INNOVATIVE STORMWATER TREATMENT ASSET CONVERSION AT AUCKLAND MOTORWAYS

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ABSTRACT

The New Zealand Transport Agency’s Auckland Motorway Alliance (AMA) maintains and operates the Auckland motorway network and is dedicated to improving the motorway experience for customers and stakeholders. The AMA have a large variety of stormwater management assets and must ensure that they deliver the right level of network service, and that safe and healthy outcomes are achieved for people, plant and the environment.

This paper outlines details of a NZ Transport Agency “Think outside the Box” award winning, innovation project. The project involved the conversion of an unsafe and inefficient Stormwater treatment device, from a Sandfilter into a StormFilter. This project is a great example of how a project team can ‘innovate’ to achieve ‘resilient’ and ‘future ready’ outcomes.

Monitoring, maintenance, and operational activities on an existing operative sandfilter exposed contractors and the public to health & safety risks. These risks involved exposure to highly toxic gases, confined space entry and required traffic control measures that resulted in a loss of network efficiency and availability.

Through positive collaborative engagement with specialist stormwater management suppliers, Stormwater360, the team were able to assess the technical and physical viability of the proposal to convert the Sandfilter into a StormFilter.

To support this innovation a business case including a net present value (NPV) assessment was undertaken, and a managerial approved variation to existing Resource Consent was secured to enable the activity.

This innovative project involved retrofitting hydraulic & operational enhancements to the existing infrastructure and partnered design and construction to deliver functionally successful and innovative outcomes.

KEYWORDS

Auckland Motorways, SW360, Maintenance and Operation, Innovative, Sandfilter, StormFilter, Stormwater Treatment Conversion, Retrofit, Health and Safety, Life Cycle Cost Analysis

PRESENTER PROFILE

Troy Brockbank is a civil engineer and the Design Manager with Stormwater360 New Zealand. He has over ten years professional experience in the stormwater industry and has developed specialist skills in designing and constructing innovative stormwater management solutions.

Peter Mitchell is a principal environmental engineer; an associate with Opus International Consultants and the stormwater asset manager of the Auckland Motorway Alliance. Peter has 24 years of experience in Stormwater Management and Environmental Engineering. Peter provides practical, safe, and innovative solutions for challenging projects, and delivers whole of life and value for money outcomes to meet and exceed customer and stakeholder expectations.

1 INTRODUCTION

The Auckland Motorway Alliance (AMA) maintains and operates the Auckland motorway network on behalf of the New Zealand Transport Agency (NZTA). The AMA is dedicated to improving the motorway experience for all stakeholders with a focus on;

- Delivering operational excellence
- Enabling smarter journeys
- Growing ideas
- Sharing knowledge and expertise
- Living Alliancing at its best

The AMA maintains and operates numerous stormwater management assets on the Auckland motorway network. This includes all elements of a traditional stormwater 'drainage' collection and conveyance network, such as slot drains, catch-pits, manholes and pipes; waterway and network crossing culverts; pump stations and soakage disposal systems. This network hosts the highest concentration of stormwater treatment devices (and rapidly growing) of any asset network in New Zealand (Mitchell, 2015).

Regionally, nationally and internationally stormwater treatment systems remain relatively new assets; as such some very important lessons are still being learned about their good management. At the time of design and delivery, the whole of life value and operational safety risks are not well understood for many stormwater treatment assets along the Auckland motorway network. In recent years, the AMA have been monitoring treatment asset functional performance and condition deterioration; the findings have determined that some sandfilters (particularly proprietary 'modular' sandfilters) are highly susceptible to premature failure and can present some significant operational and maintenance safety risks.

As a result of the monitoring program, an existing sandfilter located in Luke Street, Ōtāhuhu, Auckland, New Zealand was identified as being unsafe and furthermore an inefficient Stormwater treatment device. Monitoring, maintenance, and operational activities on this existing operative device exposed contractors and the public to health & safety (H&S) risks. These risks involved exposure to highly toxic gases, confined space entry and required traffic control measures that resulted in a loss of network efficiency and availability.

The AMA explored multiple options to improve the existing asset including; reconfiguring the existing sandfilter, total replacement of the asset and retrofitting with a superior treatment device. With over 1250 cartridges across 85 assets installed on the Auckland Motorway network, and a proven public asset maintenance 'best value for money' track record (Hannah, 2012), a proprietary radial cartridge media filter (StormFilter™) was the logical choice as a retrofit option.

