

**National Mapping Program**

# **USGS Digital Cartographic Data Standards**

## **Digital Line Graph Attribute Coding Standards**

**Geological Survey  
Circular 895-G**

1986

USGS DIGITAL CARTOGRAPHIC DATA STANDARDS

- USGS Circular 895-A: Overview and USGS Activities  
B: Digital Elevation Models  
C: Digital Line Graphs from 1:24,000-Scale Maps  
D: Digital Line Graphs from 1:2,000,000-Scale Maps  
E: Land Use and Land Cover Digital Data  
F: Geographic Names Information System  
G: Digital Line Graph Attribute Coding Standards

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DIGITAL LINE GRAPH ATTRIBUTE CODING STANDARDS

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USGS Digital Cartographic Data Standards

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## FOREWORD

In recent years, the disciplines of cartography and geography have undergone a rapid and striking reorientation as the techniques for digital collection and manipulation of data have evolved from fledgling laboratory procedures into dominant and driving forces that now pervade the disciplines. Digital techniques have provided a variety of new and powerful capabilities to collect, manipulate, analyze, and display spatial data. However, this evolution also has introduced a number of new and complex problems. One of the most pressing problems, and one which is receiving particular attention at present, is the issue of digital cartographic data standards.

The U.S. Geological Survey (USGS) has been actively developing digital cartographic and geographic techniques for over a decade and has taken significant steps to develop and define in-house standards governing the various types of digital cartographic data that are being collected and archived in a national digital cartographic data base. The in-house standards are expressed in the form of specifications documents that were prepared to govern collection of the data and in the form of user guides that were prepared for distribution with the data.

In an effort to fulfill lead agency requirements for promulgation of Federal standards in the earth sciences, the documents have been assembled with explanatory text into this USGS Circular consisting of separately bound chapters. This Circular describes some of the pertinent issues relating to digital cartographic data standards, documents the digital cartographic data standards currently in use within the USGS National Mapping Division, and details USGS efforts to define national digital cartographic data standards.

Chapter A is an overview in which the major issues involved in developing digital cartographic data standards are discussed and the activities of the USGS related to digital cartographic data production and standards development are described in detail. Succeeding chapters comprise the pertinent documents that establish USGS in-house standards for the various types of digital cartographic data currently produced by the National Mapping Division; that is, digital elevation data, digital planimetric data, digital land use and land cover data, and digital geographic names data.

This compendium of relevant material is prepared to serve as a benchmark and to assist ongoing efforts to establish acceptable standards and conventions for both Federal agencies and the public.



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## PREFACE

This Circular is the result of the efforts of numerous individuals who have contributed to the research, development, and preparation of various digital cartographic and geographic standards for the National Mapping Division of the U.S. Geological Survey. The individuals named as chapter authors represent both the originators of the various concepts as well as the writers who expanded and clarified these ideas. Their contributions, either to the concepts or the writing, are of such magnitude as to warrant crediting as authors.

Atef A. Elassal was largely responsible for the original data structures and computer file formats that are used for the Digital Line Graphs and Digital Elevation Models. The attribute coding scheme was first developed by members of the Digital Applications Team under the direction of Robert B. McEwen. The Geographic Names Information System was conceived and developed by Sam Stulberg and Roger L. Payne. The Geographic Information Retrieval and Analysis System was developed by Robin G. Fegeas, K. Eric Anderson, Stephen C. Guptill, Cheryl A. Hallam, and William B. Mitchell. The small-scale Digital Line Graph data structure and attribute coding scheme was developed by Warren E. Schmidt and Michael A. Domaratz.

The Circular was compiled in part from various user guides and technical instructions of the National Mapping Division. These documents were originally prepared by several individuals; credit is acknowledged to G. Michael Callahan, A. Joan Szeide, William R. Alder, Vincent M. Caruso, Hugh W. Calkins, Donna Cedar-Southworth, and Cheryl A. Hallam. The compilation of the various guides, instructions, and other material into the Circular format was performed with major assistance by Clark H. Cramer, Eloise R. Byrd, and Cynthia L. Cunningham.

We acknowledge these substantial contributions that have led to this publication.

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# USGS Digital Cartographic Data Standards

## DIGITAL LINE GRAPH ATTRIBUTE CODING STANDARDS

By William R. Alder, A. Joan Sziede, Robert B. McEwen,  
and Francis J. Beck

### Abstract

The discipline of cartography is undergoing a number of profound changes that center on the emerging influence of digital manipulation and analysis of data for the preparation of cartographic materials and for use in geographic information systems. Operational requirements have led to the development by the USGS National Mapping Division of several documents that establish in-house digital cartographic standards.

In an effort to fulfill lead agency requirements for promulgation of Federal standards in the earth sciences, the documents have been edited and assembled with explanatory text into a USGS Circular. This Circular describes some of the pertinent issues relative to digital cartographic data standards, documents the digital cartographic data standards currently in use within the USGS, and details the efforts of the USGS related to the definition of national digital cartographic data standards. It consists of several chapters; the first is a general overview, and each succeeding chapter is made up from documents that establish in-house standards for one of the various types of digital cartographic data currently produced. This chapter, 895-G, describes the digital line graph attribute codes together with their definitions and use with features shown on USGS 1:24,000-scale maps and digitized according to standards for USGS digital line graphs. This chapter currently describes only those categories of data from which complete coding schemes

have been defined. Coding standards for other base categories of data listed in this chapter are under development and will be published at a later date.

