Construction Method Statement

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1 BACKGROUND

Hamilton City Council (HCC) has Infrastructure Acceleration Fund (IAF) funding from Kianga Ora to develop a new water reservoir and associated pump station. These assets will provide drinking water security of supply to what is known as the Red Zone water supply zone, which is effectively Hamilton's city centre. Work on the project to date has determined that the proposed reservoir will be located close to the existing Ruakiwi water tower in Hamilton Lake Domain. The reservoir has an ancillary valve chamber structure to house all the valves and instruments required to operate the site and is the subject of this report. Discharge pipes then run from the valve chamber some 150m down Clarence Street to a new pump station that is being constructed to serve the higher level customers in the supply zone.

1.1 Purpose of report

This report has been prepared to provide a construction methodology predominantly for noise assessment purposes. It is anticipated that the contractor will make amendments to some of the sequencing and staging. But it is expected that the method presented here will represent the broad methods, including size of machinery used in the construction process.

1.2 Boundaries of report

Construction activities associated with the HCC IAF programme of work extends into the road corridor and into Clarence Street. This scope of this report is limited to the works at Hamilton Lake Domain. The site is subject of a designation to construct two reservoirs. This method statement only considers construction of the Stage 1 reservoir because construction of the Stage 2 will be constructed as a separate project in the future.

2 OVERVIEW OF DEVELOPMENT

The reservoir site development includes development of a reservoir with 25ML of usable water storage capacity. The development includes a secondary structure (valve chamber) to house the inlet and outlet pipework for the facility. Both the reservoir and valve chamber components will be shrouded in a façade wall such that the facility integrates into its park environment. The overall approximately 1Ha, foot print of the final development includes hard and soft landscaping to further complete integration of the facility into its surrounds as shown in Figure 1 below.

Figure 1: Image of Final Stage 1 Development

The reservoir will be constructed of precast 60 concrete panels with an internal diameter of 62m and will be approximately 10m tall. The walls will have cast in situ stitch pours between the panels and be post tensioned once the stitch pours are complete. Both the floors and the roof will be cast insitu and post tensioned. It will be partially buried on the Ruakiwi roadside boundary and will be sited on an engineered platform on its downslope extent to the southwest. The top water level has been selected so that the Central City water supply zone can largely be serviced by gravity in the event of power failure.

The valve chamber is constructed below grade so that pipework from the base of the reservoir can flow under gravity through the facility. The chamber is approximately 18m long and 14m wide constructed with precast panels and stitch infill concrete. It will have a steel portal frame that sits atop the concrete structure as depicted in Figure 2.

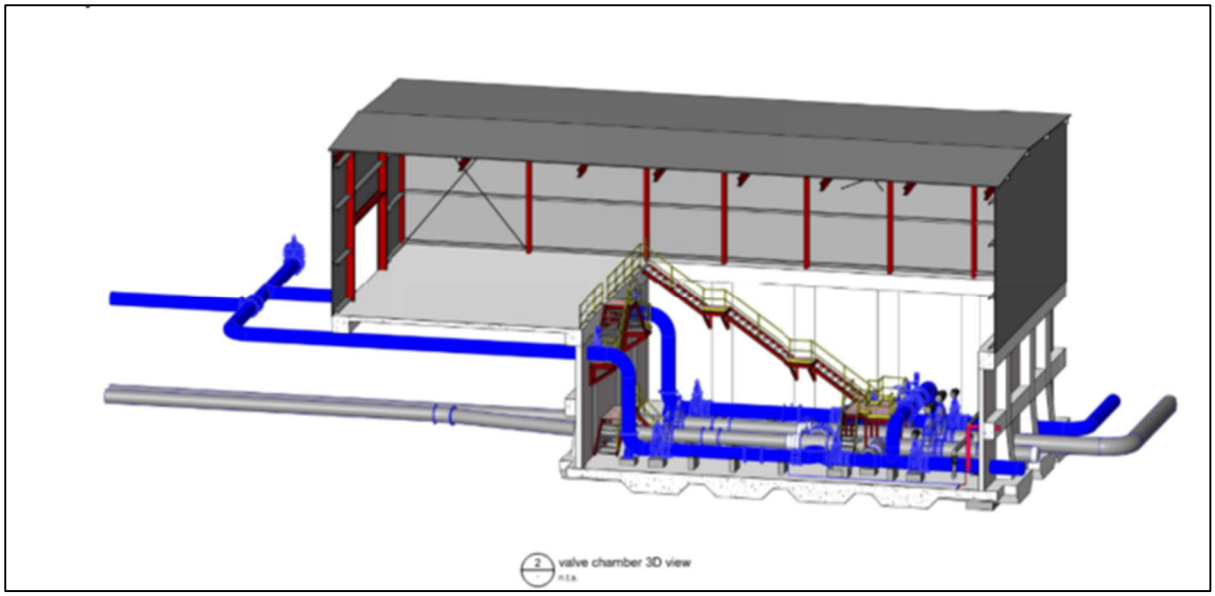

Figure 2: Sectional Isometric of valve chamber structure

Hard and soft landscaping will complete the development. The primary elements of the hard landscaping is an architectural façade wall that wraps the combined primary elements, providing a visual barrier of the facility. There is also an elevated public walkway constructed of mass concrete block wall wrapping around the reservoir. These elements will be complemented with other hardstand areas for operational vehicles and to improve public pedestrian access through the park.

