

# Improving the Otorohanga Oxidation Pond WWTP

By Cliff Boyt – Semi-retired Engineer

# Introduction

You are old Father William, the young man said  
And your hair has become very white  
And yet you incessantly stand on your head  
Do you think at your age it is right?

In my youth Father William replied to his son  
I feared it might injure the brain  
But now that I am perfectly sure that I have none  
Why I do it again and again.

*Lewis Carroll*

That is me – I wonder why I am doing this at 75!!

# Brief of My Career

- ▶ I achieved BE in 1968, then post-grad Diploma in Public Health Engineering in 1972;
- ▶ Career of 36 years at HCC – 20 years in management roles;
- ▶ “Retired” in 2004 at age 60 to try out as a sole-practicing consultant;
- ▶ I have consulted to most local bodies around Waikato – still doing some consulting, mainly to Otorohanga DC.

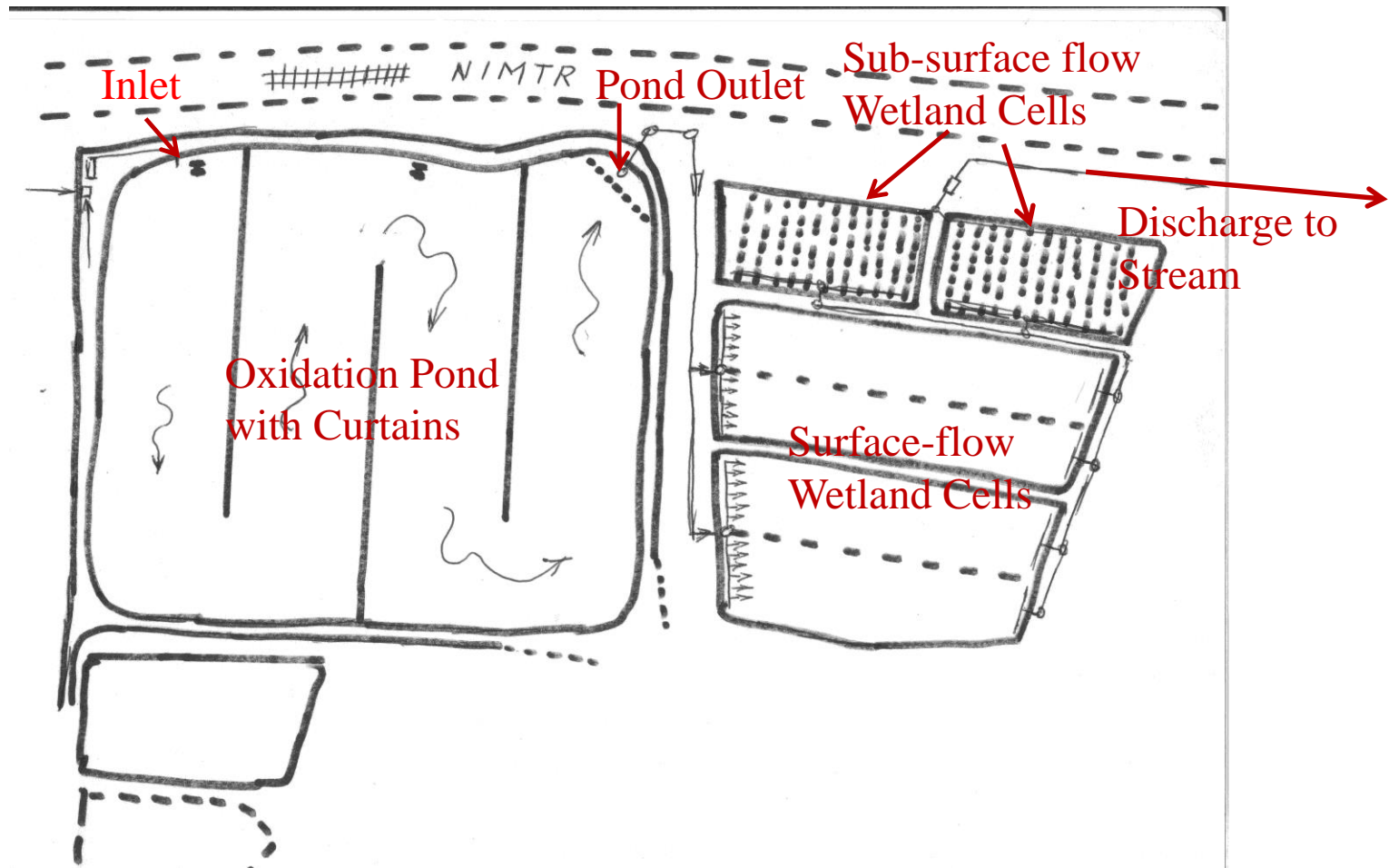
# My Involvement at Otorohanga WWTP

- ▶ Introduced by WRC in late 2010;
- ▶ WWTP was in a very poor state;
  - Oxidation pond embankments had settled and inside banks were eroding away;
  - Wetlands were weed-infested and sludged-up;
