ANIMAL WASTE MANAGEMENT IN UTAH

AN INFORMATION BOOKLET

Sponsored by Utah Departments of Environmental Quality and Agriculture Natural Resources Conservation Service, and USU Cooperative Extension Service

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March 1997

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Please feel free to contact the listed individuals regarding these topics

RULE CHANGES

PERMITTING

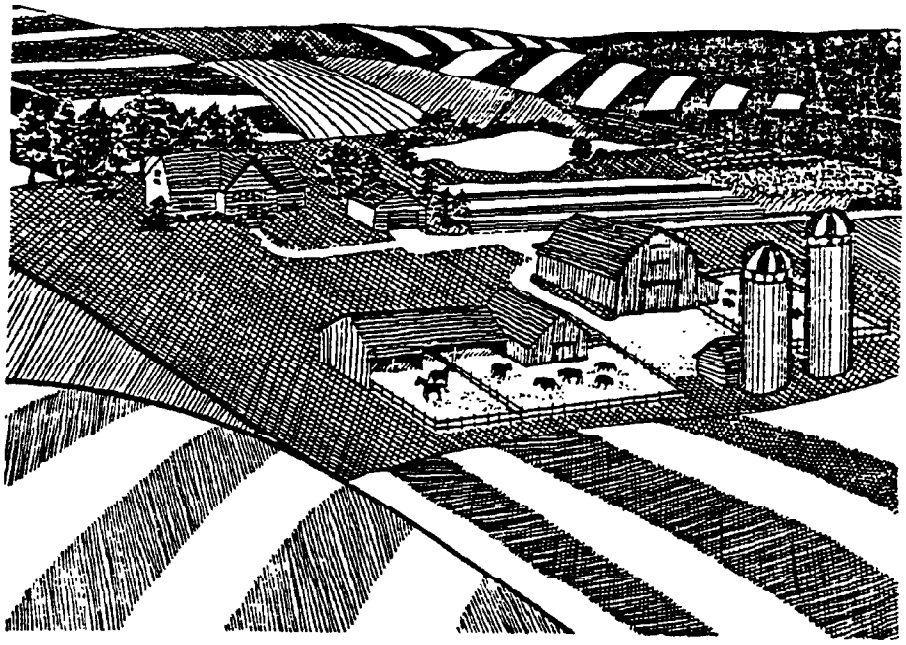
SMALL

ANIMAL WASTE LAGOONS

UTAH SMALL ANAEROBIC ANIMAL WASTE LAGOONS

(For systems under Four Million Gallons Capacity or under 1,000 animal units)

Information Pamphlet



sponsored by

Utah Department of Environmental Quality, Division of Water Quality
U.S. Department of Agriculture, Natural Resources Conservation Service
Utah State University, Cooperative Extension Service

2nd Edition, May 1995

INTRODUCTION

The intent of this pamphlet is to help individual farmers and growers to know the basic requirements to obtain approval to construct small anaerobic animal waste lagoons. This pamphlet also provides brief guidance on design and construction of such lagoons. All details are not covered, but additional sources for help are given. The pamphlet also contains principles which can be used in designing any lagoon system.

The purpose of an anaerobic lagoon is to store livestock waste and provide treatment to reduce organic concentrations and nitrogen content of the waste. There are advantages and disadvantages to all methods of handling waste. You may also consider other waste management system alternatives. All manure handling systems need to be evaluated as an important part of the entire farming or ranching operation.

APPROVALS

Approval of a lagoon system design by the Natural Resource Conservation Service (NRCS), or Division of Water Quality is required, prior to construction of these systems. NRCS approvals are limited to lagoons with less than four million gallons normal operating capacity, or under one thousand animal units, as defined below. Approvals can be obtained by submitting construction drawings with pertinent design, construction specification, operation and maintenance information. In addition, you should contact your local county health department to determine if any local permits are required.

ANIMAL UNITS

One animal unit is equivalent to one slaughter steer. The following table lists other animals:

Animal Type	Beef Cattle	Swine†	Dairy Cattle	Sheep	Turkeys	Ducks	Hens or Broilers	Horses
Equivalent to 1,000 Animal Units	1,000	2,500 over 55 pounds each	700	10,000	55,000	5,000	30,000	500

†If swine are continuously sheltered in an enclosure with a roof and concrete floors, containing all waste until discharge to a lagoon, then 1,000 animal units would equal 1,000,000 pounds of swine, based on steady state live weight.

Early consultation with agencies is encouraged as you plan for such a facility. If the size of the lagoon exceeds four million gallons, and the number of animal units exceeds one thousand, a ground water discharge permit will be needed. Contact DWQ for these permitting details.

GOVERNMENTAL AGENCIES PROVIDING TECHNICAL ASSISTANCE

Technical assistance may be provided by the Natural Resources Conservation Service (NRCS), Utah State University Cooperative Extension Service (USU CES), and DWQ. The NRCS may provide direct planning, design and field construction inspection assistance on a limited basis. Local NRCS offices exist throughout the state. Your local USU CES office can provide access to agents, specialists, and information regarding your options in livestock waste management. Information available includes technical advice, building plans, handbooks, and factsheets. Utah Dept. of Agriculture may also provide some assistance.

COST ESTIMATES

Contact the Natural Resources Conservation Service, USU Cooperative Extension Service, or your consultant for assistance with cost estimates.

REFERENCE LITERATURE

Many sources of literature on the subject are available. The NRCS *Agriculture Waste Management Field Handbook* (AWMFH) is a reference on lagoons and other related subjects. It is written on a technical engineering level. USU CES has resource materials available including: *Illustrated Plans 1993* by the Cooperative Extension Service and *Structures and Environment Handbook*, MWPS-1.

TECHNICAL REQUIREMENTS

The majority of lagoon design requirements can be found in the NRCS *Agricultural Waste Management Field Handbook* (AWMFH) Edition of April 1992. It is important that lagoons be constructed using sound engineering principles. An adequate supply of water must be available. Subsurface investigation of the site by identifying soil types and the depth to the water table must be done. The depth of one soil exploration pit must be at least 4-feet below the final elevation of the lagoon bottom. The seasonal high water table must be at least 2-feet below the bottom of the lagoon. Structural stability and the proposed lagoon dimensions must be evaluated based on these findings.

Complete plans and specifications must be submitted in order to obtain approval. See the conceptual drawings in this pamphlet. Complete plans for a system would expand these drawings to include the location of all essential lagoon structures, materials, equipment, dimensions and elevations on the plans. A separate text of specifications describing the requirements for materials and installation is usually necessary to amplify the plans.

Perhaps the most environmentally sensitive and sometimes time consuming part of designing an animal waste lagoon is the design of an acceptable soil liner. Liners are installed to prevent ground water contamination. Synthetic plastic liners have been used with a high degree of success, however they are difficult and expensive to construct. Sometimes lagoon sites may be located in native soils which are quite impermeable, and further lining is not necessary. However, usually less permeable soils must be hauled to the site, and installed as liners, or bentonite is mixed with soils to meet permeability requirements. Additional information on this subject is given later.

Other Technical Requirements:

1. **Odor Management** :

Odor Management Parameter	Physical Separation from other habitation	Year-round Operating Depth	Number of Lagoon Cells	Volatile Solids Loading Rate (VSLR)
Required	As required by local ordinances	6-feet minimum	One	Varies from 4.5 to 5.5# per 1000 cubic feet. See AWMFH.
Recommended†	1,320-feet; also see AWMFH siting standards	10-feet minimum	Two, depending on size.	25 to 50% reduction‡

† Contact agencies for further information. ‡ Mechanical aeration usage can also help control odors.

2. **Embankments (dikes):**

Embankment Parameters	Interior Slope	Exterior Slope	Top of Dike Width	Compaction	Rip-Rap Wave Shield
Required	3 Horizontal to 1 Vertical	2 Horizontal to 1 Vertical	8-feet	Compaction Plan or NRCS Supervision	None
Recommended†	Same	Same	Same	90% Standard Proctor	For large lagoons with erodible soils

† Contact agencies for further information.

3. **Piping:** Inlet and outlet piping must be specified on the plans. Protection of pipes from freezing and plugging is needed. Protect the liner from erosion. See the concept drawing. Piping should be below the expected elevation of the bottom of the ice in the lagoon.

