DairyNZ/EngineeringNZ

Practice Note 21: Farm Dairy Effluent Ponds

APPENDIX B: POND SEEPAGE TESTING

(Version 1, March 2024)

(Project 3-39662.00)

Contents

1 Preface

Practice Note 21: Appendix B - Pond Seepage Testing (Version 1, March 2024) (PN21: App B) is new and replaces in its entirety Part 1: Section 8.6 of *Practice Note 21*: Farm Dairy Effluent Ponds (Version 3, August 2017) previously prepared and published by project partners DairyNZ and EngineeringNZ.

PN21: App B is not intended to be a separate standalone document but is to be read in conjunction with the rest of PN21.

Minor changes to this version of PN21: App B are possible based on ongoing industry feedback. It is envisaged that this document will be further reviewed and amended, and incorporated into an updated version of PN21 when funding and approvals can be arranged.

2 Introduction

All ponds, regardless of their liner types, are subject to potential damage from various causes including from unsuitable design, poor installation, lack of maintenance, or inappropriate operation. Ongoing inspection and testing will identify issues affecting the pond's primary purpose of storing liquid effluent without incurring an unacceptable rate of seepage or leakage loss. The words seepage and leakage are often used interchangeably but for this document the word seepage is used.

Ponds should be regularly tested for seepage. 3 options are proposed with each being for slightly different purposes.

- An initial Pond Drop Test (iPDT) within 3 months of pond construction completion.
  - An initial standard PDT test forms part of the prerequisites for a Pond Completion Certificate prepared by a Chartered Professional Engineer (CPEng).
- A simple Pond Level Test (PLT) at least yearly.
  - A PLT can be completed by farm staff using simple measuring methods as part of a regular pond seepage monitoring programme and could be run concurrently with testing from a ponds Leak Detection System (LDS) if installed.

    Note that these tests are intended to detect gross leakage only and are not intended as an alternative or replacement of the standard PDT.
- A standard Pond Drop Test (PDT) with testing frequency as set out in the PDT Testing Frequency Flowchart.
  - PDTs are undertaken by a specialist PDT supplier ('supplier') using an extremely accurate measurement equipment system that meets the industry standard test method. The supplier will prepare a detailed test report along with an accompanying CPEng signed test certificate which the pond owner can forward, if required, to other parties including the regional council (RC) for resource consent compliance purposes.

3 Initial Pond Drop Test (iPDT)

For all new, or modified ponds, 'good practice' should be applied in the design and construction of the pond and as set out in Practice Note 21. This is best directed and confirmed through the advice and guidance of a CPEng engineer.

Following the commissioning of the pond which includes an Initial Pond Drop Test, the pond owner should request a *Pond Completion Certificate* from a CPEng with competence in a relevant practice area. This is to confirm that the pond has been satisfactorily designed and constructed and meets the following completion criteria.

> Pond Completion Certificate
>
> A signed certificate issued by a CPEng engineer to confirm that:
>
> (a) both the design and construction of the effluent pond has been satisfactorily completed and meets the good practice guidance provided in the DairyNZ/Engineering NZ Practice Note 21 (latest version); and
> (b) where a geomembrane liner is installed, a warranty certificate of at least 20 years on the liner product and 10 years on its installation has been issued by the lining contractor; and
> (c) within 3 months of construction completion, an initial PDT has been completed and the seepage rate result complies with the local regional council requirements.
>
> Note: The certificate signing may include different CPEng engineers for separate design and construction phases.

Obtaining this certificate has the advantage that it will qualify the pond for a longer PDT retest frequency (refer section 5).

4 Simple Pond Level Test (PLT)

The more that the pond owner can be involved in the monitoring of the performance of their effluent ponds the better. They and their staff are on site and can regularly observe any changes occurring in their ponds. Additionally, they are best placed to initiate investigation and remedial works should concerns arise. A regular Simple Pond Level Test (PLT) should be part of the ongoing checks on the farms effluent system.

A simple PLT can be undertaken by placing a partially submerged graduated rule fixed to a driven solid steel post at an accessible location at the ponds edge. Alternatively, where the liner is at risk of being damaged by the post, another fixing arrangement would need to be explored, such as by attachment to a permanent stable structure on the pond's perimeter. To enhance accuracy, a stainless steel rule with 0.5 mm graduations should be selected and binoculars or a magnifying glass used to read it. Means to keep safe during reading should also be considered.

