PROPOSED

OREGON SITE-SPECIFIC SOIL MAPPING STANDARDS

A COMPONENT OF THE OREGON SOILS FRAMEWORK LAYER

Draft for Comment

February 2009

Prepared by
Oregon Soils Committee

Send written comments by *15 April 2009* to the Committee in care of:
Jay S. Noller, Chair
Oregon Soils Committee
ALS 3017
Dept. Crop & Soil Science
Oregon State University
Corvallis, OR 97330
jay.noller@oregonstate.edu
Fax: 541-737-5725

TABLE OF CONTENTS

1 INTRODUCTION

Site specific soils mapping is conducted for very intensive land uses requiring detailed information about soils, generally in small areas. Site-specific soils mapping is often considered to be synonymous with Order 1 soil surveys completed by the NCSS. Minimum delineations are very small (perhaps less than 1 hectare). The information can be used in planning individual building sites, designing experimental agriculture plots preparing management plans for public lands, and other uses requiring detailed and very precise knowledge of the soils and their variability. Field procedures permit observations of soil boundaries throughout their length. The soils in each delineation are identified by transecting or traversing. Map units are mostly consociations with some complexes and are phases of soil series or are miscellaneous areas. Base map scale is generally 1:12,000 (1''=1000) or a larger map scale (Soil Survey Division Staff, 1993).

1.1 NRCS ORDER 1 AND SITE-SPECIFIC SOILS MAPPING STANDARDS

The term "Order 1" is used by the USDA/NRCS National Cooperative Soil Survey (NCSS) to describe the most detailed level of soils mapping performed under this Federal program. Site-specific soils mapping is synonymous with Order 1 soils mapping. The primary distinction is that site specific standards include enhancements in specific soils mapping requirements to reflect local environmental conditions, soils and landscapes, as well as to recognize specific state regulatory policies and compliance requirements for the land-use permitting process. The soils mapping criteria identified in these standards are appropriate for subdivision and site plan review, biosolids management and other specific land uses that are regulated in Oregon. These standards are designed to augment the basic criteria with a supplement specific to the state.

1.2 NRCS POLICY ON USE OF COUNTY SOIL SURVEY MAPS

The NRCS National Cooperative Soil Survey Program provides soil resource information and land use interpretations on the behavioral characteristics of soil based on soils mapping completed at a scale ranging from 1:15,840 to 1:24,000. Soils mapping at these scales have interpretive value for general land use planning purposes only and are not satisfactory for making site-specific land use decisions without a site visit and verification of soils. Due to the cartographic limitations of the map scale, the smallest soil delineations shown on county soil maps are 3 to 5 acres in size. Small areas of contrasting soils, less than 3 to 5 acres may not be shown on the soils map and can result in costly mistakes, both monetarily and environmentally, when site-specific land use decisions are made without first conducting an on-site evaluation or completing a site-specific soil survey.

The NRCS does not condone the enlarging of county soil survey maps to overlay site plans at a smaller scale. This procedure gives the misconception that the soils map was completed with a much higher degree of precision than what was allowed at the original mapping scale. The NRCS will not take responsibility for the mis-interpretation of soils information resulting from enlarging the county soil maps.

These mapping standards conform to the standards of the National Cooperative Soil Survey and resulting maps will provide the necessary soil interpretations needed to make site-specific land use decisions. The NRCS Soil Survey Program will provide soil scientists to complete site-specific soils mapping only when the request for such mapping is necessary to support NRCS mandated programs. All other site-Specific soils must conducted by a private consulting soil scientist or soil scientist within the agency planning to use the soils information for management purposes.

1.3 SUPPORTING PRINCIPLES BEHIND THE SITE-SPECIFIC STANDARDS

The Site Specific Soils mapping Standards (SSSMS) described in this document are based on a universally recognized taxonomic system of soil classification and are supported by national soils mapping standards established by the USDA National Cooperative Soil Survey. They allow for the development of multi-purpose soil map products which are carefully controlled and monitored through a state, regional and national quality assessment program.

