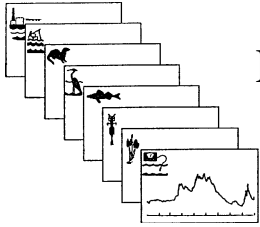


ENVIRONMENTAL MANAGEMENT PROGRAM

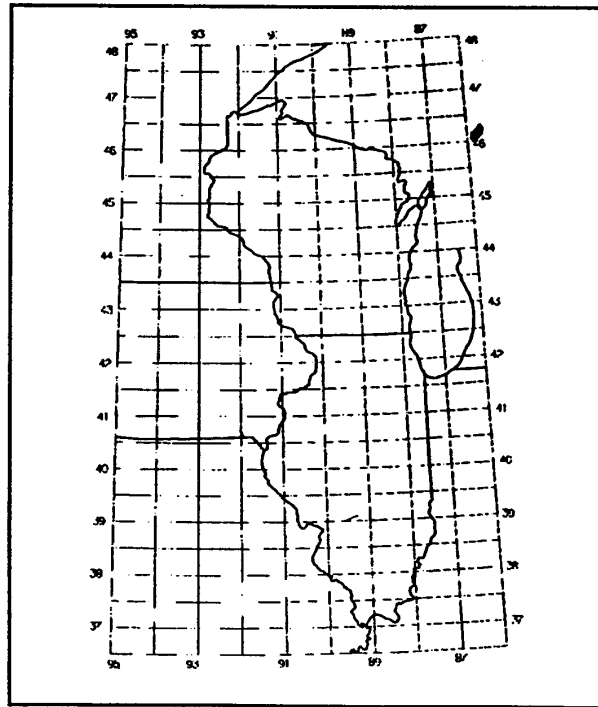


Long Term Resource Monitoring Program

Upper Mississippi River System



GUIDELINES FOR THE COLLECTION OF SPATIAL DATA FOR THE UPPER MISSISSIPPI RIVER



July 1991



U.S. Fish and Wildlife Service
Environmental Management Technical Center
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GUIDELINES FOR THE COLLECTION
OF SPATIAL DATA
FOR THE
UPPER MISSISSIPPI RIVER

by

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<p>ABSTRACT</p> <p>The Environmental Management Technical Center is responsible for developing a geographic information system for the Upper Mississippi River System. To assure useful products are developed with a high degree of quality assurance and quality control, the Analysis Team for the Long Term Resource Monitoring Program recommended that standards and conventions for data organization, coding, storage and transmission be written.</p> <p>This document includes contract specifications for acquisition of aerial photography, aerial mapping services (contour mapping), digital scanning services, photo interpretation, vector digitizing services and digital image processing. In addition, file documentation standards are included to provide potential users with descriptive and quantitative measures associated with spatial and tabular data generated by the Environmental Management Technical Center. Where applicable, specifications were written to conform to existing data bases that are available, for the Upper Mississippi River System. The specifications also require compatibility between contractor software and the software configuration found at the Environmental Management Technical Center.</p>		
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TABLE OF CONTENTS

REPORT DOCUMENTATION PAGE ii

TABLE OF CONTENTS iii

ABSTRACT v

ACKNOWLEDGEMENTS vi

INTRODUCTION 1

CONTRACT SPECIFICATIONS FOR AERIAL PHOTOGRAPHY 1

 1.0 SCOPE OF CONTRACT 1

 2.0 TECHNICAL PERFORMANCE REQUIREMENTS 2

 3.0 ITEMS TO BE DELIVERED BY THE CONTRACTOR 3

CONTRACT SPECIFICATIONS FOR AERIAL MAPPING 3

 1.0 SCOPE OF CONTRACT 3

 2.0 TECHNICAL PERFORMANCE REQUIREMENTS 3

 2.1 Aerial Photography 3

 2.2 Basic Control and Photo Point Control 4

 2.3 Stereo Compilations 4

 3.0 PRODUCTS FURNISHED BY THE CONTRACTOR 4

 3.1 Aerial photography 4

 3.2 Scribed quality topographic maps 4

 4.0 PRODUCTS TO BE FURNISHED BY THE EMTC 5

 5.0 COMMENCEMENT, EXECUTION AND COMPLETION 6

 5.1 General 6

 5.2 Completion Dates 6

 5.3 Progress Reports 6

CONTRACT SPECIFICATIONS FOR DIGITAL SCANNING SERVICES 6

 1.0 SCOPE OF WORK 6

 2.0 TECHNICAL PERFORMANCE REQUIREMENTS 6

 3.0 SCANNING SPECIFICATIONS 7

 4.0 PRODUCT SPECIFICATIONS 7

 5.0 ITEMS TO BE PROVIDED BY THE EMTC 8

 6.0 TIME REQUIREMENTS 8

 7.0 CRITERIA FOR EVALUATING CONTRACTOR BIDS 8

CONTRACT SPECIFICATIONS FOR AIR PHOTO INTERPRETATION 8

 1.0 SCOPE OF CONTRACT 8

 2.0 TECHNICAL PERFORMANCE REQUIREMENTS 8

 3.0 PHOTO INTERPRETATION SPECIFICATIONS 9

 4.0 PRODUCT SPECIFICATIONS 9

 5.0 PRODUCTS TO BE FURNISHED BY THE CONTRACTOR 9

 6.0 PRODUCTS TO BE FURNISHED BY THE EMTC 10

 7.0 PRODUCT ACCEPTANCE PROCEDURE 10

 8.0 COMMENCEMENT, EXECUTION AND COMPLETION 11

CONTRACT SPECIFICATIONS FOR DIGITIZING SERVICES 11

 1.0 SCOPE OF CONTRACT 11

 2.0 MAP REGISTRATION PROCEDURES 16

 3.0 DATA DIGITIZATION 17

Table 1. Maximum Deviation for Digitizer/Map Transformation	17
4.0 EDITING REQUIREMENTS	18
5.0 DATA REFORMATION	18
6.0 POLYGON "COMPLETION" BORDER INTERSECTIONS	19
7.0 FINAL OUTPUT FILE	19
8.0 DIGITAL DATA OUTPUT	19
9.0 TAPE DIRECTORY/SUPPLEMENTAL INFORMATION LISTING	20
Figure 1. Report Layout	20
CONTRACT SPECIFICATIONS FOR DIGITAL IMAGE PROCESSING	21
1.0 SCOPE OF CONTRACT	21
2.0 TECHNICAL PERFORMANCE REQUIREMENTS	21
3.0 CLASSIFICATION SPECIFICATIONS	22
4.0 REGISTRATION SPECIFICATIONS	22
5.0 FINAL PRODUCT SPECIFICATIONS	22
6.0 PRODUCTS TO BE FURNISHED BY THE CONTRACTOR	23
7.0 PRODUCTS TO BE FURNISHED BY THE EMTC	23
8.0 PRODUCT ACCEPTANCE PROCEDURE	23
9.0 COMMENCEMENT, EXECUTION AND COMPLETION	24
FILE DOCUMENTATION STANDARDS	25
CONTENT DESCRIPTION	25
Title	25
Subject	25
Subject, General	25
Subject, Specific	25
Major Attributes	25
Areal Coverage	25
Format	25
Responsibility	25
Notes	25
QUALITY REPORT	26
Lineage	26
Source	26
Date of file	26
Lineage quality	26
Positional Accuracy	27
Attribute Accuracy	28
Attribute Accuracy Quality	28
Attribute Accuracy Tests	29
Logical Consistency	29
Logical Consistency Quality	29
Logical Consistency Testing	30
Completeness	30
HARDWARE/SOFTWARE	30
Media	30
Size	31
Organization	31
Codes	31
Level of Documentation	31
Hardware Configuration	32
Software Configuration	32
APPENDIX A FILE DOCUMENTATION RECORDING FORM	33

ABSTRACT

The Environmental Management Technical Center is responsible for developing a geographic information system for the Upper Mississippi River System. To assure useful products are developed with a high degree of quality assurance and quality control, the Analysis Team for the Long Term Resource Monitoring Program recommended that standards and conventions for data organization, coding, storage, and transmission be written.

