SECTION 2 – NATURAL RESOURCES INFORMATION

1. Soils

Soil Interpretations

Waste Disposal Interpretations

Sanitary Facilities

(See Part 620 – National Soil Survey Handbook - Soil Interpretations Rating Guides)

Soil interpretations for sanitary facilities are a tool for guiding the user in site selection for the safe disposal of household effluent and solid waste. The interpretation guides are applicable to both heavily populated and sparsely populated areas. The ratings are for soils in their present condition and do not consider present land use. The use of these soil interpretation guides for sanitary facilities is important in site selection to minimize the potential for pollution and health hazards in local or regional areas. Improper site selection, design, or installation may cause contamination of ground water, seepage to the soil surface, and contamination of stream systems from surface drainage or flood water. Potential contamination may be reduced or eliminated by installing systems designed to overcome or reduce the effects of the limiting soil property.

The soil properties and qualities that affect use are those that influence the ease of excavation, absorption of effluent, seepage, permeability, and suitability of soil cover material. Many soil survey areas in sparsely populated parts of the country have only soil surveys of lower intensity. While some general observations may be made, onsite evaluation is required before the final site is selected.

Soil limitation ratings and associated restrictive features are given for septic tank absorption fields, sewage lagoons, and trench and area sanitary landfills. Soil suitability ratings and restrictive features are given f

Farm and ranch homesteads, outbuildings, and recreational facilities require a means to safely dispose of effluent and solid waste. A plan that includes daily cover for landfill and added protection to reduce offsite pollution minimizes the potential hazard. The interpretative guide for the use of daily cover for landfill also has additional application for the reclamation of some quarries, pits, and surface mine operations. The use of this guide should also include an evaluation of the material used in restoration of the target areas for the final establishment of vegetative cover.

Soil properties are important in selecting sites for septic tank absorption fields, sewage lagoons, and sanitary landfills and in identifying the limiting soil

properties and site features that should considered in planning, design, and installation. The soil properties that determine the ease of excavation or the installation of the facilities also affect the ratings. Soil limitation ratings of slight, moderate, or severe are given for septic tank absorption fields, sewage lagoons, and trench and area sanitary landfills. Soil suitability ratings of good, fair, and poor are given

Landfills

Daily Cover for Landfill

These soils are either partial or complete members of the set of soils that are limited for use as "Daily Cover for Landfill" if one or more soil properties within 150 cm (60 inches) of the soil surface are limiting.

"Daily Cover for Landfill" interpretation is a tool for guiding the user in site selection for the safe disposal of solid waste. The interpretation is applicable to both heavily populated and sparsely populated areas. The ratings are for soils in their present condition and do not consider present land use or mechanical alterations. The use of this interpretive guide ("Daily Cover for Landfill") is important in site selection. Improper site selection, design, or installation may cause contamination of ground water and surface waters and may create health and environmental hazards. Potential hazards and limitations may be reduced or eliminated by installing systems designed to overcome or reduce the effects of the limiting soil properties.

Daily cover for landfill is the soil material that is applied daily to compacted solid waste in an area sanitary landfill. The cover material is obtained offsite, transported, and spread on the area. The required soil characteristics for both daily and final cover materials are similar enough to share one rating.

Suitability of a soil for use as cover is based on properties that reflect workability and the ease of digging and of moving and spreading the material over the refuse daily during both wet and dry periods. Soils that are loamy or silty and that are free of stones are better suited than other soils. Clayey soils may be sticky and difficult to spread, and sandy soils may be subject to soil blowing. Slope affects the ease of excavation and of moving the cover material. It also may affect the final configuration of the borrow area and, thus, runoff, erosion, and reclamation.

The soils selected for daily cover for landfill should also be suitable for growing plants. They should not contain significant amounts of substances that are toxic to plants, such as a high content of sodium, salts, or lime. They should be thick enough over bedrock, a cemented pan, or the water table so that material can be removed efficiently while leaving a borrow area that can be revegetated. However, some damage to the borrow area is expected and plant growth may not be optimum.

