Chapter IX
WASTEWATER POND (LAGOON)

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EDITORIAL COMMENTS

This chapter needs to be revised to in order to be good guidance for sizing and constructing small domestic lagoons. Shortcomings that need to be addressed include:

1. Procedure for sizing lagoons based on average flow rather than peak flow as used for underground wastewater systems. When flow is based on 75 gallons per person per day (gpcd), lagoons are often been oversized. Homes rarely have two people per bedroom for extended times. Flow per person decreases the more people there are in a home, thus with more than 6 people the flow is typically under 50 gpcd.
2. Discuss essential factors to achieve lagoons that maintain water levels of 3 to 5 feet depth including: wastewater flow, construction, compaction, and management.
3. Discuss design and construction practices that give substantially less seepages loss than 1/4 inch per day (maximum specified by KDHE). Preferably seepage should be no more than 1/8 inch per day. The protocol addresses repairing a leaky lagoon but a comparable discussion about constructing a lagoon so it does not leak too much is needed.
4. Expand guidelines for maintenance needs including suggested times for specific tasks.
5. Recommended controls of troublesome weeds including duck weed and other floating weeds and also cattails and other rooted weeds.
6. How to care for and manage the lagoon to minimize sludge accumulation and thus extend the time until sludge removal will be needed. Develop a protocol for evaluating sludge accumulation and guidance for removal of accumulated sludge.
7. Expand discussion about using a septic tank ahead of the lagoon; add advantages and limitations.
8. Incorporate the KDHE guidance materials regarding *Intermediate Lagoon Sizes* so this chapter seamlessly covers all lagoons up to average flows of 2500 gpd.
9. Things to be aware of and to look for that would indicate that the source includes other than domestic type flows.
10. Protocols and data forms should be formatted similar to those in other chapters.

INTRODUCTION

A septic tank followed by an in-ground soil absorption system is the preferred onsite wastewater treatment system when site and soil conditions are suitable. However, when the soil is too impermeable for an in-ground system and there is adequate area, a lagoon may be an option. Soils with high clay; poor drainage; seasonal perched water table; or platy, very weak, or massive structure are typically poorly suited to soil absorption but often well suited to lagoons.

Proliferation of single-family wastewater lagoons within subdivisions of many homes should be avoided when other options are available. Multiple lots in close proximity with soil poorly suited to traditional in-ground systems may be suitable to other wastewater treatment options. A cluster system consisting of collection, pretreatment, and soil dispersal on a dedicated site should be considered as discussed in Assessing Wastewater Options for Small Communities (1999).

This chapter of the Environmental Health Handbook has been prepared to provide guidelines for the design, construction, operation, maintenance, and repair of small (less than 2500 gallons per day) nondischarging wastewater lagoons. Guidelines in this chapter are intended primarily for private wastewater facilities for individual homes. However, guidance for wastewater treatment lagoons may be adapted to serve schools; institutions; and businesses such as motels, restaurants, camps, and mobile-home parks that have domestic type wastewater.

Any system receiving industrial wastewater including shop floor drains, must to be referred to the Kansas Department of Health and Environment. Guidance provided here must be considered to be in development, thus, the user needs to search out the most current guidance.

KDHE AND LOCAL JURISDICTION RESPONSIBILITIES

The Kansas Department of Health and Environment has defined their responsibility for permitting wastewater lagoon systems which:

11) Discharge to the surface.

12) Receive more than 2500 gallons per day.

13) Receive any amount of industrial wastewater discharge.

14) Serve wastewater systems owned by local government or other public entity.

Authority to regulate wastewater lagoons is granted to local government under K.S.A. 19-3701 et seq.; K.S.A. 19-101a; K.S.A. 12-3302 or 3303; and K.A.R. 28-5-6. Local governments may regulate wastewater treatment lagoons if all conditions specified in paragraphs 1 through 3 shown below are satisfied.

1. Local governments, which have a KDHE approved sanitary code, have authority and may regulate small wastewater lagoons which receive domestic wastewater.. Domestic sewage consists of wastewater originating primarily from kitchen, bathroom and laundry sources, including waste from food preparation, dishwashing, garbage-grinding, toilets, baths, showers, laundry, and sinks.
2. Local governments may regulate wastewater lagoons to which less than 2500 gallons per day (gpd) of domestic type sewage is discharged. Wastewater lagoons receiving more than 2500 gpd of sewage (daily average) generally must obtain a permit from the Kansas Department of Health and Environment.
3. All discharging lagoons require a permit from KDHE. Local governments may regulate only nondischarging lagoons.

If the local authority chooses to exercise the option to permit and regulate the lagoon, local authority will approve plans, conduct inspections during construction, conduct periodic inspections of the property, and take enforcement action when necessary to maintain compliance with local government requirements for wastewater lagoons regulated by that local authority. The Bureau of Water will provide technical materials and other information as available to help support local government. The KDHE District Offices will provide assistance and advice, including onsite training in inspection techniques or backup inspections, as requested by the local entity. If the local unit of government objects to the proposed project, it should state the objections in writing to both the owner and KDHE to assure intergovernmental coordination.

The local authority should also inform the customer that if a city or regional wastewater collection system becomes available, within 400 to 1500 feet of the location, the local authority and/or KDHE may require connection to the central collection system and proper abandonment of the local wastewater treatment system.

If the local authority desires assistance from the Kansas Department of Health and Environment, the local authority should initially contact the appropriate District Office (District Environmental Administrator, District LEPP or District water program staff) or the Topeka LEPP program staff person.

If the local unit of government does not object to the proposed project but does not choose to exercise the option to permit and regulate the lagoon, they must refer the owner to the appropriate KDHE District Office and notify the district office. KDHE will inform the owner that the local authority has chosen not to accept local regulatory authority for the wastewater system (or for this particular lagoon, whichever is the case), and therefore, the customer is subject to state regulation. The District Environmental Administrator (DEA) or designated District staff will take appropriate action. State law requires:

a. Wastewater treatment facility plans and specifications prepared by a Kansas licensed engineer.
b. Payment of an annual wastewater permit fee. The first year's annual fee is due with the plans and specifications.
c. Operation of wastewater treatment facility by a trained and KDHE certified operator. This requires application for and passing of a certification examination, periodic continuing education, and payment of a bi-annual fee to maintain the operator certificate.

If a state permit is issued, the appropriate KDHE, District Office water program personnel shall:

a. Conduct the appropriate site inspection and provide a written report for both the Topeka and the District office files.
b. Provide review of plans and specifications and technical assistance for the owner as needed.
c. Develop the draft permit and submit the draft permit to KDHE/BOW/TSS.
d. Provide other assistance as needed to issue and support the permit, including inspection of the lagoon during and immediately after construction and follow-up inspections as needed to assure compliance with the permit and Kansas law.

The Bureau of Water shall:

a. Provide a standard format for permits to be developed by the District offices.
b. Give public notice of the draft permit application.
c. Assist the District Office with resolution of public notice comments.
d. Provide notice to the Permitee of the requirement to apply for annual permit renewal.
e. Collect the annual wastewater permit fee and issue the permits.

CONSIDERATIONS FOR LAGOON SITING

Due to space requirements and access for maintenance and repair, many factors must be considered in deciding on a lagoon for sewage treatment. These factors include:

1) Adequate space - the foot print area required by a lagoon may be 10,000 square feet or more, for an individual home and potentially larger for a business. In additional to the initial lagoon location, planning for a replacement must also be considered.

2) Separation and setback - distances from property lines, wells, surface water and drainage, easements, buildings, and flood plain are determined by local code and state minimum standards. See Table IV-7 in Chapter IV for minimum required and recommended setback.

3) Separation of tall vegetation - the site should have adequate separation distances from trees and other vegetation which could impair functioning, especially shading, air flow restriction, and leaf drop.

4) Ease of maintenance - routine care of berms, fences, and vegetation is required on a regular schedule.

5) Site conditions - slope of land and restrictive soil conditions within 5 feet of the ground surface. A high water table or a saturated zone near ground surface may prohibit a lagoon.

6) Adequate area - a minimum lot size of 3 to 5 acres is typically needed to accommodate a private well and lagoon with all of the required setback and/or appropriate separation distances.

SITE EVALUATION

See Chapter IV of this handbook for additional discussion about site and soil evaluation. Conducting a proper site evaluation for a lagoon includes the following specific steps:

1) Determine the appropriate local agency responsible for facility permitting. In most cases this would be the sanitarian in the local health department or planning and zoning office.

2) Conduct a preliminary site evaluation to select the most suitable location. See Protocol, Site Evaluation for Onsite Wastewater Systems in Chapter IV. Note all conditions which could adversely affect location and construction, such as private or public water wells or pipelines, sandy or rocky soil, utilities, easements, property lines, topography, and geology. Utilize all available site-specific information, such as site history, soil profiles, and county soil survey book available from the local USDA, NRCS office.

3) Evaluate the potential effects of unexpected overflow or release and resultant contamination to surrounding property and environment.

4) Based on soil profile evaluation obtain the estimated design loading rate (DLR) using Table IV-4 in Chapter IV. Soil textures and structures with no suitable DLR are frequently acceptable for a wastewater lagoon with adequate compaction. Fine textured soils with a DLR of 0.2 gallons per day, especially in eastern Kansas, may be suitable for lagoons.

5) Compare the results with the permeability of the soil on the site in the SCS/NRCS county soil survey to see if there is general agreement. Large discrepancies in results should be reconciled by further testing done by someone experienced with soil texture, structure, and permeability.

A lagoon location that is down slope and down wind from the source is preferred so sewage will flow by gravity at the correct slope. The site should be downwind of the residence or facility to minimize possible nuisance conditions and such as odor, in Kansas usually to the east or northeast. Only rarely do objectionable odors occur from a properly operated and maintained lagoon. However, odors may be noticed for a brief period in the spring or fall when a stratified lagoon turns over or when there are several consecutive overcast days.

