Memo

To: **Agricultural and Preservation Partners**

From: **Jeffrey C. Everett, Deputy Executive Director, State Ag. Development Committee**

Date: **5/2/2022**

Re: **Draft Soil Protection Standards (Revised) - Request for Informal Comments**

On April 19, 2021, the State Agriculture Development Committee (hereafter "SADC" or "the Committee") circulated a previous draft of the proposed soil protection standards to stakeholders and, partly due to informal comments received in response, discussed a modified approach at the October 28, 2021, SADC meeting. Pursuant to the Committee's direction at the October 28 meeting and working in concert with the SADC's Soil Protection Standards subcommittee, a revised draft proposal with corresponding rule text was discussed at the SADC's April 28, 2022 meeting. At that meeting, the Committee approved the draft be circulated to our partners to solicit informal comments before the package is finalized and prepared for publication in the New Jersey Register as a formal rule proposal. Attached are the draft rules for your consideration (***Attachment 1***) along with the corresponding outline of what would constitute Subchapters 25 and 25A of Chapter 76 of the New Jersey Administrative Code ***(Attachment 2)***

Per ***Attachment 3***, which is the PowerPoint presentation from the aforementioned April 28 meeting, you will see how the methodology shifted from heavy reliance on a suite of Best Management Practices (BMPs), which landowners and easement holders felt were too complex and difficult to administer, to a more straight forward approach that utilizes "bright-line" definitions as to what does and does not constitute "soil disturbance." Please let this memo briefly summarize the salient features of the proposal.

<u>SUBCHAPTER 25. SOIL DISTURBANCE ON PRESERVED FARMLAND</u>

§ 2:76-25.3 Definitions

This section is the foundation of the entire set of regulations, defining what is and isn't considered soil disturbance. Please note that the soil disturbance definition is derived in part from the attached report ***(Attachment 4)*** produced by Rutgers for SADC and to a larger degree, various U.S. Department of Agriculture-Natural Resources Conservation Service publications and ultimately an internationally accepted definition adopted by ICOMANTH - the International Committee on Anthropogenic Soils. Staff consulted with the very practitioners and scholars who developed this framework so that it was scientifically derived and legally defensible. Please note that the separation between "core" and "non-core" definitions will be discarded when the final rule is proposed to the New Jersey Register but in the interim, this format serves as a teaching tool along with the use of indentations as to how the various core definitions interact with one another. The foundation of this regulation is in fact the definitions, which must be read in concert with one another and in so doing, prevents a lengthier regulatory construct.

§ 2:76-25.4 Exemptions

Agriculture is inherently a soil disturbing activity but obviously one that is accorded deference throughout the proposed rule. Specifically, there are twenty-two agricultural practices we are suggesting should be exempt from counting towards the prescribed soil disturbance limit. In addition, the opportunity for future exemptions to be promulgated exists in order to expand beyond these intial twenty-two. Some of these practices are further fleshed out in the Supplemental Standards (Subchapter 25A), but all are spelled out in the Definitions section so landowners are not left wondering if a particular practice is exempt or not. Normal tillage practices and several soil and water conservation practices are among those exemptions explicitly listed.

§ 2:76-25.5 Allocation and limitation

This section memorializes the soil disturbance limitation agreed upon at the October SADC meeting, i.e. a maximum limit of 12% or 4 acres, whichever is greater. It clarifies that new disturbance placed on areas previously disturbed will not count twice, and disturbance within exception areas does not count towards the limit.

§ 2:76-25.6 Waiver

This section memorializes the soil disturbance limitation agreed upon at the October SADC meeting for farms with current disturbance within 50% of the prescribed 12%/4-acre limit to allow waivers to be issued by the SADC up to a maximum limit of 15% or 6 acres, whichever is greater. It also contemplates the requirements that need to be satisfied to be awarded a waiver bearing in mind the potential impacts of additional disturbance to adjacent properties.

§ 2:76-25.7 Aggregation and consolidation

Aggregating disturbance or transfer/aggregation is possible as spelled out in the draft. However, it would need to be done on contiguous preserved farms owned by the same owner.

§ 2:76-25.9 Soil rehabilitation application and certification procedures

This section contemplates properly rehabilitating disturbed soils to approximate their pre-disturbance condition. The affected areas will no longer count towards the soil disturbance limit upon such successful rehabilitation. Staff consulted with one of the leading authorities on soil rehabilitation to ground the regulation in well-developed scientific theory and practice. The section was bifurcated between application and certification procedures, with Appendix A serving as the technical standards.

§ 2:76-25.10 Baseline mapping and monitoring

This section relates to the SADC's partnership with Rowan University to map disturbance on all 2,700+ preserved farms. Namely, it is proposed that those baseline disturbance maps be sent to all landowners once the rule is adopted with the caveat that a site visit may be conducted upon the landowner's request to ground truth what is reflected in the mapping. It is imperative that landowners bring any mapping inaccuracies to our attention within 180 days of receiving the soil disturbance map for their property, particularly those landowners who may be eligible for a waiver because the baseline disturbance mapping is the source for determining whether landowners are eligible for a waiver. Staff envisions an online mapping application be made available where landowners could zoom in and see their farms in greater detail than a paper map can afford. This section also contemplates the documentation of future disturbance through the auspices of standard annual monitoring visits and provides for an appeal process if landowners disagree with disturbance mapping at any time.

§ 2:76-25.12 Request for hearing

As mentioned in the preceding paragraph, it is prudent to provide due process to landowners who may disagree with mapping or any other disturbance determination. Because the Farmland Preservation Program has historically relied heavily on partners, those grantees/easement holders will likewise be accorded an opportunity to request a hearing for any action where they feel they are aggrieved.

SUBCHAPTER 25A. SUPPLEMENTAL SOIL DISTURBANCE STANDARDS

§ 2:76-25A.4 Vegetative cover standard

The Exemptions section in Subchapter 25 exempts temporary parking areas, temporary storage areas, livestock confinement, and livestock training areas from the soil disturbance limit but only when "minimum vegetative cover" is maintained. Minimum vegetative cover is defined in the Definitions section as "vegetative cover of at least 70% for at least 9 months per calendar year" which borrows from the Right to Farm agricultural management practice for equine activities. Because measuring vegetation cover could be seen as a nebulous undertaking, Appendix A describes the step-point method, which has been deployed since the 1950s as a tool to assist in rangeland management.

§ 2:76-25A.5 Topsoil stockpiling standard

Best practices for creating and maintaining topsoil stockpiles are described in this section. As long as the standards are followed, topsoil stockpiles are exempted from the soil disturbance limit.

§ 2:76-25A.6 On-farm utilities construction standard

Here again, best practices are described and as long as the standards are followed, the contemplated activity - in this instance, on-farm utilities - is exempted from the soil disturbance limit.

Request for Stakeholder Comments on this rule proposal

To consider input from partners before the promulgation of these proposed rules in the New Jersey Register, the Committee is inviting interested parties to comment informally before the formal Register process commences. **Please submit your written comments within a 30-day review period that concludes June 10, 2022,** by electronic mail (strongly encouraged) to sadc@ag.nj.gov or, if necessary, by U.S. Mail at the following address:

State Agriculture Development Committee
Attn: Soil Protection Standards Comments
PO Box 330
Trenton, NJ 08625-0330

With those comments in hand, we will return to the Committee to finalize the details before a proposed rule is sent to the Register, tentatively this summer, with adoption slated for fall. In the interim, please do not hesitate to contact me at the above addresses or by phone at 609-984-2504. Thank you for your attention to this matter.

Distribution list:
State Agriculture Development Committee – Members
State Board of Agriculture – Members
County Agriculture Development Boards – Administrators
Municipal PIG Program Contacts
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Friends of Hopewell Valley Open Space
Hunterdon Land Trust
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NEW JERSEY ADMINISTRATIVE CODE - CHAPTER 76, STATE AGRICULTURE DEVELOPMENT COMMITTEE

SUBCHAPTER 25. SOIL DISTURBANCE ON PRESERVED FARMLAND (PROPOSED RULES)

SUBCHAPTER 25A. SUPPLEMENTAL SOIL DISTURBANCE STANDARDS (PROPOSED RULES)

SUBCHAPTER 25. SOIL DISTURBANCE ON PRESERVED FARMLAND

§ 2:76-25.1 Applicability

This subchapter applies to premises subject to farmland preservation deed restrictions recorded pursuant to the Agriculture Retention and Development Act, N.J.S.A. 4:1C-11 et seq, P.L. 1983, c.32.

§ 2:76-25.2 Purpose

The purpose of this subchapter is to define what activities on the premises constitute soil disturbance and to a establish soil disturbance limitation. Exceeding the soil disturbance limitation established in this subchapter will constitute a violation of the deed of easement, which prohibits activities detrimental to soil conservation and detrimental to the continued agricultural use of the premises in accordance with N.J.A.C. 2:76-6.15(a)(7) and which requires the premises to be maintained as an agriculturally viable parcel capable of sustaining a variety of agricultural operations in accordance with N.J.A.C. 2:76-6.15(a)(15)(i).

76-25.3 Definitions ("Core" which will eventually be merged with "Non-Core" Definitions)

. disturbance" means soil alteration, soil surfacing, or soil compaction.

"Soil alteration" means human-altered and or human-transported ("HAHT") soils and includes soil movement, grading, leveling, importation, exportation, cut, and/or fill but does not include normal tillage or deep tillage.

"Human-altered and human-transported soils 'HAHT,'" also known as anthropogenic soils, means soils that have profound and purposeful alteration or occur on landforms with purposeful construction or excavation and the alteration is of sufficient magnitude to result in the introduction of a new parent material ("human-transported material") or a profound change in the previously existing parent material ("human-altered material"). HAHT soils do not include soils with incidental or unintentional surficial changes due to exempt agricultural practices and are more fully described in the in the United States Department of Agriculture ("USDA"), Natural Resources Conservation Service ("NRCS"), *Keys to Soil Taxonomy, Twelfth Edition, 2014* (https://www.nrcs.usda.gov/wps/PA_NRCSConsumption/download?cid=stelprdb1252094&ext=pdf) and the USDA NRCS *Soil Survey Manual, Issued March 2017 with Minor Amendments 2018* (https://www.nrcs.usda.gov/wps/PA_NRCSConsumption/download?cid=nrcseprd1333016&ext=pdf).

"Normal Tillage" means generally accepted agricultural practices for seedbed preparation and cultivation of soil including moldboard plowing, disking, chisel plowing, hill and furrow plowing, bed shaping, and the use of similar site preparation practices as determined by the Committee where the practice does not meet the definition of human-altered and human-transported soils. Normal tillage is limited to the depth of the topsoil layer as defined herein.

"Deep tillage" means performing tillage operations below the normal tillage depth in a manner consistent with a farm conservation plan to modify adverse physical or chemical properties of a soil that inhibit plant growth, such as compacted layers formed by field operations, restrictive layers such as cemented hardpans in the root zone, overwash or deposits from wind and water erosion or flooding, or contaminants in the root zone. Deep tillage does not include elevation or topography change.

"Soil surfacing" means a human-made and/or human-placed covering over the soil including both suspended surfaces and ground-level surfaces unless identified by the Committee as an exempt agricultural practice.

"Suspended surface" means a surface placed above the soil and includes, but is not limited to, roofs of buildings, trailers, greenhouses, run-in sheds, pavilions, open-floored arenas, and decks.

"Ground-level surface" means a surface placed in contact with the soil and includes, but is not limited to, flooring, paving, asphalt, asphalt millings, reinforced concrete, recycled concrete, porous asphalt, porous concrete, stone, rock, gravel, pavers, bricks, block, rubber, sand, cinders, construction mats, pond liners, and non-topsoil stockpiles.

"Soil compaction" means any activity other than normal tillage that results in an increase in soil dry bulk density above the root limiting levels or consolidation or a reduction in a soil's capacity to infiltrate and percolate water including, but not limited to, preparing or using land for the placement of engineered structures, footings, foundations, earth-retaining structures, parking areas, storage areas, livestock training or confinement areas, or travel lanes through static force, tamping, vibration, kneading, and rolling techniques unless specifically identified by the Committee as an exempt agricultural practice.

§2:76-25.3 Definitions ("Non-Core" which will eventually be merged with "Core" Definitions)

"Actively cropped" means land on portions of the premises that is available for agricultural use and production where the following apply: crops or forages are grown directly in the soil profile for a minimum of 150 consecutive days in one (1) calendar year or for two (2) periods of not less than 90 consecutive days each in one (1) calendar year; annual crops and hay are harvested or perennial crops (other than hay) are maintained annually, and forages are consumed by direct grazing; or cover crops grown as part of a production rotation that may or may not be harvested and included in a farm conservation plan.

"Agricultural production" has the same meaning as that term is defined in N.J.A.C. 2:76-6.2.

"Agricultural productivity" means the capacity of a soil to produce a specified plant or sequence of plants under a physically defined set of management practices as measured in terms of inputs of production factors in relation to outputs or yields (*source: NRCS National Agricultural Land Evaluation and Site Assessment (LESA) Handbook*).

"Agricultural productivity standards" means minimum criteria required to prove that rehabilitation was successful including, but not limited to, crop yield, soil bulk density, fertility, and pH range for the local soil series per USDA-NRCS soil mapping criteria.

"Agricultural purpose" has the same meaning as that term is defined in N.J.A.C. 2:76-6.2.

"Agricultural use" has the same meaning as that term is defined in N.J.A.C. 2:76-6.2.

"Agriculturally viable parcel" has the same meaning as that term is defined in N.J.A.C. 2:76-6.2.

"Bulk density" means an indicator of how well plant roots are able to extend into the soil, calculated as the dry weight of soil divided by its volume (source: NRCS Soil Quality Indicators Fat Sheet and NRCS-NJ Comments).

"Certified soil rehabilitation project" means a soil rehabilitation project approved by the Committee and completed pursuant to N.J.A.C. 2.76-25.9 and Appendix A.

"Committee" means the State Agriculture Development Committee.

"Contiguous premises" means adjacent properties, even if they are separated by human-made barriers or structures or legal boundaries. Contiguous premises shall include, but are not limited to, land areas which directly abut or are separated by a general access roadway or other right-of way, including waterways *(source: NJ Freshwater Wetlands Protection Act rules).*

"Cover crop" means an annual or perennial crop consisting of a specific plant or mix of plants that are planted and grown primarily to improve soil quality by reducing soil compaction, increasing soil organic matter content, trapping or producing nitrogen, and reducing soil erosion.

"Cranberry bog" also known as a cranberry bed, means a naturally acidic peat bog that has been drained, cleared, leveled, and covered with sand for purposes of cultivating cranberry varieties developed from the native species *Vaccinium macrocarpon Aiton*.

"Deep tillage" means performing tillage operations below the normal tillage depth in a manner consistent with an approved farm conservation plan to modify adverse physical or chemical properties of a soil that inhibit plant growth, such as compacted layers formed by field operations, restrictive layers such as cemented hardpans in the root zone, overwash or deposits from wind and water erosion or flooding, or contaminants in the root zone. Deep tillage does not include elevation or topography change.

"Drylot" means an area with less than 70% vegetative cover used for livestock confinement. (Source: Equine AMP).

"Exempt agricultural practices" means those practices set forth in N.J.A.C. 2:76-25.4.

"Existing agricultural water impoundment" means an excavated, unlined farm pond or dammed impoundment fed by surface water or groundwater for irrigating agricultural crops or watering livestock that is constructed prior to adoption of these rules. Agricultural water impoundments shall not include other types of water-related structures including, but not limited to, decorative or recreational ponds, wildlife ponds, stormwater management facilities, aquaculture ponds, pools, manure lagoons, tailwater recovery ponds, ponds constructed primarily for hydropower uses, or naturally occurring ponds and wetlands but not including existing open ditches as that term is defined in this subchapter. Associated berms or dams are considered soil alteration or soil surfacing pursuant to N.J.A.C. 2:76-25.3.

"Existing open ditch" means a vegetated, unlined canal, ditch, open drain, conveyance swale, or similar structure used to convey water that was constructed prior to the adoption of these rules and may be associated with an existing agricultural water impoundment or utilized to convey runoff from crop fields or underground drainage systems.

"Farm conservation plan" has the same meaning as that term is defined in N.J.A.C. 2:76-6.2.

"Field moisture capacity" means the amount of water retained in a soil after it has been saturated and has drained freely, expressed as a percentage of the oven dry weight of the soil.

"Geotextile fabrics" means permeable, woven and non-woven plastic fabrics, typically used for separation of soil layers, erosion control and weed management but does not include biodegradable or paper fabrics.

"Geotextile field" means an area that has been covered with geotextile fabric for the purposes of nursery or floriculture production where the fabric is placed over native soil that has not been graded or surfaced but may be top-dressed with organic mulch.

"Grantee" means the holder of the development easement.

"Grantor" means the owner who conveyed the development easement, their heirs, executors, administrators, personal or legal representatives, successors and assigns.

"Hoophouse" means an individual temporary agricultural structure that is used exclusively for the production and storage of live plants by protecting same from sun, wind, excessive rainfall, or cold, or to extend the growing season. A hoop house is constructed of a metal, wood, or durable plastic frame covered with polyethylene, polycarbonate, plastic, or fabric material and does not have a permanent foundation, footings, floor, or anchoring system. The frame and exterior covering may or may not be removed during the growing season. Also known as" high tunnel," "low tunnel," "temporary greenhouse" or "polyhouse."

"Livestock training area" means an uncovered, outdoor area of the Premises used for riding, racing, training, showing, or rehabilitating livestock. Examples include but are not limited to arenas, tracks, and training rings.

