

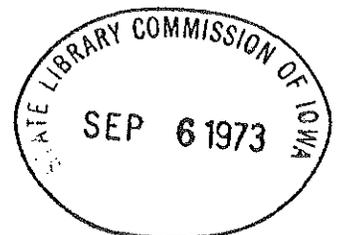
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GUIDELINES FOR THE PREPARATION OF
SANITARY LANDFILL PERMIT APPLICATIONS

by

John Charnetski, P.E.
Department of Environmental Quality

Presented at Eleventh Annual
Water Resources Design Conference
Iowa State University
Ames, Iowa
January 31 - February 2, 1973



PART I

GUIDELINES FOR THE PREPARATION OF SANITARY LANDFILL PERMIT APPLICATION

By
John Charnetski, P.E.

These guidelines relate primarily to Chapter 455B, Code of Iowa, 1973 and the Departmental Rules, which were issued pursuant to the authority of Section 406, Code of Iowa. It is assumed that the selection of the site has been preceded by the determination of the waste generation centroids and that the merits and limitations of the site have been fully assessed.

The sequence suggested in the guidelines is intended to correspond as closely as possible to the steps that are taken in preparing an application for a sanitary landfill permit. The additional data suggested, especially with respect to wells, may be difficult to obtain. It is hoped, however, that it may provide a basis for a more comprehensive submission where, in the opinion of the design engineer, the characteristics of the site make it necessary to compile more complete information.

It is suggested that the first page of the application should provide the data requested in our present "APPLICATION TO ESTABLISH AND OPERATE A SANITARY DISPOSAL PROJECT". (Appendix A) Three copies of this application form are required. This form provides the information necessary with respect to legal description, area of the site and ownership.

Instructions on ordering aerial photographs prepared by Mr. Marvin Smith of the ASCA office in Des Moines are attached. (Appendix B)

A listing of landscape architects in Iowa is also attached. (Appendix C)

Part II provides excerpts dealing with the "state of the art" in landfill, engineering and design. The selection of excerpts is of necessity subjective; another person may have chosen completely different subject matter. It is hoped, however, that the implementation of the principles described should help to promote highest possible standards in the design and management of solid waste disposal sites in Iowa.

These guidelines will be used as a handout where clarification is needed or is requested. They will not be distributed widely, since revisions may be required as experience is gained in the forthcoming years.

PRELIMINARY SITE EVALUATION

This section deals with site location requirements which can be evaluated with the aid of a topographical map and a preliminary field survey. Requirements are listed below:

1. Site Location

The landfill must be:

- a. outside of a flood plain or shoreland (subsection 5 page 7).*
- b. more than 1000 feet from private wells (subsection 6 page 7).
- c. one mile or more from a municipal well (subsection 7 page 7).
- d. at least one mile upstream or 1000 feet downstream from a municipal water intake (subsection 7 page 7).
- e. five hundred feet from a state highway right-of-way (subsection 8 page 7).
- f. one thousand feet from a federal highway right-of-way (subsection 8 page 7).
- g. 500 feet from an occupied dwelling (subsection 9 page 7).

Where the location of the site does not meet these requirements, indicate the remedial action proposed, submit evidence showing why an exception can be justified or alternatively how the site can be engineered to comply.

2. Zoning and Land Use

Zoning and land use are referred to in section 2.4(5) page 4 and section 3.1(1) page 5.

- a. Submit an outline map showing land use and zoning of the site and the adjoining area.
- b. Attach a copy of a zoning permit signed by the members of the Board of Adjustment in cases where a permit is required. Please confirm in writing where a permit is not required.

3. Aerial Photo

Plot or identify the following physical features:

- a. Show the permanent improvements on a 1"=660' aerial photo or on a supplementary map.
- b. Show the actual separation distances from the landfill site where they are equal to or less than the applicable legal limits described under Site Location in #1 above.

*Contact the Natural Resources Department where determination of applicability is required.

3. Aerial Photo* (continued)

- c. All wells within $\frac{1}{2}$ mile, including abandoned wells.
- d. Municipal wells within one mile or a municipal water intake within one mile upstream or 1000 feet downstream.
- e. State and Federal highways.
- f. Homes and buildings.
- g. Lakes and ponds, water courses and wet lands, dry runs and rock outcroppings.
- h. USC & GS or USGS bench marks.
- i. North arrow (3.1(1) page 5).

*Photos may be ordered from Eastern Aerial Photograph Laboratory, Program Performance Division, ASCS-USDA, 45 South French Broad Avenue, Asheville, North Carolina 28801.