Preparations for the test include the pond being largely free of floating solids, at least 75% full, and all inflow sources and outflow locations blocked off. The weather forecast should be checked to confirm that a settled period of mild weather without rainfall, or high winds, or freezing temperatures can be expected.

The test involves recording an initial reading (mm) on the rule at the top of the formed liquid meniscus as well as the day and time of the reading. A further reading is taken 2 to 3 days later, the level difference calculated, and the average seepage rate in mm/day determined.

$$Seepage\ Rate\ \left(\frac{mm}{day}\right) = \frac{Reading\ (final) - Reading\ (initial)}{Test\ Hours}\ x\ \frac{24}{1}$$

While the test result will not be suitable for consent compliance purposes, it will provide an indication to the pond owner whether gross pond leakage (say >5 mm/day) is occurring and if an earlier than expected PDT is warranted.

4.1 Leak Detection Systems

In addition to a simple PLT, a Leak Detection System (LDS) can also provide another gross seepage rate guide. All new ponds should be installed with an easily monitored LDS.

This approach involves collecting a measured volume of outflow over a timed period.

However, its value will only be as good as its original design and installation, and pond owners should consider the following questions:

- Does the system cover the whole base of the pond?
- Can the LDS be tested by some available means to confirm it is working satisfactorily?
- Can LDS outflow liquid be collected, analysed, and determined as consisting of effluent, or groundwater, or both?
- What leakage rate should be of concern?

4.2 Pond Owner Inspections

In addition to PLT and LDS inspections, the landowner should monitor and inspect their Farm Dairy Effluent (FDE) ponds, including its connecting infrastructure, at least on an annual basis and record observations made.

- Pond level – is there evidence of overtopping? Freeboard should be kept >0.6m to allow for unexpected filling. Consider if the pond level is unexpectedly low, or high, which may indicate a leak concern. Could there be groundwater ingress raising the water level?

- Synthetic (geomembrane) liners – no liner tugging or tearing is present, no visible damage to the liner including subsidence behind the liner, and gas is not accumulating under the liner.

  (Note: geomembrane liners can be subject to harsh UV conditions in New Zealand, and some can deteriorate much sooner than the 20 year warranties often provided by installers.)

- Pond Bunding – are there damp areas on the outer slopes of the pond bund. Also look for, shrubs or trees with roots penetrating the liner, or on the anchor trench that provides support to a geomembrane liner.

- Clay liners – no excessive erosion, drying, cracking, or visible damage to the lining.

- Pipework – check for leaks or damage to pipes, particularly where they penetrate bunding, lined walls or structures.