- ▶ Discharge was largely non-compliant; and
- ▶ Application for replacement Resource Consent was required in 11 months.

# Review and Upgrade

- ▶ We engaged G2E to review the condition and develop renovation proposals;
- ▶ We let contracts for:
  - Raising, strengthening and lining the embankments;
  - Installing impermeable curtains to create a “serpentine” flow channel  $\approx$  620 m long by 50 m wide;
  - Revising the inlet arrangement;
  - Installing new outlet control weir to maximise the flow-buffering capacity in the pond;
  - Remove a large amount of sludge from the pond; and
  - To make limited renovations in the wetlands.

# Sketch of Upgraded WWTP



# New Resource Consents

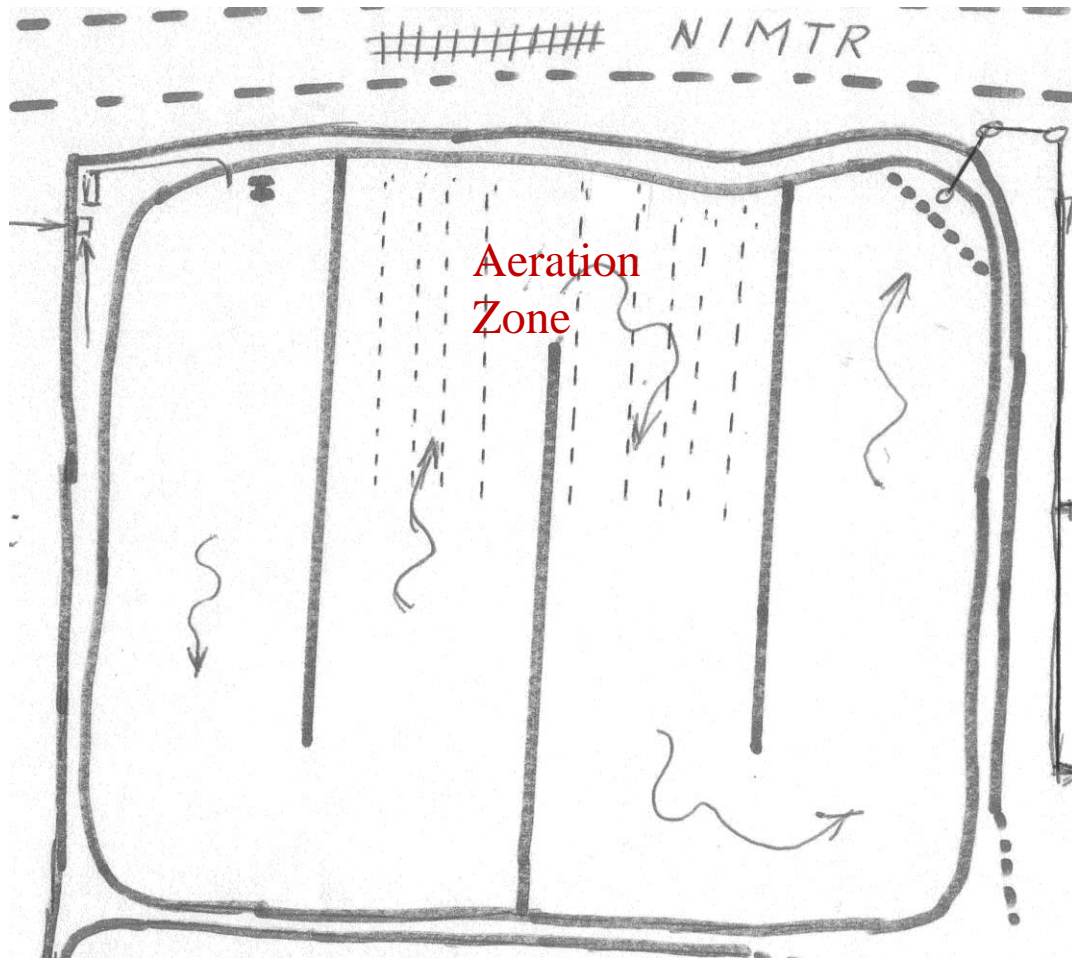
- ▶ We engaged MWH Global to work on preparation of AEE and application for new Consents;
- ▶ Application submitted by deadline!!
- ▶ Hearing held in Oct 2012;
  - Upgraded WWTP had been operating for about 5 months by then;
- ▶ We achieved Consent with Sound Conditions and 25 year life;
  - Initial discharge conditions applied for 1<sup>st</sup> 5 years then more stringent conditions from December 2017.

