianella nigra	turutu / New Zealand blueberry	
			Dodonea viscosa	akeake	
			Eleocharis acuta	sharp spike sedge	
			Eleocharis hookerianus	pōkākā	sheltered site only

B	F	R	BOTANICAL NAME	COMMON NAME	NOTES
			Eleocharis acuta	sharp spike sedge	
			Fuchsia excorticata	kōtukutuku / tree fuchsia	sheltered site only
			Griselinia littoralis	kāpuka / broadleaf	
			Hoheria angustifolia	narrow-leaved houhere	
			Juncus edgareae	wīwī / Edgars rush	
			Juncus sarophorus	wīwī / broom rush	
			Kunzea robusta	kānuka	
			Leptospermum scoparium	mānuka	
			Libertia ixiodes	mikoikoi / New Zealand iris	
			Lophomyrtus obcordata	rōhutu	
			Melicope simplex	poataniwha	
			Melicytis ramiflorus	mahoe / whitey wood	sheltered site only
			Muehlenbeckia astonii	shrubby totoraro	
			Muehlenbeckia complexa	small-leaved pohuehue	
			Myrsine australis	māpou / red matipo	sheltered site only
			Myrsine divaricata	weeping māpou / matipo	
			Olearia bullata	heketara	
			Parablechnum minus	swamp kiokio	
			Pennantia corymbosa	kaikomako	
			Phormium tenax	harakeke / flax	
			Pittosporum eugenioides	tarata / lemonwood	
			Pittosporum tenuifolium	kōhūhū	
			Plagianthus regius	manatu / lowland ribbonwood	
			Poa cita	wī / silver tussock	
			Podocarpus totara	tōtara	
			Polystichum neozelandicum	shield fern	
			Polystichum vestitum	prickly shield fern	
			Prumnopitys ferruginea	miro	
			Prumnopitys taxifolia	matai	
			Pseudopanax arboreus	whauwhaupaku / five-finger	
			Pseudopanax crassifolius	horoeaka / lancewood	
			Pseudowintera colorata	horopito / pepper tree	
			Raukawa anomalus	shrub raukawa	
			Rubus cissoides	tataramoa / bush lawyer	
			Rubus squarrosus	leafless lawyer	
			Schoenoplectus tabernaemontani	kuawa / lake club rush	
			Schoenus pauciflorus	bog rush	
			Streblus heterophylla	turepo / small-leaved milk tree	sheltered site only
			Sophora microphylla	kōwhai	
			Veronica salicifolia	koromiko / hebe	
			Zealandia pustulata	kowaowao / hounds tongue fern	

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**CASHMERE STREAM ENHANCEMENT - Sutherlands Road to Dunbars Stream
 Proposed Plant List**

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