5 Pond Drop Test (PDT)

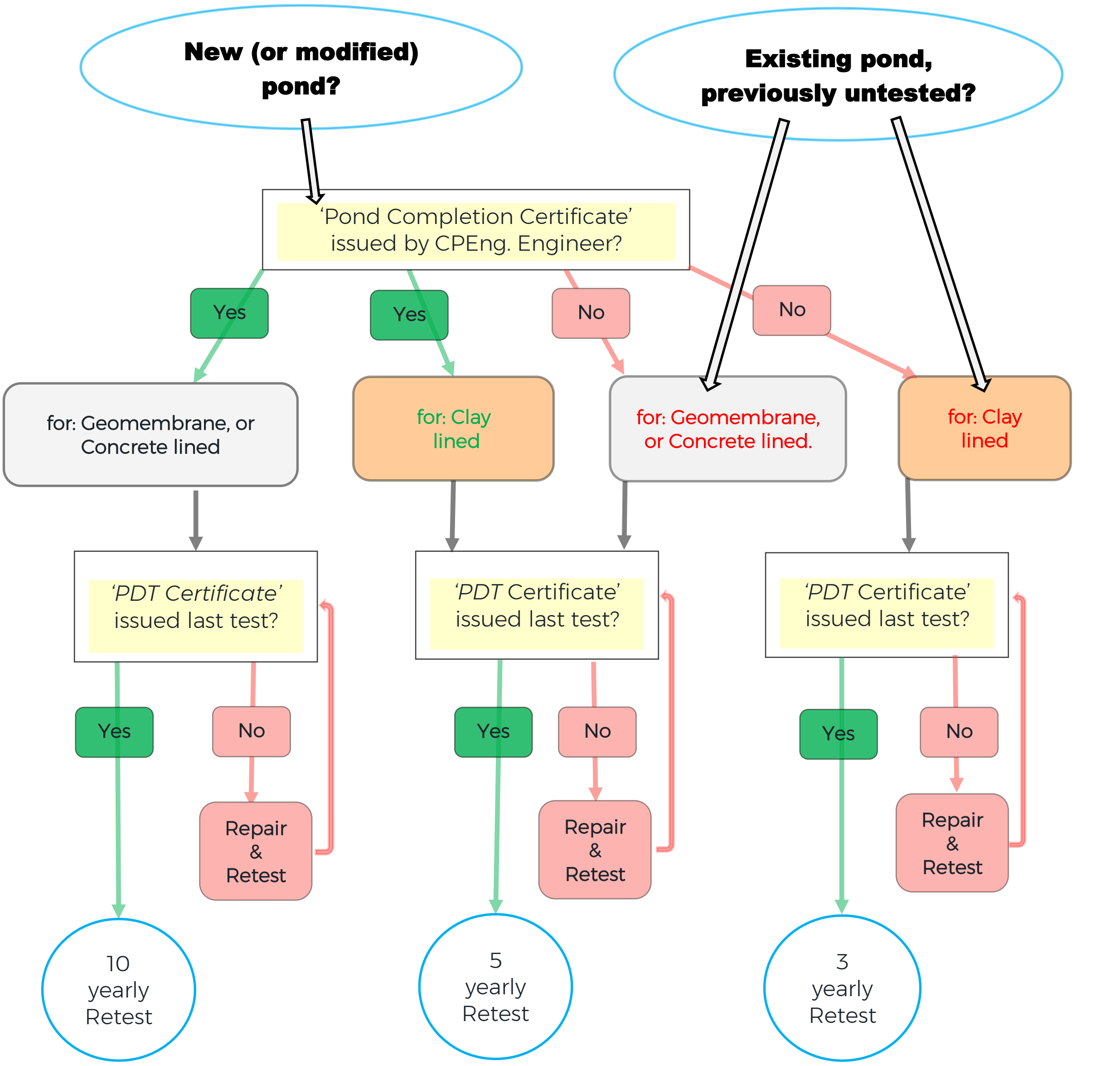
The PDT test is presently the most accurate means available to confirm that a pond's seepage rate is within acceptable limits. Such accuracy is essential to verify that the rate is satisfactory for such purposes as, sale and purchase agreements or for resource consent compliance.

Because the permeability (flow) rate of a ponds liner from its 'wetted surface' cannot be directly assessed, the PDT test which measures the change in the ponds surface water level over time has been developed as a proxy measure. The internationally accepted upper limit of the permeability (also referred to as hydraulic conductivity) of FDE pond lining material is 1×10^{-9} m/s, which is equivalent to a PDT seepage loss of -0.8 mm/day, or if rounded up, -1.0 mm/day.

To achieve the highest possible accuracy, specifically developed test equipment systems able to measure to fractions of a millimetre are needed. Environmental influences such as rainfall and evaporation must be considered, and relevant corrections made. To successfully operate this equipment, personnel with the necessary instrumentation and technical skills are essential. Furthermore, detailed spreadsheets or specific software developed for the analyst are necessary to examine the data and identify any anomalous readings that need to be rejected.

5.1 PDT Testing Frequency

To reflect the risk of excessive seepage not being detected, the following cyclic PDT Testing Frequency Flowchart has been developed. This chart reflects risk factors that can impact the ongoing performance of various types of ponds and their liners. The higher the seepage risk, the more frequent the retesting should be.



Notes:

- Refer Section 3 for *'Pond Completion Certificate'*, and section 5.7.5 for *'PDT Certificate'* requirements.
- PDT retest required within 3-months of any mechanical cleaning out of ponds or obtrusive works on them.
- For operational ponds, 'Repair and Retest' repair and retest to be undertaken within 3 months of a non-conforming PDT test.
- If a warranty that has been issued for a geomembrane pond liner material has expired, the retest frequency reverts to a 5 year retest cycle.