# The Need for Further Upgrade

- ▶ Monitoring results were good for first few months – then started to deteriorate;
  - Particularly Ammoniacal-N and Total-N;
- ▶ We discovered that more septage was being discharged than in 2011;
- ▶ Working with G2E we installed bottom-deployed aeration mid-pond;
  - 9 aeration pipes x 60 m long;
- ▶ These proved to be very successful.



# Sketch of Oxi-pond with Aeration Zone



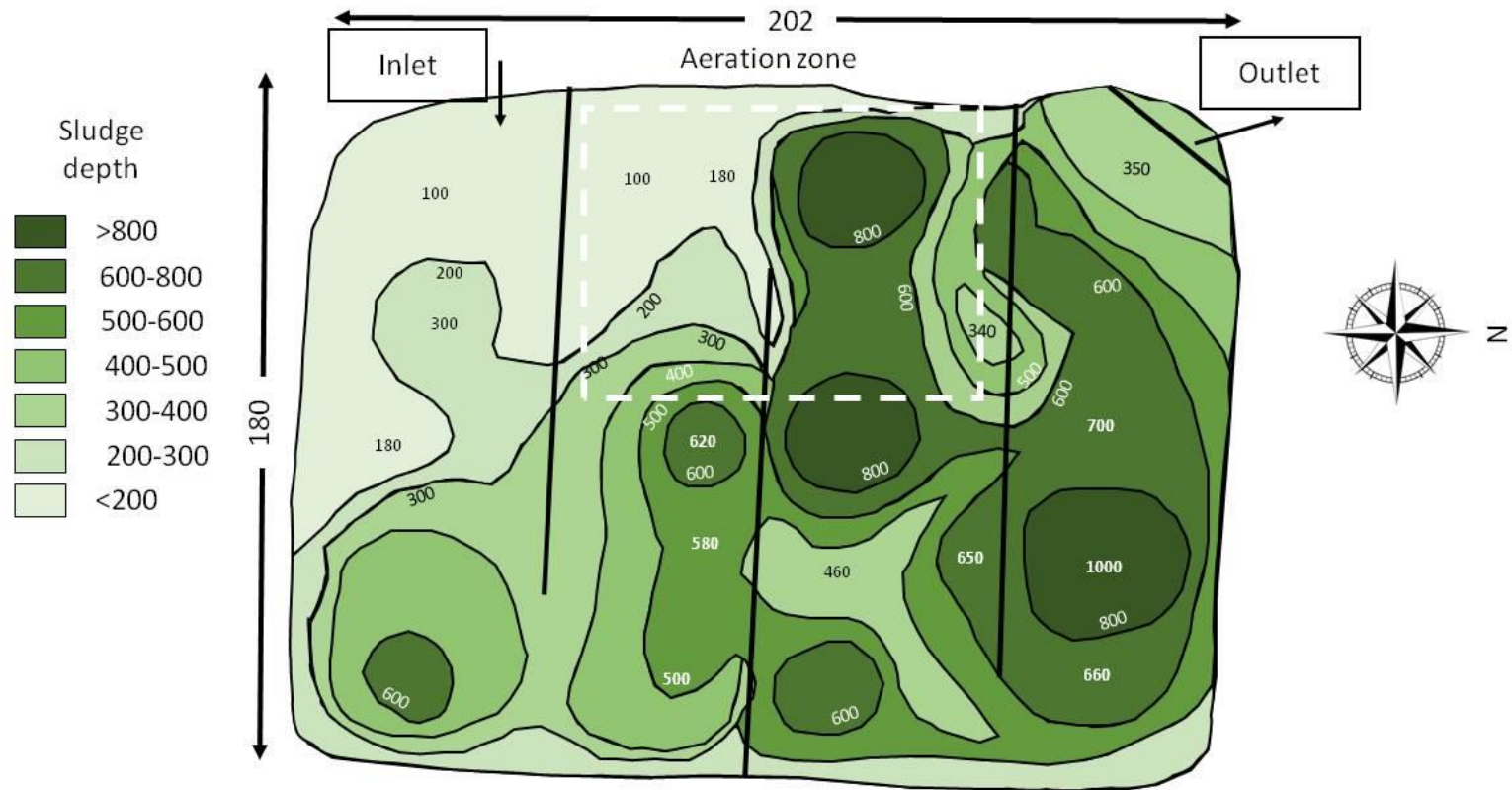
# Effect of Mid-pond Aeration

- ▶ Able to meet Ammoniacal-N and TN conditions consistently;
  - Median Amm-N =  $5 \text{ g/m}^3$  – *Consent limit 15 initially reducing to 12 from Dec 2017;*
  - Median Total-N<sub>(summer)</sub> =  $8.35 \text{ g/m}^3$ ;
    - Equates to  $10 \text{ kg/d}$ <sub>(summer)</sub> – *Consent limit = 20, initially reducing to 16 from Dec 2017;*
- ▶ All other parameters within consent – except for Total P.

# Effect of Sludge Accumulation

- ▶ From late 2015 Amm–N results started to worsen;
- ▶ Sludge survey carried out in March 2017;
  - Found large volume of sludge – particularly in second half of pond;
  - Average sludge depth 500 mm, deepest > 1 metre;
  - Sludge accumulation in 5–years  $\approx 11,000 \text{ m}^3$ ;
- ▶ Sludge contour plan demonstrated that desludging was needed;
  - Carried out July to September 2018.