4. **Miscellaneous:**

(a) A management plan for lagoon operation and maintenance, and the land application of waste must be included with the construction plans. Field application of livestock waste must be shown to balance nutrient application with the soil and plant nutrient uptake rates. Testing of nutrient concentration of the wastewater and soil is important in determining periodic application rates. Contact USU CES or NRCS for assistance with management plans.

(b) Lagoon contents shall not be discharged to surface waters. Lagoons must be located so they do not contaminate drinking water wells, springs or pipelines. Check with your local health department or DWQ for guidance.

(c) Address considerations for safety. This could include fencing or signing as necessary.

(d) Thorough compaction of the lagoon subgrade material should be provided. Field testing assistance for this may be provided by NRCS, or testing laboratories. See the conceptual drawings.

(e) A minimum fifteen years sludge storage volume is required. This volume varies by animal type. See the NRCS AWMFH for the particular rate for each animal type.

(f) Lagoons must be sized to store waste during the nongrowing season, where land application is to be used. This is usually between 120 to 180 days.

5. **Soil Liner Permeability:**

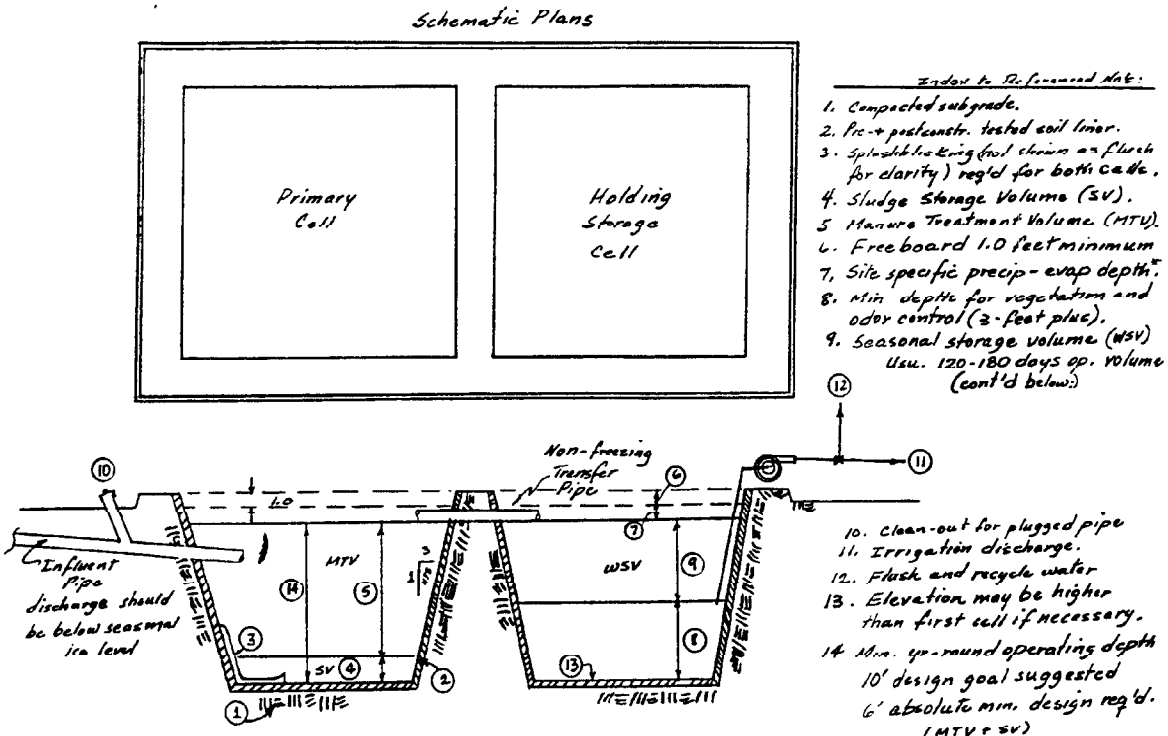
Soil Liner Parameter==>	Permeability	Thickness	Compaction	Soil Liner Material
Required ==>	$K \leq 1 \times 10^{-7}$ cm/s	12-inches minimum	Compaction Plan or NRCS Supervision Recommended	Ensure uniform liner material
Recommended †	Same	Same	Test to attain min. 90% compaction at MC = 2 to 3% > Optimum MC	Run periodic sieve analysis & Atterberg limits to insure homogeneous material

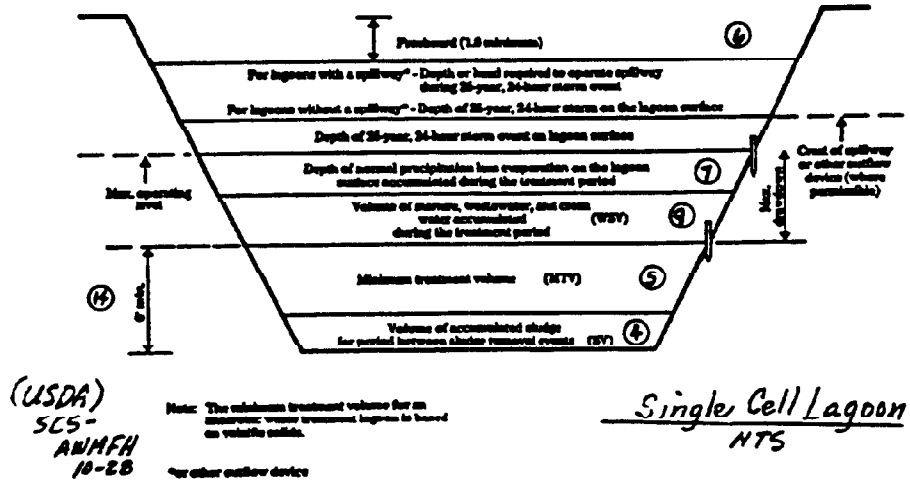
† Contact agencies for further information.

Most lagoons will need to have a synthetic plastic or imported soil liner. Soil liners are the most common. They must be 12-inches thick. A permeability coefficient (K factor), for the soil of 1×10^{-7} cm/sec or less, is required for lagoon liners. A soil laboratory analysis is required to test for the K factor. A thorough liner compaction should attain a minimum of 90% of standard proctor at two to three percent above optimum moisture content. Unified Soil Classification System (USCS) testing should be done. The construction drawings must be accompanied by a description of how lagoon compaction will be achieved.

DRAWINGS:

The following conceptual drawings are provided to help a potential anaerobic lagoon system owner understand some of the major theory of design and requirements of construction drawings prior to retaining professional assistance. Two cell lagoon and one cell lagoon are depicted. Two cell lagoons are recommended for facilities which recycle washwater, depending on size.





ANIMAL WASTE MANURE LAGOON LINERS

using soils

Quality Control and Assurance

SUMMARY OF STEPS

This information is furnished as a summary of an approved quality control and assurance (qa/qc) method. The previous page may be referred to for additional clarification. A ground water permit is required from the Division of Water Quality prior to beginning construction of large manure lagoons. For small lagoons, pre-approval is required from NRCS or DWQ.

Design Quality:

1. Select candidate liner soil or soil-mix substrate.
2. Sample soil at one sample per each acre-foot.
3. Obtain a gradation curve by sieve analysis (ASTM C 136), determine the plasticity index (ASTM D 424), and Unified Soil Classification System (ASTM D 2487) USCS name, for each sample.
4. If appropriate, segregate and eliminate inferior materials from further consideration.
5. Determine the constant head permeability (CHP), on each of the proposed liner materials at the design head, using ASTM D 2434. The maximum dry density standard and the moisture content for the tested material should meet the minimum requirements and be recorded.
6. To qualify for use, the proposed liner CHP must have a maximum coefficient of permeability of 1×10^{-7} centimeters per second or less.
7. Along with the plans and specifications for the project, specify and propose the liner qa/qc requirements to the Division of Water Quality. The liner thickness, compaction, moisture content, plasticity index, gradation curve, the USCS name classification and tolerances should be included. See the table below.

Construction Quality:

1. Liner must be at least 1-foot compacted thickness, and the maximum lift depth not more than one-half the final thickness. The liner must pass all density and moisture content tests on 100' X 100' grids for each lift.

2. Sieve analysis and PI will be tested on a 200' X 200' grid maximum for each lift. If a liner material with an unacceptable PI or USCS name, is discovered, the material should be removed. If it is desired to retain the suspect material, it must be tested by CHP, and be at least equal to or less than the permeability of the design standard. If the material will not meet the minimum CHP requirements, then it must be replaced or enhanced, and retested to meet the requirements.

