Report

Huia Water Treatment Plant Site Selection Principles

Prepared for Watercare Services Ltd (Client)

By CH2M Beca Limited

2 December 2015

Revision History

Revision N°	Prepared By	Description	Date
A	Jack Brennan	Draft- Site principles and Principles review	20/11/15
B	Jack Brennan	Final Site Principles	2/12/15

Document Acceptance

Action	Name	Signed	Date
Prepared by	Jack Brennan		2/12/15
Reviewed by	John Wardle		2/12/15
Approved by	John Wardle		2/12/15
on behalf of	CH2M Beca Limited		

Table of Contents

1 Introduction

Watercare Services Ltd (Watercare) appointed CH2M Beca Ltd (Beca), GHD and Tonkin and Taylor (T&T) to complete a site selection study for the Huia Water Treatment Plant (WTP) replacement. This is to be based on four site principles, developed internally by Watercare, that provide a sound basis for the assessment of alternative sites. The site principles are elevation, size, location and proximity to existing infrastructure.

The site selection principles are intended to provide the basis for identifying suitable locations for the new Huia Water Treatment Plant. The principles have been developed using the following holistic objectives:

- Maximise the utilisation of the existing water resources in the Waitakere Ranges
- Maintain or improve the existing raw water transmission system operation.
- Maintain or improve the existing treated water transmission system operation.
- Provide an integrated maximum treated water flow of 140 ML over a 24 hour period.
- Provide an integrated minimum treated water flow of 30 ML over a 24 hour period.

The site principles have been reviewed with consideration to the Western Water Supply Strategy (Watercare, October 2015) and compared to the existing Huia WTP and the current concept design for the new site.

2 System Overview

Based on the Western Supply Strategy (Watercare, October 2015), we have summarised the current and future infrastructure requirements in the vicinity of the Huia WTP. Figure 1 shows the key components of the existing and planned future infrastructure.