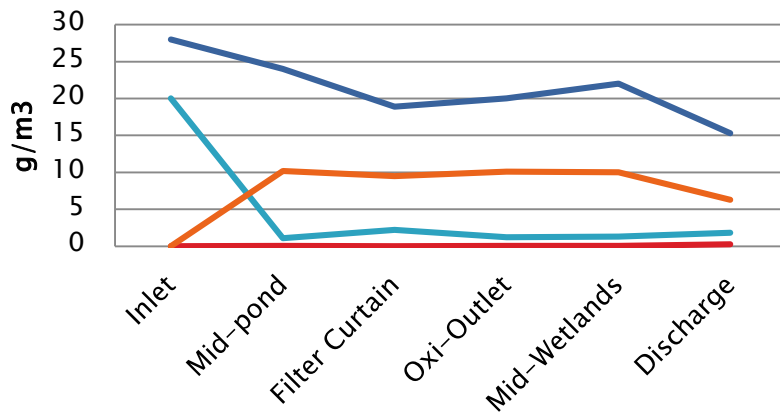
# Contour Plan of Sludge Depths



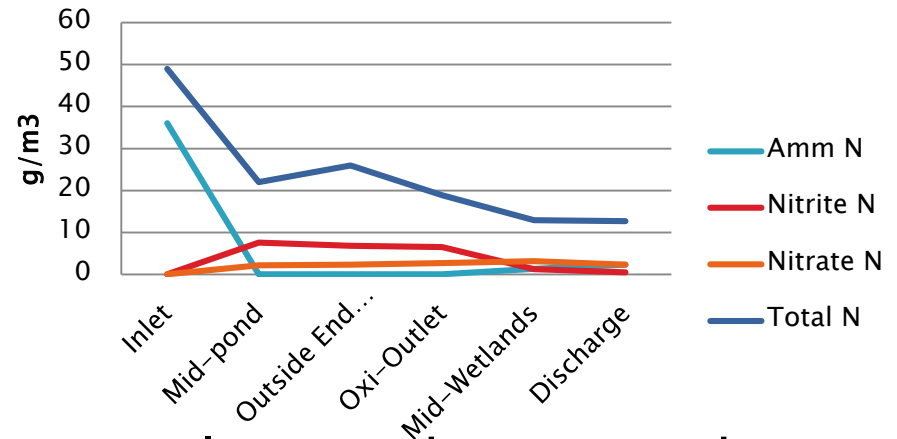
# Effect of De-sludging

- ▶ See graphs of N compounds September 2017 & 2018;