3 CONSTRUCTION METHODOLOGY

The construction methodology below has been structured to provide an indication of build sequence. This methodology does not attempt to capture every activity on site but provides a broad overview with a focus on activities that require large machinery. A level of conservatism has been built into the sequence durations. It is anticipated that the build will take between 24 – 30 months.

Some of the sequencing will be altered if the intended award date of the contract is different from that currently planned because of some environmental restrictions for tree removal and the like. It has been confirmed that preloading will be required for the site of between 4-6months, which will be confirmed during detailed design. The timing of this will impact the sequencing and will predominantly impact whether the valve chamber is constructed concurrently with or in advance of the reservoir.

3.1 Site Establishment

Site establishment will include activities that will occur concurrently including site set out, tree works, installation of erosion and sediment control measures, preparation of site access, set up of contractors offices and facilities, and developing a site fence around the perimeter of the site. A preworks site plan is included in Figure 5Figure 5. This will take approximately 2 weeks to complete.

A smaller excavator (5-8t) will be used for installation of the construction access points and installation of silt controls. A larger excavator will be used to strip topsoil (discussed in further detail in Section 3.2). Hiab trucks will be used to deliver site offices.

Tree Works includes tree relocation, pruning and removal. A staged approach to the tree works will be undertaken to lessen the impacts of the trees to remain.

There will be 32 trees relocated 23 trees to be removed. Tree relocations will use a tree spade such as shown in Figure 3. Tree pruning and removal will use chain saws and mulching equipment. Stump grinding will be required to lessen the extent of stump removal required during earthworks. It is expected that the tree works will take 2-4 weeks to complete and be carried out during other establishment activities.

Figure 3: Tree Spade

3.2 Bulk Earthworks

Once the tree works are complete the site will be stripped of topsoil, primarily stockpiled as an earth bund around the perimeter of the site, upstream of silt fences. Once the site has been stripped of its topsoil, the bulk excavation works will be undertaken.

In total, there is approximately 13,650m³ of material to be cut equating to approximately 1700 truck movements, if six-wheeler trucks are used. Some preloading of the proposed reservoir site, so some of the cut material will be used for this activity. It will take 6-8 weeks for the bulk earthworks. Once placed the preload material will remain in place for 4-6months.

Approximately, 100m of sheet piling is required, depicted in the green line in Figure 4. This will require approximately 200 piles to be installed and will be vibrated into position. This activity will take 10-15 days to complete. Sheet piling will be completed during the earthworks phase of the works, where the earthworks will be partially completed prior to piling starting and will continue after the piling is complete.

