Consistency Workshop

Point source discharge consents: costly, unachievable, inflexible and inconsistent. What a mix!

AWT Water Ltd

August 2013

Outline

- Introduction to AWT and what we do.
- Point source discharge consents:
  - Costly
  - Unachievable
  - Inflexible
  - Inconsistent
- Case Study 1 – Industrial and municipal point source discharges to the same marine receiving environment.
- Case Study 2 – Municipal point source discharges to the upper and lower reaches of the same freshwater receiving environment
- Summary

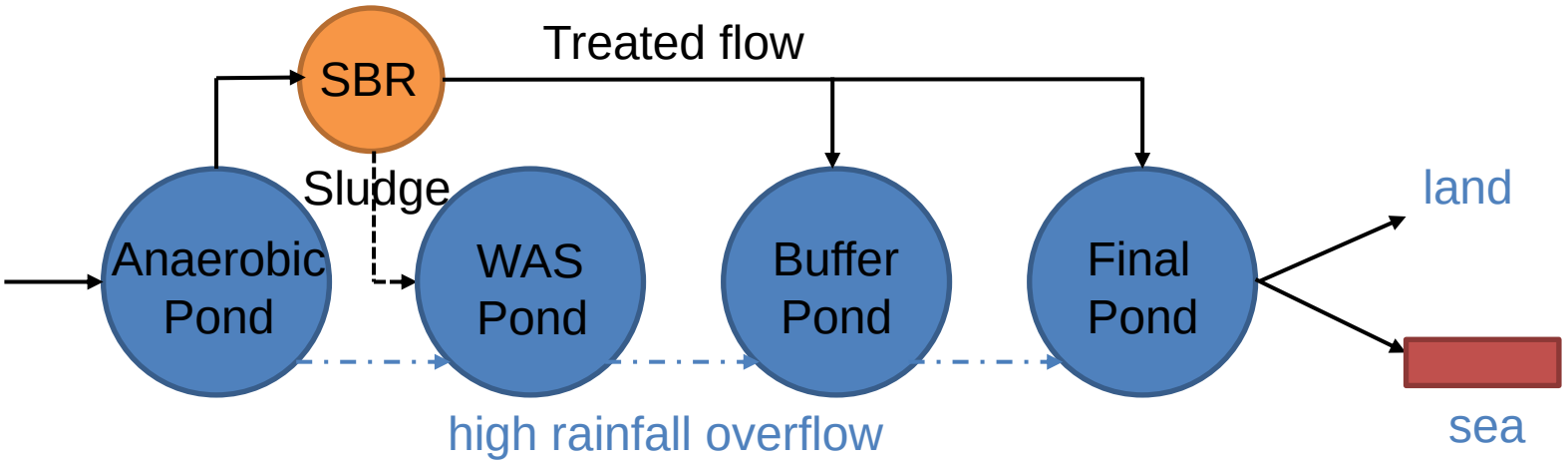
A bit about AWT

- A team of process, chemical, and mechanical engineers with experience in the design of water & wastewater treatment schemes
- Schemes ranging in size from 50 to 350,000 population equivalents.
- Clients range from large water utilities (e.g. Watercare and Melbourne Water), local authorities (e.g. Whangarei District and Taupo District) and industry (e.g. poultry, piggery and meat works)
- In most instances, wastewater treatment plants provide for enhanced nutrient removal along with disinfection.
- Optimisation of existing wastewater treatment processes and reuse of existing infrastructure is a key philosophy in all our designs.
- Research and pilot studies investigating treatment technologies (e.g. Scion)
- AWT's environmental team compliments our engineering design teams in providing client advice in resource management, resource consent acquisition, environmental monitoring and management.