Figure 1: PDT Testing Frequency Flowchart for Effluent Ponds

5.2 Test Equipment

5.2.1 Accuracy

To provide extremely accurate measurement changes in pond depth level, a continuously recording sensor with the associated data logger unit taking readings at 1 minute intervals or less is essential. Evidence from the manufacturer that the combined accuracy for these specific items is better than ± 0.2 mm is recommended.

5.2.2 Uncertainty of Error

Measurement of pond depth change to the necessary accuracy expected by regulatory authorities, and with confidence, is difficult with the test equipment systems currently available without some uncertainty being attached to the inferred seepage rate reported. Therefore, seepage test results need to also be accompanied by an Expanded Uncertainty of Error value assessment.

The 'Error' refers to the specific unknowable difference between the measured value and the unknowable true value, while 'Uncertainty' refers to the range of possible values of the error of the measurement. An error can be positive or negative since the measured value can be more or less than the true value.

To confirm the accuracy of the full PDT measurement system, it must be assessed by a recognised metrology laboratory and confirmed by their report that it has an Expanded Uncertainty of Error of less than ± 1.0 mm.

(Expanded Uncertainty of Error is based on the standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.)

Evaluation by the metrology supplier should include both a laboratory and field testing component in assessing the total of the individual identified measurement system errors.

The Expanded Uncertainty of Error analysis is to include, but not limited to, all identifiable uncertainty components in the PDT measurement system, including both pond and evaporation sensors (including calibration uncertainty, non-linearity, hysteresis, and resolution), temperature shifts, rigidity of supporting structures including thermal expansion effects, wind effects, and reading repeatability. Note that the Expanded uncertainty of Error is expressed as the sum of all the relevant uncertainties from all the error contributing components, and with a 95% confidence.

The Uncertainty of Error can be estimated by using the methods of 'A Beginner's Guide to Uncertainty of Measurement' by Stephanie Bell which is based on the United Kingdom Accreditation (UKAS) Publication M 3003, 'The Expression of Uncertainty and Confidence in Measurement', and the Publication EA-4/02 of the European co-operation for Accreditation (EA), 'Expression of the Uncertainty in Measurement and Calibration.

Suppliers of metrology services in NZ include:

WSP Research (Petone) https://www.wsp.com/en-nz/hubs/research
MetCal (Hamilton) https://metcal.co.nz/

Where a supplier operates more than one of the same PDT measurement system units and they are comprised of the same components, then a single metrology laboratory assessment report on a representative unit would suffice. A reassessment should be undertaken every 5 years, or when one of the systems components is replaced with a non-identical or alternative part.

To support their PDT test report, the PDT supplier must be able to produce on request a copy of this report to their clients, or others taking reliance on these reports.

5.3 Pond Preparation

Key to obtaining reliable test results is the preparation of the pond prior to the PDT testing commencement and will necessarily include the following tasks:

5.3.1 Cleanout the pond:

- Clean out floating weeds, crust, heavy scum, and excessive foam.
- Remove excess sludge deposited and built up on the pond base.
- Remove solids from stone/silt traps and connecting channels.

Floating crust or vegetation and thick scum can lead to fouled sensors, and pond level data errors. It can also affect evaporation rates and corrections applied. PDT testing should be postponed until a pond is sufficiently cleaned out.

Ponds also need to be regularly cleaned out to retain their maximum storage capacity. A deep sludge layer can also conceal the true seepage rate of a ponds liner.

5.3.2 Fill up the pond:

- At test commencement a pond must be at least 75% full, with the surface level at least 200 mm below the outlet minimum level. The designed outlet point may be an outflow pipe, channel, spillway, or perimeter bank.

The 75% prerequisite allows the pond's wetted surface area being tested to be maximised. It also provides some available pond capacity for unexpected inflows, such as from rainfall into the pond's catchment over the test period.

5.3.3 Do not stir the pond:

- Do not stir the pond in the 3 day period prior to test commencement.

Stirring the pond does not prevent a crust reforming and can contribute to an inconclusive or failed PDT result.