Please refer to Appendix "B" which is attached. Order forms and advise may be obtained from the State or County A.S.C.S. offices.

SITE INVESTIGATION

Public agencies may obtain available well logs and hydrologic data from the Iowa Geological Survey (319/338-1173) or through the Department of Environmental Quality.

Iowa Geological Survey has also offered to assist and advise the DEQ with respect to initial site selection. Resistivity tests, which aid in determining the nature of underlying soil material, will also be undertaken by IGS provided there is evidence that a purchase option has been executed with the vendor.

1. Report on Soils and Geology

Paragraph 3.14(a) calls for drilling 50 feet into homogeneous till or 5 feet into bedrock. A stratigraphic section drawing and a drilling location plan are also required. In addition samples at 5 feet intervals must be submitted, together with the name of the persons responsible for this phase of the investigation.

The laboratory analysis required are:

- a. Particlesize distribution - (ASTM designation D422-63 provides clay fractions down to 2 microns in size).

The sample should be selected from the confining strata nominated to retard downward movement of water and from such other strata that are representative of the stratigraphy of the site.

- b. Atterberg limits - ASTM designation D423 and D424 (see vulnerability of water resources to pollution page 5).
- c. Permeability - Where permeability data is required, samples should be from the confining unit selected in (a) above and from such additional strata which are significant from the standpoint of hydraulic continuity with wells or bodies of water.
- d. Characteristics of cover material - paragraph 3.14(b), page 6, requires a description of the cover material. An SCS soil map of the site which shows the soil type, slope and degree of erosion should be submitted. The information in soil reports also provides a valuable aid in site selection and in the investigation of the underlying soils.

2. Evaluation of the Hydrology of the Site

Water table and related information - Section 3.1(4)f(2) page 6 specifies a five foot separation in distance between the high water table* and the base of the landfill.

The water table elevation and related data must of necessity be obtained in conjunction with soil drilling. The hydrology report should include:

- a. Ground elevation of the drill hole.
- b. Elevation of the water at the end of drilling.
- c. The time taken to reach a static level.
- d. The elevation of the static water table.
- e. Depth to the water bearing horizon and the nature of the water bearing material.

Vulnerability of water resources to pollution - It is incumbent on the design engineer at this point to assess the vulnerability and importance of local and regional water resources in relation to the natural protection offered by the soils and the geology of the site (or the protection which can be achieved with engineering modification.)

Sections 3.1(4)f(1) to (3) deal with the vulnerability of local or regional water resources to pollution in terms of:

- a. The extent of lateral hydraulic connection with shallow wells (subsection f(1) page 6).
- b. The separation distance between the base of the proposed landfill and the high water table (subsection f(2) page 6 stipulates at least five feet). A concurrent problem may be the presence of perched water especially in the Cary till in Iowa.
- c. The extent of surface or subsurface connection with standing or flowing water (subsection f(3) page 6).

Subsection f(4) page 6 describes the implementation of Darcy's Law** to determine the natural protection that the soil offers against downward leakage.

*Refer to the Rules for a definition of the high water table.

**Permeability data based on published averages for soil materials are not acceptable.

A deficiency in till depth, or in the homogeneity of this till (sand lenses, etc.) will require the submission of proof that downward leakage will not exceed 0.04 cubic feet of liquid per square foot per day.

The presence of a limestone subcropping aquifer would have the same effect as a till section of an adequate depth.

A combination of a high degree of vulnerability and low natural protection therefore requires a more detailed analysis of the possible adverse effects on water resources. Suggested data for study in the case of private wells (within $\frac{1}{2}$ mile) and municipal wells (within $1\frac{1}{2}$ miles) of the site are as follows:

- a. Ground elevation
- b. Water source
- c. Static water elevation
- d. Depth to water bearing horizon
- e. The nature of the water bearing materials

In the case of municipal wells both the static and pumping water levels are required.

It is the responsibility of the design engineer to demonstrate that the extent of hydraulic connection between the site and the wells in the area and the static or flowing water in the area, if any, are such that the water resources are being adequately protected.

3. Preliminary Site Approval

The data assembled in the previous sections, including soil and/or bedrock samples, may be submitted for preliminary approval at this stage at the discretion of the design engineer.