3. Soil plasticity indexes and gradation should not be less than 15 percent of the number specified. Also, the soil classification name cannot change according to USCS. See the table below:

Liner Quality Parameter	Example Minimum Specification	Example Maximum Testing Tolerance
Maximum Dry Density ASTM D698 or D1557.	95 percent density at 2% above optimum moisture content.	95 percent minimum density for all tests.
Moisture Content per ASTM D698 or D1557.	Target 2% above optimum moisture content.	0 to 5 percent above optimum moisture content.
Unified Soil Classification System (ASTM D2487)	a soil named CH	Soil cannot be classifiable as a different USCS name.
Plasticity Index (PI) (ASTM D424)	40 percent	- 15% = 34 percent minimum
Sieve Analysis (ASTM C136)	Gradation curve	no percentage > 15% change. (E.g. 30% passing - 15% = 25% minimum

4. **Miscellaneous:**

(a) A management plan for lagoon operation and maintenance, and the land application of waste must be included with the construction plans. Field application of livestock waste must be shown to balance nutrient application with the soil and plant nutrient uptake rates. Testing of nutrient concentration of the wastewater and soil is important in determining periodic application rates. Contact USU CES or NRCS for assistance with management plans.

(b) Lagoon contents shall not be discharged to surface waters. Lagoons must be located so they do not contaminate drinking water wells, springs or pipelines. Check with your local health department or DWQ for guidance.

(c) Address considerations for safety. This could include fencing or signing as necessary.

(d) Thorough compaction of the lagoon subgrade material should be provided. Field testing assistance for this may be provided by NRCS, or testing laboratories. See the conceptual drawings.

(e) A minimum fifteen years sludge storage volume is required. This volume varies by animal type. See the NRCS AWMFH for the particular rate for each animal type.

(f) Lagoons must be sized to store waste during the nongrowing season, where land application is to be used. This is usually between 120 to 180 days.

5. **Soil Liner Permeability:**

Soil Liner Parameter==>	Permeability	Thickness	Compaction	Soil Liner Material
Required ==>	$K \leq 1 \times 10^{-7}$ cm/s	12-inches minimum	Compaction Plan or NRCS Supervision Recommended	Ensure uniform liner material
Recommended [†]	Same	Same	Test to attain min. 90% compaction at MC = 2 to 3% > Optimum MC	Run periodic sieve analysis & Atterberg limits to insure homogeneous material

[†] Contact agencies for further information.

Most lagoons will need to have a synthetic plastic or imported soil liner. Soil liners are the most common. They must be 12-inches thick. A permeability coefficient (K factor), for the soil of 1×10^{-7} cm/sec or less, is required for lagoon liners. A soil laboratory analysis is required to test for the K factor. A thorough liner compaction should attain a minimum of 90% of standard proctor at two to three percent above optimum moisture content. Unified Soil Classification System (USCS) testing should be done. The construction drawings must be accompanied by a description of how lagoon compaction will be achieved.

Requirements and Planning Checklist†

1. Evaluate the site and potential methods of waste management.
2. Make or obtain cost estimates.
3. Evaluate if adequate water rights and supply are available to run the proposed operation.
4. If an anaerobic lagoon system will be used, approval from NRCS or DWQ is required, and the requirements apply.

5. Calculate the volume of the lagoon needed and number of animal units.
6. If the volume of the lagoon exceeds four million gallons and the number of animal units exceed one thousand, then a ground water discharge permit is also required.
7. Contact DWQ if a ground water permit is required.
8. Draw a preliminary site sketch and layout.

9. Have a soil and water table investigation done, using a consultant or agencies. See below:

a. One exploration shall be at least 4-feet below the proposed bottom of the lagoon. Additional exploration is recommended.
b. Log soil types and elevation of the seasonal high water table (SHWT).
c. Evaluate findings of the investigation. The soil strata must be hydrogeologically stable and the SHWT must be at least 2-feet below the lagoon bottom.

d. Based on findings, you may need to adjust your decision on the type of waste disposal facility, siting, and dimensions for the facility.
e. Run soil tests to see if native soil is adequate as a liner, or if imported clay or bentonite addition to native soil will be needed to attain a K (permeability) value less than or equal to 1×10^{-7} cm/sec.
f. Based on cost estimates, evaluate whether to install a soil liner or a synthetic liner.

10. Locate and dimension the system, to include the requirements from the AWMFH and this pamphlet, for odor control, embankments, piping, liner permeability, etc.
11. Make draft plans and specifications for the system expanding on the concept drawing in the pamphlet.

a. This should include the location of all essential lagoon structures, materials, equipment, dimensions, and elevations.
b. The specifications should describe the materials and installation requirements needed to complete the plans successfully.

12. If land application of waste nutrients is necessary, a nutrient management plan must be drafted and included with the specifications.

13. Have your draft plans and specifications reviewed and signed by yourself or your consultant prior to submittal to the NRCS or DWQ for approval.
14. The agency will review the plans and will ask for adjustments to the design as needed, or will issue an approval letter or permit to you.

16. Notify your agency contact, of the date you begin construction.
17. Normally, the agency will do some concurrent inspection during construction.
18. Notify the agency of completion of the construction, and request final inspection or certification.
19. Receive final approval of completed construction prior to discharging water into the lagoon system.
20. Make a set of as-built plans, for a record, for you and the agency.

† Contact NRCS, USU CES, your consultant, company sponsor, or DWQ for additional help.

Utah Water Quality Board
Rules taken from *Utah Administrative Code* (UAC):
R317. Environmental Quality, Water Quality
R317-1. Definitions and General Requirements
R317-1-2. General Requirements.

2.1 Water Pollution Prohibited. No person shall discharge wastewater or deposit wastes or other substances in violation of the requirements of these regulations.

2.2 Construction Permit. **No person shall make or construct any device for treatment or discharge of wastewater (including storm sewers), except to an existing sewer system, without first receiving a permit to do so from the Board or its authorized representative, except as provided in R317-1-2.5.** Issuance of such permit shall be construed as approval of plans for the purposes of authorizing release of federal or state funds allocated for planning or construction purposes. Construction permits shall expire one year after date of issuance unless substantial and continuous construction is under way. Upon application, construction permits may be extended on an individual basis provided application for such extension is made prior to the permit expiration date.

2.3 Submission of Plans. Any person desiring a permit as required by R317-1-2.2, shall submit complete plans, specifications, and other pertinent documents covering the proposed construction to the Division for review.

2.4 Review of Plans. The Division shall review said plans and specifications as to their adequacy of design for the intended purpose and shall require such changes as are found necessary to assure compliance with pertinent parts of these regulations.

2.5 **Exceptions**

A. Individual Wastewater Disposal Systems. Construction plans and specifications for individual wastewater disposal systems shall be submitted to the local health authority having jurisdiction and need not be submitted to the Division. Such devices, in any case, shall be constructed in accordance with regulations for individual wastewater disposal systems adopted by the Water Quality Board. Compliance with the regulations shall be determined by an on-site inspection by the appropriate health authority.

B. Small Animal Waste (Manure) Lagoons. Construction plans and specifications for small animal waste lagoons as defined in R317-6 (permitted by rule for ground water permits) need not be submitted to the Division if the design is prepared or certified by the U.S.D.A. Natural Resources Conservation Service (NRCS) in accordance with criteria provided for in the Memorandum of Agreement between the Division and the NRCS, and the construction is inspected by the NRCS. Compliance with these rules shall be determined by on-site inspection by the NRCS.

2.6 Compliance with Water Quality Standards. No person shall discharge wastes into waters of the state except in compliance with these regulations and under circumstances which assure compliance with water quality standards in R317-2.

2.7 Operation of Wastewater Treatment Works. Wastewater treatment works shall be so operated at all times as to produce effluents meeting all requirements of these regulations and otherwise in a manner consistent with adequate protection of public health and welfare. Complete daily records shall be kept of the operation of wastewater treatment works covered under R317-3 on forms approved by the Division and a copy of such records shall be forwarded to the Division at monthly intervals.

Water Quality Board
Rules taken from *Utah Administrative Code* (UAC):
R317. Environmental Quality, Water Quality.
R317-6. Ground Water Quality Protection.