5.3.4 Isolate the pond to be tested:

- Effluent inflows should be diverted into temporary or other storage where this is available. All liquid inflows into the pond for the duration of the test, such as from the dairy shed, feed pads, stormwater, or surface drainage, must be prevented. All pipes to or from the pond must be firmly capped or securely blocked off.
- Weeping walls flowing into the pond must be completely cleaned out or blocked off from the pond being assessed. Depending on its construction and bed level, a weeping wall may be able to become part of the pond for the test duration such that its bed is also included in the PDT test.
- Check for leaks where liquid could be unintentionally flowing into the pond. Sumps, hoses, taps, green wash, and stormwater diversion systems must be checked for possible leakage. Look for flow along the outside of buried pipes.
- While not preferred, inflow from dairy shed washdown may be able to be accepted provided the PDT installer is informed of the times and frequencies of these milkings so data during these periods can be removed from the data analysis.

Note that any unaccountable inflows or outflows during the test will invalidate the test data while these persist.

If the pond being tested is part of a two pond system, then both ponds must be hydraulically isolated from each other. This may involve earthworks filling with compaction to temporarily seal the opening between. The alternative is for them to be tested as one pond by digging a channel at least 1m wide and 1m deep between to provide a level gradient with unrestricted flow in both directions.

If they are solely connected by a pipe this must be completely blocked or capped off.

5.3.5 Identify test site:

As to the most suitable place to site the test equipment on the pond's perimeter, the following site characteristics are preferred:

- Being able to park a vehicle as close as possible to the site to ease transportation of equipment.
- Avoidance of fences needing to be crossed.
- Easy site accessibility, including not having to walk through shrubs, trees, thick long grass, and boggy areas.
- Flatter, easily negotiable slopes, on good stable ground.
- A cleared vegetation site area on which equipment may be easily and safely placed.

5.4 Field Testing

5.4.1 Safety

Working near, in, on, or over effluent ponds is a significant risk activity and needs to be recognised as such.

Prior to undertaking work around effluent ponds, personnel must identify, assess, and control hazards associated with the work. A task-specific risk assessment should be prepared and reviewed by a competent person, and hazards and control measures recorded. The risk assessment must cover all potential risks that may be applicable to the work.

The site conditions and risks posed by working around effluent ponds can and do change. It may be necessary to re-assess the potential hazards and control measures on site prior to commencing work and as work progresses. Where conditions vary significantly from those considered in planning, on-site personnel must determine whether it is safe to proceed, if the risk assessment and control measures need amending to undertake the activity safely, or if the activity must be stopped and re-scheduled.

It is highly recommended that while on site the following measures be adopted:

- At least two people must be in sight of each other (this could be the PDT operator and a farm employee).
- At least one person must be able to raise the alarm if an emergency occurs.
- Communication devices be available that are waterproof and suitable for the location (i.e. satellite-based in remote locations).
- PPE and rescue equipment be available that has been tested and is working.
- Wear PPE and clothing that is appropriate for the work tasks being undertaken.

PN21 PART 1 Section 3 .2 contains further guidance information on the Health and Safety at Work Act.

5.4.2 Test Duration

A minimum test duration of 60 hours (2.5 days) is required, but that must be extended if unsuitable test conditions have occurred during the test period.

However, this minimum 60 hour test duration may be able to be reduced if the collected data was being continuously telemetered to the analyst. But only if they can confirm that at least 36 hours of 'good' telemetered data has been received, and the graphed data is indicating a clear and consistent seepage rate over this period.

While a minimum 60 hour test duration has been specified, there are advantages in extending this out by a further day or two more. While the PDT test continuously measures pond depth changes over the test duration, the analyst will average the accepted data and report a seepage rate in mm/day. Therefore, the longer the test duration, the more accurate the calculated average daily seepage rate will become.

5.5 Data Analysis

There are a variety of uncontrollable factors that can affect the accuracy and validity of the recorded data, and awareness of them by the analyst is necessary. These factors can include:

5.5.1 Groundwater

If the surrounding ground water level (GWL) is above the base of the pond, then it can flow back through the pond's liner and into the pond. This will be evidenced by the ponds surface level appearing to rise throughout the test. GWL can also rise and fall as the result of localised rainfall, flooding, pumping and irrigation.

A gain, or loss, in the pond level by more than 1 mm/day during the test could be indicative of a larger groundwater or seepage issue at the pond site. Further such investigation is outside the scope of this test.

5.5.2 Diurnal Effects

It should be noted that there can be distinct differences between daytime and nighttime temperatures leading to diurnal effects. Pond levels and evaporation rates can appear to cyclically go up and down and it may be appropriate to analyse the data as 24 hour sections to reduce these effects.