Progressive N Treatment –  
September 2017



Progressive N Treatment –  
September 2018



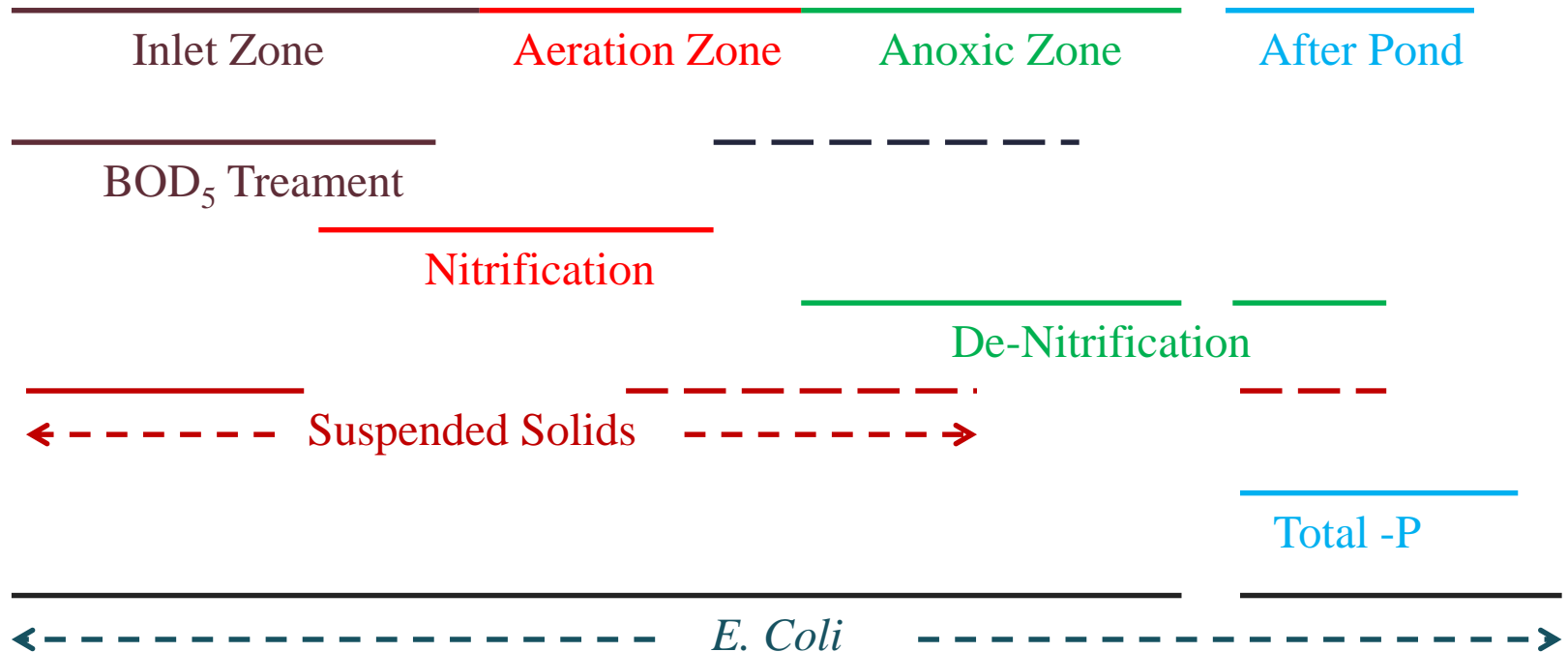
- Amm-N reduction similar – Total-N much improved.