AMA enlisted specialist stormwater management company Stormwater360 New Zealand (SW360) to the project team to provide design services, and assess the technical and physical viability of the proposal to convert the Sandfilter into a StormFilter. The project objectives being to meet or better the treatment requirements of the existing resource consent in addition to safeguarding the viability of health and safety for operation and maintenance, whilst providing best value for money.

Troy Wheeler Contractors (TWC) subsequently joined the project team as the retrofit contractor. The project team provided positive collaborative engagement to achieve the final solution and met the project objectives. Hydraulic, operation, maintenance and health and safety risks were identified, assessed, and either eliminated, isolated or minimised by order of preference through a combined team safety in design process.

The delivered innovative retrofit project was an NZTA "Think outside the Box" award winner and a great example of how the project team 'innovate' to achieve 'resilient' and 'future ready' outcomes.

2 BACKGROUND

The existing 'Luke Street Sandfilter' is located adjacent to the northbound shoulder of State Highway one (SH1) and to the south of the Ōtāhuhu Creek, in Ōtāhuhu, Auckland, New Zealand (Figure 1).

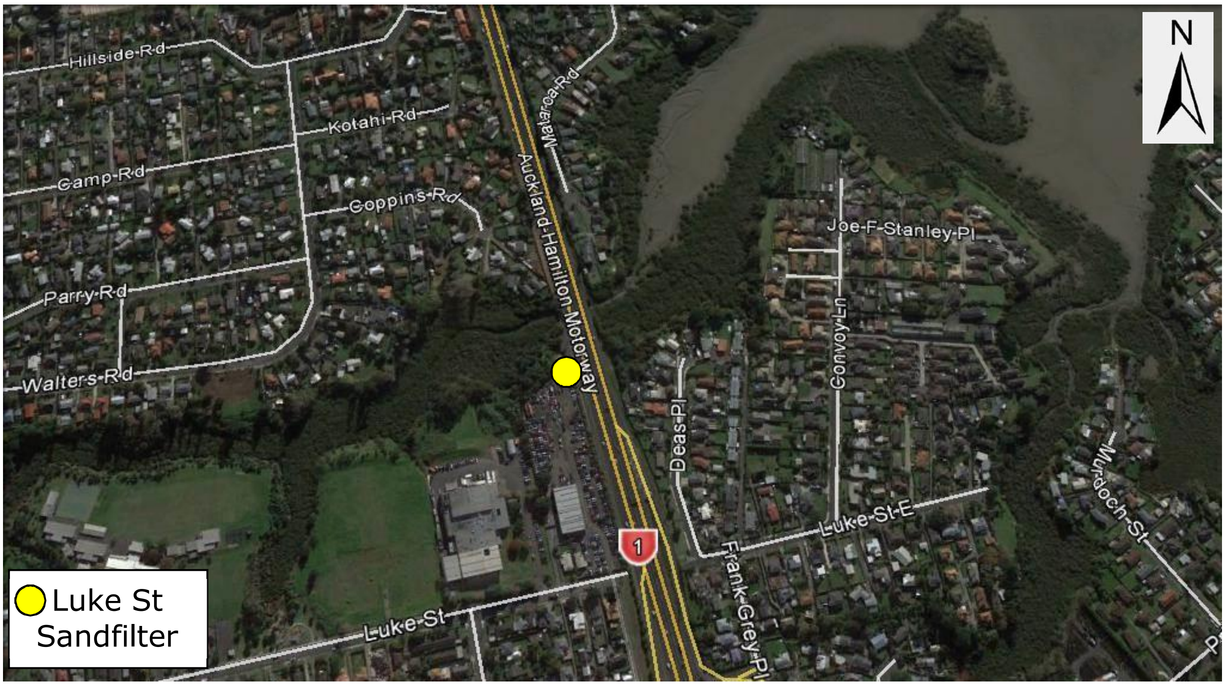

Figure 1: Locality Plan - Luke St SandFilter (Source: Google)

The sandfilter was constructed in early 2007 as part of the 'Waiouru Peninsula to SH1 Connection' Project provided by legacy Manukau City Council (MCC) & NZTA. The total project involved the construction of a new (Highbrook) interchange on State Highway 1 between the existing Papatoetoe and Ōtāhuhu interchanges. This involved widening to 8 motorway lanes between Ōtāhuhu Interchange and the new interchange, and upgrading the Ōtāhuhu on and off ramps on the western side of the interchange (GHD, 2010).

