Addendum to

Evaluating Water Storage Requirements for Akaroa Treated Wastewater Irrigation System Using Actual Flow Data from 2018-2023

29 November 2023
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1 Actual flows based on Inflow rather than Outflow meter

On 13 November 2023 Christchurch City Council informed Dr. Martin that the Akaroa Wastewater outflow meter he had used in his work to evaluate the water storage requirements for the Akaroa Treated Wastewater Irrigation System had malfunctioned, and supplied data from the inflow meter PS616 to be used instead from 1 January 2022 onward.

Dr. Martin therefore re-worked his analysis to make use of the new data, and this addendum presents the key findings from his re-analysis.

While there are interesting differences between the inflow meter and outflow meter data, the conclusion of the original evaluation that the storage has been undersized stands, exceeding 20,000m^3 in 2023, and coming very close to that in 2022.

The Inflow data also reveals that the 3,562 m^3per day maximum capacity of the proposed network, which had not been reached with the previous Outflow data, would have been exceeded in July 2023 leading to raw as well as treated wastewater overflows to the harbour.

2 Storage requirement in 2022 using Inflow meter data

For 2022, the storage requirements based on the Inflow data increase slightly from those previously calculated using the Outflow data from 18,558m^3 to 19,629m^3. The chart below compares the old and new storage requirements.

As with the original analysis, the storage has been calculated using the raw data, the data adjusted down for the 75% drinking water retentate reduction that the system sizing is predicated on but the Council has yet to achieve and then for the 20% I&I reduction on which the system is also predicated. Although the Council completed I&I work in 2022, whether any substantive reduction in I&I has been achieved from these works is yet to be determined. The green line including both reductions is therefore the best possible case, it deducts the full 20% from the actual flow data. If the Council determines it has already achieved some or all of this 20% reduction through its work, then applying an additional 20% reduction to the data underestimates the flows.

As with the previous analysis, no population growth over the life of the scheme is assumed, which would increase flows and storage further.

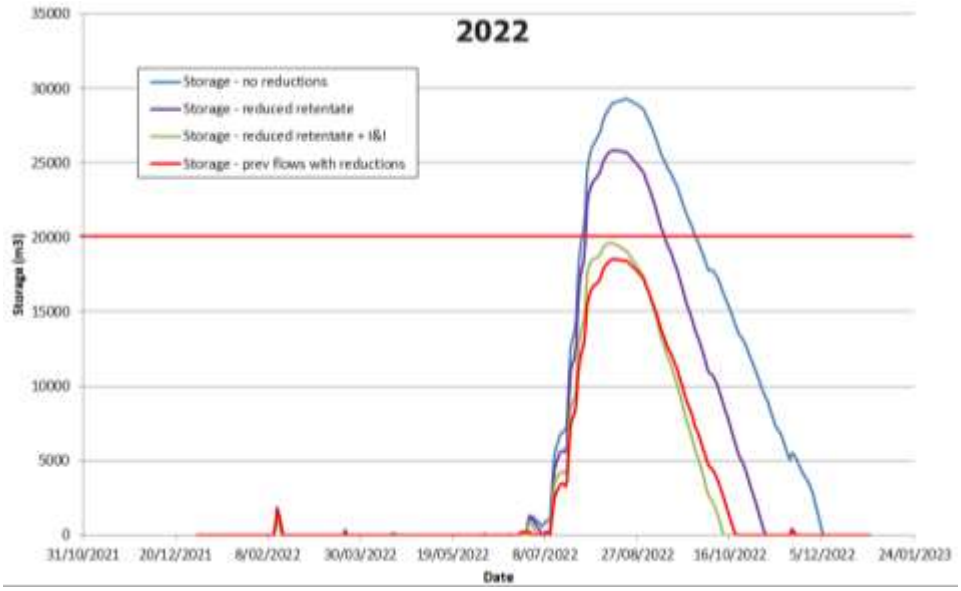

Figure 1 Storage requirement in 2022 based on Inflow meter data compared with previous

3 Storage requirement in 2023 using Inflow meter data

For 2023 using Inflow data with all the reductions applied decreases the storage requirement slightly from the 22,480m^3 stated in the original evaluation to 21,803m^3. This still exceeds the 20,000m^3 maximum storage capacity applied for.

If a 20% reduction in I&I has in fact already been achieved and only retentate is further reduced, the storage requirement remains far above 20,000m^3 at 29,210m^3.

Again the chart below compares the storage requirements for the new Inflow data under the three scenarios (no reductions from current flows, retentate reduced by 75%, retentate reduced 75% and I&I further reduced by 20%) and compares it with the storage requirement in the previous analysis with all the reductions applied.