Case Study 1

Plant A:

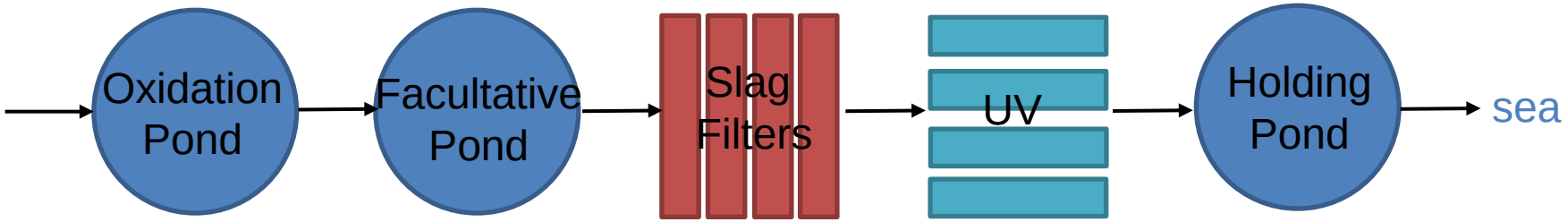
- Industrial food processing facility in operation for 40 years. Increased productivity has warranted improvements in WW treatment technology: simple anaerobic and aerobic ponds ⟹ high-rate treatment plant.
- Treatment plant designed for nitrogen removal.
- Winter ebb tidal discharge to a tidal estuary (Coastal Protection Area 2) of the Manukau Harbour. Discharge regime imposed to reduce residence time in the estuary.
- Summer irrigation discharge to farm land.
- Historical non-compliance with consent.
- AWT assisted the consent holder in renewing their consents.



Case Study 1

Plant B:

- A municipal plant also discharging to a tidal estuary of the Manukau Harbour.
- Treatment plant designed for nutrient removal and disinfection.
- Ebb tidal discharge to reduce the discharge residence time in the estuary, however all year round discharge to water.
- Historical non-compliance with consent.
- AWT assisted the consent holder with options evaluation for plant upgrades and short term consent renewals.



Case Study 1

Effluent Limits:

Parameter	Unit	PLANT A			PLANT B			PLANT C	
		Previous consent[1]	New Consent[2]		Previous consent[3]	Proposed Consent[4]		Current Consent[5]	
		95th%	median	95th%	95th%	Median	92nd%	Median	95th%
BOD_5 Unfiltered $_cBOD_5$	mg/L	20		20	10		20	10	20
TSS	mg/L	30		30	10	30	45	15	20
Total Ammoniacal N	mg/L	7	2.5	5	5		9s (15w)	10	20
Nitrite	mg/L		1.0						
TIN	mg/L	50		50	20		20	15	25 (max)
Total Phosphorous	mg/L				8		8		
Total Residual Chlorine				0.09					
DO	mgO/L	>5		>2.5	>2		>4.5		
Faecal coliform	cfu/100ml						430	14	43 (90%)

(1) – monthly grab samples taken from rock filter, compliance based on 20 consecutive samples, 6 samples per year (1 non-compliant sample)

(2) – weekly grab samples taken from final pond, based on 36 samples per year, weekly during winter, monthly during summer (1.8 non-compliant samples).

(3) – monthly grab samples taken from the final pond, based on any consecutive 12 samples (no non-compliant samples).

(4) – Fortnightly grab samples from the UV outlet, unclear what the compliance period would be but assuming a rolling compliance year (2 non-compliant samples)

(5) – fortnightly grab samples collected on the same day and time of the week at the discharge point, compliance based on 20 consecutive samples (1 non-compliant sample)