This document includes contract specifications for the acquisition of aerial photography, aerial mapping services (contour mapping), digital scanning services, photo interpretation, vector digitizing services, and digital image processing. In addition, file documentation standards are included to provide potential users with descriptive and quantitative measures associated with the spatial data generated by the Environmental Management Technical Center. Where applicable, specifications were written to conform to existing data bases that are available for the Upper Mississippi River System. The specifications also require compatibility between contractor software and software used by the Environmental Management Technical Center.

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INTRODUCTION

The Long Term Resource Monitoring Program (LTRMP) for the Upper Mississippi River System (UMRS) was authorized under the Water Resources Development Act of 1986 (Public Law 99-662). The UMRS is composed of the navigable reaches of the Upper Mississippi, Illinois, Kaskaskia, Black, St. Croix and Minnesota rivers. Program objectives are: to analyze significant resource problems such as sedimentation, water level management, and navigation impacts; to monitor selected habitats and species; and to develop data management systems and techniques which will assist resource personnel to better manage the UMRS ecosystems.

The objective is to provide decision makers with adequate information to ensure continuation of the UMRS as a viable fish and wildlife resource, while maintaining its multiple-use character. This requires an improved understanding of the interactions of ecosystem components and the long term trends in these resources.

Measurement of long term trends requires collection of scientifically valid and statistically sound data through time, in order to detect site specific or systemwide changes or trends in selected physical, chemical and biological components of the various habitats and biotic communities. This information will also provide critical baseline information needed to solve resource problem issues.

This document includes contract specifications for the acquisition of aerial photography, topographic mapping services, digital scanning services, photo interpretation, vector digitizing services, and digital image processing. In addition, file documentation standards are included to provide potential users with descriptive and quantitative measures associated with the spatial data generated by the Environmental Management Technical Center (EMTC).

CONTRACT SPECIFICATIONS FOR AERIAL PHOTOGRAPHY

1.0 SCOPE OF CONTRACT

A contract for aerial photography includes all services, labor, plant, equipment and transportation (including fuel) necessary to produce 1:15,000 vertical, true color and/or color infrared (CIR) strip aerial photography, including negatives, paper prints and/or positive transparencies, and a flight line/photo index on either county highway maps or U.S. Geological Survey (USGS) 1:250,000 NK series maps for certain portions of the UMRS. Areas of interest are supplied to the contractor.

2.0 TECHNICAL PERFORMANCE REQUIREMENTS

- 2.1 The aerial photography to be taken under this contract shall be vertically exposed with a 9 inch x 9 inch format, calibrated, 6 inch focal length, precision aerial mapping camera, equipped with a single, high resolution, distortion free type lens and appropriate filters.
- 2.2 The contractor, in consultation with EMTC staff, determine the direction and flight lines necessary to provide complete stereoscopic coverage of the areas of interest. All coverage determined inadequate by the EMTC shall be cause for the contractor to provide additional coverage at no expense to the government.
- 2.3 Sixty percent overlap along the line of flight and 30% sidelap of parallel flights is required. Deviations of more than 5% from these specified overlaps because of excessive tilt, crab, and drift will be considered unsatisfactory and cause for rejection of that particular flight or any portion thereof. Aerial photography specifications are further defined as follows:
 - 2.3.1 All images must be acquired when the sun is at least 30 degrees above the horizon.
 - 2.3.2 Excessive scale variation (5%) because of unadjusted flight altitude above mean ground elevation may be considered unsatisfactory and cause for rejection.
 - 2.3.3 Tilt shall not exceed 4 degrees average along a flight line.
 - 2.3.4 Crab shall not exceed 10 degrees as measured from the line of flight, as indicated by the principal points of consecutive photographs.
 - 2.3.5 Contractor shall determine the proper film/filter combinations to be used according to the work order and photographic conditions. The film shall be exposed and developed in such a manner that it is sharp, clear, and free of defects.
 - 2.3.6 No more that 5% cloud cover is acceptable.
 - 2.3.7 Excessive (noticeable) vignetting is cause for all products to be refused.
 - 2.3.8 Every attempt must be made to fly the photography within a one week window either side of the required date.

- 2.3.9 Photo indices shall be prepared on county highway maps or USGS 1:250,000 NK series maps indicating the flight line, photo number and direction of flight.
- 2.3.10 Contact prints of all photography delivered under this contract shall be prepared on water resistant, medium weight, medium contrast, non-glossy, print paper suitable for stereoscopic viewing.
- 2.3.11 Each frame shall be labelled with the date, of photography, scale, flight line number and frame number.
- 2.3.12 Delivery of products shall be within 20 calendar days following the flight.

3.0 ITEMS TO BE DELIVERED BY THE CONTRACTOR

- 3.1 The contractor shall provide a flight line/index map delineating each flight line and the beginning and ending frame numbers.
- 3.2 The contractor shall provide the developed negatives if applicable on a winding spool with a suitable container) and a complete set of contact prints or transparencies to the EMTC.

CONTRACT SPECIFICATIONS FOR AERIAL MAPPING

1.0 SCOPE OF CONTRACT

Stereo aerial photography and topographic mapping is completed under a work order placed under an indefinite delivery photogrammetric contract.

It is anticipated that no work order will involve the land/water interface greater than that covered by 6 to 8, USGS 7.5 minute quadrangle maps. No contours need be plotted for the water surface.

2.0 TECHNICAL PERFORMANCE REQUIREMENTS

- 2.1 Aerial Photography. Black and white stereo photography required to fulfill this Work Order shall be furnished by the contractor. The format will be 9 inches x 9 inches at either 1800 (1' interval) or 3600 (2' interval) feet above ground level. The camera shall be a 6 inch Focal Length metric camera used for precision aerial mapping. End lap for photography shall not be less than 55% or more than 65%. Multiple flight lines, where necessary, shall be spaced to provide 30% side lap. Imagery shall be obtained with no part of the terrain obscured by snow, clouds, cloud shadows or smoke. Normal shorelines must be evident.

- 2.2 Basic Control and Photo Point Control. All necessary horizontal and vertical control required for mapping under this work order will be established by the contractor and shall be of third or higher order accuracy. Positions for horizontal control will be computed with relation to the system provided to the contractor by the EMTC. Vertical control shall be established as needed. The elevations shall be referenced to the National Geodetic Vertical Datum. Analytical bridging for control may be used in this work order. Horizontal control stations will be established as needed. Data pertaining to horizontal and vertical control will be recorded on Government Form DA 1959 furnished by the EMTC and prepared by the contractor. Accurate and complete descriptions of all control stations shall be recorded, including section, township and range. Iron stakes will be set at all horizontal control stations.
- 2.3 Stereo Compilations. All planimetric details visible and identifiable on the aerial photographs, such as buildings, roads, railroads, bridges, drainage features and major fence lines shall be plotted. Besides to the 1 or 2 foot contours, spot elevations shall be plotted at all road intersections; at all low or high points of centerline grade on highways, roads, levees and other prominent features.