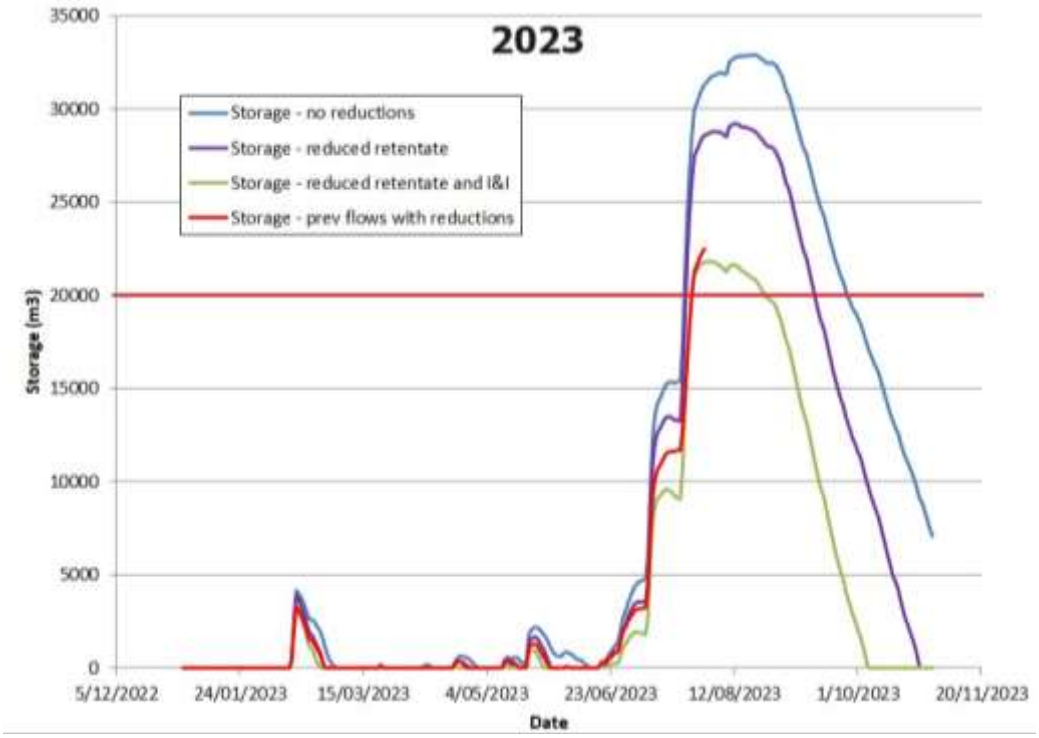

Figure 2 Storage requirement in 2023 based on Inflow meter data compared with previous

Note: The red previous flow line stops in at the end of July 2023, because at the time of the original analysis data was only available until that date.

4 Differences between the Inflow meter data and the Outflow meter data

Comparison of Inflow meter data with the previous data used from the faulty Outflow meter shows significant differences in the flows, particularly during high rainfall events. On several occasions the peak inflows during rain spikes are much higher using the Inflow meter data than the faulty Outflow meter data, as indicated by the green circles on the graphs below.

