CHAPTER 91

ANIMAL WASTE MANAGEMENT

Authority

N.J.S.A. 2A:58-10 et seq., 4:9-38, and 4:27-19.

Source and Effective Date

R.2016 d.114, effective August 25, 2016.
See: 48 N.J.R. 615(a), 48 N.J.R. 1907(a).

Chapter Expiration Date

Chapter 91, Animal Waste Management, expires on August 25, 2023.

Chapter Historical Note

Chapter 91, Animal Waste Management, was adopted as new rules by R.2009 d.88, effective March 16, 2009. See: 40 N.J.R. 917(a), 41 N.J.R. 1171(a).

In accordance with N.J.S.A. 52:14B-5.1b, Chapter 91, Animal Waste Management, was scheduled to expire on March 16, 2016. See: 43 N.J.R. 1203(a).

Chapter 91, Animal Waste Management, was readopted as R.2016 d.114, effective August 25, 2016. See: Source and Effective Date. See, also, section annotations.

CHAPTER TABLE OF CONTENTS

SUBCHAPTER 1. PURPOSE AND SCOPE

2:91-1.1 Purpose and scope

(a) These rules set forth the requirements for the development and implementation of self-certified Animal Waste Management Plans (AWMPs), high-density AWMPs and Comprehensive Nutrient Management Plans (CNMPs) for farms that generate, handle or receive animal waste. The rules in this chapter require the use of best management practices to protect water quality and public health by:

1. Controlling animal access to the waters of the State;

2. Storing manure at least 100 linear feet from surface waters of the State;

3. Applying manure using proper nutrient management practices;

4. Minimizing odors from manure storage and application areas;

5. Controlling vectors and fomites; and

6. Optimizing the beneficial use of nutrients from manure and bedding materials.

(b) These rules only apply to farms with animals identified in the definition of "livestock" at N.J.A.C. 2:91-2.1 and to farms receiving or applying animal waste. These rules do not apply to facilities regulated by the New Jersey Department of Environmental Protection under N.J.A.C. 7:26 (solid waste management rules), 7:26A (solid waste recycling rules) and 7:14A (CAFO General Permit #NJ0138631).

(c) Aquatic farms that comply with the provisions of the Aquaculture Management Practices at N.J.A.C. 2:76-2A.11 and who possess an aquatic farmer license pursuant to N.J.A.C. 2:89 shall be deemed in compliance with the requirements of this chapter.

(d) Nothing in this chapter shall be construed to alter or compromise the goals, purposes, and provisions of, or lessen the protections afforded to farmers by, the Right to Farm Act, P.L. 1983, c. 31 (N.J.S.A. 4:1C-1 et seq.), and any rules adopted pursuant thereto.

(e) Farms having documented evidence of a direct discharge of animal waste into waters of the State, as determined by NJDA following an evidentiary hearing, shall comply with the requirements set forth at N.J.A.C. 2:91-3.6.

Amended by R.2016 d.114, effective September 19, 2016.
See: 48 N.J.R. 615(a), 48 N.J.R. 1907(a).
Added (e).

SUBCHAPTER 2. DEFINITIONS

2:91-2.1 Definitions

For the purpose of this chapter, the following words and terms shall have the meanings described below, unless the context clearly indicates otherwise.

"Agricultural management practices (AMP)" means practices which have been recommended by the State Agriculture Development Committee, and adopted pursuant to the provi-

sions of the Administrative Procedure Act, N.J.S.A. 52:14B-1 et seq.

"Animal density (AD)" means the number of animal units per acre of available farmland for pasturing animals and other land available for application of animal waste. For purposes of determining available farmland, only farmland actually used for pasturing or in which animal waste is actually applied can be counted, and specifically excludes land containing structures, woodlands and waters of the State.

"Animal unit (AU)" means 1,000 pounds of live body weight calculated on an annual average basis. In lieu of calculating the actual weight of each animal, the following conversion chart may be used for determining the animal units on farm:

Animal Unit Equivalents and Manure Production

All Values Calculated from Midwest Plan Service - MWPS-18, 2000 (by the American Society of Agricultural Engineers)

Note: Animals not identified in the list shall be calculated based on species, production goals, breed or accepted species weights as determined by RCE.

Animal	Weight Pounds	Number of Animals / 1000 Pounds	Number of Animals to Equal 8 AU	10 AU	12 AU	Manure	Pounds/ Year	Pounds/ Year/ Unit	Manure Tons/Year 8 AU	10 AU	12 AU
Dairy											
Dairy	150	6.7	53.3	66.7	80.0						
	250	4.0	32.0	40.0	48.0						
Heifer	750	1.3	10.7	13.3	16.0	Solid	13000	17333.3	69.3	86.7	104.0
Lactating	1000	1.0	8.0	10.0	12.0	Solid	19992	19992.0	80.0	100.0	120.0
	1400	0.7	5.7	7.1	8.6	Solid	28000	20000.0	80.0	100.0	120.0
	1000	1.0	8.0	10.0	12.0	Liquid	38856	38856.0	155.4	194.3	233.1
	1400	0.7	5.7	7.1	8.6	Liquid	54000	38571.4	154.3	192.9	231.4
Dry Cow	1000	1.0	8.0	10.0	12.0						
	1400	0.7	5.7	7.1	8.6						
Veal	250	4.0	32.0	40.0	48.0	Solid	2200	8800.0	35.2	44.0	52.8
Veal	250	4.0	32.0	40.0	48.0	Liquid	3500	14000.0	56.0	70.0	84.0
Beef											
Calf	500	2.0	16.0	20.0	24	Solid	7000	14000.0	56.0	70.0	84.0
Finishing	750	1.3	10.7	13.3	16	Solid	11800	15733.3	62.9	78.7	94.4
Cow	1000	1.0	8.0	10.0	12	Solid	13400	13400.0	53.6	67.0	80.4
Swine											
Nursery	25	40.0	320.0	400.0	480.0	Solid	480	19200.0	76.8	96.0	115.2
Grow/ Finish	150	6.7	53.3	66.7	80.0	Solid	2100	14000.0	56.0	70.0	84.0
Gestation	275	3.6	29.1	36.4	43.6	Solid	2000	7272.7	29.1	36.4	43.6
Lactating	375	2.7	21.3	26.7	32.0	Solid	4540	12106.7	48.4	60.5	72.6
Boar	350	2.9	22.9	28.6	34.3						
Sheep	100	10.0	80.0	100.0	120	Solid	1460	14600.0	58.4	73.0	87.6
	200	5.0	40.0	50.0	60	Solid					
Poultry											
Layer	4	250.0	2000.0	2500.0	3000	Solid	39	9750.0	39.0	48.8	58.5
Broiler	2	500.0	4000.0	5000.0	6000	Solid	18	9000.0	36.0	45.0	54.0
Turkey	20	50.0	400.0	500.0	600	Solid	46	2300.0	9.2	11.5	13.8
Duck	6	166.7	1333.3	1666.7	2000	Solid	60	10000.0	40.0	50.0	60.0
Horse	1000	1.0	8.0	10.0	12.0	Solid	18250	18250.0	73.0	91.3	109.5

"Animal waste" means livestock manure and associated bedding materials and animal carcasses from normal mortalities of livestock on a farm. For the purpose of this chapter, animal waste shall be free of plastic, metal, glass, or other non-biodegradable materials with the exception of *de minimis* quantities that result from agricultural activities. This definition specifically excludes Waste Class 5: Regulated Medical Waste, as found in N.J.A.C. 7:26-3A.6, which includes contaminated animal carcasses, body parts, and associated animal bedding materials that were known to have been exposed to infectious agents during research, including research at veterinary hospitals, production of biologicals, or testing of pharmaceuticals.

"Appropriate agent" means a person outside of the U.S. Department of Agriculture (USDA) who is authorized by NRCS to provide technical assistance in the delivery of technical services to implement agricultural programs in the United States Department of Agriculture authorized by Federal farm legislation.

"Aquaculture" means a form of agriculture involving the propagation, rearing and subsequent harvesting of aquatic organisms in controlled or selected environments, and the subsequent processing, packaging and marketing, and shall include, but is not limited to, activities to intervene in the rearing process to increase production such as stocking, feeding, transplanting and providing for protection from predators. Aquaculture is a water dependent activity but shall not include the construction of facilities and appurtenant structures that might otherwise be regulated pursuant to any State or Federal law or regulation.

"Aquatic farm" means any leased or privately owned water system and associated facilities and appurtenant structures capable of holding and/or producing cultured aquatic stock. It may also refer to more than one facility and may include both hatchery and grow-out components, multi-species farms, processing, packaging and marketing.

"Aquatic organism" means an animal or plant of any species or hybrid thereof and includes gametes, seeds, eggs, sperm, larvae, juvenile, and adult stages any of which is required to be in water during that stage of its life. This definition does not include birds and mammals.

"Best management practices (BMPs)" mean activities, procedures and practices prescribed in an AWMP or CNMP which incorporates criteria and standards of the NRCS NJ-FOTG, NJDA BMP Manual or any site specific recommendations made by NJAES.

"Certification" means a written authorization from the Department to implement a CNMP approved by the local district. The certification is valid for five years from the date of issuance.

"Composting" means the aerobic, biological decomposition of organic matter, including manure, leaves, bedding and crop residues. It is a natural process that can be enhanced and accelerated by selecting organic waste "recipes," as set forth in the NJ-FOTG, with proper carbon/nitrogen balance; mixing to provide proper aeration; and monitoring to assure that ideal moisture levels and temperatures are maintained. These extra steps provide optimal conditions for the microbes that transform "raw" on-farm wastes into a relatively stable soil amendment/crop nutrient.

"Comprehensive Nutrient Management Plan (CNMP)" means a conservation plan that is a grouping of conservation practices and management activities which will help to ensure that both production and natural resource protection goals are achieved on the farm. The CNMP shall conform to the NRCS NJ-FOTG and be approved by the District in accordance with N.J.A.C. 2:91-3.6.

"Confined areas" means housed lots, feedlots, confinement houses, stall barns, milk rooms, milking centers, cowyards, barnyards, medication pens, dry lots, exercise yards and stables.

"Department" means the New Jersey Department of Agriculture.

"District" or "Soil Conservation District" means a soil conservation district established in accordance with the Soil Conservation Act, N.J.S.A. 4:24-1 et seq., which is the official soil conservation district for the county or region in which the farm is located. Contact information for each local soil conservation district can be found at http://www.state.nj.us/dep/dwq/pdf/soilcondist.pdf. For the purposes of these rules, the District is an agent of the Department.

"Farm" means parcels of land where livestock is housed, kept, stabled, confined, fed, or otherwise maintained or any parcel that receives or applies animal waste. A farm may include parcels owned, leased or otherwise available to a person.

"Fomite" means inanimate objects that serve to carry infections or toxins from one animal to another.

"High-density Animal Waste Management Plan (High-density AWMP)" means the plan developed by the farm operator utilizing the NJDA BMP Manual, for the management of animal waste. The plan shall be reviewed by the local soil conservation district to ensure conformance with the NJ-FOTG in accordance with N.J.A.C. 2:91-3.5.

"Land application" means the application of animal waste on land for the purpose of soil improvement and utilization of nutrients by plants.

"Livestock" means all aquaculture organisms, cattle, horses, ponies and other domestic equidae (mules and similar members of the horse family), swine, sheep, goats, llama, poultry, fowl, ratites (big birds such as emus, ostriches), rabbits and small ruminants as defined in N.J.A.C. 2:8-1.2(a).

"Natural Resources Conservation Service (NRCS)" means the technical agency of the USDA, authorized by Public Law 46 of the 74th Congress (7 U.S.C. §6962) for the conservation of agricultural and related natural resources. Contact information for the New Jersey NRCS field offices can be found at http://www.nj.nrcs.usda.gov/contact/.

"New Jersey Agricultural Experiment Station (NJAES)" means an arm of Rutgers, the State University, conducting research in agriculture and related natural resources, as authorized by N.J.S.A. 4:16-1 and N.J.S.A. 18A:65-3.

"New Jersey Department of Agriculture Best Management Practices Manual (NJDA BMP Manual)" means the document entitled "On-Farm Strategies to Protect Water Quality," which was published in 2003, utilized as a planning and assessment tool for agricultural best management practices, published by the New Jersey Association of Conservation Districts, in cooperation with the Department, SSCC, and USDA-NRCS which is available by contacting New Jersey Department of Agriculture, P.O. Box 330, Trenton, New Jersey 08625.

"New Jersey Field Office Technical Guide (NJ-FOTG)" means the USDA-NRCS technical reference, as amended and supplemented, customized for the State of New Jersey, prescribing practices and standards for the conservation and management of soil, water and related natural resources which is available at http://efotg.nrcs.usda.gov/efotg_locator.aspx?map=NJ.

"Pasture" means land where 70 percent or more of the area is in vegetative cover that is used as a source of nutrition and exercise for livestock.

"Person" means any natural individual, society, association, board, venture, partnership, corporation, limited liability company, cooperative, company, organization, institution and governmental instrumentality recognized by law for any purpose whatsoever.

"Rutgers Cooperative Extension (RCE)" means an arm of Rutgers, the State University, providing educational services in agriculture and related natural resources.

"Self-Certified Animal Waste Management Plan (self-certified AWMP)" means the plan developed by the farm operator utilizing the NJDA BMP Manual for the management of animal waste in accordance with N.J.A.C. 2:91-3.4. The plan shall be self-certified by the owner or operator and the declaration page filed with RCE.

"State Agriculture Development Committee (SADC)" means the committee established pursuant to N.J.S.A. 4:1C-4 et seq.

"State Soil Conservation Committee (SSCC)" means the committee established pursuant to the Soil Conservation Act, N.J.S.A. 4:24-1 et seq.

"Technical service provider (TSP)" means NRCS-certified professionals outside of the USDA that help agricultural producers apply conservation practices on the land pursuant to 16 U.S.C. §3842(b).

"USDA" means the United States Department of Agriculture.

"Vector" means a living organism that serves to carry infections or toxins from one animal to another.

"Waters of the State" means all surface and ground waters in New Jersey but does not include closed system aquatic farms.

"Woodland" means an area of land covered with a large and thick collection of growing trees.

Amended by R.2016 d.114, effective September 19, 2016.
See: 48 N.J.R. 615(a), 48 N.J.R. 1907(a).
In definition "Animal waste", deleted ", unconsumed feed" following "manure", substituted "this chapter" for "these rules" and "*de minimis*" for "de minimis", substituted the first occurrence of "that" for "which", and inserted a comma following "glass" and following "parts"; and added definition "Pasture".

SUBCHAPTER 3. ANIMAL WASTE MANAGEMENT REQUIREMENTS

2:91-3.1 General requirements

(a) With the exception of aquatic farms, no farm shall allow livestock in confined areas to have access to waters of the State unless such access is controlled in accordance with part IV of the NJDA BMP Manual, incorporated herein by reference as the chapter Appendix.

1. Copies of the NJDA BMP Manual may be obtained by contacting the local District or one of the NRCS Field Offices or by contacting RCE at Rutgers Cooperative Extension, Rutgers, The State University of New Jersey, 88 Lipman Drive, New Brunswick, NJ 08901-8525.

2. A copy of this document is also on file in the NJDA office in the Division of Agricultural and Natural Resources, Health and Agriculture Building, Market and Warren Streets, Trenton, NJ 08625.

(b) Manure storage areas shall be located at least 100 linear feet from surface waters of the State, measured perpendicular to the watercourse from the top of bank outwards. Manure storage areas shall avoid slopes five percent or greater and be designed to eliminate direct point source discharges to waters of the State, except for stormwater discharges to surface water that occurs above a 25-year, 24-hour storm event.