"Livestock confinement area" means housed lots, feedlots, confinement houses, stall barns, milk rooms, milking centers, cow yards, barnyards, medication pens, dry lots, exercise yards and stables. *(source: NJ Animal Waste Rules)*

"Low-ground pressure equipment" means construction equipment designed to distribute heavy loads to reduce soil compaction with designed ground pressure less than 12psi *(source: Penn State Extension: https://extension.psu.edu/avoiding-soil-compaction#:~:text=Topsoil%20compaction%20is%20caused%20by,percent%2010%20years%20after%20compaction)*

"Maximum dry bulk density" means the maximum bulk density measured in grams per cubic centimeter as set forth in N.J.A.C. 2:76-25A.5.

"Minimum rooting depth" means at least 40 inches or a lesser depth equal to the depth to a subsurface layer in the natural soil profile that inhibits or prevents root penetration *(source: NRCS Specifications for Prime Farmland).*

"Minimum vegetative cover" means vegetative cover of at least 70% for at least 9 months per calendar year measured pursuant to the procedures set forth in N.J.A.C. 2.76-25A.4 and Appendix A.

"NRCS" means the Natural Resources Conservation Service, an agency of the United States Department of Agriculture providing technical assistance for the conservation of agricultural and related natural resources.

"Nominal smoothing" means the movement of topsoil for an agricultural purpose that does not alter the elevation of the existing ground surface more than three (3) inches from the original pre-existing natural landform.

"Normal tillage" means generally accepted agricultural practices for seedbed preparation and cultivation of soil including moldboard plowing, disking, chisel plowing, hill and furrow plowing, bed shaping, and the use of similar site preparation practices as determined by the Committee where the practice does not meet the definition of human-altered, human-transported soils. Normal tillage is limited to the depth of the topsoil layer.

"On-farm utilities" means buried electric, sewer, water, gas, communication lines, or similar utilities that serve residential units, agricultural labor housing, farm buildings, or other permitted uses on the premises and which follow the on-farm utilities construction standards established in N.J.A.C. 2:76-25A.7.

"Organic" means a material derived from living matter such as leaves, crop residues or compost.

"Organic mulch" means a material at a depth capable of being incorporated into the soil profile consisting exclusively of organic material used for weed control, moisture retention, landscaping, travel paths, livestock bedding, soil-compaction alleviation, or as a soil amendment that is composed of tree bark, wood chips, straw, pine straw, grass clippings, leaves, compost, manure, coconut fibers, or similar materials. Organic mulch does not include rubber mulch or materials with synthetic fibers, oils, or other substances added.

"Parking aisle" means a lane within a parking area used to connect peripheral lanes to parking stalls.

"Parking area" means an area on a farm used for vehicular parking that does not meet the definition of a travel lane or storage area. A parking area encompasses parking aisles but does not include peripheral lanes. Parking areas are delineated by roads, travel lanes, peripheral lanes, fences, or otherwise delineated by land use and vegetative cover.

"Parking structure" means any fence, barrier, bollard, parking aid, traffic control device, lighting fixture, or similar structure that is installed for long-term use related to managing vehicular traffic and limits or prohibits normal harvesting or tillage activities. Temporary traffic control devices such as wooden stakes, fiberglass reflective rods, rope, and traffic cones which are installed only during a farm event and removed at the events' completion are not considered parking structures. Agricultural fencing whose primary purpose is to contain livestock or exclude wildlife and generally follows the field perimeter is not considered a parking structure.

"Peripheral lane" means established travel lanes used by vehicles to access parking areas, which typically follow the peripheral edges of a parking area. These lanes may be considered unimproved travel lanes as that term is defined in this subchapter.

"Permeable" means a material or surface treatment that allows the passage of water into the soil at a rate equal to or greater than the surrounding surface soils, or that allows the passage of water into the soil at a rate equal to or greater than the saturated hydraulic conductivity for the soil type identified in the soil survey.

"Premises" means the property under easement which is defined by the legal metes and bounds description contained in the deed of easement.

"Public parking" means_parking of vehicles registered to patrons, members of the public, or suppliers of the farm not directly employed by the farm.

“Saturated hydraulic conductivity” means a quantitative measure of a saturated soil's ability to transmit water when subjected to a hydraulic gradient (source: NRCS Soil Survey Technical Note 6).

"Soil" means the natural and native mineral and/or organic enriched material that occurs at the earth's surface due to the combined long-term interactions of soil forming factors such as geologic parent material, climate, vegetation, and topography. Natural soils are characterized by distinct layers (or horizons) that have resulted from these factors over time.

“Soil horizon” means a layer within a soil profile differing from layers of soil above and below it in one or more of the soil morphological characteristics including color, texture, coarse fragment content, structure, consistency and presence of redoximorphic features (source: DEP's Standards for Individual Subsurface Sewage Disposal Systems).

“Soil loss tolerance rate (T)” means the maximum rate of annual soil loss that will permit crop productivity to be sustained economically and indefinitely on a given soil (source: American Society of Agronomy, Soil Science Society of America, Special Publication Number 45).

“Soil profile” means a vertical cross-section of soil showing the characteristic horizontal layers or horizons of the soil, which have formed as a result of the combined effects of parent material, topography, climate, biological activity and time. (source: DEP's Standards for Individual Subsurface Sewage Disposal Systems).

“Soil structure” means the arrangement of soil particles into aggregates which form cohesive and distinct structural units.

“Soil Survey Report” means a report generated from the NRCS Web Soil Survey (https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm) that includes maps showing the distribution of soil mapping units throughout a particular geographic area, together with narrative descriptions of the soil series shown and other information relating to the uses and properties of the various soil series (source: DEP's Standards for Individual Subsurface Sewage Disposal Systems and NRCS-NJ Comments).

“Solar energy” has the same meaning as that term is defined in N.J.A.C. 2:76-24.3.

"Solar energy facilities" has the same meaning as that term is defined in N.J.A.C. 2:76-24.3.

“Solar panels” means ground-mounted photovoltaic panels associated with a solar energy facility meeting the standards set forth in N.J.A.C. 2:76-25A.6.

“Stockpile” means a pile of any material that is in place for more than 120 cumulative days in a 12-month period. Stockpiles include but are not limited to subsoil, sand, manure, leaves, wood chips, compost, building materials, gravel, road surfacing materials, timber, and metal.

“Storage area” means an area of land not in crop production used for the storage of equipment or other farm-related items but not otherwise meeting the definition of a parking area or travel lane.

"Subsoil" means the layer of soil beneath the topsoil where there is visibly less organic matter and root development than the topsoil layer, typically noticed by a change in soil color. Subsoil is considered the B soil horizon.

"Substitute soil material" means soil that has been created from a blend of basic components to have equivalent physical, chemical, and biological properties to the native soil.

"Temporary geomembrane" means an impermeable plastic film used for a variety of agricultural uses, including but not limited to plastic mulch, silage wraps, or tarps, which is removed annually.

"Temporary ground protection mats" means specifically designed construction mats consisting of wood (not including plywood), plastic, or metal that distribute heavy loads over a larger area to reduce soil compaction and that are in place for less than 120 cumulative days per calendar year.

"Temporary movable structure" means a structure that is removed from the Premises without demolition and which does not have a permanent foundation, floor, or anchoring system and is in place for no more than 120 cumulative days in a 12-month period. Temporary movable structures include but are not limited to office trailers, portable trailer-mounted-bathrooms, portable toilets, horse trailers, food carts, campers, or similar structures.

"Temporary parking area" means an actively cropped area used seasonally or periodically for public parking of vehicles related to the operation of the farm and which maintains minimum vegetative cover. Temporary parking areas do not contain parking structures.

"Temporary storage area" means an area utilized for the storage of infrequently used farm equipment or privately owned equipment associated with permissible farm activities and which maintains minimum vegetative cover.

"Temporary tents" means temporary structures with an impermeable covering to provide shelter for agriculture-related activities, also known a tensioned membrane structure or canopy. Temporary tents do not have a permanent foundation, footings, floor, or anchoring system, and are in place for not more than 120 cumulative days in a 12-month period. Temporary tents do not include hoop houses.

"Topsoil" means the uppermost layer in a natural or cultivated soil profile where cultivation, root growth, biological activity, and organic matter are concentrated. Topsoil is composed of mineral particles (sand, silt, and clay) and organic material, and allows for air exchange and water holding. Topsoil is also known as the "plow layer", "surface soil", "Ap layer", "Ap horizon", or the "surface layer". Topsoil depth is site specific, but typically varies between 6 and 12 inches.

"Topsoil stockpile" means a stockpile of topsoil constructed in accordance with N.J.A.C. 2:76-25A.5.

"Travel lane" means a generally linear feature on a farm primarily used for the conveyance of vehicles, pedestrians, livestock, and/or equipment.

"Underground drainage system" means a subsurface drainage system made of conduit such as corrugated plastic tubing, tile, or pipe, installed beneath the ground surface to collect and/or convey drainage water to improve farming conditions. Also known as "drain tile". (source: NRCS definition for subsurface drain, practice code 606)

"Unimproved travel lane" means a travel lane that is not more than 10 feet wide for one-way traffic or 16 feet wide for two-way traffic, measured from the outside of the tire tracks, plus an additional 2-foot allowance per side for a shoulder, that has not been surfaced, and is not constructed closer than 300 feet in parallel to another unimproved travel lane or travel lane. An "unimproved travel lane" is also known as a farmlane. *(source: NRCS-NJ Field Office Technical Guide standards for Access Road (Code 560)).*

"USDA" means the United States Department of Agriculture.

"Vegetative cover" means living plant cover or intact residues but does not include weeds.

"Vegetated livestock area" means a livestock training or confinement area that maintains minimum vegetative cover.

"Weed" means a plant that is not grown deliberately or is otherwise prohibited, invasive, or noxious. Examples of weeds include but are not limited to plantain, thistle, burdock, garlic mustard, and ground ivy.

§ 2:76-25.4 Exemptions

(a) The following practices shall not constitute soil disturbance for purposes of determining compliance with the soil disturbance limitation set forth in N.J.A.C. 2:76-25.5, and shall be considered exempt agricultural practices:

1. Cranberry bogs/beds;
2. Deep tillage;
3. Existing open ditches;
4. Existing agricultural water impoundments;
5. Geotextile fields;
6. Hoophouses;
7. Normal tillage;
8. Nominal smoothing;
9. On-farm utilities;
10. Organic mulch;
11. Rehabilitated soils;
12. Solar panels;
13. Temporary geomembranes;
14. Temporary ground protection mats;
15. Temporary movable structures;
16. Temporary parking areas;
17. Temporary storage areas;
18. Temporary tents;
19. Topsoil stockpiles;
20. Underground drainage systems;
21. Unimproved travel lanes;
22. Vegetated livestock areas.

(b) An agricultural practice not specifically listed in the previous subsection shall be considered an exempt agricultural practice on the premises if approved by the Committee in advance based on its determination that the agricultural practice in question meets all of the following criteria:

1. Is able to maintain minimum vegetative cover; and
2. Does not cause an increase beyond the maximum dry bulk density; and
3. Does not cause soil and water resource concerns; and
4. Does not have soil surfacing that cannot be easily removed; and
5. Does not cause soil contamination; and
6. Does not cause soil erosion; and
7. Are necessary to support agricultural production.

(c.) The Committee may designate additional exempt agricultural practices by amendment to subsection (a) of this subchapter.

1. In considering the adoption of additional exempt agricultural practices, the Committee may consult with the following agencies, organizations, or persons:

i. The New Jersey Department of Agriculture;
ii. The New Jersey Agricultural Experiment Station, including appropriate county agents;
iii. County Agriculture Development Boards;
iv.. The State Soil Conservation Committee;
v. Any other states' Departments of Agriculture, land grant institutions or Agricultural Experiment Stations;
vi. The United States Department of Agriculture, or any other Federal governmental entity; or
vii. Any other organization or person which may provide expertise concerning the particular practice.

2. A Grantee may request the Committee designate additional exempt agricultural practices.

(d) Exempt agricultural practices shall not violate any other provision of the deed of easement.

(e) Soil disturbance created solely as a result of other property interests in the premises superior in title to the farmland preservation easement, such as utility easements and road rights-of-way, shall not constitute soil disturbance for the purposes of determining compliance with the soil disturbance limitations set forth in N.J.A.C. 2:76-25.5.

§ 2:76-25.5 Limitation

(a) Soil disturbance totaling up to 12% of the premises or 4 acres, whichever is greater, will be permitted.

1. In calculating the permissible soil disturbance limit, acreage shall be rounded to three decimal places (.000).

(b) Once an area of the premises has been disturbed, it will continue to be considered soil disturbance until and unless the Committee determines that the area has been successfully rehabilitated in accordance with N.J.A.C. 2:76-25.9 and Appendix A.

(c) Activities occurring within the footprint of areas already considered disturbed will not be counted as additional soil disturbance.

(d) Soil disturbance located outside the boundaries of the premises, including but not limited to severable and non-severable exception areas, residential exclusion areas, and any other area(s) of a farm not subject to the term and conditions of the deed of easement, shall not count towards the limitation set forth in (a) above.

2:76-25.6 Waiver

(a) This subsection applies solely to premises preserved prior to the adoption date of these rules.

(b) For eligible premises, the Committee may grant a waiver of the soil disturbance limitation established by N.J.A.C. 2:76-25.5 and the baseline mapping conducted pursuant to N.J.A.C. 2:76-25.10 up to a maximum soil disturbance limit of 15% or 6 acres, whichever is greater, provided that:

1. In calculating the permissible waiver limit, acreage shall be rounded to three decimal places (.000); and

2. The owner applies for a waiver on a form prepared by the Committee; and

3. The Committee determines that one or more of the requirements at (g) below are satisfied; and

3. The Committee determines that one all of the requirements at (h) below are satisfied; and

4. If a county or a qualified tax-exempt nonprofit organization is the Grantee of the development easement, the waiver shall be approved by both that Grantee and the Committee pursuant to this section.

(c) The application shall be filed with the Committee and the Committee shall provide the Grantee, if applicable, with a copy of the application.

1. The Committee shall, within 30 days of receipt of the application, provide written notice to Grantor and Grantee, if applicable, whether the application is complete or incomplete. The notice shall specify the missing information.

2. If the application is incomplete, Grantor shall have 120 days from receipt of the notice of incompleteness to provide the Committee with any missing information.

3. The Grantee, if applicable, shall take no action on the request for a waiver until the Grantee receives copies of the complete application and all supporting materials from the Committee.

(d) Within thirty (30) days of receipt of written notice from the Committee that the application is complete, the Grantor shall provide written notice of the application, at Grantor's sole expense, via certified mail, return receipt requested, and/or by personal service, to:

i. The clerk and land use board secretary of the municipality in which the premises is located. If the premises is located within 200 feet of an adjoining municipality, then written notice of the application shall be given as set forth in (d)6 above to the clerk and land use board secretary of the adjoining municipality;

ii. The owners of all real property, on the current tax duplicates, within 200 feet in all directions of the premises. The Grantor shall be solely responsible to pay for and obtain a certified list of property owners in accordance with N.J.S.A. 40:55D-12c.;

iii. The Grantee;

iv. The county planning board, if the premises is located adjacent to a county road or county-owned property;

(e) The notice set forth in (c), above, shall describe the relief sought in the application, a description of the project or other reason(s) necessitating the application, that comments on the application may be provided to, and copies of the application materials can be obtained from, the Committee at: State Agriculture Development Committee, P.O. Box 330, Trenton, NJ 08625-0330, and sadc@ag.nj.gov.

(f) The application shall include, but not be limited to, the following information, as applicable:

1. A detailed narrative that:

i. Explains how the project for which the Grantor is seeking a waiver meets at least one of the requirements at (g) above as well as all of the requirements of (h); and

ii. Demonstrates alternate designs and/or locations for the project necessitating the waiver application are infeasible; and

2. A description of any potential impacts of the proposed project upon the premises and any contiguous properties; and

3. If the waiver request relates to the construction of agricultural buildings, all necessary information relevant to support the request, including but not limited to building plans and site plans; and

4. If the waiver request is based on economic grounds, detailed financial documentation to support the request; and

5. A description of the existing land uses in the area and any potential impacts of the proposed project or regulated activities on those land uses; and

6. Any additional information that the Committee determines is reasonable and necessary to evaluate whether the waiver request meets the requirements of this section.

(g) Grantor shall be eligible for a waiver under this section if one of the following apply:

1. There is no feasible and prudent alternative to a proposed project resulting in soil disturbance on the preserved farm beyond the limitation contained in N.J.A.C. 2:76-25.5, including not pursuing the project, which would avoid or substantially reduce the anticipated soil disturbance; or

2. Due to an situation of the Grantor and/or site conditions, compliance with this chapter would result in an exceptional and/or undue hardship for the Grantor and/or would adversely impact

agricultural operations on the premises.

(h) In addition to meeting at least one of the requirements in (f) above, a premises is eligible for a waiver under this section only if the Grantor demonstrates that:

1. Existing soil disturbance on the premises is, upon the date of adoption of this chapter, within fifty percent (50%) of the limitation set forth in N.J.A.C. 2:76-25.5; and

   i. In calculating the waiver threshold, acreage shall be rounded to three decimal places (.000).

2. The proposed project will not cause a direct negative impact on the use of property contiguous to the premises; and

3. The proposed project will be in compliance with relevant federal and state laws and regulations; and

4. The Grantor is in compliance with the farmland preservation deed of easement recorded on the premises; and

5. Grantor has obtained and implemented a farm conservation plan on the premises which is the subject of the waiver request, and management of the premises is consistent with that plan; and

(i) In determining whether to grant an application for a waiver satisfying the requirements of (g) and (h) above, consideration shall be given to the extent to which current or previous activities may have directly or indirectly caused or contributed to the need to submit a request for a waiver.