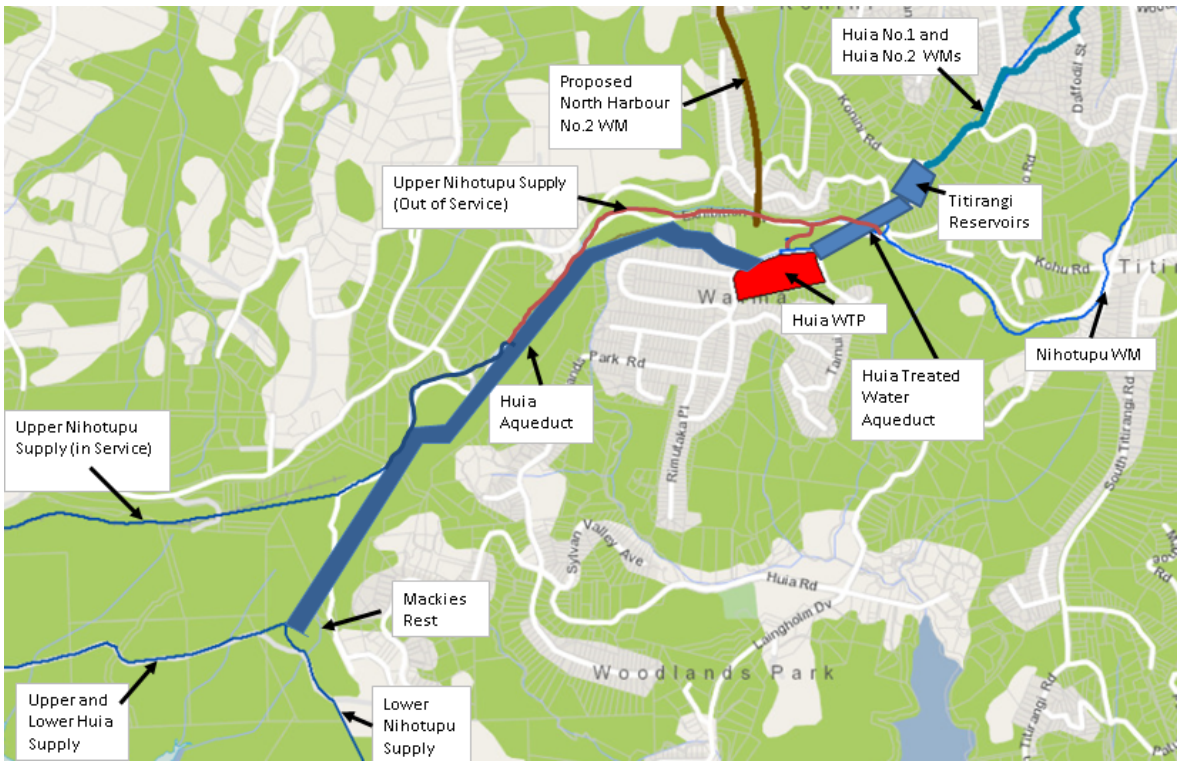

Figure 1: Existing and proposed infrastructure

The infrastructure shown in Figure 1 has been categorised in the table below as either:

- Fixed- meaning that it is not anticipated that the location or functionality of this asset will change
- Flexible- meaning that the asset has not yet been built or is in Watercare's asset management plan for replacement in the next 20 years

Infrastructure	Flexibility	Comment
Upper and Lower Huia Supply	Fixed	This component of the headworks will remain fixed with no changes.
Lower Nihotupu Supply	Fixed	This component of the headworks will remain fixed with no changes.
Mackies Rest	Fixed	Any infrastructure upstream of this point will remain fixed.
Upper Nihotupu Supply (both in service and out of service sections)	Flexible	The Upper Nihotupu pipeline is in Watercare's Asset management plan for replacement within the next 20 years.
Huia Aqueduct (Raw Water)	Flexible	The Huia Aqueduct is approximately 85 years old and was recently inspected to be in general good condition. The Huia aqueduct will thus be used where practicable during the

		evaluation process.
Huia Treated Water Aqueduct	Flexible	This aqueduct carries water from the Huia WTP to the Titirangi Reservoirs. It will be used where practicable to do so.
Titirangi Reservoirs	Fixed	This component of the transmission will remain fixed with no changes..
North Harbour No. 2 Watermain	Flexible	Originally planned to connect to the proposed Woodlands Park Reservoir, the alignment for the first section of the route (as far as the Waitakere No.1 Watermain) is considered flexible to suit the location of the WTP.

An indicative hydraulic profile (Figure 2) has been developed to provide an overview of the elevation of the existing treatment plant and associated infrastructure.