(c) Land application of animal waste shall be performed in accordance with the principles of the New Jersey Department of Agriculture (NJDA), Best Management Practices (BMP) Manual Part IV.

(d) No livestock that have died from a reportable contagious disease listed in N.J.A.C. 2:2-1.1 or as a result of an act of bio-terrorism shall be disposed of, composted or made part of any land application without first contacting the State Veterinarian. In addition, no animal waste associated with livestock that have died from a reportable contagious disease listed in N.J.A.C. 2:2-1.1 or as a result of an act of bio-terrorism shall be disposed of, composted or made part of any land application without first contacting the State Veterinarian.

(e) Any person entering a farm to conduct official business related to these rules shall follow the bio-security protocol set forth below.

1. Vehicle: To avoid transporting infectious agents or toxins from one farm to another, vehicles shall be driven and parked in areas to avoid surfaces traveled by animals, farm equipment and farm vehicles. Car windows shall remain closed to prevent flying insects from getting inside vehicle.

2. Protective clothing: Clean cloth or disposable Tyvek coveralls shall be worn at each site. Cleaned and disinfected rubber boots or disposable boots are required. These items shall be changed or cleaned and disinfected between

sites. If more than one species or group is housed on a site, each area shall be treated as a different site.

3. Equipment: All equipment shall be thoroughly cleaned and disinfected upon arrival and prior to leaving a site, except that new equipment, if clean, need not be disinfected upon arrival.

4. Order of inspection: The owner or manager of the site shall be consulted to determine the order for the site visitation. The areas with the lowest risk of exposure to infectious agents shall be visited first.

5. Cleaning: All organic debris (urine, feces) shall be removed and surfaces that have been exposed to organic debris must be thoroughly washed preceding disinfection to be effective. Disinfectants shall be applied only after removal of contaminated organic matter. Detergents shall be used on non-disposable boots and equipment to facilitate the removal of organic debris from these objects. Tools used to clean these items must also be cleaned and then disinfected prior to additional use. Washed surfaces shall be allowed to dry before applying disinfectants. Efficient cleaning removes almost 99 percent of the agent from a contaminated object.

6. Disinfecting: Detergents shall be rinsed off thoroughly prior to the application of disinfectants to avoid any potentially hazardous chemical reactions. The use of disinfectants that have the broadest spectrum of activity, including efficacy on porous surfaces with organic debris, and contact safety is ideal. No single disinfectant will satisfy all considerations. Disinfectant properties should be evaluated with regard to the intended areas of use. Disinfectants shall be allowed to remain on treated surfaces for a minimum of seven minutes.

Amended by R.2016 d.114, effective September 19, 2016.
See: 48 N.J.R. 615(a), 48 N.J.R. 1907(a).
In (b), inserted "avoid slopes five percent or greater and", and inserted a comma following the second occurrence of "State".

2:91-3.2 Aquatic farms

(a) Aquatic farms which comply with the Aquaculture Management Practices Manual set forth at N.J.A.C. 2:76-2A.11 and who possess an aquatic farmer license pursuant to N.J.A.C. 2:89 shall be deemed in compliance with the requirements of this chapter.

1. An electronic copy of the Aquaculture Management Practices is available at http://www.jerseyseafood.nj.gov/aquacultureamp.pdf.

2. A copy of this document is on file in the NJDA office of the Director, Division of Agricultural and Natural Resources, Health and Agriculture Building, Market and Warren Streets, Trenton, NJ 08625.

2:91-3.3 Farms with one to seven animal units (AUs)

(a) Farms with one to seven AUs are required to implement the general requirements at N.J.A.C. 2:91-3.1 by March 16, 2010.

(b) Farms with one to seven AUs are encouraged, but not required, to develop and implement a self-certified AWMP in accordance with N.J.A.C. 2:91-3.5.

(c) New farms or farms meeting the one to seven AU threshold after March 16, 2009, shall implement the general requirements at N.J.A.C. 2:91-3.1 within 12 months of date when the farm meets the one to seven AU threshold.

Amended by R.2016 d.114, effective September 19, 2016.
See: 48 N.J.R. 615(a), 48 N.J.R. 1907(a).
Deleted former (c); and recodifed (d) as new (c).

2:91-3.4 Farms with eight to 299 animal units (AUs) with animal densities (ADs) less than or equal to one AU per acre

(a) Farms with eight to 299 AUs and ADs less than or equal to one AU per acre shall:

1. Implement the general requirements at N.J.A.C. 2:91-3.1 by March 16, 2010;

2. Develop a self-certified AWMP consistent with the NJDA BMP Manual by September 16, 2010; and

3. Implement the plan completely by March 16, 2012.

(b) New farms or farms meeting the AU and AD thresholds after March 16, 2009, shall implement the general requirements at N.J.A.C. 2:91-3.1 within 12 months of date they meet the AU and AD thresholds in this section and shall implement the requirements of this section within 36 months from the date the farm reaches the thresholds set forth in this section.

(c) A self-certified AWMP shall include, but not be limited to, the following:

1. The name, physical address and phone number of the farm;

2. The owner or operator name, address, signature and date;

3. Records of action plan activities as set forth in worksheet E of the NJ-BMP Manual;

4. A list of BMPs proposed;

5. The size and location of manure storage area(s);

6. The size and location of composting area(s);

7. The Premises Identification Number as assigned by USDA (if available); and

8. Nutrient management records for each field. Records must include:

i. The field number, field name, physical address or other means of identification;

ii. The number of acres;

iii. The crop-yield;

iv. The type of manure applied, the date of application, and the weather conditions;

v. The total amount of manure applied;

vi. The date manure is incorporated into the field;

vii. The type of fertilizer applied, the date of application, and the weather conditions; and

viii. A declarations page meeting the requirements of (e) below.

(d) The self-certified AWMP shall be developed by the farm owner or operator or a person authorized to act on their behalf.

(e) A copy of the self-certified AWMP shall be signed by the owner or operator and the declaration page shall be filed with RCE. RCE will provide a copy of the declaration page to the NJDA.

1. The declaration page shall include the following statement:

"Certification: I hereby certify that I am the operator of the above identified farm, (as defined in N.J.A.C. 2:91). I further certify that I have developed and implemented a Self-Certified Animal Waste Management Plan for this farm in accordance with the requirements of N.J.A.C. 2:91.

I further certify that the foregoing statements made by me are true and the information provided in this document is true, accurate and complete. I am aware that if any of the foregoing statements made by me are willfully false, I am subject to punishment, including, but not limited to the penalties contained in N.J.A.C. 2:91-4.1."

2. Incidents involving false swearing or false reporting in the documents required by these rules may be referred by the Department for prosecution pursuant to N.J.S.A. 2C:28-3.

(f) A copy of the self-certified AWMP shall be retained on the farm.

(g) The owner or operator shall review and update the plan and make changes as necessary for continued conformance with the NJDA BMP manual.

(h) Should the AD increase to greater than one AU per acre, or the number of AUs exceed 299, the owner or operator shall be required to comply with the requirements set forth in N.J.A.C. 2:91-3.5 or 3.6, respectively.

2:91-3.5 Farms with eight to 299 animal units with animal densities greater than one AU per acre

(a) Farms with eight to 299 AUs and AD greater than one AU per acre shall:

1. Implement the general requirements at N.J.A.C. 2:91-3.1 by March 16, 2010;

2. By September 16, 2010, develop a high-density AWMP consistent with NJDA BMP Manual and the NJ-FOTG standards, incorporated herein by reference, and submit to the local district for review. If the high-density AWMP meets the NJ-FOTG standards, then the SCD will approve the plan.

i. Copies of the NJ-FOTG are available from the NRCS Field Offices and the State Office at 220 Davidson Ave, 4th Floor, Somerset, NJ 08873.

ii. An electronic copy of this document is available at http://www.nrcs.usda.gov/technical/efotg/.

iii. A copy of this document is also on file in the NJDA Office of the Director, Division of Agricultural and Natural Resources, New Jersey Department of Agriculture, Health and Agriculture Building, Market and Warren Streets, Trenton, New Jersey 08625;

3. File the original high-density AWMP with the local NRCS office once approved by the local district;

4. Retain a copy of the approved high-density AWMP on the farm; and

5. Implement the plan completely by March 16, 2012.

(b) A high-density AWMP shall include, but not be limited to, the following:

1. The name, physical address and phone number of the farm;

2. The owner or operator name, address, signature and date;

3. Records of action plan activities as set forth in worksheet E of the NJ – BMP Manual;

4. The list of BMPs proposed;

5. The size and location of manure storage area(s);

6. The size and location of composting area(s);

7. The Premises Identification Number as assigned by USDA (if available); and

8. The Nutrient management record for each field. Records must include:

i. The field number, field name, physical location or other means of identification;

ii. The number of acres;

iii. The crop-yield;

iv. The type of manure applied, the date of application, and the weather conditions;

v. The total amount of manure applied;

vi. The date manure is incorporated into the field; and

vii. The type of fertilizer applied, the date of application, and the weather conditions.

(c) The high-density AWMP may be developed by the farm owner or operator or a person authorized to act on their behalf.

(d) The owner or operator shall review and update the plan and make changes as necessary for continued conformance with the NJDA BMP manual and the NJ-FOTG.

(e) Should the number of AUs exceed 299, the owner or operator shall be required to comply with the requirements set forth in N.J.A.C. 2:91-3.6.

(f) New farms or farms meeting the AU and AD thresholds after March 16, 2009 shall implement the general requirements at N.J.A.C. 2:91-3.1 within 12 months of date they meet the AU and AD thresholds in this section and shall implement the requirements of this section within 36 months from the date the farm reaches the thresholds set forth in this section.

2:91-3.6 Farms with 300 or more animal units (AUs)

(a) Farms with 300 or more animal units shall:

1. Implement the general requirements at N.J.A.C. 2:91-3.1 by March 16, 2010; and

2. Develop a CNMP in consultation with the NRCS, TSP, or an appropriate agent, which conforms to the NJ-FOTG, and submit the CNMP to the local District for review and approval in accordance with (b) and (c) below.

i. Copies of the NJ-FOTG are available from the NRCS Field Offices and the State Office at 220 Davidson Ave, 4th Floor, Somerset, NJ 08873.

ii. An electronic copy of the NJ-FOTG is available at http://efotg.nrcs.usda.gov/efotg_locator.aspx?map=NJ.

iii. A copy of this document is on file in the NJDA Office of the Director, Division of Agricultural and Natural Resources, New Jersey Department of Agriculture, Health and Agriculture Building, Market and Warren Streets, Trenton, New Jersey 08625.

(b) If a District approved CNMP was developed and implemented between October 1, 2001 and March 16, 2009, full implementation of such plan shall suffice to comply with these rules until modifications are needed to the plan in accordance with (g) below.

(c) The CNMP shall include the following:

1. The name, physical address and phone number of the farm;

2. The owner or operator name, address, signature and date;

3. The Premises Identification Number as assigned by USDA (if available);

4. Manure and wastewater handling and storage that addresses collection, storage, treatment and/or transfer practices;

5. Land treatment practices;

6. Nutrient management that identifies source, amount, timing and method of application of nutrients by field;

7. Recordkeeping that documents and demonstrates implementation activities associated with CNMPs;

8. Feed management activities that address nutrient reduction in manure; and

9. Other utilization activities.

(d) The District shall approve the CNMP when it is in conformance with the standards and criteria of the NJ-FOTG. Once approved by the District, the owner or operator shall provide a copy of the CNMP to the Department for certification along with a signed authorization releasing the plan to the Department on a form provided by the NRCS for this purpose.

(e) Upon receiving the approved CNMP, the Department shall issue a certification to the applicant. The Department shall retain a copy of the certification and CNMP and mail the original to the owner or operator. The owner or operator shall retain a copy of the certification and CNMP on the farm.

(f) The certification shall be valid for a period of five years. An application for certificate renewal shall be filed with the Department on forms developed by the Department for such purposes no later than 30 days prior to the expiration of the certification.

(g) The owner or operator shall review the CNMP annually to assure compliance with the rules. An updated CNMP shall be filed within 30 days of the occurrence an increase in the number of AUs by 25 percent. All revised CNMPs shall comply with the provisions of (c) through (f) above.

(h) By March 16, 2012, the CNMP shall be completely implemented.

(i) New farms and/or farms meeting the 300 AUs or more threshold after March 16, 2009 shall implement the general requirements at N.J.A.C. 2:91-3.1 within 12 months of date they meet the 300 or more AUs threshold and shall implement (a) through (h) above within 36 months from the date the farm reaches the 300 or more AUs threshold.

2:91-3.7 Farms receiving or applying less than 142 tons of animal waste per year

(a) Farms receiving or applying less than 142 tons of animal waste per year are required to implement the general requirements at N.J.A.C. 2:91-3.1 by March 16, 2010.

(b) Farms receiving or applying less than 142 tons of animal waste per year are encouraged, but not required to develop and implement a self-certified Animal Waste Management Plan (AWMP) in accordance with N.J.A.C. 2:91-3.4.

(c) Should the amount of manure received or applied increase to 142 tons or more of animal waste per year, the owner or operator shall be required to comply with the requirements set forth in N.J.A.C. 2:91-3.8.

(d) New farms or existing farms who begin receiving or applying animal waste after March 16, 2009 shall implement (a) above within 12 months from the date the farm begins receiving or applying animal waste.

2:91-3.8 Farms receiving or applying 142 or more tons of animal waste per year

(a) Any farm that receives or applies 142 tons or more of animal waste per year shall:

1. Implement the general requirements at N.J.A.C. 2:91-3.1 by March 16, 2010;

2. Develop a self-certified AWMP by September 16, 2010, in accordance with N.J.A.C. 2:91-3.4;

3. Implement the plan completely by March 16, 2012; and

4. Maintain the following recordkeeping requirements for hauling:

i. Records of the dates of transfer and quantities of manure; and

ii. Records of the names and addresses of the sources of manure.

(b) New farms or farms that begin receiving or applying 142 tons or more animal waste annually after March 16, 2009, shall implement the general requirements at N.J.A.C. 2:91-3.1 within 12 months of the date they meet the thresholds in this section and shall implement the requirements of this section within 36 months from the date the farm reaches the thresholds set forth in this section.

2:91-3.9 Exemptions

(a) The following are not subject to these rules:

1. An agricultural event or fair approved pursuant to N.J.A.C. 2:33-1.3 that is held within the State of New Jersey;

2. Any person that handles animal waste other than animal waste from livestock, including, but not limited to, dog kennels regulated pursuant to N.J.A.C. 8:23A and game farms regulated pursuant to N.J.A.C. 7:25-4;

3. Veterinarian hospitals or clinics operated by persons licensed pursuant to N.J.A.C. 13:44;

4. Temporary petting zoos;

5. Concentrated animal feeding operations and concentrated aqautic animal production facilities regulated by the New Jersey Department of Environmental Protection (NJDEP) pursuant to N.J.A.C. 7:14A-2.13 and 2.14;

6. Any person regulated by NJDEP under N.J.A.C. 7:26 (solid waste management rules); and

7. Any person regulated by NJDEP under N.J.A.C. 7:26A (solid waste recycling rules).

2:91-3.10 Confidentiality

The New Jersey Department of Agriculture will hold confidential any information included in a self-certified AWMP, high-density AWMP and CNMP, which constitutes proprietary commercial or financial information, or is otherwise protected from disclosure under 7 CFR Part 205.501 and 205.504 or the Open Public Records Act, N.J.S.A. 47:1A-1 et seq., subject to the limitations set forth therein.