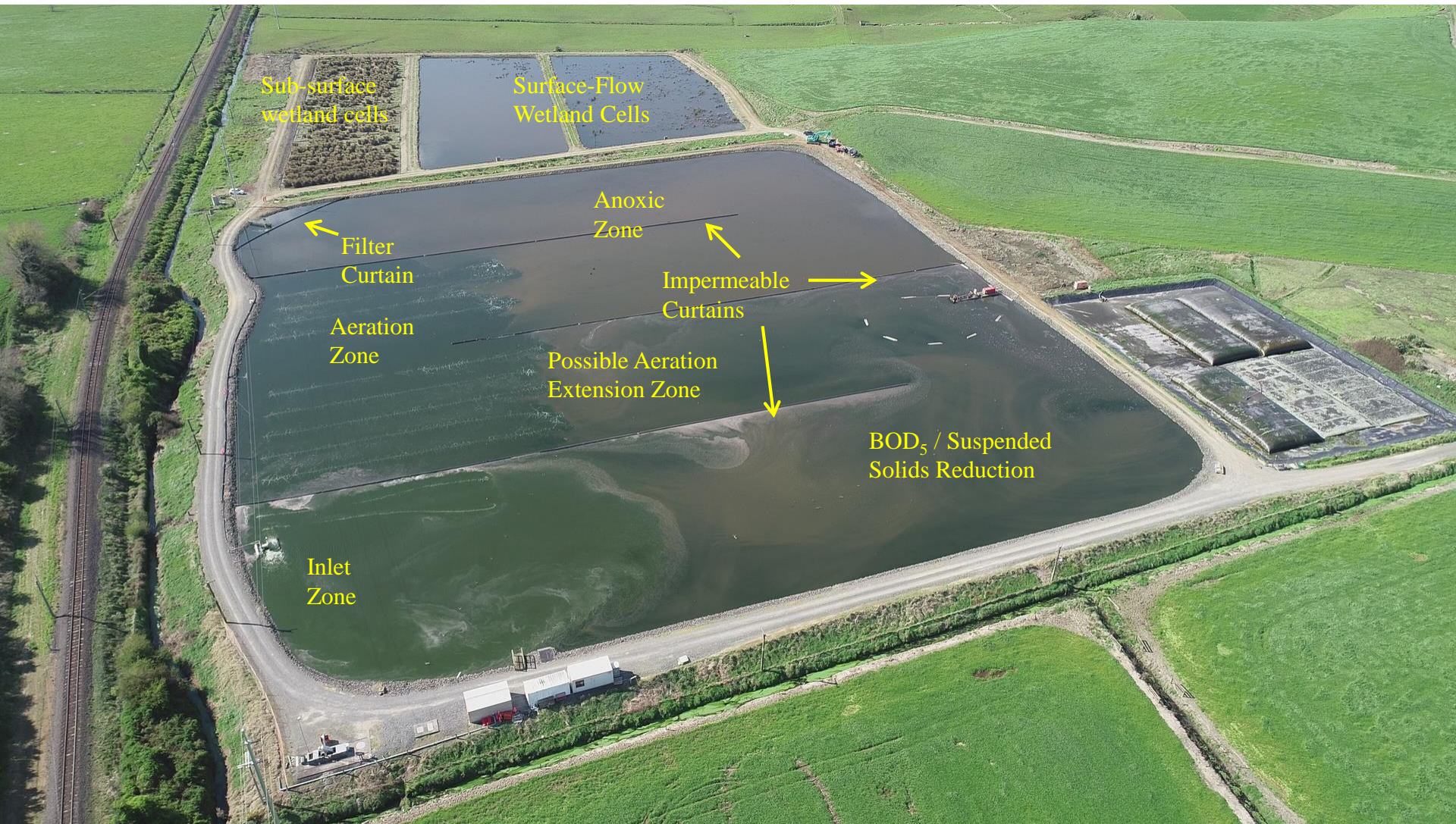
# Disinfection – *E. Coli*

- ▶ I know a lot about disinfection of wastewater;
  - In 1989 I won the IPENZ Furkert Award for my paper on work I had carried out on Inactivation of Pathogenic Viruses by chlorination of Primary Treated wastewater at Hamilton WWTP;
- ▶ UV has superseded Chlorine for disinfection;
  - Generally administered by UV lamps;
- ▶ At Otorohanga we use natural UV from sunlight to achieve similar results;
  - *E. Coli* in effluent is usually near to 100 pfu/100 ml.

# Progressive Treatment Profile

- ▶ The following shows treatment processes through the 620 m long channel:







# Wetlands

- ▶ Surface–flow cells have been decommissioned due to poor treatment performance;
  - Using western cell as settlement basin in TP trial;
  - Received Iwi support for this move;
- ▶ Sub–surface flow gravel beds modified;
  - Shallow channels cut through gravel – see next photo;
  - Provide some polishing, plus a degree of “cultural treatment”;
    - Visitors to WWTP (including Iwi) can “see” final discharge.

# Sub-surface Gravel-bed Cells



Cliff Boyt Consulting

# Coagulant Dosing Trial

- ▶ We have started a trial of coagulant dosing of oxi-pond effluent to reduce TP in discharge;
  - Dosing with liquid Alum & Polymer
  - Using Western surface-flow wetland cell as settlement basin in the trial;
  - Hopefully will use both cells alternately as settlement basins;