3.0 PRODUCTS FURNISHED BY THE CONTRACTOR

- 3.1 Aerial photography.
 - 3.1.1 Developed negative must be provided in a roll on a winding spool within a suitable metal or plastic container labeled showing the name of the project, serial number of first and last numbered negative of flight, date and mean time of flight, approximate scale and contract number.
 - 3.1.2 Each negative shall show the date of photography, scale, flight number and exposure number.
 - 3.1.3 One set of final contact prints will be made on semi-matte paper, with control points located.
 - 3.1.4 Flight line index shall be submitted showing limits of each photograph on the flight line(s).
- 3.2 Scribed quality topographic maps.
 - 3.2.1 Size. 28 inches x 40 inches; mapping area, 25 inches x 35 inches.
 - 3.2.2 Material. 0.004 inch stable-base drafting media.

- 3.2.3 Standard 5 inch or 500 foot grids relative to the system provided to the contractor by the EMTC must be used. Each grid line is to be labeled with appropriate coordinates.
- 3.2.4 All planimetric features shown in 2.3 are to be plotted.
- 3.2.5 Date of photography shall be shown on all drawings.
- 3.2.6 Horizontal and vertical control points will be plotted.
- 3.2.7 Contours at 1 foot or 2 foot intervals are to be plotted, depending on the work order.
- 3.2.8 Spot elevations will be shown for these features.
 - 3.2.8.1 Sizeable tops and depressions.
 - 3.2.8.2 Railroad grade crossings.
 - 3.2.8.3 Road intersections.
 - 3.2.8.4 High or low points on center lines of main highways and railroads.
 - 3.2.8.5 Other prominent features.
- 3.2.9 Final drawing scale will be 1 inch equals 200 feet.
- 3.2.10 Line weight and character size will be sufficient for later reduction of maps to 1 inch equals 400 feet.
- 3.3 One print of each scribed drawing will be provided.
- 3.4 Control data cards (Form 1959) for all control points established.

4.0 PRODUCTS TO BE FURNISHED BY THE EMTC

- 4.1 Map showing limits of required photography.
- 4.2 Map showing limits of required mapping.
- 4.3 All existing data pertaining to horizontal and vertical control which was previously established throughout the area by the USGS, or other sources.
- 4.4 Form 1959 for control record.

5.0 COMMENCEMENT, EXECUTION AND COMPLETION

- 5.1 General. The contractor is required to execute the work required under this contract with faithfulness and diligence in order to complete and deliver all work in accordance with the final completion date.
- 5.2 Completion Dates.
 - 5.2.1 Aerial photography shall be accomplished as soon as conditions in 2.1 can be met.
 - 5.2.2 The target date for completion of all work under this work order is set by the contract, barring any excusable delays. The contractor shall complete and deliver all work on or before that time.
- 5.3 Progress Reports. A written progress report shall be submitted 10 days after the receipt by the contractor of the notice to proceed, and every 30 days thereafter for the remainder of the contract period. The report shall show the percentages of work accomplished for each phase of the work (flying, control, compilation, etc.) for that report period and the total percentage to date for each phase. The two statistics must be made distinguishable from each other by color or symbol if the report is graphic. Any problem areas should be addressed in the required report. The report shall be delivered or postmarked not later than 3 calendar days following the end of the reporting period.

CONTRACT SPECIFICATIONS FOR DIGITAL SCANNING SERVICES

1.0 SCOPE OF WORK

The contract objective is to obtain scanning services. The EMTC provides film positive color and CIR aerial photography and/or transparencies and the contractor returns the photographs/transparencies and digital data recorded on 1/2 inch magnetic computer compatible tape.

2.0 TECHNICAL PERFORMANCE REQUIREMENTS

- 2.1 Bidders are required to include a detailed description of equipment, material and methods to be used in fulfilling this contract.
- 2.2 Bidders are required to provide references which will include the name of the firm/agency for which similar work was performed, the name of an individual within the firm/agency who is familiar with the contract, and the address and phone number of that individual.

- 2.3 Bidders are required to scan two test photographs and provide detailed time and cost information. The time data is used as a basis for estimating the cost of jobs submitted to the successful bidder(s).

3.0 SCANNING SPECIFICATIONS

- 3.1 The digitizing scanner used by the contractor must be a charged couple device. A vidicon scanner is not acceptable.
- 3.2 The digitizing scanner must produce a raster file at least 4096 by 4096 pixels.
- 3.3 The contractor must have the capability and expertise to filter red (approximately 600-700 nm), green (approximately 500-600 nm), and blue (approximately 400-500 nm) wavelengths. This involves three scanning episodes per image, one for each wavelength, which will generate three files.
- 3.4 The scanner, at a minimum, must be able to produce 8 bit data for each pixel scanned.
- 3.5 Any changes in gray levels due to the scanner/lens, i.e., vignetting, must be removed from final products.

4.0 PRODUCT SPECIFICATIONS

- 4.1 The magnetic tape provided by the contractor must have the following characteristics: 9 track, ANSI compatible tape certified at a density of 6250 bits per inch (bpi), unlabeled (no internal tape header file) without file header information, 1600 or 6250 bpi.
- 4.2 The last data file on tape will be terminated by a record that contains a blank file name and a zero counter value, then a USA standard end-of-file mark.
- 4.3 Each tape transmittal must be accompanied by a listing that provides the number and type of files on the tape, the data file ordering by file name, date of photograph, sampling interval, the number of rows and columns in each file and other pertinent bookkeeping information about tape content.
- 4.4 There may be more than one image per tape but images shall not be split between tapes.
- 4.5 Each color band shall be in a separate file (band sequential) and all files for a particular image shall be on the same tape.
- 4.6 Only one scan line per tape record will be used.

5.0 ITEMS TO BE PROVIDED BY THE EMTC

- 5.1 The EMTC will provide color or CIR film positive photographs/transparencies. Film positives and computer tapes will be returned to the EMTC when the digitizing scanning is complete. For each photograph, the direction of north will be indicated on an acetate sleeve. Each image is to be scanned in its entirety, starting at the northwest corner.

6.0 TIME REQUIREMENTS

- 6.1 Scanning shall occur at an average of no fewer than five images per week commencing with receipt of film positives following notification of award of contract. Photographs and tapes shall be shipped to the EMTC as completed in lots of 10.

7.0 CRITERIA FOR EVALUATING CONTRACTOR BIDS

- 7.1 The criteria outlined in the Technical Criteria section, will be used to evaluate proposals received as a result of this Request for Proposal (RFP).

CONTRACT SPECIFICATIONS FOR AIR PHOTO INTERPRETATION

1.0 SCOPE OF CONTRACT

- 1.1 Work to be done under contract consists of furnishing all services, labor, plant, and equipment to provide photo interpretation and mapping services. Areas of interest will be supplied to the contractor.

2.0 TECHNICAL PERFORMANCE REQUIREMENTS

- 2.1 Bidders are required to include a detailed description of equipment, material and methods to be used in fulfilling this contract.
- 2.2 Bidders are required to provide references which will included the name of the firm/agency for which similar work was performed, the name of an individual within the firm/agency who is familiar with the technical aspects of the contract, and the address and phone number of that individual.
- 2.3 Bidders are required to provide the EMTC with examples of work at the 1:24,000 USGS quadrangle level and detailed time and cost information associated with the example. The time data will be used as a basis for estimating the cost of jobs submitted to the successful bidder(s),

- 2.4 The contractor must have at least one stereo zoom transfer scope, or equivalent, for use in registering stereoscopic aerial photographs or acetate overlays to 1:24,000 USGS quadrangle maps.