SUBCHAPTER 4. PENALTIES AND ENFORCEMENT

2:91-4.1 Penalty and enforcement provisions

(a) The Department shall investigate alleged violations of the rules and take appropriate action, which may include, but is not limited to, the following:

1. Any person who violates any provision of this chapter, or the requirements of a self-certified AWMP, high-density AWMP or CNMP developed pursuant to this chapter, shall be liable for a civil administrative penalty of up to $1,000 per day for each violation as determined pursuant to the procedures set forth in this section.

2. Where non-compliance is found, the Department may allow the owner or operator up to 60 days to address or correct the non-compliance before imposing a civil administrative penalty. The length of time available to correct the non-compliance shall be based on the following factors:

i. Inability to perform the corrective action due to circumstances beyond the persons control, including but not limited to weather conditions, need for professional assistance and need for special machinery to complete the corrective action;

ii. Whether temporary corrective action can mitigate the non-compliance;

iii. The severity of the non-compliance based upon the point system as set forth in (c) below;

iv. The severity of the environmental impact caused by the non-compliance; and

v. Any other mitigating factor.

(b) If a self-certified AWMP, high-density AWMP or CNMP has been developed but not fully implemented, the Department shall determine the status of compliance with this chapter. Where non-compliance is found, the Department shall issue a civil administrative penalty in accordance with (c) below.

(c) The Department shall use the factors described below to determine the amount of a civil administrative penalty under this section. The standards below assign each violation a point value. The total number of points is used to determine the penalty amount per day for each violation. The factors, and the point values assigned to them, are as follows:

1. The seriousness of the violation shall be classified as major, moderate or minor and assigned points as follows:

i. Major conduct shall include an intentional, deliberate, purposeful, knowing or willful act or omission by the violator and is assigned three points;

ii. Moderate conduct shall include any unintentional but foreseeable act or omission by the violator and is assigned two points; and

iii. Minor conduct shall include any conduct not identified in (c)1i or ii above and is assigned one point.

2. The management plan type shall be assigned points as follows:

i. A violation impacting a self-certified AWMP is assigned one point;

ii. A violation impacting a high-density AWMP is assigned two points; and

iii. A violation impacting a CNMP is assigned three points.

(d) The Department shall sum the total points assigned according to the factors in (c) above, and shall determine the penalty amount per day using the following table:

Penalty Points Table

Total Points	Maximum Penalty Amount Per Day
2	$250
3	$500
4	$750
5 or more	$1,000

(e) If the violation is of a continuing nature, each day during which it continues shall constitute an additional, separate, and distinct offense.

(f) For a violation under this section, the Department may adjust up or down the daily civil administrative penalty amount based on the following factors:

1. The violator's compliance history;

2. The nature, timing and effectiveness of measures the violator takes to mitigate the effects of the violation;

3. The nature, timing and effectiveness of measures the violator takes to prevent future similar violations;

4. Any unusual or extraordinary costs or impacts directly or indirectly imposed on the public or the environment as a result of the violation; and/or

5. Other specific circumstances of the violator or violation.

(g) No assessment shall be levied until after the party has been notified by certified mail or personal service and has been provided an opportunity for a hearing as outlined in (j) below.

(h) Any amount assessed shall take into account the seriousness and duration of the violation and whether the violation involves the failure to develop or to implement a self-certified AWMP, high-density AWMP or CNMP and shall also provide for an enhanced penalty of double the amount of the original penalty if the violation causes an impairment to water quality as determined by the Department using the criteria set forth in N.J.A.C. 7:9B-1.14 and 7:9C-1.7. Any civil administrative penalty assessed under this section may be compromised by the Secretary of Agriculture upon the posting of a performance bond by the violator, or upon such terms and conditions as the Secretary in consultation with the State Board of Agriculture may establish.

(i) Any person who fails to pay a civil administrative penalty in full shall be subject, upon order of a court, to a civil penalty of up to $1,000 for each violation. Each day that the person fails to pay the penalty shall constitute an additional, separate, and distinct offense. Any such civil penalty imposed may be collected with costs in a summary proceeding pursuant to the Penalty Enforcement Law of 1999, P.L. 1999, c. 274 (N.J.S.A. 2A:58-10 et seq.).

(j) Anyone who is aggrieved by a determination pursuant to this section shall, upon written request transmitted to the Department within 20 days of that determination, 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., and the Uniform Administrative Procedure Rules N.J.A.C. 1:1.

1. Requests for hearings shall be sent to Director, Division of Agricultural and Natural Resources, N.J. Department of Agriculture, P.O. Box 330, Trenton, New Jersey 08625-0330.

APPENDIX

PART IV. Directory of Best Management Practices for Water Quality Protection on the Farm

A. Introduction

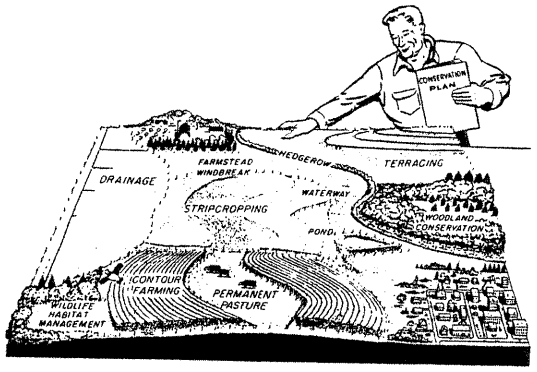
THIS DIRECTORY OFFERS a "menu" of management options designed to address water quality impacts on farms. These options are called **Best Management Practices** (BMPs). With respect to water quality, a best management practice is a method, measure or practice applied to prevent or reduce surface and ground water pollution. Another term for "best management practice" is "conservation practice," used for many years by the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS). In fact, many "conservation practices" have been in common practice since the Service was created in the dust bowl days.

With respect to water quality, a best management practice is a method, measure or practice applied to prevent or reduce surface and ground water pollution.

Many of the practices and measures listed in the **Directory** were, in fact, developed by the NRCS. The New Jersey State Office of the NRCS has assembled those practices most pertinent to New Jersey from a very wide national inventory of BMPs. These BMPs for New Jersey have been collected in the NRCS "Field Office Technical Guide" (FOTG) available at www: usda/nrcs/efotg. Each practice or measure contained in the FOTG has a detailed and technical description of the BMP, including the definition, purpose, planning considerations and design criteria.

Other BMPs have been developed by farmers and others in the agriculture industry. These BMPs have been tested and proven to be effective in addressing the problem, but currently are not among the list of practices and measures in the FOTG. Such practices may be innovative and extremely effective; some may not have yet withstood the tests of time or quality control that provide additional assurance of their overall effectiveness.

In most cases, the descriptions of BMPs in the **Directory** do not provide all the information needed to put the measure into practice. Agricultural composting is a good example of a practice that requires far more information than presented here. Some BMPs, such as the installation of a sediment basin or the implementation of an integrated pest management (IPM) program, require substantial technical assistance. Some installations require engineering. The purpose here is to acquaint farmers with the menu of options, and to provide enough information to enable further steps. These further steps may require collecting more data, obtaining technical assistance, or simply securing the proper equipment.



A BMP may be a practice, such as crop rotation or integrated pest management. Or a BMP may be a structure, such as a manure storage system or a grassed waterway.

Some of the BMPs may require state or federal permits to implement. Working in or near wetlands or water bodies, composting and use of pesticides are examples of activities that may require a permit. It is best to check with the Cooperative Extension, Conservation District or Natural Resources Conservation Service office before such a project is initiated.

NOTE: The "best management practices" included in this **Directory** have broad application to a wide range of New Jersey farm enterprises. However, certain commodities, including cranberries, forest products and aquaculture, will have particular concerns and issues that require commodity-specific tools to address them. These are not our focus here; however, Part V of this Guide includes resources and references for these and other more commodity-specific concerns.

B. More on "BMP"s

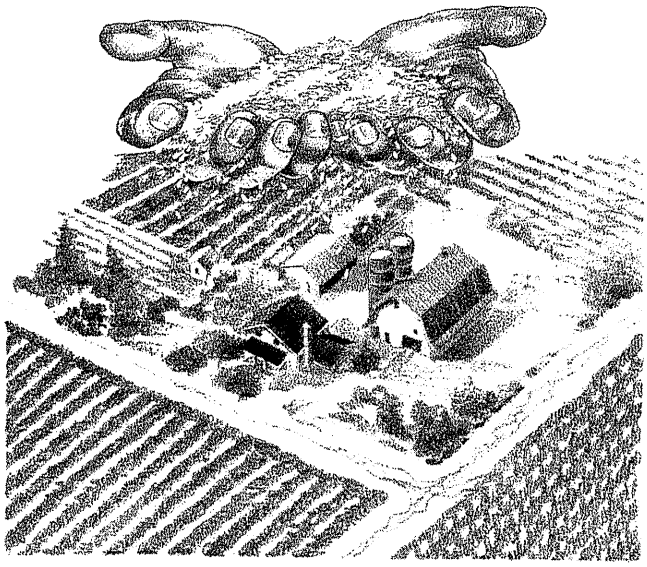
A BMP MAY BE A PRACTICE, that is, a non-structural operation such as crop rotation or integrated pest management. Or a **BMP may be the installation of a structure**, such as a manure storage system or a grassed waterway. A BMP may be used to correct existing problems and/or to prevent future potential degradation of water resources.

Rarely will the use of a single BMP for any land use activity be sufficient to adequately address water quality problems. More often, several BMPs, individually selected to fit the unique characteristics of each site and farming operation, will be required. These practices, when grouped, may be referred to as a **"conservation management system."**

Rather than focus on individual practices, a conservation management system focuses on the sum of the parts. It takes into account the range of effectiveness of any single practice, its cost, and the resulting overall cost and effectiveness. Some individual practices may not be very effective alone, but, in combination with others, may provide a key function in a highly effective system.

A single BMP may address more than one problem. For example, a riparian (streamside) buffer may remove or reduce nutrient, sediment and pesticide contamination, while also enhancing the biological diversity of plant and animal species. It is also possible that a BMP designed to address one problem may actually contribute to another. For example, a farmer who uses conservation tillage, which can reduce erosion and sedimentation, may wind up applying increased amounts of herbicides to control weed pressure, with potentially detrimental impacts to ground water.

One or more "best management practices" may be selected to eliminate, prevent or reduce farm-related water pollution. Professional technical assistance is recommended to provide a more detailed assessment and a set of recommendations for modifications to farm practices. Worksheets C1–6, provided for use with this **Directory**, offer farmers the opportunity to make appropriate selections from the "menu" of best management practices included here.



C. Using the Directory

THE BMPS LISTED IN this **Directory** have been organized into sections. These sections address strategies for:

1. erosion and sediment control
2. nutrient management
3. pest and pesticide management
4. livestock barnyard, manure and waste management
5. livestock grazing management
6. irrigation management

Best Management Practices address strategies for managing erosion and sediments, nutrients, pests and pesticides, livestock, barnyard, manure and waste, livestock grazing and irrigation.

In each section, there is a description of specific BMPs that can be incorporated into a management plan to address the problem. Each BMP is described as follows:

- **Name** of the BMP. Those that require structures to be built are designated with an "(s)".
- **Definition** – describes the practice or structural change.
- **Purpose** – describes how the practice protects water quality. Some details about implementation and options are included.
- **Initial Cost** – provides a rough estimate of costs involved in implementing or installing the practice.
  LOW – the cost of implementation or installation is less than $1,000; it may cost nothing
  MEDIUM – the cost of implementation or installation is between $1,000 and $4,000
  HIGH – the cost of implementation or installation is above $4,000
- **Maintenance Cost** – provides a rough estimate of the annual cost of maintaining the practice or the installation. For most practices, this is estimated on a per acre basis; for structural measures, the estimate will be further defined by the particular site.
- **Technical Assistance** – indicates whether outside technical assistance is: not required, desirable, or required to implement the practice.
- **Other Benefits** – gives a partial listing of additional benefits that may be derived from implementing the BMP, including other environmental protections, cost savings or efficiencies. These benefits are useful in planning for the whole farm.
- **Other Considerations** – gives a partial listing of possible "side effects" and other implications of implementing the BMP that are useful in thinking about the whole farm system.

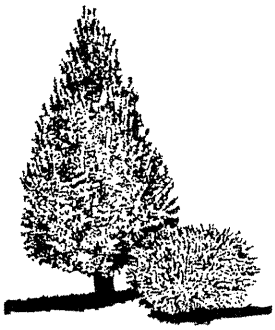
Conservation cover prevents soil erosion by keeping the soil from being disturbed. Typical plantings are grass, shrubs or trees.

1. Strategies for Erosion and Sediment Control

Management systems for controlling soil erosion and sedimentation address two resource issues: water quality and soil loss. The erosion and sediment control management practices in this section may also serve to satisfy other concerns, such as nutrient or pest management.

In addressing pollution issues, the first line of defense is to control the problem at the source, that is, to reduce the availability of the pollutant and the opportunity for it to detach from its surroundings. For sediment control, this means employing methods to keep the soil on the field. The next line of defense is to prevent the pollutant, in this case traveling soil particles, from entering a water source.

The following is a list of BMPs that are recommended to reduce or eliminate water pollution from sediments.



Best Management Practices for Erosion and Sediment Control

a. Conservation Cover

Definition: establishment and maintenance of permanent vegetative cover on land retired from production.

Purpose: to prevent soil erosion by keeping the soil from being disturbed. A permanent (perennial) cover is not typically cultivated, and the cover protects the soil from exposure. Typical plantings are grass, shrubs or trees. Such plantings may have productive value, such as walnut trees or blueberry bushes.

Initial Cost: low

Maintenance Cost: low

Technical Assistance: not required

Other Benefits: improves soil tilth; decreases pesticide and fertilizer use; may provide economic gain from perennial crops; may enhance wildlife.

Other Considerations: loss of annual cropland acreage if field is planted to a permanent cover.

b. Conservation Crop Rotation

Definition: a planned sequence of growing annual or perennial crops on the same field - the opposite of continuous cropping, where the same crop is grown in the same field year after year.

Purpose: to reduce detachment and transport of sediment by maintaining or improving the physical, chemical and biological conditions of the soil. A sequence of crops is selected to provide a high degree of soil cover and adequate organic residue for maintenance or improvement of soil tilth. Including a legume or grass in a rotation can be very effective for reducing erosion and improving soil structure. Also, rotations decrease loss of dissolved and sediment-attached nutrients and pesticides. Rotations designed for erosion control may differ from rotations planned as components of pesticide and/or nutrient management.

Initial Cost: low

Maintenance Cost: low

Technical Assistance: desirable

Other Benefits: may reduce nutrient loss and need for commercial nitrogen; addition of organic matter increases soil fertility; may disrupt build-up of insect populations, disease life cycles and weeds, thereby reducing applications of pesticides; may maximize water use efficiency; may benefit wildlife; may increase yields; may enhance enterprise diversity.

Other Considerations: when legumes are used in a rotation, the nitrogen supplied should be taken into account to prevent over-application of nitrogen on subsequent crops. Soil fertility levels should be monitored and maintained within acceptable ranges for all crops in the rotation. There are economic and management considerations regarding crop selection, as well.

The ridges and furrows created by contour farming reduce surface runoff by blocking water movement, allowing soil particles to remain in place.

c. Contour Farming

Definition: tilling, planting, cultivating and harvesting crops across the field slope.

Purpose: to reduce surface runoff and transport of sediments. Farming on the contour reduces both velocity and volume of runoff by presence of ridges and furrows that block water movement, allowing soil particles to remain in place. Contour farming may follow the establishment of terraces or diversions.

Initial Cost: low

Maintenance Cost: low

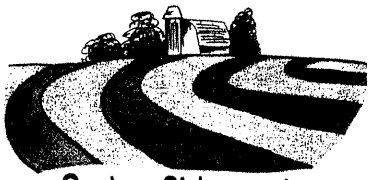
Technical Assistance: desirable

Other Benefits: see pesticide management; see nutrient management; increased infiltration may promote better crop growth and increased soil tilth.