Sanitary Landfill (Area)

Sanitary landfill (area) is a method of disposing solid waste by placing refuse in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil that is imported from a source away from the site. A final cover of soil at least 2 feet thick is placed over the completed landfill. Properties and qualities that influence trafficability and risk of pollution are the important considerations for area sanitary landfills.

Flooding is a serious problem because of the risk of washouts and pollution downstream and the difficulty of moving trucks in and out of flooded areas.

Permeability of the soil is an important consideration in all but the most arid parts of the country. If permeability is too rapid or if fractured bedrock or a fractured cemented pan is close to the surface, the risk of contaminating the water supply by leachate is great. A high water table may also transmit pollutants to the water supply and is likely to restrict truck movement during wet seasons.

Slope is a consideration because of the extra grading required to maintain roads on sloping soils. Furthermore, leachate may flow along the soil surface on sloping soils and cause difficult seepage problems in completed fills.

Sanitary Landfill (Trench)

If soil properties within 150 cm (60 in) of the surface of the soil are limitations for shallow excavations than shallow excavation have construction and performance limitations.

Sanitary landfill (trench) is a method of disposing solid waste by placing refuse in successive layers in an excavated trench. The waste is spread, compacted, and covered daily with a thin layer of soil that is excavated from the trench. When the trench is full, a final cover of soil material at least 2 feet thick is placed over the landfill.

Ratings are based on properties and qualities to the depth normally observed during soil mapping (approximately 5 or 6 feet). However, because trenches may be as deep as 15 feet or more, geologic investigations are needed to determine the potential for pollution of ground water as well as to determine the design needed. These investigations, which are generally arranged by the landfill developer, include the examination of stratification, rock formations, and geologic conditions that might lead to the conducting of leachates to aquifers, wells, water courses, and other water sources. The presence of hard, nonrippable bedrock, creviced bedrock, or highly permeable strata in or immediately underlying the proposed trench bottom is undesirable because of the difficulty in excavation and the potential pollution of underground water.

Soil properties and qualities used in ratings for sanitary landfill (trench) are listed in Table 620-19. Properties that influence the risk of pollution, ease of excavation, trafficability, and revegetation are major considerations. Soils that flood or have a water table within the depth of excavation present a potential pollution hazard and are difficult to excavate.

Slope is an important consideration because it affects the work involved in road construction, the performance of the roads, and the control of surface water around the landfill. It may also cause difficulty in constructing trenches for which the trench bottom must be kept level and oriented to follow the contour.

The ease with which the trench is dug and with which a soil can be used as daily and final cover is based largely on texture and consistence of the soil. The texture and consistence of a soil determine the degree of workability of the soil both when dry and when wet. Soils that are plastic and sticky when wet are difficult to excavate, grade, or compact and difficult to place as a uniformly thick cover over a layer of refuse.

The uppermost part of the final cover should be soil material that is favorable for the growth of plants. It should not contain excess sodium or salt and should not be too acid. In comparison with other horizons, the A horizon in most soils has the best workability and the highest content of organic matter. Thus, for a trench-type landfill operation it may be desirable to stockpile the surface layer for use in the final blanketing of the fill.

Sewage Disposal

Septic Tank Absorption Fields

If soil properties within 150 cm (60 in) of the surface of the soil are limitations for shallow excavations than shallow excavation have construction and performance limitations.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. The centerline depth of the tile is assumed to be 24 inches. Only the soil between depths of 24 and 60 inches is considered in making the ratings. The soil properties and site features considered are those that affect the absorption of the effluent, those that affect the construction and maintenance of the system, and those that may affect public health.

The soil properties and qualities that affect the absorption of the effluent are permeability, depth to a seasonal high water table, depth to bedrock, depth to a cemented pan, and susceptibility to flooding. Stones and boulders and a shallow depth to bedrock, ice, or a cemented pan interfere with installation. Subsidence interferes with installation and maintenance. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas. Also, soil erosion is a hazard where absorption fields are installed in sloping soils.

