

	Existing Site	Manuka Road	Parker Road North	Parker Road South
Headworks				
Scope/Assumptions	<ul style="list-style-type: none"> WTP shutdown for an extended period to facilitate construction. Raw Water Aqueduct replacement/rehabilitation occurs during the WTP shutdown. 	<ul style="list-style-type: none"> Upper Nihotupu watermain gravity supply to the Manuka Road site. WTP and Reservoir site elevations will result in pumping above the treated water system operating level. 	<ul style="list-style-type: none"> New tunnel Pipe will be installed inside the tunnel Access shafts will be located at start and mid-point of the tunnel 	<ul style="list-style-type: none"> New tunnel Pipe will be installed inside the tunnel Access shafts will be located at start and mid-point of the tunnel
Issues/Constraints	<ul style="list-style-type: none"> Aqueduct must be pressurised to minimise discharges to the off-spec pipeline. Complex given hydraulic grade of Aqueduct. Would require an overflow system at Mackies Rest, which would discharge water to the Lower Nihotupu Dam. Pressurisation of the Aqueduct will be difficult due to elevations and headloss added should a pipe be installed in the existing asset. Pressurisation of the Aqueduct will require the replacement of the Upper Nihotupu Raw Watermain. Retains the Aqueduct as a single point of failure, rehab of asset poses long term risk. Western water sources will not be utilised for up to 3 years and may result in adverse water quality impacts 	<ul style="list-style-type: none"> WTP will be vulnerable if the Aqueduct is not replaced. This will be complicated if the only alternate supply, following the commissioning of the Manuka Road facility, is from the Upper Nihotupu Dam. The new facility will be limited to 30 MLD, utilising the 100 year old cast iron Upper Nihotupu watermain during the Aqueduct upgrade. Aqueduct must be pressurised to minimise discharges to the attenuation lagoon. Complex given hydraulic grade of Aqueduct. Would require an overflow system at Mackies Rest, which would discharge water to the Lower Nihotupu Dam. Pressurisation of the Aqueduct will be difficult due to elevations and headloss added should a pipe be installed in the existing asset. 	<ul style="list-style-type: none"> Complexity associated with maintenance of the raw water tunnel and pipeline. The new tunnel is a potential single point of failure, however this asset will be designed for 100 years' service. Would require an overflow system at Mackies Rest, which would discharge water to the Lower Nihotupu Dam. Additional distance will be travelled to reach Huia Headworks. 	<ul style="list-style-type: none"> Complexity associated with maintenance of the raw water tunnel and pipeline. The new tunnel is a potential single point of failure, however this asset will be designed for 100 years' service. Would require an overflow system at Mackies Rest, which would discharge water to the Lower Nihotupu Dam. . Additional distance will be travelled to reach Huia Headworks.
Benefits/Opportunities	<ul style="list-style-type: none"> Readily connected to existing raw water infrastructure for which access already exists. No raw water pumping required. Provides convenient access to the Huia Headworks. 	<ul style="list-style-type: none"> Direct gravity supply from the Upper Nihotupu dam provides a limited level of redundancy for the Aqueduct. Readily connected to existing raw water infrastructure for which access already exists. The extension of the Lower Nihotupu rising main to Exhibition Drive to meet a new falling main from the Upper Nihotupu Dam to form a Combined Nihotupu Raw Water Main would greatly enhance the resilience of the raw water supply. Would also simplify engineering required to pressurise the Aqueduct. Combined Nihotupu Raw Water Main running in parallel to the Combined Huia Raw Water Supply via the Raw Water Aqueduct would both facilitate aqueduct 	<ul style="list-style-type: none"> Gravity supply to WTP from Mackie's Rest. Increased resilience provided by a completely new raw water supply line from Mackie's Rest. Readily connected to existing raw water infrastructure for which access already exists. 	<ul style="list-style-type: none"> Gravity supply to WTP from Mackie's Rest. Increased resilience provided by a completely new raw water supply line from Mackie's Rest. Readily connected to existing raw water infrastructure for which access already exists.

		<p>shutdowns for maintenance/upgrades and potentially reduce the level of upgrading required.</p> <ul style="list-style-type: none"> • Provides convenient access to the Huia Headworks. 		