Other Considerations: slowing surface runoff may increase infiltration of pesticides or nutrients.

d. Contour Strip-cropping

Definition: the practice of planting strips of crops across the contour (see contour cropping, above) so that those crops that provide limited soil cover (such as annual row crops like corn) are alternated with those that provide protective soil cover (such as hay).



Contour Stripcropping

Purpose: to reduce surface runoff and transport of sediments. Strip-cropping may be designed in a rotation.

Initial Cost: low

Maintenance Cost: low

Technical Assistance: desirable

Other Benefits: if in a rotation, legumes can contribute to soil nitrogen.

Other Considerations: may increase or decrease pesticide and/or fertilizer use.

Critical area planting reduces erosion by providing suitable plant cover on areas that are eroding or likely to erode.

e. Contour Buffer Strips

Definition: strips of perennial vegetation on the contour, 15 to 30 feet wide, separating sections of annual row crops.

Purpose: to slow runoff flow, trap sediment, nutrients and pesticides, and increase water infiltration.

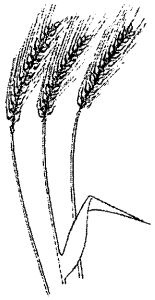
Initial Cost: low

Maintenance Cost: low

Technical Assistance: desirable

Other Benefits: vegetation provides food and cover for small upland birds and mammals. Beneficial insects can find habitat in strips, if proper vegetation is chosen.

Other Considerations: slightly reduces amount of crop production acreage, although hay can be harvested from contour buffer strips.



f. Cover Cropping

Definition: a cover of close-growing grasses, legumes or small grains grown primarily for seasonal protection and soil improvement.

Purpose: to control erosion and sedimentation by providing a soil cover, reducing exposure of soil particles; applied when the major crop does not furnish adequate cover, or following harvest; used to cover the soil during winter months; usually planted annually except where used as a permanent cover as in orchards; cover and green manure cropping also serve other important purposes (see below). Sometimes cover crops are seeded by aerial application.

Initial Cost: low

Maintenance Cost: low

Technical Assistance: not required

Other Benefits: see pesticide management; see nutrient management; cover and green manure crops add organic material to the soil, improve infiltration, aeration, tilth and wildlife habitat.

Other Considerations: cost of seeds and additional management.

g. Critical Area Planting

Definition: planting vegetation such as trees, shrubs, grasses or legumes on highly erodible or critically eroding areas.

Purpose: to reduce erosion and sedimentation by providing a suitable plant cover on areas that are eroding or likely to erode. Typically, plantings are perennial.

Initial Cost: medium

Maintenance Cost: low

Technical Assistance: desirable

Other Benefits: see nutrient management; may enhance habitat for wildlife, including "beneficials".

Other Considerations: an increase in erosion may occur during establishment of the planting in these areas; loss of cropland area.

Channels or drainageways constructed across a slope divert water away from areas where it is excessive to sites where it can be used or disposed of properly.

h. Diversion(s)
Definition: a channel or drainageway constructed across a slope.
Purpose: to divert water away from areas where it is excessive to sites where it can be used or disposed of properly and safely. The channel is constructed with a supporting ridge on the downhill side. It intercepts surface runoff water, and reduces runoff volume and velocity by reducing the length of the slope. Diversions are not designed to accommodate a large amount of sediment in the channel, and are not a substitute for other erosion control measures such as terracing. Diversions may be vegetated or nonvegetated and have an outlet.
Initial Cost: medium
Maintenance Cost: low
Technical Assistance: required
Other Benefits: diverts water carrying pollutants such as barnyard waste from surface waters; may improve wildlife habitat; improves crop health and farmability by diverting excess water.
Other Considerations: may increase delivery of pollutants to surface waters.

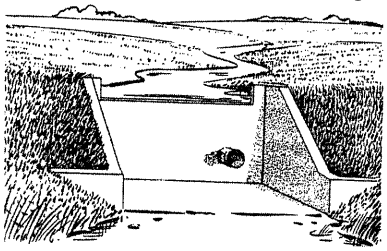
i. Field Borders
Definition: a strip of perennial vegetation established at the edge of a field.
Purpose: to reduce transport of sediment by providing "anchoring points" for contour rows, terraces, diversions and contour strip farming.
Initial Cost: low
Maintenance Cost: low
Technical Assistance: not required
Other Benefits: may have benefits for wildlife.
Other Considerations:

j. Field Strip-cropping
Definition: systematic arrangement of crops in strips across the general slope (not contour).
Purpose: to reduce delivery of sediments to water bodies by alternating crops that provide limited soil cover with those that provide high soil cover. Since crops are not grown on the contour, there will be areas of concentrated flow. Strip cropping may be done in a rotation.
Initial Cost: low
Maintenance Cost: low
Technical Assistance: desirable
Other Benefits: see pesticide management; see nutrient management; rotation may increase soil tilth.
Other Considerations: areas of concentrated flow potentially may increase delivery of sediments at a more rapid pace. There are crop selection and management considerations as well.

k. Filter Strip
Definition: an area (typically a strip) of vegetation that is planted and maintained as a permanent cover.

Grade stabilization structures control erosion in channels and prevent the formation or advance of gullies. They may also enhance habitat.

Purpose: with regard to control of erosion and sedimentation, the purpose of a filter strip is to capture sediment transported by runoff. Filter strips trap and remove solids, especially coarser grained and organic materials. Filter strips may be installed at the lower edge of fields, upgradient of terraces or diversions, or on fields next to wetlands, streams or ponds. They vary in their effectiveness and maintenance requirements.
Initial Cost: medium
Maintenance Cost: low
Technical Assistance: desirable
Other Benefits: nutrient management; pesticide management; filter strips can also be designed to handle silage juice runoff.
Other Considerations: depending on the function(s) that a filter strip is designed to perform, the degree of efficiency and level of management may vary.



l. Grade Stabilization Structure – Water Control Structure(s)
Definition: a structure used to control the grade and head cutting in natural or artificial channels.
Purpose: to stabilize the grade and control erosion in channels and to prevent the formation or advance of gullies. The structure may be a combination of earth embankment, mechanical spillway, and detention-type structure, and could include an inlet or surface drain component.
Initial Cost: high
Maintenance Cost: low
Technical Assistance: required
Other Benefits: may enhance habitat.
Other Considerations: attention to fish and wildlife habitat in design and construction; livestock should be fenced out to protect the structure.

m. Grassed Waterway(s)
Definition: a natural or constructed channel or outlet that is shaped or graded to certain dimensions and vegetated.
Purpose: to provide a stable and controlled outlet for the disposal of runoff. Grassed waterways are planted in a suitable grass/legume mix and may have a stone center. The vegetation slows runoff and filters out sediments; usually installed on sites where additional control is required to manage concentrated runoff, as from diversions.
Initial Cost: medium

Maintenance Cost: low
Technical Assistance: required
Other Benefits: see nutrient management; see pesticide management; may provide habitat for beneficials.
Other Considerations: may provide habitat for pests.

Mulching can reduce runoff and transport of sediment by trapping rain drops, especially in areas that are eroding and or bare. It may also control weeds and provide nutrients through microbial breakdown.

n. Mulching
Definition: applying plant residues or other suitable materials to the soil surface.
Purpose: to reduce runoff and transport of sediment by trapping rain drops, especially in areas that are eroding and/or bare; used to allow vegetation to establish itself, to provide cover where vegetation is not possible or desired, or in association with a crop. Plastic mulches perform some of these functions.
Initial Cost: low
Maintenance Cost: low
Technical Assistance: not required
Other Benefits: mulching conserves moisture, prevents surface compaction or crusting, controls weeds and helps establish plant cover; may provide nutrients through microbial breakdown.
Other Considerations: may lower soil temperature; may introduce weed seeds; plastic mulches do not degrade and must be removed from the field.

o. Outlet or Lined Waterway(s)
Definition: a waterway with an erosion-resistant lining of concrete, stone or other permanent material.
Purpose: to reduce erosion in concentrated flow areas, resulting in the reduction of sediment and other substances delivered to receiving waters. This practice may be a component of a waste management system where barnyard runoff is directed away from sensitive areas.
Initial Cost: medium - high
Maintenance Cost: low
Technical Assistance: necessary
Other Benefits:
Other Considerations:

p. Pasture and Hayland Planting
Definition: appropriate treatment and use of pastureland or hayland.
Purpose: regarding erosion and sedimentation, appropriate planting and management of hay or pastureland will reduce erosion and transport of soil particles. Fields covered in permanent vegetation year round are very resistant to erosion.

No-till, strip till, mulch till and ridge till systems are known to reduce erosion and sedimentation by as much as 90% in certain circumstances.

Initial Cost: medium
Maintenance Cost: low
Technical Assistance: not required
Other Benefits: may enhance plant vigor; may improve forage and haylage quality leading to improved animal health; may decrease pest and/or nutrient management requirements.
Other Considerations:

q. Residue Management: No-till, Strip Till, Mulch Till, Ridge Till
Definition: any tillage and planting system that minimizes physical disturbance of the soil and leaves approximately 30% of the surface covered by plant residue after planting.

Purpose: to reduce runoff causing detachment and transport of sediments. There are a variety of conservation tillage systems including **mulch-till, ridge-till, and strip-till**. Conservation tillage is applicable on sloping, highly erodible cropland, where adequate plant residues are produced. It is known to reduce erosion and sedimentation by as much as 90% in certain circumstances. In mulch-tillage the entire soil surface is tilled; at least 30% residue cover is left on the soil surface immediately following planting. In ridge-tillage, ridges are initially established and then planted year after year, with or without subsequent cultivation; at least 30% residue remains. Ridge-till is appropriate primarily for continuous row crops. Strip-till requires tilling of narrow strips for seeding or transplanting, leaving undisturbed surface residues in between; strip-till may be combined with ridge-till, and is appropriate for vegetable and small fruit crops. No-till is a method of planting in prior crop residue, cover crop or perennial sod crop where the surface of the field is left undisturbed. Specialized equipment is needed.
Initial Cost: low, if equipment is rented; medium if equipment is purchased.
Maintenance Cost: low
Technical Assistance: desirable for start-up
Other Benefits: increases soil tilth; increases soil temperature and moisture retention; may break pest and disease cycles; may decrease available weed seeds (no longer brought to the surface by plowing); reduces compaction; reduces fuel and labor costs and saves time.
Other Considerations: may increase ground water contamination by increased fertilizer and pesticide use and by increasing infiltration rates (but application rates may decrease over time); incorporation of fertilizers and pesticides is more difficult; careful nutrient management is advised; may delay germination due to cooler soil temperatures; residues may serve as host site for pests.

r. Riparian Buffer
Definition: an area of trees and other vegetation located adjacent to and up-gradient from water courses, water bodies and associated wetlands.
Purpose: to protect water quality by preventing streambank erosion, removing sediment, absorbing nutrients and pesticides and allowing better nutrient uptake. When plantings are carefully selected and maintained, and the practice is used together with other nutrient and sediment control practices, riparian buffers are highly effective and low maintenance.
Initial Cost: low
Maintenance Cost: low
Technical Assistance: not required
Other Benefits: may enhance conditions for desirable aquatic plants and animals; may provide commercial timber or forage; may improve wildlife habitat.
Other Considerations:

Sediment basins trap and collect sediments and excess water, allowing sediments to settle out of runoff water before it discharges into surface water bodies.

s. The Nutrient and Sediment Control System (NSCS) is both a biological filter and physiochemical treatment system. The goal of an NSCS is to maximize reduction of total and soluble phosphorus, and reduction of nitrogen, organic matter, bacteria and fine sediments reaching lakes and streams. The system is functional at different levels of efficiency during all seasons under a broad range of ecological, hydrologic and pollutant load conditions. The complete NSCS is a combination of a sediment basin, grassed buffer, a vegetated shallow pond, a deep pond, and a vegetated "polishing" area.
Initial Cost: high
Maintenance Cost: low
Technical Assistance: required
Other Benefits: Will increase habitat value
Other Considerations: Will require over one acre for a drainage area of fifty acres and increase proportionally from there.

t. Sediment Basin(s)
Definition: a depression constructed to collect and store debris or sediment.
Purpose: to trap and collect sediments and excess water and to control runoff. The basin may be dug or constructed as an earthen embankment or a combination of ridge and channels. It allows sediments to settle out of runoff water before it discharges into surface water bodies. The basin needs to be maintained by periodically removing collected materials.
Initial Cost: high
Maintenance Cost: low
Technical Assistance: required
Other Benefits: may increase habitat value if permanently seeded.
Other Considerations: may increase infiltration of soluble materials such as some pesticides.

u. Stream Channel Stabilization Measures
Definition: any of a number of constructed measures along or across natural or constructed waterways.
Purpose: to reduce erosion and sedimentation into water bodies. These measures include: spur dikes, which are fingers of stone that extend into a creek; grade control structures, which control the grade and head cutting in channels by creating a series of small "waterfalls"; and riprap bank protection, in which layers of large stones are placed along stream banks or crossings. May also include vegetative "bio-engineered" solutions such as installation of organic rolls and mats and plantings of suitable vegetation.
Initial Cost: medium - high
Maintenance Cost: medium
Technical Assistance: required
Other Benefits: may prevent loss of land or damage of facilities located near banks; may maintain capacity or stability of a channel; may enhance habitat.
Other Considerations: some constructed measures, such as riprap, may negatively impact riparian habitat, especially in stream banks.

A farm nutrient plan is a comprehensive strategy for addressing nutrient input needs on the farm. It includes information on crop requirements, nutrient availability, proper timing and amount of application and environmental considerations.

v. Tree Planting
Definition: planting and maintenance of trees.
Purpose: to reduce erosion and sedimentation by providing stable, perennial cover and root mass.
Initial Cost: low - medium
Maintenance Cost: low
Technical Assistance: not required
Other Benefits: see nutrient management; may attract beneficial insects and birds.
Other Considerations:

2. Strategies for Nutrient Management
Plants must receive sufficient and proper nutrients, at the proper times and in the necessary amounts, in order to grow and produce a crop. Farmers use a variety of amendments, including commercial fertilizers, animal and green manures and composts to assure nutrient availability for crops.
Sound nutrient management not only assures optimum production but also reduces input costs and protects water quality. Additionally, soil tilth and organic matter can be improved by correct manure and sludge application. Input costs are reduced by preventing over-application of commercial fertilizers and manures, while also reducing the amount of nutrients lost to receiving waters. It has been proven that over-application of fertilizers serves no beneficial purpose to the crop. In fact, excess nitrogen fertilizer can be harmful to crop yield and quality.
Research has shown that nitrates are a leading ground water contaminant. Commercial fertilizer and manure are significant sources of nitrates in ground water, as well as nitrates and phosphates in surface waters. Careful management of nutrients will reduce the amount of nutrients available for

transport from the field because they will be properly taken up by the plant or stored in the soil. Excess nutrients are lost with surface runoff, and by leaching through the soil into ground water. Erosion and sediment control practices are the primary mechanisms to control the transport of nutrients, especially phosphorus, that are attached to soil particles.

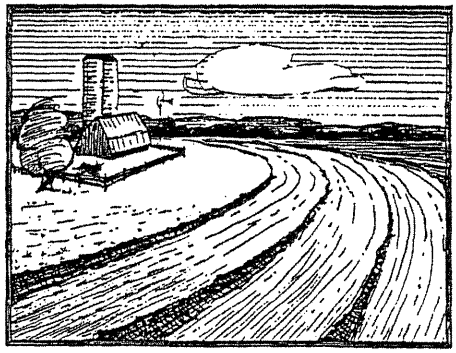
Nutrient Management Plans

A whole farm plan includes a comprehensive strategy for addressing nutrient input needs on the farm. It contains information on crop requirements, nutrient availability, proper timing and amount of application, and environmental considerations. When the source of the nutrients is not commercial fertilizer, it is important to determine the nutrient value and availability of those contributions. For example, the nitrogen contribution of any legume crop should be calculated and credited, and manures and composts should be tested for nutrient content.

