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To: Health Directors
Environmental Health Managers
OEHS Staff

From: Roger A. Cooley, P.E.
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Through: Donald J. Alexander, Director
Division of Onsite Sewage and Water Services

Subject: GMP #101 Large Subsurface Wastewater Systems/Mass Drainfields

Attached is the procedure an applicant should follow when a mass drainfield is proposed. Pages 1-4 should be provided to an applicant and his engineering consultant as a guide to help them perform the necessary soil and site evaluation for a mass drainfield. By following these procedures the consultant can determine if the selected area can be used for a mass drainfield.

The soil and site criteria in the Sewage Handling and Disposal Regulations work well for residential and small commercial establishments. However, for large mass drainfield, even if the soils comply with the Regulations, it does not mean that a system can be expected to function satisfactory. In some systems water mounding will encroach on the separation distance to the trench bottom. The standard drainfield layout may also enhance the possibility of water mounding. Additional site work including deeper borings and hydraulic conductivity measurements are required to have sufficient information to properly design a mass drainfield. This GMP should aid the consultant and the health department in siting, designing and permitting of mass drainfields. The attached procedure requires more site work and planning at the beginning of a project but should let the consultants and developers know earlier whether a site is suitable for the intended project.

If you have any questions on this procedure please contact Roger Cooley at (804) 225-4027.

LARGE SUBSURFACE WASTEWATER SYSTEMS
MASS DRAINFIELD
SOIL AND SITE EVALUATIONS

An application for a mass drainfield must be submitted to the local health department. After the submittal of the application a preliminary engineering conference (PEC) shall be held. The PEC shall include the owner or agent, his engineering consultant, and representatives of the local and district health department and engineer from the Office of Environmental Health Services. A preliminary engineering proposal (PEP) shall be prepared for all mass drainfield proposals. The need for a PEP for systems less than 5000 gpd, may be waived by the Division in lieu of a letter from the owner's engineer summarizing the agreements reached at the PEC. The PEP when submitted for evaluation shall consist of an engineering report and preliminary plans which shall contain the necessary data to support the proposed design. The PEP shall include but not be limited to the information outlined below.

A. Proposed design data and general information.

1. Design flows and analysis of sewage constituents as a basis for process design. Any changes to the proposed wastewater characteristics (either flow or strength) after the application and plan submittal may require a new application with appropriate fees.
2. Description of treatment processes and flow plans identifying the proposed arrangement of basins, piping and related equipment with unit operation design parameters and sizes.
3. Description of sludge management method.
4. Plan for imposed operational requirements to include provisions for a certified operator and hours of operation.

B. Site plan and boundary survey.

1. All corners of property and property line boundaries relevant to system design.
2. Wells/water supply sources (existing and proposed) within property or 500 feet of any proposed drainfield and within 100 feet of all other system components.
3. Existing water lines within property and within 10 feet of any projected system component.
4. Surface waters with any water quality classifications, designated wetlands, and existing storm drainage features.
5. Existing roads and structures.
6. Locations of any existing wastewater system components, drainfield/repair areas or other utility easements.

7. Areas being proposed for facilities and system components.
8. Topographic map with at least five feet contour intervals for areas to be evaluated for drainfields or reserve areas.

C. General soil and site mapping. A soil scientist and/or geologist familiar with onsite wastewater dispersal systems should prepare and work with the engineer on this portion of the report.

1. Detailed soil maps of entire mass drainfield areas at a scale of 1 inch = 200 feet (1:2400). Soil mapping includes areas where individual mass drainfields are not contiguous but share common landscapes and watersheds. As a minimum, soil mapping should delineate landforms, soils, slopes, and drainage. If soil mapping at 1:2400 is not feasible, soil mapping at the largest (most detailed) scale of any site or contour mapping provided by the project engineer for other aspects of the project shall be used. Detailed mapping can be done with a hand auger, though backhoe pits will be needed for detailed describing of the soils/geology and for VDH review.

2. Soil profiles and site features described and identified according to commonly used criteria and conventions of Virginia Department of Health and/or National Cooperative Soil Survey. Soils identified to a series or series-like level and correlated with published soil survey information for the county. If published soil survey information is unavailable; soils can be identified to a working level sufficient for scope of the project, as agreed upon by VDH and the consultant.