### INTRODUCTION

Attribute codes, also called feature codes or classification attributes, are used to describe the physical and cultural characteristics of digital line graph (DLG) data elements: nodes, areas, and lines. This chapter describes the general characteristics of the DLG coding scheme, defines the attribute codes used in each DLG data category, and provides guidance for the standardized application of these codes in the digitizing process. When an attribute code is tied to a standard cartographic symbol, the symbol number is cited. Symbol numbers refer to the following U.S. Geological Survey (USGS) Technical Instructions:

1. "Publication symbols for 1:24,000-scale Conventional Unit Standard Topographic Maps" - December 1981.
2. "Provisional Edition Maps 1:24,000- and 1:25,000-scale - Part 1 - Mapping Guidelines" - January 1982.

The attribute coding scheme for DLG's is intended to meet the following objectives:

1. Describe real world phenomena rather than their cartographic representations -- Digital cartographic data produced under the National Mapping

Program are intended to support the requirements of a broad spectrum of users, not only for traditional cartographic products, but also for input to geographic information systems and for automated spatial analyses. To achieve this goal, a data classification and coding scheme was developed to describe real world phenomena rather than only cartographic symbolization. The data are collected in logical categories that comprise unique themes, not necessarily corresponding to traditional feature separates. In the initial effort of building the DLG data base, however, the primary source materials used for data collection are published 7.5-minute quadrangle manuscripts. Field notes and compilation materials normally are not used. It is therefore necessary to prescribe the use of attribute codes based solely on information depicted on published maps. In general, every standard cartographic symbol will have a unique attribute code number; however, there are situations where more than one attribute code will be required to fully describe a feature.

2. Minimize redundant information -- Generally, attribute codes are not assigned to a feature if they can be derived based on the feature's relation to adjacent features. For example, in the United States Public Land Survey System category, township extremity lines are not explicitly coded since this attribute can be derived by examining the attributes of the two areas that bound each line.
3. Provide sufficient reference information to support integration with large, multipurpose data bases -- Many organizations maintain sets of mission-specific thematic or statistical data that are combined with cartographic base categories for both display and analysis. The DLG attribute coding scheme attempts to facilitate this process by supporting a variable number of attributes assigned to each feature, creating an open-ended structure to which a user may add information, and by

using established Federal Information Processing Standard (FIPS) codes, where available.

4. Describe the interrelations between real-world phenomena -- For example, streambanks are designated as right bank and left bank rather than bank so that the direction of flow can be determined. The nodes at the beginning of a single-line stream are coded for the same reason.

GENERAL DESCRIPTION OF ATTRIBUTE  
CODING STRUCTURE

Each attribute code identifies the general data category to which a feature belongs, as well as the specific nature of the feature. Codes may also provide additional descriptive information. Many features are uniquely described by a single attribute code. Others however may require two or more codes for a complete description. If multiple attributes are needed to describe a feature, ordering is not significant. Each element need not have associated attributes.

A DLG attribute code is composed of two distinct numeric fields: a three-digit major code, the first two digits of which identify the data category to which the feature belongs, and a four-digit minor code, which specifically describes the feature.

MAJOR CODE DESCRIPTION

The first two digits of the major code uniquely identify the data category to which the described element belongs. The following is a list of major codes and the categories they represent:

<u>Major code</u>	<u>Base category</u>
020	Hypsography
050	Combined hydrography
070	Surface cover
080	Nonvegetative features
090	Boundaries
	Transportation systems
100	Roads, trails
110	Railroads

<u>Major code</u>	<u>Base category</u>
130	Pipelines, transmission lines
140	Other significant manmade structures
150	Survey control and markers

<u>Major code</u>	<u>Nonbase category</u>
300	United States Public Land Survey System

The third digit of the major code is used to designate the interpretation of the minor code in two ways:

1. If the digit is zero, the minor code numbers represent a description or classification of a specific feature.
2. If the digit is other than zero, the minor code numbers have special interpretations as a parameter. The interpretation to be applied is described for each category.

#### MINOR CODE DESCRIPTION

The first digit of the minor code is normally zero. If nonzero, it is used as a modifier providing additional information such as road access or railroad status.

The remaining three digits are normally used to indicate the cartographic interpretation to be applied to specific elements. The type of element described by a particular code can be determined from the range of values of the last three digits:

1. node: 001 - 099
2. area: 100 - 199
3. line: 200 - 299
4. point (degenerate line): 300 - 399
5. general-purpose codes (apply to multiple feature types): 400-499
6. descriptive codes: 600-699

The general-purpose codes are used on features that may be digitized as a node, area, or line, depending on the size and position of the feature. The descriptive codes are used with another code to qualify meaning.

The last three digits also may be used as a parameter code. Parameters are used when a minor code can legitimately assume a range of values, for example, water elevation or highway route number. The meaning of a parameter code is derived from the (nonzero) third digit of the major code. Parameters are specific for both category and feature.

#### COMMON ATTRIBUTE CODES

In general, the meaning of an attribute code is unique to the data category of the feature it describes. There are, however, several exceptions.

Outside Area (000 0000) -- Each DLG provides a coherent description of that portion of the Earth's surface covered by a given map area. To maintain topological consistency and to facilitate the combination (integration) of multiple DLG's, the area outside the map area is specifically identified for each DLG category. This area element, which must be present in each data category, is assigned a single attribute code wherein the major and minor codes are both equal to zero.