SANITARY LANDFILL PLAN SUBMISSION

Drawings should provide the following information:

- a. Boundaries of the disposal site and the location of bore holes.
- b. Initial contours at appropriate intervals (2-5 feet).
- c. Final contours at intervals corresponding to (a) above.
- d. Cross section drawings showing proposed excavation and fill, including the calculation of the total volume of soil cover required, the volume available at the site and the source of additional cover where it is needed.
- e. The scheme of development of the site using a lettered or numbered grid or a numerical progression, commencing with the initial construction of a berm or trench and initial drainage, and ending with the exact sequence of cell construction or area fill that is being proposed.
- f. Evidence that the requirements of the Conservancy District's Law, Chapter 467D, Code of Iowa, 1973, have been ascertained by contacting the local Soil Conservation District and that the limits on soil loss due to wind and water erosion will not be exceeded.

Prevention measures include the planting of perennial grasses, legumes, shrubs or trees, the establishment of grassed waterways and the construction of terraces or other permanent soil and water practices approved by the State Soil Conservation Committee.

- g. The location of winter cover stockpile, wet weather area, car hulk area (if any), passenger car drop boxes, fencing and the 20 foot separation distance from the adjoining property.
- h. Location of tile drains (if any) including the alternative method proposed to drain adjoining areas, if tile lines are to be removed or blocked.
- i. Proposed all weather approach road and internal road network between the entrance and the deposit area or trench.
- j. Intermediate and ultimate land use.
- k. Landscape site development plans where required.*
- l. Monitoring for leachate - The degree of protection afforded to water resources is indicative of the need for monitoring to determine whether the leachate produced, if any, is detrimental to the environment. Knowledge of ground water movement will help in determining the proper location for monitoring wells.
- m. Monitoring the scheme of site development - Determine whether there is a need for monitoring, by way of ground control, to ensure that the operational plan is being followed. In addition, state whether an agreement or an understanding has been reached with the client in regard to monitoring.

*Refer to Appendix C for a listing of Iowa landscape architects

OPERATIONAL PLAN SUBMISSION

Whenever possible the design engineer should ensure that the manager and landfill foreman are fully conversant with the scheme of development and that the site is surveyed and staked to help ensure compliance.

The operational plan submission should include:

- a. An organization chart showing the chain of command, duties of all personnel and a personnel manning table (subsection 3.1(4)i page 6).
- b. A recommended list of equipment selected on the basis of earth hauling distances, the volume of solid waste and the soil and weather conditions (subsection 3.1(4)i page 6).
- c. A description of all fire fighting equipment and facilities proposed and the actual arrangements that have been made with a local fire protection agency (subsection 3.1(4)i(11) page 9).
- d. A description of the communication facilities provided (subsection 3.1(4) i(12) page 9).
- e. A description of the sanitary facilities and personnel and equipment shelter (subsection 3.1(4)i(13) page 9).
- f. A description of the proposed access fence, litter fence, gate with locks, sign and intended wording on the permanent sign (subsection 3.1 (4)i(17) page 9).
- g. A statement that toxic, hazardous or radioactive materials shall not be deposited in the site unless explicit instructions are first obtained from the Executive Director of the Department of Environmental Quality (Section 2.4 (3) and (4) page 4).
- h. A statement that the applicant has been provided with a copy of the Rules.

OPERATING PROCEDURES

Describe operating procedures which must be followed and which are outlined in paragraphs 2.4(1) page 4 and 3.1(4)i pages 8 and 9, namely:

- 2.4(1) - Open dumping prohibited.
- 3.1(4)i(1) - Open burning prohibited.
- 3.1(4)i(2) - Deposition of waste to minimize leachate production.
- 3.1(4)i(3) - Confine dumping area.
- 3.1(4)i(4) - Even distribution of waste.
- 3.1(4)i(5) - Thorough compaction and 6 inches of soil daily.
- 3.1(4)i(6) - Provision of winter cover.
- 3.1(4)i(7) - Site grading and drainage.
- 3.1(4)i(8) - Maintenance of 20 foot separation distance from adjoining property.
- 3.1(4)i(9) - Effective control of vectors.
- 3.1(4)i(18) - Two feet of final cover.
- 3.1(4)i(19) - Finish grading and seeding.
- 3.1(4)i(20) - Notifying Executive Director prior to removal of equipment or completion.