3. A soil legend describing map units, special symbols, and other items pertinent to the project.

4. As a minimum, relative soil ratings, limitations, and potentials for onsite wastewater disposal (septic system drainfields) or other intended uses shall be provided. The soil consultant can develop these ratings, or if available, published Soil Survey ratings can be used. Soil characteristics and properties that are limiting for wastewater treatment and disposal should be defined.

5. Underlying geology shall be described to a working field level common in mapping soils. Published geologic information, particularly geologic quadrangles, shall be provided if available. As a minimum, underlying lithology (mica schist, granite gneiss, stratified Coastal Plain sediments, etc.) shall be described along with features that are pertinent to wastewater treatment and disposal. This would include rock fractures, joints, voids and relative dip. Of particular importance is fracturing of the bedrock including hard (R horizons) and soft (Cr) horizons. Size, extent, and continuity of the bedrock fractures must be described. Chroma 2 colors, manganese coatings, clay plugs and coatings, and clay buildup at the soil-rock interface are some of the additional features to be described. The soil consultant shall comment about the relative permeability of the geology (hard and soft bedrock and Coastal Plain unconsolidated sediments) in relation to the proposed wastewater project. If geological concerns are a major issue for site suitability and approval, a geologist or hydro-geologist will need to provide a professional analysis and opinion.

6. Backhoe pits shall be used for detailed observation and describing of soils and geology, especially during the VDH review phase. Pit depth shall be at least 4 feet below any proposed trench installation depth, unless hard rock prevents excavation. The number of backhoe pits needed to promote reliability is soil and site dependent, but as a minimum shall include 3 per mass drainfield or 5 per soil series mapped at the 1:2400 scale. Where only one soil series is present in several mass drainfields, 10 total backhoe pits are sufficient.

7. A statement of professional opinion by an authorized onsite soil evaluator that the soil and site features are compatible with the project proposal.

D. Hydraulic conductivity and permeability information.

1. When VDH and project consultants agree on soils and potential water movement data for a proposed site, hydraulic conductivity and soil permeability data may be taken or derived from VDH percolation tables for texture groups, or permeability tables in published Soil Surveys. Permeability shall be determined for the most limiting soil horizon 4 feet below any proposed trench installation depth. Where trenches are proposed beneath a pronounced restrictive soil horizon, permeability data for the restrictive horizon should also be provided.

2. When necessary, in-situ hydraulic conductivity or permeability measurements that comply with VDH and/or common engineering practices may be conducted. Common methods include percolation tests, and saturated hydraulic conductivity tests. Data shall be reported in minutes per inch if using standard VDH percolation tests, and in inches per hour cross-referenced with centimeters per second if using other tests.

3. Number of permeability measurements necessary to promote reliability is site and soil dependent, but as a minimum shall include 3 measurements per mass drainfield area, or 5 per different soil series mapped at the scale of 1:200. Where only one soil series is present in several mass drainfields, 10 measurements total are sufficient.

4. All in-situ permeability measurements shall be recorded, averaged and reported. Where an occasional measurement may "fail", the area represented by the failing hole shall still be included in the proposed mass drainfield area, unless soil morphology and site features can be defined that indicate why the hole "failed", or why the failing hole is significantly different from surrounding holes.

5. Estimated or measured permeability (K_{sat}) values of the most restrictive soil within (below) 4 feet of the proposed trench depth shall be used for design purposes. Application rates used in determining total absorption area should not exceed 25% of the K_{sat} values when secondary treatment is provided. Higher percentages of K_{sat} values may be when the soils are free from restrictions, soil wetness features, or other limitations and additional wastewater treatment is provided. When wastewater treatment beyond a septic tank is not proposed the application rates should not exceed 15% K_{sat} values. Ground water mounding may restrict the loading rates to less than those values above.

E. Site-specific information on site loading capacity and assessment of groundwater impact.

1. Logs from deep borings (usually 10-20 feet deep) identifying restrictive layers, relevant changes in texture and density, and aquifer boundaries.
2. In-situ lateral hydraulic conductivity measurements of effective shallow aquifer.
3. Groundwater mounding analysis.
4. Contaminant transport assessment showing compliance with groundwater standards at property lines or at any water supply sources within property. This would include background nitrate values.
5. Suggested location of groundwater monitoring wells and sampling protocol.