Photorevised features (XX0 0000) -- Map features obtained by photorevision methods (printed in purple) and not field checked for horizontal position or classification, are assigned attribute codes based on best judgment. In addition, a code consisting of major code XX0, where XX are the two digits uniquely identifying the data category, and a minor code of zero will also be attached. For example, a class 3 road added by photorevision would be coded as follows: 100 0000--obtained by photorevision; 100 0207--improved light duty.

Indeterminate classification and (or) position (XX8 0000) -- The attribute code consisting of major code XX8, where XX are the two digits uniquely identifying the data category, and a minor code of zero, indicates that the classification and (or) position of the feature could not be determined, but for completion of the file the feature was digitized using a best estimate.

Coincident feature (XX9 00YY) -- The attribute code having major code XX9,

where XX are the two digits uniquely identifying the data category, is used to indicate that the digitized feature is coincident with a feature from another data category. The second category is identified by the last two digits of the minor code; for example: 309 0009--land line coincident with boundary; 099 0010--boundary coincident with road. These codes are included primarily as an aid in vertical integration of data from several categories.

#### HYDROGRAPHY

The purpose in digitizing hydrography is to collect information about streams, bodies of water, wetlands, coastal water, and water used for transportation in a manner that will permit the extraction and derivation of data to suit the needs of the various data users. This information is not collected for navigational purposes.

One aim is to collect hydrographic information in a reasonably simple and efficient manner. Therefore all hydrography will be collected in one file where the density of the data does not exceed the file size limitations imposed by processing software. If the amount of data on the source will exceed the file size permitted, the operator will divide the source map along a straight line into halves. Extreme care will be taken in digitizing features that cross the dividing line so that the pieces can be rejoined exactly.

One intention in collecting hydrography is to indicate the direction of the flow by theoretically looking downstream and denoting right and left banks. Where the flow direction of a stream cannot be determined from the source material, the adjoining quadrangles will be examined to obtain the information.

All double-line streams will be digitized as areas. Double-line streams that join another double-line stream or a water body will be closed by an arbitrary closure line.

The description of hydrographic features uses all of the types of codes--node, area, line, single-point, general-purpose, and descriptive codes. All

hydrographic features that have attribute codes assigned are assumed to be perennial unless the attribute code for intermittent is also assigned. Hydrographic features will not carry attribute codes for information that can be derived, such as intersections and junctions. This means that there will be unattributed nodes, areas, and lines. When an area feature, which can be identified by a code, is subdivided by linear features or closure lines, each resultant smaller area will be identified by the appropriate code.

In addition, the topological structuring software will establish area points for area points to all of the background land areas that are not assigned specific attributes. This differs from a strict network in which there is only one background area. These background area points will not fall within the physical location of the area but are assigned to complete the structure.

#### HYDROGRAPHY ATTRIBUTES

The following codes are used in digitizing hydrographic information:

##### Node attributes

050 0001	Upper origin of stream
050 0002	Upper origin of stream at water body
050 0003	Sink
050 0004	Stream entering water body
050 0005	Stream exiting water body

##### Area attributes

050 0100	Alkali flat
050 0101	Reservoir
050 0102	Covered reservoir
050 0103	Glacier or permanent snowfield
050 0104	Salt evaporator
050 0105	Inundation area
050 0106	Fish hatchery or farm
050 0107	Industrial water impoundment
050 0108	Area to be submerged
050 0109	Sewage disposal pond or filtration beds
050 0110	Tailings pond
050 0111	Marsh, wetland, swamp, bog

050 0112 Mangrove area  
 050 0113 Rice field  
 050 0114 Cranberry bog  
 050 0115 Flats (tidal, mud, sand,  
 gravel)  
 050 0116 Bays, estuaries, gulfs,  
 oceans, seas

**Line attributes**

050 0200 Shoreline  
 050 0201 Manmade shoreline  
 050 0202 Closure line, (water-water)  
 050 0203 Indefinite shoreline  
 050 0204 Apparent limit  
 050 0205 Outline of a Carolina bay

**Single-point feature attributes  
 (degenerate lines)**

050 0300 Spring  
 050 0301 Nonflowing well  
 050 0302 Flowing well  
 050 0303 Riser  
 050 0304 Geyser  
 050 0305 Windmill

**General-purpose attributes (apply to  
 nodes, areas, lines, or degenerate  
 lines.)**

050 0400 Rapids  
 050 0401 Falls  
 050 0402 Gravel pit or quarry filled  
 with water  
 050 0403 Gaging station  
 050 0404 Pumping station  
 050 0405 Water intake  
 050 0406 Dam or weir  
 050 0407 Canal lock or sluice gate  
 050 0408 Spillway  
 050 0409 Gate (flood, tidal, head,  
 check)  
 050 0410 Exposed rock  
 050 0411 Crevasse  
 050 0412 Stream  
 050 0413 Braided stream  
 050 0414 Ditch or canal  
 050 0415 Aqueduct  
 050 0416 Flume  
 050 0417 Penstock  
 050 0418 Siphon  
 050 0419 Channel in water area  
 050 0420 Wash or ephemeral drain  
 050 0421 Lake or pond  
 050 0422 Coral reef