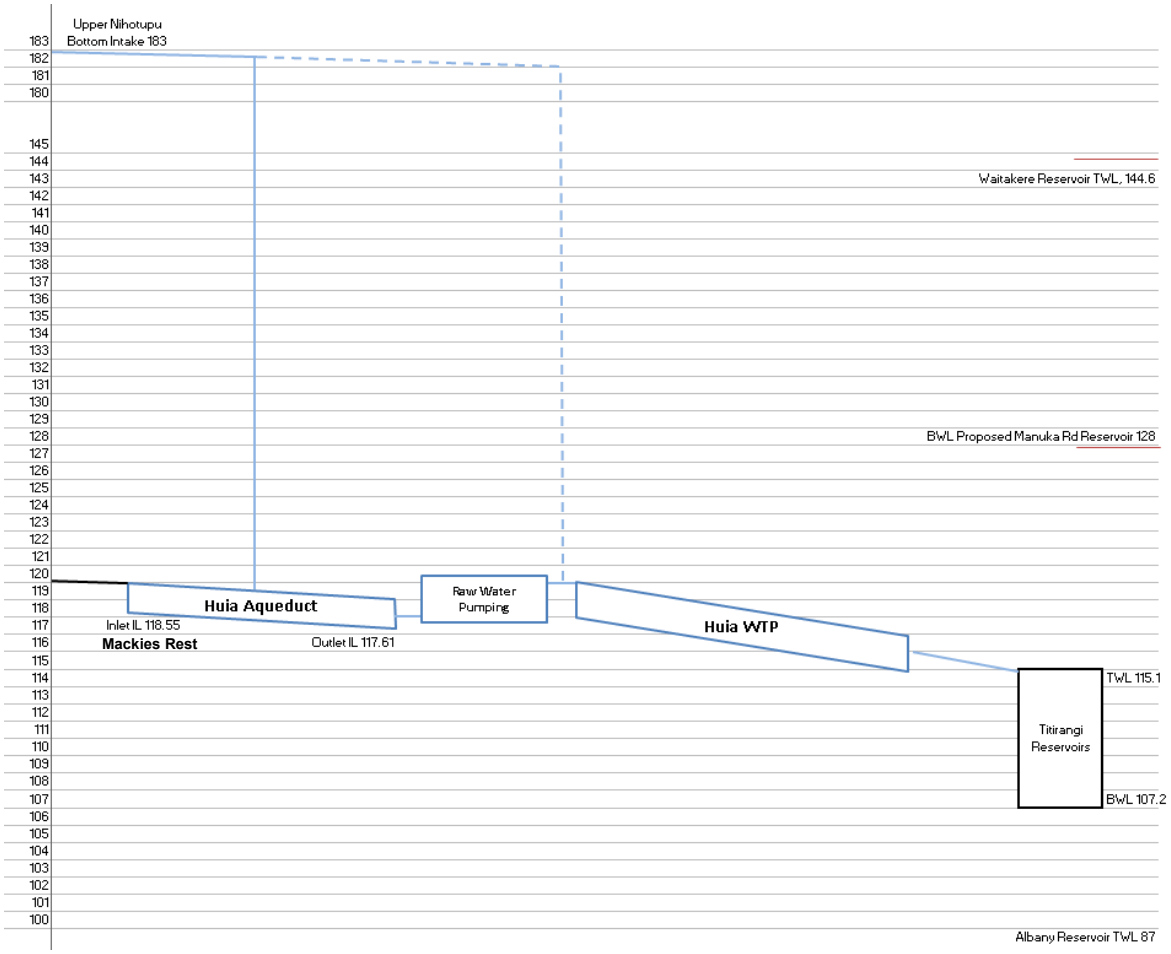

Figure 2: Indicative hydraulic profile

3 Proposed Principles

The principles are split into four groups which are elevation, size, location and proximity to existing infrastructure. Each of the principles are listed below and then followed by the supporting information.

3.1 Elevation

E1 The proposed site must allow for a treated water reservoir top water level at or above 115 m RL and bottom water level at or above 107m to not be lower than the Titirangi Reservoirs

E2 The water treatment plant site must allow for a gravity supply from the Upper Nihotupu Dam.

E3 Pumping shall be minimised as far as practicable.

E4 Pumping shall be limited to the raw water or the treated water, not both.

E5 It is preferred that the treatment plant is located within the elevation band of 105 to 145m.

E6 The distance between the WTP and the treated water reservoirs will be kept at a minimum

3.2 Size

S1 The minimum site size for the treatment plant alone (no attenuation lagoon/storage, or reservoirs): 40,000 m².

S2 The minimum site size for attenuation storage: 10,000 m².

S3 The minimum site size for treated water reservoirs: 15,000 m².

S4 The minimum site size for the WTP plus attenuation: 50,000 m².

S5 The minimum total area for all infrastructure on one site: 60,000 m²

S6 The site length to width ratio is appropriate for a suitable site layout for construction and operation.

S7 Allowance should be made for site discharge flow attenuation.

3.3 Location

L1 The site must allow the new WTP to be constructed and tested without compromising the supply security to the Auckland metropolitan supply system.

L2 The site(s) must not be located on or in close proximity to a known active earthquake fault.

L3 The site(s) must not be prone to flooding.

L4 The site(s) must not be located in an area of foundation instability

L5 The site(s) must not be located in the Upper Huia, Lower Huia, Upper Nihotupu, Lower Nihotupu or Waitakere raw water dam catchments

L6 All connecting pipes should be in public roads where reasonable.

L7 The slope of the site, where the structures would be constructed, is not greater than 20 percent.