Separation distances from surface water, wells, property lines, and public water lines must be in compliance with local codes and/or KDHE Bulletin 4-2 or Chapter IV, Table IV-7 in this handbook. The site for a lagoon should be 100 feet or more from the house and property boundaries, 50 feet from any surface water, 30 feet from potable water lines, outside areas subject to flooding or the100 year flood plain, and away from utility easements.

A detailed site plan showing all physical features, surface and buried, and contour elevations will be a great help to locate and design a wastewater lagoon. The bottom of the lagoon should be at least 4 feet above highest groundwater level or other limiting condition.

To assure adequate drainage and to avoid the risk of a backup in the residence or facility, the top of a lagoon berm should be below the lowest drain or clean out.

Sometimes the lagoon must be located upgrade from the house which necessitates a pump tank and pump. Pumps are subject to failure, require maintenance, and will increase costs. When pumping is required, it is advisable to add a septic tank and use an effluent pump. To assure good hydraulic operation have the system designed by an experienced person. Adherence to hydraulic principals including pump selection and backflow prevention from the lagoon are essential.

When the site evaluation indicates a lagoon is the most appropriate and acceptable option, sizing, design, specifications, and construction plans are the next step.

SIZING THE LAGOON

The primary objectives of sizing the lagoon is to provide adequate depth, wastewater treatment and prevent overflow. Optimum lagoon water depth is 5 feet measured from the bottom of the lagoon to the water surface. Satisfactory operation occurs with water depths of 3 to 5 feet. Water level may drop as low as 2½ feet for short periods without adversely affecting the lagoon's operation. However, sunlight may penetrate a shallower depth and plant growth across the lagoon bottom with depths less than 2½ feet will impair a lagoon's operation. Additional water should be added to maintain at least 3 feet of depth at all times.

Estimating wastewater retention in a lagoon is achieved by identifying the amount of wastewater flow minus the net water loss. Water loss occurs through evaporation and seepage.

Evaporation plus seepage can range up to 14 feet annual loss in southwestern Kansas to 10 feet or less in eastern Kansas. Seepage varies with the soil and compaction from very low to the maximum allowable of 0.25 inches per day (few inches to 7.6 feet per year). Precipitation and evaporation data is collected only at certain sites across the state and has been extrapolated to include areas where data were not available.

Wastewater flow for sizing a lagoon is based on average flow rather than peak flow that is used for sizing an inground wastewater system. Lagoons easily handle temporary high flows with a rise in water level which results in an increase in losses. Conversely, inground systems must be able to handle these peak flows to avoid a malfunction or failure.

Actual water records, when available, are a preferable source of determining expected average flow. Factors to consider when estimating wastewater flow to size lagoon:

1) Wastewater design flows are based on average number of persons expected to reside in the house. This is certainly less than full occupancy of 2 persons per number of bedrooms. Use a wastewater flow rate of typically 40 to 50 gallons per person per day. Use 2 to 5 person average occupancy for a 3 bedroom house with corresponding flows of 125 to 250 gpd.

2) Assess lifestyle factors for a deviation above or below the average wastewater flow. For example, a couple living in a 4-bedroom home might better utilize a lagoon dug deeper to a smaller base, requiring less water to maintain adeqate depth. If needed later, a second cell could be added that would achieve maximum capacity sizing. An overflow pipe between the two cells that maintained 5 feet of water in the first cell before overflowing into the second cell could be used. Ideally water in the first cell should rise to 5 feet deep and be drawn down to no less than 3 feet deep.

3) Additional water may need to be added especially during dry periods. Ways to do this are from roof guttering and downspouts or sump pump that includes or diverts drainage, or the household water supply, especially from a private well.

4) Avoid discharging large doses of chemicals to a lagoon to protect its chemical balance. Large doses of disinfectants as from well shock chlorination and possibly swimming pools or hot tubs and some other chemicals can upset the lagoon's biological balance.

Table IX-1 lists guidelines for three household sizes and three locations in Kansas. Experience and advice from agencies and contractors will help determine the most suitable size. Table IX-1 shows the side length for square lagoons and diameter for round lagoons. Other shapes may be used but length should not exceed twice the width.

The findings of site investigation and pertinent preliminary information should be reviewed with both parties. An original and at least two sets of construction plans and specifications should be prepared. The contractor and home owner should receive the copies and the original should be retained in the office permit files.

Applicants need to be informed that single-family wastewater lagoons are to be constructed, operated, and maintained according to county or city/county requirements. Failure to do so can

result in a declaration of a public health nuisance by the local board of health (KSA 65-159) and prosecution by the county attorney (KSA 65-160).

Additionally, applicants should be informed that if a central collection system becomes available, within 1500 feet of the property, the connection to the central collection system may be required, as defined by county code. If connection occurs, proper abondonment of the wastewater lagoon must occur.

Table IX-1. ***Recommended sizes for square and round wastewater lagoons.***

	Square - side length ft[a]	Round diameter ft[a]	Surface area square feet[a]	Volume 1000s gal[a]	Minimum flow per month[b]
Western					
Small	35	40	1,225	18	4
Medium	40	45	1600	26	5.5
Large	45	51	2025	32	7
East Central					
Small	40	45	1600	26	4
Medium	45	5	2025	32	5
Large	50	56	2500	43	6
Eastern					
Small	45	51	2025	32	3
Medium	50	56	2500	43	4
Large	55	62	3025	56	5

These sizings are based on an assumed 1/4 in/day seepage loss
Small = 3 or less people; Medium = 3-5 people; Large = 6 or more;
[a] contents at 5 ft depth;
[b] minimum flow (1000 gallons/month) to maintain a 3 ft depth

LAGOON DESIGN DATA

All city and county code requirements shall be met prior to construction. Construction of a wastewater lagoon may be considered if the soil properties at the bottom of the lagoon are satisfactory as indicated by slow percolation rates, minimal porosity and fine soil texture. Soil profiles can be used to determine texture, giving percentages of sand, silt, and clay. A soil profile evaluation is recommended because permeability rates obtained from a perc text varies in

accuracy depending on soil moisture content at the time of testing. In the absence of a soil profile evaluation a permeability rate of less than an inch per hour indicated by a perc test may be a good indicator for a suitable lagoon site.

Separation Distance Requirements: *These measurements are from the inside of the berm at the 5 feet operational water level as measured vertically from the bottom of the lagoon*.

1) A minimum of 50 feet (200 ft recommended) from property boundaries. Some times adjacent property owners are willing to agree to a legal easement in which a wastewater lagoon may be constructed closer than 50 feet. An adjacent property owner needs to be made aware that construction of a well requires a 100 foot distance from a wastewater lagoon. If a legal easement is obtained, a wastewater lagoon may be constructed closer than 50 feet from adjacent property. Legal easements must be filed with the register of deeds to protect the interests of all present or future parties.

2) Public roadways (total right-of-way), may be considered part of the separation distance; however, no part of a wastewater lagoon may be placed on a public access or utility easement.

3) Potable water supply or suction line must be 100 feet from the lagoon's operational water level.

4) Pressurized water-supply lines, public or private, must be separated by at least 25 feet separation from the lagoon operational water level. Lagoon berm may under NO circumstances infringe on easement for a water supply. At the time of this writing, DIG SAFE does not check for Rural Water District lines; always contact rural water districts in the area before beginning construction.

PRETREATMENT OPTIONS FOR LAGOONS

In most cases a lagoon will work fine with no pretreatment of normal household wastewater before it enters the lagoon. The ideal sewer grade is 1/8 to 1/4 inch of drop per foot of sewer pipe or 1 to 2 percent grade of the sewer line. Slopes substantially greater or flatter than this can lead to problems of solids separation from the wastewater. A septic tank can be added ahead of the lagoon to remove solids and reduce the problems resulting from a substantially flatter or greater grade on the line leading to the lagoon. A septic tank has the advantages of: removing solids (this expands the range of suitable sewer grade slope), reduces organic load (aids lagoon function), minimize the chances of odor as long as discharge line is under water surface, and reduces rate of solids accumulation.

A lagoon can serve as a soil dispersal unit for a site with very limiting soil conditions. The design for the lagoon can be modified depending on the use and purpose it serves. The size of the lagoon can be minimized and compaction could be reduced or eliminated if wastewater entering the lagoon is more highly treated such as from an enhanced treatment component. However, enhanced pretreated effluent is still sewage and because of bacteria and safety the lagoon should still be fenced.

GUIDELINES FOR DESIGNING AND CONSTRUCTING LAGOONS

1) **Rock or porous strata**. Excavation that penetrates or terminates in rock or porous strata should be over excavated a minimum depth of 2 feet on both the side slopes and bottom. The entire excavation area must be filled with non-permeable earthen material to limit seepage from the lagoon to a maximum value of 1/4 inch per day (0.01 inch per hour). Use high clay subsoil that is free of rocks or fill soil that is mixed with bentonite clay and applied at the manufacture's recommended rate and then compacted may also be used.

2) **Compact to avoid excessive water loss.** Compaction is essential to achieve consistency in low water loss from lagoons. A sheepsfoot roller compacted lining of at least 3 – 8 inch lifts to make a lining of at least 1½ feet thick is strongly recommended.

3) **Prevent surface water entry.** Divert surface runoff to prevent sediment entry and lagoon overfill/overflow. Construct the berm above the surrounding soil level or make an interception terrace (trench and ridge) to carry runoff away from the upslope side to accomplish this.

4) **Prevent berm erosion with vegetation.** Following final grading establish a perennial or temporary annual groundcover on the berm, as soon as feasible, and mulching until vegetation is established helps prevent erosion.

5) **Assure adequate air flow and avoid shading.** Sunlight and air circulation over the lagoon are essential for good lagoon operation. Trees need to be located at least 30 feet outside the embankment and shrubs should be at least 15 feet outside the embankment. Because sunlight is essential for algae to produce oxygen, a lagoons east, south, and west sides should not be shaded. It is recommended that no plants grow taller than a 22 degree angle (approximately 2½ horizontal to 1 vertical ratio) from the top outer edge of the berm.