(j) The request for a waiver shall be approved, approved with conditions, or denied by the Committee, if the Committee is the grantee of the development easement, within 90 days after written notice of a complete application has been issued to the Grantor; if a board or a qualifying tax-exempt nonprofit organization is the grantee of the development easement, then the request for a waiver shall be approved, approved with conditions, or denied by that grantee within 90 days of receiving the complete application from the Committee. Such time periods may be extended by the Committee, the board or the qualifying tax-exempt nonprofit organization for good cause or with the consent of the Grantor.

1. The decision set forth in (i), above shall be memorialized by resolution of the Grantee, if applicable, and Committee setting forth detailed findings of fact and conclusions of law.

2. The Committee and the Grantee, if applicable, shall provide the Grantor with a copy of its decision to approve, approve with conditions, or deny the application, and shall also provide copies of the decision to the individuals and entities listed in (c), above, as applicable.

   i. The Grantee shall provide the Committee with a copy of the Grantee's decision within 10 days of the issuance of the decision.

   ii. The Committee shall approve, approve with conditions, or deny the request for a waiver within 60 days of receipt of the Grantee's approval. Such time period may be extended by the Committee for good cause or with the consent of the Grantor.

4. Decisions by the Committee and by the Grantee, as applicable, shall be memorialized by resolution adopted at a meeting held in accordance with the Byron M. Baer Open Public Meetings Act, N.J.S.A. 10:4-6, et seq.; decisions by the Committee shall be considered final administrative agency action subject to the right of appeal to the Appellate Division of the Superior Court.

(k) The Committee, or the Grantee, if applicable, may issue a waiver conditioned on, and which will become effective only upon, the Grantor's receipt of all necessary local, State, and Federal approvals, provided that if such approvals contain any requirements for implementation of a project associated with the waiver that are inconsistent with N.J.S.A. 4:1C-11, et seq., this subchapter, or the waiver itself, the waiver will be deemed null, void, and of no further force or effect.

(*l*) The Committee and the Grantee, if applicable, may include other reasonable conditions in granting the application for a waiver.

(m) The approval of an application for a waiver, with or without conditions, shall not run with the land, and the Committee's resolution shall explicitly so state, in addition to the following:

1. The right to apply for a waiver shall automatically terminate if there is a change in the record ownership of the premises, except upon sale, conveyance or transfer to the Grantor's immediate family member.

a. If the Grantor is an individual, "immediate family member" shall mean the Grantor's spouse, child, parent, sibling, aunt, uncle, niece, nephew, first cousin, grandparent, grandchild, father-in-law, mother-in-law, son-in-law, daughter-in-law, stepparent, stepchild, stepbrother, stepsister, half-brother, or half-sister, whether the individual is related by blood, marriage, or adoption.

b. If the sale, conveyance or transfer of the record ownership of the premises is made to a business entity, such as a corporation, limited liability company, partnership or trust, the new Grantor of the subject property shall be entitled to the waiver provided that the transferring Grantor, or an immediate family member or members of the transferring Grantor, as defined in 1(a) above, hold(s) a majority interest in the business entity or trust.

2. A project completed in accordance with this section shall not be deemed a violation of the soil disturbance limitation set forth in N.J.S.A. 2:76-25.5 for successors in title to the premises.

(n) Nothing in this subchapter shall be interpreted as providing a project constructed pursuant to a waiver with protection under section 9 of the "Right to Farm Act", P.L.1983, c.31 (N.J.S.A. 4:1C-1, et seq.) if the project is not otherwise eligible for such protection.

§ 2:76-25.7 Aggregation and consolidation

(a) The soil disturbance allocation pursuant to N.J.A.C. 2:76-25.5 may, upon joint approval if applicable, of the Grantee and the Committee, be aggregated on a contiguous premises owned by the same Grantor provided the total disturbance acreage does not exceed the combined individual allocations for each parcel comprising the contiguous premises.

1. The decision set forth in (a), above shall be memorialized by resolution of the Grantee, if applicable, and Committee setting forth detailed findings of fact and conclusions of law.

2. The Grantee shall provide the Grantor and Committee with a copy of its decision to approve, approve with conditions, or deny the application.

i. The Grantee shall provide the Committee with a copy of the Grantee's decision within 10 days of the issuance of the decision.

3. The Committee shall approve, approve with conditions, or deny the request for aggregation within 60 days of receipt of the Grantee's approval. Such time period may be extended by the Committee for good cause or with the consent of the Grantor.

i. The Committee shall provide the Grantor and Grantee with a copy of its decision to approve, approve with conditions, or deny the application.

4. Decisions by the Committee and by the Grantee, as applicable, shall be memorialized by resolution adopted at a meeting held in accordance with the Byron M. Baer Open Public Meetings Act, N.J.S.A. 10:4-6, et seq.; decisions by the Committee shall be considered final administrative agency action subject to the right of appeal to the Appellate Division of the Superior Court.

(b) No aggregation between contiguous premises owned by the same Grantor shall be permitted unless those premises are restricted such that each premises is permanently associated with, and shall not be conveyed separate and apart from, each other at any time in the future.

(c) In the event the Committee approves an aggregation and consolidation in compliance with this section, the Committee shall prepare a Corrective Deed of Easement reflecting the reallocation of the permitted disturbance and prohibiting further division on the respective premises in the future. The Corrective Deed shall be recorded with the County Clerk, and a copy of the recorded Corrective Deed shall be provided to the Grantor and, if applicable, to the Grantee.

§ 2:76-25.8 Division of the premises

(a) Each parcel resulting from a division of the premises approved by the Committee pursuant to N.J.A.C. 2:76-6.15(a)(15) must comply with the soil disturbance limitation prescribed in N.J.A.C. 2:76-25.5 at the time of division.

1. A parcel ineligible for a waiver pursuant to N.J.A.C. 2:76-25.6 shall not be deemed eligible as a result of a division of the premises.

(b) The soil disturbance limitation prescribed in N.J.A.C. 2:76-25.5 shall be allocated at the same proportion for each of the parcels resulting from a division of premises pursuant to N.J.A.C. 2:76-6.15(a)(15) unless subject to aggregation in accordance with N.J.A.C. 2:76-25.7.

(c) In the event the Committee approves a division of the premises, the Committee shall prepare a Corrective Deed of Easement reflecting the division and the allocation of the allowable soil disturbance on the respective premises. The Corrective Deed shall be recorded with the County Clerk, and a copy of the recorded Corrective Deed shall be provided to the Grantor and, if applicable, to the Grantee.

(d) In no event shall an increase in the total soil disturbance limitation prescribed in N.J.A.C. 2:76-25.5 result from a division of the premises.

§ 2:76-25.9 Soil rehabilitation application and certification procedures

(a) A Grantor may complete a certified soil rehabilitation project for purposes of rehabilitating disturbed soils so that they no longer count towards the soil disturbance limit established pursuant to N.J.A.C. 2:76-25.5.

(b) Not less than 180 days prior to commencing any proposed rehabilitation activities, the Grantor shall submit to the Committee a rehabilitation application and plan ("application package") on a form prepared by the Committee consistent with this subchapter and with the Soil Rehabilitation Standards set forth in Appendix A.

(c) The Committee shall have the discretion to reduce, and/or determine the non-applicability of rehabilitation plan components set forth in Appendix A based on relevant, site-specific conditions of the premises.

(d) The Committee shall, within 60 days of receipt of the application package, notify the Grantor whether the application package is administratively complete.

1. If the application package is determined administratively incomplete, Grantor shall be notified in writing with a summary of deficiencies.
2. If the application package is determined administratively complete, the Committee shall commence a technical review of the rehabilitation plan.

(e) The rehabilitation plan technical review period shall be 90 days.

1. If the Committee determines portions of the rehabilitation plan are missing technical information necessary to complete a technical review:
   i. The Grantor shall be notified in writing; and
   ii. The review period shall be paused pending submission of any requested information; and
   iii. The Grantor shall have 30 days to supply the requested information; and
   iv. Acceptance of the submitted information shall restart the review period; and
   v. Failure to submit the documentation within the timeframe shall be considered a withdrawal of the application package.
2. If the Committee determines the rehabilitation plan does not meet the technical Soil Rehabilitation Standards set forth in Appendix A, the Committee shall provide a written denial letter to the Grantor stating the reason(s) for the denial. The Grantor may request a hearing pursuant to N.J.A.C. 2:76-25.12 for any such denial.
3. If the Committee determines the rehabilitation plan meets the technical Soil Rehabilitation Standards set forth in Appendix A, the Committee shall provide written notice advising the Grantor to commence the rehabilitation process. Notice shall be by certified mail return receipt requested. The Grantor shall commence the rehabilitation project within 12 months of receipt of the notice to commence.

(f) The Committee may extend the application review timeframes listed above with appropriate justification. Notice of all such extensions shall be in writing to the Grantor. Failure by the Committee to act upon an application package within the review period(s) shall constitute approval of the rehabilitation plan.

(g) If the rehabilitation plan is approved, the Grantor shall complete rehabilitation in accordance with approved rehabilitation sequence.

1. The Grantor shall notify the Committee of intent to commence the rehabilitation plan at least 5 business days prior to start of physical work.
2. Before each subsequent step in the rehabilitation sequence begins, interim approval of the previous step shall be obtained by the Grantor from the Committee.
   i. If interim approval is not obtained, the Grantor shall have not more than one (1) year to meet the standards of that step or the rehabilitation plan shall be considered unsuccessful.
      (1) Not more than one (1) extension not more than one (1) year long shall be approved per step.
      (2) Not more than two (2) extensions shall be approved per rehabilitation plan.
   ii. If interim approval is obtained, the Grantor shall retain the documentation for final certification and shall proceed with the rehabilitation sequence.
3. The Committee, at its discretion, may require an inspection of the premises before, during, or after rehabilitation to determine compliance with rehabilitation criteria. The Committee shall provide at least 24-hours advance notice of the inspection to the Grantor.
4. The Committee may conduct an inspection of the site and may collect soil samples or other relevant site information to determine if rehabilitation was conducted according to the rehabilitation criteria.
5. The Committee reserves the right to issue a stop-work order upon evidence of work undertaken that violates the approved rehabilitation plan.
6. Upon completion of all rehabilitation activities, the Grantor shall submit a final certification report in accordance with Appendix A.
   i. The Committee shall complete an administrative review within 60 days of receipt of the final report.
   ii. The Committee shall schedule a site visit and review all submitted materials for technical completeness.
   iii. If the Committee determines rehabilitation was not completed according to the approved rehabilitation plan, the Committee shall notify the Grantor of deficiencies and recommend corrective measures to bring the rehabilitation area into compliance with the standards within the timelines described in Appendix A.
   iv. If the Committee determines that the rehabilitation work is still deficient after all stated timelines have passed, a resolution shall be issued denying the certification of rehabilitation and the and the land will continue to be counted towards the soil disturbance limitations set forth in N.J.A.C. 2:76-25.5. The Grantor may request a hearing pursuant to N.J.A.C. 2:76-25.12 for any such denial.
   v. If the Committee determines that rehabilitation has been completed according to the approved rehabilitation plan, the Committee shall issue a final certification that all

Soil Rehabilitation Standards in Appendix A have been satisfied. A resolution memorializing the certification shall be issued and the rehabilitated land area will no longer be counted towards the soil disturbance limitations set forth in N.J.A.C. 2:76-25.5.

§ 2:76-25.10 Baseline mapping and monitoring

(a) Baseline mapping of soil disturbance on each premises shall be established as of the date of adoption of this subchapter.

(b) Written notice of the baseline soil disturbance mapping shall be provided to the Grantor and the Grantee, if applicable, by certified mail, return receipt requested, at the recipient's last known address.

1. If the notice is returned as unclaimed or undeliverable, then the Committee shall make good faith efforts to provide an alternate manner of notice.

2. The written notice shall include a baseline map and a link to the Committee's website connecting to an online version of the baseline map depicting the extent and classification of identified soil disturbance features on the premises.

3. The written notice shall include a statement that the Grantor and/or Grantee may provide comments on the preliminary calculated extent or assigned classification of baseline map features in writing to the Committee within 180 days of receipt of the notice.

i. The Committee shall conduct a site visit, as necessary, to premises that are the subject of written comments before issuing a final baseline map.

4. The written notice shall include a statement that underscores the importance of commenting on and finalizing the baseline map within the specified time period, particularly for purposes of establishing eligibility for a waiver in accordance with N.J.A.C. 2:76-25.6.

5. The written notice shall include a statement that a request for a hearing shall be made in accordance with N.J.A.C. 2:76-25.12 in cases where the Grantor and/or Grantee disagrees with the final baseline map.

(c) Review of soil disturbance mapping shall occur regularly as part of the monitoring of each premises required pursuant to N.J.A.C. 2:76-6.13, N.J.A.C. 2:76-6.18A, N.J.A.C. 2:76-11.1, N.J.A.C. 2:76-16.1, or N.J.A.C. 2:76-17A.16, or upon request of the Grantee.

1. The current version of soil disturbance mapping shall be available to the Grantor and/or Grantee at any time upon written request.

2. Newly identified potential soil disturbances discovered during annual monitoring must be reported to the Committee as part of the requisite annual monitoring report or within 60 days upon identification for those farms within 50% of the soil disturbance limit established at N.J.A.C. 2:76-25.6.

(d) The Grantor and/or Grantee may submit to the Executive Director an appeal of the calculated extent or assigned classification of soil disturbance map features at any time.

1. Upon request, the Executive Director shall confer with the Grantor and/or Grantee as appropriate, within 60 days of the revised soil disturbance map submission completed as part of the annual monitoring process to review the request and supporting documentation as set forth herein.

2. If Grantor and/or Grantee disagrees with the revised soil disturbance calculation Grantor and/or Grantee may request a hearing pursuant to N.J.A.C. 2:76-25.12.

(f) When new soil disturbances are identified through the monitoring process, the Grantee and/or Grantor shall submit to the Committee the following supporting documentation:

1. Description of newly identified or amended disturbances characterized by type, location and size (in sq./ft.) as follows:

i. Soil disturbance types as defined in N.J.A.C. 2.76-25.3:

(1) Altered soil; and/or

(2) Surfaced soil; and/or

(3) Compacted soil.

ii. Property location identified by tax block and lot number and general description (for example, Northeast corner of Block A, Lot X) and with georeferencing using latitude and longitude being preferred .

iii. Size measured coarsely using basic field tools, including but not limited to tape measures, pacing, or hand-held Global Positioning System (GPS) units with GPS measurements being preferred. Vegetative cover should be measured in accordance with Appendix A - Method for Measuring Vegetative Cover.

iv. For areas where classification of soil disturbance is initially unclear, such as with soil alteration (cut/fill) or minimum vegetative cover, or exemptions, the monitor shall err on the side of including the potential disturbance and additional follow-up may be required to more accurately quantify disturbance areas with more precise tools.

2. Photos of each new disturbance shall be taken and provided to the Committee in digital format.

3. Any additional information that the Committee determines is reasonable and necessary.

§ 2:76-25.11 Enforcement

(a) The Grantee and/or the Committee, upon a finding that the owner of a preserved premises has violated this subchapter, may pursue any remedies available in N.J.S.A. 4:1C-33 and the deed of easement pursuant to N.J.A.C. 2:76-6.15.

§ 2:76-25.12 Request for hearing

(a) Any Grantor and/or Grantee who is aggrieved by an action of the Committee pursuant to this subchapter may submit a written request to the Committee for a hearing.

1. A request for a hearing shall be sent to the Committee within 20 days of receipt of notice of the Committee's action.

2. Requests shall be sent to the Executive Director, State Agriculture Development Committee, New Jersey Department of Agriculture, P.O. Box 330, Trenton, New Jersey 08625-0330.

3. Grantor and/or Grantee shall be afforded the opportunity for a hearing thereon in the manner provided for contested cases pursuant to the Administrative Procedure Act, N.J.S.A. 52:14B-1 et seq.

4. The decision of the Committee shall be considered a final administrative agency decision, subject to the right of appeal to the Appellate Division of the Superior Court.

§ 2:76-25.13 Severability

Should any section, subsection, sentence, clause, phrase or term of this subchapter be declared void, invalid, illegal or unenforceable, for any reason, by the adjudication of any court or other tribunal having jurisdiction, such a declaration shall not affect the validity of the remaining provisions, which are hereby declared to be severable and which shall continue to remain in full force and effect.

SUBCHAPTER 25A. SUPPLEMENTAL SOIL DISTURBANCE STANDARDS

§ 2:76-25A.1 Applicability

This subchapter applies to premises subject to farmland preservation deed restrictions recorded pursuant to the Agriculture Retention and Development Act, N.J.S.A. 4:1C-11 et seq, P.L. 1983, c.32.

§ 2:76-25A.2 Purpose

The purpose of this subchapter is to promulgate technical standards for certain agricultural practices for which a singular definition as set forth in N.J.A.C. 2:76-25.3 is infeasible. Where those agricultural practices are undertaken in a manner noncompliant with the supplemental standards established in the subchapter, the acreage where those activities have occurred will count towards the soil disturbance limitation set forth in N.J.A.C. 2:76-25.5.

§ 2:76-25A.3 Definitions

"Basal cover" means the portion of the soil surface covered by plant bases. It does not include foliar cover (the vertical projection of exposed leaf area), or canopy cover (the vertical projection of outermost perimeter of natural spread of foliage, may be more than 100% if plants overlap).

"Bulk Density" has the same meaning as that term is defined in N.J.A.C. 2:76-25.3.

"Degraded Soil" has the same meaning as that term is defined in N.J.A.C. 2:76-25.3.

"Dense Vegetative Cover" means more than 90% live vegetative cover over a topsoil stockpile year-round.

"Low Ground Pressure Equipment" means construction and/or agricultural equipment specifically designed to distribute the weight of the equipment over a larger area with tracks or other design features. Examples include a tracked excavator, tracked skid steer or wide tracked tractor.