To the extent the SSSMS are based on the soils mapping standards of the National Cooperative Soil Survey, they are supported by University Agricultural Experiment Stations, Cooperative Extension Services, as well as the US Forest Service, USEPA, the US Army Corps of Engineers, US Fish and Wildlife Service and many other state and federal agencies. Although SSSMS are based on national standards which are consistent across state lines, there are some application procedures that are unique for each state.

The original Federal authority for the National Cooperative Soil Survey is contained in the record of the 53rd Congress, chapter 169, Agriculture Appropriations Act of 1896. The authority was elaborated in public law 74-46, the Soil Conservation Act of April 27, 1936, and again in Public Law 89-560, Soil Surveys for Resource Planning and Development, September 7, 1966. Title 7 Code of Federal Regulations Chapter VI, Subchapter B – Conservation Operations, Part 610 – Technical Assistance authorizes the National Cooperative Soil Survey to assist land owners and others who are responsible for making decisions and setting policies that influence land use, conservation treatment, and resource management. Authorized activities include evaluation of soil, water, vegetation and other resources data needed for making land use, environmental and conservation treatment decisions.

The standards of the National Cooperative Soil Survey meet all of the requirements of the soil science profession and are accepted as the standard.

Three principal publications provide reference documentation on the standards of the National Cooperative Soil Survey and subsequently to the Site-Specific Soils mapping Standards for Oregon. They are as follows:

Agricultural Handbook 18, Soil Survey Manual, 1993, USDA, NRCS

The purpose of the Soil Survey Manual is to provide the major principles and concepts for making and using soil surveys and the standards and conventions for describing soils. Accessible online at http://soils.usda.gov/technical/manual

National Soil Survey Handbook- 430-VI, USDA, NRCS, and all amendments to this handbook.

The National Soil Survey Handbook provides guidelines, definitions, policy, responsibilities, and procedures for conducting soil surveys, planning soil surveys, collecting and maintaining soil survey documentation and distributing the information to users. Accessible online at http://soils.usda.gov/technical/handbook

Agriculture Handbook 436, Soil Taxonomy; A Basis System of Soil Classification for Making and Interpreting Soil Surveys, 1999, USDA, NRCS, and all amendments.

Soil Taxonomy provides the common base for the organization of knowledge about soils and a universal means to communicate this knowledge. Accessible online at http://soils.usda.gov/technical/ classification/taxonomy

The soil data collection process is carried out using scientific methods and processes that provide reproducible results. Soil survey investigation procedures are based on universally accepted (American Society for Testing and Materials, Soil Science Society of America, et.al.) scientific design and sampling strategy and are documented sufficiently to allow others to apply these methods consistently (USDA/NRCS/NSSC Soil Investigations Report No. 42. 1996).

This document is drafted from the *Site-Specific Soil Mapping Standards for New Hampshire and Vermont*, SSSNNE Special Publication No. 3 Version 3.0, (December, 2006), a cooperative effort between the Society of Soil Science of Northern New England (SSSNNE) and the USDA/NRCS National Cooperative Soil Survey. The SSSNNE publication is not copyrighted and is provided by SSSNNE; it has been modified herein to incorporate Oregon specific needs related to site-specific (Order 1 and Order 0) soils mapping. As well, this document includes some text and provisions of the *Standards and Specifications for High-Intensity Soil Survey for Agriculture in Illinois,* jointly produced by the USDA-NRCS and Illinois Soil Classifiers Association. As of the preparation of this document, no explicit documents or policy are known to its preparers that govern site-specific soils mapping within the State of Oregon. Documented standards are needed to

ensure consistency among state and federal agencies performing NCSS (National Cooperative Soil Survey) mapping projects and to explicitly document data collection requirements (for field sampling) and data accuracy requirements (for digital mapping and final map production).

2 HOW TO USE THIS DOCUMENT

It is emphasized that these Standards are the minimum to which the soil scientist must comply. They are a bridge from source documents which explain site-specific soils mapping standards in greater detail. For further clarification on any criteria discussed in these Standards, the soil scientist should refer to the appropriate originating document. There is a list of reference documents in the bibliography including those that specifically contain the criteria for site-specific soils mapping. Soil scientists should work with the end user of the soil map product to determine the level of detail appropriate for the proposed use. These site specific soils mapping standards have been developed through a cooperative effort between Oregon State University (Department of Crop and Soil Sciences), Oregon Department of Administrative Services, and several other state and federal agencies, and private concerns, including the Oregon Society of Soil Scientists, in response to a need to provide regulatory agencies, local officials, and land use planners with consistent high quality, large-scale, soil resource information.