3.0 PHOTO INTERPRETATION SPECIFICATIONS

- 3.1 The contractor will be expected to meet with EMTC staff before initiation of photo interpretation (PI) work in order to: 1) become familiar with the existing data base; and 2) to ensure that new data which is generated is consistent with that which already exists.
- 3.2 All PI work completed under this contract will utilize the applicable theme classification codes provided by the EMTC.

4.0 PRODUCT SPECIFICATIONS

- 4.1 The contractor will utilize stable-base drafting mylar material for the quadrangle overlays.
- 4.2 All interpretive work will be registered to the base map by using the tic marks supplied to the contractor by the EMTC. This information will be provided when the contractor meets with the EMTC staff (Section 3.1).
- 4.3 At the discretion of the EMTC, the contractor will provide LTRMP with draft pencil (lead not greater than 0.30mm) copies of the quadrangle overlays per the Product Acceptance Procedure as outlined in Section 7.

5.0 PRODUCTS TO BE FURNISHED BY THE CONTRACTOR

- 5.1 The contractor will furnish all supplies and materials necessary for the successful completion of the contract.
- 5.2 The Contractor will furnish draft copies of all quadrangle overlays to the EMTC for review.
- 5.3 At the discretion of the EMTC the Contractor will furnish final inked versions of each quadrangle overlay which must register exactly to the base maps per Section 4.2 and 6.3, contain the correct theme codes and any revisions or additions which might follow.
- 5.4 The Contractor will furnish a written report which details procedures of the contract and any variances which were granted the Contractor by EMTC about theme classification codes.

6.0 PRODUCTS TO BE FURNISHED BY THE EMTC

- 6.1 EMTC will provide the Contractor with stereoscopic aerial photography for the areas of interest.
- 6.2 EMTC will provide the Contractor with the USGS, 1:24000 quadrangle base maps.
- 6.3 EMTC will provide the Contractor with registration tic marks for each quadrangle which will be used when registering the theme to the geographic information system (GIS) data base.

7.0 PRODUCT ACCEPTANCE PROCEDURE

- 7.1 Procedures for product acceptance governs how products are received, reviewed and accepted or rejected by the EMTC.
 - 7.1.1 Initially, a preliminary document called a RFP will be issued by the Contracting Officer or authorized representative to the Contractor for review and preparation of a proposal.
 - 7.1.2 The Contractor shall complete all work on an EMTC designated "checkout" unit, including the generation of all deliverable products, before starting any other map unit. This "checkout" unit will require that two maps be interpreted and that edges match on common polygons and lines at the map border. These materials along with the associated aerial photography are to be forwarded to the EMTC for review within 10 days of receipt of the EMTC furnished materials. Qualified EMTC employees will review the quality of the Contractor's work to assure the contract is being performed in accordance with the technical specifications. This preliminary check will allow the EMTC to find repetitive errors or mistakes early, providing feedback that will eliminate needless rework. This preliminary check will be performed on the first work order submitted and any other as requested by the EMTC.
 - 7.1.3 For each subsequent product transmittal, the EMTC will review the draft maps. If this check suggests that the work has not been thoroughly and properly performed, the contractor will be notified and a new set of products for that map unit will be required after corrections. Correction calls will be placed on a registered overlay and returned to the contractor for corrections along with the original draft map.

- 7.1.4 The EMTC will perform a review within 14 working days following receipt of the deliverable products (or as specified in the individual work order) and notify the Contractor of any unit requiring rework.
- 7.1.5 Steps (7.1.3-4) will be repeated until the deliverable products are deemed acceptable by the EMTC. The Contractor will be responsible for correcting all errors at no additional cost to the government within 5 working days of receipt, whether marked on the first or subsequent transmittal.

8.0 COMMENCEMENT, EXECUTION AND COMPLETION

- 8.1 General. The contractor is required to execute the work required under this contract with faithfulness and diligence in order to complete and deliver all work in accordance with the final completion date.
- 8.2 The target date for completion of all work under this work order is set by contract, barring any excusable delays. The contractor shall complete and deliver all work on or before that time.
- 8.3 A written graphic progress report shall be submitted 10 days after the receipt by the contractor of the notice to proceed, and every 30 days thereafter for the remainder of the contract period. The report shall show the percentages of work accomplished for each phase of the work for that report period and the total percentage to date for each phase. The two statistics must be made distinguishable from each other by color or symbol if the report is graphic. Any problem areas should be addressed in the required report. The report shall be delivered or postmarked not later than 3 calendar days following the end of the reporting period.

CONTRACT SPECIFICATIONS FOR DIGITIZING SERVICES

1.0 SCOPE OF CONTRACT

- 1.1 The objective of this multi-year contract is to provide digitizing services to the EMTC on a work order basis.
- 1.2 Technical Performance Requirements.

- 1.2.1 All data will be digitized by the contractor from the best available source; preferably stable base USGS quadrangle separations, stable base overlays, or photographs. The most the maps and overlays will be at a scale of 1:15,000, but some may be at other scales, both smaller and larger, and at other projections as defined by the EMTC.
- 1.2.2 The contractor must have the capability and expertise to digitize, perform graphic edit, change projections, perform map subsetting by area (windowing), merge data files within these subareas, perform edge matching, and tailor the data for use by ARC/INFO software for any given job. Additional requirements include error analysis, output to a 1/2 inch, 1600/6250 bpi tape in ARC Export and/or ASCII Digital Line Graph optional format 3 (DLG3) formats, hard copy map plotting, and report generation.
- 1.2.3 The contractor must selectively duplicate individual spatial/topological features from one or more digitized maps to a target map, maintaining mathematical consistency between multiple data layers defined by coincident boundaries.
- 1.2.4 The contractor will be expected to maintain compatibility with all ARC structure and format changes during the life of the contract. The contractor will also be required to maintain compatibility with older versions.
- 1.2.5 Bidders are required to include a detailed description of equipment, material and methods to be used in fulfilling this contract.
- 1.2.6 Bidders are required to provide references which will include the name of the firm/agency for which similar work was performed, the name of an individual within the firm/agency who is familiar with the contract in a technical sense, and the address and phone number of that individual.
- 1.2.7 Bidders are required to digitize two test data sets and provide detailed time and cost information. The time data will be used as a basis for estimating the cost of a work order submitted to the successful bidder(s).

1.3 Contractor Responsibilities.

- 1.3.1 The contractor(s) shall furnish all material, labor, supervision, work space and equipment necessary to produce and deliver digital data products as set forth in the contract. Specific labor intensive tasks include the following.
 - 1.3.1.1 Digitizing of all data themes as identified, according to the specification in Sections 1 through 4.
 - 1.3.1.2 Coordinate with the EMTC personnel to correct source material errors. This may require that interim plots identifying errors or inconsistencies in the data be supplied to the EMTC.
 - 1.3.1.3 Coordinate editing and production verification plots (deliverable product) as detailed in Sections 3 through 9.
 - 1.3.1.4 Coordinate system conversion, map subsetting and internal edge matching according to the specifications in Section 5.
 - 1.3.1.5 Polygon "completion" as described in Section 5 and 6.
 - 1.3.1.6 Coordinate system conversion and digital data output file structuring/formatting per specifications in Sections 5 through 8.
 - 1.3.1.7 Generate tape (deliverable product) version of all digital data according to Sections 8 and 9.
 - 1.3.1.8 Associated tape directory and file parameter listings (deliverable product) as described in Section 9.
- 1.3.2 Contractor must have the equipment, personnel, and expertise necessary for the completion of this contract, holding to the time frame and specifications contained herein.