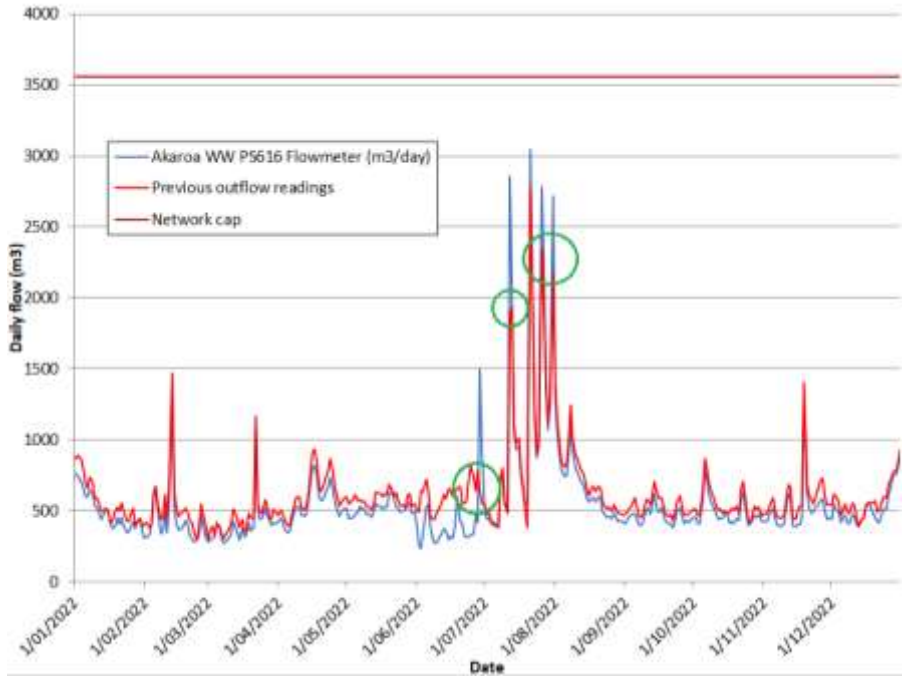

Figure 3 Inflow meter data versus faulty Outflow meter data for 2022

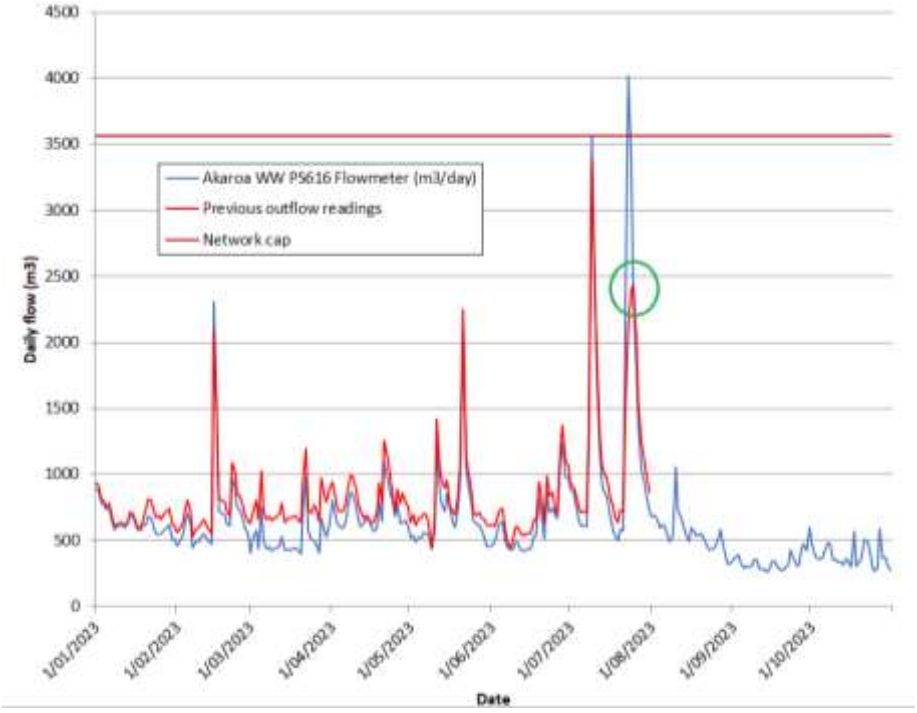

Figure 4 Inflow versus faulty outflow meter readings for 2023

5 New Network flow cap of 3,562m^3 cap exceeded in 2023

Appendix U of the Application provides the PDP Irrigation Model and Water Balance Summary Letter. Under section 3.0, describing how the storage has been sized, PDP set out that when wastewater flow exceeds 3,562m^3 per day it will overflow into the harbour prior to reaching the WWTP (Treatment Plant) and that this value corresponds to the volume from the network during a 24 hour, 1 in 10 year average recurrence interval storm. The red horizontal lines on the two previous Figures highlight this cap.

As can be seen, the flow data from the Outflow meter used in the original evaluation did not reach this cap. However, with the much higher peaks recorded by the Inflow data, this cap has now been breached. On 23rd July 4,019m^3 was recorded by the Inflow meter as arriving at the current Akaroa wastewater treatment plant. It also came very close on 9th July when 3,554m^3 was recorded.

The cap on the new network means that flows exceeding 3,562m^3 per day will not reach the new Treatment Plant, but instead create a raw sewage overflow, whereas under the current network, they clearly do reach the Treatment Plant as recorded by the Inflow meter.

6 Conclusion

Calculation of the storage required based on actual flows from the Inflow meter PS616 rather than the Outflow meter previously used still indicates that the storage in the ATWIS application would have insufficient capacity. The 20,000m^3 maximum storage in the consent application would still have been exceeded in 2023, and would have come very close in 2022, which was well over the 12,000m^3 PDP advised would be sufficient, and the Council planned to construct initially.

The Inflow meter data also shows that the proposed Network capacity cap was exceeded in 2023 which would have resulted in a raw overflow. Of particular concern is that this data appears to indicate that the new proposed network has less capacity to deliver raw wastewater to the treatment plant than the present system.

Both of these results indicate that further reductions to the I&I beyond what has been achieved to date and greater than a 20% reduction, plus the 75% drinking water retentate reduction are essential if the system is to avoid raw overflows and fit within the storage size as applied for.