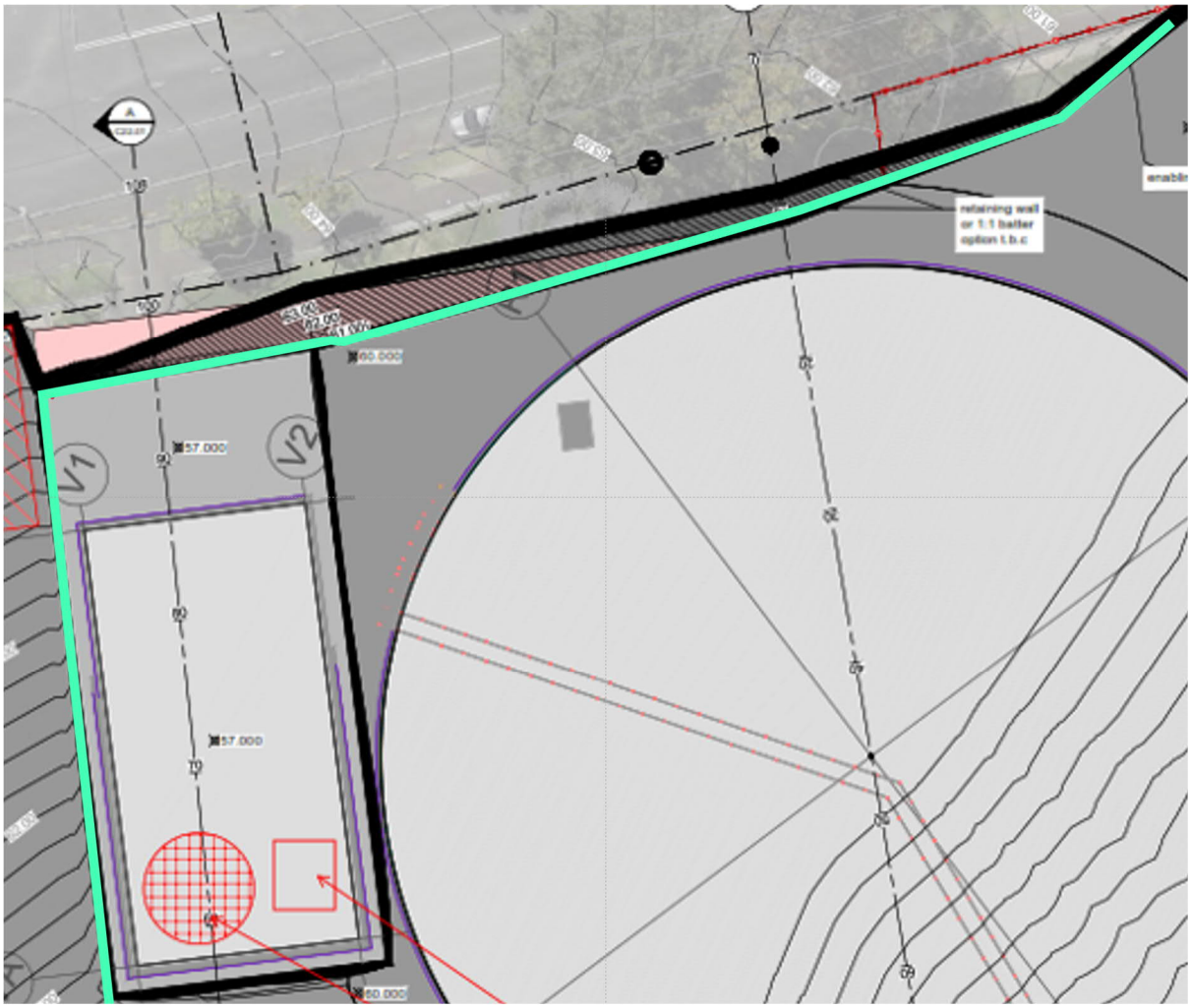

Figure 4: Sheet piling extents (in green)

