Review of California Draft Regulations
Onsite Wastewater Treatment Systems (OWTS)

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It is obvious that close attention has been paid to the scientific literature in the development of the OWTS regulations. The regulations are well-crafted and are built on a solid scientific foundation.

The only area that might be given extra attention is the management of cluster systems. While the regulations do cover cluster systems (systems of several septic tanks discharging to a common drainfield), specific reference to cluster systems would add clarity.

The following comments address the specific issues raised by the Board.

Issue 1: Notification requirement for flows greater than 5,000 gpd...

This standard is based on the Colorado River Board (CRB) Guidelines for Sewage Disposal from Land Developments, hence the 5,000 gpd 'trigger' for notification of the Regional Water Board. The CRB Guidelines note that commercial and/or industrial dischargers are required to file regardless of flow to be treated. Does Para.24901 also need to include this statement?

Why 5,000 gpd has been selected is not clear to this reviewer. It represents the flow from 20 average households (250 gpd/household). This represents a significant development. Since this is basically a reporting requirement, it seems a 2,500 gpd 'checkpoint' would be more conservative. As noted in Plews el al. (1985) larger OWTS are more likely to fail. They note a level of concern at 3,500 gpd.

Issue 2: Requirement for OWTS effluent limit...

Regardless of whether 150 mg/L is the right number, is this an instantaneous, daily, or monthly (30 day) average?

If I understand this regulation correctly, this limit would only apply to systems that accept high strength wastewater, that is, atypical of domestic wastewater. Data we collected in the early nineties suggest that meeting

the BOD limit would be difficult for domestic wastewater (see Table 1); whereas TSS is easily met even without an effluent filter (Table 2).

Effective monitoring is questionable. Without special sampling ports, an instantaneous grab sample seems the only plausible alternative. Given the highly variable effluent concentrations, it would have limited meaning. Perhaps requiring pretreatment of high concentration wastes before sending them to septic tanks is more plausible. Another consideration is to require these systems to have special sampling boxes downstream of the septic tank for monitoring.

Table 1. Mean Biochemical Oxygen Demand (BOD_5) Results.
Note: Phase II is not continuous data (*).

SEPTIC TANK DESIGN	# of DATA PTS	BOD_5 INFLNT (mg/L)	# of DATA PTS	BOD_5 EFFLNT (mg/L)
PHASE I - Rectangular 1,000 gallons				
1. CONVENTIONAL TANK	76	254	75	175
2. BAFFLED TANK	75	253	76	160
3. COMPARTMENT + BAFFLES	76	249	76	147
PHASE II - Two Compartments*				
4. 2,000 GALLON TANK*	61	242	65	165
5. 1,000 GALLON ROUND TANK*	68	237	73	193
6. COMPARTMENT + BAFFLES 2*	79	248	85	173

Table 2. Mean Total Suspended Solids (TSS) Results.
Note: Phase II is not continuous data (*).

SEPTIC TANK DESIGN	# of DATA PTS	TSS INFLNT (mg/L)	# of DATA PTS	TSS EFFLNT (mg/L)
PHASE I - Rectangular 1,000 gallons				
1. CONVENTIONAL TANK	122	269	127	64.6
2. BAFFLED TANK	124	254	127	63.8
3. COMPARTMENT + BAFFLES	124	252	127	50.7
PHASE II - Two Compartments*				
4. 2,000 GALLON TANK*	63	212	63	54.5
5. 1,000 GALLON ROUND TANK*	73	221	76	79.0
6. COMPARTMENT + BAFFLES 2*	83	217	87	74.3

Issue 3: Requirement for effluent filter...

Effluent filters are proven; required in other states, and require monitoring. This latter fact will lead to fewer drainfield failures due to solids overloading as system back up will prompt owners to take action.

Issue 4: Requirement for groundwater monitoring...

While the need for data is valid, it is questionable whether this requirement will yield any systematically useful data. It seems to be a compromise to minimize the cost of data collection for the property owner. The results will be a 'hodge-podge' of data collected from domestic wells. Basically, wells will be randomly located on the property and not scientifically located to monitor groundwater. In other words, only the occasional domestic well will be located downgradient and within 100 feet of the OWTS on a property.

It is recognized that "it is rarely possible to predict the direction of OWTS discharge flow" even with an expensive study. Collecting data to determine

contamination by an OWTS without knowing site groundwater conditions is a waste of time and money and could even lead to erroneous conclusions.

It is true, however, that sampling a domestic well will give the owner valid information about well water quality. If this is a good thing, then it should be a drinking water regulation and sampling should be more often than once every five years (annually is recommended by US EPA). It does not belong in an OWTS regulation.