The benefits of agricultural composting are many. Compost is an excellent soil conditioner which, when properly managed, is free of weed seeds.

Nutrient management includes the following core components:

a. farm and field maps showing acreage, soils, crops and water bodies
b. yield expectations
c. a summary of the nutrient planning resources available to the farmer, including:
    1) soil tests results
    2) nutrient analysis of manures and composts
    3) nitrogen contribution to the soil from legumes (if applicable)
    4) other significant nutrient sources
d. an evaluation of field limitations based on environmental considerations
e. establishing mix of nutrient sources and requirements
f. timing and application methods
g. equipment operation and calibration



Such a plan requires that farmers have a good understanding of crop requirements, soil types and sensitive areas on and near the farm, such as wetlands and shallow aquifers. Nutrient management incorporates this knowledge with a site-specific set of management practices to 1) apply nutrients at rates necessary to achieve realistic crop yields, 2) improve the timing of nutrient application, and 3) use agronomic crop production technology to increase nutrient use efficiency.

The following is a list of the BMPs that are recommended to reduce or eliminate water pollution from crop nutrients.

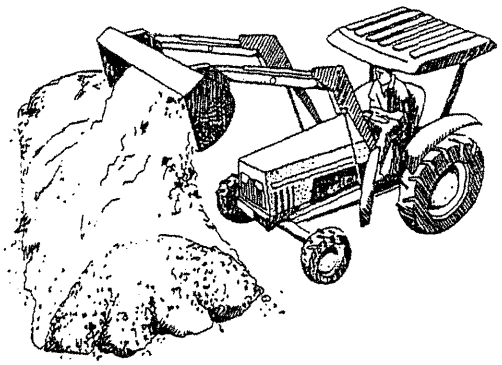
Filter strips-strips of close growing vegetation along a water body-can reduce nutrients in runoff entering the water. They may also provide habitat for wildlife.

Best Management Practices for Nutrient Management

a. Agricultural Composting

Definition: the aerobic, biological decomposition of organic matter, including manure, leaves, bedding and crop residues. It is a natural process that can be enhanced and accelerated by: selecting organic waste "recipes" with proper carbon/nitrogen balance; mixing to provide proper aeration; and monitoring to assure that ideal moisture levels and temperatures are maintained. These extra steps provide optimal conditions for the microbes that transform "raw" on-farm wastes into a relatively stable soil amendment/crop nutrient.

Purpose: to conserve nutrients produced on the farm; to lower the risk of pollution by stabilizing nitrogen in an organic form, and reducing its loss to ground and surface water.



Initial Cost: low - high
Maintenance Cost: low to high
Technical Assistance: highly desirable for start-up.
Other Benefits: The benefits of agricultural composting are many. Compost is an excellent soil conditioner which, when properly managed, is free of weed seeds. Farmers can lower their risk of nuisance complaints about odor and flies. Compost is often easier to handle than manure. Farmers have the opportunity to create a product with significant economic value; many garden centers, suburban neighbors and landscapers are eager to purchase high quality farm compost.
Other Considerations: Most of the nutrients in agricultural compost are in a stable organic form and are released slowly to growing plants. Nutrient availability, timing, and rates of application need to be accounted for in the overall nutrient management plan. The compost "pad," or site where active composting will take place, should be carefully located and designed. A poorly situated pad, like a poorly situated manure stacking area, can contribute to pollution problems.

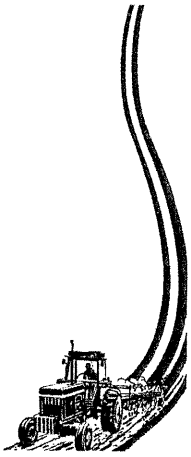
b. Filter Strips

Definition: strips of close growing vegetation surrounding or along a water body.
Purpose: to reduce nutrients in runoff entering the water. The width of the vegetative strip will depend on soil characteristics, type of vegetation used, topography and hydrology.
Initial Cost: low
Maintenance Cost: low
Technical Assistance: desirable for initial information
Other Benefits: see pesticide management; may provide wildlife habitat.
Other Considerations:

c. Conservation Crop Rotation
Definition: the successive planting of different crops in the same field — the opposite of continuous cropping.
Purpose: one purpose of crop rotation is to reduce the need for nitrogen fertilizer by planting a legume. Also, continuous applications of manure can result in the build-up of excessive levels of phosphorus; crops in an unmanured part of the rotation may take up phosphorus, thereby reducing the potential for loss by run-off of excess phosphorus. Rotation is valuable for controlling soil erosion, building soil tilth, increasing yields and eliminating or reducing certain diseases or pests.
Initial Cost: low
Maintenance Cost: low
Technical Assistance: desirable for start-up
Other Benefits: see erosion and sediment management; see pesticide management; may improve soil fertility.
Other Considerations:

Proper and timely adjustment of equipment used to apply nutrients can minimize the chance of over-application of fertilizer and manure.

d. Cover Cropping
Definition: the practice of planting a crop primarily for protecting and improving the soil between periods of regular crop production.
Purpose: regarding nutrient management, to provide nutrients for subsequent crops, thus reducing the total amount of additional nutrients necessary; to take up all the excess nutrients left in the field after the harvest of the main crop (called a "catch crop"); also, to utilize excess nutrients from the field, thus reducing the amount of nutrients that may leach to ground water. Annual cover crops are either harvested, plowed under, grazed or killed with herbicides before the primary crop is planted. Perennial cover crops, between trees and vines in orchards, for example, are left in place and managed by mowing.
Initial Cost: low
Maintenance Cost: low
Technical Assistance: not required
Other Benefits: see erosion and sediment management; weed pest control.
Other Considerations:



e. Equipment Calibration
Definition: proper and timely adjustment of equipment used to apply nutrients.
Purpose: to minimize the chance of over-application of fertilizer and manure. Calibration insures that recommended rates are being applied.
Initial Cost: low
Maintenance Cost: low
Technical Assistance: desirable for start-up
Other Benefits: this practice also applies to calibration of pesticide application equipment.
Other Considerations: should be done annually, and whenever fertilizer or pesticide is changed.

Intercropping-the growing of two or more crops simultaneously on the same field-adds nitrogen and other nutrients to the soil. Inter-cropping of certain crops is also intended to improve yields per acre and provide "crop insurance".

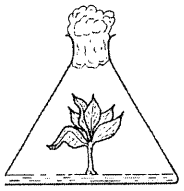
f. Fertilizer Storage, Handling and Containment
Definition: the management of fertilizer substances on the farm.
Purpose: to assure safety and prevent spills and leaks in which uncontrolled amounts of fertilizer might leach or run off into surface or ground water. Fertilizer storage areas, valves and containers should be secured when not in use. Dry fertilizer should be stored inside a structure or device capable of preventing it from getting wet. Liquid fertilizer should be stored in containers approved for and compatible with the fertilizer being stored. Fertilizer storage areas should be located away from wells, areas that are very porous, and any surface water bodies.
Initial Cost: low - medium
Maintenance Cost: low
Technical Assistance: not required
Other Benefits: may improve health and safety.
Other Considerations: storage areas should be inspected annually to ensure safety.

g. Green Manure Cropping
Definition: the practice of planting a grass or legume crop primarily to be plowed down for its contribution to soil fertility.
Purpose: to provide nutrient value to the subsequent crop.
Initial Cost: low
Maintenance Cost: low
Technical Assistance: not required
Other Benefits: moisture retention; enhances soil tilth and organic matter; reduces soil salinity; may reduce need for purchased fertilizer.
Other Considerations: may increase costs (seed and labor); plowdown may provide excess nitrogen.

h. Intercropping
Definition: the growing of two or more crops simultaneously in a specific pattern or fashion on the same field.
Purpose: regarding nutrient management, the purpose of intercropping is to add nitrogen and other plant nutrients to the soil. Legumes and grass crops are often used. Seeding in of the second crop may be done at various stages of the main crop's development.
Initial Cost: low
Maintenance Cost: low
Technical Assistance: desirable for start-up
Other Benefits: may reduce weeds.
Other Considerations: intercropping of certain crops is also intended to improve yields per acre and to provide "crop insurance" in case of a crop failure.

Providing fertility through enriching the soil with naturally occurring amendments "feeds the soil, then the soil feeds the plant."

i. Nutrient Budgeting



Definition: evaluation of the contributions of all sources of nutrients to the needs of a particular crop.
Purpose: to encourage the use of manure and other agricultural wastes, and other nutrient-contributing practices (e.g., cover cropping, planting legumes) and to avoid application of excess nutrients. Nutrient budgeting accounts for the contributions of all sources of nutrients, so that additional commercial fertilizers and/or animal manures are only applied to make up a lack. Testing of manures, composts, effluents as well as green manure and legume contributions can be performed. Management that focuses on providing fertility through enriching the soil with naturally occurring amendments "feeds the soil, then the soil feeds the plant".
Initial Cost: low
Maintenance Cost: low
Technical Assistance: required for start-up
Other Benefits: may reduce costs of purchased inputs; may promote recycling of on-farm wastes.
Other Considerations:

j. Nutrient Record Keeping

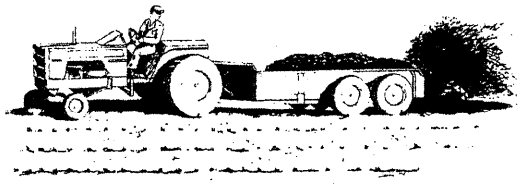
Definition: a system of documenting field, crop and nutrient application data.
Purpose: to provide historical and planning data in order to make informed decisions about nutrient applications that are resource-protecting and efficient. Record keeping is an important part of a nutrient management plan. Useful forms are available from technical assistance providers.
Initial Cost: none
Maintenance Cost: not applicable
Technical Assistance: not required
Other Benefits: helps to make efficient use of both manures and purchased inputs.
Other Considerations:

k. Plant Tissue Testing

Definition: a test that determines the nutritional status of plant tissues.

Proper timing and application of fertilizers in environmentally sensitive ways can avoid runoff and maximize plant uptake.

Purpose: to determine existing or potential nutrient problems. Plant tissue testing is an excellent tool for determining exact plant nutrient needs for many essential nutrients including nitrogen, phosphorus, potassium, calcium, magnesium, iron, zinc, manganese, copper, boron, molybdenum, chlorine, sulfur and others. Though not routinely done on all crops, testing may help diagnose nutrient deficiencies.
Initial Cost: low
Maintenance Cost: not applicable
Technical Assistance: required
Other Benefits:
Other Considerations:



l. Proper Timing and Application Methods

Definition: a set of practices that addresses the application of nutrients in environmentally sensitive ways.
Purpose: to protect water resources by selecting the best fertilizer, properly timing and locating applications to avoid runoff and maximize plant uptake. Manure and fertilizer should not be applied on frozen ground; they should be incorporated immediately. Fertilizer nitrogen is best applied just before the period of maximum uptake by crops, and in amounts matching the ability of the crop to take it up. Application under rainy conditions or when soil is saturated should be avoided. Application to very shallow soils or to exposed bedrock also should be avoided. Sometimes split applications are effective. In selecting fertilizers, less leachable forms and slow release varieties are advantageous both for water protection and effectiveness. Banding, which is the application of fertilizer along the row, close to the plant, rather than broadcasting, is an effective method of crop fertilization that can reduce nutrient loss.
Initial Cost: none
Maintenance Cost: not applicable
Technical Assistance: not required
Other Benefits: may enhance efficient use of fertilizers.
Other Considerations:

m. Soil Nitrate Testing

Definition: a test that determines the soil nitrate-nitrogen concentrations immediately prior to side- or top-dressing with nitrogen fertilizer.
Purpose: to avoid the application of excess nitrogen fertilizer by determining crop nitrogen needs.
Initial Cost: low
Maintenance Cost: not applicable
Technical Assistance: required (soil testing lab)
Other Benefits:
Other Considerations: may reduce farm fertilizer and labor costs.

n. Soil Testing

The management of agricultural pests is a major concern to nearly every New Jersey farmer.

Definition: determination of nutrient content of a soil sample by a laboratory.
Purpose: to avoid excessive use of nutrients while ensuring that the right amounts are applied for desired crop yield. At least one soil sample for each field and crop type should be tested for phosphorus, potassium, calcium, magnesium and soil pH, and any other nutrients of concern for the planned crop. Nitrogen application should not be based on a routine soil test prior to planting a crop; a special nitrogen soil test is needed during the growth of the crop. Soil tests should be updated on a regular basis, and before fertilizers are applied; results will change over time, depending on fertilizer and other additions, precipitation, runoff, leaching, erosion and crop uptake.
Initial Cost: low
Maintenance Cost: not applicable

Technical Assistance: required
Other Benefits: may yield economic savings from reduced fertilizer purchase.
Other Considerations:

o. Yield data
Definition: information about crop yields to determine realistic expectations.
Purpose: to manage nutrient applications to match realistic yield expectations. Yield data is based on yield history and other relevant information provided by the grower. For example, a farmer might average the three highest yields in five consecutive crop years. Information from Rutgers Cooperative Extension can be used when field data is not available. Increased yield expectations due to new and improved varieties and hybrids should be considered. Yield data will also depend on climatic conditions, available moisture and soil type.
Initial Cost: low
Maintenance Cost: not applicable
Technical Assistance: not required
Other Benefits:
Other Considerations:

3. Strategies for Pest and Pesticide Management

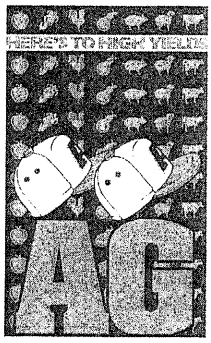
The management of agricultural pests is a major concern to nearly every New Jersey farmer. Pests include insects, weeds, diseases, fungi and vertebrates (e.g., rodents) that can reduce if not destroy crop production. Agriculture has always been faced with the need to limit crop damage due to pests. Since the 1950s, petrochemical-based pesticides have become an important tool for farmers. Of course, pesticides are applied in non-agricultural settings as well, for example on home lawns, golf courses, roadsides and utility rights-of-way.

A good pest management plan will emphasize natural controls and non-chemical tactics whenever possible, while maintaining a healthy crop with high yield and quality.

Wherever pesticides are used, there are concerns about potential impacts to water quality. Negative impacts to surface water bodies have been documented since the 1940's. More recently, studies have shown public and private water supply contamination from pesticides. Because of these and other concerns (e.g., the health and safety of the pesticide handler), pesticides and their application have become increasingly regulated, resulting in higher costs to the grower.

- pesticide application: including the rate, formulation, timing and mode of application (e.g., foliar, injection, surface incorporation)
- pesticide properties: including solubility, mobility, stability, and degradation
- climate: including precipitation, temperature and wind
- soil properties: including composition (% sand, clay and silt; soil organic matter), porosity, moisture content and pore size
- site characteristics: including topography, slope, proximity to water resources
- agricultural management practices: including tillage choices, mixing, loading and storage practices, cover cropping, irrigation/chemigation

Clearly, a goal of any pest management strategy is to reduce risks of contaminating surface and ground water. The basic concept of pest management in this regard is to encourage effective and safe use of pesticides, only when necessary, without causing environmental harm. The most effective approach is, first, to limit the amounts and types of pesticides (availability), and second, to use practices that minimize the movement (detachment, transport and deposition) of pesticides to surface and ground water.