**General descriptive attributes**

050 0601 Underground  
 050 0602 Overpassing

050 0603 Elevated  
 050 0604 Tunnel  
 050 0605 Right bank  
 050 0606 Left bank  
 050 0607 Under construction  
 050 0608 Salt  
 050 0609 Unsurveyed  
 050 0610 Intermittent  
 050 0611 Abandoned  
 050 0612 Submerged  
 050 0613 Wooded  
 050 0614 Dry  
 050 0615 Mineral or hot (sulphur,  
 alkali etc.)  
 050 0616 Navigable - Transportation  
 050 0617 Underpassing  
 050 0618 Earthen construction

**Parameters**

05N ---- Water surface elevation N =  
 1 for feet, 2 for meters, 6  
 for feet below datum, and 7  
 for meters below datum.  
 Elevation value in four  
 spaces, right justified.  
 055 ---- River mile, value in four  
 spaces, right justified.  
 050 0000 Photorevised feature.  
 058 0000 Best estimate of classi-  
 fication or position.  
 059 00-- Coincident feature, major  
 code in two spaces.

**INSTRUCTIONS FOR USE OF HYDROGRAPHY  
 ATTRIBUTES**

This section provides detailed in-  
 structions for the use of the hydrography  
 attribute codes.

Node Attributes

050 0001 Upper origin of stream --  
 This code identifies a node placed at the  
 true beginning of a stream, where it is  
 first shown. It is not used to mark  
 stream junctures (even though the name of  
 the stream changes) or streams which exit  
 from a water body.

050 0002 Upper origin of stream at  
 water body -- This code identifies stream  
 origin as it exits a water body. It is  
 not used to identify any subsequent exits  
 from water bodies further downstream.

050 0003 Sink, or channel is no longer evident -- A sink is the definite point at which a stream flows underground, usually shown with symbol 407. Some streams seep into the ground at indeterminate points at which the stream symbol is dropped and symbol 407 is not used. In either case, this code is used to identify a node placed at the point of disappearance. This code is not used to identify points where streams enter manmade features, such as aqueducts or siphons.

050 0004 Stream entering water body -- This code is placed at the node where a single-line stream intersects a water body, or at the two nodes where the shorelines of a double-line stream intersect a water body.

050 0005 Stream exiting water body -- This code is placed where a stream exits a water body, other than at an upper origin of a stream. The node is placed for a single-line stream at the point where the stream touches the edge of the water body. For a double-line stream, nodes are placed where the banks touch the shoreline of the water body.

#### Area Attributes

050 0100 Alkali flat -- This code identifies an area shown by symbol 450 and labeled.

050 0101 Reservoir -- This code identifies a reservoir shown by symbol 413 or 179 and labeled or named as a reservoir. Use code 050 0200 for identification of natural shoreline around symbol 413, and code 050 0201 for manmade shoreline around symbol 179. This code is not used to identify features related to sewage treatment, fish farming, or water filtration.

050 0102 Covered reservoir -- This code identifies a reservoir area shown by symbol 180 and named or labeled as a reservoir. Use code 050 0201 for identification of manmade shoreline of this feature.

050 0103 Glacier or snowfield -- This code identifies an area depicted by symbols 428, 429, or 430. Since the symbols vary only because of the contouring, which is not pertinent to the hydrographic category, the same code will

be applied to all three symbols. The outline of the area will not be given an attribute code.

050 0104 Salt evaporator -- This code identifies each section of areas shown by symbol 439. The pattern of ditches will be digitized and coded. (See code 050 0414)

050 0105 Inundation area -- This code identifies the area of land between the normal operating level and the high water line in reservoirs, or in lakes impounded by dams. This area will be shown with symbol 448. Use code 050 0412 or 050 0414 for identification of drainage pattern through the area, and code 050 0203 for indefinite shoreline.

050 0106 Fish hatchery or fish farm -- This code identifies any area shown by symbol 179 and labeled. The label may vary to indicate the species or the controlling agency. The outline, if shown in black, is coded 050 0201, and 050 0200 if shown in blue. The major ditches are coded if shown (see code 050 0414) in which case each section will have a coded area point placed in it.

050 0107 Industrial water impoundment -- This code identifies an area shown by symbol 410 and that carries a label indicating the water is collected for industrial use, such as industrial waste pond or cooling pond. This does not include the features related to sewage treatment, fish farming, water filtration, or mining.

050 0108 Area to be submerged -- This code identifies an area shown by symbol 702. This code is used when a dam is under construction and the limits of the intended reservoir are known.

050 0109 Sewage disposal pond or filtration plant -- This code identifies any area related to the treatment of sewage. These features may be shown by symbol 410. The features will be labeled in various ways such as sewage disposal pond or filtration bed. This code may also be applied to ponds that are themselves unlabeled but which are shown by symbol 700 and are located adjacent to a labeled sewage disposal plant. Use code 050 0200 for blue outlines or code 050 0201 for black outlines. In symbol 700, do not digitize the black interior dividing lines.

050 0110 Tailings pond -- This code identifies an area shown by symbol 323 and labeled tailings pond. Use code 050 0204 for outline of pond when it is limited by the contour. Do not code the outline otherwise.