L8 Provision should be made for an appropriate receiving environment under gravity for off-specification/overflow discharges

3.4 Proximity to Existing Infrastructure

P1 The site(s) must be accessible from an existing roadway suitable for road tanker transport

P2 For roads that are susceptible to slips, road access must be provided to the plant from at least two directions

P3 The connection point to the treated water network shall allow the existing transmission network to operate to meet or improve all levels of service.

P4 The site shall be within a reasonable distance to an appropriate treated water network connection node to enable the transmission network to operate as required.

P5 The proposed site will be capable of supplying the Titirangi Reservoirs and the WMNH2.

P6 The connection point to the raw water headworks shall allow the raw water headworks to operate as required.

P7 The raw water connection shall be made downstream of Mackies Rest, utilising existing infrastructure where practicable.

4 Commentary on Principles

No.	Comment	Related Principle
Elevation		
1.	A gravity supply from the treated water reservoir into the transmission system is required. The BWL of the Titirangi Reservoirs is approximately 107 m. This level currently supplies the transmission system under gravity. This limit will maintain conditions for the current operation of the transmission system, and allow for the integration of planned future upgrades.	E1
2.	The upper limit is constrained such that a gravity supply from the Upper Nihotupu Dam is feasible. This gravity supply is part of a Watercare's long term plan to provide resilience around the Huia raw water aqueduct. The minimum offtake level from the Dam is 183.44 m RL, and the maximum height for the treatment plant inlet will be limited to the minimum offtake level plus any losses from the pipework to the water treatment plant. These losses will be variable depending on the length of raw water main required. The maximum consented flow from the Upper Nihotupu Dam is 54 ML/d and the existing supply main is approximately 610 mm ID.	E2
3.	It is preferable from a sustainability perspective to optimise pumping and the associated energy costs. An order of magnitude estimate of this cost is approximately $13,000 per annum for every metre of pumping height.	E3
4.	There is a strong preference to pump once only throughout the raw water/water treatment/new storage process. Reliable communications are required between any pumped infrastructure and the water treatment plant to provide security of supply, and minimising the number of pump stations decreases points of failure.	E4
5.	The minimum elevation of 105m is described under E1. The maximum elevation of 145m is derived from the elevation of Waitakere Reservoir; there is no network benefit of exceeding this elevation.	E5
6.	Minimising the distance between the WTP and the treated water reservoirs is important because: ■ No connections are permissible between the Water Treatment Plant and the Treated Water Reservoir. Minimising distance will maximise potential for future growth to connect as close as possible to the bulk supply ■ Watercare's standard practice is to not allow for any customer connections from their transmission mains. This reduces the operational constraints for any shutdowns or maintenance of these mains. This will also provide communications and operational benefits to have the treatment plant close to the WTP	E6

Size		
7.	A site is required that is sufficiently sized to support the proposed water treatment process and infrastructure. The MWH concept design has a proposed site size of 26,000 m² for the water treatment plant, 5,800 m² for the two treated water reservoirs, 500 m² for the raw water pumping station and 3,500 m² for the existing attenuation pond. An allowance for a peroxide dosing system is to be included to support a future transition to an advanced oxidation process. Approximately 500 m² is assumed for this unit process. This is a total site size of approximately 36,000 m² and represents a relatively efficient and tight configuration. There is no provision for any future capacity expansion.	S1-S8
8.	In comparison, a basic estimate (Kawamura 2000) recommends that the required site area, A (in acres) is determined through the following relationship: $A > Q^{0.7}$ where Q is the flowrate in MGD. This equates to a site area of approximately 51,000 m².	S1-S8
9.	The proposed water treatment plant is conceptualised to be a high rate plant, requiring a smaller footprint than a conventional plant, so it is appropriate that a minimum area of 35,000 m² is considered. A site this size would need to be largely level and not too narrow to allow for an efficient plant layout.	S1, S4
10.	The size allowance of the site discharge attenuation pond shall be aligned with the volumetric requirements to enable compliance with the likely consented discharge rate to the local (site specific) receiving environment, and the discharge volumes generated during the baseline off specification scenario. Where required, this may need to be simplified by adopting the sizing of the current site attenuation pond.	S7
Location		
11.	The proposed water treatment plant and treated water reservoirs are to be utilised for a significant period of time. To minimise any risks to the long term operation of the future infrastructure, it should not be built in any areas that are known to increase the risk to the operation of the infrastructure. This includes active fault lines, flood plains and landslips.	L1 – L4
12.	Construction within the raw water supply catchment is seen to present a high risk of contamination. This could occur during construction or the operation of the proposed infrastructure. Watercare also advocate a strong stance that there is no infrastructure in the catchments, and the construction of water treatment infrastructure would be contrary to this.	L5
13.	Construction of water treatment infrastructure is preferred to occur in public roads to provide accessibility for operation and maintenance requirements and simplify on-going access rights	L6
14.	A slope of more than 20% represents an average site slope of 1:5, At this slope access around treatment units is difficult for vehicles, significant earthworks become necessary, structures become complex and hydraulic losses in the plant become more significant resulting in possible site area increases	L7
15.	It is possible for a plant failure to cause all of the water entering the WTP to overflow. An operational requirement is to safely discharge this water from the treatment process.	L8
Proximity		
16.	Watercare require reliable access to the water treatment plant and treated water tanks at all times for operational purposes. Heavy vehicle access will also be required for chemical deliveries and construction works. This is typically for a B-train sized vehicle for other treatment plants. Thus, the main access road must be suitable for heavy vehicle usage and if there is a high risk of a slip, a second vehicle	P1, P2