PART II

THE "STATE OF THE ART"
IN SANITARY LANDFILL DESIGN & MANAGEMENT

Excerpts from papers and speeches

I. Importance of Engineering Design and Management

Even though a sanitary landfill can cause operational problems and have a negative effect on the surrounding area, it appears that most of these problems can be minimized through proper design and implementation. (1)

There should be a one to three percent slope for adequate drainage. Keep side slopes gentle to prevent erosion. Seed the top and side slopes promptly. Dig drainage ditches to carry away water without erosion. (4)

If lifts are to be placed on top of each other, make sure compaction and drainage are adequate. Allow about one year for settling between lifts. (4)

II. Cover and Surface Grading

. . . more emphasis needs to be placed on the use of cover as a design variable which regulates to a large extent the rate at which decomposition proceeds, as well as the movement of the products of decomposition. (1)

The grading of the final surface of the fill area must provide a slope of not less than one (1) percent but not exceeding fifteen (15) percent except as approved by the Department. (6)

III. Control of a High Water Table

Draw down the groundwater below the level of the landfill base and keep it there. Seal the quarry above groundwater level so no leachate from the fill could reach groundwater. Draw off the leachate for chemical and biological treatment and reduction. (5)

IV. Leachate

Preliminary laboratory scale results indicate that biological treatment of sanitary landfill leachate is efficient in removing a substantial portion of the organic pollutants. Anaerobic treatment of raw leachate was most promising, providing greater than 90 percent BOD reduction for detention times greater than 10 days at temperatures in the range of 23-30°C. Aerobic polishing of the anaerobic effluent produced BOD values commensurate with surface water discharge. Aerobic treatment of leachate also proved to be promising, resulting in BOD removals in excess of 90 percent at approximately 23°C and at loadings of less than 0.03 lb BOD₅/cu ft/day. Foaming and poor solids-liquid separation did occur in the bench-scale units, however.

Laboratory studies indicated that leachate could be added to domestic wastewater in an extended aeration activated sludge plant at a level of at least 5 percent by volume (leachate COD = 10000 mg/l) without seriously impairing effluent quality. At greater than 5 percent V/V, leachate additions resulted in substantial solids production, increased oxygen uptake rates, and poorer mixed liquor separation.

Several chemicals were used in an attempt to treat leachate chemically. Lime was used to precipitate hydroxides and Na₂S to precipitate sulfides; Cl₂ and KMnO₄ to oxidize organic and inorganic matter; alum and FeCl₃ to coagulate particulate and colloidal matter. The results indicate that chemicals alone

IV. Leachate (continued)

will not provide efficient removal of organics (COD); however, good removals of multivalent cations and color may be expected with lime, the oxidants, and the coagulants. Undesirable aspects of chemical treatment include high dose requirements and the generally large amounts of sludge produced.

Chemical treatment seems to be particularly useful in treating biological process effluent. Lime precipitation was effective in removing color and iron from both anaerobic and anaerobic-aerobic polished effluent, and did provide some incremental removal of COD. (2)

Even though it appears that leachate problems are greatly overemphasized, several methods are available to minimize problems should they develop. First is proper site selection, in which the coarsest soils, fractured rock, and nearby surface waters are avoided. In these cases little if any removal of contaminants by the soil will be experienced. Second, by proper selection of cover material, its slope, plantings, and possibly by adding water in the form of recycled leachate, sewage sludge, or other water sources, one can postpone or hasten the rate of leachate production. Lastly, by contouring the bottom of the site and installing leachate collection devices, any leachate collected can be treated biologically or chemically or otherwise disposed of in a safe manner. (1)

A major goal in planning, designing, and operating a sanitary landfill is to minimize all sources of water reaching the refuse so that leachate production is avoided. (3)

V. Gas

Cases are known where explosions were traced to the presence of a landfill. It appears, however, that the likelihood and frequency of such problems are not nearly as severe as is commonly thought. Problems are most likely to occur if soil conditions hinder the passage of methane to the atmosphere, resulting in a build-up of gas, sub-surface lateral migration, and eventual break-through at some point. If break-through occurs where the explosive mixture of 5 to 15% methane in air is attained in a confined space, the danger can be severe. Methods to avoid such problems include free venting of gas to the atmosphere through porous soils or venting devices, sealing off buildings from gas flow by impermeable barriers, and not building on or near the site. (1)

Many authorities do not advocate the use of impermeable materials as cover because they do not allow gas to escape to the atmosphere. Instances are recorded where methane gas from refuse decomposition has moved laterally through permeable soil into a surrounding area with subsequent buildup of explosive concentrations in cellars, sewers, and other enclosed places. Carbon dioxide produced in the landfill has also been observed to move long distances and to increase slightly the hardness in the groundwater. These potential problems may be controlled and virtually eliminated by the use of gas vents in and around the landfill or by surrounding the landfill with an impermeable gas barrier. (3)

VI. Hazardous and Problem Wastes

It was indicated that the federal governments in both the U.S. and U.K. are gathering information on present practices and on the quantities and characteristics of such wastes. In the U.S. this is being done by contract to research organizations, while in the U.K. new legislation requires notification to local authorities of the intent to dispose of such wastes. (1)

Sanitary landfill is not an acceptable method for the disposal of liquid wastes and sludges containing free moisture. (8)