050 0111 Marsh, wetland, swamp, bog -- This code identifies any area shown by symbol 431. If the area being digitized has no definite outline shown, the operator will follow the edge of the pattern to delimit the area. (See code 050 0204) If any portion of the wetland is overprinted with green (symbol 432), that area will be a separate area and will be coded as marsh, as well as with the code to indicate that the marsh is wooded. (See code 050 0613) Any portion of a wetland which is overprinted with blue (symbol 433) will be digitized as a separate area with the code assigned to indicate that it is a marsh (050 0111) and is submerged (050 0612). There are instances where the marsh symbol will be overprinted with both blue and green and will therefore be digitized as a separate area with the codes for marsh, wooded, and submerged all assigned. Any streams shown in wetland areas will be digitized as separate features. (See code 050 0412)

050 0112 Mangrove area -- This code identifies an area shown by symbol 437. If the outline of the area is not clearly defined, the operator will follow the edge of the pattern to delimit the area. (See code 050 0204)

050 0113 Rice field -- This code identifies an area shown by symbol 436. If the outline of the area is not clearly defined, the operator will follow the edge of the pattern to delimit the area. (See code 050 0204)

050 0114 Cranberry bog -- This code identifies each section of an area shown by symbol 438 and labeled cranberry bog. Sometimes there will be several cranberry bogs in a group with one label, cranberry bogs. The ditch pattern will be digitized as shown and also coded. (See code 050 0414)

050 0115 Flats (tidal, mud, sand, gravel) -- This code identifies a number of features that fall into the general category of flats. These features will be shown by symbols 232, 316, 322, and

329. The area will usually be labeled as to type, that is, mud, tidal, gravel, or sand. Do not include in this category features such as sand dunes or beach areas between dry land and open water. Use code 050 0204 for outline of area.

050 0116 Bays, estuaries, gulfs, oceans, seas -- This code is used to identify a seaward area of water. The inland extent is defined at the place where a double-line stream reaches a width of 1 nautical mile with no further constrictions, if the conformation of the land and water do not otherwise make the division obvious. The operator will place a closure line (050 0202) to separate the bay, estuary, gulf, ocean, or sea from a double-line stream.

#### Line Attributes

050 0200 Shoreline -- This code identifies a natural shoreline shown by symbol 400. This also applies to an apparent shoreline shown by the same symbol.

050 0201 Manmade shoreline -- This code identifies the shoreline around or along a reservoir, dam, seawall, pier, wharf, or jetty which is shown by a black line. It will also be used when the shoreline is replaced by a levee or the contouring of an earthen dam.

050 0202 Closure line (water-water) -- This code identifies a line digitized to form the closure line between water bodies to retain the separate identity of each. It would be used, for example, where a double-line stream enters a lake or bay.

050 0203 Indefinite shoreline -- This code identifies a line shown by symbol 401, which indicates that the shoreline cannot be definitely established. This symbol is frequently used around inundation areas.

050 0204 Apparent limit -- This code identifies a line digitized around various wetland features when a definite shoreline or limiting feature does not exist. The edge of the pattern, such as marsh or mangrove will be followed as closely as possible and will carry this code to indicate the arbitrary nature of the line.

050 0205 Outline of a Carolina bay -- This code identifies a line shown by symbol 401 or by symbol 2205.19 on a provisional edition map. The feature will be outlined by a dashed blue line and will be noted on the map collar. Any other hydrographic feature within the area of a Carolina bay, such as marsh, lake, or ditches, will be digitized as a separate feature. If a bay outline is a complete and closed ellipse, the interior area will not have an attribute code unless it is a hydrographic feature in its own right.

#### Single-Point Feature Attributes

050 0300 Spring -- This code identifies a feature shown by symbol 427 and labeled. This code also applies to a spring located in a double-line stream for which the tail of the symbol is omitted, and to a spring that carries a name rather than the label spring. This code may also be used on a node when the spring symbol occurs directly on a line that is being digitized in the combined hydrography category.

050 0301 Nonflowing well -- This code identifies a point placed on a feature shown by symbol 426 and labeled. In areas where wells are numerous, they may not all be labeled but will still be digitized. This code may also be used on a node when the well symbol occurs directly on a line that is being digitized in the combined hydrography category.

050 0302 Flowing well -- This code identifies a point placed on a feature shown by symbol 426 and labeled flowing well. This code may also be used on a node when the well symbol occurs directly on a line that is being digitized in the combined hydrography category.

050 0303 Riser -- This code identifies a point placed on a feature shown by the located object symbol 198 and labeled riser. A riser is a vertical overflow pipe controlling the water level in a reservoir.

050 0304 - Geyser -- This code identifies a point placed on a special type of spring that ejects hot water and steam periodically. It will be shown by symbol 427 and labeled.

050 0305 Windmill -- This code identifies a point placed on a well shown by symbol 199. If the label indicates the well is dry or salt, use codes 050 0614 or 050 0608 in addition.

#### General-Purpose Attributes

050 0400 Rapids -- This code identifies a node placed on symbol 443 on a single-line stream to show small rapids. It may also identify an area shown by symbol 442, which is a large section of rapids on a double-line stream. The outline of the rapids symbol will be the limit of the area. The area of the rapids is implicitly part of the area of the stream and does not need to be coded as stream also.

050 0401 Falls -- This code identifies a node placed on symbol 441 on a single-line stream to show a small falls. It may also be used to identify a digitized line which follows symbol 440 to depict a large falls on a double-line stream.

050 0402 Gravel pit or quarry filled with water -- This code identifies a body of water that has formed naturally in a manmade excavation. It will be labeled as gravel pit or as quarry. If the feature is 0.030 inches or less in diameter, it will be digitized as a degenerate line. If it is greater than 0.030 inches on the source map, it will be digitized as an area.