- ▶ Initial results are promising;
  - TP reduced to around  $2.6 \text{ g/m}^3$ ;
  - Currently trying different dose rates to optimise cost vs result;
- ▶ We will run trial until after next summer before making decisions about future.

# Conclusions

- ▶ An Oxidation pond can provide good standard of treatment;
  - Need at least 50 days in-pond retention at average daily flow;
  - Need to install curtains to create long-channel flow;
  - Need outlet control to utilise wet weather flow buffering;
  - Need bottom-deployed aeration around mid-pond for Nitrification;
  - Need to manage solids in pond, particularly downstream from aeration zone to ensure good de-nitrification;
  - TP reduction requires after-pond treatment;
  - We can achieve sound disinfection with natural UV;
- ▶ With this arrangement we can manage all Parameters.

# My Parting Advice

- ▶ **KISS – Keep It Simple Stupid**
- ▶ **Don't over-think things**
- ▶ **If it doesn't feel right it probably isn't right!!**

# Acknowledgements

- ▶ Gilles Altner of Global Environmental Engineering G2E;
  - ▶ Jim Bradley and the consents team at MWH Global – now part of Stantec;
  - ▶ Roger Brady and the team at Otorohanga DC;
  - ▶ The consents team at Waikato Regional Council; and
  - ▶ James Sukias of NIWA for his guidance and peer-reviewing my paper.
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