3 ORIGINAL (SANDFILTER) ASSET

The original Luke St sandfilter was a modular proprietary sandfilter system. It was designed as a volume-based stormwater device in accordance with Auckland Councils Technical Publication 10 (TP10) (2003) to provide water quality treatment of >75% Total Suspended Solids (TSS) on a long-term average basis as required by the site resource consent conditions (GHD, 2010). The total designed contributing catchment to be treated by the sandfilter was for 6,500m² impervious motorway between the Ōtāhuhu Creek to south of Luke Street (T Miller, 2013, pers.comm., 30 October).

3.1 OPERATION

Stormwater runoff entered the stormwater reticulation network through traditional roadside catchpits located along the SH1 Luke St northbound off-ramp and associated auxiliary lane. Peak flows were discharged via piped reticulation to an offline configuration sandfilter treatment system, consisting of an upstream pre-treatment sedimentation chamber, and two downstream conventional sand filtration treatment chambers (Figure 2).

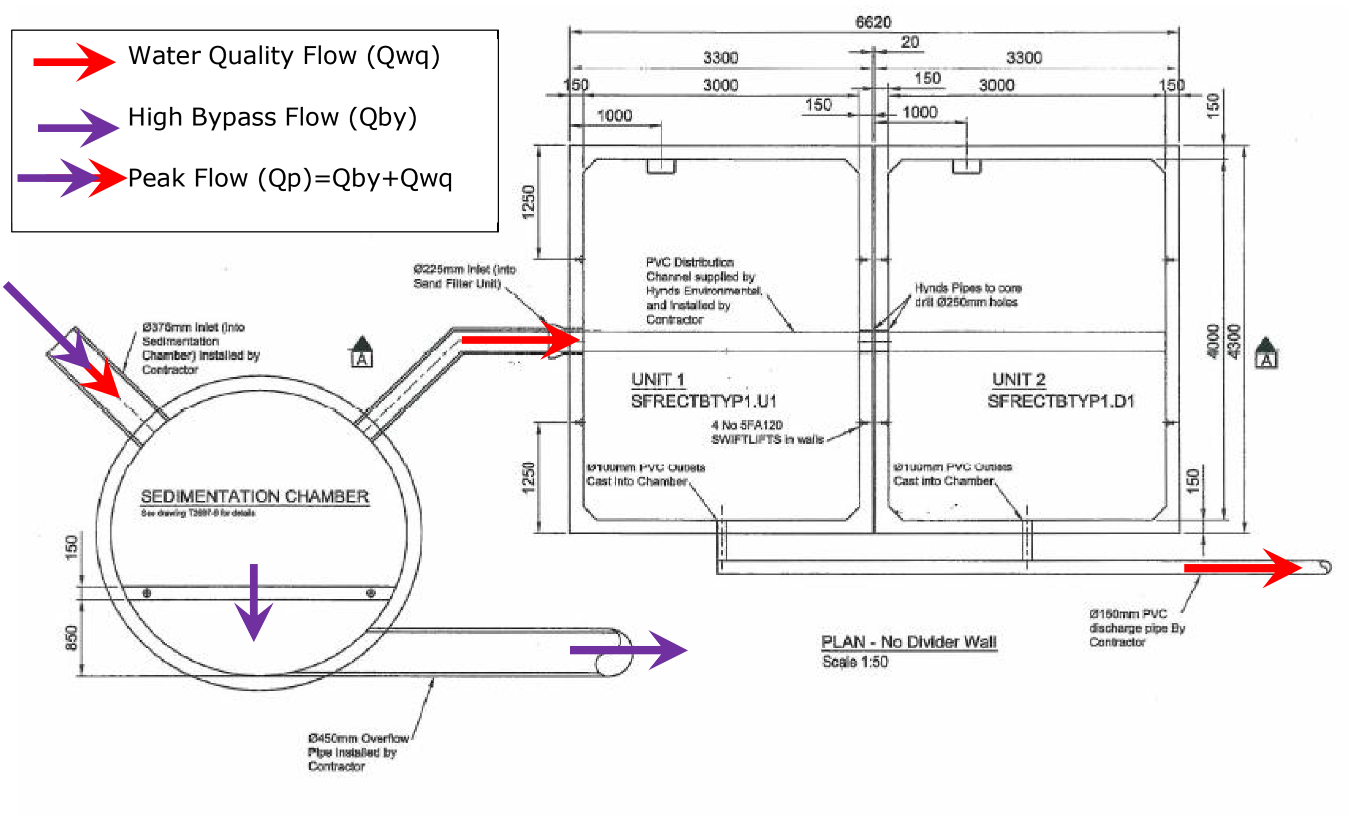

Figure 2: Original Sandfilter Layout Plan (Amended from Source: Hynds Environmental)