	access must remain possible.	
17.	The new water treatment plant and treated water tanks are required to integrate into the existing water supply system to maintain or exceed the existing and required levels of service. Suitable connections are required to the existing raw water and transmission systems such that the levels of service are met or exceeded.	P3 – P7

Appendices: Initial Review of Site Principles

A review of the site principles was completed by CH2M Beca, with input from GHD and T&T to confirm their validity, consistency and applicability to the site selection process. The table below provides the comments to the specific principles outlined in the "Guiding Principles for Huia WTP siting" document.

Review of Principles

	Principle	Comment
1	**Elevation**	
1.1	The site shall enable the installation of treated water reservoirs to support a Minimum Water Level (MWL) of 128.0 m RL in the treated water reservoir ■ 128.0 m RL is the MWL identified to enable the treated water transmission network to operate effectively ■ The MWL shall be set at a reservoir level of 0%. ■ Assuming a treated water reservoir with an invert level at the nominal ground level this would require a site elevation of approximately 128.0 m RL ■ Assuming a treated water reservoir with an invert level at the nominal ground level this would require a site elevation of approximately 128.0 m RL ■ Raising the MWL beyond 128 m RL is not prohibitive, but offers limited marginal benefit to the network operation and conflicts with the principle to minimise pumping as far as practicable, by introducing significant hydraulic inefficiency ■ A maximum reservoir height (Top Water Level – TWL) of 5 meters (above finished ground level) and minimum reservoir height (TWL) of 0 meters (above finished ground level) is considered reasonable ■ On this basis the site would require a minimum finished site elevation range of ~ 128 – 133 m RL, depending on the proportion of the reservoir that is sunk into the	This is higher than the design level for the proposed Woodland Park Reservoir, and the Titirangi Reservoirs. The treated water reservoir needs to have a TWL at or above that of the Titirangi Reservoirs (115m). This is because: a. There should be a gravity supply to Albany reservoir b. There are a large number of BSPs that are supplied directly off the head of Titirangi reservoirs and any reduction in this level will affect the supply to customers. This results in the Manuka Road site and the existing Huia WTP meeting this principle. Other points to consider are: ■ A MWL is typically the minimum operating level and usually 30%. ■ Water depth of a reservoir is typically in the range of 8-10 m for economic reasons- we propose to remove this assumption.