VII. Internal Access Roads and Litter Control, etc.

An all-weather access road negotiable by loaded collection vehicles shall be provided from the entrance gate of the landfill to the unloading area unless provisions are made for an alternate disposal site with all-weather access roads to the unloading area to be used during periods of inclement weather. (6)

Litter control fences shall be located in the immediate operating area, approximately fifty (50) to seventy-five (75) feet downwind from the working face. (6)

The surface contours of the site shall be maintained such that surface water run-off will not flow into or through the fill. (7)

VIII. Demolition Materials

Due to the unusually combustible nature of demolition materials, demolition landfills or landfills incorporating large quantities of combustible materials shall be cross-sectioned into cells by earth dikes sufficient to prevent the spread of fire between cells, in accordance with engineering plans required by these regulations. Equipment shall be provided of sufficient size and design to densely compact the material to be included in the landfill. (7)

REFERENCES

1. Engineering Foundation Conference, August 1972. "Evaluation of Sanitary Landfill Design and Operating Practices". Conference Summary and Position Paper, by Professor Robert K. Ham, Conference Chairman, Department of Civil and Environmental Engineering, The University of Wisconsin, Madison, Wisconsin 53706.
2. Treatability of Leachate from Sanitary Landfills (presented at 27th Annual Purdue Industrial Waste Conference, Lafayette, Indiana, May 3, 1972), Professors W. C. Boyle and R. K. Ham, Department of Civil and Environmental Engineering, the University of Wisconsin, Madison, Wisconsin 53706.
3. Sanitary Landfill - Leaching Prevention and Control, Joseph A. Salvato, William G. Wilkie and Berton E. Mead, Journal of Water Pollution Control, October 1971.
4. Empire State Study Defines Ideal Disposal Operation, Solid Waste Management, April 1972.
5. How to Doctor a Quarry for Landfill, Joseph A. McHenry, P.E., A.W. Martin, Associates, Inc., King of Prussia, Pa., December 1970, The American City.
6. Pennsylvania Solid Waste Regulations adopted November 21, 1969 and amended January 30, 1970.
7. Oregon Solid Waste Regulations, April 1, 1972.
8. Position on Sanitary Landfill, June 1972, EPA OFFICE OF SOLID WASTE MANAGEMENT PROGRAMS.

APPENDIX A

APPLICATION TO ESTABLISH AND OPERATE A SANITARY DISPOSAL PROJECT

To: Department of Environmental Quality
Solid Waste Management Division
Lucas State Office Building
Des Moines, Iowa 50319

I. I (we) hereby apply for a permit to construct and operate a _____
(sanitary landfill,
_____ in compliance with the requirements of Chapter 455B, 1973, Code
incinerator, etc.)
of Iowa. This application pertains to a new facility ; to an existing non-conforming
facility .

It will serve a population of _____ and will be known as the _____

The legal description of the _____ acre site is _____ of
Section _____, Twp. _____, Range _____ in the County of _____

Zoning status: _____

Site is owned by _____ or leased from _____

II. To the best of my knowledge, the design of the above described sanitary disposal project
complies with the requirements outlined in the Departmental Rules.

Name of Engineer	Address	Phone	Date
Signature _____ (Engineer)		(Iowa Reg. Eng. #)	

III. I certify that the construction and operation of the above described sanitary disposal
project will be in accordance with plans, specifications, and information submitted to and
approved by the Iowa State Department of Environmental Quality and with conditions which
are enumerated in the permit.

Name and Address of Legal Applicant	Phone	Date
Signature _____ (Applicant)	(Title)	

APPENDIX B



UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL STABILIZATION AND CONSERVATION SERVICE
Room 937 Federal Building
Des Moines, Iowa 50309

January 31, 1973

Mr. John Charnetski
Department of Environmental Quality
Lucas Building
Des Moines, Iowa 50319

Dear Mr. Charnetski:

Agricultural Stabilization and Conservation aerial photography coverage of Iowa can be purchased only from the Eastern Aerial Laboratory at Asheville, North Carolina. Ordering information and assistance is available through the State or county ASCS offices. Delivery is direct from the laboratory to the buyer and delivery time is usually two to three weeks after receipt of the order.

Scale adjusted black and white aerial coverage of the respective county is in the custody of each county ASCS office. The photographs are used for farm acreage determinations but arrangements can usually be made with the county office for viewing a specific photo or photos at the office. The most recent flights vary in age from 1964 to 1972. The enlargements used by the counties are at a scale of 1"=600' except in Shelby, Audubon and Benton where the scale of the most recent flights is 1"=1000'.

