NJ650.1401 General

a) Introduction

The New Jersey Water Management Guide (NJWMG) has been adapted from the July, 1987 New Jersey Drainage Guide. The material has been developed to assist New Jersey NRCS field personnel and others working with New Jersey landowners to provide general planning, design, and management guidance on various methods of water management, primarily drainage techniques, commonly used in the State. The NJWMG has been expanded to include guidance for the restoration of wetlands through the interruption or removal of previously installed drainage practices.

Today, NRCS assistance on drainage practices is largely limited to the restoration of existing drainage systems or their modification to enhance water quality objectives. In some instances, the conversion to higher value agriculture in marginal areas or disease concerns lead to the installation of new systems. When a new system is designed or an old system is restored, the conservation planner must be aware of the potential impacts on adjacent wetland areas. Likewise, when the goal is the restoration of a wetland area through the removal of drainage practices, consideration must be given to the impacts on neighboring properties due to a rise in ground water levels or reduction in the efficiency of surface water removal.

The New Jersey Water Management Guide includes in an appendix recommendations for drainage of many of the soil series found in New Jersey that commonly require drainage. The recommendations are largely historical in nature and based on experience with the particular soil or a similar soil. The recommendations are intended to serve as guidance. More site specific methods for the design of drainage systems can be found in National Engineering Handbook Part 642, Drainage, Chapter 4, and Part 650, Engineering Field Handbook, Chapter 14.

b) Types of drainage systems

Drainage is the removal of excess surface or subsurface water. Excess water may be due to on-site conditions such as a high ground water table, or may originate from off-site sources related to either surface or subsurface flow, or both.

Removal of excess water is accomplished by installing drainage practices or a system of practices planned considering the source of the excess water and desired conservation goals. Surface water generally is removed by a combination of practices of open ditches, land forming, and underground outlets. Subsurface flows are removed or controlled by open ditches or buried conduits. A lateral drain, or system of lateral drains, is generally located to lower the water table. Water control structures such as flashboard weirs installed in drainage conduits or open ditches can be added to the drainage system to provide for management of water table levels. Even though most references relate to agricultural settings, the applicability includes urban areas as well.

Solutions for all drainage problems may not require structural practices. In some cases, surface ponding or saturation may be due to development of compacted or tight layers at or near the soil surface that may be treated with agronomic practices such as deep tillage or through the planting of deep rooting warm season grasses.

Surface drainage

Surface drainage involves removal of excess surface water by developing a continuous positive slope to the free water surface or by pumping. It may be accomplished by open ditches, land grading, underground outlets, pumping, or any combination of these that facilitates water movement to a suitable outlet. Drainage by this method applies to nearly level topography where:

- Soils are slowly permeable throughout the profile.
- Soils are shallow, 8 to 20 inches deep, over an impermeable layer.
- Topography consists of an uneven land surface that has pockets or ridges which prevent or retard natural runoff.

- Surface drainage supplements subsurface drainage.

Subsurface drainage

Subsurface drainage is the removal of excess ground water within the soil profile. It is also used to facilitate the leaching of salts from the soil and maintenance of a salt balance. Typically, perforated plastic tubing is used, while older systems may include clay and concrete tile, or mole drains. Open ditches constructed to an adequate depth and properly located may also be used to remove excess ground water. Subsurface drainage is applicable to wet soils having sufficient hydraulic conductivity for drainage where a suitable outlet is available or an outlet can be obtained by pumping.

Interception drainage

Interception drainage systems remove excess water originating upslope, deep percolation from irrigation or rainfall, and water from old, buried stream channels. Interception drains are open ditches or buried conduits located perpendicular to the flow of ground water or seepage. They are installed primarily for intercepting subsurface flow moving down gradient. Although this method of drainage may intercept and divert both surface and subsurface flows, it generally refers to the removal of subsurface water.

Water table management

Water table control systems can be an alternative to single purpose drainage systems. The basic premise is to install certain structural measures and to operate them in a manner that controls the water table at a predetermined elevation. The structural practices can range from installing a flashboard or stop-log structure in the outlet ditch to installing a complete system consisting of land forming, subsurface drain tubing, water control structures, well and pump to provide supplemental water, and observation wells for monitoring.

Drainage pumping

Pumps or pumping systems have many applications in drainage systems. Pumps may be used as outlets for surface or subsurface drainage when gravity outlets are not available or the available outlet is not deep enough to satisfy minimum depth requirements. Additional information can be found in the National Engineering Handbook Part 624, Drainage, Chapter 7.

Pumps for water supply are often needed for sub-irrigation or water table management systems. Wells and pumps for wells are also described in NEH Part 623, Irrigation, and Part 650 EFH, Chapter 12.

c) Investigations and planning

When drainage is considered, an investigation is necessary to determine the nature and extent of the problem. Planners need to evaluate the cause of the problem and develop practical alternatives to achieve the desired objectives. Environmental considerations must be a part of the planning process and investigations necessary for habitat enhancement or mitigation, and for environmental protection, should be an integral part.

In making a field investigation, the following items should be noted:

- Location and extent of any wetlands.
- Areas in which crops show damage or area of surface ponding or saturation.
- Observations of unique landscape features, ecologically significant areas, land use patterns, operation (land management) aspects, and site visibility.
- Topography and size of the watershed area.
- Size, extent, and ownership of the area being considered for drainage.
- Location of the drainage outlet and its condition.
- Presence of cultural resources.

- Potential impacts outside the area being evaluated.
- General character of soil throughout the area needing drainage, including land capability, land use, crops and yields. Log soil borings and record locations.
- High-water marks or damaging floods and dates of floods.
- Sources of excess water from upslope land or stream channel overflow and possible disposal areas and control methods.
- Condition of areas contributing outside water and possible treatment needed in these areas to reduce runoff or erosion.
- Condition of any existing drainage system and reasons for failure or inadequacy. Old subsurface drainage systems that have failed because of broken or collapsed sections may well be the cause of a wet area.
- Location, condition, and approximate size of existing conservation practices.
- Utilities, such as pipelines, roads, culverts, bridges, and irrigation facilities and their possible effect on the drainage system.
- Estimate of surveys needed.
- Additional considerations to comply with applicable environmental permits.

The intensity of this investigation and the makeup of the investigation party depend upon the size of the area and complexity of the problem. In all cases, as much information as possible should be obtained from local farmers and residents. The investigation must be extensive enough to provide a clear picture of the size and extent of the drainage problem.

The environmental values of an area must be fully considered when planning to develop a new drainage system or improve an existing system. Alternatives and options should be evaluated from the perspective of the landowner, neighbors, and the community. Alternatives should aim towards balanced and sustainable systems that fit within the natural setting. Agricultural developments, natural resource conservation, biodiversity, wildlife habitat, water quality, economics, health, and social considerations may all play a role in the decision-making process, and appropriate evaluations should be made.

Additional information on investigations and planning can be found in NEH Part 650, EFH, Chapter 14.

Planning considerations and design requirements for specific conservation practices are found in Section IV of the Field Office Technical Guide. Drainage related conservation practices include:

Code 310 Bedding,
Code 356 Dike,
Code 554, Drainage Water Management,
Code 466 Land Smoothing,
Code 462 Precision Land Forming,
Code 533 Pumping Plant,
Code 587 Structure for Water Control,
Code 606 Subsurface Drain,
Code 607 Surface Drain, Field Ditch, and
Code 608 Surface Drain, Main or Lateral.