5.5.3 Wind Speed

Wind can create surface waves affecting recorded levels on both the pond and evaporation pan surfaces. Further, wind against the side of the pan can cause it to rock, or being overtopped, leading to unstable or incorrect readings.

Where the average wind speed exceeds 25 km/h over a 10 min interval then these data sections should generally be excluded from the analysis. However, average wind speeds of up to 30 km/h over a 10 min interval might be acceptable if the close analysis of the data section shows no impact on the quality of the data.

5.5.4 Anomalous Data

Following field testing, all recorded data needs to be downloaded into a spreadsheet or specifically developed software where it can be closely analysed. Graphing the data and the visual assessment of it must be carefully undertaken to identify any sections of anomalous data which must be removed from the analysis. Sources of such data can include the impacts of wildlife, inlet or outlet pipes on automatic timers, and disused pipe networks, as well as groundwater, catchment, and surface inflows.

5.6 Data Corrections

Relevant corrections must be applied to the selected sections of data during the post testing analysis. Rainfall and evaporation will have an impact, but there may be other environmental factors depending on the equipment system used for which corrections must be made.

5.6.1 Rainfall

To identify times that any rainfall starts and stops, a continuously recording automatic data logging rainfall gauge must be installed at the test site. It needs to incorporate a tipping bucket arrangement and record the start and end time for each continuous rainfall aggregation of 0.2 mm or more.

All test periods during which rainfall has been recorded are to be excluded from the analysis. The reasoning for this is that the recorded rainfall often does not always exactly align with the actual pond depth increase because the pond surface is usually smaller in area than the actual pond catchment area. Further, there can be surface channels and other inflow sources which will direct rainfall into the pond during rainfall periods and will not be reflected in the rain gauge reading.

The accuracy of the PDT test is dependent on limiting error sources to fractions of a millimetre. Removing rain affected data sections eliminates this error source.

5.6.2 Evaporation

Pond depth data must be corrected for the evaporation on the pond during the test. This is best achieved by using a floating evaporation pan of not less than 800mm in diameter and 450mm high (including freeboard).

The floating pan must incorporate a depth measuring sensor, similar in accuracy to the pond level sensor, with continuously recorded readings being taken at 1 minute, or less, intervals.

International research literature confirms that floating evaporation pans more closely simulate actual pond evaporation, and with less variability than alternative land based pans. Therefore, to provide the necessary test accuracy, land based pans should not be used.

However, evaporation rates in floating pans can still be influenced slightly by the heat transfer characteristics of the pan material and pan rim height affecting evaporative sun and wind action across the pans liquid surface.

While pans manufactured from metals have the higher thermal conductivities, lighter weight High Density Polyethylene (HDPE) pans have the highest heat transfer coefficients among the plastics and can be successfully used.

The measured evaporation from the floating pan needs to be corrected to an open water condition by applying an evaporation coefficient during data analysis. Based on research, this will likely sit between 0.85 and 1.00 depending on the specific conditions experienced (e.g. nearer to 0.85 for a high evaporation test scenario and closer to 1.00 for a minimal evaporation test.) An average coefficient of 0.90 can generally be adopted.

PDT suppliers should consider undertaking their own research to determine an appropriate coefficient for their specific floating evaporation pan.

5.7 Test Report

5.7.1 Result Reporting

Test reports are to express the seepage (as a negative number) in the form of:

$$\textbf{Seepage} = \boldsymbol{RESULT}(\textbf{mm}) \pm \textbf{1.0}(\textbf{mm}) \ \text{millimetres per day}$$

[Where: $\boldsymbol{RESULT}$ is determined from the PDT test, but additionally assigned an Expanded Uncertainty of Error of ±1.0 mm; seepage is expressed as a negative number.]