Case Study 1

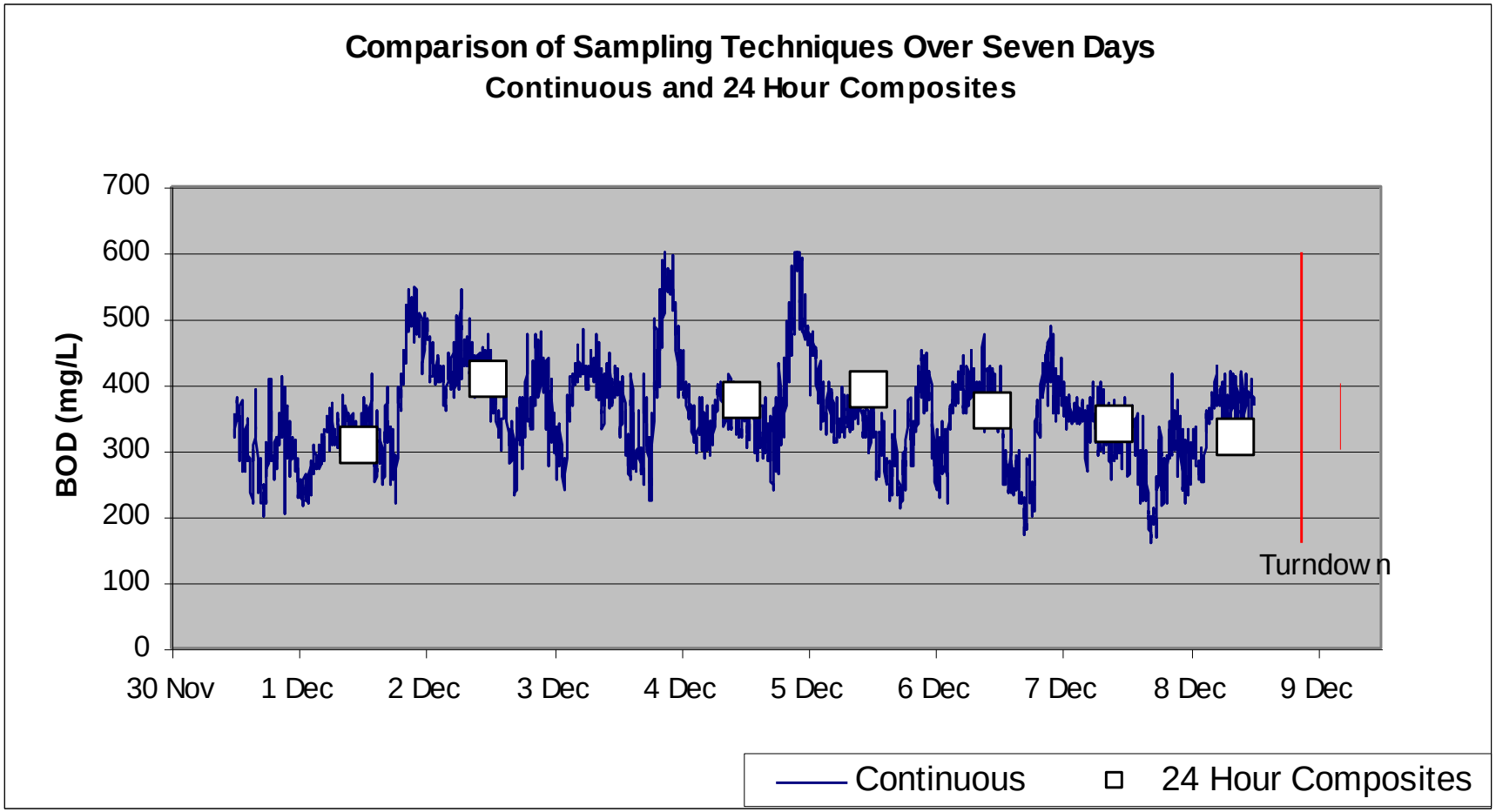
Inconsistent Conditions:

A number of inconsistencies and uncertainties arise from the different methods used and prescribed in consents for characterising wastewater and examples of these are discussed for Plants A and B:

Aspect	Potential for Inconsistency and Uncertainty
Sample Parameter	Type of parameter prescribed and detection limits applied – TN vs TIN; TP vs DRP; BOD_5 vs $cBOD_5$, vs soluble $cBOD_5$ vs COD.
Sampling Location	Sampling site selection - High-rate reactor tank vs holding pond vs rockfilter. In-stream sampling sites depend on plume characteristics. External factors i.e. sample contamination from external influences.
Sample Collection	Frequency and timing of sampling. Number or method of samples collected (composite vs grab samples). Technique and capabilities of the person/instrument used.
Chain of Custody & Analysis Technique	Method of sample storage, preservation, time stored or transported, and laboratory techniques and methods.
Compliance Criteria	Statistical analysis criteria for determining compliance – Number of samples and median vs percentile vs maximums.