"Low Intensity Topsoil Stockpile" means an option for stockpiling topsoil designed in accordance with N.J.A.C. 2:76-25A.5.

"Maximum Dry Bulk Density" has the same meaning as that term is defined in N.J.A.C. 2:76-25.3.

"Minimum Rooting Depth" has the same meaning as that term is defined in N.J.A.C. 2:76-25.3.

"Minimum Vegetative Cover" has the same meaning as that term is defined in N.J.A.C. 2:76-25.3.

"Moderate Intensity Topsoil Stockpile" means an option for stockpiling topsoil from which hay may be harvested pursuant to N.J.A.C.2.76-25A.5.

"Normal Tillage" has the same meaning as that term is defined in N.J.A.C. 2:76-25.3.

"On-farm utilities" has the same meaning as that term is defined in N.J.A.C. 2:76-25.4.

"Premises" has the same meaning as that term is defined in N.J.A.C. 2:76-25.3.

"Soil" has the same meaning as that term is defined in N.J.A.C. 2:76-25.3.

"Soil compaction" has the same meaning as that term is defined in N.J.A.C. 2:76-25.3.

"Soil disturbance" has the same meaning as that term is defined in N.J.A.C. 2:76-25.3.

"Soil horizon" has the same meaning as that term is defined in N.J.A.C. 2:76-25.3.

"Soil Loss Tolerance Rate (T)" has the same meaning as that term is defined in N.J.A.C. 2:76-25.3.

"Soil profile" has the same meaning as that term is defined in N.J.A.C. 2:76-25.3.

"Soil structure" has the same meaning as that term is defined in N.J.A.C. 2:76-25.3.

"Solar energy" has the same meaning as that term is defined in N.J.A.C. 2:76-25.3.

"Solar energy facilities" has the same meaning as that term is defined in N.J.A.C. 2:76-24.3.

"Solar panels" has the same meaning as that term is defined in N.J.A.C. 2:76-24.3.

"Solar-related disturbance area" means the total contiguous or noncontiguous area(s) supporting the solar energy facilities and related infrastructure. The total area calculation shall include all areas of land that are devoted to or support the solar energy facilities; any areas of land no longer available for agricultural or horticultural production due to the presence of the solar energy facilities; any areas of the farm used for underground piping or wiring to transmit solar energy or heat where the piping or wiring is less than three feet from the surface. It does not include building mounted solar energy facilities.

"Step-point method" means the quantitative means of determining minimum vegetative cover pursuant to N.J.A.C. 2:76-25A.4 and Appendix A.

"Stockpile" has the same meaning as that term is defined in N.J.A.C. 2:76-25.3.

"Subsoil" has the same meaning as that term is defined in N.J.A.C. 2:76-25.3.

"Topsoil" has the same meaning as that term is defined in N.J.A.C. 2:76-25.3.

"Topsoil Stockpile" has the same meaning as that term is defined in N.J.A.C. 2:76-25.3.

"USDA" has the same meaning as that term is defined in N.J.A.C. 2:76-25.3.

§ 2:76-25A.4 Vegetative Cover

(a)~~.~~ Temporary parking areas, temporary storage areas, livestock confinement, and livestock training areas are exempt agricultural practices pursuant to N.J.A.C. 2:76-25.4 when minimum vegetative cover as defined in N.J.A.C. 2:76-25.3 is maintained.

(b)~~.~~ The measurement of vegetative cover shall be conducted according to the method detailed in Appendix A.

(c) The Committee and Grantee, as appropriate, shall consider the following factors affecting the quality of vegetation and the ability of a field to maintain minimum vegetative cover:

i. The weight of the equipment, livestock, or vehicles; and
ii. The frequency of use of the area each day or season; and
iii. The yield potential of the pasture; and
iv. Pasture management (i.e. mowing, irrigating, fertilizing, seeding, and pasture rotation); and
v. Plant species present; and
vi. Drainage; and
vii. Soil type; and
viii. Weather conditions and season.

§ 2:76-25A.5 Topsoil stockpiling

(a) General performance criteria:

1. Topsoil stockpiles shall not be located in regulated areas such as wetlands, waters of the state, floodplains, or wetland transition areas.
2. Topsoil stockpiles shall be oriented to allow drainage around the stockpile, to keep the topsoil well drained and aerobic, and to avoid ponding water around the soil.
3. Topsoil movement shall only take place when soils on the site are significantly below field moisture holding capacity to minimize soil compaction.
4. Topsoil shall be removed and placed using low ground pressure equipment unless work is done from ground protection mats or existing travel lanes.
5. The area to be stripped of topsoil:
    i. Shall have existing vegetation removed by harvesting, mowing, or treating with herbicide according to the manufacturer's label.
    ii. Shall not be tilled before excavating topsoil to maintain the soil structure.
    iii. Bulky vegetation (e.g., mulch, corn stover, excessive grass) shall not be incorporated into topsoil stockpiles but shall be harvested or otherwise removed.
6. When moving, handling, and grading topsoil, care shall be taken to avoid overhandling and compaction.
    i. Topsoil shall not be moved using bulldozers and land planes or similar equipment that impacts soil structure.
    ii. When possible, the topsoil shall be placed directly onto the final stockpile location or shall be placed directly into a vehicle to be transported to the stockpile location.
7. Topsoil stockpile placement shall avoid overlying prime farmland soils when feasible.
8. Topsoil shall be managed in a way to maintain its soil structure to the maximum extent practicable (e.g., avoid deliberately pulverizing soil clods).
9. Care shall be taken to avoid soil smearing; if the soil is smeared during construction, soil shall be scarified to allow for water and air infiltration and exchange.
10. Topsoil stockpiles shall be maintained to be free of woody vegetation unless specifically permitted herein.
11. Topsoil stockpiles shall be created as either low intensity topsoil stockpiles or moderate intensity topsoil stockpiles, depending on the goals of the farming operation, as described below.
12. If equipment travel over the topsoil stockpile is necessary for construction or maintenance of the stockpile, travel shall be limited to the minimum number of passes required. Travel shall not increase soil dry bulk density above the values listed in the following table as set forth in [USDA-NRCS-SSESC website link]:

Maximum Dry Bulk Densities (grams/cubic centimeter) by soil type Soil Type/Texture Bulk Density

Soil Type/Texture	Bulk Density (g/cc)
Coarse, Medium and Fine Sands and Loamy Sands	1.80
Very Fine Sand and Loamy Very Fine Sand	1.77
Sandy Loam	1.75
Loam, Sandy Clay Loam	1.70
Clay Loam	1.65
Sandy Clay	1.60
Silt, Silt Loam	1.55
Silty Clay Loam	1.50
Silty Clay	1.45
Clay	1.40

Source: USDA Natural Resource Conservation Service, Soil Quality Information Sheet, Soil Quality Resource Concerns: Compaction, April 1996 and Table 19-1 of the Standards for Soil Erosion and Sediment Control in New Jersey, July 2017(b)

(b) Low Intensity and Moderate Intensity Topsoil Stockpiles

1. Low intensity topsoil stockpile areas cover a smaller area than moderate intensity topsoil piles but do not grow a harvestable crop. For low intensity topsoil stockpile areas:
   i. Existing vegetation shall be removed before placement of topsoil fill.
   ii. The existing topsoil shall be tilled or ripped to eliminate any transition zone between the existing topsoil and the topsoil stockpile to be placed on the area.
   iii. Topsoil shall be stockpiled to a maximum height of three (3) feet above original grade.
   iv. The side-slopes of the topsoil stockpile shall be no greater than 4 Horizontal:1 Vertical (25%) to reduce erosion potential and allow for routine mowing.
   v. When topsoil is planned to be stockpiled for more than 30 days it shall be seeded and mulched according to the Critical Area Planting (342), Tables 3 and 4 available electronically here: https://efotg.sc.egov.usda.gov/references/public/NJ/NJ342.pdf , where the purpose of planting is to stabilize berms and low embankments.
      1. Seeding will occur within the recommended planting dates in table 2 for the species selected.
      2. Any stabilization outside the seeding window shall be mulched in accordance with the *Standards for Soil Erosion and Sediment Control in New Jersey, Stabilization with Mulch only* available electronically here: https://www.nj.gov/agriculture/divisions/anr/pdf/2014NJSoilErosion

ControlStandardsComplete.pdf, until permanent seeding occurs within the seeding window.

2. Moderate intensity topsoil stockpile areas are lower in height than low intensity stockpiles, and cover more land area, but may be cropped with hay, providing an economic opportunity not available on low intensity topsoil stockpiles. For moderate intensity topsoil stockpile areas:
   i. All vegetation shall be removed prior to placement of topsoil fill.
   ii. The existing topsoil shall be tilled or ripped to eliminate any transition zone between the existing topsoil and the topsoil stockpile to be placed on the area.
   iii. Topsoil shall be placed at a depth of not less than 12 inches and not more than 18 inches.
   iv. Side slopes shall be no greater than 6 Horizontal: 1 vertical.
   v. Seeding shall be an appropriate long-term, deep rooting perennial hay crop within 30 days.
   vi. During establishment, no harvesting shall occur until the crop has reached a sufficient height to ensure vigorous, deep root establishment.

(c) Maintenance of Topsoil Stockpiles:

1. Agronomic nutrient testing of the surface of the topsoil stockpile shall be completed as soon as the stockpile is constructed. Appropriate amendments shall be added to the soil to establish and maintain dense vegetative cover as recommended by the soil test results.
2. Dense vegetative cover shall be established and maintained on the topsoil stockpiles within 30 days of final soil placement and grading. Topsoil stockpiles shall be reseeded as necessary to maintain dense vegetative cover. There shall be no tillage of topsoil stockpiles after initial establishment except as expressly provided herein.
3. Permanent vegetation on low intensity soil stockpiles shall be mowed no lower than six (6) inches and shall be maintained free of woody vegetation unless otherwise specified herein. Equipment travel over the stockpiles shall be minimized and shall only occur when the stockpile is significantly below field moisture capacity.
4. Permanent vegetation on moderate intensity soil stockpiles shall be mowed or harvested not less than 4 inches and shall be allowed to regrow at least 12 inches prior to subsequent harvests. Care shall be taken to avoid excessive equipment traffic over the topsoil stockpile. Hay bales shall not be stockpiled on the soil stockpile and shall not be removed from the field unless the ground is significantly below field moisture capacity or the ground is frozen.
5. Tillage may occur on moderate intensity topsoil stockpiles to establish a hay crop not more than once every 5 years. Seeding or overseeding of hay crops may occur at any frequency necessary to maintain the hay.

6. Trees, shrubs, and woody vegetation shall not be planted or be allowed to establish on topsoil stockpiles unless specifically approved by the Committee through resolution. Nursery stock shall not be established on topsoil stockpiles.
7. Signage shall be maintained on each topsoil stockpile preventing improper use. Topsoil stockpiles shall not be used for picnic areas, parking, travel, pasture or other livestock use, growing crops, filling depressions or containers, or any other use unless specifically provided for herein.
8. All erosion rills that form on the stockpile shall be addressed promptly by stabilization with seed and mulch or biodegradable erosion control matting, if necessary, for vegetation to establish.

§ 2:76-25A.6 On-farm utilities construction

(a) On-farm utilities general construction criteria are as follows:

1. Construction activities shall be completed while soil moisture is significantly below field moisture capacity.
2. Low ground pressure equipment and/or ground protection mats shall be used during construction to reduce soil compaction. Gravel construction roads and unprotected construction roads are counted towards soil disturbance limitation set forth in N.J.A.C. 2:76-25.5 and shall adhere to N.J.A.C. 2.76-25.9. after construction is complete.
3. No mechanical or structural soil compaction (e.g. with a sheep-foot compactor or vibratory compactor, or similar) shall occur prior to or during installation.
4. Low ground pressure equipment and/or ground protection mats shall be used during construction.
5. No land grading shall occur on the site.
6. After construction is complete, bare soil over, under, and around the utility shall be seeded to a permanent vegetative cover that is compliant with the *Standards for Soil Erosion and Sediment Control in New Jersey* available electronically here: https://www.nj.gov/agriculture/divisions/anr/pdf/2014NJSoilErosionControlStandardsComplete.pdf,, or compliant with a farm conservation plan approved by the Soil Conservation District.
7. Soil loss from the utility area shall be maintained at or below the Soil Loss Tolerance Rate "T".

    1) (b) Buried utility construction criteria are as follows: All underground utilities (electric, sewer, water, gas, communication lines, or similar) shall be buried below the minimum rooting depth, or compliant with the depths required by building code, if greater.
        i) To the maximum extent practicable, underground utilities shall be buried using a trenching machine.
        ii) If use of a trenching machine is not feasible, an open (excavated) ditch may be used and should be the minimum width necessary to install the utility. The following conditions apply when underground utilities are installed using an open ditch;
            1. Topsoil and subsoil shall be staged separately from each other and stored in accordance with N.J.A.C. 2:76-25A.5 et seq.
            2. Topsoil shall not be used as bedding beneath buried utility pipe.
            3. After installation, topsoil shall be replaced to an equivalent depth as existed before installation. Excess subsoil may be removed from the premises or reused on site in compliance with an approved farm conservation plan.

iii) Horizontal directional drilling may be utilized as appropriate below the minimum rooting depth. Access areas shall follow Soil Rehabilitation N.J.A.C.2.76-25.9

(c) Solar energy facility construction criteria

1. The solar energy facility (SEF) must be approved pursuant to N.J.A.C. 2:76- 24.1 et seq. prior to construction. If built prior to approval, as-built designs and a site visit by SADC are required. At their sole discretion, the SADC may determine if an installation is compliant with this standard or may recommend modifications to bring the installation into compliance with the standard.
2. SEFs shall be designed in a manner to minimize the solar-related disturbance area.
3. The land within the SEF may be utilized for crop production, pasture/grazing, or other soil-based agriculture when part of an approved farm conservation plan.
4. Only the land underneath solar panels and solar arrays installed according to this standard shall be exempt from the soil disturbance limitation set forth in N.J.A.C. 2:76-25.5. The footprint for all other infrastructure required for the SEF shall be counted towards the soil disturbance limitation set forth in N.J.A.C. 2:76-25.5.
5. Travel lanes used solely to access the SEF do not qualify for the unimproved travel lane exemption pursuant to N.J.A.C. 2.76-25.4.
6. Nothing in this BMP will abrogate, supersede, or replace the solar energy generation rules at N.J.A.C. 2:76- 24.1 et seq. or N.J.S.A. 4:1C-32.2 or N.J.A.C. 2:76-23.1.
7. Mounting Requirements for SEF are as follows:
   i. For SEF mounted to the ground by a screw, piling, or similar system that does not require a footing, concrete, or other permanent mounting there are no additional installation requirements.
   ii. For SEF mounted using ballast such as gravel contained within structures, concrete block, or similar materials for the purpose of providing ballast for mounting the SEF:
      a. Ballast structures shall be designed to minimize the overall footprint of the ballast area.
      b. All topsoil shall be stripped from the footprint of the ballast structure, concrete block, or similar material and stockpiled according to N.J.A.C. 2.76-25A.5.
      c. No structural compaction of topsoil or subsoil shall occur within the ballast area.
      d. The area of the ballast structure is not exempt from the soil disturbance limitation set forth in N.J.A.C 2:76-25.5.
   iii. For SEF mounted using permanent mounting techniques (i.e. concrete footings) where written justification from a licensed professional engineer has been approved:
      a. Footings shall be minimized to the maximum extent practicable.
      b. The area around the footings shall be protected from soil compaction.

c. The area of the footings is not exempt from the soil disturbance limitation set forth in N.J.A.C 2:76-25.5.

8. Maintenance
   i. Minimum vegetative cover shall be maintained over the entire solar-related disturbance area to minimize runoff and soil erosion.
   ii. The SEF shall be kept in good working order. Land beneath defunct panels does not qualify for soil disturbance exemptions in N.J.A.C. 2.76-25.4.
9. Removal:
   i. At the end of its useful life, all infrastructure associated with the SEF shall be removed from the soil and properly disposed of. All permanent footings, concrete structures, conduits, and underground utilities shall be removed to a minimum depth of 30 inches. Infrastructure buried deeper than 30 inches may be left in place.
   ii. The entire solar-related disturbance area shall follow the rehabilitation standards pursuant to N.J.A.C. 2.76-25.9 once the infrastructure has been removed.

§ 2:76-25A.7 Severability

Should any section, subsection, sentence, clause, phrase or term of this subchapter be declared void, invalid, illegal or unenforceable, for any reason, by the adjudication of any court or other tribunal having jurisdiction, such a declaration shall not affect the validity of the remaining provisions, which are hereby declared to be severable and which shall continue to remain in full force and effect.

Appendix A - Soil rehabilitation standards

(a) To be considered for a certified soil rehabilitation project pursuant to N.J.A.C. 2:76-25.9, the Grantor shall submit:

1. A narrative description of:
   i. The extent and type of existing soil disturbance,
   ii. The proposed future agricultural use of the area once rehabilitated including how the proposed use prioritizes focusing farm development on already disturbed or previously rehabilitated areas instead of on undisturbed locations,
   iii. A complete description of each horizon within the soil profile to:
      (1) Two feet below the depth of the disturbance if the disturbance was soil alteration deeper than the minimum rooting depth, or
      (2) A depth of two feet below the minimum rooting depth, or parent material, whichever is greater,
   iv. Permits required by other government agencies,
   v. An evaluation of the applicability of rehabilitation criteria described herein,
   vi. A discussion of how the proposed rehabilitation activities will meet the applicable criteria,
   vii. Justification for requests for waivers and/or leniency from the requirements of NJAC 2:76-25.9
2. Charts showing:
   i. Historic and/or current yield for the disturbed areas including:
      (1) Documented justification of the yield chosen in compliance with yield criteria below,
      (2) Relevant cropping data including irrigation status, fertilizer applied, etc.)
   ii. A proposed sequence and timeline for rehabilitation. Excluding any crop-testing requirements, the timeline for rehabilitation shall not exceed three (3) years.
   iii. The proposed cropping rotation for the five years following rehabilitation, including:
      (1) Crop type and variety;
      (2) Irrigation;
      (3) Tillage practices;
      (4) Soil inputs (fertilizer, herbicide, etc)
   iv. The proposed crop yield comparison methodology with proposed sampling frequency and locations.
   v. Identification of the following soil properties for the soil map units to be rehabilitated. The properties identified below shall be reported as both NRCS typical values and the Official Series Description, available through Web Soil Survey (https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm) and the NRCS Soil Survey website

(https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/soils/survey/class/data/?cid=nrcs142p2_053587); and current *in-situ* conditions as identified by in-field evaluation.