6.2 GROUND WATER DISCHARGE PERMIT BY RULE

A. Except as provided in R317-6-6.2.C, the following facilities are considered to be permitted by rule and are not required to obtain a discharge permit under R317-6-6.1 or comply with R317-6-6.3 through R317-6-6.7, R317-6-6.9 through R317-6-6.11, R317-6-6.13, R317-6-6.16, R317-6-6.17 and R317-6-6.18:

1. facilities with effluent or leachate which has been demonstrated to the satisfaction of the Executive Secretary to conform and will not deviate from the applicable class TDS limits, ground water quality standards, protection levels or other permit limits and which does not contain any contaminant that may present a threat to human health, the environment or its potential beneficial uses of the ground water. The Executive Secretary may require samples to be analyzed for the presence of contaminants before the effluent or leachate discharges directly or indirectly into ground water. If the discharge is by seepage through natural or altered natural materials, the Executive Secretary may require samples of the solution be analyzed for the presence of pollutants before or after seepage;

* * *

[2-16. (Not Shown).]

17. animal feeding operations, as defined in UAC R317-8-3.5(2), which are not located within Zone 1 (100 feet) for wells in a confined aquifer or Zone 2 (250 day time of travel) for wells and springs in unconfined aquifers, in accordance with the Public Drinking Water Rule UAC R309-113, and which meet either of the following criteria:

a. operations which incorporate low volume liquid waste handling systems of less than 4 million gallons capacity,or

b. operations with fewer than the following numbers of animals confined:

i.. 1,000 slaughter and feeder cattle,

ii.. 700 mature dairy cattle, whether milked or dry cows,

iii. 2,500 swine each weighing over 25 kilograms (approximately 55 pounds), for facilities without animal waste collection and treatment systems approved by the Executive Secretary,

iv. 1,000,000 pounds steady state live animal weight of swine for facilities with animal waste collection and treatment systems for which a construction permit has been issued by the Executive Secretary

v. 500 horses,

vi. 10,000 sheep or lambs,

vii. 55,000 turkeys,

viii. 100,000 laying hens or broilers, if the facility has continuous over flow watering,

ix. 30,000 hens or broilers, if the facility has a liquid manure handling system,

x. 5,000 ducks, or

xi. 1,000 animal units:

18. animal feeding operations which do not utilize liquid waste handling systems,

Water Quality Board
Rules Taken from *Utah Administrative Code (UAC)*
R317. Environmental Health. Water Quality.
R317-8. Utah Pollutant Discharge Elimination System (UPDES).

3.5 Concentrated Animal Feeding Operations

(1) Permit required. Concentrated animal feeding operations are point sources subject to the UPDES permit program.

(2) Definitions.

(a) "Animal feeding operation" means a lot or facility, other than an aquatic animal production facility, where the following conditions are met:

1. Animals, other than aquatic animals, have been, are or will be stabled or confined and fed or maintained for a total of forty-five (45) days or more in any twelve (12) month period; and

2. Crops, vegetation forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility; or

3. Two (2) or more animal feeding operations under common ownership if they adjoin each other or if they use a common area or system for the disposal of wastes and meet the conditions of a(1) and (2) above.

L: R317-8-3.5(2

MEMORANDUM OF AGREEMENT

Regarding Animal Waste (Manure) Lagoons

This memorandum is a record of an agreement between the United States Department of Agriculture, Natural Resources Conservation Service (NRCS) formerly known as the Soil Conservation Service, and the Utah Department of Environmental Quality (DEQ).

Current Status

Prior to constructing an animal waste (manure) lagoon within the state of Utah, an owner is required to obtain a construction permit from the Division of Water Quality (DWQ). For larger facilities, a ground water permit may also be necessary. Most small facilities, not requiring ground water permits, are designed under the assistance of NRCS.

Purpose and Method

DWQ and NRCS have a mutual goal of cooperating to enhance the water quality of ground and surface waters. The agencies have a history of cooperation. In order to facilitate the process for approval and construction of small animal waste lagoons, DWQ rules (R317-1-2.5) now provide that construction plans and specifications for small animal waste lagoons, as defined below, need not be submitted to DWQ if the design is prepared or certified by the NRCS in accordance with criteria provided in the Memorandum of Agreement. A small animal waste lagoon is defined as a lagoon, not located within a public drinking water source protection Zone 1 or 2, as defined in R309-113, and which is either less than 4 million gallons capacity or receiving waste from fewer than 1,000 animal units. For example, a 2,000 cow dairy with a lagoon less than 4 million gallons, or a 600 cow dairy with a lagoon over 4 million gallons, are defined as small lagoons.

Facilities located accordingly, of this size and smaller, and so certified need not submit plans to the Division of Water Quality, and will not be required to receive from DWQ a construction permit or a ground water discharge permit prior to construction.

Standards

NRCS and DWQ design standards generally shall apply. Where any conflict exists between the standards, the stricter standard shall apply. The design standards of NRCS are contained in Section IV of the *Field Office Technical Guide* and the *Agricultural Waste Management Field Handbook* issued April 1992. The *Agricultural Waste Management Field Handbook* is the reference for planning, designing, operating and maintaining animal waste systems. DWQ design criteria are contained in the *Utah Anaerobic Animal Waste Lagoon* pamphlet issued January 1994. The NRCS standards are the primary guidance. An additional requirement contained in the pamphlet is that constructed soil liners must be at least one-foot thick, with a laboratory permeability not exceeding 1 X 10^{-6} cm/sec for lagoons 2-feet or less in water depth, and not exceeding 1 X 10^{-7} cm/sec for lagoons greater than 2-feet in water depth.

Any deviation from these standards or questions on undefined criteria will be resolved by consultation between DWQ and NRCS. As updates and changes to these standards occur, NRCS and DWQ will communicate the changes with each other, with in-house personnel, and other agencies involved in agriculture. These agencies include Utah State University, Cooperative Extension Service, Utah Department of Agriculture, Utah Farm Bureau, agricultural associations, and others.

Construction

Periodic inspection of construction will be provided by NRCS. NRCS will also make final inspection on each facility and certify that construction is complete and conforms to requirements.

Reporting

NRCS shall furnish to DWQ a copy of letters to each property owner, which certifies construction completion. A copy of the as-built plans of certified projects will also be provided to DWQ.

Deficiencies

If sites with NRCS certified construction completion are found to have operational or maintenance deficiencies, or if the site owner is not following the waste utilization plan, NRCS will inform the site owner of the actions needed to correct the deficiencies. If necessary actions are not taken within a reasonable time, NRCS will inform DWQ. However, NRCS will inform DWQ immediately if a certified facility has serious deficiencies, such as unauthorized surface water or ground water discharges.

Period

This agreement shall remain in force unless and until it is terminated by either party upon written notice.

We agree to the foregoing MEMORANDUM of AGREEMENT.

Phillip J. Nelson

Phillip J. "Skip" Nelson, Utah State Conservationist
Natural Resources Conservation Service
Date 4-14-95

Dianne R. Nielson

Dianne R. Nielson, Ph.D., Director
Utah Department of Environmental Quality
Date 4-21-95

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WATER SUPPLY

PROTECTION ZONES

HIGHLIGHTS OF THE DRINKING WATER SOURCE PROTECTION RULE

* The effective date of the Drinking Water Source Protection Rule is July 26, 1993.

* Phase-in dates for public water systems are as follows:

Population Served by the System	DWSP Plans due by:
Over 10,000 - 50% of its wells	December 31, 1995
Over 10,000 - 100% of its wells	December 31, 1996
3,300-10,000 - 100% of its wells	December 31, 1997
Less than 3,300 - 100% of its wells	December 31, 1998
Springs and other sources	December 31, 1999

* This rule requires public water systems to designate a responsible person.

* This rule also requires public water systems to submit plans that include: A delineation report; an inventory of potential sources of contamination; a management program to control each potential contamination source; a plan for controlling or prohibiting new potential contamination sources; an implementation schedule; and a contingency plan.

* **Delineation** - Three management zones are delineated so that more intensive management can be focused in the most vulnerable areas. DWSP zones are delineated around each ground-water source according to the following criteria and thresholds:

  * Zone One is a 100-foot fixed radius around the well or margin of the spring called the **accident prevention zone.** Its purpose is to prevent accidents and to protect the annulus of the well or the spring collection area.

  * Zone Two is a 250-day time of travel to the well or spring called the **attenuation zone.** Its purpose is to reduce concentrations of pathogenic microorganisms and some chemicals to levels below maximum contaminant levels (MCLs) before ground water reaches the well or spring.

  * Zone Three is a 15-year time of travel to the well or spring called the **remedial action zone.** Its purpose is to provide protection to the drinking water source and to afford sufficient time for remediation or developing a new source in case of a contamination incident.