Peak influent flows entered the pre-treatment sedimentation chamber, a 3.2m dia manhole, via a 375mm reinforced concrete pipe (RCP) inlet. The chamber provided primary settling and capture of large/coarse sediment particles during low flows, up to and including the water quality flow (Qwq). Low flows exited the chamber via a 225mm diameter RCP outlet, located 910mm below the inlet pipe, and discharged to the downstream filtration chambers for treatment. The internal base of the sedimentation chamber was located 390mm below the low flow outlet invert, and provided a permanent water sump to aid sediment storage and prevent resuspension of collected material. A weir, with top of weir located 300mm above the inlet pipe invert, spanned the width of the chamber and provided for an offline peak diversion bypass for high flows greater than the water quality flow. High flows were then discharged via a 450mm dia RCP to a downstream manhole prior to outfall.

The main sand filtration treatment was contained and spread across two proprietary pre-cast concrete modular box culvert units; each having a 3m x 4m internal footprint. Untreated influent entered the first filtration unit onto a 200mm dia half pipe PVC channel, which provided distribution of influent evenly across both units. Treatment was provided by filtering influent through a 400mm layer of sand, beneath the distribution channel, upon geotextile. A 2.05m ponding layer, located above the distribution channel, provided live storage attenuation of incoming flows and ensured that the total water quality volume passes through the filter without bypass. The ponding layer depth also provided hydraulic driving head to aid percolation through the treatment sand layer. A 100mm dia perforated pipe manifold, located in a 150mm thick drainage aggregate layer, provided for collection of treated stormwater prior to discharge through a solid 100mm dia PVC outlet into an external 150mm PVC manifold. Treated effluent eventually discharged via a 450mm dia RCP to a wingwall outfall located on the banks of the Ōtāhuhu Creek.

3.2 IDENTIFIED PROBLEMS

As result of ongoing monitoring the treatment asset functional performance, and condition deterioration identified by the AMA, this sandfilter was determined to be unsafe and furthermore an inefficient Stormwater treatment device. Several deficiencies were identified with this asset as detailed below.

3.2.1 VEHICLE ACCESS

Maintenance activities needed to be undertaken at night as a w-section guardrail (Figure 3), running along the adjacent motorway, prevented vehicle access to the asset. This meant traffic control was required to close the motorway shoulder and divert traffic from the adjacent lane during every maintenance activity. These closures were typically implemented over consecutive nights (typically 3-4) to allow time to undertake maintenance, which resulted in a loss of motorway network efficiency and availability for road users.

3.2.2 OPERATION

Proprietary underground sandfilters are highly susceptible to premature consumption and failure. The rate of media consumption and the sandfilter filtration profile (horizontal only) meant that when the media became blocked the contaminated runoff will bypass the filtration media and discharge, untreated, direct to the receiving environment of the Tamaki River.

The upstream sedimentation chamber did not seem to be in good working order and did not tend to capture coarse particles. The round chamber provided insufficient flow length to promote setting, however was effective in energy dissipation.

The current sandfilter distribution channel was ineffective, and tend to promote scouring of the sand filter bed and provided uneven distribution of flows.

3.2.3 MAINTENANCE

The sandfilter required regular inspections and maintenance in order to deliver the legal requirements of the Resource Consent operation and compliance conditions.

Pre-maintenance inspections were undertaken in four month cycles and involved non-confined space techniques to determine the condition of the asset for operational functionality, and hence need for further maintenance activities (D Logan, 2013, pers.comm.).

Maintenance was typically carried out every 18 months (average) and involved either rejuvenation or complete renewal of the treatment media. These activities required specialised confined space entry, which exposed operators to health and safety risks associated with the buried nature of the asset and accumulated gases.

Figure 3: View of Sandfilter site from motorway 2012 (Source: Google)

The sandfilter vault system has a 2.0m internal height, and is buried approximately 1.7m below finished surface level. This combined with the fact that it is a closed top sandfilter system means that it is an extremely high risk environment to work inside due to gas exposure and confined space entry needs.

This sandfilter has a history of high levels of highly toxic gases, that have accumulated over time (M Punter, 2012, pers.comm.). The original vault system had poor venting, a single 100mm dia PVC pipe, and only one (manway) access in each unit.

Offset manhole risers on each unit have been installed to prevent a full fall to the bottom of the vault. However, as the access holes are not aligned, it prevents a safe rescue from the confined space (M Punter, 2013, pers.comm.).

Periodic renewal maintenance of the sandfilter typically takes three to four activity (night) shifts. This required traffic management controls to be in place over consecutive nights.