The Iowa State ASCS Office in the Federal Building, Des Moines, has custody of contact prints comprising stereo coverage of the most recent flights for each of the Iowa Counties. Those contact prints are available for viewing, but not for sale.

Sales information is provided on the attached form ASCS-441, Order For Aerial Photographs, which lists standard sizes, approximate scales and prices. Form ASCS-441 is available at the State or county ASCS Offices.

Prior to 1969 most of the ASCS aerial photographic coverage of Iowa had been produced at a scale of 1:20,000. Since 1969 several counties have been flown at higher altitudes resulting in coverage at scale of 1:38,000 or 1:40,000. We are attaching a report indicating by county the year of the most recent flight and the scale of the photography. The size and scale of available enlargements is dependent on the scale of the photography. Generally, four sections of land are centered on a negative for 1:20,000 scale while 16 sections are centered on a single negative at 1:40,000 scale.

Thus a 1"=660' enlargement on 24"x24" paper is an enlargement of a single negative while a similar 1"=660' enlargement at 1:40,000 scale covers about 1/4 of the area of a single negative. The 1:40,000 scale column in the table on Form ASCS-441 applies to both 1:38,000 and 1:40,000 scales.

In addition to the standard enlargements listed on Form ASCS-441, sectional enlargements are available as indicated in the quadrant example; ie., for 1:20,000 scale photography, a standard 1"=660' enlargement is furnished on 24"x24" paper at a current cost of \$4.50 without scale accuracy; a section enlargement of one quadrant of that photo comprising slightly over 1/4 of the total area would be available at a scale of 1"=330' on 24"x24" paper for the same \$4.50 price. Also available on this basis are five additional quadrant size positions on the negative: (1) exact center, (2) top center, (3) bottom center, (4) left center and (5) right center.

For the counties with 1:20,000 scale photography, sectional enlargements corresponding to each of four standard enlargements are available:

<u>Standard Enlargement</u>	<u>Sectional</u>	<u>Paper Size</u>
1"=1320'	1"=660'	13"x13"
1"=1000'	1"=500'	17"x17"
1"=660'	1"=330'	24"x24"
1"=400'	1"=200'	38"x38"

In addition, a sectional enlargement can be furnished covering a quadrant sized area but centered on a specific point on the photograph; such special sectionals must be ordered through the State ASCS office and cost double the price of the standard enlargement.

Mylar reproducibles are available in the above standard or sectional sizes but should be ordered and priced through the State ASCS office.

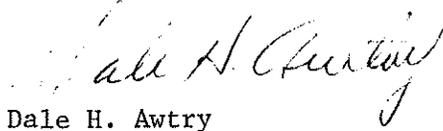
For 1:38,000 and 1:40,000 scale photography, sectionals at 1"=330' can be furnished but cover less than 1/4 of the total area of the photograph. They are printed on 38"x38" paper, cost double the price of the 1"=660' enlargement and must be ordered through the ASCS State office.

Photocopies which are photographic reproductions of part of a photograph are printed on ordinary 8 1/2"x11" bond paper. They are stocked in county ASCS offices for approximately a seven year interval between flights.

(3)

They may be purchased for \$1.00 each depending on their availability but will not be reproduced for sale. Due to paper shrink they cannot be furnished with scale accuracy.

Very truly yours,

A handwritten signature in cursive script, appearing to read "Dale H. Awtry".

Dale H. Awtry
State Executive Director

Attachments

INSTRUCTIONS

IMPORTANT - On LABEL on face of order print or type items 1 thru 3 only.

IDENTIFICATION OF PHOTOGRAPHY

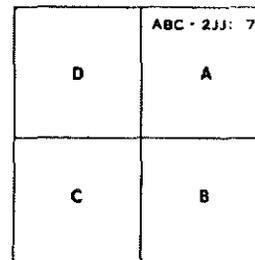
PAPER SIZE	QUANTITY	SYMBOL	ROLL NO.	EXPOSURE NO.
1	2	3	4	5
24" x 24"	1	D J D	3 A	96

Column 1. Enter paper size 9½" x 9½", 24" x 24" etc.,. When ordering indexes enter "Photo Index" and list sheet numbers and year of photography.

Column 2. Enter number of prints wanted from each exposure number.

Column 3, 4 and 5. Enter the symbol, roll number, and the exposure number of the negative, Exposure numbers may be listed in inclusive sequences. This information is in the upper right corner of each photograph and may be obtained from photo-index sheets or from the Agricultural Stabilization and Conservation Office in the county where the farm or area photographed is located.