An optional, two-mile radius delineation procedure may be used to establish protection areas. This procedure is most appropriate for small, rural systems whose ground-water sources are located in areas where there are few if any potential contamination sources.

* **Inventory** - An inventory of potential contamination sources within each of the DWSP zones is required. Each potential contamination source identified on the inventory is then ranked according to the risk it poses to a particular well or spring.

* **Management program for each potential contamination source** - A management program for each potential contamination source is developed to prevent contamination of the public drinking water source.

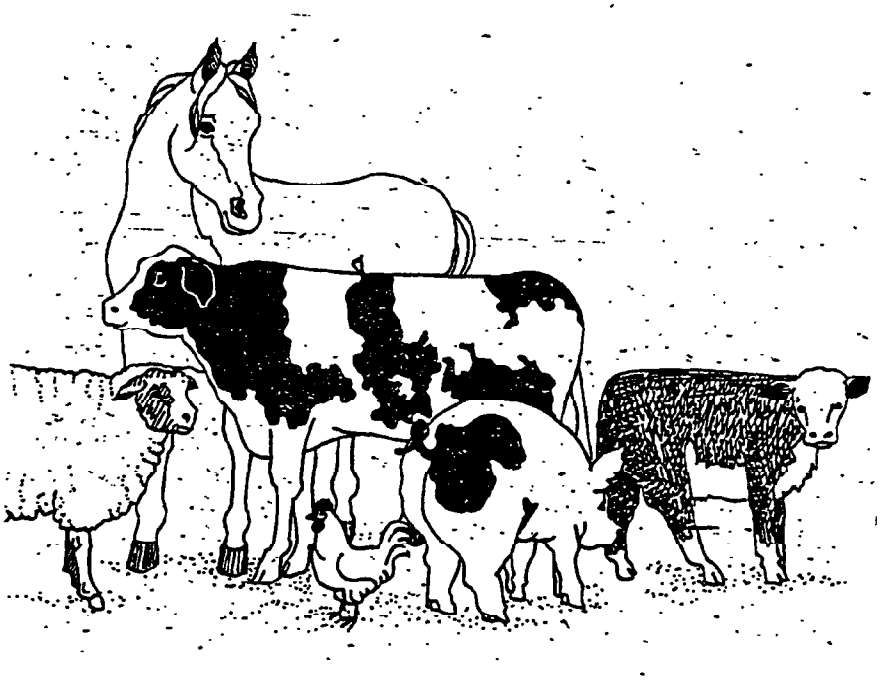
* **Plan for controlling and prohibiting new potential contamination sources** - A plan is required to prohibit or control any new contamination sources that request to locate within established DWSP zones.

* **New wells and springs** - Prior to constructing any new ground-water sources of drinking water each PWS will be required to develop a Preliminary Evaluation Report which demonstrates that a source meets certain requirements. PWSs will be required to submit Preliminary Evaluation Reports and Engineering Plans and Specifications to DDW concurrently; review by DDW will also be conducted concurrently. DDW will not grant plan approval to a PWS in accordance with R309-106-5(2) until requirements are met. Construction standards relating to protection zones and management areas (fencing, diversion channels, sewer lines, etc.) are found in R309-106. After the source is constructed a DWSP Plan shall be developed, submitted, and implemented accordingly.

* **Minimum management requirements for new wells and springs** - PWSs are required to exclude pollution sources from zone one in all aquifer settings and zone two in unconfined aquifer settings. Examples of pollution sources include, but are not limited to, the following: storage facilities that store the liquid forms of extremely hazardous substances, septic tanks, drain fields, class V underground injection wells, landfills, open dumps, landfilling of sludge and septage, manure piles, salt piles, pit privies, drain lines, sewer lines, and animal feeding operations with more than ten animal units.

* **Contingency plans** - A contingency plan for the entire water system is also required from each PWS.

USDA Natural Resources Conservation Service: SLC office 524-5025, or contact your local NRCS field office.
USU Cooperative Extension Service: Logan office 797-3772.
Division of Water Quality: SLC office 538-6067.



FINANCING FACILITIES

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UTAH DEPARTMENT

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State of Utah
DEPARTMENT OF AGRICULTURE
GOVERNOR'S CABINET

350 North Redwood Road
Salt Lake City, Utah 84116-3087
(801) 538-7100
(801) 538-7126 FAX

AGRICULTURAL RESOURCE DEVELOPMENT LOANS

Agricultural Resource Development Loans (ARDL) are available through the Utah Soil Conservation Commission and administered through the Utah Department of Agriculture's Marketing and Enhancement Division. Low-interest loans are made available for a maximum term of 12 years at 3 percent interest with a one-time technical assistance fee of 4 percent.

The ARDL program is a revolving fund with assets of over $20 million and more than $15 million out in loans. Animal waste projects are part of the ARDL portfolio and have addressed waste bunkers for solid and liquid waste, delivery systems for crop utilization and composting projects.

CONTACT: Marlo Cloward, ARDL Administrator
801-538-7176

NON-POINT SOURCE POLLUTION CONTROL

Non-point Source Pollution (NPS) control administered by the Division's Environmental Quality Section is partially funded through a federal grant from the Environmental Quality Agency. Projects are also supported by matching funds from local and state governments and private sources.

The program focuses on watershed management, on-ground conservation and groundwater issues in four priority watersheds: Little Bear River in Cache Valley; Otter Creek in Piute and Sevier Counties: Beaver River in Beaver County: and Chalk Creek in Summit County.

Animal waste management projects are part of the overall focus of the NPS program. Cost-sharing is available on qualifying projects in the identified priority watersheds.

CONTACT: George Hopkin, Environmental Quality Section Chief
(801) 538-7177

LARGE

LAGOON

SYSTEMS

Ground Water Discharge Permits
for
Large Animal Waste Lagoons

The goal of regulation under a ground water discharge permit is to prevent concentrations of contaminants in the ground water from rising above "protection levels" as defined in the Ground Water Protection Regulations, and to provide some ongoing means to demonstrate that unacceptable ground water pollution is not occurring.

Because of the wide range of types of permitted facilities and of site characteristics where they are built, there is a great variety of permit conditions which can accomplish these goals. Large animal waste treatment lagoons will mostly have similar design characteristics and in Utah they will generally be located in similar hydrogeologic settings. The following discussion mainly deals with these "typical" cases, but there is enough flexibility in the ground water permitting program to develop appropriate permit conditions for different cases.

Almost all large animal waste lagoons will have a design that allows some leakage of their contents into the subsurface. Also, the great majority of these facilities in Utah will be located in hydrogeologic settings typical of Great Basin alluvial valleys. The one precedent that has been permitted so far, Circle Four Farms in Milford Valley, Beaver County, is an example of these "typical" conditions. Even within Great Basin valley settings, however, site conditions may vary and different permit requirements may be needed.

To demonstrate that ground water is not being contaminated, discharging lagoons in "typical" settings will use monitor wells to compare ground water quality upgradient and downgradient of the lagoon. At this stage of our experience, we believe that one upgradient well and one downgradient well are adequate for most large animal waste lagoons. More wells may be required in complicated hydrogeologic settings or to resolve an out-of-compliance situation. Monitor wells must be constructed to the standards of the RCRA Tecnical Enforcement Guidance Document, OSWER 9950.1. The wells must be screened in the same uppermost aquifer or saturated zone underlying the lagoon. The screened interval should intercept the upper surface of this aquifer (the water table) but should allow for seasonal variation in the depth to the water table.

To locate the wells properly, ground water flow directions must be estimated. In general, the water table is a surface roughly parallel to the land surface but with subdued relief. Local features such as irrigation ditches, pumping wells, streams or dry washes may influence ground water flow directions locally. A survey of ground water elevations in nearby wells may help to determine flow directions at the lagoon site. In many Utah settings, however, water supply wells are not drilled into the shallow water table aquifer but deeper confined aquifers, and care must be taken in interpreting ground water elevations in wells.

Monitor wells should be located along a line which passes through the center of the lagoon or lagoon system and is parallel to the estimated ground water flow direction. The downgradient well should be located as close as practical to the edge of the lagoon. The upgradient well should be located far enough away to be outside of any influence from the lagoon, but not so far that ground water chemistry is significantly different than that directly under the lagoon. A log should be kept of the materials encountered during well drilling. This may help in interpreting the results of future monitoring. When ground water levels have stabilized after well completion, usually about a week, water elevations should be measured to verify that the estimated flow directions are correct.