3.2.4 COSTS

Underground sandfilters are very challenging and time consuming to maintain. The operational delivery of the Luke St sandfilter costs on average nearly $15,000 per year to maintain (P Mitchell, 2013, pers.comm.).

3.2.5 HYDRAULICS

The system required a large (2m) driving head to push the required water quality flows through the sand media bed. This promoted surcharge of the upstream pipe network.

3.2.6 AS-BUILT DRAWINGS

The as-built drawings were insufficient as they contained incorrect data and levels.

4 OPTIONS ASSESSMENT

The NZTA has a legal responsibility (Resource Consent) to safely treat and discharge runoff from the consented section of motorway. From a planning perspective, there were three primary options to be considered:

Option A) Do nothing – i.e. retain the existing sandfilter system that has several operational safety risks and is certainly not cost effective.

Option B) Replace or retrofit with an asset that provides an alternative level of treatment performance to that consented – This option will require a new resource consent (costing time and money).

Option C) Replace or retrofit with an asset that provides an equivalent level of treatment performance to that already consented – This option would only require a Managerial approved variation to the existing Resource Consent.

Each primary option was assessed against maintenance requirements with regards to time, frequency and cost. Option C was chosen as the preferred option to achieve these requirements.

Multiple devices were considered as a replacement or retrofit option to tie in with the existing stormwater network. However, with over 1250 cartridges across 85 assets installed on the Auckland Motorway network, and a proven public asset ‘best value for money’ maintenance track record (Hannah, 2012), a proprietary radial cartridge media filter (StormFilter™) was the logical choice as a retrofit option.

5 RETROFIT SYSTEM

The existing Sandfilter structure was retrofitted with StormFilter cartridges to improve hydraulic functionality of the stormwater network, improve operation of treatment device and, reduce time and costs during maintenance activities. StormFilters are proprietary radial media cartridge filtration systems that, like underground sandfilters, are housed within a vault structure. However due to the contained nature of the StormFilter cartridges these assets are a lot less susceptible to accumulating hazardous gases and are a much cleaner environment to work inside as the contaminants are mostly isolated inside the cartridges.

The retrofit project also provided an opportunity to provide vehicle access and safety improvements. The proposed retrofit was intended to reduce the adverse environmental effects on water quality from this catchment.

5.1 STORMFILTER DESCRIPTION

The StormFilter is a proprietary stormwater treatment device distributed in New Zealand by Stormwater360. The device utilises radial media cartridge filters (Figure 4) to passively filter stormwater runoff, capturing particulates, and adsorbing materials such as dissolved metals and hydrocarbons (Hannah, 2012). The StormFilter is an Auckland council approved treatment device for removing >75% total suspended solids on a long term annual basis (Afoa, et al., 2015).