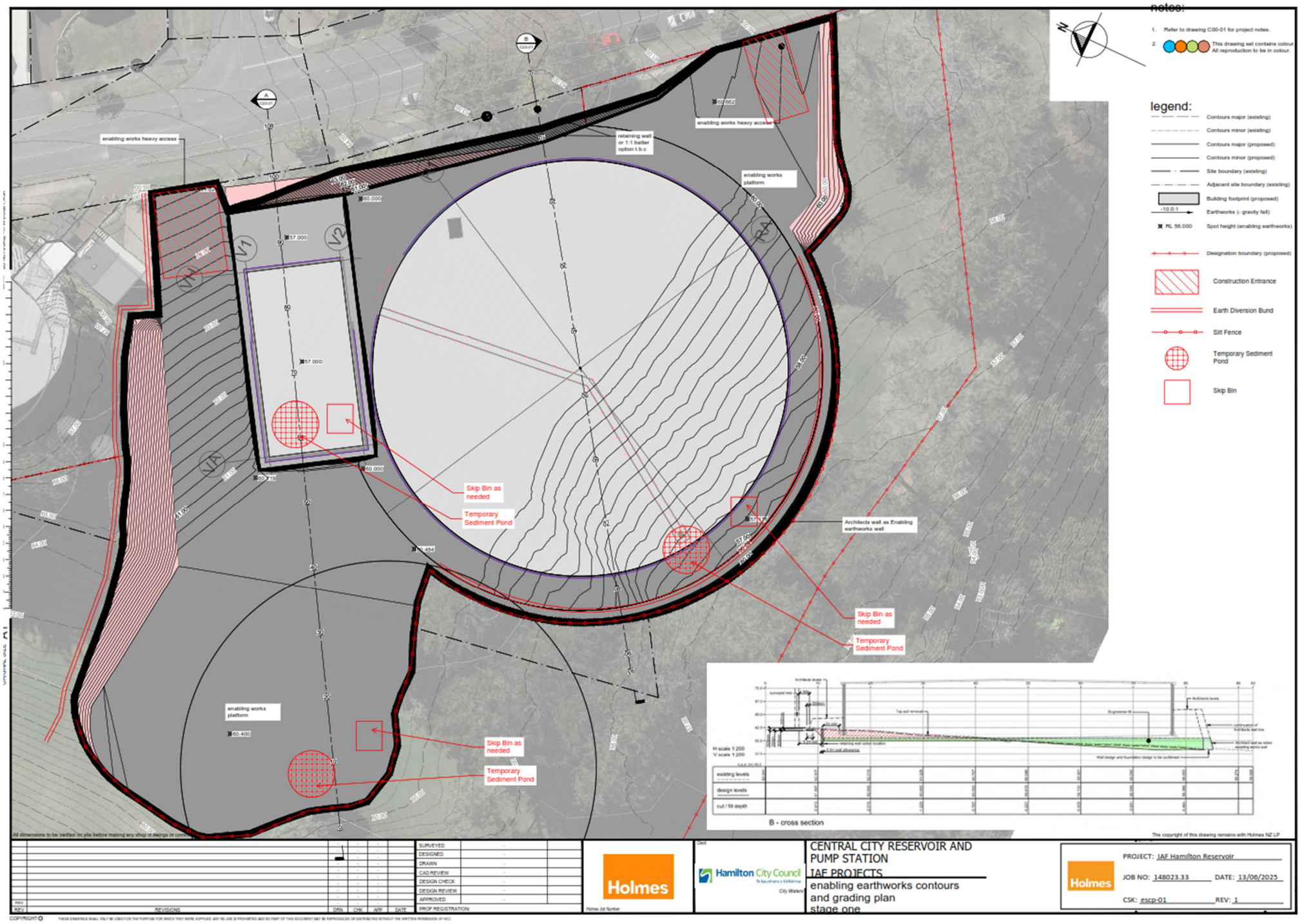

Figure 5: Site Establishment Works

Bulk earthworks will take approximately 4-6 weeks and will be undertaken using a couple of larger excavators 25-35t, a site 25t dump truck while the preload site is being developed (1wk). The earthworks are shown in Figure 1Figure 6, with the darker shades of red depicting greater excavation and green areas showing fill. Approximately, 30% of the total import volume of circa 6000m3 of material will be introduced to the site during the bulk earthworks phase.