* QUADRANT NUMBERING SYSTEM



(Area Covered by Negative)

Example: Your area of interest lies wholly within lower left quadrant, you should order ABC-2JJ: 7C. When more than one quadrant from the same negative is ordered, image overlap will be furnished.

If you do not know your area of interest as related to the negative, we suggest a visit to the ASCS office for assistance.

PRICES (Quoted prices are based on paper size)

Remittance is required before prints will be made, and must be by check, money order, or draft payable to ASCS. Stamps will not be accepted.

TYPE OF REPRODUCTION	SIZE	** APPROX. SCALE FROM 1:20,000 PHOTOGRAPHY	** APPROX. SCALE FROM 1:40,000 PHOTOGRAPHY	COST (per print)	
				1 - 25	EXCESS OVER 25
Contact Print ^{1/}	9½" x 9½"	1" = 1667'	1" = 3334'	\$1.75	\$1.25
Enlargement	13" x 13"	1" = 1320'	1" = 2640'	3.00	2.50
Enlargement	17" x 17"	1" = 1000'	1" = 2000'	3.50	3.00
Enlargement	24" x 24"	1" = 660'	1" = 1320'	4.50	3.50
Enlargement	24" x 24"	1" = 330' * (Quadrant)	1" = 660' * (Quadrant)	4.50	3.50
Enlargement	38" x 38"	1" = 400'	1" = 800'	9.00	8.00
Photo Index (No. of sheets per county depends on size of county)	20" x 24"			3.00	3.00

* All enlargements are made at diameters to fit paper size unless scale accuracy is requested. For "scale accuracy" add \$0.50 per print.

1/ For polyester base paper (9½" x 9½" only) add \$0.75 per contact print.

2/ Applies to first 25 prints ordered regardless of size of order.

3/ Applies to each print in excess of 25. Quantity prices apply only when order is shipped to one address.

ADDRESS ORDERS FOR PHOTOGRAPHS OF THESE STATES

Western Aerial Photography Laboratory
 Program Performance Division
 ASCS-USDA
 2505 Parley's Way, Salt Lake City, Utah 84109
 Tel. Area Code 801, 524-5856

Arizona	Nevada
Arkansas	New Mexico
California	North Dakota
Colorado	Oklahoma
Hawaii	Oregon
Idaho	Texas
Kansas	Utah
Louisiana	Washington
Montana	Wyoming
Nebraska	

ADDRESS ORDERS FOR PHOTOGRAPHS OF THESE STATES TO:

Eastern Aerial Photography Laboratory
 Program Performance Division
 ASCS-USDA
 45 South French Broad Avenue, Asheville, N.C. 28801
 Tel. Area Code 704, 254-0961 Extension 610

Alabama	Michigan	South Dakota
Connecticut	Minnesota	Tennessee
Delaware	Mississippi	Virginia
Florida	Missouri	West Virginia
Georgia	New Hampshire	Wisconsin
Illinois	New Jersey	
Indiana	New York	
Iowa	North Carolina	
Kentucky	Ohio	
Maine	Pennsylvania	
Maryland	Rhode Island	
Massachusetts	South Carolina	

Orders for photography not held by Agricultural Stabilization and Conservation Service should be forwarded to the holding agency; if address is not known forward to the Coordinator of Aerial Photographic Work of the Department, ASCS, U. S. Department of Agriculture, Washington, D. C. 20250.