Score				
Treatment				
Scope/Assumptions	<ul style="list-style-type: none"> • Will involve completely new process units for the entire treatment process, there is the expectation that good design will ensure good operability. • Designs will meet all regulatory requirements. • All sites will require the facilities and space to accommodate operational and administrative staff. 	<ul style="list-style-type: none"> • Will involve completely new process units for the entire treatment process, there is the expectation that good design will ensure good operability • Designs will meet all regulatory requirements. • All sites will require the facilities and space to accommodate operational and administrative staff 	<ul style="list-style-type: none"> • Will involve completely new process units for the entire treatment process, there is the expectation that good design will ensure good operability • Designs will meet all regulatory requirements. • All sites will require the facilities and space to accommodate operational and administrative staff 	<ul style="list-style-type: none"> • Will involve completely new process units for the entire treatment process, there is the expectation that good design will ensure good operability • Designs will meet all regulatory requirements. • All sites will require the facilities and space to accommodate operational and administrative staff
Issues/Constraints	<ul style="list-style-type: none"> • Constrained site will pose design challenges/issues that may result in the introduction of other H&S risks such as confined spaces. • No off-spec storage/attenuation adversely impacts operability. • Requires the installation of infrastructure to facilitate full plant discharges to the Manukau Harbour. • Utilising the existing raw water aqueduct as the sole supply in an unpressurised configuration results in the inability to rapidly shutdown or reduce flows into the plant if process issues requires a flow reduction or diversion. • Slopes of existing site will adversely impact vehicle access and movement through this site. • Treated water must be pumped to the Woodlands Park Road Reservoirs. May be more complicated than Parker Road options if reservoirs are constructed with a TWL of 128m. • Large standby generation capacity required due to the pumping requirements. This may compromise reliability of Huia during a mains power failure. • Security system management complexity due to local bush environment. 	<ul style="list-style-type: none"> • Constrained site will pose design challenges/issues that may require the introduction of other H&S risks such as confined spaces • WTP will be split over two sites (three including the reservoirs which introduces H&S and Operational risks, as the raw water pump station will be located on the existing site. • Requires raw water pumping adjacent to the existing WTP, introduces complexity. • Large standby generation capacity required due to the pumping requirements. This may compromise reliability of Huia during a mains power failure. • Mapping WTP processes on a constrained site reduces flexibility in safety in design and limits ability to easily incorporate additional water treatment processes if required by future changes in raw water quality or Drinking Water Standards. • Security system management complexity due to local bush environment. Further complicated by the need to operate over two sites. • Service providers and contractors required to access multiple sites introducing site security and H&S risks. 	<ul style="list-style-type: none"> • WTP staff will be required to travel longer distances to reach other Northern Water Supply WTPs. • Treated Water must be pumped to onsite reservoirs at a lower level than the Woodlands Park Road Reservoirs TWL. • Standby generation capacity will be greater than what is currently installed at the Huia WTP but less than what will be required for the 'Existing WTP' and 'Manuka Road' sites. 	<ul style="list-style-type: none"> • WTP staff will be required to travel longer distances to reach other Northern Water Supply WTPs. • Treated Water must be pumped to onsite reservoirs at a lower level than the Woodlands Park Road Reservoirs TWL. • Standby generation capacity will be greater than what is currently installed at the Huia WTP but less than what will be required for the 'Existing WTP' and 'Manuka Road' sites.

	<ul style="list-style-type: none"> • Mapping WTP processes on a constrained site reduces flexibility in safety in design and limits ability to easily incorporate additional water treatment processes if required by future changes in raw water quality or Drinking Water Standards. • Service providers and contractors required to access multiple sites introducing site security and H&S risks. 			
Benefits/Opportunities	<ul style="list-style-type: none"> • Existing site provides convenient access to Headworks and other Northern Water Supply WTPs 	<ul style="list-style-type: none"> • Construction of a separate Combined Nihotupu Dams raw water pipeline on Exhibition Drive would provide a significant improvement in resilience, better management of raw water flow during an off spec process event by being able to shut off the Nihotupu flow at the inlet to the plant, and reduction in on site standby power generation requirement for raw water pumping • Existing site provides convenient access to Headworks and other Northern Water Supply WTPs. 	<ul style="list-style-type: none"> • The larger space available on these sites for the treatment plant structures is also an advantage with regard to increasing the potential to avoid confined spaces to gain access to equipment for operation and maintenance. • Proposed attenuation structures provide a great deal more operational flexibility and environmental mitigations than those proposed for the 'Existing' and 'Manuka Road' sites. • Operating and managing a large single site is more efficient that operating over three distinct locations, particularly from a security and H&S (lone worker/site access management) perspective. • The ability to restrict all of the flow into the plant, through a pressurised raw water supply, and the scope for a large attenuation pond and greater assimilative capacity of the waterway discharged compared to Manuka Road is an advantage for this site. • Larger operating area provides the ability to easily incorporate additional water treatment processes if required by future changes in raw water quality or Drinking Water Standards. • Opportunity to consolidate control and communications infrastructure to a single location. • Security system is less complex than the 'Existing' or 'Manuka Road' sites give the flatter topography and greater space available. • Service providers and contractors required to access a single site reducing site security and H&S risks. • Relocation of Historic building (that was previously relocated) provides improved site layout opportunities. 	<ul style="list-style-type: none"> • The larger space available on these sites for the treatment plant structures is also an advantage with regard to increasing the potential to avoid confined spaces to gain access to equipment for operation and maintenance. • Proposed attenuation structures provide a great deal more operational flexibility and environmental mitigations than those proposed for the 'Existing' and 'Manuka Road' sites. • Operating and managing a large single site is more efficient that operating over three distinct locations, particularly from a security and H&S (lone worker/site access management) perspective. • The ability to restrict all of the flow into the plant, through a pressurised raw water supply, and the scope for a large attenuation pond and greater assimilative capacity of the waterway discharged compared to Manuka Road is an advantage for this site. • Larger operating area provides the ability to easily incorporate additional water treatment processes if required by future changes in raw water quality or Drinking Water Standards. • Opportunity to consolidate control and communications infrastructure to a single location. • Security system is less complex than the 'Existing' or 'Manuka Road' sites give the flatter topography and greater space available. • Service providers and contractors required to access a single site reducing site security and H&S risks. • Relocation of Historic building (that was previously relocated) provides improved site layout opportunities.

