Folder [Williamson Pond 2 20240222 weather event]

Williamson Pond Addendum Report

This addendum report is based on rain event 19th and 20th February 2024

Reported rainfall was 40mm.

To be read in conjunction with my earlier report: 20231205 Williamson Park Pond Stormwater Detention Basin Alternate Design.

I conducted a drive around Whangamata on the morning of 22 February 2024 to observe the surface ponding and flooding. Rainfall was heavy during the night and again about 7am.

I have also completed a report dated 22 February 2024 with photos of street and property flooding I observed during my drive around..

My observations are:

1. Surface ponding was not consistent from Street to Street.
2. I believe this is in part because rain does not fall evenly across the Delta
3. No rain water overflowed the weir to escape into the Ocean
4. The pond level rose to almost the soffit level then dropped within 72 hours to what is likely the new water table level after the rain event.
5. This means the hydraulic weight of the pond water either drove the water out the base of the pond, and/or, in part infiltration out the sides of the pond walls into the aquifer because the water level in the pond is higher than the surrounding water table.
6. The deduction is the pond water is recharging the aquifer.
7. The pond capacity and rate of absorption into the aquifer is satisfactory for a 40mm rain event overnight.

Learnings from rain event 19th February 2024

We are struggling to get agreement on how and what to do with the pond(s).

I will classify this rain event as the most substantial rainfall we have had since the winter rains of 2023.

The rain event was a considerable quantity but not a 10%AEP. To reach a 10%AEP would require this level of rain over about an hour.

This means the pond is functioning as a detention pond as it contained all surplus road water runoff for this event preventing any discharge into the Ocean.

The pond level dropped within 72 hours ie good infiltration rates into surrounding aquifer.

My learning's are:

1. Whilst the general water table is low much of the rainwater will be soaking into the aquifer via any permeable ground
2. The pipe system is being charged by a combination of runoff from impervious roads and surplus water run off surfaces that could not keep up with absorbing into the aquifer so became surface water but only from the within the immediate pipes catchment area.
3. The weir did not overflow to the Ocean which means all the pipe system discharge into the pond is 'recharging' the aquifer.
4. The quantity of discharge into the pond could be reduced if the pipes had holes or soakage devices in line to recharge the aquifer further towards the source of surface water entering cesspits.

5. The greatest drainage principle is 'redistribution' - ie moving surplus water from surface ponding to somewhere else where the water can be managed - in this 40mm rain event ALL rain water went into the aquifer either directly or via the pond.

6. The aquifer prior to this rain event was low (compared to after Gabrielle) and could have absorbed a lot higher rainfall incidence. More likely 100mm-150mm which is more like average winter rainfalls.

7. The 19th rainfall event includes a 'first flush' BUT all water was managed and went into the aquifer. Some was detained for 72 hours.

8. This is an important consideration because a stormwater management plan pipes are designed to manage up to 10%AEP.

9. The pipes purpose in this rain event was to redistribute water to the pond so it could be absorbed into the aquifer. The volume of the pond allowed the aquifer recharge to occur over 72 hours.

10. If the pipe system included a series of soakage devices along its length the surface water runoff entering the pipe system could be absorbed over a wider aquifer with the result the pond would not be receiving as much rain water and be capable of managing much larger rainfall events.

11. As no surface water overflowed the weir, no rain water escaped to a waterway in first flush there is a compelling reason to require cleaning devices like the defender.

12. In this rain event the water table was low allowing the pond water to recharge the aquifer in 72 hours. This means last year the pond did not drain because the surrounding water table was too high for the hydraulic head to work.

13. On that basis, when the surrounding water table is above the invert the detention pond is actually a permanent lake and is a liability.

14. If the pond had an outlet to drain out any water above the invert level the surrounding water table if it was higher than the invert would bleed back into the pond and then flow out the outflow pipe into the Ocean. This would mean contaminated water would be discharging into the Ocean. If cleaning water was the issue the defender, if required, would need to be located at the discharge into the Ocean, not as water discharges into the pond.

15. The pond is a 'depression' that relieves the surrounding water table down to its level. The pond therefore serves as a supplementary water table management device. Where the surrounding water table is above the sea level it could therefore drain to the Ocean through the weir by gravity.

16. The act of 'draining the water table to the Ocean will not be contaminated water - it is the water table itself, therefore does not need a 'defender'.

17. This principle, recharging and reducing the water table, could be used right across Whangamata. Dig depressions to recharge or reduce the water table by a series oof connected pipes or overland flow paths and then pipe away when any undesired surplus. Monitoring will determine the mechanics. The depth of the depressions must relate to desired water table management levels.

18. This principle is all rainwater recharges the aquifer until it is unable to cope and then be piped away means lighter rain events in summer and during droughts will be recharge water and not be lost water. The aquifer will benefit.

19. It is expected the aquifer will have varying absorbency, varying infiltration rates and varying pathways to discharge into the Ocean and surrounding water ways. This means the depressions will be tailor made to suit.

20. This process will mean reduced pipe diameters, pipe networks that are individualized, be less disruptive to the environment and services and cost less as we won't have to deal with expensive and high maintenance 'defenders'.

21. The rate of infiltration of the pond water to the Ocean could be vastly improved by removing the material whatever it is from behind the weir. If this allowed more water out the detention pond would work quicker and reduce the 72 hours.