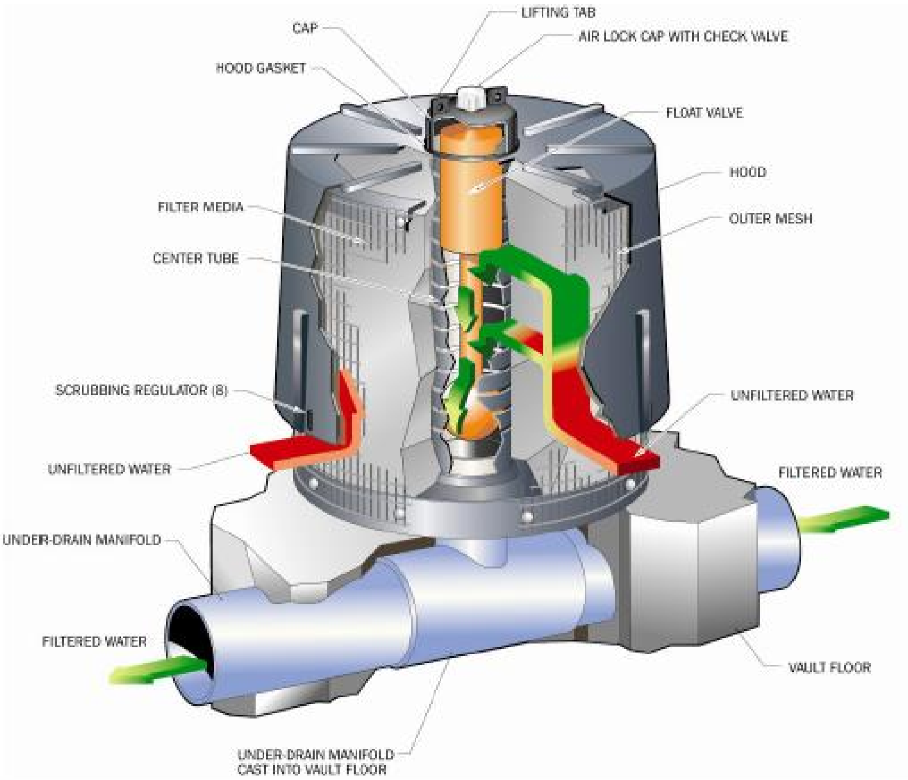

Figure 4: StormFilter Cartridge

The StormFilter is sized as a flow-based stormwater device to treat a water quality flow (Qwq) as opposed to a traditional volume-based device which is sized to treat a water quality volume (WQV or Vwq) (Auckland Council, 2015; Brockbank & Jonathan, 2016). In Auckland, the StormFilter is required to treat a Qwq calculated by rational method using a minimum water quality intensity (iwq) of 10mm/hr, approx. 90th percentile (Auckland Council, 2013; Auckland Council, 2015; Afoa, et al., 2015).

Contaminant loading generated from an upstream catchment can heavily influence the maintenance requirements and frequency of a treatment device (Lehman, 2009; Hannah, 2009). Historically, higher sediment loads are assumed on high trafficked roads (>5000 v/d) compared to typical residential and low trafficked roads (Auckland Council, 2013). However, there is little or no regulatory requirement or guidance in New Zealand on designing stormwater treatment devices for mass contaminant loads. Hence little or no consideration is typically given by designers.

The StormFilter can be designed to a solids-based design method, that measures system loading capacity relative to anticipated solids loading rates (Lehman, 2009), to predict an estimated maintenance frequency. This provides flexibility to designers to balance lifecycle costs with respect to maintenance requirements.

Stormwater360, in conjunction with NZTA and Beca Infrastructure, developed a solid-based design method for public StormFilters on high use roads, and was originally used on the SH20 Manukau Harbour Crossing project circa 2009 (M Hannah, 2011, pers.comm.). The flow rate through each cartridge is reduced to half of the approved treatable flow (approx. 0.7L/s/m² treatment flux). This method increases the number of cartridges required, as opposed to the standard full (approx. 1.4L/s/m² treatment flux) flow-based method, whilst increasing contact time of contaminants and hence removal efficiencies. This method uses a proprietary blend of zeolite, perlite and granulated activated carbon (ZPG) media to target heavy metals as well as TSS. A forebay is also added to aid in the removal of heavier coarse particles and dissipate energy from incoming flows to reduce resuspension of collected material.

This solid-based design method has now been used on approximately 85 separate StormFilter assets, with over 1250 total installed cartridges, installed on the Auckland Motorway network (as at March 2017). This has provided the AMA 'best value for money' with regards to maintenance costs. This method was also implemented by the legacy Waitakere City Council.

5.2 OPERATION

Peak flows from the upstream catchment are discharged via piped reticulation to an offline configuration StormFilter treatment system, consisting of an upstream pre-treatment sedimentation chamber, a new secondary forebay and StormFilter treatment bay (Figure 5).