	finished ground level	
1.2	Minimise pumping as far as practicable	This is a valid principle as it is appropriate to minimse operating costs and it promotes sustainability.
1.3	The site shall support direct gravity flow from the Upper Nihotupu Dam at the minimum off take level. ■ The Upper Nihotupu Dam has a TWL of 217.78mRL and minimum off take level of 183.44mRL ■ The existing pipework that could be fully or partially reinstated depending on the site location is ~ 610mm ID. ■ A maximum flow of 54 ML/d, should be assumed when considering sites and the pipework required to supply to these sites from the Upper Nihotupu Dam. ■ Depending on the distance from the site to the Upper Nihotupu dam or existing pipework the head loss will be variable. This head loss and/or new infrastructure requirement should be considered when evaluating site location options. ■ Provided the site is not elevated above the resultant gravity feed HGL which based on the minimum dam off take level is likely to be in the range 140 -180 (dependent on the site location and pipe size), it is unlikely that this requirement will constrain the site selection.	This is a valid principle because it allows for future resilience through maintaining a gravity supply from the western dams, and an alternative flow path around the Huia Aqueduct. A maximum flow of 54 ML/d from the Upper NIhotupu Dam is the maximum consented flow. To achieve this flow to the Huia WTP, it is understood that additional capital investment is required.
1.4	No connections are permissible to the pipework between the WTP and the treated water reservoirs. ■ Accordingly the distance between the WTP and network shall be minimised to promote infrastructure efficiency. ■ Siting the treated water reservoirs and the WTP on the same/adjacent sites is preferred.	This is a valid principle because otherwise those connections are vulnerable if there is an outage at the WTP. The preference to have the WTP and treated water reservoir on the same site will increase the reliance between an off-site raw water pumping station and the WTP. This principle is more suited to the location or proximity principle.
1.5	As per the current site operation, the site elevation shall only require either treated water OR raw water pumping (from the aqueduct), not both. ■ This either requires that the WTP is elevated above the Treated Water	The principle to only pump once is valid as it maintains existing system resilience through the reliance of multiple pump stations. The proposed Manuka road site would require both raw and treated water pumping if the

	Reservoir TWL, enabling the WTP to gravity feed to the reservoir under all conditions and that the raw water is pumped out of the aqueduct to this elevation OR, requires the WTP is at an elevation that enables gravity flow from the aqueduct (TWL of 119.00 and invert at 117.61) under all conditions and the treated water is pumped to the treated water reservoir TWL. ■ Given that the strong preference is to co-locate the treated water reservoir and the WTP, siting the WTP at an elevation sufficient to gravity feed treated water to the treated water reservoir is preferred. –Allowing for approximately 5mH2O head loss through the WTP processes and a maximum reservoir height of 5 meters (TWL 133), this will require a TWL of approximately 138 at the beginning of the WTP process. ■ Incorporating a reasonable allowance for maximum (8 meters) and minimum (0 meter) structure height above the finished ground level. ■ On this basis the finished WTP site elevation would need to be in the range: –~ 130 - 138 at the head of the WTP process. –~ 125 – 133 at the end of the treated WTP process to gravity feed to the treated water reservoirs.	reservoir BWL was at 128 m RL. A level below 117 m RL appears feasible with a gravity feed to the plant and a treated water pump station pumping water up to the treated water reservoirs on another site. This would also only require two sites. A 5m headloss is appropriate for the anticipated DAF/ozone/GAC process train. A worst case scenario would be if this turned into a DAFF/ozone/GAC process which would add another 3m head loss, but this seems unlikely. A structure height of 8 meters above ground level should be conservative. Two elevation bands are recommended; one with a gravity raw water system and pumping to a Reservoir and the other with raw water pumping to a combined WTP/Reservoir site.
1.6	This provides a relatively narrow finished site elevation range. ■ Minimum finished site elevation is 125 (for 8m tall structure at the end of WTP process) ■ Maximum finished site elevation is 138 (for 0 m tall structure at the commencement of the WTP process. ■ An allowance beyond this range should be incorporated for reasonable site cut and fill. A reasonable starting point would be to identify sites with a nominal site elevation in the range 120 – 145.	We are proposing to revise this principle to: The treated water reservoir will be located within an elevation band with: ■ A gravity feed from the Upper Nihotupu Watermain. ■ A gravity feed to the Titirangi Reservoirs. ■ This is approximately within the range of 105 m RL to 180 m RL. ■ It is noted that exceeding the level of the Waitakere WTP provides little benefit from a supply perspective, and provides a significant cost in Opex.
2	**Size**	