1.4 Required Contractor Equipment and Specifications.

- 1.4.1 Digitizing tablets used by the contractor must have a one-thousandth of an inch (.001) grid resolution and three-thousandths (.003) repeatability.
- 1.4.2 Digital plotter must have a step size resolution of one thousandth of an inch (.001) and the capability to produce mylar and vellum products.
- 1.4.3 Usable equipment must include a select switchable 1600/6250 bpi magnetic tape drive (refer to Section 9 for tape format specifications).
- 1.4.4 At least one graphics CRT will be available per work station for digital map file display, graphic editing and acreage validation.
- 1.4.5 A line printer must be available for file listings.
- 1.4.6 Necessary hardware interfaces for ARC/INFO software must be available.

1.5 Materials Furnished to the Contractor. All material furnished to the Contractor is Government property and must be returned at the completion of the associated work order.

- 1.5.1 USGS 1:24,000, 1:62,500, 1:100,000 or other scale maps or stable base mylar overlays for all listed areas.
- 1.5.2 A list of all maps to be digitized.
- 1.5.3 All mylar overlays will be labeled by map name or identifying number and have all tic marks necessary for registration.
- 1.5.4 A list of all data themes delineated on maps or stable base overlays with list of legend attributes and legend format.
- 1.5.5 Digital or graphic copy of the menu showing symbols to be used for each data theme.
- 1.5.6 All data themes will be clearly and neatly delineated and edge matched.
- 1.5.7 All criteria for acceptance plots.
- 1.5.8 Any previously digitized data required for map unit setup, edge matching, or duplicating of related themes.

- 1.5.9 Written instructions for any special procedures, such as duplication of lines from related themes.
- 1.5.10 Registered source materials and exacting instructions on transfer procedures and requirements on a project basis.
- 1.6 Materials Furnished by the Contractor. The contractor will prepare and furnish, in acceptable form to EMTC, the following materials in order to qualify for final payment, subject to all the other terms of the contract requirements.
 - 1.6.1 Magnetic tapes for all digital data in the final formats (ARC external format or DLG optional format 3), for direct import into a Prime (PRIMOS) operating environment, according to the specifications detailed in the following sections and the delivery order for each project.
 - 1.6.2 Verification plot for each digitized map showing edited, color or symbol coded data categories at source map scale.
 - 1.6.3 A tape directory/supplemental information listing, one per deliverable tape, that provides information for assembling, tracking and checking all map file data.
- 1.7 Software Requirements. It will be necessary for the contractor to have a current version of ARC, the output of which is compatible with ARC running in a PRIMOS environment.
- 1.8 Product requesting, ordering, and acceptance procedures. Procedures for product acceptance governs how products are received, reviewed and accepted or rejected by the EMTC.
 - 1.8.1 Initially, a preliminary document called a RFP will be issued by the Contracting Officer or authorized representative to the Contractor for review and preparation of a proposal.
 - 1.8.2 The Contractor shall complete all work on the EMTC designated "checkout" unit, including the generation of all deliverable products, before starting any other map unit. This "checkout" unit will require that two maps be digitized and that edge matching be performed on common polygons and lines at the map border. These materials are to be forwarded to the EMTC for review within 10 days of receipt of the EMTC furnished materials. Qualified EMTC employees will review the quality of the Contractor's work to assure the contract is being performed in accordance with the technical specifications. This preliminary check will allow the EMTC to find repetitive errors or mistakes early, providing feedback that will eliminate needless rework. This preliminary check will be performed on the first work order submitted and any other as requested by the EMTC.

- 1.8.3 For each subsequent product transmittal, the EMTC will review all plots. If this check suggests that the work has not been thoroughly and properly performed, the contractor will be notified and a new set of products for that map unit will be required after corrections. Correction calls will be placed on the verification plots or other registered overlay and these returned to the contractor for corrections.
- 1.8.4 The EMTC will perform a review within 14 working days following receipt of the deliverable products (or as specified in the individual work order) and notify the Contractor of any unit requiring rework.
- 1.8.5 Steps (1.8.3-4) will be repeated until the deliverable products are deemed acceptable by the EMTC. The Contractor will be responsible for correcting all errors at no additional cost to the government within 5 working days of receipt, whether marked on the first or subsequent transmittal.

2.0 MAP REGISTRATION PROCEDURES

- 2.1 General Information. All maps will be carefully registered, then analyzed for acceptability by the procedure detailed below. A precise algorithm for converting x,y digitizer coordinates to Universal Transverse Mercator (UTM) values will be necessary to accomplish the registration procedure.
 - 2.1.1 If a map fails to register within the tolerances detailed below, the EMTC must be notified and supplied with all registration results as set forth in (9.2.2). The EMTC will either furnish new source material or waive registration requirements for sources not meeting established standards.
 - 2.1.2 The Contractor will calibrate all digitizing tablets used for this contract on a weekly basis using a grid on stable base material of known coordinates.
- 2.2 Technical Information. The Contractor will need to register four to six known geographic locations and a check point. The check point will be checked both before and after the digitizing process, and also periodically while digitizing.

- 2.2.1 The criteria for registration acceptability are based on the map scale. Mean deviation in both x and y directions must be within acceptable limits, as given in Table 1.

Table 1. Maximum Deviation for Digitizer/Map Transformation

Geounit Size		Maximum Deviation (Seconds)	National Map Accuracy Standard	Maximum Deviation (USGS Maps)
1E x 2E	(1:250,000)	2.80	420 feet	1.50
1/2E x 1E	(1:100,000)	1.13	170 feet	0.75
15' x 15'	(1:62,500)	0.70	150 feet	0.40
7.5' x 7.5'	(1:24,000)	0.27	40 feet	0.15

- 2.2.2 All registration parameters, including x,y values, UTM values, and computed error figures must be preserved in electronic storage and output as part of the listing associated with each tape transmittal. See Section (9.2.2) for details of report formatting.

3.0 DATA DIGITIZATION

All data will be digitized according to the specifications below, and written to files according to data category.

- 3.1 Modes of Data Capture. Digitizing will be accomplished by one of two methods: 1) point mode digitizing; 2) scanning.
- 3.2 Digitizing Specifications.
- 3.2.1 All coverages will be digitized in double precision.
- 3.2.2 Point, line and polygon data will reside in separate coverages.
- 3.2.3 Sufficient points must always be collected or retained to trace the theme detail within 1/100th of an inch (0.01") at each corresponding point. Deviations from centerline of this standard will be cause for EMTC to reject the associated map products, thus requiring redigitizing the entire map.
- 3.2.4 No duplication of points that occur consecutively in a data string is permitted.

- 3.2.5 All digitized data entities will be coded as point line or polygon. Adjacent points will be written to a data file in ARC format.
- 3.2.6 The last coordinate pair must be exactly (mathematically) equal to the first coordinate pair for all coordinate strings enclosing an area (polygon).
- 3.2.7 All lines will be clearly identified as to type.
- 3.2.8 All point data will be clearly identified as to type.

4.0 EDITING REQUIREMENTS

- 4.1 Conditions Requiring Editing. All digitized map data will be graphically inspected and all errors edited as defined below.
 - 4.1.1 Any deviations of the digitized data plots as compared to the source map that exceed 1/100th of an inch (.01") will be edited to the correct location or redigitized.
 - 4.1.2 All confluences of line and polygon data must be exact, mathematically; that is, no "overshoots" or "undershoots" are permitted. Lines that connect polygons must intersect those polygons precisely, i.e., every end point must be an intersect point of the respective polygon.
 - 4.1.3 No duplicate features are allowed on the output files described in (7.3).
- 4.2. Completeness of Editing. Any violations of the requirements set forth under (4.1) can be considered sufficient case for the rejection of derived deliverable map file products, at the discretion of the EMTC.
- 4.3 Verification Plot. A single verification plot of each data theme containing all edited data categories at source map scale, will be provided to the EMTC as a deliverable product.