Sample Collection

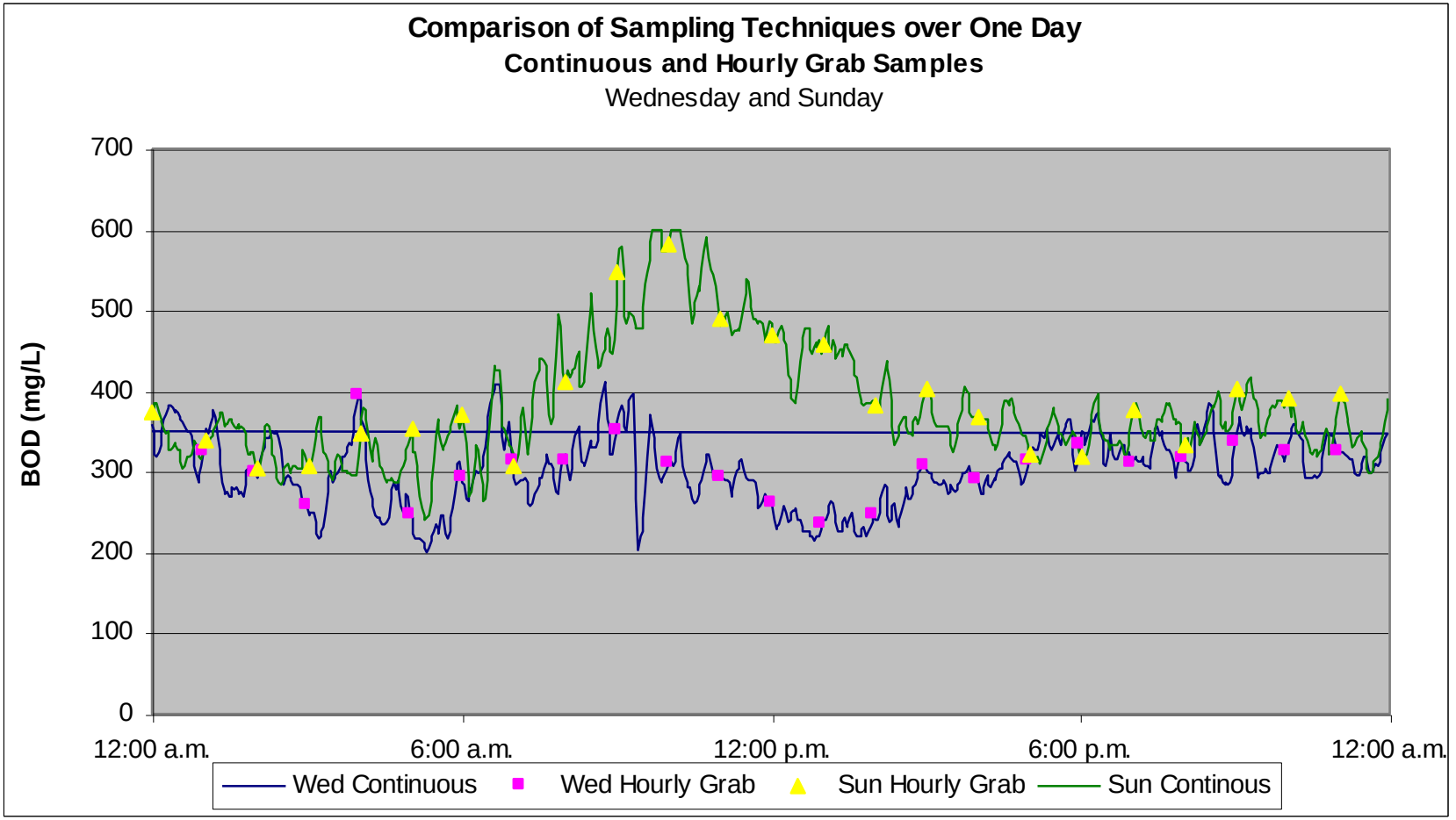
Variation in concentrations during the day versus timing of sampling



The 24-hr composite results do not show the detail of the concentration variation.