Rather than "simply a starting point', it is likely this requirement will be a false start.

Issue 5: Recommendation against discharge of water softener brines...

This may "highlight the increase in salinity", but it will not have any impact. The disposal of backwash brines is problematic and, to be effective, an alternative disposal solution must be forthcoming. If not, it is entirely possible that a more serious problem may be created from improper disposal of brines.

The citation of Perkins (1989) is misleading as Perkins states, "The brine solution...can be drained into the septic tank without harm. Although it has been theorized that salt could have a bad effect on the drain field...no such effect has been shown." Patterson's reference (1996) to his Ph.D. thesis is not a refereed publication; further only refers to finely textured soils.

The literature contains many references of salt contamination from irrigation practices, so we know an increase in salinity can cause a serious problem. It is logical to conclude that brines have a similar effect, but until California has some documented cases, even a recommendation does not belong in the regulations.

Issue 6: Protocol to determine seasonal high groundwater level...

The determination of seasonal high groundwater level using soil molting is well documented and is codified in other state regulations (see Attachment 1: Maine Onsite Regulations). The use of monitoring wells is similarly documented and the ten-foot requirement is scientifically sound.

Issue 7: Requirement for disinfection...

I am assuming that the requirement for supplemental treatment is to allow OWTS in locations where OWTS would not normally be allowed. Obviously, not allowing installation on poor sites is best, but sufficient technology does exist so that safe disposal can be designed for an otherwise marginal site.

Highly permeable soils do not provide adequate treatment. It is also well known that the presence of too many particles can render disinfection ineffective, so that the pretreatment requirement is needed.

I do not understand the need for Para. 24913(c)(2). If the site "can be expected to provide reasonable treatment for pathogens...," why is additional treatment required? Are these not "a properly sited and designed conventional OWTS?"

Issue 8: Reduction of total nitrogen...

It is a given that nitrate is highly mobile and a conservative anion (little denitrification has been shown to occur within the soil (Sikora and Keeney, 1975)). Using the drinking water standard of 10 mg N/L ensures compliance in areas where very little or no effective dilution takes place.

Issue 9: Certification of supplemental treatment technology...

This requirement is essential to ensure the integrity of supplemental treatment units. Over the years, I have seen devices purported to remove wastes that did not work as claimed. NSF has had a long history of testing and certifying, while ATSM[1] has been equally as successful in establishing standards.

The detailed prescription for wastewater and hydraulic design loading seem unnecessarily detailed (Para.24913(e)(2) and (3) given 'real world' variability. For example, the wastewater should only specify a minimum concentration, e.g., BOD: 125 mg/L or higher, or meet ASTM Standard D5905-98(2003).

The hydraulic loading should only address Para.24913(e)(3)(A) and should be conducted for a continuous six months. The other scenarios are

[1] C913-02 Standard Specification for Precast Concrete Water and Wastewater Structures; D5905-98(2003) Standard Practice for the Preparation of Substitute Wastewater

superfluous, if not down right silly. Either the system will operate or it will fail under scenario A.

First, the wastewater prescription is only an average estimate so that many other concentrations can and will occur (addition of garbage grinders, for example). Second, the testing period is only six months and there needs to be time to reach equilibrium and stable operation. Third, actual operation of systems may or may not follow any logical pattern and guessing at what might occur will not provide any assurance of a better testing regime.

If (B), (C), and (D) remain, should the systems be required to meet the standard 100% of the time or, say, 95% of the time?

Perhaps more importantly, a minimum sampling frequency and number of samples should be given.

Issue 10: Inspection of disinfection units...

If systems are required to have disinfection systems in order to be approved, then monitoring is essential. Further, California has an excellent study prepared by Leverenz et al (2006). My own experience has been limited to chlorine tablet systems and indeed they were a problem with tablets jamming and going undetected for months. Thus, weekly inspections are a reasonable requirement to ensure the protection of public health. These systems are going to be installed in areas of 'subpar' conditions, so it is even more important that performance be monitored.

Issue 11: Use of bottom area for design...

The pros and cons of sidewall and bottom area have been debated over the years, and, as the regulation calls for, the correct approach is to use just the bottom area.

Issue 12: Maximum design application rates...

Hydraulic loading rate is a critical factor in the design of OWTS; fortunately substantial history is available to have reliable application rates. Table 2 is within the appropriate ranges.

Issue 13: Requirement for additional soil...

The 'Y-axis' in Figure 2 does not have units.

It is reasonable to require additional action where soil is very porous for conventional OWTS; however, the option given (c) is to use pressure distribution AND either (1) more suitable soil or (2) reduced application rate is required. Is not an acceptable alternative to add disinfection instead (Para.24913(c))?