Some soils are underlain by loose sand and gravel or fractured bedrock at a depth less than 4 feet below the distribution lines. In these soils the absorption field may not adequately filter the effluent, particularly when the system is new; as a result, the ground water supply may be contaminated. Soils that have a hazard of inadequate filtration are given a severe rating.

Percolation tests are used by some regulatory agencies to evaluate the suitability of a soil for septic tank absorption fields. These tests should be performed during the season when the water table is highest and the soil is at minimum absorptive capacity. The percolation rates do not correspond to the permeability rates because they are measured by different methods. Experience indicates that soils that have a percolation rate faster than 45 minutes per inch function satisfactorily, soils that have a rate between 45 and 60 minutes per inch have moderate limitations, and soils that have a rate slower than 60 minutes per inch have severe limitations.1/

In many of the soils that have moderate or severe limitations for septic tank absorption fields, it may be possible to install special systems that lower the seasonal water table or to increase the size of the absorption field so that satisfactory performance is achieved.2/ However, such systems are not considered in this guide.

1/ U.S. Department of Health, Education and Welfare, Public Health Service, l969 Manual of Septic Tanks, PHS Publication No. 526, p. 8.

2/ Bouma, J. l974. New Concepts in Soil Survey Interpretations for Onsite Disposal of Septic Tank Effluent.

Sewage Lagoons

If soil properties within 150 cm (60 in) of the surface of the soil are limitations for shallow excavations than shallow excavation have construction and performance limitations.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the wastes. Lagoons have a nearly level floor surrounded by cut slopes or

embankments of compacted, relatively impervious soil material. Relatively impervious soil for the lagoon floor and sides is desirable to minimize seepage and contamination of local ground water.

Soil permeability is a critical property in evaluating a soil for sewage lagoons. Most porous soils will eventually seal when being used for a sewage lagoon. Until they do, however, the hazard of pollution is severe. Soils that have a permeability rate that exceeds 2 inches per hour generally are too porous for the proper operation of sewage lagoons and may cause contamination. Fractured bedrock within a depth of 40 inches may create a pollution hazard. Bedrock and cemented pans create construction problems.

Slope must be gentle enough and the soil material must be thick enough over bedrock or a cemented pan to make smoothing practical so that the lagoon is uniformly deep throughout.

If floodwater overtops the lagoon, it interferes with the functioning of the lagoon and carries away polluting sewage before sufficient decomposition has taken place. Ordinarily, soils susceptible to flooding have a severe limitation for sewage lagoons. If floodwater velocities are slow and flooding is rarely deep enough to overtop the lagoon

Soils that contain a large amount of organic matter are not suitable for the floor of an aerobic lagoon.

Depth to water table is important if it influences the water level in the lagoon. If it does, a pollution hazard exists. Sometimes depth to water table is disregarded if the lagoon floor is of slowly permeable soil material that is at least 4 feet thick. Soils that contain excess rock fragments greater than 3 inches are undesirable sites.

These reports are available on the Soil Data Mart http://soildatamart.nrcs.usda.gov/Survey.aspx?State=WA.

Waste Management

(See Part 620 – National Soil Survey Handbook - Soil Interpretations Rating Guides)

Soil interpretations for waste management provide a means to use organic wastes and waste-water as productive resources. Using these resources will result in energy conservation, prevent waste, and minimize problems associated with their disposal. The planned use of many wastes has proven beneficial to the producer and the user of these by-products. The characteristics of the soil are important in the application of organic wastes and wastewater to land for fertilization and irrigation. They are also important considerations if the soil is used as a medium for the treatment and disposal of these wastes. Favorable soil properties are required to prevent environmental damage.