3 SITE-SPECIFIC SOILS MAPPING STANDARDS

3.1 MAPPING PROCEDURE

Site-specific soils mapping involves the application of soil science, an academic and technical field of agricultural and environmental science, by a university-trained soil scientist. The mapping procedure by which the site-specific soil mapper conducts a study at minmum involves creation of a Work Plan, a determination of soil survey area size (or extent), map scale, mapping base, field procedures, map unit purity, identification of map units, map labelling, soils legend, cartographic procedures, and description and classification of soils.

3.2 WORK PLAN

A work plan should be developed for each site-specific soils mapping project. The plan should address the aims and objectives of the project, project scope, milestones and deliverables.

3.3 SURVEY AREA SIZE

Site-specific soils mapping addresses the range of area sizes that are more detailed than what NCSS standard soils mapping (survey) may suitably address. No limit to size of area is set by this standard. In general, the extent of land holding, e.g., farm or ranch, under study dictates the survey area size.

3.4 MAP SCALE

Map scale must be large enough to permit refined distinctions among small homogeneous areas of soils. The minimum size map unit delineation should be identified in the work plan. It should represent the size of the smallest area that is managed for the intended land use. The map scale must accommodate legible delineations of the smallest size map unit. The soil scientist and the map user shall choose a scale which meets their needs. Base map scale shall be 1:12,000 (1’’=1000’) or larger.

3.5 MAPPING BASE

The soil scientist will insure that base maps are of suitable quality to meet the mapping standards defined in this document. All base maps should meet National Map Accuracy

standards. Types of suitable base maps include, but are not limited to: Aerial photos; Topographic maps; Orthophotos (e.g. NAIP Imagery); Digital Orthophoto Quads (DOQs).

3.6 FIELD PROCEDURES

In areas where soils retain a relatively high degree of predictability, delineations are identified by traversing the landscape making sufficient soil observations to enable accurate soil boundary placement and to ensure appropriate soil map unit composition. Soil boundaries are observed throughout their length, and their placement corresponds to changes in soil properties or landform. Remotely sensed data is used as an aid in boundary delineation.

In areas where soils are complex and less predictable, delineations are identified by transecting the landscape and making soil observations at appropriate intervals to justify the map unit selection. Sufficient transecting is completed to ensure accurate soil line placement and to ensure appropriate soil map unit composition. Soil boundaries are observed throughout their length within the subject property boundaries, and their placement corresponds to changes in soil properties or landform. Remotely sensed data may be used as an aid in boundary delineation.

Soil map units are appropriately separated for the purpose of carrying out land use applications.

Ground control is required and shall be at the density specified by the soil scientist. Individual agencies may require specific ground control depending on the purpose of the soil map product being produced. Point data will be collected at each point of observation during the course of the survey. The point data will be georeferenced and relevant soil description information recorded manually. The purpose of the survey, soil variability, map scale and professional judgment of the soil scientist will dictate where and how many points will be observed. *At a minimum*, two observations should be made within each delineation.

3.7 MAP UNIT PURITY

Different kinds of soil map units are used to accommodate different complexities of soil patterns on the landscape to best meet the purpose of the survey. Two kinds of map units are appropriate for site-specific soil survey mapping – *consociations* and *complexes*.

3.7.1 CONSOCIATIONS

Map units will contain 75 percent or more of pedons that fit within the range of the taxon that provides the name for the map unit, or are in a similar taxa. No one similar soil is greater than the named reference taxa. The total amount of dissimilar inclusions will not exceed 25 percent. No single dissimilar soil will make more than 10 percent of the map unit. Limiting inclusions do not exceed 15 percent of the map unit. (More intensive separation of dissimilar inclusions within a map unit can be made at the discretion of the soil scientist).