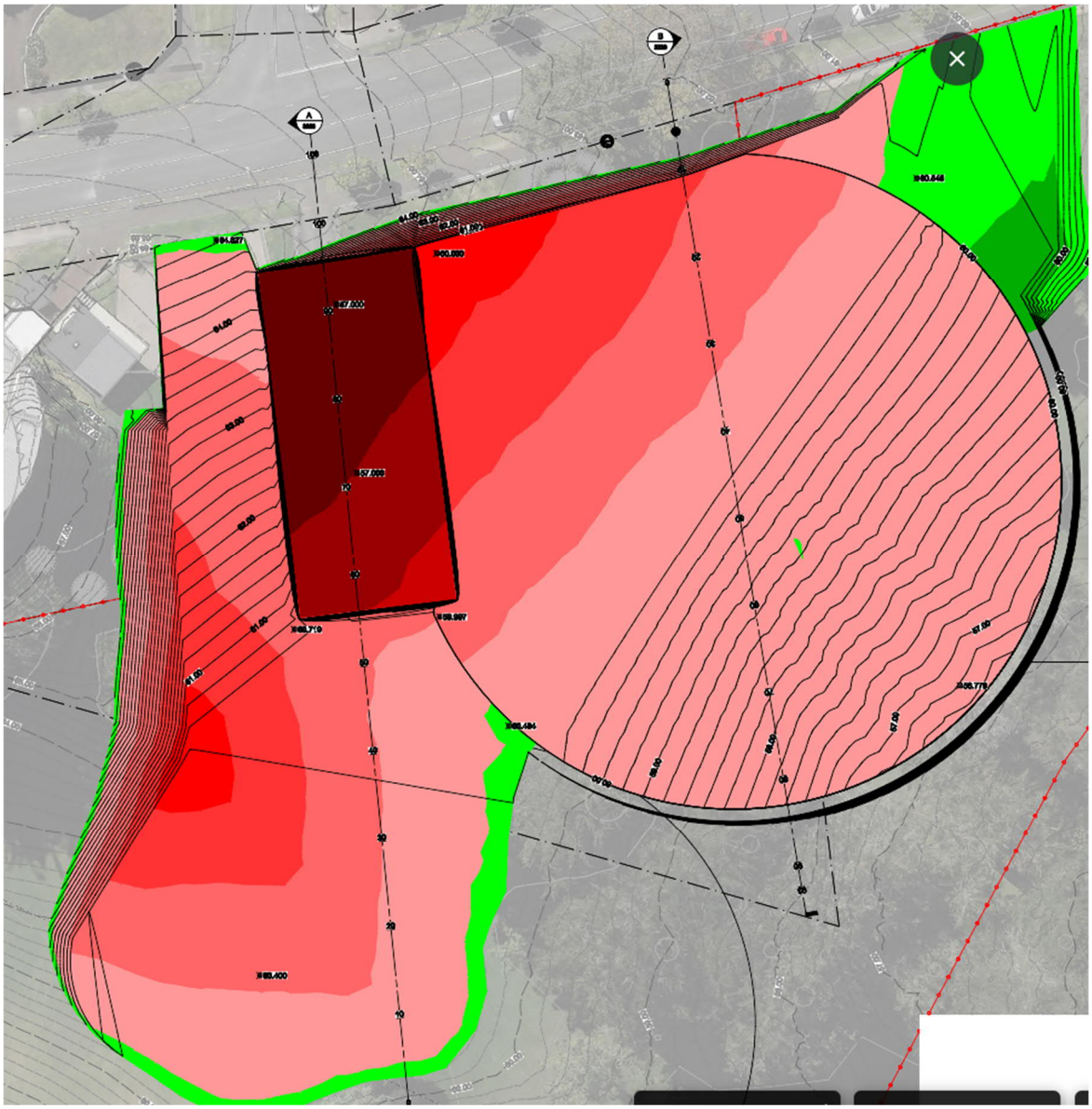

Figure 6: Bulk Earthworks

Engineered material will also be imported onto the site progressively as the bulk earthwork is undertaken to ensure the site remains largely stabilised and to provide a better access for truck movements.

3.3 Stormwater Pipeline

During the earthworks phase, work will also commence to construct the new scour outlet between Hamilton Lake and the main construction site. Work for this activity will commence at the lake and work its way uphill towards the proposed reservoir site. The outlet structure is shown in Figure 7.

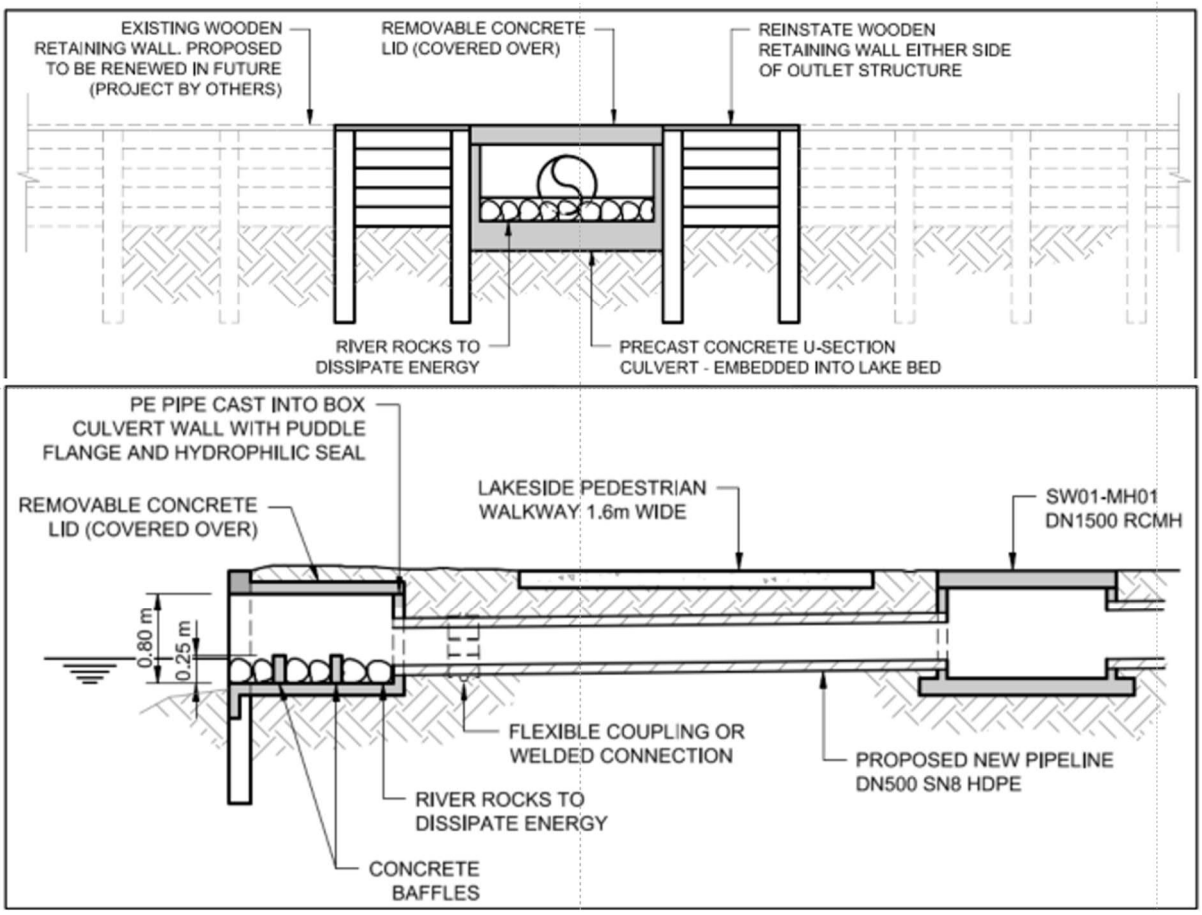

Figure 7: Scour/Stormwater outfall

A small coffer dam will be constructed at the lake edge like that shown in Figure 8 to facilitate construction of the scour/stormwater outlet, the outlet itself will be a precast concrete structure of approximately 1.5m wide x 2m long and 1m deep. It will have a removable lid and contain energy dissipation baffles. Once the structure is in place work will be completed to reinstate the lakes retaining wall that is located on either side of the proposed outlet structure. The outlet structure will take 6-8 weeks to construct.