The interpretation guides for wastewater includes municipal and food processing wastewater and lagoon or storage pond effluent. Manure, food processing waste and municipal sludge may be liquid; however, for the purposes of these guides, they are not considered to be wastewater unless the water content is more limiting to the rate of application than the nutrient or biochemical oxygen demand (BOD) content. The rating is for each soil in its present condition and does not

consider present land use. The suitability ratings provided for each interpretation are based on the influence of existing soil properties on the use. For each soil rated, the degree of suitability and the most restrictive features that affect the proposed use are identified. The restrictive features are identified for each moderate or severe suitability rating as it affects use and performance for the desired purpose. Thus the user can develop alternatives for use and management.

These guides are designed for the management of defined classes of organic wastes and wastewater, whether or not the objective is treatment for utilization by a crop1/ (as with manure and food processing wastes, municipal sewage sludge, and wastewater used for irrigation); treatment without regard to crop needs (such as treatment of water by the slow process, treatment of water by the overland flow process, and treatment of water by the rapid infiltration process); or land reclamation (as with carbonaceous materials used as a soil conditioner and stabilizer). Not considered in these guides, but important in evaluating a site, are allocation and accessibility of the area, size and shape of the area, and use and management of the treatment area. Geology, hydrology, and climate are considered only to the extent that they are reflected in the kind of soil mapped. Waste quality and rate of application are considered to the extent that they are within the "safe" limits as recommended in such publications as Application of Sewage Sludge of Cropland--Appraisal of Potential Hazards of the Heavy Metals to Plants and Animals, November 1976, MCD-33, EPA 430/9-76-013; Municipal Sludge Management--Environmental Factors, October 1977, MCA-28, EPA 430/9-77-044; Criteria for Classification of Solid Waste Disposal Facilities and Practices, EPA, in Federal Register, Vol. 44, No. 179, September 13, 1979, pp. 53460-53464; and Process Design Manual for Land Treatment of Municipal Wastewater, October 1977, EPA 625/1-77-008, or within the regulatory guidelines adopted by the individual state(s) if the state regulation is more restrictive.

This section contains guides for interpreting soils for use in the management of manure and food processing wastes; the management of municipal sewage sludge; the management of wastewater used for irrigation; the treatment of wastewater by the slow rate process; the treatment of wastewater by the overland flow process; the treatment of wastewater by the rapid infiltration process; and the management of carbonaceous material as a soil conditioner and stabilizer. Wastewater includes municipal and food processing wastewater and lagoon or storage pond effluent. Manure, food processing waste, and municipal sludge may be liquid; however, for the purpose of these guides they are not considered to be wastewater unless the water content is more limiting the to rate of application than the nutrient or biochemical oxygen demand content.

Agricultural Waste and Sewage Sludge Disposal (AWM-1)

Land Application of Manure and Food Processing Waste

If soil properties within 150 cm (60 in) of the surface of the soil are limitations for manure and food processing waste attenuation, plant growth, or natural decomposition processes than land applications of manure and food processing waste has environmental and health limitations.

(1) Manure is the excrement of livestock and poultry. The consistency of manure is labile. It changes in storage or treatment, and it depends upon the bedding used and upon whether the manure is diluted or allowed to dry. Food processing wastes consist of damaged fruit and vegetables and the peelings, stems, leaves, pits, and soil particles removed in food preparation. Most wastes produced in the processing of milk, cheese, and meats are liquids. Paunch manure is an exception.

(2) Manure and food processing wastes have variable nitrogen content. The material is solid, slurry, or liquid. A high nitrogen content limits the application rate. Toxic or otherwise dangerous wastes, such as those mixed with the lye used in food processing, are outside the meaning of manure and food processing wastes as used in this interpretation.

(3) The soil properties and qualities considered are those that affect soil absorption, plant growth, microbial activity, the susceptibility to wind or water erosion, and the rate and method of the application of wastes. Soil properties that affect absorption are permeability, the depth to a seasonal high water table, sodium adsorption ratio, the depth to bedrock or a cemented pan, and the available water capacity. Soil reaction, sodium adsorption ratio, salinity, and bulk density are soil properties that affect plant growth and microbial activity. The wind erodibility group, erosion factor, slope, and susceptibility to flooding are used to measure the potential for wind and water erosion. Stones and the depth to a seasonal high water table can interfere with the application of wastes. Permanently frozen soils are not suited to the treatment of wastes.