Sample Collection

Variation in concentrations between days of the week versus timing of sampling.



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Case Study 1

Inconsistent Conditions:

Aspect	Example
Sample Parameter	Plants A & C require $cBOD_5$ whilst Plant B requires BOD_5 why? All plants require TIN why not TN?
Sampling Location	Plant A sampling point was outlet of the rock filter moved to final pond prior to discharging through rock filter. Is the outlet of the high rate treatment plant a more appropriate sampling point? Proposed Plant B sampling point outlet of UV prior to holding pond.
Sample Collection	Plant A monthly grab samples during winter increased to weekly grab samples during winter and monthly during summer. No time or day specified. Plant B monthly grab samples increased to fortnightly and to be taken at the same time and day of the week.
Compliance Criteria	Plant A compliance based on 95th percentile of 36 annual samples = 1 non-compliant result allowed. Plant B compliance based on 95th percentile on a rolling 12 samples = no non-compliant samples vs proposed change to 92nd percentile over rolling 26 samples = 2 non-compliant.

Case Study 1

Costly Conditions:

…Consent Holder shall engage a consultant specialising in Marine Biology to undertake an assessment of effects on the receiving environment at and around the discharge point. Ideally the assessment should include an appropriate control site. ....

- 5 biological surveys required, one every second year during the months of April & May.
- Non-compliances but no enforcement taken:
  - Only 4 reports were undertaken in total.
  - Only one report was undertaken within the specified timeframe.
  - No reports were carried out at the same time of year.
- Surveys provided some useful information to support the renewal consent, although the regulator discounted them due to the inconsistencies discussed even though no advice and/or enforcement had not been given.
- Even if compliance had been achieved, it remains questionable whether the methodologies applied would have detected any significant 'anomalies' in a biological system subjected to a wide range of temporal and spatial variability.
- Finding a comparable control site would have been difficult in a catchment already impacted by a number of other landuse changes – potential to introduce variation into the effects equation.
- The amount of sampling needed in order to obtain enough precision in the data to confidently determine effects would have been high resulting in potentially greater compliance costs.

Case Study 1

Costly Conditions (continued):

- A useful alternative method to supplement and/or replace field surveys is Whole Effluent Toxicity (WET) testing.
- Uses well established toxicological testing procedures to measure the response of exposure of marine organisms to different concentrations of [in this case] the treated effluent.
- It tests a representative range of animal/plant groups that are likely to occur in the particular environment e.g. algae (48 hr cell growth); amphipod (96 hr survival); blue mussel (48 hr embryo development).
- It is a useful measure of toxicological risk that can be interpreted in relation to the actual field conditions and in terms of the likely ecological significance of any identified toxicological effect.
- The toxicological data can be used to calculate dilutions required for no toxicity.
- The sampling and analysis required is quick and reasonably priced.
- There is however risk of mis-interpretation of WET testing results due to the complexity of the analysis and expertise required.
- Council officers remained focused on the <13x dilution estimate as an absolute value following application of a 10 times acute-chronic ratio due to no statistically significant toxicity measured.
- Provides an indicator of the scale of toxicity of a sample, rather than being an absolute measurement of observed toxicity.

Case Study 1

Inflexible Conditions (Up The Pipe / Process Focused):

The plant shall not be required to treat more than the stated design maximum loads of COD, TSS, Total Ammonia, TN/TKN and BOD per batch. Monthly samples of plant influent shall be taken ….

- Why does the regulator need to know the daily loads of BOD, TSS and so on to the plant if effluent quality limits are being met?

That the only wastewater spray irrigated on to land on the site shall be treated wastewater abstracted from the maturation pond.