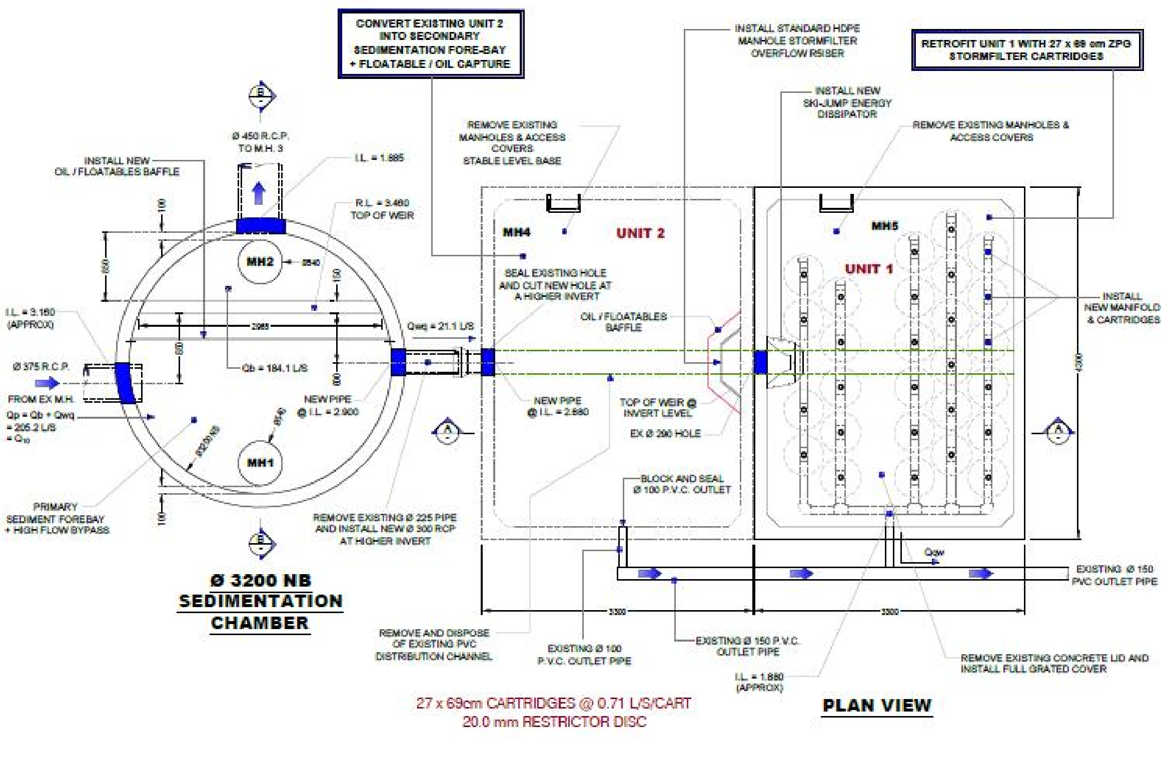

Figure 5: Retrofit (StormFilter) Layout Plan (Source: Stormwater360)

The sedimentation chamber was retained to provide primary settling and capture of large/coarse sediment particles during low flows, up to and including the water quality flow (Qwq). The low flow pipe has been raised to provide for an extended 1m sump, and upsized from a 225mm RCP to 300mm RCP to aid floatables flowing into the downstream units. A new baffle will help prevent oil & floatables bypassing over the high flow diversion weir.

The directly downstream vault unit 2 has been retrofitted to a large forebay to provide secondary sedimentation to remove coarse particles. A weir structure has been installed on the outlet to raise the permanent water level in the unit and to provide a 1m sump. A baffle has been installed on the outlet structure to aid in capture of floatables and prevent discharge to the downstream filtration unit 1.

Unit 1 has been retrofitted with 27x69cm ZPG media StormFilter cartridges (Figure 6) to provide stormwater quality treatment in accordance with the resource consent conditions. This required only minor modifications, primarily underdrainage related to the existing structure.

Figure 6: Installing StormFilter Cartridges (Source Stormwater360, 2016)

5.3 IMPROVEMENTS

As per the initial underpinning objectives for converting the sandfilter to a StormFilter the device has delivered on multiple safety and treatment outcomes. These are further summarised in the sections below.

5.3.1 ACCESS

A new opening in the existing w-section guardrail (Figure 7) has been installed to facilitate vehicle access to the asset without the need for a full lane or shoulder closure, and also allows maintenance activities to be undertaken during the day.

Figure 7: New Guardrail opening. Pre-Sandfilter retrofit (Source: P Mitchell, 2015)

5.3.2 HEALTH AND SAFETY

A safety in design workshop was attended by the entire project team (including designer, contractor, maintenance team, asset owners) to discuss the preliminary design, prior to construction. As a result, numerous safety features have been implemented into the final delivered product.

A significant improvement has been the removal of the original concrete lid and replacement with a webforge grating (Figure 8). This feature will help to reduce the risks associated with confined space entry by; decreasing the need for an confined space entry ie visual inspection can be undertaken from above without entering asset, decreasing risk of gas exposure, accumulated highly toxic gases and associated need for venting, and increasing visual contact with confined space entrant and better access points for rescue.

Handrails (Figure 9) have been installed on the perimeter to the asset to help prevent falls from heights into the device.

Figure 8: Grated top of StormFilter Retrofit (Source: T Brockbank, 2016)

Figure 9: Handrails installed on StormFilter Retrofit (Source: Stormwater360, 2016)

5.3.3 OPERATION AND MAINTENANCE

StormFilters designed using the solids-based method are not susceptible to premature consumption and failure, as the anticipated site sediment loads have been allowed for. StormFilters provide filtration treatment on both the horizontal and vertical profile, and their nature of operation (by activated siphon) generates a healthy 'self-rejuvenation' of the treatment filtration media.

The increase in permanent pool water in the upstream sedimentation pond, and the conversion of the existing structure into a forebay will also aid in prolonging the life of the StormFilter cartridges and extend the overall frequency between maintenance events.