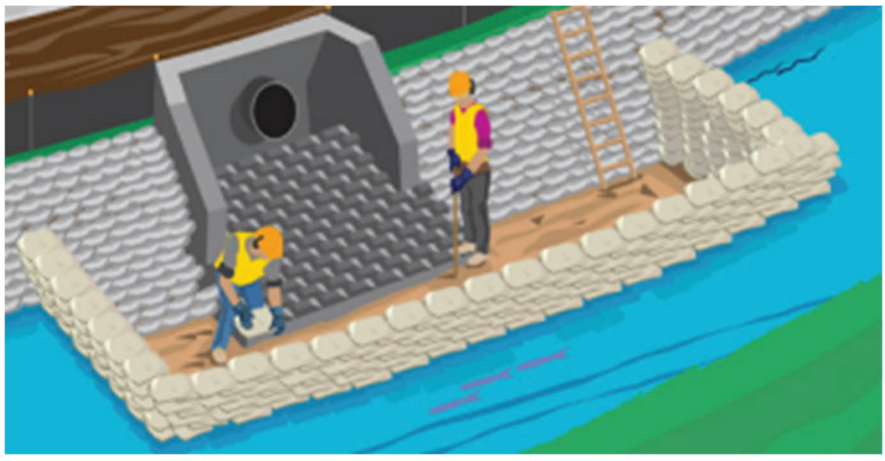

Figure 8: Image of typical coffer dam construction for work undertaken at the edge of the lake

Once the energy dissipation structure is built, works will progress to construct the scour/stormwater pipe back up towards the reservoir. The site will be progressively reinstated and "bought-in" to minimise the period that construction is being undertaken in the more highly used area of the park.

Work on the stormwater pipeline will utilise an 18-23t excavator, with assistance from a smaller 8-12 t excavator for backfilling operations. The pipeline is being constructed through the road, which will require a small amount of saw cutting and asphalt placement. Permanent works on the stormwater pipe will progress up to the edge of the construction site. The existing water tower scour will be tied into this outlet to bypass the construction site. This first section of the stormwater pipe will take approximately 4-6wks to construct from commencement to reinstatement.

3.4 Discharge mains

The main discharge pipes that run from the reservoir site down Clarence Street will be constructed concurrently with the scour/stormwater outlet. It is anticipated the drill will be set up in Clarence Street, drilling up hill to the valve chamber site. The drill rig will have its solids management located at the pump station site. This way the pilot bores can drill up to the reservoir site where the back reamer will be installed and from there they will back-ream to create an annulus large enough for the product pipe.

Product pipe will be welded and strung out in the construction area and encroaching in the reserve. There are two discharge product pipes to be installed, and these will be constructed sequentially. The drilling activities from the time the drill establishes will be approximately three months.

Drilling the discharge mains will take the pipes short of the to be constructed valve chamber. The area is circled in greed in Figure 9 below, noting that the other pipework shown in this image will be constructed after the discharge pipes are constructed.