(1) Soil chemical properties:
   (A) Cation-exchange capacity
   (B) Electrical conductivity
   (C) pH/ soil reaction

(2) Soil health properties:
   (A) Available water capacity
   (B) Bulk density
   (C) Organic matter
   (D) Sodium adsorption ratio

(3) Soil physical properties:
   (A) Saturated hydraulic conductivity (Ksat)
   (B) Texture

(4) Soil qualities and features:
   (A) Depth to restrictive layer
   (B) Drainage class
   (C) Hydrologic soil group
   (D) Depth of rooting zone

(5) Official series description of:
   (A) Color
   (B) Structure
   (C) Topsoil and subsoil thickness (A&B horizons)

3. Additional attachments:

i. A copy of a current farm conservation plan for the premises that identifies changes in use.

ii. If the current conservation plan is outdated, a revised farm conservation plan describing the proposed cropping sequence, including tillage methods and cover crops for a minimum of five (5) years following the completion of rehabilitation.

iii. A map or maps of the premises. Maps may be created from a new survey, an edited version of the original farmland preservation survey, an edited aerial image with a scale and date of image, a map created with Geographic Information System (GIS) software, or any similar data source. Submitted maps shall be at a scale that clearly depict the following:

(1) All areas of existing soil disturbance and the associated acreage,
(2) The areas of proposed soil rehabilitation,
(3) Soil types in the area of remediation.

iv. A site plan showing:
   (1) A grading and topography plan showing the following within 100 feet of the rehabilitation area,
   (2) Existing and proposed contours, clearly labeled,
   (3) Regulatory areas (e.g. wetlands and wetland buffers),
   (4) Existing infrastructure within 100 feet (e.g. buried utilities, buildings),
   (5) Existing and proposed staging and stockpile areas for topsoil and subsoil.
   (6) Relevant construction details to protect the soil during and after construction, including but not limited to:
      (A) Notes about limiting soil compaction,
      (B) Notes and details about preventing erosion during rehabilitation,
      (C) Notes about soil stabilization after grading is complete.
   (7) Any other relevant data the Grantor feels is necessary to describe the proposed rehabilitation activities.

(b) After rehabilitation activities and testing have been completed the Grantor shall submit to the Committee the Final Certification Report which, at minimum, shall include:
   1. Records of interim approvals for each step in the approved rehabilitation sequence;
   2. A comparison of the pre-existing and rehabilitated soil properties;
   3. Documentation of acceptable bulk density tests with a map depicting the approximate location of the tests, and date(s) of testing;
   4. Certification of clean fill, including source of soil, if applicable;
   5. Results of soil tests, including quantity and type of amendments applied;
   6. Crop yield comparisons, farming practices, and sampling pattern and locations; and
   7. An as-built survey showing slopes if grading occurred.

(c) All certified rehabilitation projects shall consider the following general rehabilitation criteria:
   1. All rehabilitation earthwork shall be completed while the soil moisture is sufficiently below field moisture capacity to avoid rutting and damage to soil structure.
   2. Soil rehabilitation earthwork shall be timed to complete grading at the onset of the optimal seeding period to minimize the duration and area of exposure of disturbed soil to erosion. Immediately after rehabilitation, vegetative cover shall be established in accordance with the specified cover crop mixture or crop rotation.
   3. Low-ground-pressure equipment (i.e. tracked) and/or ground protection mats shall be used during soil rehabilitation.
   4. Minimum depth of soil and/or substitute soil material to be reconstructed shall be 48 inches; or
      i. A lesser depth if the Official Series Description lists the solum (A, E, B horizon) thickness as less than 48" deep.

ii. A greater depth if determined by the Committee to be necessary to restore the original soil productive capacity.

5. The depth to the soil restrictive layer from above (citation needed) the pre-disturbance soils will be used as a basis for determining replacement rooting zone depth. The depth and quality of the rooting zone of the reconstructed soil should be equal to or greater than the pre-disturbance soil rooting zone or the rooting zone of a reference site if pre-disturbance rooting zone depth is unknown.
6. Topsoil should be returned to the area to a thickness not less than that of the pre-disturbed soil.
7. The following soil properties shall approximate or be more favorable for plant growth than pre-disturbance conditions:
   i. Surface infiltration rate
   ii. Hydraulic conductivity
   iii. Texture
   iv. Structure
   v. Porosity (e.g. Bulk Density)
   vi. Consistency
   vii. Penetration resistance
8. The reaction (pH) and other chemical properties of the major horizons of the reconstructed soil must be within the ranges of the pre-disturbed soil or be similar to or as favorable for plant growth.
9. Final grading of the reconstructed soil should provide for adequate surface drainage and for slope gradients within a 1% slope gradient of the original topography.
10. After topsoil replacement, soil shall be tilled appropriately to encourage root and water penetration into the subsoil to reduce runoff and erosion.
11. Any reconstructed subsoil horizons shall be deep-tilled with appropriate implements to ensure root penetration and that restricting layers do not limit downward water percolation.
12. Erosion control measures consistent with the Standards for Soil Erosion and Sediment Control (citation needed) shall be implemented prior to rehabilitation unless rehabilitation is part of an approved farm conservation plan.
13. Average annual soil erosion for each rehabilitated area shall be maintained at or below the tolerable rate until rehabilitation is certified complete.
14. The rehabilitated area shall maintain a positive Soil Conditioning Index (SCI) until rehabilitation is certified complete.

(d) Rehabilitation projects which require the removal of surfaces and/or structures shall also consider the following criteria:

1. All structures, surfaces, and associated foreign materials and debris, including buried infrastructure shall be removed in their entirety within the soil profile. Buried infrastructure below parent material may remain in place.

2. Demolished structures and surfaces shall be removed from the premises for disposal, reuse, or recycling, or may be retained on the premises for beneficial reuse if approved in the rehabilitation plan.
3. Removal of gravel or other surfacing shall be completed in a manner that minimizes gravel mixing with subsoil and compaction of the subsoil. The removal equipment shall remain on the gravel or ground protection mats during rehabilitation and egress from the site by backing out to avoid driving on undisturbed soil.
4. Human made or processed artifacts (e.g. concrete, glass, brick, asphalt, etc.) in each horizon remaining in excess of 5% by volume of native soil shall not be considered rehabilitated.

(e) Rehabilitation projects which require subsoil replacement and/or grading shall also consider the following criteria:
1. Return land to pre-existing slopes by importing subsoil or removing fill using low ground pressure equipment.
2. Rehabilitated areas shall be consistent with the pre-disturbance contour of the land. The rehabilitated slope shall be within 1% of the pre-disturbance slope.
3. If subsoil was removed from the site, certified clean subsoil of shall be imported to a depth informed by NRCS typical values and the *in-situ* analysis completed for the application (reference section above). Replacement subsoil shall have similar physical characteristics to the native subsoil unless the Grantor can demonstrate using soil with similar physical characteristics will prohibit rehabilitation (e.g. excessive clay content).
4. Subsoil shall be tested for bulk density according to the soil bulk density and decompaction rehabilitation criteria (reference section below).
5. Scarify subsoil surface before placing additional subsoil or topsoil layers.
6. Replace subsoil to equivalent depth as undisturbed location. Subsoil shall be placed in lifts of not more than 6" and excessive voids shall be removed prior to placement of additional subsoil.
7. Follow topsoil replacement criteria below (reference section).

(f) Rehabilitation projects which require topsoil replacement shall also consider the following criteria:
1. Check subsoil surface for excessive compaction following the soil bulk density and decompaction rehabilitation criteria (reference section below).
2. Scarify subsoil surface to eliminate slippage surfaces and promote root penetration.
3. Identify replacement material
   i. Topsoil may be used from an on-site topsoil stockpile, or
   ii. If a topsoil stockpile is not available, topsoil may be imported from offsite. Certified rehabilitation shall not be granted to projects where topsoil is graded off other parts of the farm.
      (1) Imported topsoil or substitute soil material shall be friable, loamy, with similar coarse fragment content to the original topsoil, free of debris, objectionable weeds and stones, and contain no toxic substance or adverse chemical or

physical condition that may be harmful to plant growth. In all cases, topsoil shall have not more than 15% coarse rock fragments greater than one (1) inch in size.

(2) Imported topsoil shall have an organic matter content greater than or equal to that of the pre-existing soil.

(3) Organic matter content may be raised by additives not explicitly prohibited by the Deed of Easement. Paper-mill byproducts, sludge, biosolids, and other waste products shall not be permitted as soil amendments without Committee approval and as part of a farm conservation plan.

(4) Manure from the farm operation may be incorporated into the soil as part of a manure management plan.

iii. If off-site topsoil is not available, substitute soil material may be utilized,

(1) With written justification and committee approval,

(2) If the soil properties are equivalent to the pre-existing topsoil or adjacent existing topsoil.

4. When replacing topsoil, soil structure and bulk density shall be prioritized by limiting soil handling to the minimum necessary for replacement.
5. Topsoil shall have similar soil properties to the pre-existing soil as identified in the application (reference section).
6. When placing topsoil, an allowance shall be made for settling so the final depth of topsoil is equivalent to or greater than pre-disturbance conditions.
7. Topsoil shall be tested in accordance with the soil testing standard (reference section) and amended accordingly.
8. After final placement, the surface shall be prepared for vegetation establishment using standard tillage practices and seeded as soon as conditions permit.
9. Any former topsoil stockpile areas shall be prepared using standard tillage practices and vegetated as soon as conditions permit.

(g) For the sections of the rehabilitation criteria requiring soil bulk density testing and decompaction, the ensuing criteria shall be followed:

1. Test the soil in at least five (5) locations per acre at the minimum rooting depth and at the surface for excessive compaction using the soil test methods described below.
2. Rehabilitated soils shall have bulk density values less than or equal to bulk density values in an undisturbed reference location and not more than those listed in Table 19-1 of the Standards for Soil Erosion and Sediment Control in New Jersey (reference needed):

i. Maximum Dry Bulk Densities (grams/cubic centimeter) by soil type Soil Type/Texture Bulk Density

Soil Type/Texture	Bulk Density (g/cc)
Coarse, Medium and Fine Sands and Loamy Sands	1.80
Very Fine Sand and Loamy Very Fine Sand	1.77
Sandy Loam	1.75
Loam, Sandy Clay Loam	1.70
Clay Loam	1.65
Sandy Clay	1.60
Silt, Silt Loam	1.55
Silty Clay Loam	1.50
Silty Clay	1.45
Clay	1.40

Source: USDA Natural Resource Conservation Service, Soil Quality Information Sheet, Soil Quality Resource Concerns: Compaction, April 1996 and Table 19-1 of the Standards for Soil Erosion and Sediment Control in New Jersey, July 2017

3. Soil test methods shall be selected from the handheld soil penetrometer test method, tube bulk density test method, or nuclear density test method described in the Standard for Land Grading in the Standards for Soil Erosion and Sediment Control in New Jersey.[1]
4. If soils are determined to be excessively compacted after testing, the soil shall be tilled/scarified to the minimum rooting depth using a chisel plow, subsoiler, or other similar equipment. Vegetative measures designed to loosen the soil (forage radish, cover crops, etc.) may be utilized alone or in conjunction with other mechanized methods.
5. After decompaction, the soil density shall be retested at least at the minimum rooting depth, the subsoil surface, and the topsoil surface until compaction has been rehabilitated. The committee may require additional bulk density sampling within the soil profile for especially compacted soils.
6. Once soils have bulk density values below the maximum bulk density (reference chart) the Soil Testing and Amending Rehabilitation Criteria shall be followed.

(h) As part of a rehabilitation plan, soils shall be tested and amended according to the following criteria:
1. Collect topsoil samples after all grading, soil replacement, and decompaction has been completed. Collect five (5) to ten (10) representative topsoil samples across each disturbance area to create a composite mixture for testing at a rate of at least 1 soil test per disturbance area (i.e. a removed lane gets one test, and a rehabilitated arena gets another lab test) but not less than one sample per three acres.
2. Sample collection shall follow laboratory standards.

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[1] New Jersey Standards for Soil Erosion and Sediment Control are incorporated by reference: https://www.nj.gov/agriculture/divisions/anr/pdf/2014NJSoilErosionControlStandardsComplete.pdf

3. The soil test where no topsoil was imported shall be the NJ Ag Experiment Station Full Farm Test or equivalent, including, nutrients, pH, estimated CEC & cation saturation, plant-available (inorganic) nitrogen, organic matter content, and recommendations from a Rutgers Cooperative Extension agent.
4. For rehabilitation projects where topsoil was imported from offsite or created from component parts, the Topsoil Specification Test, Ecological Research Test, and/or Compost/Technical Test may be required based on site-specific conditions.
5. The committee reserves the right to require any additional soil tests as is necessary to prove the quality of imported topsoil or substitute soil material.
6. Amendments shall be applied according to soil test results.
7. Topsoil shall be tilled to incorporate all necessary fertilizers and amendments using a large offset disk, roto-tiller, chisel plow or similar equipment, then seeded with a fast-growing cover crop until the appropriate crop planting time.
8. Soil organic matter shall be measured within the rehabilitation area and in a representative portion of the surrounding cropland. The soil shall be amended with suitable organic matter sources until organic matter content within the rehabilitation area is within equivalent to pre-existing conditions or that of the surrounding farm fields.

(i) As part of a rehabilitation plan, crop yield shall be verified according to the following criteria:

1. Establish a baseline comparison using one or more of the following methods:
   i. Pre-recorded crop yields from no more than five (5) years prior to the date of rehabilitation with farming practices enumerated,
   ii. Parallel crop yields from another field farm with the same soil type and with equivalent farming practices (irrigation, fertilizer application, seed type, tillage),
   iii. If pre-recorded or parallel crop yields are not feasible, county yield values from the Soil Survey Report may be permitted at the discretion of the Committee.
2. Determine post-rehabilitation crop yield:
   i. After topsoil and subsoil rehabilitation the area shall be initially planted with a deep-rooted cover crop.
   ii. The crop rotation established at the time of application shall be implemented in the following crop season.
   iii. For measuring crop yield, crops may include corn, soybeans, or other small grain but may not include vegetables, tree fruit, or hay unless approved by the committee.
   iv. Crop yield shall be measured at harvest time utilized a standardized protocol to be described and documented by the Grantor. Sampling locations and collecting protocol are site specific and shall be approved in the application prior to commencing soil rehabilitation.

v. Crop production shall be measured for at least five (5) years after all other rehabilitation standards have been met and certified.

vi. For sites where parallel crop yield comparison is not possible, adjustment for weather-induced variability in the annual crop production may be permitted by the Committee for not more than two of the five crop yield measurements.

vii. Crop yield testing shall be considered a success when the 5-year averaged yield is not less than 90% of the pre-recorded crop yields or county values, or when the parallel crop yields are not less than 90% of the yields in the control fields for three of the five testing years.

viii. Crop yields that fail to meet the minimum rehabilitation thresholds after ten (10) years will be considered unsuccessful and the land will continue to be counted towards the soil disturbance limitations set forth in N.J.A.C. 2:76-25.5.

Appendix A - Method for measuring vegetative cover

a. Delineate land use area by physical breaks (e.g. fences, roads, hedge rows, etc.) and/or by visible evidence of soil degradation captured from a drone, aerial imagery, other remote sensing device, or in-person observation.
    i. Measurement area to be sampled is determined by criteria of soil, topography, vegetative cover, and land use. Sampling results shall be stratified by soil and landform and correlated to a specific set of distinct and local environmental and land use factors.
        1. Each measurement area shall have similar vegetative cover to avoid diluting degraded areas in well vegetated acreage.
        2. Each measurement area shall be contiguous (a single polygon, instead of multiple parts).
    ii. Measurement areas shall not exceed 1-acre;
    iii. The minimum measurement of vegetative cover shall be 0.1-acre.

b. Measurement areas shall be sampled at a frequency of 100 points per acre using the following methodology; [1]
    i. Establish 5 equally spaced transects of 20 equally spaced points;
    ii. For smaller areas, proportionally reduce the number of points, not the spacing;[2]
    iii. To the maximum extent practicable, utilize a pre-determined transect design with points spaced 10 feet apart and rows spaced 40 feet apart (see example figure below);
    iv. Pace or measure to each sampling location and look at the land cover touching the middle of the boot tip. Alternatively, a measuring tape or pre-measured rope with knots may be used;
    v. Record land cover at each sampling location on a chart or spreadsheet as "vegetation," "weed," "crop residue," "bare ground," or "other" (rocks, wood, etc.);
    vi. A leaf hanging over bare soil shall be marked as bare soil;

c. The step-point method is only to estimate basal cover of grass and is not a method to estimate vegetative cover beneath trees.[3]

d. Tally points in each land cover category and divide by the total points collected in that measurement area; measurement areas with more than 70

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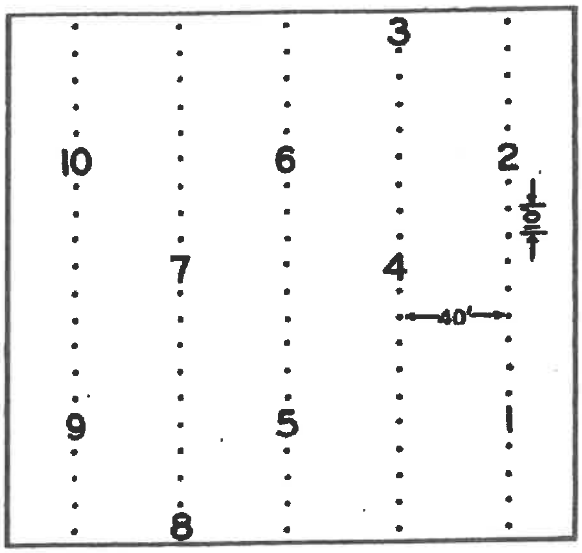
[1] Evans, R. A., & Love, R. M. (1957). The step-point method of sampling—a practical tool in range research. Journal of Range Management, 10(5), 208-212. https://journals.uair.arizona.edu/index.php/jrm/article/viewFile/4810/4421

[2] An experienced operator can sample an acre area using the step-point method in about one-half hour.