Pest Management

As with nutrient management (see page 33), the most effective approach for environmentally sensitive pest control is to develop and implement **pest management plan**. The goal of pest management is to reduce the impact of pests to tolerable levels. The plan focuses on the assessment of options based on site- and crop-specific data. Developing a whole farm plan that includes sound agricultural management practices for how, what, where and when to apply pesticides will help minimize the problems associated with pesticide use. Natural controls and non-chemical tactics should be emphasized wherever possible. A good plan will maintain a healthy crop with high yield and quality, while protecting water quality and other environmental interests.

At minimum, pest management includes:

- an evaluation of past and current pest problems and cropping history
- an evaluation of the physical and biological characteristics of the site
- evaluation, selection and implementation of appropriate alternative pest management strategies
- proper selection, application and timing of pesticide(s)
- proper mixing, loading, and storage of pesticides

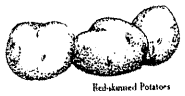
In New Jersey, IPM programs have reduced pesticide use on such crops as apples, strawberries, cranberries, corn, alfalfa, eggplant and potatoes.

An integral component of pest management is the practice of integrated pest management (IPM). IPM is an approach aimed at reducing pesticide use to the minimum quantity while ensuring high quality crops and protecting human health and environmental quality. IPM includes the selection, integration and implementation of pest control methods based on predicted economic, ecological and sociological consequences. IPM includes the use of pesticides only when pest populations exceed economic thresholds (when making a decent return on the crop is threatened) and only when alternative control tactics are not appropriate or available. An IPM program strives to minimize crop losses by optimizing the use of cultural management techniques and biological pest controls.

Typically, there are four components of an IPM system:

- **pest identification:** all potential pests as well as all beneficial insects are inventoried; particular species or varieties may require special treatment
- **monitoring:** also known as scouting, the aim is to accurately sample and record pest populations and to identify the location and time where a pest problem may become intolerable
- **action thresholds:** action thresholds and injury levels are established for each individual pest species. The action threshold is the level at which a control action must be taken in order to prevent damage
- **methods of prevention and suppression:** include some combination of controls described below to manage pest populations

There are many options for suppressing pests, usually used in combination. These tactics may be grouped in the following categories:


Red-skinned Potatoes

- biological controls
- cultural controls (including host resistance)
- physical and mechanical controls
- chemical controls

IPM guidelines have been established for a number of field crops, fruits and vegetables in New Jersey. New guidelines for other crops are continually being developed. Nonetheless, certain integrated pest management strategies can be successfully employed in a wide variety of situations, even without a certified program in place. Plans may be developed by the producer or by a private crop consultant who may be employed to help develop and implement the plan.

Once pest management has been developed, a variety of best management practices can be employed to implement aspects of the plan. Some plans may include particular IPM strategies that are included in the best management practices that follow. Best management practices that comprise elements of an IPM Program are included below.

The following is a list of the BMPs that are recommended to reduce water pollution from pesticide storage and use.

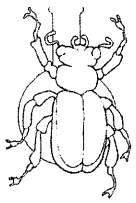
Best Management Practices for Pest and Pesticide Management

a. Appropriate Biological Controls

Appropriate biological controls include the use of natural predators to help keep pest populations in check.

Definition: use of natural enemies, including predators, parasites and diseases to help keep pest populations in check.

Purpose: to reduce or eliminate pests by introducing biological control agents that may not be native to the area, or not present in sufficient quantities, into the environment. For example, beneficial mites are commercially available and can be released in the field. These must be introduced before pest numbers are out of control, and periodic re-releases are usually needed. These agents include parasites, predators or disease pathogens such as bacteria, fungi and viruses.



Initial Cost: low
Maintenance Cost: low
Technical Assistance: required for initial information and start-up
Other Benefits:
Other Considerations:

b. Appropriate Cultural Controls

Definition: use of various farming practices that impact pest populations.

Purpose: to destroy or remove a pest's habitat by such practices as plowing, crop rotation, manipulation of planting and harvest dates, animal housing sanitation and manure management, and tillage. For example, alfalfa fields with significant numbers of alfalfa weevils may be harvested early to avoid further losses and reduce weevil populations. Crop rotation can be extremely effective in breaking up pest life cycles (e.g. the Colorado potato beetle). Various methods can be employed to destroy breeding refuges and over-wintering sites, including escaped apple trees for apple maggot. Included in this category are all practices that provide optimum growing conditions for the crop, thereby enhancing plant health and resistance and reducing plant stress. There is a wide range of cultural controls. Not all of them are appropriate on all farms, and farmers need to select carefully.

Examples of cultural controls include the following:

- site selection: choosing sites that are less favorable to pests
- cultivar selection: choosing varieties that are resistant to pests
- crop rotation: rotating away from crops of the same family can prevent weed growth and break up pest cycles
- intercropping: planting a mixture of crops may reduce insect damage, e.g., underseeding broccoli with clover
- cover cropping: can provide shelter for beneficials
- trap cropping: planting crops to attract the pest away from the main crop; for example in tomatoes, trap crops of potatoes and eggplant can be used for Colorado potato beetle
- tillage: provides weed control and may kill some insects and pathogens
- timing and method of planting: may help to avoid a generation of the pest
- sanitation: removal of pest habitat such as cull piles or dropped fruit; for example, potato cull piles provide a place for potato late blight and other diseases to overwinter
- pruning: removes a food source or point for infection and increases circulation
- healthy seed and transplants: avoids introducing pests; use of seed that has been certified disease-free

Properly calibrating pesticide application equipment assures proper application rates throughout the season, reducing both pesticide waste and the risk of environmental contamination.

Initial Costs: low
Maintenance Cost: low
Technical Assistance: not required - desirable
Other Benefits: certain cultural control practices may also improve soil tilth and fertility.
Other Considerations:

c. Appropriate Physical Controls

Definition: use of physical structures or mechanisms to exclude pests from crops.

Purpose: to prevent or reduce crop losses from pest damage by providing physical barriers such as netting over small fruits and screening in greenhouses or milkhouses. Row covers and fencing are also examples.

Initial Cost: low - high
Maintenance Cost: low
Technical Assistance: not required
Other Benefits:
Other Considerations:

d. Calibrate and Maintain Pesticide Application Equipment

Definition: adjustment of application equipment by properly calibrating applicator nozzles; general maintenance of equipment parts.

Data collection allows farmers to make informed pest management decisions based on knowledge of cropping patterns, current and historical pest problems, pesticide use and soil and physical characteristics of the site.

Purpose: to assure proper pesticide application rates throughout the season. Such calibration should occur minimally at the beginning and middle of each season; ideally, each time pesticides or application rates are changed. Improper calibration of application equipment can result in application rates that are significantly different from the intended rate. Low applications can result in poor pest control, yield losses and costly repeat applications. Rates which are too high waste pesticide, reduce profitability and pose a greater risk of environmental contamination than necessary. Higher than recommended application rates also promote the development of pest resistance to the pesticide, do not achieve better pest control and may result in poor pest control. Since nozzle wear can increase application rates and change spray patterns, calibration rates should be checked during the spray season. Even small, hand operated applicators, such as hand-pump sprayers, should be calibrated each season. Sprayer equipment should be maintained regularly.
Initial Cost: low
Maintenance Cost: low
Technical Assistance: desirable for initial information
Other Benefits: lower costs due to less pesticide use.
Other Considerations:

e. Data Collection
Definition: inventory of field, crop and pest information.
Purpose: to make informed pest management decisions based on knowledge of cropping patterns, current and historical pest problems, pesticide use and soil and physical characteristics of the site. Attention should be paid to the history of crop production, information on soil types, exact acreages of each field, and information about past pest problems, pesticide use and other information for each field. Additionally, particular attention should be directed to areas where mixing, loading and storage activities take place, and physical limitations such as proximity to well heads and surface water, runoff potential, highly permeable or poorly drained soils, and shallow aquifers.
Initial Cost: none
Maintenance Cost: not applicable
Technical Assistance: not required
Other Benefits: may enhance efficiency and reduce cost
Other Considerations:

Proper storage and handling of pesticides avoids contamination risks associated with accidental spills and misuse of pesticides.

f. Pesticide Application Plans and Records
Definition: a procedure for planning and documenting pesticide use that includes specific pesticide selection, application and handling.
Purpose: to assure the proper selection, timing and rates of application to maximize effective and judicious use of pesticides while minimizing unnecessary, excessive or inappropriate uses. Pesticides that are least likely to cause contamination to surface or ground water should be selected. Available models such as NPURG can assist in determining relative risk from a pesticide given crop, soil, water and topographic conditions. If an evaluation indicates a high risk, consideration of slope, foliar coverage and other risk reducing site factors or management practices such as spot spraying or banding will help. Such plans should also account for proper timing of applications. Replace calendar date scheduled applications with crop, pest and weather specific timing to increase effectiveness and reduce risk as well as waste (from, for example, application before a heavy rain or during windy conditions). Record keeping is an important component of any pesticide use, as well as a legal requirement. Knowing what went on which field and how successful it was in obtaining desired results is useful planning data.
Initial Cost: low
Maintenance Cost: low
Technical Assistance: desirable for start-up
Other Benefits: may enhance wildlife habitat; may contribute to farmer health and safety
Other Considerations:

Appropriate biological controls include the use of natural predators to help keep pest populations in check.

g. Protect and Enhance Natural Controls
Definition: The encouragement of naturally-occurring populations of biological control agents such as beneficial mites and certain fungi, worms and wasps.
Purpose: to allow natural controls to contribute to pest management by fostering and not destroying their habitat. Natural enemies can be encouraged by providing shelters or food sources. For example, a sod or weedy cover in an apple orchard provides an overwintering site for predatory mites, which control European red mite and two-spotted spider mite. Selecting pesticides that have minimal effect on beneficials is an important consideration; applying only when needed, and carefully scheduling to have the least effect on beneficials, will also encourage native populations of many biological control organisms.
Initial Cost: none
Maintenance Cost: not applicable
Technical Assistance: desirable for initial information
Other Benefits:
Other Considerations: other management practices, such as burning or mowing of field edges, may diminish beneficial populations.

Convergent Lady Beetle
A. Larva B. Adult

h. Safe Storage, Mixing, Loading and Disposal of Pesticides
Definition: specific management activities for the proper storage and handling of all pesticides.
Purpose: to avoid contamination risks associated with accidental spills and misuse of pesticides. Surface water, ground water and soil can be contaminated in areas where pesticides are stored under inappropriate conditions, or improperly mixed and loaded into application tanks, where equipment is washed and rinsed after application, and where containers are disposed of improperly. Pesticides should be stored in the original containers with the label intact, in a closed and locked building. Such containers should be recycled where possible. The building should be located at least 200 feet down-gradient from any surface water body and 150 feet down-gradient from any wellhead. A secondary containment area, such as a curbed, impermeable pad, is recommended to contain any accidental spills or leaks.

Chemical mixing and storing and equipment rinsing stations should be located at least 300 feet away from aquifer and wellhead areas and open water. Backflow prevention devices should be installed and operating properly. Proper warning signs must be posted, and use of an impervious pad to contain spills and facilitate clean-up is desirable. Of course, such materials should be locked and out of reach of children and animals. Mixing and loading areas should be located to minimize the impact of spills. All transfer of pesticides between containers should be conducted over a spill containment surface designed to intercept, retain and recover spills, leaks and wash water. This can be a specially constructed pad or alternate system such as a portable basin.

Initial Cost: medium - high
Maintenance Cost: low - medium
Technical Assistance: required
Other Benefits: may reduce human health and safety risks, may reduce future liability risks
Other Considerations:

Scouting for pests provides an early detection system that locates and identifies potentially serious pest situations before economic losses occur.

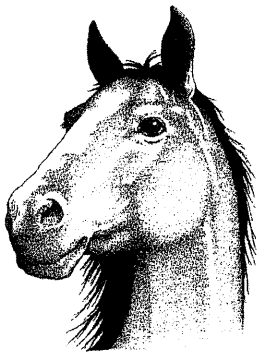
i. Scout for Pests
Definition: crop monitoring for presence of pests.
Purpose: to accurately sample and record pest populations and to recommend and track control actions based on scouting data. Determining how many pests are present on a crop at a point in time requires that the crop be monitored on a regular schedule. Scouting usually involves visual plant or animal inspections and/or environmental monitoring. Scouting provides an early detection system that locates and identifies potentially serious pest situations before economic losses occur. Used with pest action thresholds, it also helps to avoid unnecessary pesticide applications. Samples are collected according to certain protocols. Often, scouting is done by agribusinesses or private consultants.
Initial Cost: low
Maintenance Cost: low - medium
Technical Assistance: desirable for initial information
Other Benefits: may result in higher quality crop
Other Considerations: a consultant may be hired to perform this function and provide pest management advice.

j. Special Handling of Sensitive Areas
Definition: with respect to pesticide application, particular attention to and appropriate management of areas such as wet spots, stream sides and areas near well heads; may include avoiding application entirely.
Purpose: to reduce risk of contamination by identifying sensitive areas and reducing or eliminating pesticide applications there. Use of a map locating such areas is helpful, making sure that the applicator is aware of such locations and any specific requirements. New Jersey Department of Agriculture has useful fact sheets about applying high risk pesticides in high risk areas.
Initial Cost: low
Maintenance Cost: low
Technical Assistance: not required
Other Benefits:
Other Considerations: these sensitive areas should be treated with special handling when applying nutrients also, to avoid leaching of nutrients, especially nitrates, into ground water

Special handling of sensitive areas involves reducing or eliminating pesticide applications to wet spots, stream sides and areas near well heads.

4. Strategies for Livestock Barnyard, Manure and Waste Management
Concerns about potential contamination of surface and ground water from livestock focus on two components of farm animal management. The first is on areas or structures where animals are stabled or held and fed or maintained, plus areas used for processing and storage of product (such as feed), manure, facility wastewater (e.g., milkhouse waste, barn and pen cleaning water, animal washing) and other related runoff. These areas are typically centered around the barnyard and are sometimes referred to as "confined animal facilities". The second is on animal grazing areas, particularly riparian, or stream-side zones (see Section 5, below).

Pollutants from confined animal facilities include nutrients, salts, pathogens and organic solids from manure and bedding. Phosphorus is a concern from milkhouse cleaning. Milk itself, if it gets into a stream and decomposes, uses up oxygen, and bacteria growing in milk transmit diseases downstream. Surface waters can be seriously impacted, causing fish kills, anaerobic conditions, eutrophication and unsuitability for drinking, fishing or swimming. Ground water can be contaminated by nutrients and salts from manure storage areas and related runoff seeping into the ground. Silage wastes are extremely concentrated and can be toxic to plant and animal life if discharged directly. Water running from up-slope through a confined animal facility, as well as rain and snow from roofs, increases the volume of facility runoff.



While most livestock manures are applied to cropland, improperly stored or handled manure can pose a direct threat to water resources. Direct runoff from manure stockpiles, leaking or overflowing storage units and barnyards can contribute nutrients (and pathogens; see below) directly into sensitive areas.

Some common disposal practices not only threaten groundwater but also may be illegal.

It has become commonplace to think of manure as a "waste". **Regarding manures as valuable and cost-saving resources that contribute to farm fertility, rather than as a waste, may lead to improved handling and utilization.** As a resource, manures applied to cropland add nutrients and organic matter to soils. But over-application of manures can contribute to water pollution because excess nutrients that are not taken up by the crop leach or runoff. So "waste management" and "nutrient management" are companions in a comprehensive management system and whole farm plan.