5.3.4 TIME

StormFilters typically only need biannual monitoring (compared with 3 x p.a. for a sandfilter). Full maintenance of the asset is anticipated to be undertaken every 18-24 months, and importantly the periodic renewal maintenance of the 27x69cm Cartridge StormFilter will only require a single confined space entry exercise and a single shift of activity (compared with 3 shifts for the original sandfilter), providing significant cost savings. The operational benefits of reduced maintenance time and reduced exposure to safety risks associated with gas accumulation and confined space entry needs are significant.

5.3.5 COSTS

StormFilters are much easier to monitor and maintain due to the discreet cartridges that house the media. Unlike sandfilters, there can be high confidence in the timing required to deliver operational maintenance needs for StormFilters. Operational delivery of the retrofitted StormFilter is anticipated to cost, on average, about $2,500 per year (T Brockbank, 2015, pers.comm.), This compared with $15k p.a. for the original sandfilter (P Mitchell, 2012, pers.comm.) will result in an estimated saving of $12,500 per year. In simple terms it will only take six years to achieve payback and positive returns. Not to mention the significant reduction of safety risk in perpetuity.

5.3.6 ENVIRONMENTAL

The StormFilter has been designed using a solids-based method, i.e. a treatment standard over and above conventual TP10 (2003) standards, however still conforming with current Auckland Council approvals (Afoa, et al., 2015). This method focuses on prolonging maintenance of the asset whilst providing enhanced TSS, heavy metals and hydrocarbon removal efficiencies compared to the original sandfilter. This will aid in reducing the risk of premature clogging of the filter, which is typical of modular conventual sandfilters. These improvements will help reduce adverse environmental effects to the downstream receiving waterway, Ōtāhuhu Creek.

6 CONCLUSIONS

The original sandfilter device, constructed in 2007, had been identified as being unsafe and furthermore an inefficient Stormwater treatment device. Monitoring, maintenance, and operational activities on this existing operative device exposed contractors and the public to health & safety (H&S) risks. This resulted in a loss of network efficiency and availability to road users.

The options assessment undertaken by Auckland Motorways identified a unique, and New Zealand first, solution in the form of retrofitting a StormFilter into the original sandfilter structure to improve operation and maintenance, health and safety, and hydraulic issues. The innovative conversion project resulted in several benefits including:

- Improved motorway network efficiency and availability

- A more functionally reliable and resilient Stormwater treatment asset
- Improved monitoring capability and reduced maintenance time
- Safer operations and improved safety for all customers and stakeholders
- Hydraulic enhancements and improvements
- Whole of life value for money and cost savings
- Environmental outcome improvements
- Future-proofed to enable improved performance capability

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REFERENCES

Afoa, E., Blackbourn, S. & Wells, J., 2015. *Stormwater360 StormFilter: Interim Proprietary Device Evaluation, Part 1 – Air, Land and Water Plan Evaluation,* Auckland: Prepared by Morphum Environmental Ltd for Auckland Council.

ARC, 2003. *Technical publication 10: Stormwater management devices - Design guidelines manual.* Auckland Regional Council, Auckland.

Auckland Council, 2013. *TR2013/035; Auckland Unitary Plan stormwater management provisions: Technical basis of contaminant and volume management requirements,* Auckland: Auckland Council.

Auckland Council, 2015. *Code of Practice for Land Development and Subdivision: Chapter 4 – Stormwater.* 2 ed. Auckland: Auckland Council.

Brockbank, T. & Jonathan, K., 2016. *Designing Stormwater Treatment Devices – Resilient Considerations And Implications.* Presented at Water New Zealand's 2016 Stormwater Conference, Nelson.

GHD, 2010. *Waiouru Peninsula to SH1 Connection - Stormwater Management System - Operation and Maintenance Procedure Manual,* Auckland: GHD.

Hannah, M., 2009. *Sizing Stormwater Best Management Practices.* Presented at Water New Zealand's 6th South Pacific Stormwater Conference, Auckland.

Hannah, M., 2012. *Costing Analysis Of A Public Stormwater BMP – A Seven Year Review.* Wellington, Presented at Water New Zealand's 2012 Stormwater Conference.

Lehman, J., 2009. *Intergrating Maintenance into Stormwater Treatment Design.* Presented at Water New Zealand's 6th South Pacific Stormwater Conference, Auckland.

Mitchell, P., 2015. *Stormwater Maintenance And Operations At New Zealand's Most Critical Road Network – Auckland Motorways.* Presented at Water New Zealand's 2015 Asia Pacific Stormwater Conference, Auckland.