For most "typical" sites, ground water monitoring will involve an ongoing comparison of water chemistry between the upgradient and downgradient wells. Under standard permit conditions sampling for compliance monitoring is done quarterly. In order to make this comparison and to set protection levels, background (i.e. upgradient) water chemistry and its natural variability must be understood. To obtain a statistically significant measure of the variability, at least eight independant samples must be collected from the upgradient well over a one-year period. It is in the permittee's interest to have an accurate estimation of natural variability in the ground water, to avoid a false exceedance of protection levels. Accordingly, in situations where there may be high natural variability the permittee may want to collect more than the required eight samples. The permittee should begin collecting these samples as soon as possible so a preliminary determination of background water quality and protection levels can be made for the permit. After completion of background monitoring the permit is revised to incorporate the new background water quality data and new protection levels derived from them.

The intent of ground water monitoring is to reveal whether seepage from the lagoon is affecting ground water quality. The clearest indication of this happening would be a rise in concentrations of the various nitrogen compounds in ground water. Accordingly, both background and regular quarterly monitoring will include nitrate + nitrite, as well as ammonia for anaerobic lagoons. Organic nitrogen levels in ground water would probably also be affected, but analysis for Total Kjeldahl Nitrogen has proven to be inconclusive, probably because organic nitrogen exists at least partially in particulate form.

Seepage from lagoons is likely to have a different composition of major dissolved ions than underlying ground water. Accordingly, background monitoring is done for the eight major ions (sodium, potassium, calcium, magnesium, chloride, sulfate, carbonate and bicarbonate) and also for total dissolved solids (TDS) and phosphorus. Regular quarterly monitoring will include sulfate, chloride and TDS to evaluate possible changes in major ion chemistry.

Ground water sampling should conform to generally accepted methods. DWQ currently requires conformance to the RCRA Technical Enforcement Guidance Document. As a permit condition, permittees are required to develop a sampling and analysis plan. This plan lists sampling, handling, and analysis procedures that the permittee is required to follow for permit compliance monitoring. The plan must list which analytical methods are to be used for each parameter.

To insure ground water samples are representative of aquifer conditions, standing water must be removed from the well casing before any samples are taken. When feasible, three casing volumes of water should be purged from the well before sampling. As part of standard ground water sampling methods, "field parameters" are measured at the time of sampling. These include temperature, pH and specific conductance. Ground water elevation should be measured before any water is purged from the well.

Land application of animal wastes at or below the expected crop nitrogen uptake rate (the agronomic rate) is "permitted by rule" under the Ground Water Protection Regulations and an individual ground water discharge permit is not required. Application above the agronomic rate may require regulation under a permit, with a compliance monitoring program to insure ground water is not being contaminated.

TYPICAL MONITORING PARAMETERS

1. Regular Quarterly Monitoring

   (a) Field Parameters: temperature, specific conductance, pH, ground water elevation

   (b) Laboratory Parameters: nitrate + nitrite, ammonia (for anaerobic lagoons), sulfate, chloride, total dissolved solids

2. Background Monitoring

   At least eight independant samples taken over one year.

   Regular quarterly parameters as in (1) above, plus: sodium, potassium, magnesium, calcium, carbonate, bicarbonate, phosphorus.

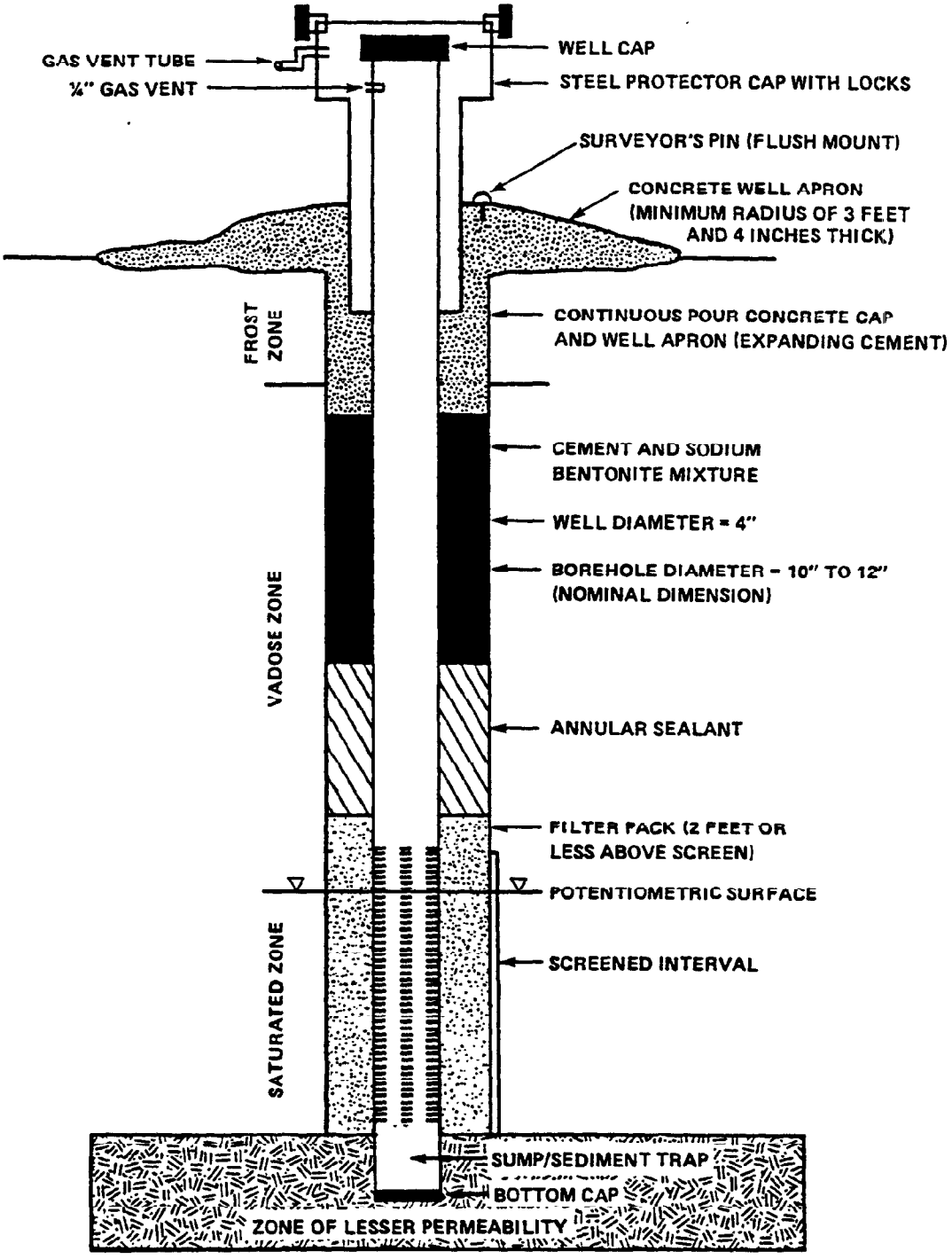
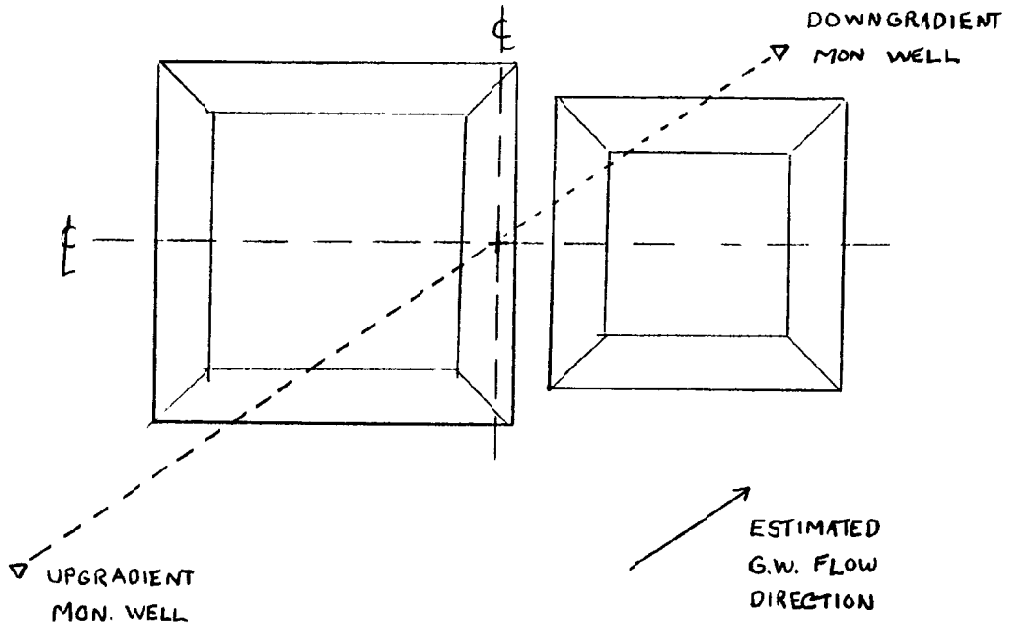
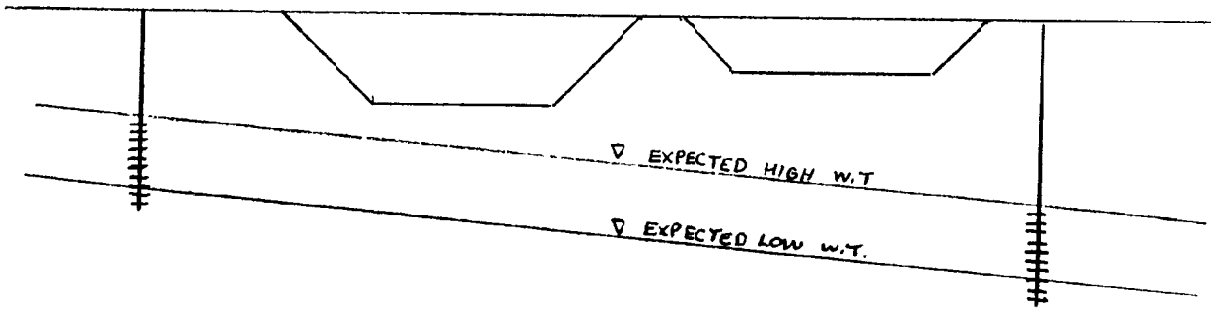