[3] University of Idaho, College of Natural Resources, https://www.webpages.uidaho.edu/range357/notes/cover.pdf. Basal area measures the proportion of the plant that extends into the soil.

points per acre (70%) of "vegetation" and/or "crop residue" are not considered degraded soil.



- Step-point

3 Frame-point and step-point

New Jersey State
Agriculture Development Committee

Soil Protection Standards

NEW JERSEY STATE AGRICULTURE DEVELOPMENT COMMITTEE
Farmland Preservation
Right to Farm
1983

Original Concept - Best Management Practices

↓ Degree of Reversibility	Land Uses	Soil Effects Classifications	Soil Protection Treatment
	Cut/fill activities (includes stormwater basins)	Permanent Soil Disturbance ("Red" Category)	Must adhere to prescribed limitation.
	Permanent buildings/structures		
	Permanent travel lanes		
	Permanent livestock training areas		
	Permanent parking and storage areas/hardscape		
	Semi-permanent travel lanes	Semi-Permanent Soil Disturbance ("Orange" Category)	Additional allowance obtainable if voluntarily following Best Management Practices (BMPs). Otherwise, considered Red Category.
	Semi-permanent livestock training areas		
	Semi-permanent parking and storage areas		
	Agricultural water impoundments		
	Soil stockpiles		
	Geotextiles and geomembranes	Temporary Soil Disturbance ("Yellow" Category)	No limitation if voluntarily following Best Management Practices (BMPs). Otherwise, considered Red Category.
	Temporary structures		
	Temporary travel lanes		
	Temporary livestock training areas		
	Temporary parking and storage areas		
	Ground-mounted solar energy facilities		
	Cropland and pastureland	Soil Protection ("Green" Category)	No limitation.
	Woodland		
	Wetlands and streams		

Summary of SADC Meeting - October 28, 2021

Previous Approach Was Modified Based on Stakeholder Input

- **Collapse 8 of the former 11 Best Management Practices (BMPs) into either disturbance or non-disturbance categories that are governed by prescriptive definitions instead of technical standards.**

- **Move 3 of the former 11 BMPs to “Supplemental Standards” because they defy treatment by way of a simplistic definition.**

- **Include Rehabilitation Standards for disturbed soil, which if adhered to, would remove that acreage from counting towards the disturbance limit.**

Revised Prescriptive Approach

DISTURBANCE LIMITATIONS	SOIL EFFECTS CLASSIFICATION	LAND USES	LAND USE EXAMPLES	BRIGHT-LINE TESTS	FORMER BMPs
LIMITATIONS SET BY STANDARDS	SOIL DISTURBANCE	Cut/fill	Site leveling, stormwater basins, berms, non-organic stockpiles, manure lagoons, future ponds, tailwater recovery systems	Soil movement in excess of normal tillage as defined	Agricultural Water Impoundments BMP, (Sub)soil Stockpiling BMP
		Suspended Surfaces	Houses, garages, barns, sheds, covered arenas	Surface over soil as defined	Not applicable
		Ground-level Surfaces	Surfaced roads and parking lots, outdoor arenas, tracks, rip-rap, asphalt, concrete, gravel, pavers, bricks, blocks, shells, sand, cinders, recycled asphalt, dense graded aggregate, rock	Surface over soil as defined	Semi-permanent Livestock Training Areas BMP, Semi-permanent Parking and Storage Areas BMP, Semi-permanent Travel Lanes BMP
		Degraded soil	Frequently used unsurfaced roads and parking lots, sacrifice lots	Less than 70% vegetative cover as defined	Not applicable
EXCEPTIONS FROM LIMITATIONS	SOIL PROTECTION	Cut/fill	Topsoil stockpiles	Supplemental Standards - Topsoil Stockpiling	(Top)soil Stockpiling BMP
			Cranberry bogs	Definition	Not applicable
			Conservation practices planned to NRCS standard	Definition	Not applicable
			Soil preparation for production	Definition	Not applicable
		Suspended Surfaces	Hoop houses/temporary greenhouses	Definition	Temporary Structures BMP
			Temporary tents	Definition	Temporary Structures BMP
			Temporary movable structures	Definition	Temporary Structures BMP
			Solar panels/other utilities	Supplemental Standards - On-Farm Utility	Ground-Mounted Solar Energy Facilities BMP
		Ground-level Surfaces	Permeable geotextiles (weed fabric)	Definition	Geotextiles and Geomembranes BMP
			Other temporary ground covers (timber mats)	Definition	Not applicable
			Farm lanes	Definition	Temporary Travel Lanes BMP
			Seasonal parking, overflow event parking,	Supplemental Standards - Vegetative Cover	Temporary Parking and Storage Areas BMP
			Livestock turnout areas	Supplemental Standards - Vegetative Cover	Temporary Livestock Training Areas BMP
			Organic surfaces, mulch, wood chips, leaves	Definition	Not applicable
NO LIMITATIONS		Ag. and Natural Resources	Cropland, pastureland, lawn, fallow fields, R.O.W.	Normal tillage as defined	Not applicable
			Woodland, wind breaks, forestry activities	Definition	Not applicable
			Natural wetlands, streams, existing ponds	Definition	Not applicable
			Former disturbed areas	Soil Rehabilitation Standard	Not applicable

Summary of Subcommittee Meeting - April 11, 2022

- **Consensus reached that draft proposal meets the intent of the October 28, 2021, SADC meeting deliberations.**

- **Consensus reached that draft proposal should be brought before the full SADC.**

- **Consensus reached on draft regulation text (except for disturbance aggregation).**

Exemptions - Unqualified and Qualified*

1. Cranberry bogs/beds
2. Deep tillage
3. Existing open ditches
4. Existing agricultural water impoundments
5. Geotextile fields
6. Hoophouses
7. Normal tillage
8. Nominal smoothing
9. On-farm utilities
10. Organic mulch
11. Rehabilitated soils
12. Solar panels
13. Temporary geomembranes
14. Temporary ground protection mats
15. Temporary movable structures
16. Temporary parking areas
17. Temporary storage areas
18. Temporary tents
19. Topsoil stockpiles
20. Underground drainage systems
21. Unimproved travel lanes
22. Vegetated livestock areas

*Do not count as disturbance

Unqualified Exemption - Tillage-Related

"Normal Tillage" - generally accepted agricultural practices limited to the depth of the topsoil layer for seedbed preparation and cultivation of soil including moldboard plowing, disking, chisel plowing, hill and furrow plowing, and bed shaping.

"Deep tillage" - tillage operations below the normal tillage depth in a manner consistent with a farm conservation plan to modify adverse physical or chemical properties of a soil that inhibit plant growth but does not include elevation or topography change.

Unqualified Exemption - Water-Related

Unqualified Exemption - Temporary Use-Related


Temporary Geomembranes


Hoophouses

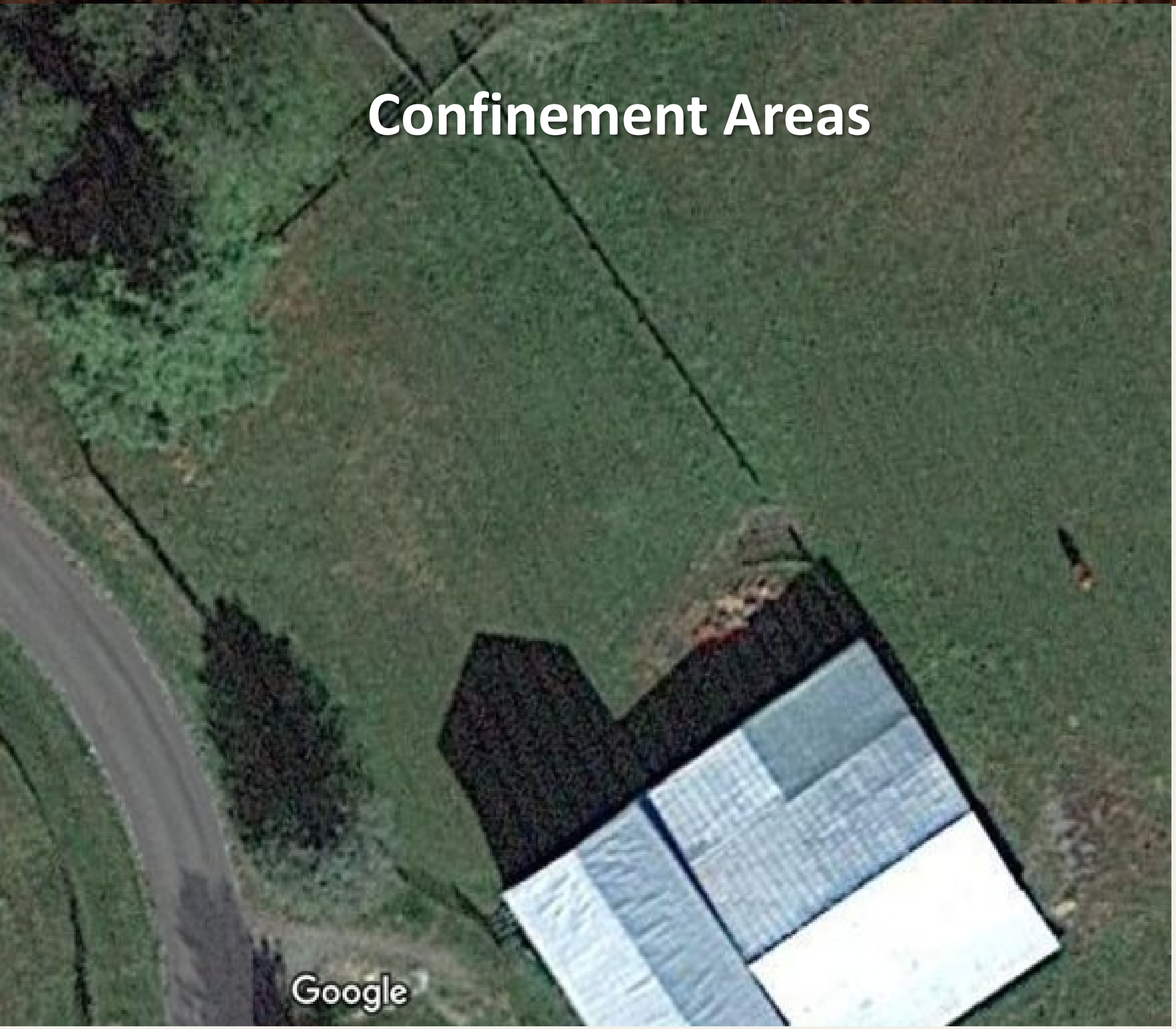

Temporary Tents

Temporary Movable Structures

Qualified Exemption - Temporary Parking/Storage Areas

Maintain at least 70% vegetative cover for at least 9 months per calendar year.

Qualified Exemption - Vegetated Livestock Areas



Maintain at least 70% vegetative cover for at least 9 months per calendar year.

<u>Qualified</u> Exemption - Topsoil Stockpiles

- **Topsoil movement shall only take place when soils on the site are significantly below field moisture holding capacity to minimize soil compaction.**
- **Topsoil shall be removed and placed using low ground pressure equipment unless work is done from ground protection mats or existing travel lanes.**
- **The side-slopes of the topsoil stockpile shall be no greater than 4 Horizontal:1 Vertical (25%) to reduce erosion potential.**

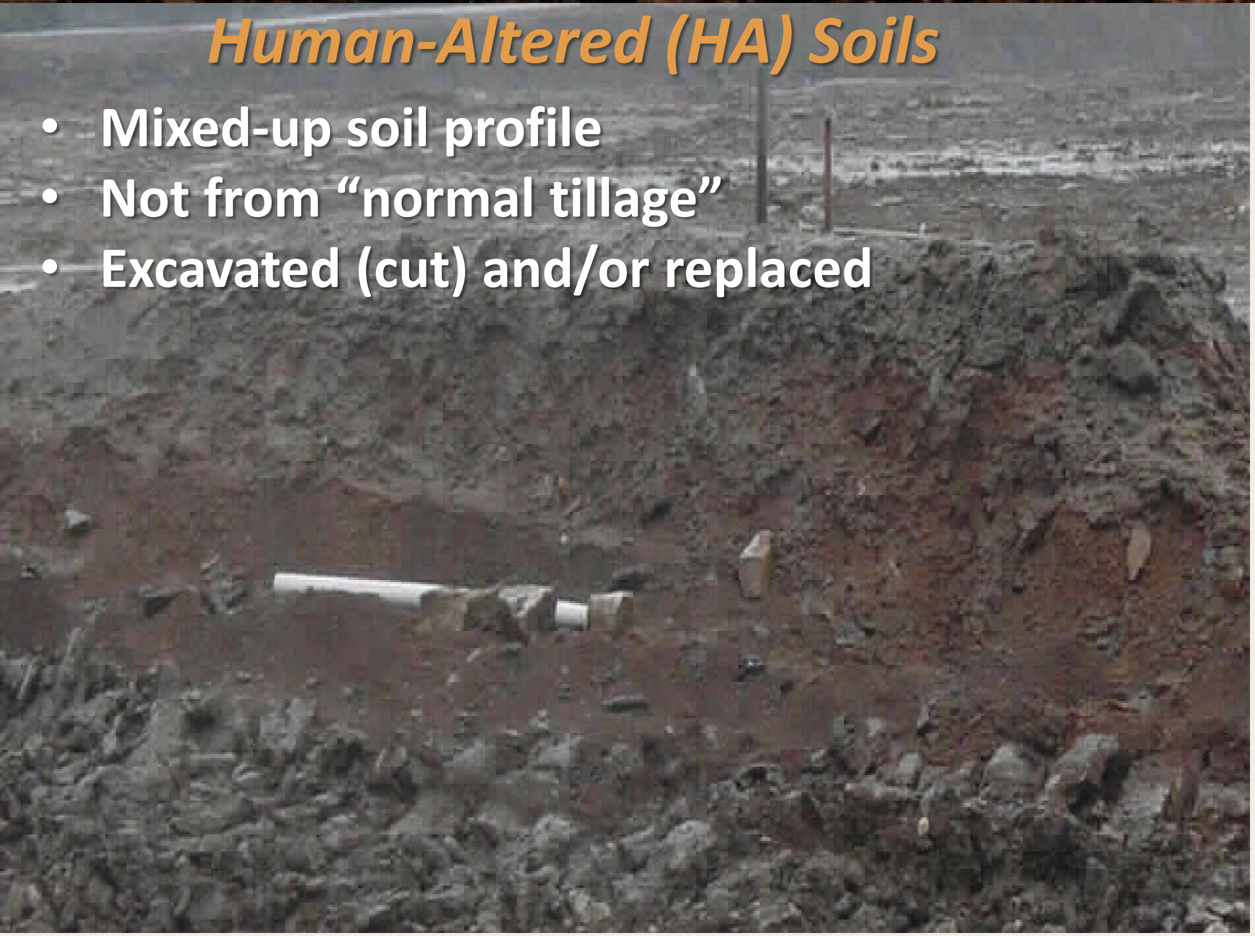
Qualified Exemption - On-Farm Utilities

- **Complete construction activities while soil moisture is below field moisture capacity**
- **Use low ground pressure equipment and/or ground protection during construction.**
- **No mechanical or structural soil compaction prior to or during installation.**

Soil Disturbance

1. Soil alteration
   - Cut
   - Fill
2. Soil surfacing
   - Roofs
   - Pavement/gravel
3. Soil compaction
   - Vegetative cover as a simple test

Soil Alteration (Human-Altered Human-Transported Soils*)



Human-Altered (HA) Soils

- Mixed-up soil profile
- Not from “normal tillage”
- Excavated (cut) and/or replaced

Human-Transported (HT) Soils

- Soil imported and deposited (fill)
- Purposeful transport by humans

Soils with profound and purposeful alteration or occur on landforms with purposeful construction or excavation and does not include soils with incidental or unintentional surficial changes due to standard ag. practices (source: NRCS Soil Survey Manual and International Comm. on Anthropogenic Soils Circular)

Soil Surfacing

- **Suspended surfaces (roofs)**
- **Ground-level surfaces (roads)**

Soil Compaction

*"Soil compaction" - any activity other than normal tillage that results in an increase in soil dry **bulk density** above the root limiting levels or consolidation or a reduction in a soil's capacity to infiltrate and percolate water… unless specifically identified by the Committee as an exempt agricultural practice.*

*"**Bulk density**" - an indicator of how well plant roots are able to extend into the soil, calculated as the dry weight of soil divided by its volume.*

Limitation

At the October 28, 2021, SADC meeting and at the April 11, 2022, Subcommittee meeting, consensus was reached on a proposed soil disturbance limit:

- **Up to 12% of the premises or 4 acres, whichever is greater, will be permitted.**
- **Disturbance acreage shall be rounded to three decimal places (.000) per existing survey specs.**
- **Activities occurring within the footprint of areas already considered disturbed will not be counted as additional soil disturbance**
- **Soil disturbance located outside the boundaries of the premises, including but not limited to severable and non-severable exception areas, residential exclusion areas, and any other area(s) of a farm not subject to the term and conditions of the deed of easement, shall not count towards the limitation.**

Waiver

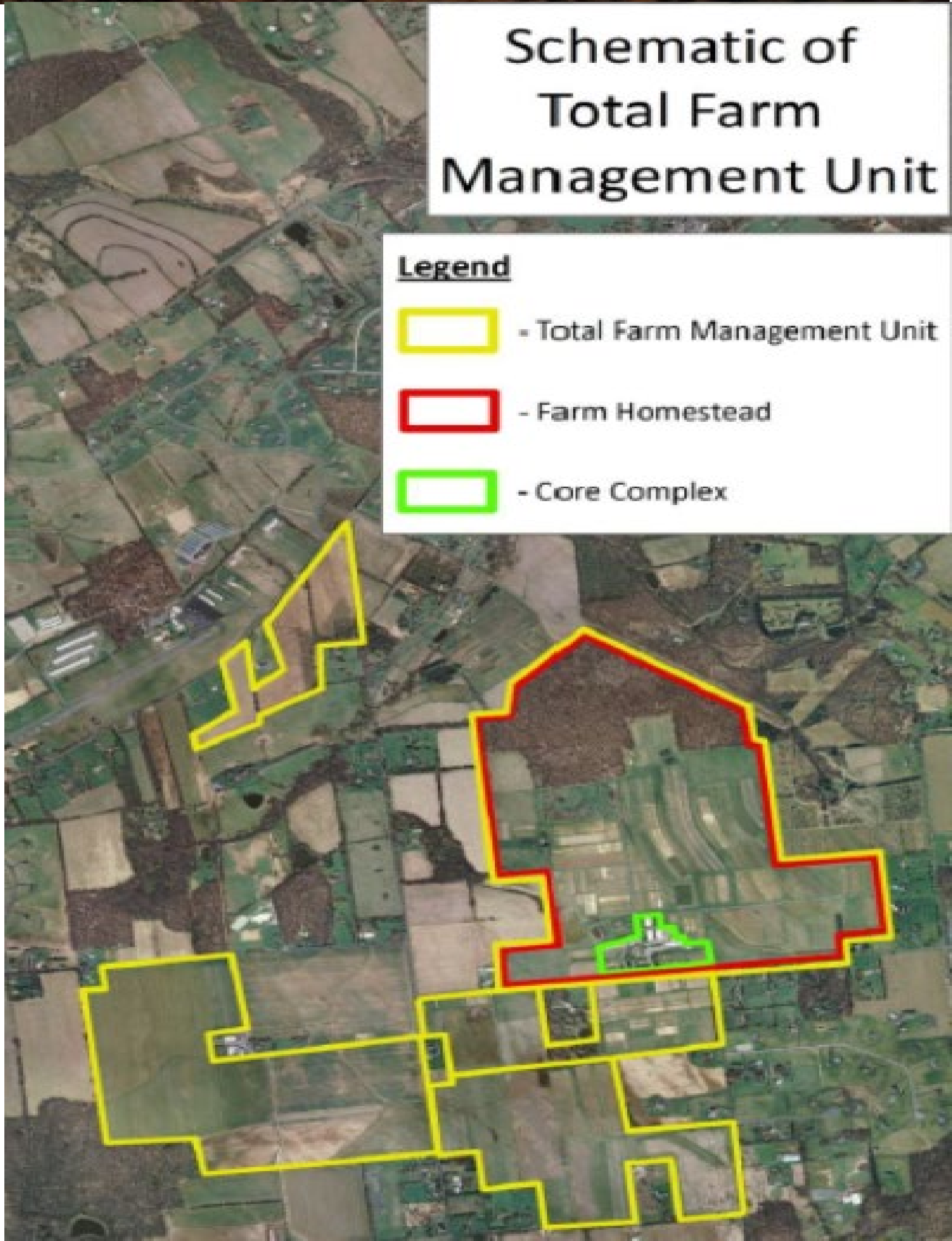
Farms currently within 50% of the prescribed 12%/4-acre limit can apply for a waiver for a maximum of 15% or 6 acres, whichever is greater, if certain conditions are met:

- **There is no feasible and prudent alternative to a proposed project resulting in soil disturbance on the preserved farm beyond the limitation.**
- **Due to an extraordinary situation of the Grantor and/or site conditions, compliance with the limit would result in an exceptional and/or undue hardship for the Grantor and/or would adversely impact ag. operations on the premises.**
- **The proposed project will not cause a direct negative impact on adjacent properties.**
- **The Grantor is in compliance with the farmland preservation deed of easement and has obtained and implemented a farm conservation plan.**

Aggregation and Consolidation

Aggregation can be accomplished on contiguous preserved farms owned by the same owner provided:

- **The total disturbance acreage does not exceed the combined individual allocations for each parcel comprising the contiguous premises.**
- **Each premises is permanently associated with, and shall not be conveyed separate and apart from, each other at any time in the future.**
- **A Corrective Deed of Easement reflecting the reallocation and prohibition of further subdivision is recorded in the land records.**



Soil Rehabilitation

Baseline Mapping and Monitoring

Baseline disturbance maps will be sent to all landowners once the rule is adopted:

- **A site visit may be conducted upon the landowner's request to ground-truth numbers.**

- **Landowners need to bring any baseline mapping inaccuracies to SADC's attention within 180 days of being notified, particularly those landowners who may be eligible for a waiver.**

- **The rule sets forth an appeal process if landowners disagree with disturbance mapping at any time.**

Request for Hearing

- **Provides due process to landowners who may disagree with mapping or any other disturbance determination.**

- **Because the Farmland Preservation Program has historically relied heavily on partners, those grantees/easement holders will likewise be accorded an opportunity to request a hearing for any action where they feel they are aggrieved.**

"...the ARDA and the existing SADC regulation have a dual purpose: to strengthen the agricultural industry and to preserve farmland. Both are important goals; neither is subordinate to the other....the approach must be to balance farmland preservation and strengthen the agricultural industry."

State of New Jersey v. Quaker Valley Farms, LLC
Argued January 2, 2018
Decided August 14, 2018 (7-0 decision)

RUTGERS
New Jersey Agricultural Experiment Station

Assessment of Soil Disturbance on Farmland

Presented to

New Jersey State Agriculture Development Committee

by

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Assessment of Soil Disturbance on Farmland

Purpose of the Summary

This summary was produced to assist in decision-making by the State Agriculture Development Committee (SADC) about the impact that selected farm activities have on soil characteristics, how negative impacts on soil properties may be remediated, and whether these activities should be encouraged or discouraged on New Jersey preserved farmland. New Jersey's Farmland Preservation Program consists of the purchase of development rights to parcels of land with the intention that the land use will henceforth be limited to agricultural and horticultural production. The land title is attached to a deed of easement which specifies the terms of the sale, including restrictions placed on the use of the property. Generally, non-agricultural uses are not permitted. In addition, no activity is permitted which would be detrimental to water conservation, erosion control, or soil conservation. Our intent is to discuss these issues with the acknowledgement that impacts on soils differ due to site-specific factors and properties, and that site specific remediation practices may be needed to alleviate or mitigate any negative impact on soil properties. We also present our findings and recommendations without considering the extent of disturbance (acreage) or purpose for it, but acknowledge the goal of maintaining soil quality, health and conditions that allow for current and future uses for agricultural and horticultural production.

Literature Search Limitation and Scope

Because the scientific literature on soil degradation is vast and spans many decades, continents, and climatic zones, the literature search used to develop this summary was limited to research on humid, temperate zone agriculture, similar to New Jersey conditions and soils, disregarding a sizable literature from arid and semi-arid regions as well as tropical climate regimes. In addition to the literature review findings, our professional expertise and opinions and common professional knowledge are the basis for the statements and recommendation made within.

Guidance from the New Jersey State Agriculture Development Committee (SADC)

Ranking criteria are applied when land parcels are selected for the Farmland Preservation program. Part of this ranking is a determination of the soils based on a classification system developed by the New Jersey unit of the Natural Resources Conservation Service.

- **Prime farmland** is land that has the best combination of physical and chemical characteristics (defined below) for producing food, feed, forage, fiber and oilseed crops and is also available for these uses. It has the soil quality, growing season, and moisture supply needed to economically produce sustained high yields of crops when treated and managed according to acceptable farming methods, Prime Farmlands are not excessively erodible or saturated with water for a long period of time, and they either do not flood frequently or are protected from flooding.
- Farmlands of **statewide** importance include those soils in land capability Class II and III that do not meet the criteria as Prime Farmland due to erosion hazard, wetness, or susceptibility to flooding. These soils are nearly Prime Farmland and economically produce high yields of crops when treated and managed according to acceptable farming methods. Some may produce yields as high as Prime Farmland if conditions are favorable.
- Farmland of **local** importance includes those soils that are not prime or statewide importance and are used for the production of high value food, fiber or horticultural crops.
- Farmland is classified as **unique** if it is being used for special crops production.

(Source: http://www.nj.nrcs.usda.gov/technical/soils/njfarmindex.html)

Although NJ soils are grouped into these four classifications, each individual soil's inherent properties and intrinsic agricultural productivity vary. Our approach in this analysis is to discuss specific management practices that may unintentionally or purposefully degrade soil characteristics and to make recommendation on how to remediate, when possible, any negative impacts. Any practice which results in the land no longer being tillable, or which forces a downgrade of the soil classification to more limited use, would make it less suitable for long-term agricultural sustainability and is contrary to soil conservation goals. However, soils of varying quality, or classification as listed above, will react to the impact to different degrees and may require remediation of differing types or lengths of time to be effective.

Soil Quality and Sustainability in Agriculture

Soil quality is defined as "the capacity of a specific kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation" (USDA-NRCS, 2007). Considering the focus on function, specific functions of concern should be defined in advance when applying the concept of soil quality. Soil quality concepts are commonly used to evaluate sustainable land management in agricultural ecosystems, and preventing a decline in soil quality is essential to the concept of sustainability in agriculture. By analogy to living systems, the relative condition and functioning of the soil ecosystem is often referred to as soil "health".

An important part of the soil quality definition is that quality is specific to each kind of soil. The quality of a soil has two distinct aspects, *inherent* quality and *dynamic* quality. Inherent quality is use-invariant and represents intrinsic properties (qualities) of soils as determined by the factors of soil formation--climate, topography, biota, parent material, and time. The inherent quality of soils is often used to compare the capabilities of one soil against another, and to evaluate the worth or suitability of soils for specific uses.

Soil Quality as Influenced by Management

In contrast with *inherent* soil quality, which derives from soil-forming factors, *dynamic* soil quality can vary depending on how the land is managed. Management choices affect the amount of soil organic matter, soil structure, soil depth, water and nutrient holding capacity (USDA-NRCS, 2007). These in turn affect soil functions relevant to agriculture in general and to this study in particular, such as i) food and biomass production (include physical support of plants and habitat for roots), ii) storing, filtering and transformation of matter and energy (water, nutrients and organic matter) and iii) biological habitat and gene pool.

Use-dependent effects most often manifest in surface and near-surface layers result in an increase (aggradation), decrease (degradation) or sustained capacity of a soil to perform the functions listed above. The soil properties considered most representative of the overall soil health or quality include: organic matter content, soil structure, bulk density, infiltration rate, and activity of the biological community. Collectively, management will aggrade, sustain or degrade the quality of the soil. Management practices and uses of the land that have a positive (aggrading) effect on soil quality include for instance those practices leading to an increase in organic matter content. On the other hand, management practices causing compaction, erosion, or acidification have a degrading effect on soil quality and result in an increased input to maintain plant growth; thus precluding the concept of sustainability. A similar set of functions would apply to animal agriculture with additional functions related to waste management.

Soil quality can be evaluated relative to a standard or reference condition that represents the full capacity of that soil to function for a specific use. Several systems have been developed to evaluate soil quality and soil health, and numeric soil quality indices have been created to facilitate a comparison of one soil against another as well as to evaluate the change in quality expected from a change in management. The limitation that a given soil can only be compared to its own full potential, or to another soil of the same inherent properties, remains. This is especially relevant to New Jersey soils which vary greatly in their inherent quality from one region and physiographic province to another. Therefore, while a condensation of soil quality into a single value may be of limited practical value, the exercise of assessing relative change in the important soil properties can be a useful tool in guiding decisions for management. In order to make decisions about management practices, a NRCS soil management plan could be used to assess if a planned practice or use will significantly destroy or impair soil quality, and include a remediation plan to restore the affected characteristic or factor.

Compaction

Soil structural integrity is always part of the minimum data set for the evaluation of soil quality, and compaction with its damage to soil structure and/or tight packing of soil particles is the most widespread kind of soil physical degradation across all soil textures**.** It is recognized as a ubiquitous problem in the agriculture of all temperate-zone industrialized countries. The degree and depth of the disturbance by compaction, as well as soil type, influences whether a remedy is possible or feasible, or whether the damage is permanent.

To the extent that soil drainage is impaired, compacted soils are relatively wet in the spring which slows soil warming and results in delayed planting. Equipment and fuel requirements for tillage of compacted soil are increased. Winter freezing/thawing cycles are only minimally helpful at alleviating compaction and only near the surface. The major consequences of agronomic compaction are summarized below.

Soil structure is destroyed.

- Soil aggregates of structured soils are destroyed, and particles are re-oriented into platy structure (having primarily horizontal fissures) or kneaded into a high-strength mass. Subsequent tillage may break the mass into clods but does not restore the original structure. In coarse-textured soils, particles are forced into a close-packing arrangement, and pore size distribution is proportionately affected.
- Total pore space of the soil is decreased.
- Larger pores, which function as conduits for water, air, and roots, are preferentially destroyed, decreasing permeability, aeration, and root growth. Not only size but also continuity of pores is reduced.

Plant growth is negatively affected.

- Cool, wet soils (as may result from poor drainage of compacted soils) delay planting and reduce and slow germination and crop development.
- Roots are prevented from proliferating in the topsoil and extending to the subsoil because of high soil strength (resistance to penetration).
- Crops with limited root systems are unable to take up adequate water and nutrients and are susceptible to induced drought, nutrient deficiencies, and aeration stress.
- Plants are stunted and display delayed development.
- Stressed plants are susceptible to disease and insect damage.
- Crop yields are reduced.

Natural hydrology is circumvented.

- Reduced macro-pore-space results in poor infiltration and can result in excess puddling and/or increased runoff volumes and rates. Weight of construction equipment corresponding to differing levels of compaction is not as important to infiltration rate as whether compaction occurred at all, with compacted soil effectively acting as an impervious surface (Gregory, et al, 2006).
- Increased water volume in storm drains and streams leads to flooding hazards.
- Groundwater recharge is reduced along with stream base flow during dry periods.
- Supply of fresh water is decreased.
- Even in cases where topsoil compaction is relieved and water can infiltrate, subsoil compaction limits internal drainage. "Perched" water in the soil profile can create anaerobic zones, presenting further risks to roots, and increases susceptibility of topsoil to erosion.

Increased water runoff poses a water pollution hazard.

- Increased water runoff speed and volume results in increased chemical as well as biological contaminant load to streams and other water bodies.
- Risk of soil erosion increases with increasing runoff.
- Soil particles themselves ("suspended solids") are detrimental to water quality but also transport nutrients (especially phosphate) which can be pollutants.

Soil compaction is not easily or rapidly remedied.

- Surface tillage treats - but does not remediate - surface (8-10") compaction.
- Tillage after compaction yields clods rather than aggregates; additional tillage is needed to break up clods and smooth ground to create a seedbed. Broken up clods still do not function physically or biologically like naturally formed aggregates.
- Because of tillage-induced loss of soil strength, "loosening inevitably brings the risk of greater subsequent compaction" (Gabriels, *et al*., 1997).

Biological amelioration has been used for long-term treatment.

- Roots of grasses and deep tap-rooted crops help penetrate compacted layer.
- Tree roots can penetrate highly compacted soil (1.6 g cm^{-3} clay loam) and increase infiltration rates under experimental conditions (Bartens et al., 2008).
- Organic matter amendments promote earthworm populations and other soil organisms, whose activities loosen the soil and re-create structure.
- Treatment may entail years of remediation effort and expense without a saleable crop and reduced yields until soil conditions improve.

Compaction often reaches subsoil (12-20" or more), beyond the reach of normal tillage operations.