Para.24914(d) states that supplemental systems, which have disinfection, must also use pressure distribution. At the very least, I find this section is very confusing and potentially contradictory. If a supplementary system has adequate disinfection, why is there a further requirement?

Issue 14: Minimum of 3 feet of unsaturated soil...

This is reasonable. I do not understand the reason that "during operation" is used in the first line of Para.24914(c). It is either superfluous or its significance escapes me.

Issue 15: Supplemental treatment equivalent to one-foot of soil...

The concept that treating septic tank effluent (STE) prior to discharge to the drainfield will take less soil to treat is sound. Whether such 'pre-treatment' will substitute for one foot of soil is unknown.

The study by Duncan, et al. (1994) used laboratory columns rather than field data. Their results varied from 30% to 70% greater infiltration rates with significant reductions in pollutants monitored.

Since the minimum depth of unsaturated soils needed for treatment may be less than 3 feet, adding supplemental treatment provides sufficient confidence that treatment can be achieved within two feet or less. As a regulatory limit, the reduction should certainly be no more than one foot.

Why isn't disinfection an acceptable alternative as in the case of porous soils?

Issue 16: Use of engineered fill...

This is a conservative standard based on a solid history of performance.

Issue 17: Reduction allowance for gravel-less dispersal systems...

The practice of giving credit for gravel-less dispersal systems is relatively common and has been successful.

Issue 18: Minimum coverage for dispersal systems...

Locating dispersal systems in the root zone offers several treatment advantages; however, there is a need for minimum cover to prevent systems from being too close to the surface.

Issue 19: Use of seepage pits...

The use of seepage pits is a bad practice and should be discouraged. Seepage pits should only be use in conjunction with supplemental treatment. The requirement of 10 feet of soil beneath the infiltrative layer should always be required and no reductions be permitted. The 10 feet above seasonal high level of groundwater should stand.

There may be considerable infiltration through the pit bottom before clogging forces discharge through the sidewalls. Thus, significant flow can enter and in the likely case of little dispersion could produce a contaminant plume.

Issue 20: Performance of ET beds...

The proper operation of ET beds is highly dependent upon meteorological conditions. Periods of unusually heavy precipitation can overwhelm an ET system. Thus the 25-year return frequency is necessary if the system is expected to handle variations in precipitation.

Issue 21: Impacts of OWTS on impaired water bodies...

Preventing further degradation of an impaired water body is good science.

Appendix 1

MAINE SUBSURFACE WASTE WATER DISPOSAL RULES

10-144 CMR 241

SECTION 404.0 ON-SITE MONITORING OF SEASONAL HIGH GROUNDWATER TABLE CONDITIONS

404.1 When used: When the "A" or "Ap" (plow layer) horizons are greater than 7 inches thick or the site evaluator is unable to determine the seasonal groundwater table depth at the proposed disposal field site by direct soil profile observation or by soil drainage class/moisture regime using Table 400.1. Groundwater monitoring documentation may be provided which shows that soil mottling, or other color patterns, at a particular site are not an indication of seasonally saturated soil conditions. Documentation shall be made by directly measuring seasonal groundwater levels and temperatures in accordance with the procedures cited in this Section.

404.1.1 Groundwater table modifications: Seasonal groundwater table monitoring documentation shall be provided for sites where an attempt has or is being made to lower the seasonal water table level, to verify that soil mottling or other color patterns at a specific site are not a true indication of seasonally saturated soil conditions or high groundwater levels or that site modification has successfully drained a particular site to make it suitable for subsurface wastewater disposal in compliance with these Rules.

404.1.2 Monitoring responsibility: A Maine Licensed Site Evaluator shall be responsible for establishing and conducting the monitoring program. The Licensed Site Evaluator shall be responsible to adequately determine site conditions, properly locate and install monitoring wells on site, and accurately collect monitoring data.

404.1.3 Monitoring program proposal: A Maine Licensed Site Evaluator shall submit a completed proposal to the Department and the LPI prior to initiating any monitoring program. A preliminary scaled plan shall be submitted by the site evaluator which illustrates the location of proposed monitoring well, property lines, dwelling(s), disposal system(s), terrain slopes, existing well(s), artificial drainage, and natural surface drainage. Logs of soil profiles observed, proposed monitoring well depths, a description of procedures and equipment to be employed to collect accurate monitoring data, and other pertinent information shall also be provided.

404.1.4 Departmental approval: The Division of Environmental Health shall approve the monitoring program prior to its initiation. Failure to request prior approval from an applicant is considered cause not to accept any results of a monitoring program.