As with pest management and nutrient management above, developing a waste management system is the recommended first step. Such a system will address limiting discharges from confined animal facilities by identifying appropriate systems that collect solids, reduce contaminant concentration and reduce runoff. The system will also address management of stored runoff and accumulated solids by identifying an appropriate waste utilization system. Utilizing wastes to the fullest extent possible is a prudent waste management strategy as well as a potentially effective and cost-efficient nutrient management strategy. A good waste management system will include management practices for storage, handling, treatment and disposal of manure and other agricultural wastes. The aim is to minimize the potential impact of the manure-associated pollutants in both ground and surface waters. A waste management system may consist of one or more components, appropriately suited to the particular operation.

Cost effectiveness is a major concern when choosing appropriate waste management practices for a farm. Livestock operations of all sizes may need to or choose to install storage structures, which can be a costly component of a livestock enterprise. There are numerous manure storage systems available; the choice of the system will depend on the location, type and size of the farm operation, available sites and equipment, and economics.

Consider the variety of products commonly used in households and on farms: paints, solvents, oils, cleaners, wood preservatives, batteries, adhesives and pesticides. In addition, some common disposal practices not only threaten groundwater but also may be illegal.

Small, unusable amounts often wind up spilled, buried, dumped or flushed onto farm property. Minimizing the amounts of these substances used on the farm, along with practicing proper disposal practices, can reduce both health risks and the potential for groundwater contamination. Farmers and their families are generally familiar with the hazards of pesticides commonly used in the farm operation, but they may be less aware of the hazards of other chemicals that make many tasks around the home and farm easier or more efficient.

Improper use of hazardous products may cause toxic health effects. Improper storage may allow chemicals to leak, causing potentially dangerous chemical reactions, toxic health effects or groundwater contamination. Improper disposal allows these dangerous chemicals to enter directly into drinking water through surface water or groundwater.

Your drinking water is least likely to be contaminated by your hazardous wastes if you follow appropriate management procedures or dispose of wastes in any location that is **off your farm site**. However, proper offsite disposal practices are essential to avoid risking contamination that could affect the water supplies and health of others.

A good waste management plan will include management practices for storage, handling, treatment and disposal of agricultural wastes.

The following is a list of the BMPs that are recommended to reduce or eliminate water pollution from barnyards, manures and wastes.

Best Management Practices for Barnyard, Manure and Waste Management

a. Combined Waste Facility(s)
Definition: a structure or system for handling more than one type of waste.
Purpose: to meet environmental protection needs by maximizing efficient waste facility design. For example, milkhouse waste may be added to liquid manure or manure run-off storages that already exist. If a facility is being constructed to handle multiple storages, it must be designed to handle the total volume. Milkhouse wash water will dilute manure which makes it easier to pump. Silage leachate also may be combined with other wastes and manures.
Initial Cost: high
Maintenance Cost: medium
Technical Assistance: required
Other Benefits:
Other Considerations: federal cost share may be available

b. Diversion(s) – grass or other
Definition: a drainageway constructed across a slope to divert surface runoff.
Purpose: to divert water away from barnyard, bunker silage storage areas and other heavy use areas, preventing excessive runoff from carrying organic wastes, sediments and other pollutants to surface water bodies.
Initial Cost: medium - high
Maintenance Cost: low

Technical Assistance: required
Other Benefits: may facilitate barnyard maintenance by reducing surface water
Other Considerations: will require periodic maintenance to remove debris and assure stability.

c. Filter Strip
Definition: a strip or area of vegetation for removing sediment, organic matter and other contaminants from runoff and wastewater.
Purpose: to trap organic materials from concentrated livestock areas by trapping them in the vegetative material of the filter strip. Properly located filter strips may also filter pollutants from controlled overland flow treatment of liquid wastes. Filter strips must be managed and maintained. Saturated filter strips will not function properly.
Initial Cost: medium - high
Maintenance Cost: medium
Technical Assistance: desirable
Other Benefits: may provide wildlife and/or beneficials habitat
Other Considerations: will require maintenance.

Filter strips are areas of vegetation for removing sediment, organic matter and other contaminants from runoff and wastewater.

d. Heavy Use Area Protection(s)
Definition: installation of semi-impervious or hard impervious surfaces in heavily used areas.
Purpose: to prevent degradation and to stabilize areas intensely used by livestock, and to allow for collection, management, and utilization of animal wastes, thereby reducing migration of contaminants to surface water bodies. Grading and surfacing of heavily used areas helps protect them from erosion, trampling, rutting or other deterioration, and helps prevent the collection of pollutants. Concrete or asphalt paving will be necessary if runoff is to be collected for treatment. Compacted gravel or other earth materials may otherwise be sufficient to stabilize the ground surface. Drainage and runoff control devices and filter strips may be components of heavy use area protection.
Initial Cost: medium - high
Maintenance Cost: low
Technical Assistance: desirable
Other Benefits:
Other Considerations:

Manure composting prevents water contamination by biologically treating organic wastes. The by-product of this process is a safe-to-use soil amendment.

e. Manure Composting
Definition: the process of controlled and accelerated aerobic biodegradation and stabilization of livestock manures. (See also, Agricultural Composting, under Nutrient Management)
Purpose: to prevent water contamination by biologically treating organic wastes. The by-product of this process is a safe-to-use soil amendment. Composting stabilizes nutrients and reduces pathogens, making them less likely to leach into surface or ground water. Active composting usually takes place in windrows, static aerated piles or in-vessel structures. Passive "composting", with no active effort to manage or monitor the process, is not an effective or acceptable technique for managing organic wastes high in nitrogen. Successful composting requires careful attention to: site selection and design, selection and carbon : nitrogen ratio of ingredients, moisture, temperature, timing, proper equipment and management.
Initial Cost: medium - high
Maintenance Cost: low
Technical Assistance: required
Other Benefits: compost may be used on farm as a soil amendment/crop nutrient or sold commercially.
Other Considerations: needs careful management; there may be odor concerns; there may be regulatory considerations.

f. Manure Storage Facility(s)
Definition: a permanent, constructed structure for temporary storage of animal manures or other organic agricultural by-products.
Purpose: to reduce contaminant loading to surface waters by intercepting and storing polluted runoff from manure stacking areas, barnyards and feedlots. Such structures may be earthen impoundments (ponds), tanks or other facilities constructed of concrete, wood, steel, plastic or other materials. Tanks are used for liquid and slurry wastes and can be open or covered, inside or outside or beneath slotted floors. Stacking facilities are used for solids and may be open or roofed.
Initial Cost: high
Maintenance Cost: medium
Technical Assistance: required
Other Benefits:
Other Considerations: federal cost share may be available.

g. Manure Storage Field Stacking Area
Definition: a temporary stacking area for solid manures located in a field.
Purpose: to temporarily stockpile manure for at most six months in a location where ground and surface water will be least threatened by contamination. As a component of a waste management plan, such an area is not a substitute for a manure storage structure, but may supplement the storage volume of such a structure. A stacking area allows temporary storage, when weather or field conditions may prevent daily field application, or when waiting to spread until after crop harvest. A well designed, located and managed stacking area may help in the timely application of stored manures, thereby reducing water quality impacts; a poorly designed, sited or maintained area may cause increased water quality problems.
Initial Cost: low - medium
Maintenance Cost: low

Technical Assistance: desirable; may be necessary for establishment
Other Benefits:
Other Considerations: site must be carefully selected to avoid negative impacts to ground water, wetlands and other sensitive areas, and to avoid odor problems with neighbors.

Manure storage facilities reduce contaminant loading to surface water by intercepting and storing polluted runoff from manure stacking areas, barnyards and feedlots.

h. Plan for Manure and Waste Utilization
Definition: using animal manures or other appropriate by-products on land in an environmentally acceptable manner while maintaining or improving soil and plant resources.
Purpose: to reduce transport of sediment and other pollutants to surface waters by applying wastes to fields where they may be incorporated, allowing crops to use nutrients that might otherwise contaminate ground water. As an essential part of a manure management plan, a waste utilization plan needs to be coordinated with a nutrient management plan that determines the amount, form, placement and timing of waste applications to meet agronomic needs. Technical assistance is useful to evaluate field and other conditions to maximize utilization without compromising water quality.
Initial Cost: low
Maintenance Cost: low
Technical Assistance: desirable
Other Benefits:
Other Considerations:

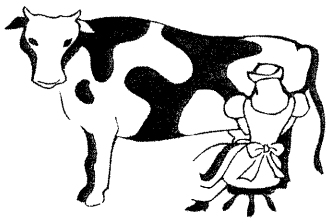
i. Roof Runoff Management(s)

Using animal manures or other appropriate by-products on land in an environmentally acceptable manner; maintains and improves soil and plant resources.

Definition: a facility for collecting, controlling and disposing of runoff water from roofs.
Purpose: to prevent roof runoff water from flowing into or across concentrated waste areas, barnyards, livestock or equipment laneways or other areas where clean roof runoff could wash contaminants into surface or ground waters. Such facilities include erosion-resistant channels or subsurface drains installed along building foundations below eaves, and roof gutters and downspouts.
Initial Cost: low - medium
Maintenance Cost: low
Technical Assistance: not required
Other Benefits: may contribute to animal health and safety
Other Considerations:

j. Sediment Basin(s)
Definition: a depression constructed to collect and store polluted runoff.
Purpose: to slow runoff that may contain animal manures. The basin may be dug or constructed as an earthen embankment. It allows solids to settle before runoff is discharged.
Initial Cost: medium - high
Maintenance Cost: low
Technical Assistance: required
Other Benefits: may control erosion and sediment; may enhance nutrient management
Other Considerations: basin will need periodic cleaning or dredging.

k. Silage Leachate Waste Management
Definition: a planned system for collection, storage and disposal of silage wastes in an environmentally acceptable manner.
Purpose: to collect, store and dispose of silage leachate in a manner that minimizes threats to water resources. Silage leachate is an extremely strong organic waste, using up tremendous amounts of oxygen if released into water bodies or into the soil. The best strategy is to prevent or minimize the formation of silage leachate and to safely store and dispose of if any generated. Proper siting and sizing of silage facilities is the first step. Practices such as harvesting the silage at a moisture content that will not result in excessive silage leachate production, covering the silage pile to eliminate rain infiltration, and installing drains and/or diversions to separate ground water and surface water runoff from the ensiled forage are also important. A properly designed waste collection and storage system may combine silage leachate with other agricultural wastes. Leachate may be land applied, alone in diluted form, or mixed with manure or other wastes according to a waste utilization plan and a nutrient management plan, paying particular attention to application rates.
Initial Cost: high
Maintenance Cost: medium - high
Technical Assistance: required
Other Benefits: may have nutrient value as soil amendment
Other Considerations: federal cost share may be available.



l. Wastewater Treatment System(s)
Definition: a planned system for biological treatment of wastewater generated in milkhouses, typically consisting of a settling tank, distribution system and treatment system.
Purpose: to reduce threats to water quality by biologically treating organic milkhouse waste. In situations where milkhouse waste is not combined with liquid manures, biological systems for treatment will reduce the amount of suspended solids, biological oxygen demand and dissolved nitrogen that may enter the water table. Such systems are not designed to include waste milk or sewage. An underground treatment system is similar to a traditional septic system. In suitable soils, organic matter treatment beds function like leach fields, using organic matter to absorb the waste.

Silage leachate may be land applied, alone in diluted form or mixed with manure or other wastes according to a waste utilization plan and a nutrient management plan, paying particular attention to application rates.

Initial Cost: high
Maintenance Cost: medium
Technical Assistance: required
Other Benefits:
Other Considerations: regular maintenance is required; discharging milkhouse wastes into a municipal sewer should be considered; this practice may not be effective in treating the cleaning agents used to disinfect the milking system; availability and disposal of organic bedding material must be considered.

m. Petroleum Product Storage Facility
Definition: a permanent above ground structure for the storage of petroleum products for use in farm machinery.
Purpose: to reduce contaminant loading to surface and groundwater by preventing spills and leakage. Such structures should be made of non-corrosive materials located above ground so they can be periodically examined for leakage.
Initial Cost: High
Maintenance Cost: Low
Technical Assistance: desirable for siting
Other Benefits:
Other Considerations:

n. Hazardous & Household Waste Management
Definition: proper use and disposal of toxic or pathogenic products as a result of domestic use around the farmstead. This includes but is not limited to sewage, paint, solvents, cleaners, preservatives, batteries, adhesives.
Purpose: to reduce the use and encourage the proper disposal of hazardous wastes. Small amounts of these materials can be hazardous to your health especially when found in the drinking water. Proper management can reduce the potential for toxic effects.
Initial Cost: high
Maintenance Cost: medium
Technical Assistance: desirable
Other Benefits: proper use of chemicals can save money
Other Considerations: small amounts of toxic materials can be deadly to humans and animals.

5. Strategies for Livestock Grazing Management
Water quality concerns related to livestock grazing focus on potential impacts to sensitive areas such as streambanks, wetlands, estuaries, ponds and lakeshores. Sensitive areas also include the riparian zone, an extremely diverse and vital vegetated ecosystem along a water body.
Impacts to ground water, surface water bodies and the riparian zone include sedimentation, and the introduction of nutrients, pathogens and organic solids. Healthy riparian and wetland ecosystems rely, in part, on good management of the immediate areas as well as upland areas. Careful selection of grazing management systems, controlled access and vegetative stabilization practices all should be considered in the development of a grazing and pasture management plan.

A grazing management system needs to accommodate the demands of vegetation, terrain and type of livestock operation. A well-designed system supplies and improves grazing lands and facilities, develops appropriate water sources, and protects streamsides and other sensitive water resources. Well-managed pastures are stable, with suitable plantings and minimal erosion. Uncontrolled access to streams and ponds for watering may seem economical and convenient, but cost-efficient alternatives that avoid negative water quality impacts are available. Pasturing systems (for example, rotational grazing) can be designed to maximize forage opportunities while minimizing stresses on land and water systems.
The following is a list of the BMPs that are recommended to reduce or eliminate water pollution from livestock grazing.

Water quality concerns related to livestock grazing focus on potential impacts to sensitive areas such as streambanks, wetlands, estuaries, ponds, and lake shores.

Best Management Practices for Livestock Grazing Management

a. Alternative Water Supply(s)
Definition: several options for livestock watering that keep animals away from streambanks and riparian zones.
Purpose: to protect streambanks, wetlands and riparian zones from adverse impacts from livestock trampling and waste. For example, a pipeline may be installed to convey water to an upland area. A livestock pond can be excavated or constructed with a dam or embankment. A trough or tank, with devices for water control and wastewater disposal may be installed. This practice may encourage better distribution of livestock over the pasture and grazing may be better controlled. In some cases, the development of a well or spring is a positive alternative.
Initial Cost: low - high
Maintenance Cost: low
Technical Assistance: desirable
Other Benefits:
Other Considerations:

b. Fencing(s)
Definition: enclosing or dividing an area of land with a suitable structure that acts as a barrier to livestock.
Purpose: to keep animals from riparian zones and other sensitive water resources, to prevent wastes from entering water bodies, streambank degradation, compaction of soils and loss of vegetation in riparian zones. As part of a grazing management plan, location of fencing should take into account the fact that fencing can have the effect of concentrating animals in particular areas, such as along the fence line, where paths may become channels that concentrate and accelerate runoff. Some fencing, when installed across the slope, can serve to slow down runoff. Exclusion fencing may be accompanied by installation of properly designed and located livestock crossing across streams.
Initial Cost: high
Maintenance Cost: low
Technical Assistance: desirable
Other Benefits: prevention of livestock access to some areas can preserve desirable habitat and plant species.
Other Considerations: Fencing must be installed properly using appropriate materials to be effective.

c. Pasture Management
Definition: proper treatment and use of pastureland.
Purpose: to minimize adverse impacts to ground and surface water by maintaining or improving the quality and quantity of forage, protecting the soil, conserving water and optimizing the use of fertilizers and pesticides on pasture. Practices include postponing grazing or resting grazing land for a prescribed period, which protects pasture areas with bare ground or little ground cover from eroding. Proper pastureland management will minimize movement of sediments from exposed soils and nutrients from manures to ground and nearby surface waters. As vegetative cover increases, the filtering processes are enhanced, trapping more silt and nutrients. Early spring grazing on wet and soft soils should be avoided. Soil testing and proper application of lime, manures and other nutrients are key to healthy pasture management.
Initial Cost: low
Maintenance Cost: low
Technical Assistance: not required
Other Benefits: may enhance crop health and vigor
Other Considerations:

Fencing keeps animals from riparian zones and other sensitive water resources, preventing wastes from entering water bodies.

d. Plan for Proper Grazing
Definition: A plan for grazing at an intensity that will maintain enough cover to protect the soil and maintain or improve the quantity and quality of desirable vegetation.
Purpose: to reduce transport of sediments and other pollutants from grazed areas by assuring a healthy and stable vegetative cover. Overgrazed pastures result in poor plant cover and plant health, and exposed soils. Deferred grazing and rotational grazing are two practices that encourage proper grazing intensity. Pasturing animals in woodlands should be limited to areas that produce a significant amount of forage that can be harvested without damaging other forest values or creating negative impacts to ground or surface water quality. Wooded areas should be grazed at a rate that maintains adequate cover for soil protection and maintains or enhances the quantity and quality of trees and forage vegetation.
Initial Cost: low
Maintenance Cost: low
Technical Assistance: desirable
Other Benefits: optimum livestock health; improved forage production and quality
Other Considerations: grazing areas may be restricted by eliminating wooded and/or wet areas.