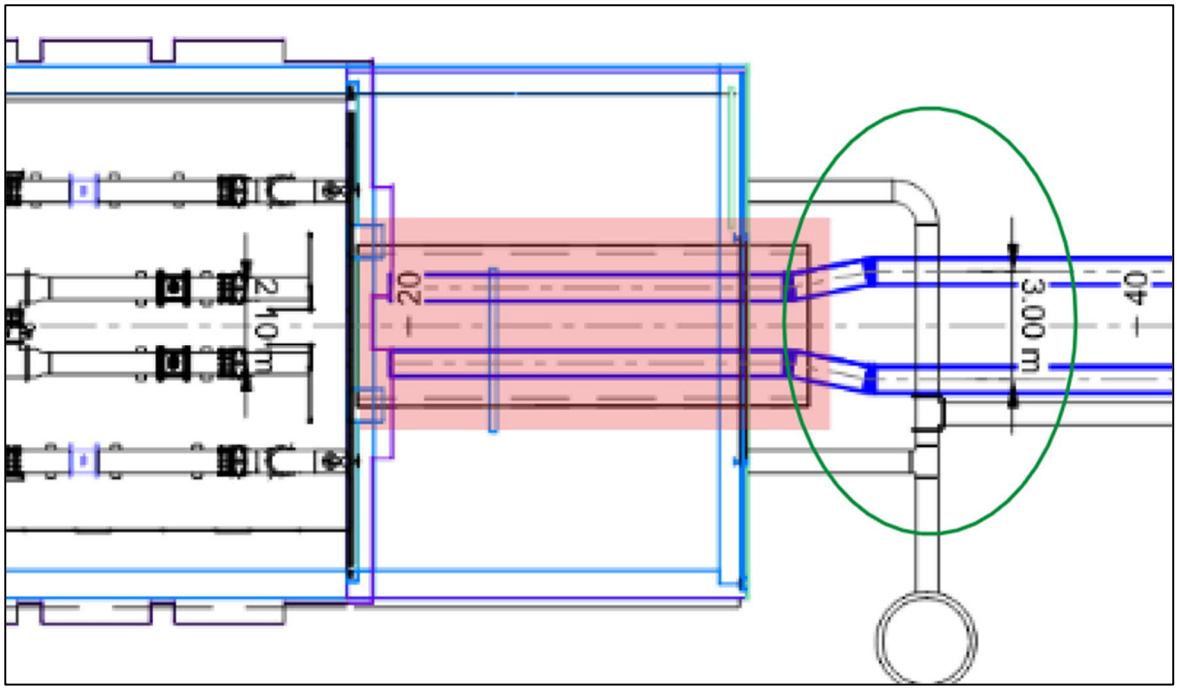

Figure 9: Valve Chamber and discharge pipe configuration

3.5 Valve Chamber

Construction of the valve chamber will commence once the discharge pipes have been drilled and installed to the edge of the site. Works will be carried out in the following sequence:

Preparation of subbase	This work is placing engineering grade material (GAP 65 & GAP 20). A 8 – 12 t excavator will be used for this, followed by a roller and or plate compactor. A number of truck movements will be required to deliver the materials to site.
Construct concrete floor	Insitu concrete, deliveries of steel to site and a large concrete pour. There is potential to undertake this in several pours depending on logistics. Either a boom pump parked on Ruakiwi Road or a line pump on the main site will be used for these pours. A single pour will take approximately 6 hours of placement so would likely be completed during normal working hours.
Erect precast wall panels	Crawler crane on site for duration – this will take three days to establish/assemble on site with a smaller mobile crane. Panel installation will take 1wk. There will also be an elevated work platform used for this work.

	The crane will be an approximately 400t machine.
Construct wall stitches waler beams and pillars	This will require insitu formwork construction, steel fixing and concrete pours. It is likely to take 5 days. There will be several smaller pours using a boom pump. Work will use the crane and elevated work platform.
Apply tanking to VC	This work requires small tools and use of elevated work platforms and access equipment.
Discharge chamber box culvert installation	The precast culvert box culvert that abuts the valve chamber will then be installed using the crawler crane and take 1wk.
Discharge Pipework installation	The discharge pipes will then be constructed between the end of the drilled section and the valve chamber but not inside the valve chamber.
Valve Chamber Portal Frame	The above ground section of the valve chamber is constructed of a steel portal frame with colour steel cladding. The steel framework will be erected concurrently with the reservoir preparation works. The cladding will be done later in the programme. Fabrication of the steel frame will be off site with minor welding undertaken on site during the fit up. The installation will be undertaken using elevated work platforms, small tools and the crawler crane.
Cladding and Roof installation	A roofing company will clad and install the roof of the valve chamber. This work predominantly uses small tools and elevated work platforms and will take 2-4 weeks including installation of gutters.
Valve chamber fit out.	Fitout comprises installing the gantry crane, installing stairs and access platforms, connecting the discharge pipes to the internal valve chamber pipework, constructing the internal electrical and control room, running electrical cable tray and cables, installation of instrumentation and small diameter pipe work. Pipe fabrication will predominantly be carried out off site with fit up on site. It is not a critical

	path activity and will be undertaken concurrently with other works. There will be approximately 5 -10 main deliveries of fabricated pipe delivered to site. Fitout includes the electrical installation that will be completed once all the pipework is installed. The fit out will take approximately 3-4 months to complete.

3.6 Reservoir Preparation works

Reservoir preparation works is the work comprises elements of the work that are between the newly constructed valve chamber and the reservoir. It includes preparation of engineered fill that the reservoir will be placed on.

There are multiple sections of pipe that are to be constructed between the valve chamber and the reservoir. These will be constructed in this period before work commences on the reservoir itself. Works comprise installation of pipe work and manhole chambers. This work will take approximately 6-8 wks and will use a 18 23 t excavator.