3.7.2 COMPLEXES

Map units consist of areas of two or more kinds of soils that are in a regularly repeating pattern so intricate that the two components cannot be delineated separately at the scale of mapping. The major components that provide the name for the map unit are sufficiently different in morphology or behavior that the unit cannot be named as a consociation. No single dissimilar soil will make up more than 10 percent of the map unit. Limiting inclusions do not exceed 15 percent of the map unit. The total amount of dissimilar inclusion will not exceed 25 percent. At the discretion of the Soil Scientist, areas of dissimilar inclusions, too small to be delineated, will be shown with special features or symbols.

3.8 IDENTIFICATION OF MAP UNITS

The identification of soil map units utilizes taxonomic class names at the series level, and accompanying phase terms. The primary identification of the map unit is described in terms of ranges of soil properties within the limits of defines NRCS/NCSS Official Series Description and ranges of inclusions. Some map units may require naming at a categorical level above the series. The identification of soil series and phases of soil series do not allow for adjacent map units to be identified with the same map symbol.

3.8.1 SOIL SERIES NAMES

Consociations, or complexes composed of major components that fall within the range and characteristics of existing official series, will use the series name to identify the map unit

3.8.2 PHASE OF SOIL SERIES

Soil phases are used to identify distinctions within official soil series. They subdivide taxonomic classes at the series level and recognize soil properties that may be used as differentiating criteria. Phase selection is governed by the property which has the greatest impact on use and management of the soils in a survey area. Phases, beyond those identified in official NRCS soils legends, are used only when adequate documentation demonstrates the need to separate map units at the series level on the basis of soil behavior, use and management. Phases to consider include slope, stony and bouldery phases, depth, substratum phases, and physiographic phases. For use of any phase, differentiae must be significant to soil behavior or use and management

3.8.3 ANTHROPOGENIC SOIL MAP UNITS AND MISCELLANEOUS LAND TYPES

Anthropogenic soils and miscellaneous areas have little or not identifiable soil as defined in Soil Taxonomy. Most situations are a result of human activity that has altered the parent material. Map units are named in terms of characteristics of the parent material in the local area. Typically, map units are identified at the Great Group level.

3.9 SOILS LEGEND

There are three types of soils legends used in site-specific soils mapping: total numeric legends, alpha-numeric legends and total alpha legends. The National Cooperative Soil Survey Program in each state has established its own method of maintaining a soils legend and protocols for establishing new legend symbols. In Oregon, the soil survey legends used for Order 2 soil surveys, as amended by the Major Land Resource Area (MLRA) soil legends, should be used as the basis for establishing a legend for a high-intensity soil survey project. Any changes or additions to the MLRA legend should be coordinated with the NRCS MLRA soil survey project leader.

3.10 MAP LABELING

Site specific soil surveys shall be completed by a qualified soil scientist and shall be signed by the soil scientist completing the work.

With the exceptions of 3.7.B below, the following statements will be included on all map products produced by consulting soil scientists working in the private sector:

> "This map product is within the technical standards of the National Cooperative Survey. It is a special-purpose product, intended for [intended purpose of the site soil survey]. It was produced

by a professional soil scientist, and is not a product of the USDA Natural Resource Conservation Service. There is a report that accompanies this map."

Should a client or agency impose constraints on the soil scientist that precludes him or her from producing a product that meets the standards of the National Cooperative Soil Survey, a statement will be added to the map label indicating:

"This map product is not within the technical standards of the National Cooperative Soil Survey because…"

3.11 CARTOGRAPHIC PROCEDURES

Cartographic guidelines for soils map compilation and soils map finishing should be those specified in the National Soil Survey Manual and respective NCSS technical guides. For Digital Soils Mapping, see section 5. Also, cartographic procedures resulting in digital representation of soils mapping should follow the Oregon Soils Framework Layer Standard, to which this subject standard is related to.