050 0403 Gaging station -- This code identifies a point placed on symbol 200. If the gaging station symbol occurs directly on a line such as a single-line stream or bank of a double-line stream, it will be digitized as a node on that line. If the symbol is placed off the line, it will be digitized as a degenerate line.

050 0404 Pumping station -- This code identifies a point placed on symbol 201 or symbol 163 and labeled. If the feature occurs directly on a digitized line, it will be coded as a node. If it is separate from the line, it will be coded as a degenerate line.

050 0405 Water intake -- This code identifies a point placed on a labeled water intake shown by symbol 198. If the symbol is on a digitized line, it will be

digitized as a node. If the symbol is separate, it will be digitized as a degenerate line.

050 0406 Dam or weir -- This code identifies a feature shown by symbols 152, 153, 154, 155 or 313. The feature may be labeled or named. A weir may be labeled diversion weir. The code will be used as a line code in two cases: (1) the dam is shown by a black line, or (2) the dam is shown by contouring as in symbol 313 for which a line will be digitized along the edge of the impounded water and coded. The code will be used as an area code when the dam is a large structure outlined to scale. The area point will be placed within the outline and coded. The radiating lines within symbol 153 will not be digitized or coded. See code 050 0407 for treatment of lock in symbol 154. If the dam is of earthen construction, also see code 050 0618.

050 0407 Canal lock or sluice gate -- This code identifies canal locks or sluice gates shown by symbols 160, 161, and within 154, and is used as a node or line code depending on the size of the feature. Symbol 160 will be digitized as a node on the single-line stream. Symbol 161 will be digitized as a line across a double-line stream. The lock symbol within symbol 154 will be digitized as a node on the dam line if shown at symbol size (0.075 in. x 0.033 in.). If digitized to scale and larger than the symbol, the outline of the lock will be digitized and coded. The enclosed water areas in this last case are not coded as stream because that information is implied by the feature.

050 0408 Spillway -- This code identifies a spillway, which is shown on a map in various ways. The spillway will be digitized as a node, area, line, or degenerate line according to the size of the feature. If it is shown by a small circle or dot, it will be a degenerate line. If the feature is shown by drainage lines, perennial or intermittent, it will be digitized as a line. If the spillway is indicated by an arrangement of contour lines or a black box, it will be digitized as an area. If a spillway is represented as an integral part of the dam, it will be a coded node on the digitized line of the dam. Some judgment

will be required to correctly digitize the spillway as the feature itself is not always labeled. The label, spillway elevation NNNN, which may be placed in the impounded water area, is sometimes the only reference to the feature.

050 0409 Gate (flood, tidal, head, check) -- This code identifies a variety of features used to control or divert the flow of water. These features are shown by a tick or black line. If shown by a tick on a single-line stream, a node will be digitized and coded. If shown by a line on a double-line stream, the line will be digitized and coded.

050 0410 Rock, bare or awash -- This code identifies rocks or groups of rocks shown by symbols 236, 237, and 238. A rock or group of rocks will be digitized as an area if greater than 0.030 inches in diameter. If a rock is 0.030 inches or less, it will be coded as a degenerate line. If the rocks are shown by symbol 238, the outline will be digitized but not coded. A point will be placed in the area and coded.

050 0411 Crevasse (glacial) -- This code identifies crevasse lines and crevasse areas depicted by symbol 453. If the crevasse area contains less than four lines, the individual lines will be digitized. Crevasse areas that contain four or more lines will be digitized as an area. The edge of the crevasse pattern will be digitized as an apparent limit. (See code 050 0204)

050 0412 Stream -- This code identifies all naturally flowing water except braided streams. (See code 050 0413) Single-line streams are digitized as lines. Double-line streams are digitized as areas. The limits of the double-line stream area are formed by the left and right banks (codes 050 0605 and 050 0606), by a closure line (code 050 0202) to separate the stream from a water body which it enters, or by the neat line. See codes 050 0004 and 050 0005 for use of node points which, along with the left and right bank information, will imply the direction of flow. The course of a submerged stream in an impounded water area will be digitized as a separate area with the stream code and the description code for submerged (code 050 0612). Do not code the left and right banks of a submerged stream.

050 0413 Braided stream -- This code identifies the braided stream (shown by symbol 404), a special case in which the stream subdivides into interlacing channels. In map compilation, where possible, the actual channels are shown. However, if the channels are obscured by vegetation, the outer limit is scribed accurately and the inner channels are represented by a conventional pattern. The use of pattern versus actual channel is not noted on the map. Therefore, the braided portion of a stream will be digitized as an area carrying this code. The outer limits will be digitized and carry left and right bank codes (see codes 050 0605 and 050 0606). The braided area will be separated from a double-line stream by a closure line (code 050 0202), and from a single-line stream by nodes (see codes 050 0004 and 050 0005). If the braid is less than 0.030 inches wide, it may be digitized as a line.

050 0414 Ditch, canal -- This code identifies any manmade, flowing water feature used for irrigation, drainage, or transportation shown by symbols 416 through 422. These may be labeled or unlabeled. Obviously manmade water courses will be included in this category, even if not labeled. Some natural streams have portions that appear to have been straightened by man. If the artificial channel is not identified as such by a label or name change, do not use this code. Single-line ditches and canals are digitized as lines. Double-line ditches or canals are digitized as areas. The banks and the points where canals or ditches join water bodies will be coded and digitized in the same way as streams. Navigable canals used for transportation will have an additional code added to preserve this information. (See code 050 0616) Use additional description codes to identify canals that are abandoned or intermittent, etc.