5.0 DATA REFORMATION

- 5.1 Conversion of edited x,y data to latitude/longitude or UTM. When specified as required output, error-free map data shall be converted to the latitude/longitude and/or UTM coordinate system using the registration points collected in Section 3.

5.2 Internal data file editing, map border and edge matching.

- 5.2.1 All polygons comprised of data from more than one map must undergo edge matching along each map border internal to that polygon.
- 5.2.2 All actual "line" type data will be edited to affect a smooth and continuous transition across map borders. The matching line segments will be logically merged to form a single line data file entity.
- 5.2.3 All other line segments that are parts of "polygon" type data will be edited to affect a smooth and continuous map border transition.

6.0 POLYGON "COMPLETION" BORDER INTERSECTIONS.

- 6.1 Conditions Requiring "Completion". All polygons intersecting an area or project border must be "completed" at the border.

7.0 FINAL OUTPUT FILE

- 7.1 General Flow. All data files, once through the editing and polygon completion phases are to be in ARC export format or DLG Optional 3 format, per individual work request, and ready for direct import into a Prime (PRIMOS) operating environment.
- 7.2 Coordinate System Conversion. Either the latitude/longitude or UTM coordinate system may be requested by the EMTC.
- 7.3 File Layout. All digital entities within a particular file must contain only data from a single category.

8.0 DIGITAL DATA OUTPUT

8.1 Tape Format.

- 8.1.1 All files generated in Section 7 will be downloaded to magnetic tape. Each tape will contain one or more files but a file may not be divided between two tapes.
- 8.1.2 The magnetic tape must have the following characteristics: 9-track, ANSI compatible tape certified at a density of 6250 bpi. Unlabeled (no internal tape header file), ASCII 1600 or 6250 bpi (work order specified). Physical record size shall not exceed 12000 bytes.

9.0 TAPE DIRECTORY/SUPPLEMENTAL INFORMATION LISTING

- 9.1 General Content: Each tape transmittal must be accompanied by a computer generated listing that provides the data file ordering by file name and other pertinent bookkeeping information about tape content. Additionally, each file shall have a formatted layout (9.2) showing map registration parameters and registration error analysis results.
- 9.2 Report Layout. The layout shown in Figure 1 is one acceptable format; other arrangements that detail the same information in an equally readable style will be acceptable. The EMTC reserves the right to judge alternative proposals. Paragraph (9.2.2) is repeated, once for each data theme file.

Transmittal No.	Date:				
Project:					
Tape No.	No. Files:				
File Name	No. of Entries				
<p>REGISTRATION DATA RESULTS OF POLYNOMIAL TRANSFORMATION</p>					
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; text-align: center;">COORDINATES</td> <td style="width: 50%; text-align: center;">RESIDUALS</td> </tr> <tr> <td style="text-align: center;">NORTHING EASTING</td> <td style="text-align: center;">NORTHING EASTING</td> </tr> </table>		COORDINATES	RESIDUALS	NORTHING EASTING	NORTHING EASTING
COORDINATES	RESIDUALS				
NORTHING EASTING	NORTHING EASTING				
1.	_____	_____	_____	_____	
2.	_____	_____	_____	_____	
3.	_____	_____	_____	_____	
4.	_____	_____	_____	_____	
5.	_____	_____	_____	_____	
6.	_____	_____	_____	_____	
STANDARD DEV. IN X = _____ STANDARD DEV. IN Y = _____					

Figure 1. Report Layout

CONTRACT SPECIFICATIONS FOR DIGITAL IMAGE PROCESSING

1.0 SCOPE OF CONTRACT

This contract involves providing a land cover classification for the UMRS. The flood plain delineates the project area. The land cover classification of the project area uses Landsat Thematic Mapper data and requires that portions of eight scenes be processed. The output file must be in the ERDAS, (filename.gis) format and also include the color lookup table file (filename.trl). Following classification, the data must be registered to the 1:24,000 USGS quadrangle maps using the UTM coordinate system. Besides being available at the 1:24,000 scale, the data must also be accessible at the pool level without overlap. Aerial photography and ground truth information will be provided to the Contractor in order to validate the classification. Based on this information, and that contained in Section 8, the Contractor will correct any errors in the output files using either an editor (right polygon, wrong class) or a refined classification procedure. Any changes must be coordinated with the EMTC.

2.0 TECHNICAL PERFORMANCE REQUIREMENTS

- 2.1 The Contractor must utilize an image processing system fully compatible with ERDAS in fulfilling this contract.
- 2.2 The contractor must extract the project area as defined in Section 1 by either using a digital elevation model (DEM) or by using a manual approach, i.e., digitizing the flood plain as a vector file and using that file to "cut" the project area or "mask" the area outside the project area.
- 2.3 The project area must be extracted from the Landsat data files (bands) prior to classification. The option which ignores zero values when they exist in all input files will be utilized during the classification process.
- 2.4 The Contractor must provide the EMTC with the land cover output files in the ERDAS, .gis format in addition to the file's color table file (.trl).
- 2.5 The output files must be registered to the USGS 1:24,000 quadrangle maps utilizing the UTM coordinate system.
- 2.6 A procedure to aggregate the 1:24,000 files at the pool level must be provided.
- 2.7 The Contractor will follow the file naming convention provided by the EMTC.

3.0 CLASSIFICATION SPECIFICATIONS

- 3.1 A land cover classification system which is used on the UMRS should meet the following criteria.
 - 3.1.1 The minimum level of accuracy should be no lower than 85%.
 - 3.1.2 The accuracy of interpretation for all categories should be equal.
 - 3.1.3 The classification system should work throughout the UMRS.
 - 3.1.4 The system should allow for the use of subcategories which can be obtained from ground survey work or larger scale aerial data.
 - 3.1.5 Categories should lend themselves to aggregation.
 - 3.1.6 Change detection should be possible using future land use data.
 - 3.1.7 Multiple land covers should be recognizable.

4.0 REGISTRATION SPECIFICATIONS

- 4.1 The Landsat data will be georeferenced to the UTM coordinate system using a minimum of 12-15 points for that portion of the project area included on a Landsat Thematic Mapper quarter-scene.
- 4.2 The Contractor will provide the EMTC with the statistics, including residuals, for each quarter-scene registration. Errors should not exceed one-half pixel and the final solution should be based on at least 10 points.
- 4.3 Control points should not be taken outside of the flood plain.

5.0 FINAL PRODUCT SPECIFICATIONS

- 5.1 The final products shall meet the criteria in Section 4.1 as well as the following.
 - 5.1.1 The final products will be georeferenced to the UTM coordinate system.
 - 5.1.2 The final products will provide land cover information at both the quadrangle and in the pooled reaches, at the pool level.

6.0 PRODUCTS TO BE FURNISHED BY THE CONTRACTOR

- 6.1 The contractor will furnish all supplies and materials necessary for the successful completion of the contract.
- 6.2 The Contractor will furnish draft copies of all quadrangle overlays to LTRMP for review.
- 6.3 The Contractor will furnish final versions of each quadrangle overlay which must register to the base maps and reference the correct "Grouped Codes" as defined by the EMTC for vegetation (land cover) and any revisions or additions which might follow.
- 6.4 The Contractor will furnish a written report which details procedure and also includes any variances which were granted the Contractor by the EMTC about class codes.

7.0 PRODUCTS TO BE FURNISHED BY THE EMTC

- 7.1 EMTC will provide the Contractor with Landsat Thematic Mapper data for the entire UMRS.
- 7.2 EMTC will provide the Contractor with stereoscopic aerial photography for the areas of interest.
- 7.3 EMTC will provide the Contractor with the USGS, 1:24000 quadrangle base maps.