6) **Fence for human and animal safety.** These lagoons contain raw sewage that can easily spread disease. If unfenced, these lagoons create both a hazard and liability, especially with drowning the second leading cause of accidental death in children. State and county codes require that all wastewater lagoons be fenced. Fencing needs to be located 3 feet outside the berm toe. A 4-foot wide rigid-frame, hinged gate can allow easy access to mowing equipment. Gating must provide the same degree of resistance to entry as fencing, and requires a padlock. Fencing diagrams are located in Figures IX-1, IX-2, IX-3, IX-4, and IX-5.

   Specification for lagoon fence

   a. Height: 4 feet minimum. If fence will also be accessible to livestock, a double strand of barbed wire placed above the fence top or an electrical fence placed outside the inner fence may also be installed.
   b. Size: 12.5 gauge wire.
   c. Open space: 8 square inches or smaller. Example 2" x 4"
   d. Warning signs. A sign stating WASTEWATER TREATMENT Lagoon or RAW SEWAGE, KEEP OUT, shall be posted on the gate or fence adjacent to the gate.

CONSTRUCTION

1) **Soil condition**. Soil that is moist enough to compact into a firm ball is most suitable. Muddy soil is not only difficult to work, but also forms clods that can be difficult to smooth out. Soil that is too dry for compaction into a firm ball can have moisture added.

   Top soil needs to be removed and stockpiled for later use on the berm. Once the lagoon construction is completed, the top soil may then be placed on the berm surface to support groundcover growth. Berm compaction needs to be done in layers, preferably by sheepsfoot roller, rather than by machine traffic or other provision. This practice is critical if the soil is borderline acceptable for a wastewater lagoon. Fill layers shall be no more than 6 inches thick.

2) **Lagoon Depth**. Lagoons are normally excavated to a depth no greater than 8 feet below the surface of the surrounding ground. Greater depth may contribute to problems of inadequate sunlight and/or air transfer. Surfaces of the berm and lagoon bottom, shall have uniform slope. They need to be free of rocks, debris, ruts, and ridges. When rock is encountered in excavation, the hole must be over excavated by at least 2 feet to remove rock, then filled and compacted with at least 2 feet of clay material.

3) **Berms.** Wastewater lagoons shall be completely enclosed by berms which shall be 3 feet higher than the surface of the surrounding ground. Both the interior and exterior slope shall be at no less than 3 feet of lateral movement for each foot of vertical drop; 3.5 ft is better when space allows.

4) **Linings.** Where soil percolation rates exceed 1 inch fall per hour, the bottom and interior sides of the wastewater lagoon need to be lined with a compacted clay of sufficient thickness to reduce the soil absorption rate to 1/4 inch per day or less. See compacted lining guidelines at the end of this chapter. Refer to manufacturer's recommended rate when using bentonite clay, asphalt cement, or membrane application.

5) **Sewage Inflow.** Pipe carrying wastewater from the house to the lagoon must be at least 4 inches in diameter. Schedule 40 thermoplastic sewer pipe with solvent welded joints is recommended. Slope can vary between 1/8 and 3/8 inch per foot. A 1/4 inch slope per foot or 2 foot slope per 100 feet, is recommended to avoid solids accumulation in the line. Pipe entry needs to be located below the water surface and extend nearly to the lagoon center, ideally located at 18 to 20 inches off the bottom. Beneath the pipe ending, a concrete pad of 2 feet x 2 feet x 4 inch thickness, placed at the lagoon center bottom, can protect the lagoon lining from effluent damage. Supporting the end pipe can be done by anchoring it above concrete blocks with posts and/or steel support.

6) **Monitoring lagoon-water depth.** A post with markings, located near the center is recommended for ease in observation of water depth.

7) **At least two cleanouts need to be installed.** One located near the outside of the house and the second one near the lagoon where the ground surface is approximately 6 inches higher

than the berm, are favorable locations. Additional cleanouts are recommended with any change in pipe direction or distance of greater than 100 feet. A Tee or Y design may be used. However, a Y shaped design allows easier access, and double cleanouts allow for easier cleaning in both directions.

8) **Top Soil Replacement to Berm.** Application of topsoil is for the purpose of supporting groundcover growth. Reapplying topsoil by spreading in a loose manner is desirable, or if packed too firmly it can be tilled, prior to planting groundcover. Perennial groundcover, for preventing erosion, needs to be seeded as promptly as possible following construction. Natural Resources Conservation Service or Extension may provide recommendations for groundcover most suitable to one's specific location. Protective covering of straw or hay mulch may be beneficial in holding the soil and seeding during the process of establishing groundcover growth.

9) **Fencing Installation.** Fencing must be completed as soon as possible for public safety. Posts need to be placed 2½ to 3 feet deep and backfilled with tightly compacted soil. Placing cemented posts at a 2½ foot depth is an alternative option. Wire needs to be stretched tightly using a come along (wire stretcher), tractor, or other method.

INSPECTION

Sample inspection report forms are provided at the end of this chapter. These may serve as a guideline in addressing important points of an inspection.

OPERATION AND MAINTENANCE

1) **Groundcover establishment and maintenance.** All of the area bounded by the toe of the berms and within the fence shall have an ample stand of low-growing perennial groundcover. Once the groundcover is established, it needs to be regularly maintained during the growing season at a height of 6 inches or less. Under no circumstances shall trees or tall weeds be allowed to develop on the berm area. Near the lagoon edge, it is preferable to cut the vegetation shorter than 6 inches to prevent any drooping into the water. Ideally, grass clippings should be removed from the lagoon area. At a minimum, they must be directed away from the lagoon.

2) **Remove any trees and additional vegetation.** All trees, weeds, cattails, duckweed, and other undesirable vegetation need to be removed promptly with the first signs of their development in the water or along the berm. Removing weeds by hand before they become embedded and contribute to the lagoon's organic load is advisable. Excess vegetation can create additional problems, including a reduction of air flow, decreased evaporation, lagoon filling, shading, and less sunlight activity over the lagoon. Mosquito production is often directly proportional to the amount of such vegetation. Destruction of the lagoon's seal by root penetration can also occur. See protocol - Sealing a Leaking Lagoon at the end of this chapter.

3) **Herbicide use is best avoided.** Improper use can cause temporary system failure. If use becomes necessary, consult with the local county Extension office or environmental health

officer for the most recent product advice. Follow the manufacturer's label, and avoid spillage or drift that might cause chemical holes or kill groundcover on the berm.

4) **Maintain desirable water depth - as close as feasible to 5 foot.** A short-term depth of 2.5 feet during drought conditions is acceptable. Adequate treatment can become a problem if the depth becomes less than 2.5 feet. Therefore, a design of directing roof drains and/or sump pump wastewater to the lagoon as a temporary condition is desirable and must have a plan for rerouting the same wastewater elsewhere during prolonged periods of wet weather. Two feet of freeboard (berm height above the water surface) for water storage needs to be maintained to provide for times of exceptional storms. For emergency situations in which wastewater is encroaching on the freeboard and may overflow the lagoon, follow procedures in protocol Emergency Dewatering.

5) **Berm damage.** A certain amount of erosion will occur after first-time construction. Any damage incurred by reasons of weather, animal entry, or other means shall be repaired by shaping the area to the original plan and reestablishing perennial groundcover. Among the most common causes of damage are settling, erosion, and rodent burrowing.

6) **Evaluation of wastewater lagoon condition.** Proper operation of a wastewater lagoon can be evaluated by color, odor, and water testing. Generally, routine testing is beyond the ability of the owner or user. Thus, one must rely on appearance and odor for operation information. Table IX-2 gives a color interpretation guide. Lagoon color is directly related to pH and dissolved oxygen (DO).

Table IX-2. Visual Indicators of a Lagoon's Condition

COLOR	CONDITION	SYMPTOM OR CAUSE
Dark sparkling green	good	high pH and DO
Dull green to yellow	not as good	-pH and CO_2 are dropping -blue-green type algae are becoming predominant
Gray to black	very bad	lagoon is septic with anaerobic conditions prevailing
Tan to brown	OK if . . . Not good if. . .	due to predominance of a type of brown algae (not found in Kansas) not good, if due to silt or bank erosion

Source: Stabilizing Lagoons - Operations Manual. Aug 1977, EPA Office of Water Program Operations, O-15

7) **Maintenance of essential lagoon features.** The fence, gate, vegetation height, and inlet pipe shall also be maintained in the condition called for in the original plans and specifications. Any diversions provided to keep surface runoff away shall be maintained in satisfactory condition and at sufficient height to protect the lagoon.

8) **Odors.** Properly operating lagoons rarely emit an odor. Odors may indicate that the lagoon is not functioning properly. Odors may be due to the following: a) sludge may be filing the lagoon; b) lagoon may be improperly sized; or c) overloaded. Odor that persists longer than two days, indicates an operational problem and the cause must be determined.

SLUDGE REMOVAL

Wastewater lagoons will begin to fill with silt, sludge, and organic debris after a period of extended use. Lack of maintenance will increase the rate of fill. Leaves, uncut grass, grass clippings, water fowl, animal burrowing, and livestock damage will accelerate the rate of filling occurring in the lagoon. Original lagoon volume must be maintained so that overflow does not occur.

Evidence of filling includes 1) Overflow; 2) Presence of cattails or other aquatic vegetation toward the center of the lagoon; 3) Overloaded condition indicated by heavy algae growth, dark lagoon water, decreased wave action, slow flowing toilets, and foul air odor; 4) Water level on the berm is near overflow condition during periods of normal rainfall.

Any of the above conditions, by themselves, may be attributed to inadequate lagoon sizing or unusually heavy or light wastewater flow. Dewatering may be necessary to determine the cause. Consulting the local environmental health officer for assistance in determining whether to clean and reconstruct, abandon, or initiate other corrective action, may be beneficial.

Procedure to clean and reconstruct the lagoon:

1) Regulating Authority shall be contacted for permit requirements or improvement requirements.