(4) The soil rating guide is based on utilizing the nutrients in the wastes for crop production and is not directed toward reclaiming or restoring critical areas or making the most efficient use of moisture. Applications of liquid wastes can be made by tank wagon or conventional irrigation methods that are modified as necessary to function properly. Applications of solid and slurry wastes can be made at the surface or subsurface.

Land Application of Municipal Sewage Sludge

If soil properties within 150 cm (60 in) of the surface of the soil are limitations for waste product attenuation, plant growth, or natural decomposition processes than land applications of municipal sewage sludge has environmental and health limitations.

Municipal sewage sludge as used in this guide is the residual product of the treatment of municipal sewage. The solid component is composed mainly of cell mass, primarily bacteria cells which have developed during secondary treatment and which have incorporated soluble organics into their own bodies. Sludge also contains small amounts of sand, silt, and other solid debris. Municipal sewage sludge has variable nitrogen content. Some sludge contains constituents that are toxic to plant growth or hazardous to the food chain (such as heavy metals or exotic organic compounds) and should be chemically analyzed prior to use.

The water content of sludge ranges from about 98 percent to about 40 percent or less. The sludge is called liquid if it is more than about 90 percent water, slurry if it is about 90 to 50 percent

water and solid if it is less than about 50 percent water. Depending on the water content, the sludge can be moved by pump, conveyor, or auger.

The soil properties and qualities considered in rating the degree of limitation are those that affect soil absorption, plant growth, microbial activity, the susceptibility to wind or water erosion, and the rate and method of application. Soil properties and qualities that affect absorption are permeability, the depth to a seasonal high water table, soil reaction, sodium adsorption ratio, salinity, and bulk density. They also affect plant growth and microbial activity. Slope and the susceptibility to flooding are used to measure the potential for water erosion. Stones and the depth to a seasonal high water table can interfere with the application Stones and the depth to a seasonal high water table can interfere with the application

The soil rating guide is based on utilizing the nutrients in the waste for crop production and is not directed toward reclaiming or restoring critical areas or making the most efficient use of moisture. Applications of slurry sludge can be by tank wagon or by irrigation equipment that is modified as necessary to function properly. Applications of solid and slurry sludge can be made at the surface or subsurface.

Disposal of Wastewater by Irrigation

If soil properties within 150 cm (60 in) of the surface of the soil are limitations for surface or sprinkler irrigation systems, waste product attenuation, plant growth, or natural decomposition processes than disposal of wastewater by irrigation has application, environmental or health limitations.

The wastewater considered in this guide is municipal wastewater and wastewater from food processing plants, lagoons, and storage ponds. Municipal wastewater is the water in the waste stream from a municipality. It contains domestic waste and, in some areas, includes industrial waste. It may be untreated, although this is rare, or it may be wastewater that has received primary or secondary treatment. Food processing wastewater is the wastewater resulting from the preparation of fruits, vegetables, milk, cheese, and meats for public consumption. In some places it has a high content of sodium and chloride. Lagoon and storage pond effluent, as discussed in this guide, refer to the effluent from facilities used to treat or store domestic wastes, wastewater from food processing, or liquid animal wastes. The effluent from a municipal or food processing plant lagoon or storage pond commonly is very low in carbonaceous and nitrogenous matter. The nitrogen content ranges from 10 to 30 mg/l. The effluent from animal waste treatment lagoons or storage ponds has much higher concentrations of these materials mainly because the manure has not been diluted as much as domestic wastes. The nitrogen content varies considerably but generally is from 50 to 2,000 mg/l.

Some wastewater may cause an increase in sodicity or salinity in the soils in arid and semiarid regions but it generally does not in humid regions. The heavy metal contents of effluents are usually low; however, chemical analyses should be made prior to use.