FIGURE 3-1. GENERAL MONITORING WELL – CROSS SECTION



Locating Monitor Wells (Ideal Case)



GROUND WATER CLASS	DESCRIPTION	PROTECTION LEVELS
I	Total Dissolved Solids(TDS) <500 mg/l; no contaminants higher than ground water standards.	1.1 x background concentration for detectable contaminants and TDS. The greater of 0.1 x ground water standard or limit of detection for non-detectible contaminants.
II	TDS between 500 and 3000 mg/l; no contaminants high than ground water standards.	1.25 x background concentration for detectible contaminants and TDS; the greater of 0.25 x ground water standard or limit of detection for non-detectable contaminants.
III	TDS between 3,000 and 10,000 mg/l or one or more contaminants exceeding ground water standards.	1.25 x background for TDS; the greater of 1.5 x background concentration or 0.5 x ground water standard for detectible contaminants; the greater of 0.5 x ground water standard or limit of detection for non-detectible contaminants.
IV	TDS >10,000 mg/l	case-by-case; protective of human health and the environment.

P:\WQ\PERMITS\MNOVAK\WP\TDS3-1.TBL

R317-6-2. Ground Water Quality Standards.

2.1 The following Ground Water Quality Standards as listed in Table I are adopted for protection of ground water quality.

TABLE 1
GROUND WATER QUALITY STANDARDS

Parameter	Milligrams per liter (mg/l) unless noted otherwise and based on analysis of filtered sample except for Mercury and organic compounds
PHYSICAL CHARACTERISTICS	
Color (units)	15.0
Corrosivity (characteristic)	noncorrosive
Odor (threshold number)	3.0
pH (units)	6.5-8.5
INORGANIC CHEMICALS	
Cyanide (free)	0.2
Fluoride	4.0
Nitrate (as N)	10.0
Nitrite (as N)	1.0
Total Nitrate/Nitrite (as N)	10.0
METALS	
Arsenic	0.05
Barium	2.0
Cadmium	0.005
Chromium	0.1
Copper	1.3
Lead	0.015
Mercury	0.002
Selenium	0.05
Silver	0.1
Zinc	5.0
C GANIC CHEMICALS	
Pesticides and PCBs	
Alachlor	0.002
Aldicarb	0.003
Aldicarb sulfone	0.002
Aldicarb sulfoxide	0.004
Atrazine	0.003
Carbofuran	0.04
Chlordane	0.002
Dibromochloropropane	0.0002
2, 4-D	0.07
Endrin	0.002
Ethylene Dibromide	0.00005
Heptachlor	0.0004
Heptachlor epoxide	0.0002
Lindane	0.0002
Methoxychlor	0.04
Polychlorinated Biphenyls	0.0005
Pentachlorophenol	0.001
Toxaphene	0.003
2, 4, 5-TP (Silvex)	0.05

VOLATILE ORGANIC CHEMICALS	
Benzene	0.005
Carbon tetrachloride	0.005
1, 2 - Dichloroethane	0.005
1, 1 - Dichloroethylene	0.007
1, 1, 1 - Trichloroethane	0.200
para - Dichlorobenzene	0.075
o-Dichlorobenzene	0.6
cis-1,2 dichloroethylene	0.07
trans-1,2 dichloroethylene	0.1
1,2 Dichloropropane	0.005
Ethylbenzene	0.7
Monochlorobenzene	0.1
Styrene	0.1
Tetrachloroethylene	0.005
Toluene	1
Trichloroethylene	0.005
Vinyl chloride	0.002
Xylenes (Total)	10
OTHER ORGANIC CHEMICALS	
Trihalomethanes	0.1

RADIONUCLIDES

The following are the maximum contaminant levels for Radium-226 and Radium-228, and gross alpha particle radioactivity, beta particle radioactivity, and photon radioactivity:

Combined Radium-226 and Radium-228	5pCi/l
Gross alpha particle activity, including Radium-226 but excluding Radon and Uranium	15pCi/l
Beta particle and photon radioactivity from man-made radionuclides	The average annual concentration of beta particle and photon radioactivity from man-made radionuclides shall not produce an annual dose equivalent to the total body or any internal organ greater than four millirem/year.

Except for the radionuclides listed below, the concentration of man-made radionuclides causing four millirem total body or organ dose equivalents shall be calculated on the basis of a two liter per day drinking water intake using the 168 hour data listed in "Maximum Permissible Body Burden and Maximum Permissible Concentration Exposure", NBS Handbook 69 as amended August 1962, U.S. Department of Commerce. If two or more radionuclides are present, the sum of their annual dose equivalent to the total body or to any organ shall not exceed four millirem/year.

Average annual concentrations assumed to produce a total body or organ dose of four millirem/year:

Radionuclide	Critical Organ	pCi per liter
Tritium	Total Body	20,000
Strontium-90	Bone Marrow	8

UTAH ANIMAL WASTE MANAGEMENT

Water Quality Protection

Basic Aspects of Water Quality Rules Pertaining to Animal Waste Management

Utah Division of Water Quality, Department of Environmental Quality

Authority:

Federal Clean Water Act
Utah Water Pollution Control Act
Utah Administrative Code, Rule 317

Definitions:

1. *Animal Unit (AU):*

One (1) Animal Unit (AU) = 1 slaughter steer, 0.7 mature dairy cows, or 1,000 lbs. combined weight of all swine (steady state live average weight) housed indoors, with an approved flush disposal system .

2. *Small Animal Waste Lagoon:*

A lagoon with less than Four Million Gallons Capacity, at maximum normal operating depth, or one which services less than 1,000 animal units (AU).

Topics for Discussion:

I. Surface Runoff Control

II. Small Lagoon Approval Requirements

III. Large Animal Waste Lagoons

IV. Animal Waste Lagoons

I. Surface Runoff Control

Must control runoff by keeping the discharge out of the "Waters of the State"

A. Surface runoff in contact with animal waste must be contained.

1. Waters of the State Include:

   a. Irrigation ditches
   b. Rivers & Streams

2. Areas Needing Runoff Control Include:

   a. Barnyards and Feedlots
   b. Manure Stacking
   c. Manure Bunkers
   d. Manure Lagoons & Treatment Facilities
   e. Storage Structures

B. Non-Point Source (NPS) Pollution Control:

1. Voluntary Compliance to Assist in Pollution Reduction
2. Cost Sharing Cooperative Using Federal Funds
3. Can Help Farms With Pollution Problems

C. Limit to required runoff controls

1. When storms exceed 25-year storm of 24-hour duration
2. Examples of 25-year 24-hour storm events:

   a. Provo at KOVO radio station = 2.23-inches of precipitation
   b. Logan at USU campus station = 2.48-inches of precipitation

D. Retaining Water from Storm Events

1. Facilities need to be sized to prevent discharge, by retaining the 25-year storm of 24-hour duration.
2. Facilities are in violation if they discharge from a storm event less than a 25-year storm of 24-hour duration.