2) Lagoon dewatering must be accomplished with the greatest degree of environmental safety possible. Refer to protocol Emergency Dewatering Procedure.

3) Sludge may then be removed, utilizing a backhoe, bulldozer, or front-end loader in accordance with guidelines established by the local regulatory agency. The sludge can then be taken to a publicly owned wastewater treatment facility such as a landfill permitted and willing to accept sludge, or it can be tilled into farm land. If the sludge material is applied to farmland, it needs to be tilled into the soil as soon as possible (within 24 hours). (Refer to EPA 503 Regulations).

4) Clay or bentonite layers, or lining originally installed to control seepage losses need to be checked and restored. See protocol Sealing a Leaking Lagoon.

5) Inlet pipes and cleanouts need to be checked for proper functioning and repairs made if needed.

6) Berm restoration. Berm must be reshaped, packed and smoothed. Reseeding and restoring the fence to an approved condition, needs to be done.

7) Water level should be restored to a 2 ½ foot depth before the lagoon is returned to service.

LAGOON ABANDONMENT

Reasons for abandonment of a wastewater lagoon may include:

1) Public sewer available within a feasible property distance.

2) Lagoon will not retain wastewater.

3) Sludge level is at a depth that impairs proper functioning of the lagoon.

4) Local environmental health officer determines the system can not be made to function properly, cannot adequately protect health of property owner, health of the public, or the quality of state waters.

Abandoning a wastewater lagoon would normally entail: dewatering, sludge removal by a licensed septage hauler, and returning the land area to the contour it held prior to lagoon construction. Kansas Department of Health and Environment issues addendums as new laws and procedures are developed. Wastewater lagoons are subject to these additions. Current guideline procedures for abandoning a wastewater lagoon are:

1) Dewater according to the dewatering procedure.

2) Push berms in to fill lagoon. A slight elevation above the center is desirable to eliminate the possibility of an area holding water, once settling occurs.

3) Cover the area with topsoil and reseed with suitable groundcover.

REFERENCES AND OTHER READING MATERIALS

The following publications are available from K-State Research and Extension, Distribution Center - 24 Umberger Hall, Manhattan, KS 66506 or local Extension office.

Aquatic Plants and Their Control, C-667, KSU Agricultural Experiment Station and Cooperative Extension Service, August 2005.

Reducing Pond Water Losses, R-15, Decamber 1977, available from Ext Bio and Ag Engr, 147 Seaton Hall, Kansas State University, Manhattan, KS 66506.

Site and Soil Evaluation for Onsite Wastewater Systems, MF-2645, KSU Agricultural Experiment Station and Cooperative Extension Service, March 2004.

Wastewater Flow and Characteristics, Chapter 4, Section 2 of Environmental Health Handbook, 3rd Edition, KSU Agricultural Experiment Station and Cooperative Extension Service, October 2004.

Wastewater Pond Design and Construction, MF-1044, KSU Agricultural Experiment Station and Cooperative Extension Service, August 1998 (to be revised).

Wastewater Pond Operation, Maintenance and Repair, MF-2290, KSU Agricultural Experiment Station and Cooperative Extension Service, April 2005.

The following publications are available from other state Cooperative Extension in as indicated.

Individual Home Sewage Treatment Systems: Lagoons, AE 892, North Dakota State University, www.ag.ndsu.edu/pubs/ageng/structu/ae892-3.htm, February 1997.

Residential On-site Wastewater Treatment: Lagoon Design and Construction, G01-1441-A, NebGuide, U of Nebraska, Cooperative Extension, August 2004.

Residential Sewage Lagoon Systems: A Homeowner's Guide to Installation and Maintenance, WQ 402, U of Missouri, Extension, Columbia, MO, March 1997.

Reducing Pond Seepage, G1555, November 1997, MU Guide, available from Outreach and Extension, University of Missouri - Columbia, Agriculture Building, Columbia, MO, 65211, January 1998.

The following publications are available from the respective state environment agency as shown.

Assessing Wastewater Options for Small Communities in Kansas, Kansas Department of Health & Environment, K-State Research & Extension, Midwest Assistance Program, and Crawford County Health Department, on KDHE web site at http://www.kdheks.gov/nps/ww_options_manual/index.html, November 1999.

Lagoon Sewage Disposal Systems: It's Your On-site System, Operation and Maintenance Guide for Homeowners, Oklahoma Department of Environmental Quality, July 2003. www.deq.state.ok.us/ECLSnew/Fact%20Sheets%20ECLS/july03/Lagoon.pdf