- This condition in fact limits the operator from irrigating directly from the high-rate treatment plant or the balancing pond both which should have the same, if not better effluent quality than the final holding/maturation pond.

… The wastewater treatment plant shall comprise the following key system components: primary oxidation pond (6.48ha) maturation pond (1.2Ha), cascade aerator, 3 Brush Aerators in Primary Pond (minimum), 1 Brush Aerator in Maturation Pond (optional), 30,000m^2 slag filter made up of 10 beds in parallel…

- Prescribing specific treatment processes/components in the consent can limit the consent holder to a specific technology.

That no new development within the proposed new …Business Park and no 'Conditional Trade Wastes' shall be permitted to be discharged into the treatment plant without the written approval of the Manager…

- Is it appropriate and/or legal for the regulator to limit any new development if plant compliance is being achieved?

Case Study 1

Unachievable Conditions (difficult to comply with):

To discharge up to 610m^3 of treated wastewater … (and up to 8.4m^3 of contaminated stormwater per mm of rainfall) by discharge to sea from 1 April – 31 October each year and at other times when the discharge to land … is not practicable

- Stormwater allowance - provides for stormwater runoff from working and pond areas. This is calculated for the day the rain fell, however the excess water can take up to 1 or 2 days to flow through the system = non-compliances.
- 'not practicable' - Interpretation of these words had historically resulted in much debate with the regulator. Key issue was its subjectivity in meaning. This was later reworded as part of the renewal process to state

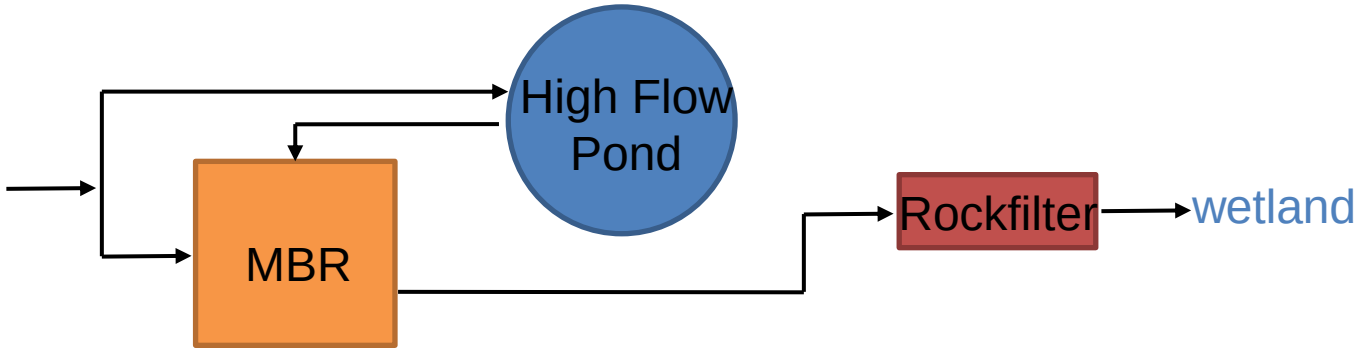
"1 April – 31 October each year on the basis that discharge to land under this permit is unable to be undertaken during this time due to soil conditions".