A plan for proper grazing reduces transport of sediments and other pollutants from grazed areas by assuring a healthy and stable vegetative cover.

e. Prescribed Grazing (Planned Grazing System)
Definition: a practice in which two or more grazing units are alternately rested and grazed in a planned sequence.
Purpose: to decrease movement of sediments, nutrients and other substances into downstream waters by increasing the quality and quantity of vegetation in grazed areas. With a planned grazing system (e.g., the "Voisin" method, or intensive rotational grazing) livestock spend less time in each pasture or section of pasture. The vegetation helps trap manure.
Initial Cost: low - medium
Maintenance Cost: medium (for management time)
Technical Assistance: desirable
Other Benefits: may yield economic savings; may increase grazing efficiency; may increase and improve quality and production of forage (including season extension); may improve flexibility in a grazing program; grass-based livestock management may decrease manure handling, decrease fertilizer use, require less machinery; may enhance wildlife habitat
Other Considerations: requires increased management; requires supplying livestock water.

f. Riparian Buffer
Definition: an established area of vegetation located next to and up-gradient of water courses, water bodies and associated wetlands.
Purpose: to maintain or improve surface water quality by removing or buffering the effects of sediment, nutrients, organic matter and some pesticides. As a grazing practice, it is most applicable in areas downslope from pastures. Management practices include protecting or establishing vegetation, installing an up-gradient filter strip, installing livestock exclusion fencing, excluding heavy equipment, and designing and installing proper livestock access and crossings. Buffer width varies depending on soil type and vegetative cover; 35 feet is considered minimum. If possible, native species should be planted/encouraged and fertilizers and pesticides should not be used.
Initial Cost: low - medium
Maintenance Cost: low
Technical Assistance: desirable
Other Benefits: may enhance streambank stabilization; may improve wildlife and aquatic habitat (see also, nutrient management, pest management and erosion and sediment control)

Vegetative stabilization practices which improve or reestablish vegetative cover on pastures reduce erosion into water bodies.

Other Considerations: may reduce amount of active grazing land; may limit livestock access to water or shade.

g. Stream Crossing
Definition: a stabilized area to provide access across a stream for livestock; may be used for farm machinery.
Purpose: to avoid degradation of streams and streambanks from animal trampling and wastes. Properly designed and installed stream crossings minimize bank and streambed erosion, reduce sediment and enhance water quality. A crossing might be graded and stoned or might consist of a constructed bridge or a culvert.
Initial Cost: low - medium
Maintenance Cost: low
Technical Assistance: desirable
Other Benefits: some stream crossings may enhance wildlife habitat
Other Considerations: may require wetlands permit.

h. Vegetative Stabilization
Definition: practices designed to improve or reestablish vegetative cover on pastures.
Purpose: to reduce erosion into water bodies. Such practices include seeding or reseeding stands of adapted forage species, planting vegetation such as grasses, shrubs or trees on highly erodible or critically eroding areas, brush and weed management and prescribed burning.
Initial Cost: low
Maintenance Cost: low
Technical Assistance: desirable
Other Benefits: may enhance habitat
Other Considerations:

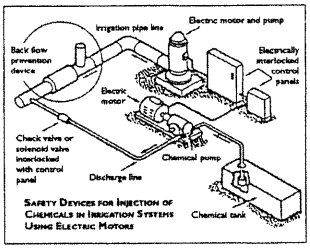
6. Strategies for Irrigation Management
While cranberry producers are the most significant users of irrigation water in New Jersey, other growers irrigate vegetable, fruit, nursery, greenhouse and other specialty crops. While New Jersey typically is blessed with abundant rainfall, irrigation is occasionally necessary. Chemigation, the practice of applying fertilizers and/or pesticides to crops through irrigation systems, is also used by some farmers.

A backflow prevention system prevents chemical backflow to the water source during chemigation.

The concern associated with irrigation is the potential movement of pollutants such as sediments, organic solids, pesticides, metals, microbial organisms, salts and nutrients from the land into ground and surface waters. Ground water is particularly vulnerable where coarse textured soils allow high infiltration.

Proper irrigation management will help minimize discharge of pollutants while also reducing water waste and improving water use efficiency. An irrigation management plan will include components that address irrigation scheduling practices, efficient application, proper utilization of tailwater, drainage and runoff, and backflow prevention. The first step in such a plan is the development of a water budget and water balance for the crop to be irrigated. Technical assistance may be required for these calculations.

The following is a list of the BMPs that are recommended to reduce or eliminate water pollution from crop irrigation.



Best Management Practices for Irrigation
a. Backflow Prevention(s)
Definition: a system to prevent chemical backflow to the water source during chemigation.
Purpose: to prevent contamination of a water source by installing devices that prevent chemicals from entering the irrigation water source in cases when the irrigation pump shuts down. There are several different systems used as backflow preventers such as an air gap, a check valve with vacuum relief and low pressure drain, a double check valve, a reduced pressure principal backflow preventer and an atmospheric vacuum breaker. Factors to consider when selecting a backflow prevention system are the characteristics of the chemical that can backflow, the water source and the geometry of the irrigation system.

Initial Cost: low - medium
Maintenance Cost: low
Technical Assistance: not required
Other Benefits:
Other Considerations:

b. Efficient Irrigation System
Definition: a planned system of crop irrigation that has as one goal the efficient use of water resources. Systems will vary with the type of crop grown, the soils and the topography.
Purpose: to ensure efficient use and distribution, minimize runoff or deep percolation and eliminate soil erosion. Several kinds of systems, properly designed and operated, can be used. Drip or trickle irrigation is a system in which all necessary facilities are installed for efficiently applying water directly to the root zone of plants by means of applicators (e.g. porous tubing or perforated pipe) operated under low pressure. A typical trickle system has a mainline with a control head, leading to laterals placed in the field. Runoff is reduced in this system, but potential hazards to shallow ground water exist if chemigation is used.

A planned system of crop irrigation has as its goal the efficient use of water resources. Systems will vary with the type of crop grown, the soils and the topography.

A sprinkler irrigation system applies water by means of perforated pipes or nozzles operated above ground, under pressure. Proper management of such a system controls runoff and prevents negative impacts to downstream surface waters. Chemigation with this system allows management of nutrients, wastewater and pesticides, but poor management may cause pollution of surface and ground water. Surface and subsurface irrigation systems deliver water by surface means, such as furrows, borders, contour levees or ditches, or by subsurface means. Proper management of such systems will prevent downstream pollution associated with runoff and percolation, including elevated temperatures of receiving waters.

Initial Cost: medium - high
Maintenance Cost: medium
Technical Assistance: not required
Other Benefits: conserves water; enhances efficient delivery of fertilizer and/or pesticides (known as "fertigation")
Other Considerations:

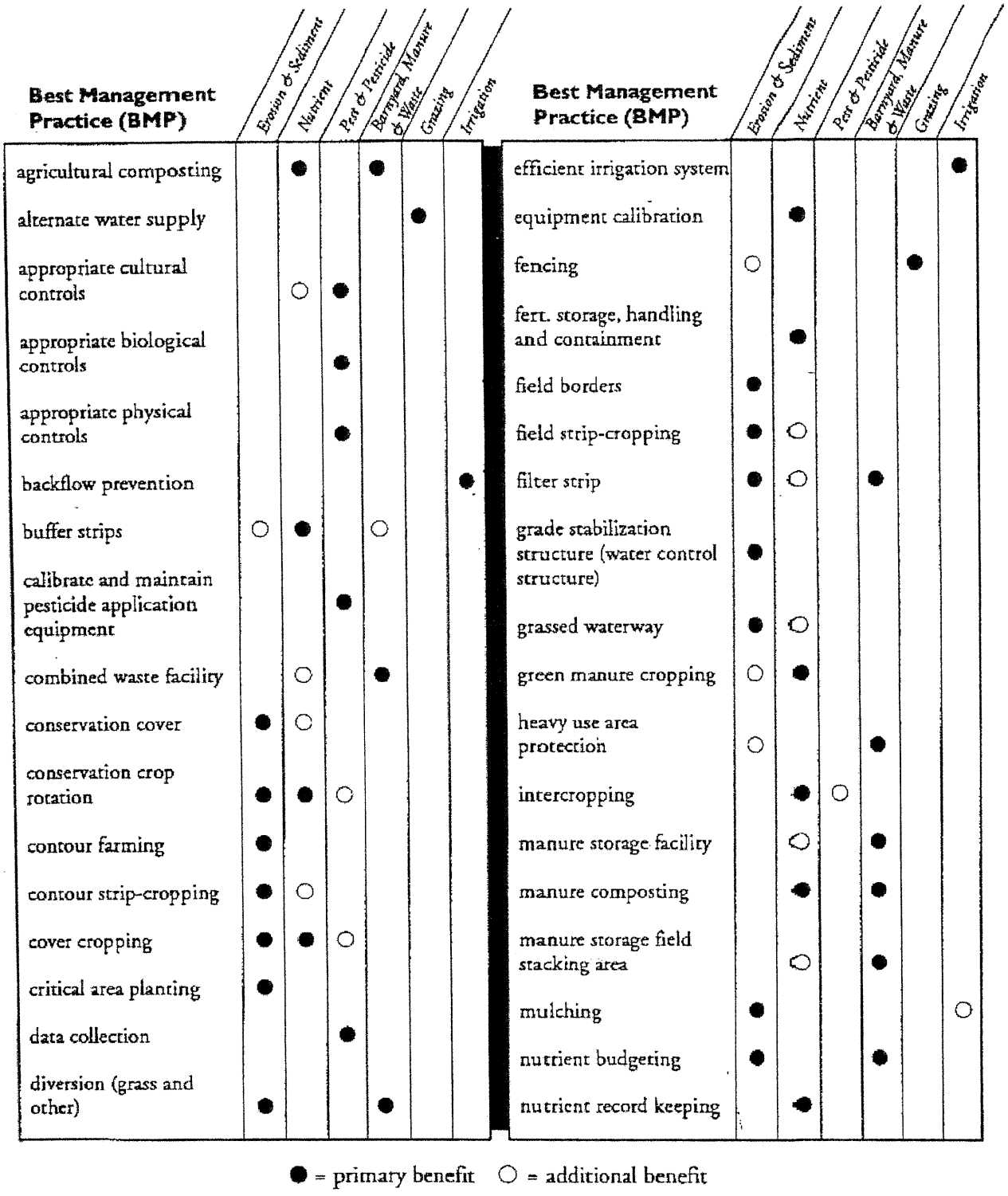
c. **Irrigation Water Management**
Definition: determining and controlling the rate, amount and timing of irrigation water in a planned and efficient manner.
Purpose: to minimize the loss of dissolved substances and sediments from the irrigation system to surface or ground water. Effective use of available irrigation water will promote the desired crop response, control water loss and protect water quality. An irrigation management plan will take into account the various and complex factors that need to be considered. The grower must know how to determine when irrigation water should be applied and how to measure or estimate the amount of water required for each irrigation. Proper scheduling requires consideration of factors such as soil properties, type of crop, its drought sensitivity and status of crop stress, stage of crop development, availability of a water supply and climatic factors such as rainfall and temperature. Proper irrigation also requires the ability to make necessary adjustments to the water stream, rate and time, and management of irrigation runoff.
Initial Cost: low
Maintenance Cost: low
Technical Assistance: required
Other Benefits: conserves water
Other Considerations:

A tailwater recovery system collects, stores and transports irrigation tailwater for reuse in the farm irrigation distribution system.

d. **Tailwater Recovery System(s)**
Definition: a facility to collect, store and transport irrigation tailwater for reuse in the farm irrigation distribution system.
Purpose: to increase water efficiency and reduce potential for contamination by recovering irrigation water for reuse in irrigation or for proper disposal. Using runoff water to provide additional irrigation or to reduce the amount of water diverted increases the efficiency of irrigation water use. In a tailwater recovery facility, sediments and substances attached to them (e.g. salts, metals, soluble nutrients and pesticides) are trapped, thereby decreasing downstream impacts to water quality. Recovered water with high salt or metal content will have to be disposed of in an environmentally safe manner and location.
Initial Cost: high
Maintenance Cost: medium
Technical Assistance: not required
Other Benefits:
Other Considerations:

e. **Water-measuring Device(s)**
Definition: an irrigation water meter, flume, weir or other water-measuring device installed in a pipeline or ditch.
Purpose: to measure the rate of flow and/or application of water and the total amount of water applied to the field with each irrigation. Such information can assist the grower in maximizing the efficiency and effectiveness of irrigation scheduling and equipment and provide data with which to consider modifications.
Initial Cost: low
Maintenance Cost: low
Technical Assistance: not required
Other Benefits: conserves water
Other Considerations:

Summary of BMP Contributions to Farm Management Systems



Summary of BMP Contributions to Farm Management Systems

Best Management Practice (BMP)	Erosion & Sediment	Nutrient	Pest & Pesticide	Barnyard, Manure & Waste	Grazing	Irrigation
outlet or lined waterway	●			○		
pasture management	○	○		○	●	
pasture and hayland planting	●				○	
pesticide application plans and records			●			
plan for irrigation water management						●
plan for proper grazing	○				●	
plan for waste utilization		○		●		
plant tissue testing		●				
prescribed grazing (planned grazing system)	○			○	●	
proper timing and application methods		●				
protect and enhance natural controls		●				
residue management: no-till, strip till, mulch till, ridge till	●	○	○			
riparian buffer	●		○		●	
roof runoff management	○			●		

Best Management Practice (BMP)	Erosion & Sediment	Nutrient	Pest & Pesticide	Barnyard, Manure & Waste	Grazing	Irrigation
safe storage, mixing, loading and disposal of pesticides			●			
scout for pests			●			
sediment basin	●			●		
silage leachate waste management				●		
soil nitrate testing		●				
soil testing		●				
special handling of sensitive areas		○	●			
stream channel stabilization measures	●					
stream crossing	○				●	
tailwater recovery system		○	○			●
tree planting	●					
vegetative stabilization	○				●	
wastewater treatment system				●		
water-measuring device						●
yield data		●				

● = primary benefit ○ = additional benefit