Score				
Transmission				
Scope/Assumptions	<ul style="list-style-type: none"> Treated Water Storage top water level will be approximately 128m RL. New treated water reservoir are connected to the North Harbour No. 2. Cross connections between the North Harbour No.1 and North Harbour No.2 will be installed during the construction of the Western Terminus of the NH No.2. Treated Water Aqueduct and Titirangi Reservoirs Inlet structures will be upgraded to provide benefit. 	<ul style="list-style-type: none"> Treated Water Storage top water level will be approximately 128m RL. New treated water reservoir are connected to the North Harbour No. 2. Cross connections between the North Harbour No.1 and North Harbour No.2 will be installed during the construction of the Western Terminus of the NH No.2 Treated Water Aqueduct and Titirangi Reservoirs Inlet structures will be upgraded to provide benefit. 	<ul style="list-style-type: none"> Treated Water Storage top water level will be between 115m and 120m RL. New treated water reservoir are connected to the North Harbour No. 2. Cross connections between the North Harbour No.1 and North Harbour No.2 will be installed during the construction of the Western Terminus of the NH No.2 	<ul style="list-style-type: none"> Treated Water Storage top water level will be between 115m and 120m RL. New treated water reservoir are connected to the North Harbour No. 2. Cross connections between the North Harbour No.1 and North Harbour No.2 will be installed during the construction of the Western Terminus of the NH No.2
Issues/Constraints	<ul style="list-style-type: none"> Requires an upgrade/replacement of the Huia Treated Water Aqueduct to provide connectivity to the Titirangi Reservoirs. Service Providers and Contractors required to access remote site, introducing site security and H&S risk. 	<ul style="list-style-type: none"> Requires an upgrade/replacement of the Huia Treated Water Aqueduct to provide connectivity to the Titirangi Reservoirs. Service Providers and Contractors required to access remote site, introducing site security and H&S risk. 	<ul style="list-style-type: none"> Requires upgrading of the Nihotupu Treated Watermain or installation of a transfer pumpstation to provide connectivity to the Titirangi Reservoirs. May also require operational modifications to the Titirangi Reservoirs to improve system operation. 	<ul style="list-style-type: none"> Requires upgrading of the Nihotupu Treated Watermain or installation of a transfer pumpstation to provide connectivity to the Titirangi Reservoirs. May also require operational modifications to the Titirangi Reservoirs to improve system operation. Parker Road South Site a pipe through private property would not be acceptable as a long term solution for the pipeline and a drilled or tunnelled option.
Benefits/Opportunities	<ul style="list-style-type: none"> The existing Western Transmission System has been designed with Huia at its current location. Opportunity for pressure reduction in NH No.2 to operate at same pressure as NH No.1 	<ul style="list-style-type: none"> The existing Western Transmission System has been designed with Huia at its current location. Opportunity for pressure reduction in NH No.2 to operate at same pressure as NH No.1 	<ul style="list-style-type: none"> Treated watermain located in road corridor improves accessibility. Reservoirs located at a lower levels provide higher levels of system energy efficiency. Single site provides substantial operational facility management benefits, with contractors only required to access a single facility. Opportunity to operate NH No.2 at same pressure as NH No.1 	<ul style="list-style-type: none"> Single site provides substantial operational facility management benefits, with contractors only required to access a single facility. Opportunity to operate NH No.2 at same pressure as NH No.1
Score				
TOTAL				