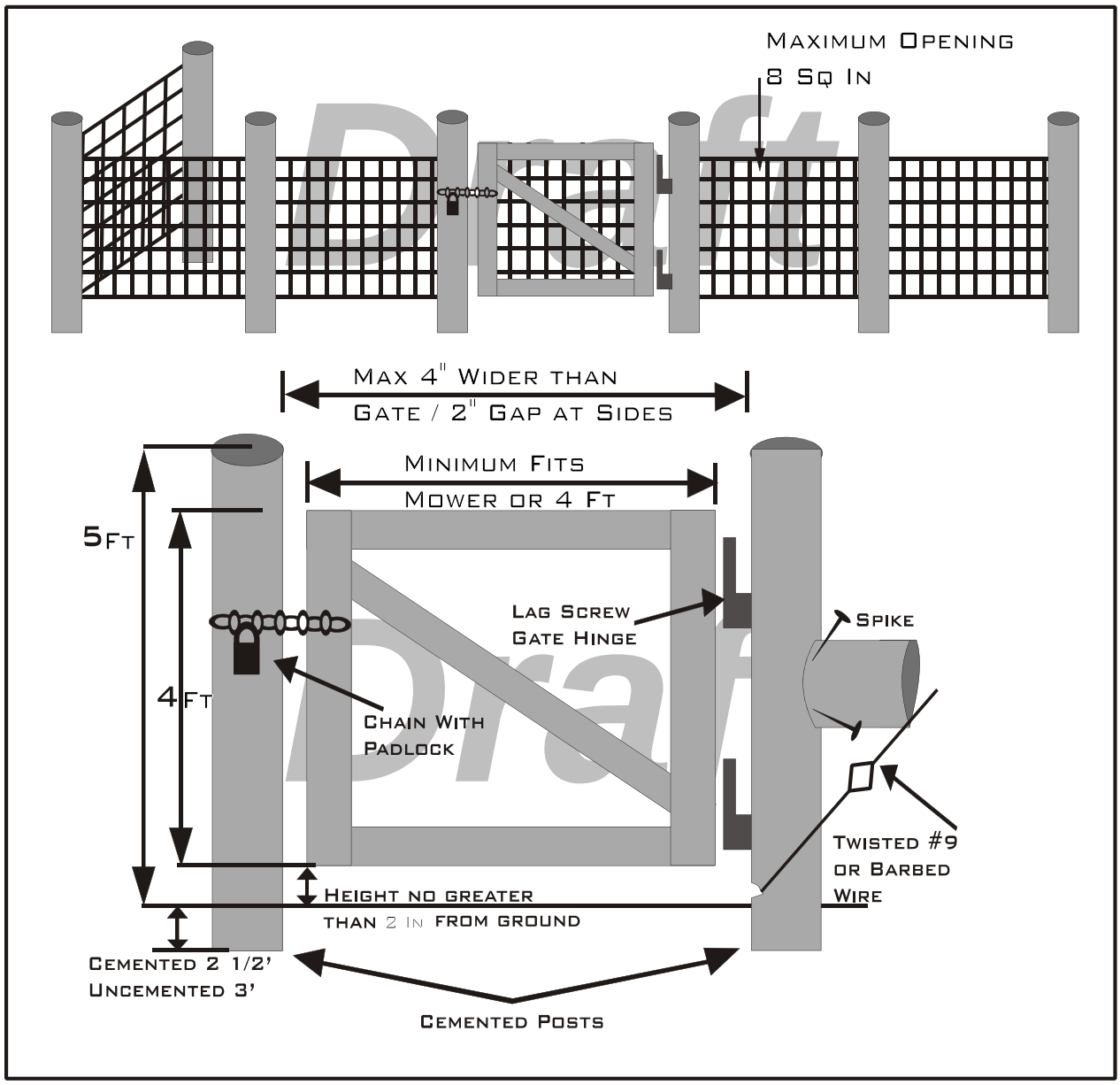

Figure IX-1. Gate and Fencing

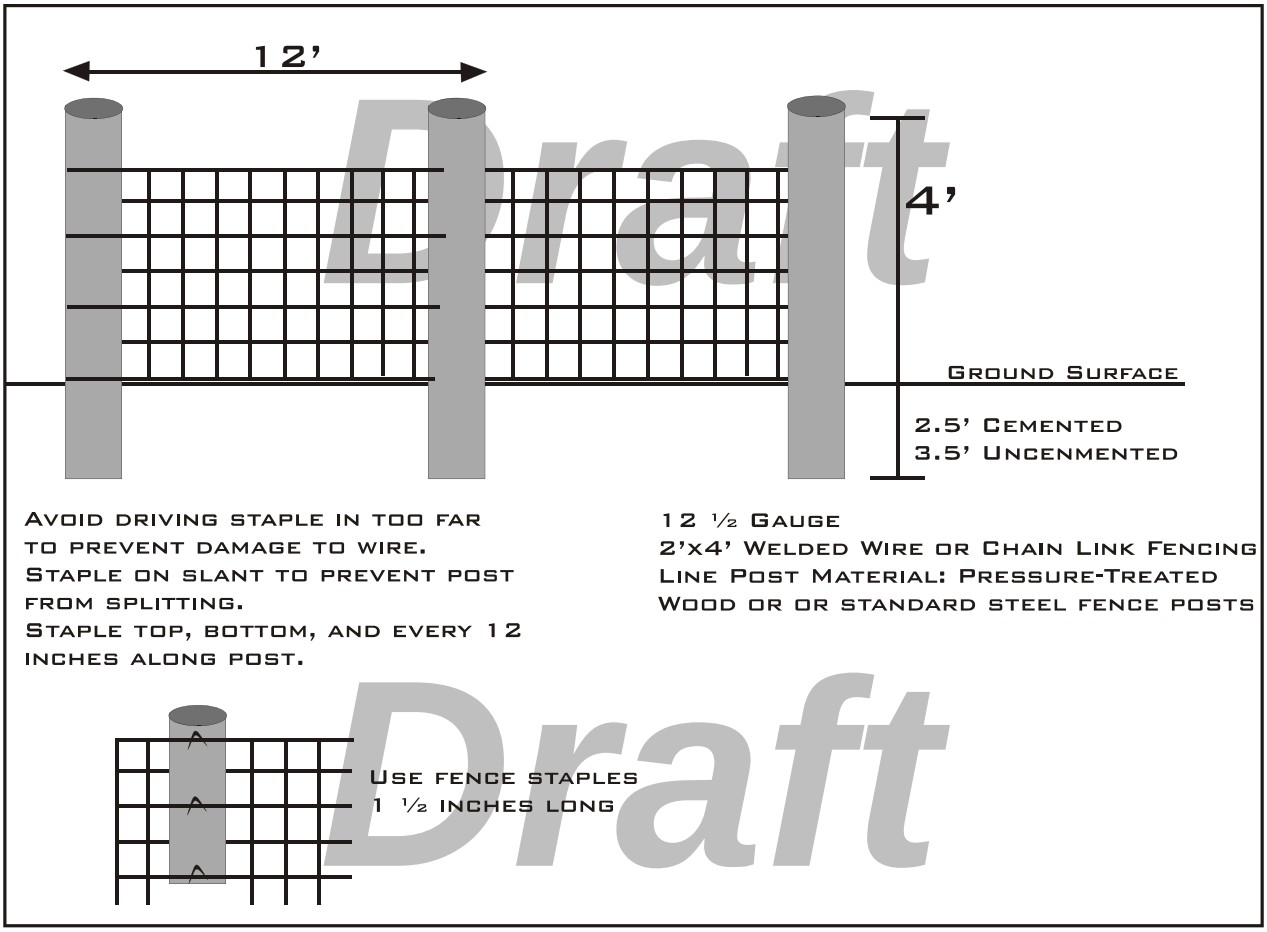

Figure IX-2. Fencing: The Standard Fence

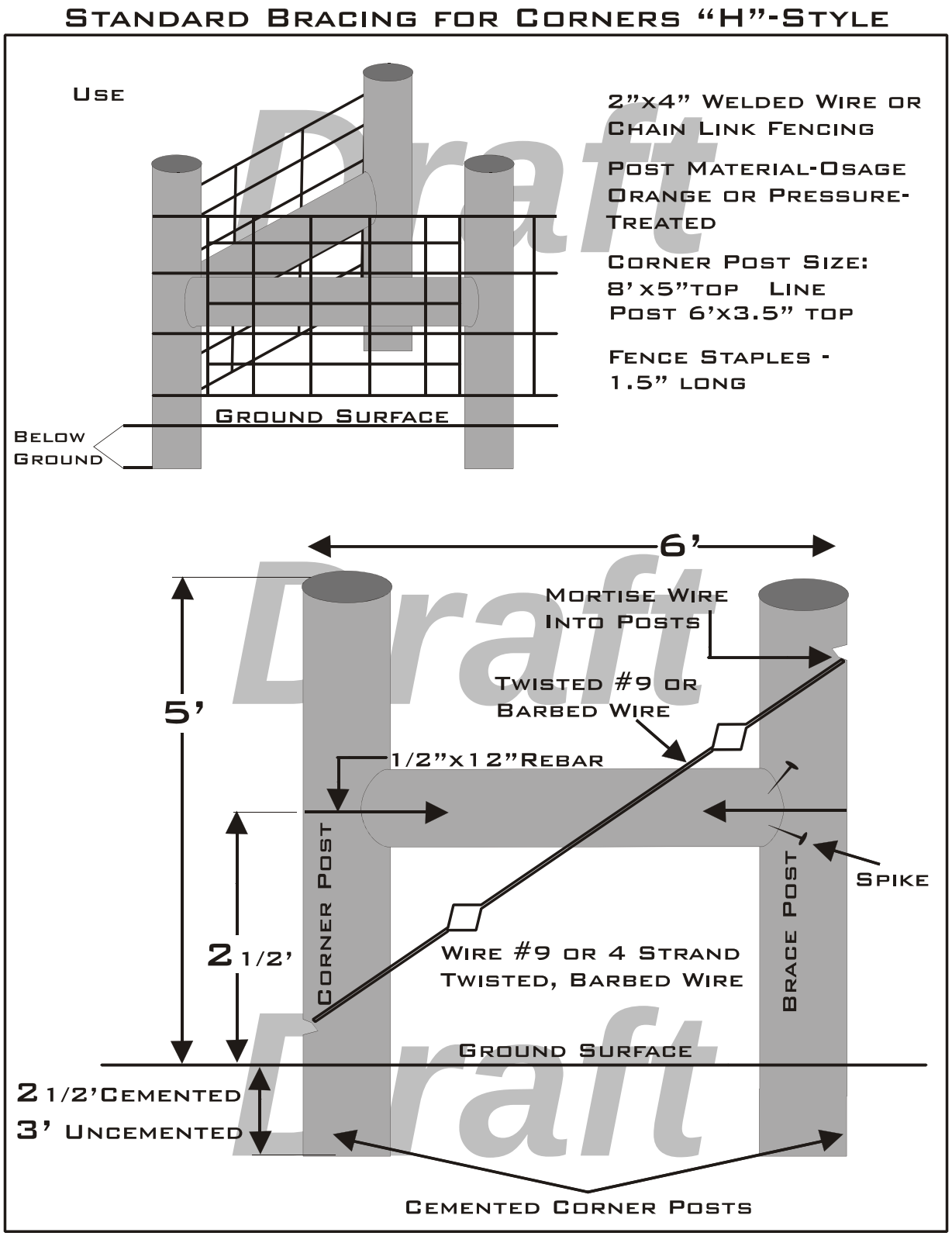

Figure IX-3. Fencing: "H" Style Corner Brace

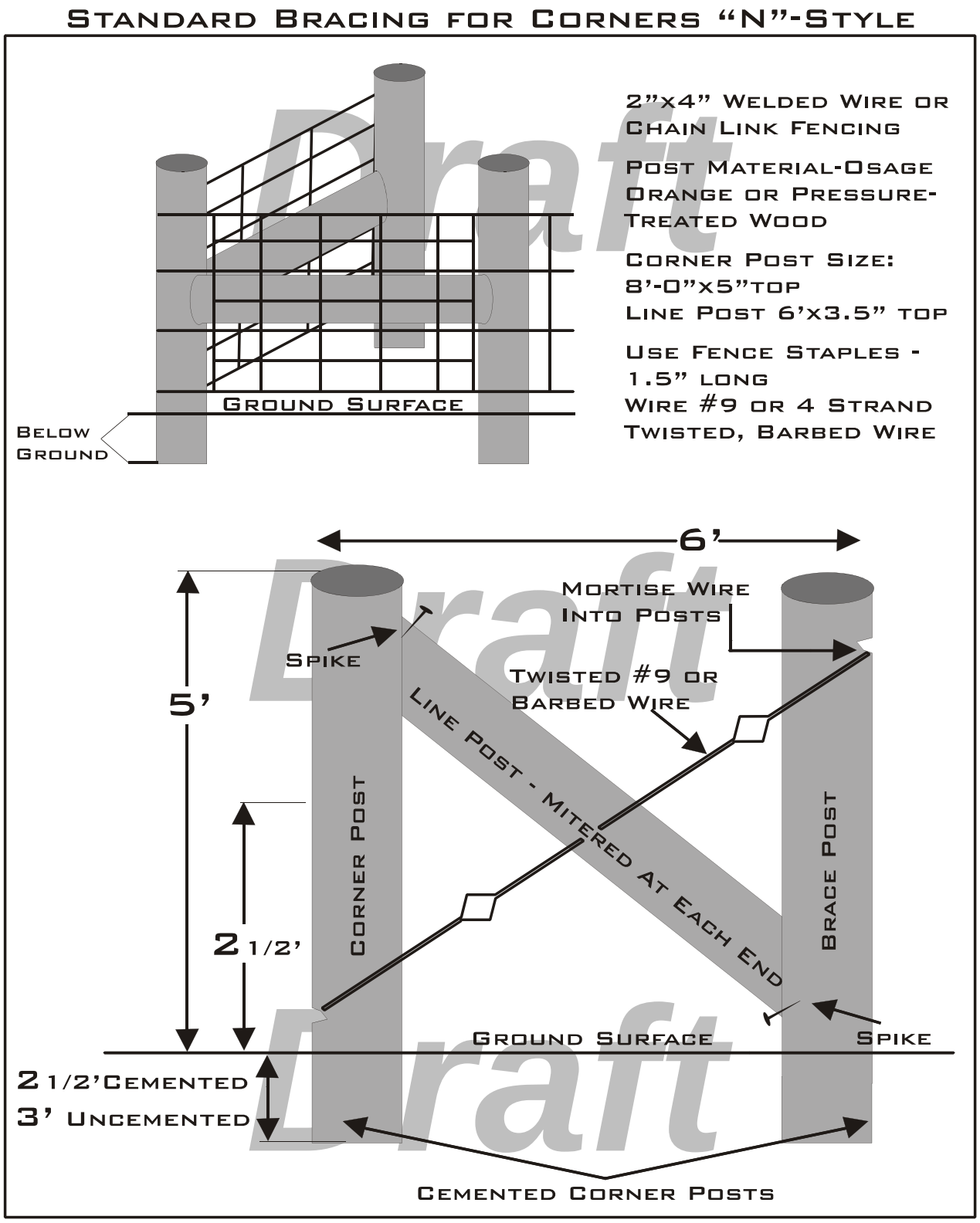

Figure IX-4. Fencing: "N" Style Corner Brace

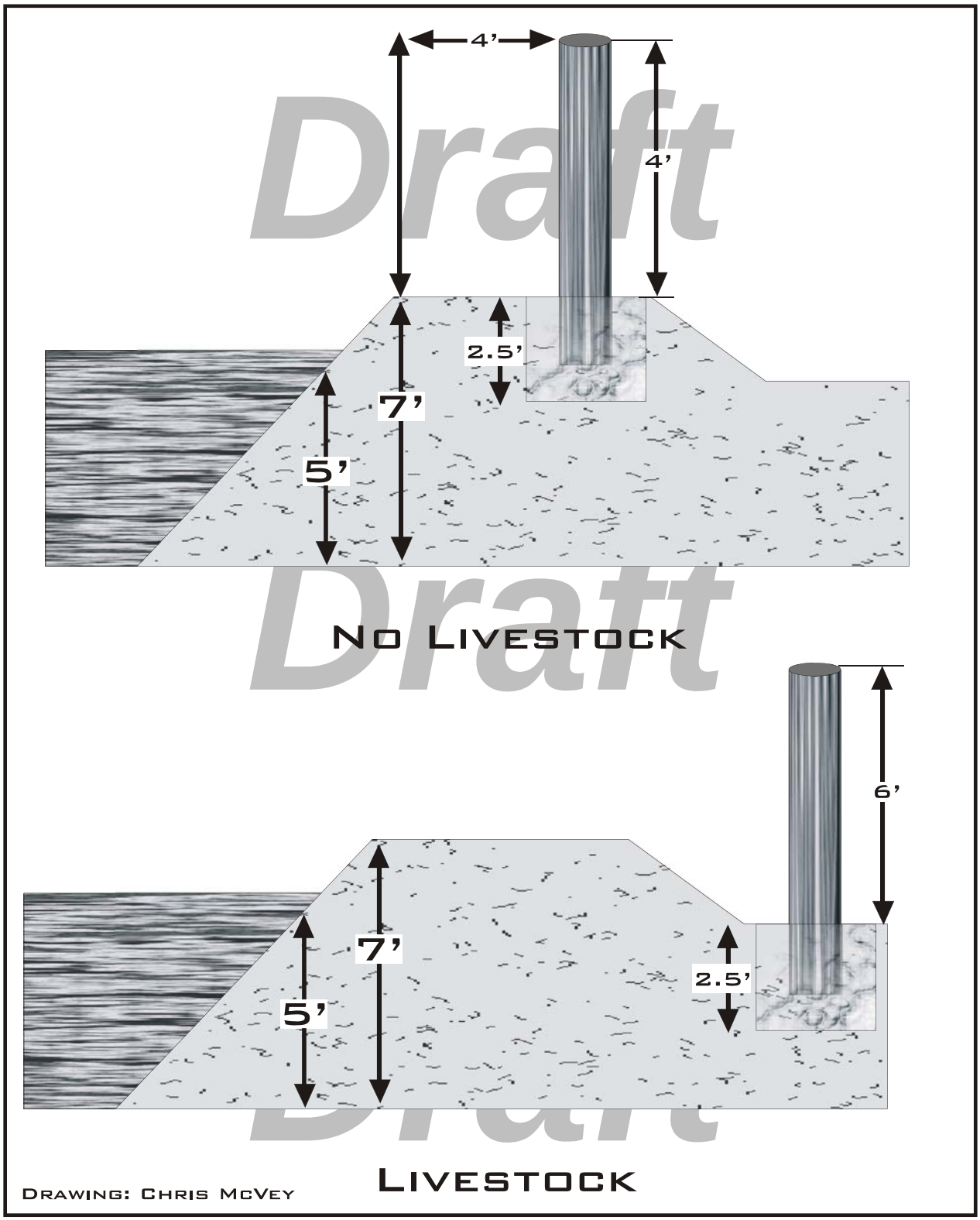

Figure IX-5. Fencing: Placement

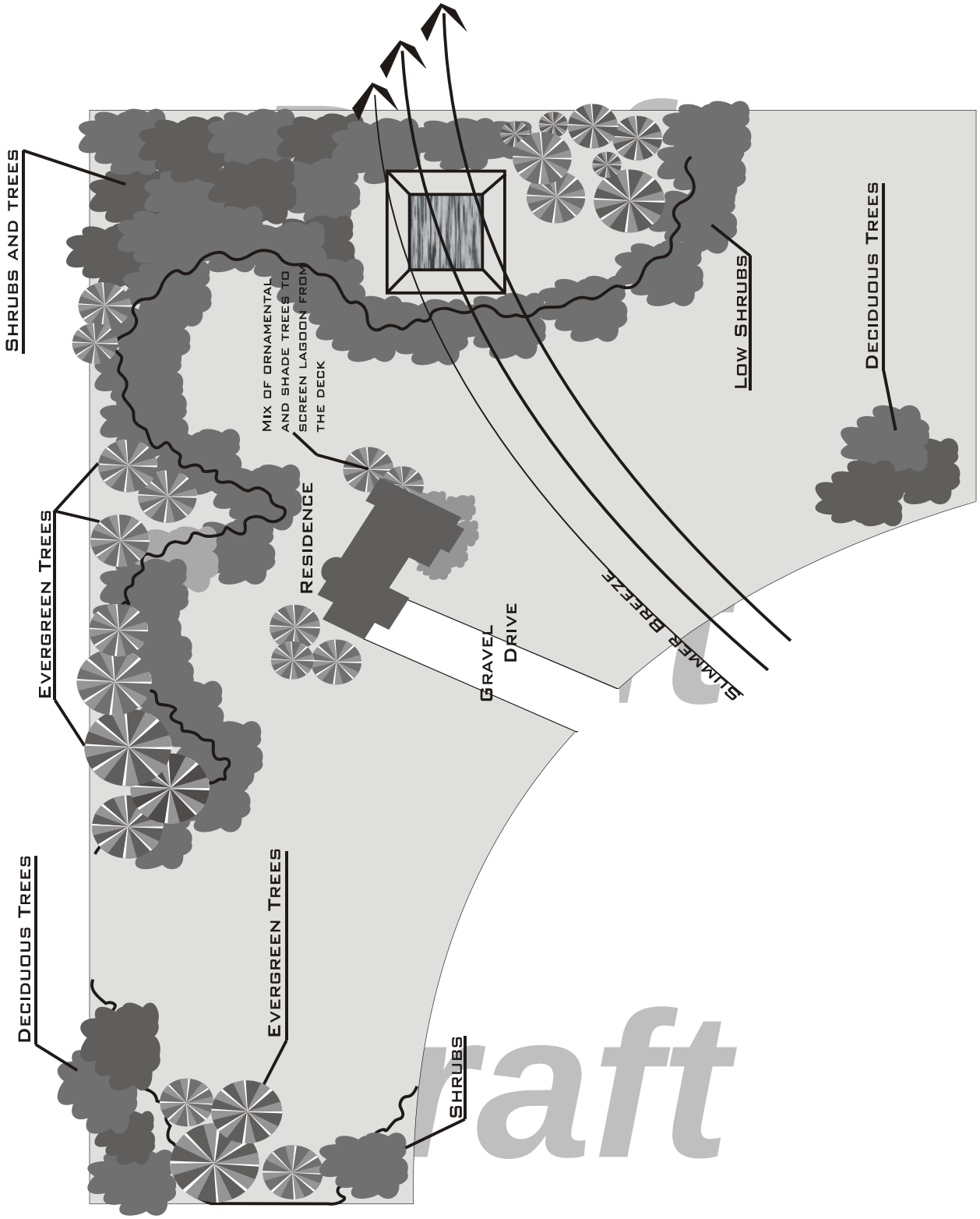

Figure IX-6. Lagoon Siting and Design

PROTOCOL
EVALUATING AND SITING A LAGOON

GOAL: Determine if a lagoon system is well suited to the site conditions and determine the best location on the property for a lagoon. It should protect public health, assure safe wastewater treatment, and prevent contamination to the state's water supplies.

POLICY: Site and soil evaluation for a new wastewater lagoon may be completed upon a request of the landowner, realtor, contractor, lending agency, or other interested party and payment of necessary fees. Listed below are evaluation points for discussion during the inspection. All individuals who have legal interest in the outcome of the evaluation need to be provided with a report summarizing the assessment. Whenever a site is unsuitable, a letter documenting the reasons and offering alternative solutions, if possible, is recommended. Letters and documents need to be maintained on file for future reference.

PROCEDURE

1) Follow the code and local regulatory agency policies and procedures regarding the application and site evaluation.
2) Evaluation may include an initial inspection visit to the property to meet with the owner and any other interested parties.