2.1	The site shall be sized sufficiently to support the proposed water treatment process and infrastructure. ■ As a basic estimate Kawamura (2000) recommends the following relationship: A > Q0.7 (where A = area in acres and Q = plant capacity in MGD). Using this relationship a 140 ML/d WTP, requires a site area of ~ 51,000 m2. ■ Given that relatively high rate treatment processes have been provisionally adopted the MWH concept is developed on a parcel of land approximately 26,000 m2 for the main WTP, 5,800 m2 for the two service reservoirs, 500 m2 for the raw water pumping building and ~ 3,500 m2 for reuse of the existing attenuation pond. This equates to a total of ~36,000 m2 and represents a relatively efficient and tight configuration. ■ The existing WTP site is approximately 20,000 m2, with no onsite storage and no upwash tank and restricted site ring road access.	It is recommended to split this into site size requirements for the WTP and the Treated water infrastructure with a preference to locate both on the same site. It would be preferable to err on the larger rather than smaller size. The Manuka Road site development area should be set as the minimum area i.e. 36,000m2 plus some additional site area credits for some usable space on the existing plant site e.g. for construction accommodation/laydown. The Manuka Rd site is tight because it may not have ideal laydown and temporary accommodation/facility area for safe construction, and secondly one might question how large the attenuation pond should actually be - the existing 3500m2 might have been driven by what area was available rather than what volume was desirable. It is likely that not all parts of a site would be usable e.g. excess slopes, front setback, landscaping, or desire for buffer distances to neighbours. The following minimum land area criteria are suggested to guide site size: ■ Treatment plant alone (no attenuation lagoon/storage, or reservoirs) : 40,000 m² ■ Add for attenuation storage: 10,000 m² ■ Add for reservoirs: 15,000 m² ■ Total area for WTP plus Attenuation: 50,000 m² ■ Total area for all infrastucture on one site: 60,000 m² (land reserved for 2nd reservoir could be used as construction laydown initially).
2.2	Allowance should be made for site discharge flow attenuation. ■ The size allowance of the site discharge attenuation pond shall be aligned with the volumetric requirements to enable compliance with the likely consentable discharge rate to the local (site specific) receiving environment, and the discharge volumes generated during the baseline off specification scenario. Where required, this may need to be simplified by adopting the sizing of the current site attenuation pond. ■ Where sites are practicably able to utilise the existing site attenuation pond, consideration should be given to reducing this size requirement accordingly.	This is a valid principle.
2.3	No allowance should be made for	This principle cannot be assessed without

	future capacity expansion.	reviewing the Watercare's future supply-demand balance. There may be benefit in increasing the capacity of the plant in the future to operate at a higher output during peak periods.
2.4	Allowance should be made to support a future transition to an advanced oxidation process for emerging contaminants. This shall be peroxide dosing to supplement the planned ozonation system.	This is probably not allowed for in the above analysis. In any case the site requirement is not significant - unlikely to be more than 500 m2.
2.5	The site aspect ratio should allow for an optimal site layout ■ Assuming a maximum 2:1 length to width site ratio, the narrowest site dimension should not be less than ~ 130 m	This is a constructability consideration, and is not required as a principle.
2.6	On this basis sites greater than 35,000 m2 should be considered	This is a valid principle, but is for the finished site. This will require areas for laydown and temporary offices during construction.
3	**Location**	
3.1	The site must allow the new WTP to be constructed, commissioned and tested without interrupting or compromising the supply security of the existing Huia WTP.	This prevents the use of the existing site so suggest this is modified to: The site must allow the new WTP to be constructed, commissioned and tested without interrupting or compromising the supply security of the Watercare supply system
3.2	The site must be within the Auckland municipal boundary.	This is a valid statement but will not be a determining factor in the site selection process and we propose to remove it.
3.3	The site must not be located on a known earthquake fault.	There are inactive faults but no active earthquake faults identified in the Waitakere Ranges
3.4	The average slope of the site, where the structures would be constructed, is not greater than 10 percent.	This significantly limits suitable sites in the Waitakere ranges. It is recommended that this is changed to 20%; any greater than this would present access and construction issues
3.5	The site must not be prone to slips or flooding.	This is two separate points- slips can often be engineered out unless there is global instability. Flooding susceptibility is valid
3.6	The site shall not be located in the Upper Huia, Lower Huia, Upper Nihotupu or Lower Nihotupu raw water dam catchments.	This is a valid statement because of the contamination risk this would present to these sources. It would also set a precedent for others to construct within these catchments
3.7	The site location shall avoid sites of cultural significance.	It is proposed that this is modified to: The site shall minimize environmental and cultural affects
3.8	The site location shall avoid sites containing scheduled trees that would prohibit infrastructure construction or compromise operation.	We propose to remove this and cover this aspect by revised principle 3.7