The soil properties and qualities important in design and management are the sodium adsorption ratio, depth to a seasonal high water table, the available water capacity, permeability, wind erodibility, erosion factor, slope, and flooding. The soil properties and qualities that influence construction are stones, depth to bedrock or to a cemented pan, and depth to a seasonal high water table. The properties and qualities that affect performance of the irrigation system are depth to bedrock or to a cemented pan, bulk density, the sodium adsorption ratio, salinity, and soil reaction. The cation exchange capacity also affects performance, and it is used here as an estimate of the capacity of a soil to adsorb heavy metals. Permanently frozen soils are not suited to irrigation.

The soil rating guide is based on the utilization of the water for crop production and is not directed toward only the disposal or treatment of the wastewater. Checks should be made to ensure that heavy metals, nitrogen, and other salts are not added in excessive amounts.

Agricultural Waste Water Disposal (AWM-2)

Overland Flow Process Treatment of Wastewater

If soil properties within 150 cm (60 in) of the surface of the soil are limitations for surface or sprinkler application systems, waste product attenuation, plant growth, or natural decomposition processes than disposal of wastewater by OVERLAND FLOW has application, environmental or health limitations.

In this process wastewater is applied to the upper reaches of sloped land and allowed to flow across vegetated surfaces which are sometimes called terraces, to runoff collection ditches. The length of the run generally is 150 to 300 feet. Application rates range from 2.5 to 16.0 inches per week. The wastewater leaves solids and nutrients to plants and soil surfaces as it flows downslope in a thin film. Most of the water reaches the collection ditch, some is lost by evapotranspiration, and a small part percolates to the ground water.

The wastewater considered is from municipal wastewater, food-processing plants, lagoons, and storage ponds. Municipal wastewater is the waste stream from a municipality. It contains domestic waste and possibly industrial waste. It may be, although rarely is, raw sewage (untreated), or it may be wastewater that has received primary or secondary treatment. Food-processing wastewater is the wastewater resulting from the preparation of fruits, vegetables, milk, cheese, and meats for public consumption. In some places it is high in sodium and chloride. Lagoon and storage pond effluents, as discussed here, refer to the effluents from a lagoon or storage pond that is used to treat or store food-processing wastewater, domestic wastes, or animal wastes. Domestic wastes are very dilute, and the effluent from a facility that treats them commonly is very low in carbonaceous and nitrogenous matter. The nitrogen content ranges from 10 to 30 mg/l. Lagoons and storage ponds that treat animal wastes have an effluent that has a much higher concentration of these materials mainly because the manure has not been diluted as much as domestic wastes. The nitrogen content varies considerably but generally is 50 to 2,000 mg/l. The heavy metal content generally is low; however, chemical analyses should be made prior to use.

The soil properties and qualities considered in rating the degree of limitation are those that affect absorption, plant growth, microbial activity, and the design and construction of site. The properties that affect adsorption are soil reaction and the cation exchange capacity. Soil reaction, salinity, and the sodium adsorption ratio are soil properties that affect plant growth and microbial activity. Slope, permeability within a depth of about 30 inches, depth to a seasonal high water table, flooding, depth to bedrock or to a cemented pan, and stones are soil properties and qualities that influence design and construction. Permanently frozen soils are not suited to treating wastewater.

The soil rating guide is based on the treatment of the wastewater and is not directed toward the use of the water as a source of moisture for crop production. However, areas are vegetated because plants are a necessary part of the soil-plant treatment process. Wastewater generally is applied by sprinkler or surface application methods.

Rapid Infiltration Disposal of Wastewater

If soil properties within 150 cm (60 in) of the surface of the soil are limitations for surface or sprinkler irrigation systems, waste product attenuation, plant growth, or natural decomposition

processes than disposal of wastewater by irrigation has application, environmental or health limitations.

In this process the wastewater is applied in a level basin and percolates through the soil. The treated water eventually reaches the ground water. Application rates range from 4 to 120 inches per week.