3) Inspect property and proposed lagoon site for conditions affecting location. Such conditions include, but are not limited to: wells, soil conditions, property lines, easements, depth to groundwater, and slope. The County Soil Survey can be utilized to determine probable soil type and general suitability for a wastewater lagoon. Note: Conducting a soil profile evaluation is the best method of assuring suitable soil conditions.
4) Mark the proposed lagoon location with flags and take photos of the proposed lagoon site from each side and looking away from the site in each direction.
5) If site conditions have been evaluated as favorable for a wastewater lagoon, an application requesting a wastewater lagoon installation permit needs to be completed by the landowner.
6) Lagoon sizing can be done according to round, square, or rectangular designs. (Refer to Table IX-1.)
7) Instructions and diagrams for construction need to be provided in writing for agency files and a copy given to the landowner.
8) A permit to construct a wastewater lagoon shall be provided to the landowner. It is recommended that the landowner be given a time limit in which construction is to be completed. The landowner needs to be instructed that delays which prevent completion by the agreed upon time will require the landowner to contact the inspector for an extension. If an extension is not requested, the property owner may be requried to reapply. It is the landowner's responsibility to contact the inspector for construction inspections.
9) Once the inspector has been notified that construction is complete, a final inspection needs to be made to assure compliance with county codes. Lagoon construction is not complete until the fence has been built. If construction is acceptable, a permit to operate shall be issued at that time.
10) Permit to operate shall state that the regulating agency has the right to inspect the lagoon at any time it deems necessary to determine county-code compliance.