3.9	All connecting pipe mains must be in public roads.	Given the topography of the area, some tunneling may be required. It is recommended that this statement is modified to: “It is preferred that all pipelines are in public roads”
3.10	The site must provide a reasonable means of gravity off spec/overflow discharge to a local receiving environment.	This is a valid statement. Further information is required for off-spec/overflow requirements.
4	**Proximity**	
4.1	The site shall be accessible by existing roadway suitable for road tanker transport.	This is a valid statement as heavy traffic is required for construction, maintenance and operation of the new infrastructure. However, there is a difference between operation and construction in the frequency of heavy vehicle movements
4.2	For roadways that are prone to slips, road access must be provided to the plant from at least two directions.	As site access may be required at any time, this is an appropriate principle. Definition is required during the evaluation stage on the types of vehicles required to access the site if there is a slip on the main access way. I.e. is only operator access or also chemical deliveries required?
4.3	The connection point to the treated water network shall allow the existing transmission network to operate as designed, without the requirement for major modification.	It is recommended that this is modified to state that the transmission system should be operated to meet all required levels of service. This allows more flexibility if the Reservoir/treatment plant location is a significant distance away from the Huia aqueduct
4.4	The site shall be within a reasonable distance to an appropriate treated water network node, that enables the transmission network to operate as intended.	This principle is valid as any new infrastructure is to maintain or improve the existing system and required to meet all required levels of service.
4.5	The treated water reservoirs shall connect to the North Harbour 1 Watermain at a suitable location and the Titirangi reservoirs at a suitable location.	We propose to revise this statement to: The proposed site will be capable of supplying the Titirangi Reservoirs and the WMNH2 using new and/or existing infrastructure
4.6	The connection point to the raw water headworks shall allow the raw water headworks to operate as designed.	It is proposed to modify this principle to state that the raw water headworks shall operate as intended. The term designed can be read to state that the existing infrastructure (e.g. the Huia Aqueduct) must be maintained and this may not be the best option.
4.7	The site shall be within a reasonable distance to the existing raw water supply infrastructure.	This is a valid statement.
4.8	The raw water connection shall be made to the existing raw water aqueduct.	This principle limits possible design options. It is proposed to modify this principle to connect to the existing infrastructure downstream of Mackies Rest. Where practicable, existing infrastructure should be utilised.

Other general comments from the principles review are:

- The existing site principles will discard the proposed Manuka Road site, and the existing Huia Water Treatment Plant (WTP) site.
- The bottom water level (BWL) of the proposed treated water reservoir is higher than the design level for the proposed Woodland Park Reservoir, and the Titirangi Reservoir.
- The elevation and site size conditions are based on a single parcel for both the WTP and Treated Water Reservoir.
- There is no mention of the avoidance of significant ecological areas (Waitakere Ranges)
- There is no mention of the avoidance of heritage buildings.
- There is no mention of the avoidance of significant Mana Whenua areas.
- There is no mention of a required buffer zone between the proposed sites and neighbours.
- There is no mention of any electrical requirements to the site.
- There is no requirement for the number of properties to be acquired for a potential site.

Recommendations

The existing principles are very tight, and would discount the proposed Manuka Rd site and the existing Huia WTP. These should be relaxed to allow for these sites to be included.

The site principles are largely technical requirements; the environmental, social and cultural impacts of the site will need to be assessed during the multi-criteria analysis.