5.7.2 Seepage Pass/Fail Criterion

It is expected that Regional Councils (RCs) will be mostly accepting of maximum seepage limits of:

$$\textbf{Seepage} \le -\textbf{1.0} \pm \textbf{1.0} \ \text{mm/day}$$
$$(\textit{Includes an Expanded Uncertainty of Error of} \pm 1.0 \ \textit{mm}; \ \textit{seepage is expressed as negative})$$

Or, alternatively expressed as being within the following seepage limits:

$$+\textbf{1.0} \le \textbf{Seepage} \ge -\textbf{2.0} \ \text{mm/day}$$
$$(\textit{Includes an Expanded Uncertainty of Error of} \pm 1.0 \ \textit{mm}; \textit{seepage is expressed as negative})$$

It up to each RC to be decide at what pond test seepage rate value they might want to take follow up actions on if the reported seepage rate was outside a specified range. Other RCs may only consider following up with the landowner if they deem the leakage to be excessive by some other criterion, or there are other contributing issues. Therefore, reports should avoid stating that the pond passes or fails as this is up to the individual RC to determine.

Another consideration for RCs in the setting of any pass/fail criterion will be whether the depth of the pond is a relevant factor. Deeper ponds have a higher hydraulic head than shallower ones and will therefore have a higher seepage rate for the same liner. PN21 Part 2 Section 2.3 explores this matter further.

5.7.3 Report Information

The test report should contain all information that would assist potential readers to understand how the reported seepage result was obtained, and supported by other relevant site details:

- Pond owner, name, and address
- Pond name and location
- Estimated pond dimensions
- Condition of pond
- Test method details
- Test date(s), start/end times
- Weather details
- Test periods, both included and excluded from the analysis
- Change in pond level, including corrections applied
- Seepage Rate for the effective monitoring period
- Seepage Rate (mm/day)
- Factors that may have affected results
- Graph of level changes
- Aerial plan, and photographs
- Name and dated signature of (i) the analyst who prepared the report, and (ii) the CPEng reviewer.

- While an inspection of the pond site is outside of the scope of the PDT test, any observable concerns by the PDT field technician that may contribute to leakage should be recorded as observations on the PDT report. Observations that should be recorded include trees on pond embankments, high water table relative to pond level, evidence of slumping/subsidence, or other issues identified.
- All prepared PDT test reports to be reviewed with the report signed off by a Chartered Professional Engineer (CPEng) with competence in a relevant practice area.

5.7.4 Test Limitations

The test report should include a limitations statement that advises the pond owner of any limitations from the PDT supplier. Examples of the types of limitations may include the following, but suppliers could add their own as well:

- Where the Client, or their staff, provides information to the ('supplier'), or where we have obtained and/or relied upon information provided from another party, we have not verified this information. The ('supplier') assumes no responsibility for any inaccuracies in, or omissions to, that information.
- No inspections, other than any noted within, have been undertaken in support of the conclusions of this report.
- Groundwater and surface water inflows through the ponds wetted surface area from lower than surface level was assumed to be negligible during the test.
- Analysis accuracy is dependent on the Client having prepared their pond and operated it during the test as advised in pre-visit instructions.

- Dissimilar measured evaporation rates between adjacent ponds and test equipment locations at similar times may be due to factors such as differences in salinity, turbidity, surface sludge content, water depth, and ambient atmospheric conditions experienced.
- Reliance should not be placed on the absolute values derived from the analysis. All data collected, and its analysis, is subject to error and variability within the limitations of the test equipment and method.
- A change in circumstances, facts, or information after this report has been prepared may affect the adequacy or accuracy of its conclusions. The ('supplier) is not responsible because of any such changes.

5.7.5 PDT Certificate

A separate accompanying PDT Certificate is also to be issued to the Client along with the test report. This certificate must contain as a minimum the following information:

- Pond owner name and address
- Pond location/name
- Test dates
- Seepage rate (i.e. unaccountable change in pond level) in mm/day
- CPEng name, registration number, and dated signature
- Any other information the Client wishes to be added to the PDT Certificate.

On approval by the Client, a copy of the certificate may be able to be sent directly to RCs or other parties where the pond owner does not wish the full test report to be made available, but alternatively consents to the PDT Certificate being forwarded to a nominated party.

To assist this process, it is suggested that at the time of contract arrangements being made with the PDT supplier, that pond-owners be given the opportunity to accept, or decline, their approval for the supplier to forward a copy of the PDT certificate to the RC on their behalf. Regional Councils have advised that for meeting consent conditions, such an arrangement could reduce unnecessary administration time by all parties.

REFERENCES

Differences in Evaporation Between a Floating Pan and Class A Pan on Land

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https://doi.org/10.1111/j.1752-1688.2008.00181.x

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