404.1.5 Monitoring well construction: Monitoring wells shall consist of 2 inches minimum diameter solid PVC pipe which extends above the soil surface a minimum of 24 inches for ease of location. This pipe shall be placed a minimum of 3 inches into a 6 inch minimum thick layer of clean stone or gravel that is placed at the base of the excavation. Compacted native soil shall be installed in the area between the pipe and the excavation. Monitoring wells shall have a vented cover and the pipe shall be surrounded by a mounded seal extending 6 inches down from the ground surface consisting of a layer of puddled clay, bentonite, or a bentonite/grout mixture or native soil material, to prevent direct entry of precipitation or other contaminants. Site conditions may require modifications of monitoring well design, in which case the Division of Environmental Health shall be consulted.

404.2 Monitoring well observation period: Groundwater level and temperature monitoring shall be done during the time of year when seasonal high groundwater table conditions are expected to occur. The first observation shall be made on or before April 1st. Subsequent groundwater level

readings shall be made at least every seven days until June 15th or until the site is determined to be unacceptable, whichever comes first. Seasonal groundwater table depths below the mineral soil surface and the soil water temperatures shall be recorded.

404.3 Site conditions: Sites to be monitored shall be carefully checked for groundwater drainage tile and open ditches that may have altered the natural seasonal groundwater table.

404.4 Witnessing the location and installation of monitoring wells: The property owner shall give the plumbing inspector permission to witness the excavation and installation of the monitoring wells. The plumbing inspector may require a maximum of 15 days written notice prior to witnessing the location and installation of the monitoring wells.

404.5 Minimum number and location of monitoring wells: There shall be at least two monitoring wells plus an additional well for every 300 gpd design flow above 300 gpd. The site evaluator shall locate the monitoring wells so that the wells will reveal representative groundwater table conditions in the soils beneath the footprint of the proposed disposal field and fill material extensions.

404.6 Monitoring well depth: In general, monitoring wells shall extend to a depth of at least 3 feet below the ground surface, except that special soil conditions may require different monitoring well depths, such as the following: In permeable soils that overlie a hydraulically restrictive soil horizon, monitoring wells shall terminate within the mottled soil horizon above the hydraulically restrictive soil horizon; in cases where a mottled soil horizon lies above a permeable unmottled soil, wells shall terminate in the lower part of the mottled horizon. The site evaluator shall determine the depth of the monitoring wells for each site. However, for complex situations, the Division of Environmental Health shall be consulted prior to installation of the monitoring wells.

404.7 Monitoring well data calibration: Climatic conditions may cause significant year to year fluctuations in the highest seasonal groundwater table. Monitoring well data shall be compared with water resources conditions information obtained from the United States Geological Survey (USGS) to determine whether the observed seasonal high groundwater table is at or near its normal level. The Division of Environmental Health shall be consulted if USGS data indicate above or below normal groundwater levels. In addition, specific unusual climatological events occurring during the monitoring period shall be recorded, such as heavy rainfall. Comparison results shall be included with a monitoring report as prescribed in Subsection 404.9.

404.8 Determination of seasonal high groundwater table conditions: Acceptable or unacceptable seasonal high groundwater table conditions, based on depth and temperature measurements, as modified by water resources information described in Subsection 404.7, shall be determined in accordance with the following Subsections:

404.8.1 Water table is found at depths greater than allowed in Table 600.2 or 600.4: If the water table is found at depths greater than the minimum allowed in Table 600.2 or 600.4, monitoring shall continue until June 15th or until the site has been determined to be unacceptable as prescribed in Subsection 404.8.2.

404.8.2 Water table is found at depths shallower than allowed in Table 600.2 or 600.4: If the water table is found at a depth shallower than allowed in Table 600.2 or 600.4, and, if the corresponding soil water temperature is at or above 41°F, the site shall be considered unacceptable, and the site evaluator shall notify the Department in writing. If the corresponding soil water temperature is below 41°F, monitoring shall continue until June 15th or until the site has been determined to be unacceptable.

404.9 Reporting findings: If monitoring discloses that a site is acceptable, the applicant may submit an application for a disposal system permit that includes a written monitoring report prepared by the investigating site evaluator. The monitoring report shall provide monitoring well locations, ground elevations at the monitoring wells, soil profile descriptions, measurement data and dates of measurement depths to observed water tables, and soil water temperatures, as well as supporting data indicating that monthly precipitation amounts are within the normal range.

404.10 Monitoring well abandonment: At the completion of the monitoring program, all monitoring wells located within the footprint of the proposed disposal field and fill extensions shall be abandoned and sealed to prevent the migration of surface water or potential contaminants to the subsurface. Monitoring well pipe shall be completely removed and the excavation filled with compacted native soil.