22. The invert pipe is dry again meaning flow rates practically stop once rain stops.

23. We need to rethink the changes required for the pond. It is a detention device to recharge the water table.

24. We can use this concept around Whangamata to effectively drain off surface ponding and to manage the water table should it rise to unmanageable levels.

25. The importance of overland flow paths would be critical as when the water table is high and rainfall exceeds the remaining capacity we will need overland flow paths of suffer extensive surface flooding for extensive periods of time - as we do now.

Implications to design concepts:

The purpose of the pond and its behaviour in rain events is now better understood.

The purpose of the pond as a detention device is required

The issue is the pond water level cannot be managed in its current design and that the water level is controlled by the surrounding water table not what discharges into it.

The issue of having high water levels in the pond means weir over-topping into the Ocean of contaminated water is more likely and pipe discharge rates into the pond are impeded meaning the piped system is unable to operate effectively. This has a cost to us because low flow rates means larger pipe sizes which is more expensive.

The pond does NOT assist in extreme weather events because it is of inadequate volume and the surrounding aquifer is already full.

The pond should not be the overland flow path. That way no 'defenders' are required as all pond water is recharging the aquifer. Allow overland flow to go somewhere else. Overland flow paths do not require defenders.

The weir height is acceptable

The weir itself is acceptable

What is not acceptable is the depth of the pond - now at sea level influence on water table

What is not acceptable is having to dig it out to maintain it

What is not acceptable is the build up of whatever material is behind the weir itself. This is not supporting infiltration

The 'pond' must be redesigned into a detention depression to assist recharging the aquifer

The pipe system needs up grading with holes and more soakage devices along its length to recharge the aquifer en-route to the detention depression.

The only time rainwater will be held in the detention device is when the pipes new soakage devices become overwhelmed to an extent pipes will get water in them - and when the water table is higher than the invert of the discharge pipe.

The weir needs to allow water through the rock baskets.

The pond solution (iii)

1. Cut and mill the Pine trees
2. Cut off the top soil as apparently according to councils 1970 engineer the pond cleaning was to dump the sludge around the pine trees. This needs removing to be used later as top soil.
3. Clean out the pond basin
4. Bulldoze the clean fill from the knoll of the pine trees to the height of the invert.
5. Slope the bottom to the BBQ area (re-contour)
6. Remove the material behind the weir rock baskets (must still be strong enough to repel King tide swells.
7. Install a culvert quarter pipe from the invert to the weir - to marshall smaller rain events preventing ponding and mush areas.
8. Culvert to have holes along the bottom to assist infiltration
9. Consider adding more rocks to the existing weir to strengthen it
10. The re-contoured surround is now the detention area with free flowing slope back to the culvert.

11. Begin modifying the pipe system with inline soakage devices.

12. Reduce the catchment area into the pond by 20% every 10 years

13. Do not need defenders because no first flush can escape to the Ocean.

14. Have a maintenance plan to the soakage devices.

End.

20240222_100309.jpg

Photo taken 8am 20th February 2024 following overnight rain said to be 40mm

Water level in pond approximately 100mm below soffit.

This means it is about 250mm below overflow of weir height.

Ie no rain water entered the Ocean.

There was no debris indicating water level rose to the weir ramp.

20240223_090342.jpg

Photo taken 8.00AM on 23 February one full day after rain event.

Pond level now 400mm above invert. ie 500mm of water in the pond has been absorbed into the surrounding aquifer. It works.

A calculation can be done for infiltration into the water table.

This means the pond does allow recharge of the aquifer.

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20240224_075721.jpg

Photo 8:00AM 24 February 2024 water level now at about 100mm above invert.

ie water table is still being recharged by pond water.

4

20240225_081938.jpg

Photo taken 8:00AM 25 February 2024 now at invert level with just a wetting of the discharge pipe base.

ie water is still infiltrating and recharging the aquifer.

ie in just 72 hours the aquifer has recharged 1:0M depth of water.

Water level has since lowered to about 200mm below invert.

It is noted infiltration rates will observe the common Hyperbola graph - faster rates with head of water and slower as water table level and pond level differential is less

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Date	Water depth	
20230129	1150	
20230202	250	
20230228	800	
20230313	-100	Pumps running for 2 weeks cleaned out
20230318	600	
20230411	1000	
20230429	900	
20230510	1050	
20230618	1000	
20230627	1200	Weir overtopping, sand against weir
20230713	1000	
20230812	700	
20230904	400	
20230922	150	Algae bloom appearing
20231020	150	Massive algae bloom
20231025	-100	Pumps drained cleaning algae bllom
20231031	700	
20231105	450	
20231116	-100	
20231121	400	
20231212	-300	
20240201	-300	
20240222	900	40mm rain overnight
20240223	400	
20240224	100	
20240225	0	
20240229	-200	
20240301	-200	

20240301_140401 _SC_.jpg

Graph is a continuation of my earlier report. I did not collect results between December and this rainfall event. I saw no reason as the water level has remained constant throughout.

The spike on 19th February (the 40mm rain event) highlights the fact when rainfall exceeds a certain level surface water then runs into pipes and into the pond. Lesser rainfall events did not come with pipe discharge.

The 40mm rain spike did not reach weir height so no overtopping into the Ocean.

20240303_235130 _SC_.jpg

The 19th Rain event on a better time scale. It took just 72 hours to fall to -200mm from invert. ie infiltration rates are good when the surrounding water table is lower than the pond water level.

The -200mm will in time reduce but is higher than the start because the 40mm rain would have increased the water table by up to 80mm.