II. Small Lagoon Approval Requirements

A. New Lagoon or Animal Wastewater Treatment Systems require approval

B. For a good review of lagoon construction permit requirements, see the new pamphlet entitled: *Utah Small Anaerobic Animal Waste Lagoons.*

C. Manure bunkers (lined with concrete) and storage tanks do not need a permit if NRCS provides owner assistance.

D. Nutrient Managment Plan needs approval. Must be at agronomic rate.

III. Large Animal Waste Lagoons

A Ground Water Discharge Permit Regulations:

All New LARGE Animal Waste Lagoons (> 4 Million Gallons and >1,000 AU) Need a Ground Water Discharge Permit **PRIOR** to construction.

B. Requirements Include:

a. Ground water monitoring wells (usually).

b. Liner Quality Assurance & Control Plan.

c. Requirements Pertaining to Small Lagoons.

d. Thirty-day public comment period.

IV. Animal Waste Lagoons

A. Animal Waste Lagoon Systems
The new lagoon pamphlet details how to obtain a construction permit

B. Main concerns in lagoon design

1. Control of seepage into ground water
2. Surface water discharges
3. Structural failure
4. Storm Event containment

C. Four Common Lagoon Types: *Aerobic, Aerated, Anaerobic, and Wetland Lagoons*

1. Aerobic Lagoons
   a. Most common type of lagoon for municipal wastes.
   b. 3-foot minimum to 6-foot maximum year-round operating depth range

2. Aerated Lagoons
   a. Requires mechanical blowers or agitators
   b. Have an Electrical Power Operating Cost but are very volume/area efficient

3. Anaerobic Lagoons
   a. Most popular for new lagoon construction
   b. 6-foot minimum year-round operating depth
   c. New information pamphlet available

4. Created Wetland Lagoons
   a. Currently considered experimental
   b. No discharge allowed
   c. Natural Wetlands must not be polluted
   d. Guidance Pamphlet planned to be issued late 1995

D. Lagoon Liners Required

1. All lagoons need to be lined to impede ground water infiltration (seepage)
2. Maximum allowed **permeability** (hydraulic conductivity) is:
   a. 1×10^{-7} centimeter/second, sometimes a tighter liner may be required.
   b. 1×10^{-6} cm/sec. for lagoons less than 2-feet deep.

IV. Animal Waste Lagoons (cont'd)

E. Liner Types:

1. Native clay soils (if available)
2. Imported clays
3. Augmented clays (bentonite)
4. Asphalt paving
5. Synthetic liners

If you have any questions on this information, please feel free to contact DWQ, USU Extension Service, or NRCS.

swmconf.ot

TOTAL

WASTE MANAGEMENT

SYSTEM

PLANNING

CONSIDERATIONS IN PLANNING AND DESIGNING AGRICULTURAL WASTE MANAGEMENT SYSTEMS

May 1995

Natural Resources Conservation Service provides assistance to landowners regarding agricultural waste management issues using a systems approach. A total system accounts for all the waste associated with an agricultural enterprise throughout the year from production to utilization.

Definitions

Agricultural Waste Management System: A system in which when all the necessary conservation practice components are installed and managed such that liquid and solid waste, including storm runoff from concentrated waste areas, does not degrade the soil, water, air, plant and animal resources.

Agricultural Waste: Wastes associated with the production and processing of food and fiber. These wastes normally include animal manure, crop residues, dead animals, and agricultural chemicals, fertilizers and pesticides.

Agricultural Waste Management System Planning Process

For an orderly approach to planning, the Natural Resources Conservation Service uses a 9 step planning process which consists of:

1. Problem
2. Objectives
3. Inventory
4. Analyze data
5. Alternatives
6. Evaluate Alternatives
7. Decision making
8. Implementation
9. Follow up

Problem

1. Identify problems (existing and potential)

2. Impacts of federal, state and local laws

Objectives

1. Enterprise

2. Waste utilization

3. Management

Inventory (Livestock Waste)

1. Number, type, and weight of animals (expansion)

2. Type and volume of wastes produced

3. Soils, geology data

4. Topography

5. Existing facilities and locations (barn, corrals, free-stalls, pipelines, utilities, waste storage and disposal areas).

6. Present waste handling procedures

7. Crops, yields, acres

8. Level of management

9. Adjacent land use

10. Existing and/or potential sources of pollution

    a. Corrals and feedlots

    b. Surface runoff, drains and roof areas

    c. Milking parlor waste water

    d. Manure storage areas

    e. Manure disposal areas

    f. Livestock watering facilities

Analysis of Resource Data

1. Existing pollution and/or environmental concerns (soil, water, animals, plants, air, visual).

    a. Bacteria

    b. Nutrients

c. Organic matter

2. Potential pollution and/or environmental concerns

3. Functions of animal waste management systems.

a. Production - amount and nature of the waste

Kind, consistency, volume, location and timing (seasonal?)
Minimize production of waste
Leaking waterers
Milking center wash water
Runoff - keep clean water clean
Equipment, labor, costs
Future expansion

b. Collection - capturing and gathering of waste

Method and frequency
Type and location of collection point(s)
Equipment, labor, costs

c. Storage - Temporary containment of waste to facilitate and control timing of the system's operation

Duration determined by the waste utilization schedule, i.e., weather, field conditions, crop
Type, size, location
Costs

d. Treatment - reduces pollution potential (physical, biological, chemical)

Overcomes shortcoming of other system functions
Too much production
Limited opportunity for utilization
Waste characteristics before and after treatment
Type, size, location
Equipment, labor, costs

e. Transfer - Movement of waste through the system

Collection to storage or treatment or utilization
Storage to treatment or utilization
Treatment to storage or utilization

Method and frequency
Distance
Equipment, labor, costs

f. Utilization - Recycle and reuse of wastes

Land application
Compost
Bedding
Animal feed
Energy production

Location(s)
Method
Timing, rates and volumes
Equipment, labor, costs

Alternatives

1. To control or reduce pollution and environmental concerns.

   a. Limit availability

   b. Prevent detachment

   c. Interrupt transport

2. Types of controls

   a. Management

   b. Vegetative

   c. Structural

3. Method or methods for handling wastes

   a. Solid

   b. Slurry

   c. Liquid

4. Production

   a. Diversions

   b. Roof runoff controls (gutters and downspouts)

   c. Number of animals

5. Collection

   a. Alley scrapers

   b. Flush alleys

   c. Manure pack

d. Gutters

6. Storage

a. Ponds

b. Tanks

c. Dry stack

7. Treatment

a. Lagoons

b. Composters

c. Solid separators

d. Settling basins

e. Oxidation ditches

f. Constructed wetlands

8. Transfer

a. Pipelines

b. Hauling equipment

c. Gutters

d. Pumps

e. Push-off ramps

9. Utilization

a. Spreader

b. Irrigation System

c. Commercial sale

d. Refeeding

e. Bedding

f. Energy generation

Evaluation of Alternatives

1. Handling methods - method or combination of methods for handling waste.

2. System - combination of practices that can be used to make a complete waste management system. (Management, vegetative, and structural). Production collection, storage, treatment, transfer and utilization.

3. Practice - for a given practice what are the options. Example, holding pond - depth vs surface area dimensions, lining provisions.

4. Preliminary cost estimate (construction and O&M).

5. Labor demands and timing.

6. Impacts to the environment (existing and potential concerns).

7. Acceptability

Decision Making and Plan Write-up

1. Waste management system components.

2. Waste utilization procedures (manure spreading schedule, rates, etc.).

3. Prepare inspection plan and update O&M plan as appropriate.

4. Inspection of construction operations

5. Final certification

References

Agricultural Waste Management Field Handbook

Practice Standards (Field Office Technical Guide)

MOA between Utah Department of Environmental Quality and Utah Natural Resources Conservation Service

Prepared by:

G. Arthur Shoemaker
State Conservation Engineer
Natural Resources Conservation Service