050 0415 Aqueduct -- This code identifies features represented by symbols 418, 419, 421, 423, 424, or 425, which are labeled aqueduct. Single-line aqueducts are digitized as lines. Double-line aqueducts are digitized as areas. The banks and intersections of aqueducts with water bodies will be digitized and coded in the same manner as streams. An

aqueduct going into a water tunnel underground is shown by symbol 424, regardless of the size. Therefore, the portion of the aqueduct in the tunnel will be digitized as a line and will carry the code for tunnel (050 0604) in addition to the aqueduct code. This code combination will also be used for a feature shown by symbol 424 but labeled water tunnel. Use additional descriptive codes to identify aqueducts that are abandoned or elevated.

050 0416 Flume -- This code identifies features which are shown by symbol 418, 419, 421, 422, or 425 and labeled flume. A flume is an artificial, open, inclined channel that conveys water for a special purpose and is frequently an elevated feature. A single-line flume will be digitized as a line. A double-line flume will be digitized as an area. The banks and the points where flumes intersect water bodies will be coded and digitized in the same manner as streams. Use additional general descriptive codes to describe abandoned or elevated flumes.

050 0417 Penstock -- This code identifies a feature shown by symbol 423 or 425 and labeled penstock. A penstock is an underground or exposed pipe conveying water from a canal or from a dam to a hydroelectric plant. It is usually shown as a single-line feature that will be digitized as a line. The penstock may be carried underground in an aqueduct tunnel, symbol 424, in which case the single line will be digitized and carry the additional code for tunnel (050 0604). In the event that a penstock is shown as a double-line feature in itself, it will be digitized as an area. The banks and intersections with water bodies will be coded and digitized in the same manner as streams.

050 0418 Siphon -- This code identifies features shown by symbol 452. A siphon is a pipe conveying water to another level, either over or under an obstruction. The dashes in the symbol may be omitted on siphons less than 200 feet long and a wing tick or break in the underpassing symbol used instead. --A single-line siphon will be digitized as a line. A double-line siphon will be digitized as an area. Use the code to indicate overpassing (050 0602) or underpassing (050 0617) on the portion of the

siphon crossing the obstruction. The code for overpassing will be used if the relationship of the features is not clear on the source material.

050 0419 Channel in water area -- This code identifies a feature shown by symbol 444. A channel in a water area is generally shown with a double-line and will be digitized as an area feature. Arbitrary closure lines are normally required to complete the definition of an open-ended channel. The limits of the area will not otherwise be coded. This code does not apply to submerged river courses in inundated areas.

050 0420 Wash or ephemeral drain -- This code identifies features shown by symbol 317 or 409 and usually labeled. This code applies to symbol 409 only when the feature is labeled as a wash. A wash is an ephemeral drainage feature because it is normally dry, but will contain runoff from heavy storms or snowmelt for a few hours. A wash shown by symbol 409 will be digitized as a line. A wash shown by symbol 317 will be digitized as an area. The edge of the wash pattern will be digitized as the limit of the area but not coded. Any permanent channel in a wash will be digitized as is appropriate.

050 0421 Lake or pond -- This code identifies a natural body of water of any size. A lake or pond 0.030 inches or less in diameter will be digitized as a degenerate line. Any lake or pond larger than 0.030 inches will be digitized as an area feature. The limits of the lake or pond will be coded with the appropriate shoreline code.

050 0422 Coral reef -- This code identifies a coral reef or rock shown by symbol 233 or 234. A coral reef or rock will be digitized as an area if greater than 0.030 inches in diameter. The outline of the symbol will be digitized but not coded. If the coral reef or rock is shown by a symbol of 0.030 inches or less, it will be coded as a degenerate line.

General Descriptive Attributes--Apply  
To Multiple Types of Feature

050 0601 Underground -- This code will be added to any feature (other than

a tunnel) that is underground according to the label on the map such as an underground aqueduct shown by symbol 423. This code is not used to describe a portion of a feature placed underground to pass under another feature. (See code 050 0617)

050 0602 Overpassing -- This code describes a feature or section of a feature that passes over rather than intersects another feature. The code will generally be applied to a linear hydrographic feature carried over another feature in a manmade object, such as an aqueduct over a stream. The code will be applied only to the overpassing portion of a longer elevated feature or to a section of a feature between wing ticks that is raised just to cross the obstruction. In some instances, such as a double-line stream passing over an aqueduct, the relationship of the feature is shown more simply by using code 050 0617 on the underpassing feature rather than by using the overpassing code, since only one of the two conditions need be coded.

050 0603 Elevated -- This code describes a feature raised above ground level that either is labeled elevated or has wing ticks to indicate the elevated portion as in symbol 425. This code is not used to describe any portion of a feature raised at some point to pass over another feature. (See code 050 0602)

050 0604 Tunnel -- This code describes any feature carried through a tunnel as indicated by symbol 424 or by the label. The code will apply only to the portion of the feature in the tunnel. The concept of a tunnel conveys the idea of underground or underpassing. Therefore the additional attribute 050 0601 is not used.

050 0605 Right bank -- This code describes the limit of a double-line stream that would be on the right side if one were facing downstream.