Because the thickness of soil material needed for proper renovation of the wastewater is more than 72 inches, geologic and hydrologic investigations during the planning stages are needed to ensure proper design and to determine reliability of performance as well as the potential for pollution of the ground water.

The wastewater considered generally is from municipal wastewater treatment plants. The nitrogen content generally is low. Normally, the heavy metal content is low; however, chemical analysis should be made prior to use.

The soil properties and qualities that influence risk of pollution, design and construction, and performance are major considerations. They are listed in Table 620-27. Depth to a seasonal high water table, flooding, and depth to bedrock or to a cemented pan present potential hazards and influence design and construction. Slope and stones are also important considerations in design and construction. The properties and qualities that influence performance are permeability and soil reaction. Permanently frozen soils are not suited to treating wastewater.

The soil rating guide is based on the treatment of the wastewater and is not directed toward the use of the water as a source of moisture for crop production. Vegetation is not a necessary part of the treatment process; hence, the basins may or may not be vegetated.

Slow Rate Process Treatment of Wastewater

If soil properties within 150 cm (60 in) of the surface of the soil are limitations for surface or sprinkler application systems, waste product attenuation, plant growth, or natural decomposition processes than disposal of wastewater by SLOW RATE has application, environmental or health limitations.

In this process wastewater is applied to the land at a rate normally between 0.5 and 4.0 inches per week. The primary purpose is wastewater treatment rather than irrigation of crops. Application rates commonly exceed those needed for supplemental irrigation for crop production. The applied wastewater is treated as it moves through the soil. Much of the treated water percolates to the ground water, and some enters the atmosphere by evapotranspiration. Surface runoff of the applied water generally is not allowed. Waterlogging is avoided either through control of the application rate or the use of tile drains, or both.

The wastewater considered includes municipal wastewater and effluent from food-processing plants, lagoons, and storage ponds. Municipal wastewater is the waste stream from a municipality. It contains domestic waste and possibly industrial waste. It may be, although rarely is untreated sewage or may be wastewater that has received primary or secondary treatment. Food-processing wastewater is the wastewater resulting from the preparation of fruits, vegetables, milk, cheese, and meats for public consumption. In some places it is high in sodium and chloride. Lagoon and storage pond effluents, as discussed here, refer to the effluents from a facility used to treat or store food-processing wastewater, domestic wastes, or animal wastes. Domestic and food-processing wastewater is very dilute, and the effluent from facilities that treat or store it commonly is very low in carbonaceous and nitrogenous matter. The nitrogen content ranges from 10 to 30 mg/l. Lagoons or storage ponds for animal wastes have an effluent that has a much higher concentration of these materials mainly because the manure has not been diluted

as much as domestic wastes. The nitrogen content varies considerably but generally is 50 to 2,000 mg/l. The heavy metal content generally is low; however, chemical analyses should be made prior to use.

The soil properties and qualities considered in rating the degree of limitation are those that affect soil absorption, plant growth, microbial activity, the susceptibility to wind or water erosion, and the application of wastes. Properties and qualities that affect absorption are the sodium adsorption ratio, depth to a seasonal high water table, the available water capacity, permeability, depth to bedrock or to a cemented pan, soil reaction, cation exchange capacity, and slope. Soil reaction, the sodium adsorption ratio, salinity, and bulk density are soil properties that affect plant growth and microbial activity. Wind erodibility group, erosion factor, slope, and susceptibility to flooding are used to measure the potential for wind erosion and water erosion. Stones can interfere with the application of wastes. Permanently frozen soils are not suited to treating wastewater.

The soil rating guide is based on the treatment of the wastewater and is not directed toward the use of water as a source of moisture for crop production. However, it is assumed that crops are grown or may be grown as a part of the soil-plant treatment process. Checks should be made to ensure that heavy metals and nitrogen are not added in excessive amounts.

These reports are available on the Soil Data Mart http://soildatamart.nrcs.usda.gov/Survey.aspx?State=WA.