INSPECTION OF EXISTING WASTEWATER LAGOON

GOAL: Determine system integrity in order to provide for safe public water and to prevent contamination of any water supply within the state.

POLICY: Evaluation of an existing private wastewater lagoon may be completed on the request of a lending agency, real estate agency, land owner, or complainant. A written letter summarizing evaluation should be sent to all parties who have interest in the outcome of the evaluation. Possible parties may include, but are not be limited to: buyers, sellers, realtors, lending institutions, zoning boards, and contractors. When a system does not comply with county requirements it is the responsibility of the inspector to determine the needed corrections. Proof of system correction and adequate operation must be established prior to approval of the system.

EVALUATION

1. Acquire any previous records such as files of permit, inspections, and contractor bills. Name and address of current property owner.
2. Information that may be appropriate for evaluation purposes:
   A. Identification of any additional features used in conjunction with the wastewater lagoon such as and the location of these additional features such as: septic tank, holding tank, or devices altering the gravity flow of wastewater.
   B. Proof of where water lines are located (public or private).
   C. Receipts for septage pumping and/or herbicide purchase.
   D. Name and address for anyone not living in the household and served by the same system. (i.e. two homes sharing the same lagoon.)
   E. Location of any wells or cisterns used for potable and nonpotable purposes.
   F. Easements for right-of-way which include the lagoon area.
   G. Number of persons presently and potentially served by system and an average estimated wastewater flow.
   H. Map showing location of sewage pipes, wells, potable water pipes, and improvements.
   I. Name of buyer with address and phone number.
   J. Real Estate and/or Lending Agency's address and phone number, if applicable.
   K. Contractor name, address, and phone number or contact information for person constructing the system.
   L. System maintenance person's name, address, and phone number, if applicable.
3. Examine water and sewage pipes where they exit the house and from the basement, if possible. Determine that all household wastewater is discharged into the lagoon.
4. Check clean outs for proper flow of wastewater and location. They need to be located at every

change of direction and within 100 feet of each other along a straight line. They should also be covered to prevent entry of water, such as rainfall. It is desirable to have a combination cap and vent to allow dissipation of gases that may back up with a clogged pipe.

5. Measure the slope of the wastewater pipe from the house to the lagoon (12.5 inches to 36 inches per 100 feet.) Determine if there is a possiblity of backflow from the lagoon or clean out during times of high lagoon water. A contractor's or an engineer's level may be needed to give an accurate evaluation of potential backflow occurrence.
6. Fencing. Check adequacy of height, spacing, strength, and safety measures such as a lock and posted signs to prevent unauthorized entry of humans or animals.
7. Berm evaluation. Observe area for rocks, clods, ruts, groundcover, erosion, trees, tall weeds, accessibility to farm machinery, ability to divert surface runoff away from lagoon, and presence of animals. Note any shading by adjacent vegetation.
8. Lagoon evaluation. Check that a post with measurement markings at every inch is located near the lagoon center. Check that water depth is maintained between 2.5 feet and 5 feet. An absence of aquatic vegetation is an indication that water depth stays above 2.5 feet. There should be no foul odor. The color should be sparkling dark green, which indicates the pH is correct and there is adequate dissolved.
9. Surface area. Measure the width of the lagoon at the operational level (five feet water depth) and determine the current surface area. The surface area of the system should reasonably correspond to the surface area indicated on the recommended model size.
10. Evaluate the outlet pipe. The pipe should enter the lagoon beneath the water level and extend to a point located near the lagoon center. The pipe end should be set at a height of approx. 1.5 feet off the bottom of the lagoon. A concrete pad should be placed under the pipe end to prevent lining damage from force of wastewater discharge. Check that the end of the pipe is stabilized, such as being supported by concrete blocks and secured by chain or other means to prevent movement and possible breakage.
11. Evaluate corrections and replacement considerations. Know how many years the lagoon has been in operation. Know if the lagoon has ever risen higher than the 2 feet of freeboard. Know if the lagoon ever overflowed. Know if the water level ever dropped below 2.5 feet. If there are indications of sludge build up, or undersizing of lagoon for amount of household wastewater discharge, consider what options exist to build a second cell or provide other system replacement. This needs to be documented on a map of the site. If the household has a relatively low amount of wastewater discharge for the lagoon sizing, consider if it is feasible to add water from roof drains, sump pumps, or other sources.
12. Complete change of ownership papers on permit records if appropriate. Provide owners with a copy of the permit.

PROTOCOL
EMERGENCY DEWATERING PROCEDURE

One method for preventing overflow in an emergency situation is to remove some of the lagoon water by irrigation. This water must be distributed so that all water is absorbed into the ground without runoff. Perforated hoses, sprinklers, and sprayers can be useful but may clog if solids are present. Irrigation is not an option when the ground is saturated or frozen. At these times, the acceptable alternative is to have the excess sewage hauled by a licensed septage hauler. Stringent water conservation practices should be used during such times.

The area to be irrigated shall not be within 50 feet of property line not under the control of the facility owner or within 100 feet of a water well. The preferred irrigation area is relatively level tilled cropland or grassland. The irrigation area should not be used for children's play area, garden area, or an accessible to lactating dairy animals. Care should be taken to minimize taking up fresh or untreated sewage and sewage solids with the irrigation water. The water intake should be about 8 to 12 inches below the water's surface.

Dewatering is not to be considered a normal operating procedure; it is an emergency procedure to be used on rare occasions. If the threat of overflow persists, other measures must be taken such as enlargement of the existing lagoon or construction of an additional cell. The lagoon owner must get permission from the appropriate regulatory authority before dewatering.

PROTOCOL
SEALING A LEAKING LAGOON

Excess seepage in farm lagoons can be both undesired and detrimental. It can often lower the water in the lagoon to unusable levels. Seepage can commonly be attributed to areas of permeable soils in the reservoir (or dam), or attributed to leakage through rock ledges in the reservoir area. Several methods can be used to reduce the seepage. The method of choosing is largely dependant upon what is causing the seepage. A thorough investigation of the leaky lagoon should be made before any method of sealing is selected. Once the cause of seepage is reasonably determined, the best and most practical method for sealing can be chosen.

Sealing with earth blankets

Sites with too little clay to prevent excessive seepage or sites with exposed rock ledges in the reservoir area, can be sealed by an earth blanket compacted over the leaky area. The best blanket material should have a good mix of particle sizes - from small gravel or coarse sand to fine sand, silt, and clay in the desired proportions. The clay particles should make up about 20 % of the weight. The area to be sealed should be prepared by draining the lagoon and permitting the area to dry. The area should then be worked with a disc, tiller, or similar equipment and the blanket material uniformly spread over the area in 6 to 8 inch layers. Each layer should be thoroughly compacted by a roller before the next layer is placed. Generally, two or three layers is adequate. For this method to be practical, a suitable borrow area should be close enough to permit hauling the blanket material at a reasonable cost.

Sealing with flexible membrane lining

This method, though generally expensive, is perhaps the most effective because it eliminates virtually all seepage when properly installed. Flexible membranes made of plastic, rubber, or similar materials are placed as impermeable liners in the bottom of the lagoon. All membranes should be contstructed of high-quality materials and should be certified by the manufacturer to be suitable for use as liners. The area to be lined should be drained and allowed to dry until the surface is firm and can support the people and equipment that must travel over it during installation of the lining. All rocks, stumps, hard clods, and other materials that could damage the liner should be removed from the surface before the liner is laid.

Sealing with bentonite

It is important to remember that bentonite is a high swell clay material and is suitable for use on soils having a high proportion of coarse-grained materials and insufficient clay. Bentonite absorbs several times its own weight of water and when completely saturated can swell 8-20 times its original volume. When mixed with the coarse material and thoroughly compacted, the saturated bentonite then swells to fill the voids and pores, sealing the lagoon. Because upon drying bentonite returns to its original volume, it is not usually suitable for lagoons with a wide fluctuation in the water level. Rates of application vary from 1-3 pounds per square foot, depending on the site material. The area to be treated must be drained and dried prior to applying the bentonite. (Dumping bentonite in the water in an undrained lagoon does not work and can have detrimental effects on the water quality.) Bentonite can be purchased in bag or bulk as a powder or in pellet form. Farm supply stores, Coops, or well drillers often supply bentonite.

Sealing with soil dispersant

Excessive seepage can occur in a lagoon even in clay soils because the clay particles are arranged to form an open, porous, or honeycomb structure. Applying small amounts of certain chemcials to these porous materials can disperse them and reduce soil permeability. These chemicals are referred to as dispersing agents. Sodium chloride (common salt), sodium tripolyphosphate (STPP), and tetrasodium pyrophosphate (TSPP), are all effective dispersing agents. Commercial phosphatic fertilizer should *not* be used. Rates of application range from 0.05-0.33 pounds per square foot depending on the type of soil and the type of dispersant used. Prior to application, the area should be drained and dried. The dispersing agent should be applied at a uniform rate and thoroughly mixed into each 6-inch layer treated with a disc or tiller. Each treated layer should then be thoroughly compacted. Farm and feed supply stores and Coops often supply the proper type of salt or dispersing agent. Before any investment is made in sealing a lagoon, an evaluation of the problem area by a trained soil scientist, engineer, or technician is beneficial. Contact the local Natural Resources Conservation Service for assistance on sealing leaking lagoons.

PROTOCOL
COMPACTED LINING FOR SMALL WASTEWATER LAGOON

Purpose: Guidelines for lagoon construction where soils do not have extremely slow drainage and were it is shallow to bedrock (bottom of lagoon is less have a foot above or into rock).

Suitable Soil: Determine that subsoil is at least 30 percent clay either by determining soil texture or testing the soil to determine percent clay.