8.0 PRODUCT ACCEPTANCE PROCEDURE

- 8.1 The procedure outlined in this subsection will govern how products are received, reviewed and accepted/rejected by the EMTC.
 - 8.1.1 Delivery Order. Initially, a preliminary document called a RFP will be issued by the Contracting Officer or authorized representative to the Contractor for review and preparation of a proposal.
 - 8.1.2 The Contractor shall complete all work on the EMTC designated "checkout" unit, including the generation of all deliverable products, before starting any other map unit. This "checkout" unit will require that two quadrangle overlay maps be generated and that edges match on common polygons and lines at the map border. These materials along with the associated aerial photography are to be forwarded to the EMTC for review within 10 days of receipt of the EMTC furnished materials. Qualified EMTC employees will review the quality of the Contractor's work to assure the contract is being performed in accordance with the technical specifications. This preliminary check will allow the EMTC to find repetitive errors or mistakes early, providing feedback that

will eliminate needless rework. This preliminary check will be performed on the first work order submitted and any other as requested by the EMTC.

- 8.1.3 For each subsequent product transmittal, the EMTC will review the draft map. Correction calls will be placed on a registered overlay and returned to the contractor for corrections along with the original draft map. The Contractor will then proceed with the classification of the project area.
- 8.1.4 The EMTC will perform a review within 14 working days following receipt of the deliverable products (or as specified in the individual work order) and notify the Contractor of any unit requiring rework.
- 8.1.5 Steps (8.1.3-4) will be repeated until the deliverable products are deemed acceptable by the EMTC. The Contractor will be responsible for correcting all errors at no additional cost to the government within 5 working days of receipt, whether marked on the first or subsequent transmittal.

9.0 COMMENCEMENT, EXECUTION AND COMPLETION

- 9.1 General. The contractor is required to execute the work required under this contract with faithfulness and diligence in order to complete and deliver all work in accordance with the final completion date.
- 9.2 The target date for completion of all work is specified in the work order, barring any excusable delays. The contractor shall complete and deliver all work on or before that time.
- 9.3 Progress Reports. A written progress report shall be submitted 10 days after the receipt by the contractor of the notice to proceed, and every 30 days thereafter for the remainder of the contract period. The report shall show the percentages of work accomplished for each phase of the work for that report period and the total percentage to date for each phase. The two statistics must be made distinguishable from each other by color or symbol if the report is graphic. Any problem areas should be addressed in the required report. The report shall be delivered or postmarked not later than 3 calendar days following the end of the reporting period.

FILE DOCUMENTATION STANDARDS

CONTENT DESCRIPTION

- 1) Title: The title of the data file shall describe the primary purpose of the file.
- 2) Subject: The subject matter of the data file shall be described both generally and specifically. This will provide the user easy initial access to data through a uniform general listing. Continued review of specific subjects will allow the user to access a file's application to an identified need.
 - a) Subject, General: The general category of the data file subject shall be selected from the EMTC subject list.
 - b) Subject, Specific: Specific subject classification shall provide sufficient detail for other users to understand the content of the file. Classification will be made by the originator.
- 3) Major Attributes: The five major attributes (if applicable) which are contained in the file shall be identified. An attribute is a single category of information. At the EMTC, all input files will initially contain one theme and one theme only. Files with more than one attribute are the result of modeling/analysis or overlay work.
- 4) Areal Coverage: The political or physical unit(s) which best describe the area covered by the file shall be identified. This information is only intended to generally describe the geography.
- 5) Format: The format of the data file shall be described as either positional (related to a specific location on the ground), or tabular (related to a known area). Mark the correct format on the file descriptor.
- 6) Responsibility: Information on the agency, institution, or business responsible for compiling the data shall be provided. The smallest definable subunit within any of the organizations listed above which is responsible for the compilation of the data will also be provided along with the address and telephone number.
- 7) Notes: A space shall be provided for use by the data collector. It could include internal file coding, additional comments, or other useful information.

QUALITY REPORT

The purpose of the quality report is to provide detailed information for a potential user to determine the suitability of the data for the intended use. This "truth in labeling" approach will allow the user to make the decision on whether to use the data. All land records data shall include a quality report consisting of the following sections:

8) Lineage: Lineage is the flow of data from the time it is first obtained until it is put into a usable form. All data goes through some sort of processing whether it is development on film or digitizing a map for computer storage. Each step in the processing has potential for altering the data, and therefore knowledge of the process and the steps taken to ensure accuracy in processing are important in assessing the quality of the data.

a) Source: Describe the source material from which the data was taken as well as the date of the source material.

b) Date of file: Provide the date that the data was compiled into a usable form. This is the date that the source material was combined with any additional information to provide the desired information. Do not use the date that the computerized file was completed unless the dates are the same.

c) Lineage quality: Evaluate the quality of the data processing (lineage quality). This should be done by the individual processing the data or by an independent source. The findings should be documented for review by other potential users. The extent of the documentation shall be made known as a level rating.

Level 1. A written document or technical report provides an in-depth description of all source materials, all computer components, and all technical processes used to develop the data, including all mathematical computations.

Level 2. Same as Level 1 but only partial documentation is available.

Level 3. Some of the source materials, computer components, and technical processes are known and are partially supported by documentation.

Level 4. Very little information is available about the development of the data base.

- 9) **Positional Accuracy:** Positional accuracy is a measure of how well the data is related to the ground. Many different reference systems exist to relate data to the ground. Most are developed to meet special needs, and while useful in a given area, they do not have universal application.
- a) The most universal reference is latitude/longitude, but other systems, such as the Wisconsin Coordinate System (WCS), a three plane state coordinate system or UTM projection can be mathematically transformed to latitude/longitude. To provide for transferability, all coordinates used for the transfer of positional data must have a known and expressed relationship to latitude and longitude. Similarly, vertical data shall be expressed in relationship to the National Vertical Datum.

If a standard reference is used, simply mark latitude/longitude, Wisconsin Plane Coordinate System (WCS), or UTM. For WCS and UTM, identify the zone.

- b) If a non-standard reference is used, identify the method used and completely describe its mathematical relationship to latitude/longitude and/or the National Vertical Datum.
- c) In the case of tabular data, describe the spatial unit used to establish a position for the tabular record such as political units, public land survey sections (PLSS), river mile index, etc.
- d) **Positional Accuracy Quality:** The individual compiling the data file must test the data to determine how accurately it describes points on the ground. A statement of the findings shall be documented for review by other potential users. The extent of the documentation shall be made known as a level rating.

Level 1. All digital data coordinates have a known and expressed mathematical relationship to latitude/longitude and the geodetic control network on the source documents is known documentation is available.

Level 2. Same as Level 1 but only partial documentation is available.

Level 3. The digital data was captured utilizing a geodetic control network other than latitude/longitude or UTM, but the relationship to latitude and longitude is expressed, some documentation is available.