Ammoniacal-N summer limit of 8gN/m^3 and winter limit of 12gN/m^3…

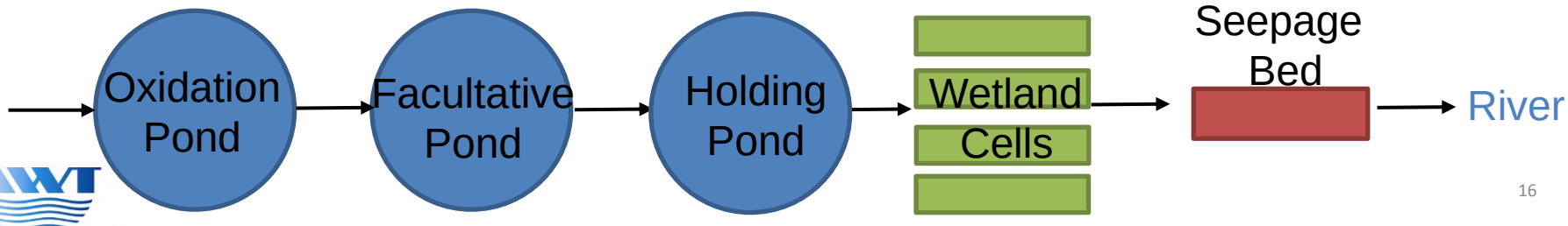
- Inappropriate and unachievable discharge limits imposed on particular treatment technologies. In this example, Plant B is a pond based treatment process, with historical data supporting non-compliance with proposed limits. Nonsensical for short-term consent – would require significant upgrade to achieve.

Case Study 2

- Municipal treatment systems with point source discharges to freshwater
  - **Plant D** - located in the upper catchment – upstream plant (MBR plant, rockfilter)
  - AWT provided technical expertise with treatment plant design, support through the consenting phase and annual wetland ecological monitoring.



  - **Plant E** - located in the lower catchment – downstream plant (oxidation ponds, mechanical aerators, wetland and gravel seepage bed)
  - Due to ongoing non-compliance plant has been upgraded to include a high-rate sequencing batch reactor, UV and removal of wetland.
  - AWT provided technical expertise with the design of the upgrade.



Case Study 2

Effluent Quality Limits

Parameter	Unit	PLANT D Upstream Plant(1)		PLANT E Downstream Plant(2)	
		median	90th%ile	90th %ile	Max
$cBOD_5$	mg/L	15	30	12	15
TSS	mg/L	20	30	18	20
Total Ammoniacal N	mg/L	2.5	5	10	15
Total Nitrogen	mg/L kg/d	8 12	15		
Total Phosphorus	mg/L kg/d	<1.7 2.5	<4	8	10
pH		7	6 – 9		
Faecal coliform	MPN/100ml	100	400*	10^3	10^4

(1) Monitoring requires daily volumes and fortnightly parameter analysis based on 24 hr composite sampling cycled to sample on a different day each fortnight. Compliance based on a 100 day rolling median.

(2) Grab samples take fortnightly from the seepage bed, although as part of recent upgrades sampling location was changed to outlet of UV. Compliance determined annually.

Case Study 2

Inconsistent conditions:

- The upstream Plant D is a superior treatment process and discharges to a pristine lake environment compared to Plant E a passive pond based system not designed to target phosphorus removal discharging to the lower reaches of a large catchment.
- Why has more stringent BOD and TSS limits been imposed for the downstream plant?
- The example illustrates the inconsistencies around setting of effluent limits within the same catchment.

Unachievable conditions:

- Biological processes are difficult to operate within maximum limits.
- Plant D consent introduces the idea of Mass load limits for TN and TP.
- Environmental effects of nitrogen and phosphorous inputs (excluding Ammonia) are associated with the total load in the waterway rather than the concentration occurring in a given discharge.
- A mass load limit approach enables more flexibility in day to day plant operations and also allows loads from a range of sources to be managed in a receiving environment as a whole rather than being limited to addressing individual sources (more holistic approach).

Summary

- Not only are there inconsistencies and anomalies with consent condition requirements between regions but also within regions.
- Where non-compliance has not been addressed through enforcement, this is often later dealt with through the development of costly monitoring, overally prescriptive and operationally inflexible conditions.
- Limitations in technical resources and understanding by the regulator can result in unachievable treatment and operational requirements.
- Consents are increasing in length and complexity. Can consents be simplified to ensure better compliance?
- Can greater consistency be achieved through the national development of template conditions, providing regulators guidance on parameters to be applied, sampling locations, collection and analysis?
- Are there simpler more cost effective monitoring techniques available to reduce inconsistencies and uncertainties inherent with sampling?
- Are mass load limits more appropriate than concentration limits for nutrients?
- Can greater consistency be achieved through nationalisation of regulatory functions of discharges?