Construction Procedure:

1) Remove topsoil and stockpile it near the site for use later.
1) Test to determine if soil is at or slightly above the plastic limit by rolling out a small clump of soil into a wire shape 1/8 inch diameter or smaller without breaking apart. If it breaks it is either not wet enough or does not contain enough clay. Add water and test again. If repeated attempts are not successful there may not be enough clay and the choice of a lagoon for this site should be reconsidered. It takes a lot of water and time to wet the soil.
2) Remove the subsoil 12 to 18 inches below the bottom and sides of the lagoon and stockpile for reuse. When the bottom is shaped, measure the bottom area and, using a level, determine elevations near the inner corners and center. Measure horizontal distances from permanent reference points to the corners to verify thickness of the constructed lining. need to add a figure to illustrate this
3) Compact the bottom and side layer using at least 4 passes
   a. A sheepsfoot or other full coverage roller is preferred.
   b. If sheepsfoot roller is not available, use a heavily weighted wheel tractor making passes so there is complete coverage of the surface to equal one pass with a full coverage roller. Given the small percent of tire to machine width, to get full coverage of the surface may require a total of 16 to 20 passes for each width of the tractor.
5) Add a layer of loose subsoil (clay) material and compact. If material that was removed is not adequate then like subsoil material must be imported to the site.
   a. Sheepsfoot roller, add 9 inches of loose material and compact to 5 to 6 inch thickness.
   b. If tractor is used for compaction, add 6 in. of lose material and compact to 3.5 to 4 in.
6) Repeat step (5) until a 1.5 foot thick compacted layer is constructed.
7) After the compacted liner is complete, finish final grade of the compacted bottom and sides of the lagoon to maintain the proper side slope.
8) Place the topsoil over the outside, top and the top third of the inside of the berm.
9) Using field tests verify that compaction has been achieved.
   a. Compaction makes the soil firm and it should be very difficult to insert a hand probe more than a few inches. This gives a good indication of compaction. Recommend an electronic soil compaction meter (Field Scout or equivalent) to test compaction.
   b. To evaluate compaction of the entire liner thickness use a 4 pound hammer to drive an 18 to 24 inch long number 3 rebar 1½ to 2 feet into the lagoon lining. Count the number of blows to drive it for each 6 inch interval. The number of blows should increase with depth. The bar will be quite difficult to remove, so if removal is important plan how to do this before you go to the field. If a shorter bar is used and left flush or slightly below the surface, removal is not essential.

INSPECTION REPORT FORM
DATA FOR A SMALL LAGOON (SHORT FORM)

Name of Owner_____

Address of Owner_____

Person(s) Contacted At Site _____ Phone No. _____

Section _____, Township _____, Range _____, County _____

Number of Occupants Served _____ Number of Bedrooms _____

Approximate Vertical Distance-water level to top of embankment _____

Number of bedrooms _____ X 100 gpd = _____ total gpd = Alternative estimated flow

Review: Mark lagoon deficiencies, provide any necessary details on back.

1. Lagoon used by more than one household
2. Lagoon construction incomplete or substandard
3. Lagoon not sized according to plans and specifications
4. Lagoon area not fenced and/or gated according to plans & specifications
5. Lagoon within 100 feet of well
6. Lagoon too close to property line
7. Evidence of irrigation use routinely for effluent disposal or evidence of lagoon discharging
8. Surface drainage into lagoon
9. Eroded, damaged, sloped steeper than 3 ½ to 1, or in need of modification
10. Lagoon berm not mowed; trees growing and/or vegetation height more than 6 inches
11. Inadequate or NO stand of groundcover on berms
12. Cattails or other vegetation growth in lagoon
13. Tree growth too near to lagoon allowing leaf debris in lagoon, and/or blocking sunlight and airflow action on lagoon
14. Other (include anaerobic conditions)

Name:_____

Date:_____Title:_____

INSPECTION REPORT FORM
DATA FOR A SMALL LAGOON (LONG FORM)

Name of Owner_____

Address of Owner_____Phone No._____

Person(s) Contacted At Site_____

Legal Description_____S____T____R____, County_____

Number of Occupants Served _____ x 50 gpd = _____ total gpd = Estimated Flow

Approximate Vertical Distance - Water Level to Top of Embankment_____

Horizontal Distance to nearest property line_____

Distance to property owner's nearest well_____

Distance to neighboring property owner's nearest well_____

Review: Mark lagoon deficiencies, provide any necessary details on back.

CONSTRUCTION:
_____Lagoon construction incomplete or substandard.

SIZING:
_____Lagoon used by more than one household
_____Lagoon not sized according to plans and specifications (MODEL__.
_____Lagoon does not meet size requirement for number of people or estimated wastewater flow

LOCATION:
_____There is not a potential site for a second system
_____Lagoon is located on easement (type) _____.
Easement Holder _____
_____Lagoon located too near well(s) or weeds and trees

PLUMBING:
_____Household is served by two or more disposal systems
_____Greywater is not discharged into lagoon
_____Sewer pipe slope is not within acceptable limits
_____Berm is above the point where sewage exits house
_____Outlet pipe does not terminate in approximate lagoon center

_____Water from roof/patio/foundation drains enters lagoon
_____Overflow pipe present
_____Clean outs not properly installed/maintained

FENCING:
_____Fencing/gate requirements have not been met

VEGETATION:
_____Berme vegetation is over 6 inches high
_____Floating vegetation present
_____Cattails present

BERM:
_____Berm does not have stand of short-rooted perennial groundcover
_____Lagoon berm eroded/damaged/berm slopes not within acceptable limits
_____Animals/farm machinery has access to lagoon berm
_____Surface drainage can enter lagoon

OPERATION:
_____Water depth not between 2 ½ feet and 5 feet
_____Seepage present
_____Lagoon overflowing
_____Lagoon too shallow to prevent overflow
_____Lagoon water used routinely for irrigation
_____Lagoon overloaded
_____Wave action sluggish or absent
_____Evidence of siphoning or pumping

REGISTRATION:
_____Application form incomplete
_____Provide map of sewage/potable water pipes
_____Lagoon is not registered with health department
_____Change of ownership forms have not been received
_____Required fees have not been paid

OTHER: _____

Inspector: _____ Date: _____

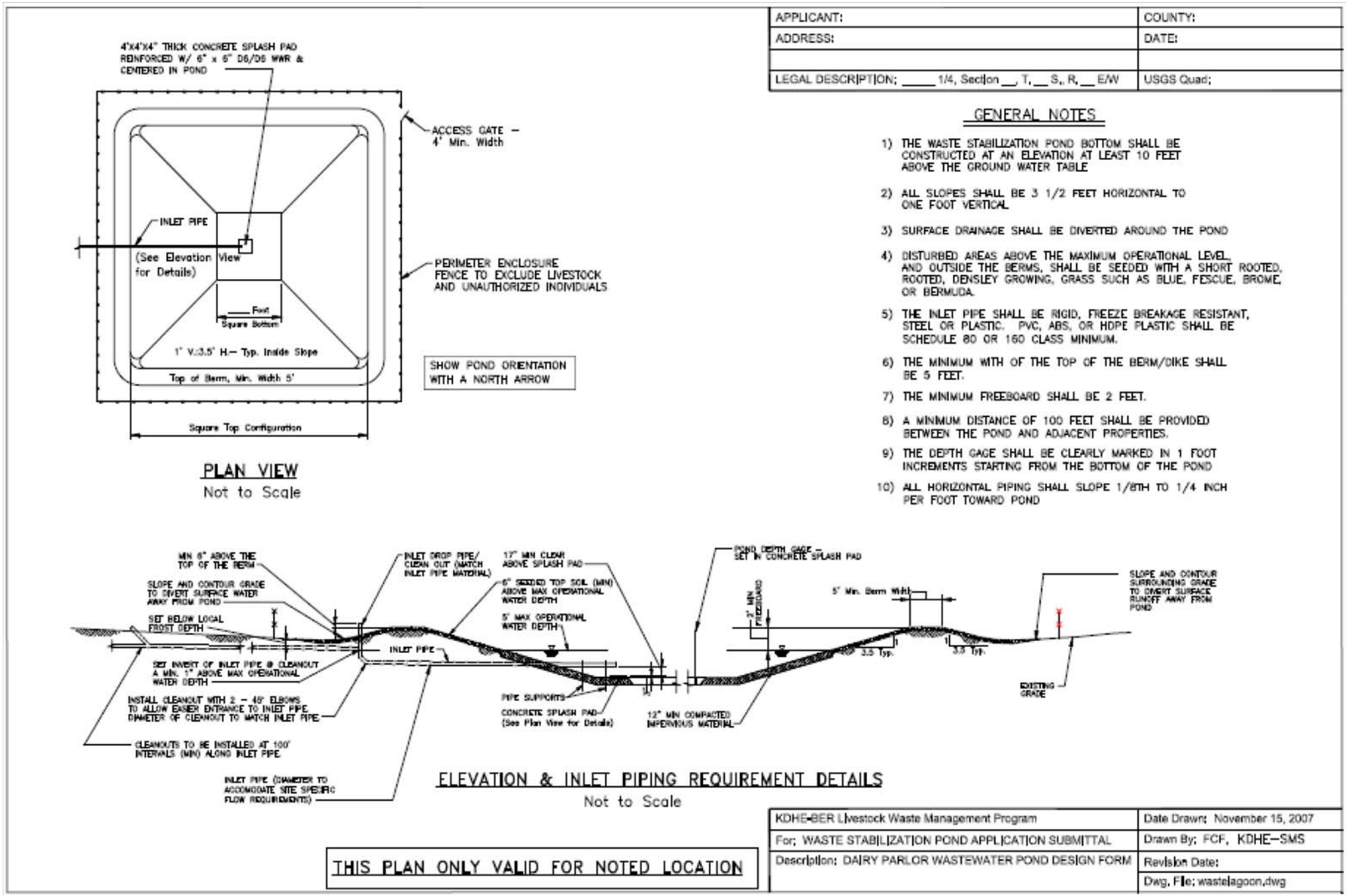

Figure IX-7. Blank Lagoon Plan Sheet and Construction Drawing