- Level 4. Very little information is available about the coordinate positions of the data.
- e) Positional Accuracy Testing: The extent of the testing shall be included in the documentation and be made known to potential users as a level rating.
- Level 1. Supplemental computer data has been merged with the created digital data, or a source of higher accuracy has been compared to check for coordinate precision.
 - Level 2. Numerous measurements have been taken on the computer system to check for coordinate position and faults in line closure.
 - Level 3. A graphic inspection (check plots) has been made to the original data to check the overall fidelity to the source document.
 - Level 4. An estimate based on experience and user feedback has been made.
- 10) Attribute Accuracy: An attribute is an element, or category of the data file. Having ensured that the data were accurately processed and correctly positioned, the next test is whether or not they have been correctly described.
- a) Attribute Accuracy Quality: The quality of the data attributes should be evaluated to ensure the attributes correctly describe what occurs on the ground. A report of attribute accuracy - the methods used, the findings, and any corrections made shall be prepared for review by potential users. The extent of documentation shall be expressed as a level rating.
- Level 1. A written document or technical report provides an in-depth description of method(s) used to evaluate attribute accuracy, findings-and-corrections-quality, and the resulting findings.
 - Level 2. Same as Level I but only partial documentation is available.
 - Level 3. Some information exists on the process used to evaluate attribute accuracy and the results are partially documented.
 - Level 4. Very little information is available.

- b) Attribute Accuracy Tests: Several different methods can be applied to the evaluation of attribute integrity. Each provides a degree of accuracy. The extent that the evaluation process was applied to the data shall be expressed as a level rating.

Level 1. Over 25% of the data file was field verified.

Level 2. The data file was compared with an independent source of higher accuracy and a discrepancy index was prepared for the entire file. The relationship between the file and the independent source is explained and discrepancies corrected or clarified.

Level 3. A discrepancy matrix was prepared based on independent point samples. The sample procedure and the location of the sample points is described.

Level 4. An estimate based on experience or user feedback has been made.

- 11) Logical Consistency: Logical consistency inquires about the "reasonableness" of the data, providing an additional test. Factors such as intersections not crossing, lines being entered more than once, the presence of overshoots and/or undershoots, totals not adding to 100%, structures located in lakes, etc. are examples of inconsistencies.

- a) Logical Consistency Quality: All data shall be tested for consistency (reasonableness). The methods used, findings, and corrective actions shall be documented and available for review. The extent of this testing will be expressed as a level rating.

Level 1. A written document or technical report provides an in-depth description of tests performed, the resulting findings, and the corrective actions taken.

Level 2. Same as Level I but only partial documentation is available.

Level 3. Some information exists on the tests conducted and the results are partially documented.

Level 4. Very little information is known or available.

b) Logical Consistency Testing: The extent that the test(s) have been applied to the data shall be expressed as a level rating.

Level 1. Exhaustive testing has been done on all portions of the data to check for consistent conditions. Inconsistencies should not exist.

Level 2. More than 50% of the file has been tested. Some inconsistencies are known to exist.

Level 3. A graphic comparison has been made to the original data and random points have been tested for inconsistencies. Some inconsistencies are known to exist.

Level 4. An estimate based on experience and user feedback has been made. Inconsistencies are known to exist.

12) Completeness: This section is comparable to the legend information on a map and is intended to help the user better understand the data. Selection criteria, definitions used, geometric thresholds, taxonomic completeness and other relevant mapping rules are the types of supporting information to be included in the report. A report of completeness shall be prepared providing relevant information about the data and shall be expressed as a level rating.

Level 1. A written document or technical report exists and provides an in-depth description of the data characteristics.

Level 2. Same as Level 1 but only partial documentation is available.

Level 3. Some information exists and is partially documented.

Level 4. Very little information is available.

HARDWARE/SOFTWARE

13) Media: The media description should include sufficient information for the reader to determine whether or not the computer equipment at their site can process the information. Information must include:

a) The media type (magnetic tape reel, magnetic tape cartridge, optical disk, flexible disk, disk, cards, paper, tape, etc.)

- b) Density/capacity (800, 1600, or 6250 bpi, 360Kb, 300Mb, etc.) and, where appropriate,
 - c) Manufacturer and model (especially for media other than magnetic tape).
- 14) Size: The size should give an indication of the volume of computer-readable information, both as:
- a) Number of records (or table entries).
 - b) Millions or billions of bytes.
- 15) Organization: The organization description should include information which will allow the reader to decide whether or not a given computer system can process the information and what conversions might be necessary. It should show:
- a) The maximum record length or table entry size.
 - b) Whether these records are of fixed or varying length.
 - c) Describe the overall file organization. i.e., sequential, random, indexed, etc.
 - d) For data describing spatial objects, specify type of geometric unit used for representation.
- 16) Codes: The codes section should describe what data encodings exist on the file for both character and numeric information. This should include where applicable:
- a) Character code.
 - b) Binary integer format.
 - c) Floating point format.
 - d) Packed decimal format.
 - e) Other special encoding used.
- 17) Level of Documentation: An honest evaluation of the quality and quantity of the computer information available to describe the file shall be provided.

- 18) Hardware Configuration: The major hardware components used at the site which may affect the ability of another site to process the data should be described. The listings should include:
- a) Vendor.
 - b) Model.
 - c) Machine class (<1 mip = micro/mini; 1-5 mips = supermini; or mainframe).
 - d) Terminal hardware.
 - e) Space used to store and access file.
- 19) Software Configuration: The software used at the site which may affect the ability of another site to process the information should be listed. The listing should include:
- a) Operating system and version.
 - b) File manager.
 - c) Data base manager.
 - d) Other software available for required data entry, inquiry, and/or graphics.

APPENDIX A

FILE DOCUMENTATION RECORDING FORM

CONTENT DESCRIPTION

1) Title: _____

2) Subject:

a) Subject, General: _____

b) Subject, Specific: _____

3) Major Attributes:

a) _____

b) _____

c) _____

d) _____

e) _____

4) Aerial Coverage: _____

5) Format:

a) Positional ()

b) Tabular ()

6) Responsibility:

Name: _____

Agency: _____

Unit: _____

Address: _____

City, State: _____

Telephone: _____

7) Notes: _____

FILE DOCUMENTATION RECORDING FORM

QUALITY REPORT

8) Lineage:

- a) Source: _____
- b) Date of File: _____
- c) Lineage Quality: _____

9) Positional Accuracy:

a) Horizontal Reference Used:

- Lat/Long ()
- WCS ()
- UTM ()
- Other () _____

b) Vertical Reference Used:

- No Vertical Information ()
- National Datum ()
- Other () _____

c) Spatial Reference for Tabular Data:

- Political Unit ()
- Physical Unit ()
- PLSS Sections ()
- River Mile Index ()
- Other () _____

d) Positional Accuracy Quality ()

e) Positional Accuracy Testing ()

10) Attribute Accuracy:

a) Attribute Accuracy Quality ()

b) Attribute Accuracy Testing ()

11) Logical Consistency:

a) Logical Consistency Quality ()

b) Logical Consistency Testing ()

12) Completeness: ()

FILE DOCUMENTATION RECORDING FORM

HARDWARE/SOFTWARE

13) Media:

- a) Media Type: _____
- b) Density/Capacity: _____
- c) Manufacturer/Model: _____

14) Size:

- a) Number of Records: _____
- b) Number of Bytes: _____

15) Organization:

- a) Maximum Record Length: _____
- b) Fixed/Variable: _____
- c) File Organization: _____
- d) Geographic Representation: _____
 - Point: ()
 - Line, Unstructured Graphics ()
 - Line, Topographical Network ()
 - Polygon ()
 - Raster Grid ()

16) Codes:

- a) Character Code: _____
- b) Integer Format: _____
- c) Floating Point Format: _____
- d) Packed Decimal: _____
- e) Special Encoding: _____

17) Level of Documentation: ()

18) Hardware Configuration:

- a) Vendor: _____
- b) Model: _____
- c) Machine Class: _____
- d) Terminal/Hardware: _____
- e) Storage/Access: _____

19) Software Configuration:

- a) Operation System: _____
 - b) File Manager: _____
 - c) Database Manager: _____
 - d) Other Software: _____
-