3.7 Reservoir Construction

As mentioned in the introduction, preloading will impact the sequence of the reservoir/valve chamber construction. If possible, these activities will be constructed concurrently but this methodology has been developed on the assumption that commencement of reservoir construction will be hindered by the preloading of the site. The elements of reservoir construction are as follows:

Preload material removal	This is a bulk earthworks activity and will take approximately 1 week.
Importing of engineered subbase/ potentially site concrete	This preparation will take approx. 10-15 days and will involve excavators and compaction equipment. This will be approximately 40% of import material to the site.
Construct reservoir floor	This will involve insitu placement of reinforcing steel and post tensioned ducts, and a concrete pour. The concrete pour may be conducted as either one or two pours (two is more likely). This concrete pour will be significant and is likely to commence outside working hours (i.e. an early start 5-6am for first truck delivery). The pour will be in excess of 1200M3, require some (circa) 200 trucks and boom concrete pump(s). Once the

	floor has cured the post tension strands will be installed and the floor post tensioned. Floor construction will take approximately 4-6 weeks.
Panel Installation	The panels will be lifted into place. The crawler crane will be relocated such that it can operate centrally to lift panels into place. There are 60 panels to be installed. The panels are substantial and will be delivered per site with one panel per truck. Panel erection will take approximately 4 weeks.
Column installation, panel infill pours, and roof beam installation	Once all the panels have been placed. Stitch pours will be constructed. Scaffolding will be required. There will be concrete pumping with a boom pump and deliveries of precast elements to site. These activities will take 12-16 weeks.
Post Tension the walls	This involves installing post tension cable through preinstalled ducts and then tensioning the cables and will take approx. 1-2 weeks.
Reservoir Foundation Nibs	This requires insitu boxing, steel fixing and concrete placement. Two weeks construction. Pour in one or two smallish pours.
Reservoir roof construction	The reservoir roof will be cast in situ with formwork supported using shore loading. The roof will be completed in two halves to reduce the amount of formwork required. The area to be cast will be “decked out” and the steel placed. A single large concrete pour will be completed to construct each half of the roof. Each pour will be relatively large (circa 450m3) and require an early start to the day to received the 75 trucks of concrete. A boom pump, concrete vibrators and potentially a power float will be used for this activity. The roof will require 7 days of curing before the shoring can be relocated to the second section. Post tensioning will be completed after the roof is installed and has sufficiently cured. Scaffolding will be removed through the hatches using the crawler crane.

	The roof will take approximately 12-16 weeks to construct.
Reservoir Structure finishing works	Finishing works to the reservoir include, installing the internal pipework, install remaining sealants, installing stairs and other internal steelwork. This is not critical path.
Commissioning Works	The timing of the reservoir commissioning works is dependent on completion of the water associated works at reservoir (i.e. res and valve chamber works), as well as the pump station works in and pipelines in Clarence St. Commissioning includes undertaking a drop test (filling the reservoir with water), cleaning the structure and readying it for service. Commissioning is not dependent on the architectural works or landscaping being completed and will be undertaken concurrently. Commissioning of the facility will take approximately 4-6 weeks.

3.8 Architectural Treatments and finishing ground works

Once the reservoir structure is largely completed back filling for the buried sections and construction of the mass block wall will progress. The works are outlined below in a somewhat chronological order but there will be aspects of concurrency with these activities.

Backfilling	Back filling will occur largely using imported material. Approximately 1500m3 of material will be imported to the site for this activity
Mass Concrete Block wall	The mass concrete block wall will be constructed concurrently with backfilling of the reservoir. The wall is some 200m long and varies in height along its length, from a single block height to a course of 6 blocks at 500mm intervals. There will be approximately 250-300 blocks to form the installation at a weight of 750kg per block; i.e. approximately 15 deliveries of blocks. These will be lifted into place with either an excavator or small crane truck. An 8-12t excavator will be used for much of the back fill, with a smaller

	machine (3-5t) taking the backfill up to finished level. A plate compactor or a small roller will be used prior to steel placement. It will take approximately 6- 8 week to construct the wall and back fill.
Drainage and paving	A footpath will be constructed on top of the retaining wall at 5m wide. The depth of the footpath will be stage. The footpath will tie into a channel drain that runs around the perimeter of the structure and feeds into the site stormwater system. This activity will predominantly be constructed using small tools apart from the concrete pours for the driveways and paths. These will be poured progressively as the site is finished off. There are likely to be 5-10 individual concrete pours for this phase.
Façade wall.	An exo-skeleton will be installed around the perimeter of the water facility from which the façade will be installed. The façade will be approx. 500 lineal metres and take 12 weeks to install. Areas of façade that do not back onto the reservoir or valve chamber will be supported from free standing columns that will be installed using a pendulum auger mounted to a 12t excavator. Installation will be from a combination of elevated work platforms with assistance from a telehandler for lifting the structural steel into place. Small hand tools will also be used.
Balustrades, stairways, external lighting	A balustrade will be installed around the perimeter of the mass block wall. There will also be stairs installed to obtain a permanent access to the roof of the reservoir, and an accessway across the roof to the hatches. There will be various external lights installed, some of which will be ground mounted and others will be pole and building mounted. These items will be lifed into place with cranes and telehandlers. And will take approximately 4 – 6 weeks to install.

Planting and Reinstatement	The site facilities will be removed with the final contouring to reinstate the site. There are elements of final hard and soft landscaping that will be completed. Small and medium excavators and other items of small plant will be used during this phase. This will take 6-8 weeks to complete with regular maintenance of this work for a period immediately following completion.