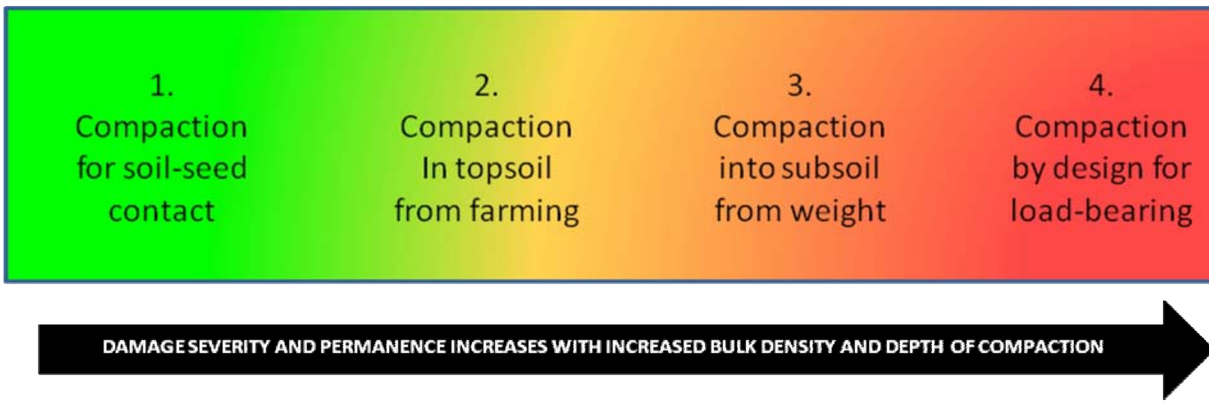
- Subsoil "ripping" or deep tillage would be required to break up deep compaction, requiring special equipment and high energy expenditure.
- Limited area is treated per pass.
- As with surface tillage, there is "risk of greater subsequent compaction".
- Subsoil compaction is a long-term and possibly unsolvable problem; depending on degree of compaction, recovery may require from 3 to 9 or more years, or the damage may be permanent. Deliberate compaction, particularly with vibratory forces, increases the depth and degree of compaction possible.
- Maximum compaction (or optimal compaction sought by engineers of loessial silt loam can result in density of about 105 pounds per cubic foot, about equal to 1.68 g/cm^3 or 36.6% total porosity. Compare this to "ideal" soil density for plant growth: 50% porosity, 1.32 g/cm^3.
- Vibratory compaction (applying dynamic or time-variable load) is a more "efficient" (severe) method of compaction than static loading.
- There is no reference to attenuation time of a compacted condition for engineering purposes. The assumption is that when done well, it will not loosen naturally--it is a permanent change.
- Soil compaction for engineering purposes results in a nearly impermeable surface or layer.

Compaction as a Continuum

An idealized soil in good agronomic condition is often depicted as having 50% of its volume occupied by soil mineral and organic matter and 50% of its volume consisting of pore space. This pore space may be occupied primarily by air or water or a combination of both in relative amounts depending on recent precipitation, internal drainage, and uptake of water by plants rooted in the soil.

As illustrated in Figure 1, there is a continuum of degrees of compaction ranging from light compaction needed to prepare a seedbed (level 1) to severe compaction designed for engineering purposes and that would preclude plant growth without remediation practices (level 4).

Figure 1. Degrees of soil compaction often encountered in agricultural operations, ranging from mild (1) to most severe (4).



A description of those compactions levels follow:

1. Acceptable compaction occurs after tillage and planting, where soil is pressed against the newly planted seed. Good contact between soil and seed is important for germination, keeping soil moisture in contact with the seed. These types of compaction are understood to be acceptable and necessary for many types of agricultural production.
2. Compaction in the topsoil resulting from field operations beyond primary and secondary tillage. This category of compaction is negative and unintended, but difficult to avoid. It can be partially remedied by management options of two kinds: i) additional field operations or practices, such as planting of cover crops and green manures for the purpose of improving soil structure, or ii) acceptance of reduced crop yield. The extent of impact is greatly dependent on site-specific soil properties including soil texture, soil moisture conditions, and production practices being used.
3. Compaction that extends beyond the topsoil and into the subsoil may be beyond economically feasible remediation, depending on the depth of the damage. In an agronomic setting, the topsoil is the Ap horizon, and its depth is determined by the reach of conventional tillage equipment, up to approximately 30 cm or 12 inches. Where the depth of subsoil compaction is no more than 50-60 cm or 20-24 inches, possible remedies may include a lengthy rotation with deep, tap-rooted species in combination with the contracting of specialized subsoiling operations. Each carries a substantial direct or opportunity cost which may make any remedy unfeasible, depending on the value of the land in full production. Subsoil compaction is normally considered permanent damage, and may be manifested in reduced crop yields, impeded root growth, and decreased water percolation.
4. Deliberate compaction of soil in the context of structural engineering and slope stabilization is more drastic still. No overlap is found between the appropriate compaction required for field production and the engineering compaction specified for load-bearing construction. The literature does not consider the effects of such extreme compaction on crop yield since the context and intent in such cases is a permanent conversion of soil as a growth medium to soil as an

engineering medium. For instance, deep tillage is used to alleviate compaction on mined sites, but when this practice is used for reclaiming severely compacted soils to plant forest, the return on the investment could be neutral to negative (Sweigard et al., 2007). In agriculture enterprises, the acreage that is converted to this state should be minimized if the objective is to maintain as much of the preserved farmland in a productive and quality state. This limitation however may exclude specific practices that are necessary for some types of agricultural production; our intent is to solely discuss this from a soil quality and health standpoint.

Focus of Research on Compaction and Remediation

Research on agricultural compaction is normally undertaken to minimize it, prevent it, remediate it, measure it, or compute yield reduction and other damages resulting from it. No research literature was found on the subject of site remediation following intentional compaction for engineering/construction purposes (level 4 as described above). Some literature exists on restoration of normal hydrologic function to unpaved logging roads in forests, on remediation and restoration following military training operations, and on remediation of utility rights of way through agricultural areas. Land reclamation following surface mining may provide a good indication of the magnitude of the restoration required following compaction for structural engineering purposes. This is extraordinarily costly restoration requiring specialized equipment not normally associated with agriculture. While it may be technically possible, in the absence of any budgetary limitation, to restore land productivity following such drastic disturbance, it is not considered feasible given any reasonable level of expected economic return (ten-year-old numbers range from $5000 to $20,000 and more per acre).

Compaction is not always recognized by the land user as a source of yield reduction. When land is partially degraded but still producing an economic yield, the land manager will typically modify his management to compensate for whatever is limiting to production. In many cases, rather than resulting in a reduction of yield, compaction damage manifests in the need for increased energy use, more frequent field operations, and higher fertilizer and water use - increased inputs which would not be needed in well-structured soil.

Subsoil compaction, below the depth of 30 cm or 12 inches (tillage depth), is usually considered a permanent degradation of agricultural land. The literature is full of statements that subsoil compaction must be avoided rather than remedied. As with land restoration following strip-mining, this may reflect the extreme cost of restoration rather than a declaration that no remedy is physically possible. Costs of restoration of desirable soil properties include the financial costs of soil amendments, labor, equipment, fuel and reduced yields. In addition, natural processes that improve soil, such as biological activity, soil aggregation, etc. depend also on time and site specific conditions that influence rates of improvement.

Specific Farm Practices

Most practices cannot be called destructive or constructive without knowledge of the impact of that practice on the soil resource of a specific site. For example, "leveling" which did not reduce the thickness of the topsoil could be a relatively benign operation of topsoil grooming used to increase infiltration if its use reduces overland flow. Alternatively, "leveling" could be highly destructive, such as a situation in which the entire topsoil horizon is penetrated or removed to match the elevation of some other point in the level plane. For this reason we focus on the extent of the soil disturbance resulting from the practice rather than the type of practice itself. Site-specific knowledge is needed to determine if a practice on a given site would cause a level of disturbance and reduction of soil quality that are incompatible with soil conservation.

Tillage is generally accepted as a routine and acceptable agricultural practice. However, tillage usually results in some degradation of soil quality because it breaks down soil structure, compacts soil, and decreases certain populations of soil organisms. This must be balanced with the necessity of tilling soil to prepare the soil for the crop. On the other hand, the necessity of tilling is over-estimated by the farmer in many cases, and the soil disturbance by excessive tillage (again, a matter of degree) degrades soil quality more than necessary to grow the crop. Therefore minimization of the frequency of soil tillage (using minimum tillage to no-tillage practices) or the use of less destructive implements (moldboard or chisel plow versus rototiller) is recommended when possible.

Geotextiles are sometimes used in specialty crop production systems in New Jersey; and little if any information is available regarding their effects on biological/microbial properties of the underlying soil. As with the example of land leveling, it is the degree of attendant soil disturbance and not merely the use of geotextile that determines the effect of this kind of disturbance. Factors that can be expected to relate to effects of geotextile use on underlying soil include: relative infiltration and/or aeration/evaporation rates; traffic loads applied, placement of gravel/stone over geotextile, and type of geotextile. Despite the lack of specific research on the impact of geotextiles on soil properties, basic concepts of soil science can be used to deduce possible results. If used only as a weed-blocking cover over undisturbed soils, geotextile cover of soil might lead to a gradual reduction in soil organic matter (as oxidation occurs without any input of organic matter from growing plants) and subsequent consequences. It might be expected that this, and the resulting reduction in soil quality, can be remedied by removing the textile and using practices to increase organic matter levels.

Increasing soil organic matter levels (carbon) is essential, however, it is difficult to access the rate of accumulation with soil building practices. The amount of increase over time varies depending on the type of management practices employed. These include reduced tillage intensity, increased crop rotation complexity, inclusion of legumes in rotation, inclusion of winter cover crops, efficient use of fertilizers, pesticides and irrigation, and erosion reduction (Paustian et al., 2007; West and Post, 2002), as well as manure management, effective crop species selection (Conant et al, 2001) or the addition of non-traditional materials such as non-composted municipal leaves (Heckman and Kluchinski, 2000). The rate of organic matter accumulation, or loss, varies due to the type of management that impacted the soil originally, the soil's inherent properties and current status, climate and other factors. This ideally requires *in situ* measurement over time to determine impacts. Carbon Management Response curves are reported as useful tools (West et al., 2004) to estimate the loss and gain of carbon between changes in land use, but none of the specific farm practices of concern are included in this work.

Regardless, organic matter is undoubtedly accumulating in the soil when above practices are utilized. The organic matter values may not show significant increases for many years, but improvement in physical soil properties such as aggregation and moisture holding can be realized. Research in New Jersey found 3 consecutive annual applications of 10 and 20 dry tons/A of municipal leaf waste increased soil organic matter levels 0.5 to 0.7% (Heckman and Kluchinski, 2000) one year after the final application. These high rate applications of high carbon material are atypical and suggest that green manures or cover crops use would increase levels at a much lower rate. Therefore, organic matter levels may increase slightly over several years but potentially could take decades of sound management. However, the benefits of any small increase would be manifested in improvements several soil properties. Therefore it is difficult to provide a specific time frame necessary to restore soil organic matter levels to initial or higher levels.

Seasonal use of impervious cover over undisturbed soil where the soil is being used in its existing condition as the growth medium (high tunnel hoop houses): High tunnel usage continues to increase throughout the country in areas where climatic crop producing limitations can be overcome, essentially allowing for growing season extension in the spring and fall months. The construction, unlike permanent greenhouses, does not involve the compaction or excavation of soil to build or pour concrete foundations. Rather, wood framing is used to establish a based to which PVC tubes driven into the ground and looped to the opposite side of the frame are attached. Once the support structure is completed, polyethylene greenhouse covering is attached. Our professional assessments is the main impact of this situation will be the limitation of precipitation (presumably rainfall) infiltrating and passing through the soil. Principles of water conservation, as well as economic motivation, will limit irrigation to what is necessary to keep the root zone moist for plant growth and is unlikely to allow leaching to groundwater. The increased soil temperatures may be sufficient to increase soil biological activity; this may enhance nutrient availability but increase oxidation and loss of soil organic matter. Stormwater management may be necessary to handle excess water attempting to infiltrate/runoff the areas surrounding the impervious structures. Steps to remediate any negative impact on soil properties are minimal; the return to traditional agricultural production (*sans* hoop house) can be easily achieved and management practices such as introduction of organic materials into the soil will remediate any loss of soil organic matter.

Long term use of impervious cover (high tunnel hoop houses for two years or more): This situation is between those described above and below; effects will depend on time and specific practices.

Long term impervious cover (roof) over undisturbed soil: Based on our professional assessment and/or cited research, the potential limitations that a roof imposes on natural soil processes are the amount and quality of sunlight, and the amount and quality of water passing through. Certain situations (glass houses) may allow direct sunlight, while opaque roofs will allow only indirect sunlight or artificial light underneath. Light limitation will affect plant growth and therefore organic matter addition and microbiological population and activity in the soil. Elimination of natural precipitation from soil may or may not have an effect, depending on other management factors. Frequent irrigation may allow similar total amounts of water as expected in precipitation (about 40" in New Jersey), but it is likely that rarely would the soil experience near-saturation conditions that cause leaching through the soil profile to groundwater. This could be expected to become a problem when/if fertilizing, as in glasshouse or hoop house situations. Routine application of fertilizer without leaching water application can lead to salt build-up (salinity), another form of soil degradation not normally encountered in New Jersey's humid climate but common in agriculture of arid regions. Remediation steps would include the reintroduction of organic materials to increase soil aggregation and other physical properties and biological activity. Rainfall and irrigation, and use of soil amendments such as gypsum, would help to leach any accumulated salts over time, most likely over several months or a year or two, depending on the level of salt accumulation, rainfall patterns, and soil permeability and drainage.

Permanent structure and long term impervious cover with soil substantially disturbed (including geotextile, alone, geotextile with gravel cover, or concrete foundation): When the function of a soil is strictly an engineering media, there are wholly different sets of quality criteria. They would include optimum water content (for compaction), compressibility, bearing capacity, shrink-swell behavior, strength, (etc.). The quality indicators for the engineering function are by necessity contrary to those for the cropping (food and biomass production) and hydrology functions of soil. In particular, soil compaction is necessary to provide a stable base for a permanent structure. For that reason, effort is made to compact soil to the greatest degree and depth possible (and in the process, destroy naturally developed soil structure) or to remove any of the soil that may impede providing such a base. The densified soil underneath a permanent structure (impervious cover) may still contain organic matter, and that content may remain relatively constant considering conditions conducive to limited decomposition while organic matter additions are precluded by the built structure. The impervious nature of the structure and the compaction required to build it prohibits the soil from infiltrating, filtering, and passing precipitation to groundwater, so that all precipitation impacting the structure and the surrounding affected soil have to be controlled by otherwise-unnecessary stormwater devices/structures.

Geotextile and geotextile with gravel cover could actually mitigate the negative effects, but concrete foundation "seals" the fate of the entombed soil. Recently evolving study of urban soil provides data to predict concrete's effects. The classification system being developed for urban soils, expanding on the classification systems for "natural" soils, includes "Technosols" whose development and properties are dominated by their extensive disturbance by man (Schwartz et al. 2009). Sealing of soil by concrete, which also occurs on farmland, qualifies a soil as a Technosol. The imperviousness of this type of Technosol and its effects on infiltration, runoff, and water pollution is not the only effect; pH of the soil underlying the concrete and its subsequent or concomitant effect on geochemical cycles and biological activity (Charzynski et al., 2009) are additional factors that alter soil functions in the long term. For example, pH approaching 8.3 negatively affects most agricultural and horticultural crops.

Remediation under these conditions would be more difficult and costly. After the removal of any structures and debris, specialist deep-tillage equipment requiring significant energy and time inputs may allow for cultivation of the soil and incorporation of soil organic amendments. Over time, the status of the soil may improve to the point where some crop yields would be expected but they would be less than similar undisturbed soils. The primary impacts would be that the majority of the soils' inherent characteristics are negatively impacted and its profile would be permanently and negatively altered. Therefore, to preserve the soil in its natural state, or to lessen the impact of such practices, the extent of disturbance (acreage) should be limited or the purpose for it justified in a soil management plan.

Long-term impact of outdoor equine training tracks: The construction of equine training tracks may involve grading (leveling and/or smoothing), compacting the soil base, and layering with desirable footing material. Subsequent management includes tractor-mount raking and rolling to eliminate vegetation and to smooth and firm the surface. Spraying the surface with water when dry is typical to control dust and prevent wind erosion. The effects on underlying soil would include primarily compaction of the soil by both horse and tractor traffic. The surface soil texture is likely to be affected when the original soil is fine-textured or loamy; these soil types are most likely to have addition of footing material due to requirement for rapid infiltration/permeability and susceptibility to compaction when wet and hardness when dry (whereas sandy soil is inherently more suitable because of rapid water infiltration/permeability and poor cohesiveness). Organic matter content of the soil will be depleted as the original humus is oxidized and the only input is limited to the occasional manure pile. The surface of the (non-vegetated) track is likely to experience erosion by water during rainstorms and by wind when dry. Turf tracks are better protected from erosive forces, but additional management requirements are necessary to maintain the turf as a "crop" (nutrient levels, irrigation, etc.). Remediation steps would include the reintroduction of organic materials to increase soil aggregation and other physical properties and biological activity.

Impact of Practices on Soil Functions and Potential for Remediation

A qualitative summary of the practices discussed and their impact on selected soil functions is presented in Table 1. The matrix can serve as an initial comparison among practices. The assessment of impact of each practice is expected to vary with soil type and would need to be validated with either additional data or modeling.

As outlined, there is a continuum of impacts for any soil function (Table 1). Soil under almost any condition can be improved, but there is potential for a loss of productivity if the soil structure has been irreparably harmed. The determination of what is "acceptable" and "unacceptable" soil disturbance can only be established through research involving the set of practices under consideration and the soil and climate conditions in New Jersey. Most minor to significantly negative practices can be remediated through various cultural practices, however increasing costs (time, money) may be prohibitive and crop yield or quality may be depressed for periods of time.

Table 1. Summary of the relative impact of practices on selected soil functions and their potential for remediation[1]

Practice	Soil Functions			Potential for Remediation[2]
	Food and Biomass Production	Storing, Filtering and Transformations	Biological Habitat and Gene Pool	
Geotextiles	Very negative (no biomass production)	Limited reduction of biological activity and of exchanges of matter and energy with the atmosphere.		Medium to High
Impervious Cover-Seasonal	Enhanced (biomass production augmented)	Limited negative or neutral impact due to short time scale.		Very High
Permanent Structures	Very negative impact on all soil functions			Very Low
Outdoor Equine Training Tracks	Very negative impact on all soil functions			Low

[1] Based on the authors' professional judgment and experience as no specific research on the impact of the listed practices was found in the literature review.

[2] Potential for remediation is based on the degree of alteration of soil properties and do not consider the spatial extent of soil modification introduced by a given practice.

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