Approximate Scale of Most Recent Iowa Photographic Coverage

IOWA CHECKSHEET * 1:20,000
1597 Townships

Check Digit, County Code Number of Townships	Year Last Flown	Scale	Check Digit, County Code Number of Townships	Year Last Flown	Scale
8 001 Adair 16	1967	*	6 101 Jefferson 12	1969	*
4 003 Adams 12	1966	*	2 103 Johnson 21	1970	*
9 005 Allamakee 18	1971	*	7 105 Jones 16	1970	*
5 007 Appanoose 16	1967	*	3 107 Keokuk 17	1969	*
1 009 Audubon 12	1968	*	9 109 Kossuth 28	1965	*
7 011 Benton 20	1969	1:45,000	5 111 Lee 15	1969	*
3 013 Black Hawk 17	1970	*	1 113 Linn 20	1970	*
8 015 Boone 17	1971	1:38,000	6 115 Louisa 12	1969	*
4 017 Bremer 14	1971	*	2 117 Lucas 12	1967	*
0 019 Buchanan 16	1970	*	8 119 Lyon 18	1968	*
6 021 Buena Vista 16	1968	*	4 121 Madison 16	1967	*
2 023 Butler 16	1964	*	0 123 Mahaska 18	1969	*
7 025 Calhoun 16	1972	1:40,000	5 125 Marion 13	1967	*
3 027 Carroll 16	1968	*	1 127 Marshall 17	1971	*
9 029 Cass 16	1966	*	7 129 Mills 13	1966	*
5 031 Cedar 17	1969	*	3 131 Mitchell 17	1971	1:38,000
1 033 Cerro Gordo 16	1970	1:38,000	9 133 Monona 19	1966	*
6 035 Cherokee 16	1968	*	4 135 Monroe 12	1967	*
2 037 Chickasaw 12	1971	*	0 137 Montgomery 12	1966	*
8 039 Clarke 12	1967	*	6 139 Muscatine 14	1969	*
4 041 Clay 16	1968	*	2 141 O'Brien 16	1968	*
0 043 Clayton 22	1970	*	8 143 Osceola 12	1968	*
5 045 Clinton 20	1969	*	3 145 Page 16	1966	*
1 047 Crawford 20	1968	*	9 147 Palo Alto 16	1972	1:40,000
7 049 Dallas 16	1967	*	5 149 Plymouth 24	1968	*
3 051 Davis 15	1969	*	1 151 Pocahontas 16	1972	1:40,000
9 053 Decatur 16	1967	*	7 153 Polk 18	1967	*
4 055 Delaware 16	1970	*	2 155 East Potta. 14	1966	*
0 057 Des Moines 11	1969	*	0 156 West Potta. 14	1966	*
6 059 Dickinson 12	1968	*	8 157 Poweshiek 16	1970	*
2 061 Dubuque 17	1970	*	4 159 Ringgold 17	1966	*
8 063 Emmet 12	1972	1:40,000	0 161 Sac 16	1968	*
3 065 Fayette 20	1971	*	6 163 Scott 14	1969	*
9 067 Floyd 13	1971	*	1 165 Shelby 16	1968	*
5 069 Franklin 16	1970	1:38,000	7 167 Sioux 23	1968	*
1 071 Fremont 14	1966	*	3 169 Story 16	1972	1:40,000
7 073 Greene 15	1972	1:40,000	9 171 Tama 21	1970	*
2 075 Grundy 14	1971	*	5 173 Taylor 16	1966	*
8 077 Guthrie 16	1967	*	0 175 Union 12	1967	*
4 079 Hamilton 16	1972	1:40,000	6 177 Van Buren 14	1969	*
0 081 Hancock 16	1972	1:40,000	2 179 Wapello 14	1969	*
6 083 Hardin 15	1971	*	8 181 Warren 17	1967	*
1 085 Harrison 20	1966	*	4 183 Washington 15	1969	*
7 087 Henry 12	1969	*	9 185 Wayne 16	1967	*
3 089 Howard 12	1970	1:38,000	5 187 Webster 21	1972	1:40,000
9 091 Humboldt 12	1972	1:40,000	1 189 Winnebago 12	1972	1:40,000
5 093 Ida 12	1968	*	7 191 Winneshiek 20	1971	*
0 095 Iowa 16	1970	*	3 193 Woodbury 24	1966	*
6 097 Jackson 18	1970	*	8 195 Worth 12	1971	1:38,000
2 099 Jasper 19	1967	*	4 197 Wright 16	1972	1:40,000

APPENDIX C

Iowa firms offering consulting service in landscape architecture

Landscape Architecture firms -

Jon Crose and Associates
3116 $\frac{1}{2}$ Ingersoll
Des Moines, Iowa 50312

Harrison and Associates
Box 359
Nevada, Iowa 50201

Elizabeth Howerton
1350 Crestline Court
Bettendorf, Iowa 52722

Yale C. Moeller
4040 42nd Street
Des Moines, Iowa 50316

Craig J. Ritland
148 Vincent
Waterloo, Iowa 50701

Schlott and Farrington
535 DeLong Avenue
Council Bluffs, Iowa 51501

Firms employing landscape architects as staff members

Smith-Voorhees-Jensen Associates
(Mr. Jim Bradshaw)
1040 5th
Des Moines, Iowa 50314

Wallace Holland Kastler Schmitz & Co.
(Mr. Gary Claude)
Willowbrook Plaza, Box 1467
Mason City, Iowa 50401

Stanley Consultants
Stanley Building
Muscatine, Iowa 52761

Powers-Willis & Associates
(Mr. Jim Maynard)
1223 South Riverside
Iowa City, Iowa 52240

Environmental Planning and Research, Inc.
(Mr. James L. Brown)
4209 N.W. 6th Avenue
Des Moines, Iowa 50313