3.12 DESCRIPTIONS AND CLASSIFICATIONS OF SOILS

Soil scientists should follow appropriate standards and modes of soil-profile description standardized by the NCSS, i.e. the *Field Book for Describing and Sampling Soils*, latest version. The site-specific soil scientist must be familiar with the soil taxa of the soil survey area within which they are conducting the study. They must be familiar with the proper mapping, classification, correlation and interpretation of the soils in the area of the subject study. These descriptions, classifications and map concepts of the soil taxa are generated and maintained by the local NRCS MLRA Office. Additionally, the performance of description and classification of soils must conform to guidelines of the *National Soil Survey Handbook*, *Soil Survey Manual*, and *Soil Taxonomy*, in their latest versions. Any changes to the established taxonomic unit descriptions, map unit descriptions, and table of classifications should be coordinated with the local NRCS MLRA Office.

4 REPORT TO ACCOMPANY SOIL MAP

A narrative report will accompany all map products. Minimum requirements to be included in the report are as follows:

1. Reference to these mapping standards;
2. Date soil map was produced;
3. Geographic location and size of site;
4. Soil identification legend for the site-specific soil map symbols;
5. Purpose of the soil survey (intended use of parcels).
6. Soil map unit description
7. Map unit symbol and map unit name
8. Landscape setting and surface features
9. Drainage class and parent material
10. If a complex, estimated percent of components, and pattern
11. Nature of dissimilar inclusions and estimated percent
12. Signature of the soil scientist who is responsible for the map. If the soil scientist is certified, then the certification stamp is also required;
13. Other distinguishing features of the site and soil determined to be significant by the soil scientist;
14. Maximum size of limiting inclusions;
15. If special features symbols are used, the size of the area represented by each symbol is included as part of the definition of the symbol; and
16. Soil profile descriptions may be included, if appropriate, at the discretion of the soil scientist.

5 DIGITAL SOILS MAPPING

Order 1 and Order 0 soil survey maps may be produced using digital and predictive soils mapping technologies. Digital mapping products are held to the same data accuracy standards as map products resulting from field-based mapping. The density and location of ground control points shall be determined by the soil scientist. FGDC (Federal Geographic Data Committee) compliant metadata should accompany all digital soils maps, base maps and intermediate data. In addition to items listed in 8. above, the accompanying report will include:

A thorough explanation of the digital soils mapping techniques employed, sufficiently detailed so that the procedure could be replicated by a soil scientist and GIS specialist team. Software titles, versions, and extensions used should be given. Specific software settings and parameters used should be explained; Sources and original resolution for all digital data used, in tabular format; A detailed explanation of all data pre-processing, including but not limited to re-sampling, reclassifying, vector-to-raster conversions, and line-placement adjustments; Results of any statistical/geostatistical analysis, in tabular form.

6 DATA SHARING

With the willingness of the soil scientist and the concurrence of his/her client, the high intensity soil survey data will be provided to NRCS MLRA Soil Survey Staff for possible inclusion in the National Soil Information System (NASIS).

7 CERTIFICATIONS

The State of Ogregon does not require registration or certification for the performance of site-specific soils mapping. Appropriate individuals would include those having status as Certified Professional Soil Classifier (ARCPACS) or Registered Professional Soil Scientist (National Society of Consulting Soil Scientists).

8 REFERENCES

Soil Survey Staff. 1993. *Soil Survey Manual*. Soil Conservation Service. U.S. Department of Agriculture Handbook 18.

Soil Survey Staff, 1993. *National Soil Survey Handbook*- 430-VI, USDA, NRCS, and all amendments to this handbook.

Soil Survey Staff, 1999. *Soil Taxonomy; A Basis System of Soil Classification for Making and Interpreting Soil Surveys*, Agriculture Handbook 436, USDA, NRCS, and all amendments.

ISCA-NRCS, 1999. *Standards and Specifications for High-Intensity Soil Survey for Agriculture in Illinois*, jointly produced by the Illinois Soil Classifiers Association and USDA-NRCS.

Soil Survey Staff. 2004. *Soil Survey Laboratory Methods Manual*. Natural Resources Conservation Service. USDA-NRCS-NSSC Soil Investigations Report No. 42.

SSSNNE, 2006. *Site-Specific Soil Mapping Standards for New Hampshire and Vermont*, SSSNNE Special Publication No. 3 Version 3.0, a cooperative effort between the Society of Soil Science of Northern New England (SSSNNE) and the USDA/NRCS National Cooperative Soil Survey.