050 0606 Left bank -- This code describes the limit of a double-line stream that would be on the left side if one were facing downstream.

050 0607 Under construction -- This code describes any feature having a label indicating that it was under construction at the time the map was made, typically canals or dams.

050 0608 Salt -- This code describes any feature, such as a marsh or well, labeled salt. Do not assume any feature is saline if it is not labeled.

050 0609 Unsurveyed -- This code describes stream features shown by symbol 408, which indicates a stream is unsurveyed, and is also applied to any other feature labeled unsurveyed.

050 0610 Intermittent -- This code describes any hydrographic feature such as stream, pond, or canal, which is depicted by an intermittent symbol, such as 405, 412, 417, or 420. This code overrides the default value of perennial, which is assumed in the basic codes.

050 0611 Abandoned -- This code describes any feature labeled abandoned.

050 0612 Submerged -- This code describes any feature overprinted by blue tint to indicate it is submerged, such as a marsh or an old river course in an impounded water area.

050 0613 Wooded -- This code describes any hydrographic feature overprinted with green tint to indicate it is wooded, usually a marsh or lake. Note that this code may be used in conjunction with the submerged code for both wooded and submerged marshes.

050 0614 Dry -- This code describes any feature labeled dry, such as a dry lake or dry well.

050 0615 Mineral or hot (sulphur, alkali, etc.) -- This code describes any well, spring, or water source labeled to indicate that the water is hot or contains minerals. The labels vary according to the substances in the water.

050 0616 Navigable - transportation -- This code describes any canal labeled as navigable and is therefore a transportation feature. It is also used for channels intended for transportation, such as the Intracoastal Waterway.

050 0617 Underpassing -- This code describes a feature or a section of a feature that passes underneath, rather than intersects, another feature. This code will generally be applied to a linear feature, such as an aqueduct under a canal. In some cases, such as a single-line stream passing under a siphon, the relationship is more simply shown by using code 050 0602 on the overpassing feature rather than using the

underpassing code, since only one of the two conditions need be coded.

050 0618 Earthen construction -- This code describes a dam that is of earthen construction as depicted by symbol 313.

#### Parameters

05N ---- Water surface elevation -- This code is used to contain the value of the water surface elevation shown on bodies of water. The value depicted on the map may be shown thereon as normal pool elevation, elevation, or as a value printed in blue. The operator will enter a value in place of the N in the major code as follows: N is equal to 1 if the elevation value is given in feet, 2 if the value is in meters, 6 if the value is in feet below datum, and 7 if the value is in meters below datum. The elevation value is then entered into the minor code, right justified. If a value in feet exceeds four digits, the operator will convert the value to meters.

055 ---- River mile mark -- This code identifies a river mile mark. The point will be placed on the black cross next to the label Mile NNN. If the cross occurs in the area of a double-line stream, it will be digitized as a degenerate line. If the cross occurs directly on a line that is also being digitized, the point will be digitized as a node on that line. Enter the value in the minor code, right justified. If the source material has the value shown at intervals such as at every fifth mark, the operator will assign the appropriate intermediate values.

050 0000 Photorevised feature -- Map features obtained by photorevision methods that are printed in purple and that are not necessarily field checked for position and classification will be assigned this code and an attribute code based on best judgment.

058 0000 Best estimate of classification or position -- This attribute code assigned to a feature indicates that the classification and (or) the position of the feature could not be determined, but for completeness of the file the feature was digitized by using a best estimate.

059 00-- Coincident feature -- The feature being digitized occupies the same position as a feature in another category. The first two digits of the major code of the coinciding feature are entered in the spaces.

requirements of many users. The PLSS is therefore included as a nonbase data category of the National Mapping Program. It is identified in the DLG files by major code 300.

#### UNITED STATES PUBLIC LAND SURVEY SYSTEM

#### GENERAL PRINCIPLES

The Bureau of Land Management (BLM), Department of the Interior, is responsible for establishing and administering the system of rectangular surveys that subdivides the public lands. These surveys, and the evidence thereof, form the basis of patents issued when the public lands pass out of Federal ownership and of the overall administration and management of the lands retained in Federal ownership.

Public lands are divided by north and south lines run according to the true meridian, and by others crossing them at right angles, into townships 6 miles square. Townships are, in turn, subdivided by parallel lines run east to west and south to north at 1-mile intervals into sections of, as nearly as possible, 640 acres. Corner monuments are placed along all lines, as they are surveyed, at 1/2-mile (quarter-section) intervals. The monumentation is intended to establish a permanent marking of the lines and to fix the corner positions so that the location of the surveyed lands may always be definitely known.

All lands in the public domain are subject to subdivision by a rectangular system of surveys established and regulated by the BLM. The public domain includes the land ceded to the Federal Government by the Thirteen Original States, supplemented with acquisitions from the native Indians and foreign powers; it encompasses major portions of the land area of 30 Western States. Under congressional mandate, cadastral surveys of the public lands were undertaken to create parcels suitable for disposal by the government. The extension of the rectangular system of surveys over the public domain has been in progress since 1785.

With respect to the ideal rectangular plan, a survey of the public lands is accomplished by establishing, in order, the following:

Data describing the Public Land Survey System (PLSS) are required by Federal surface and mineral management agencies, as well as any organization concerned with land ownership in the 30 Western States that were formed from the public domain. Additionally, many agencies have encoded mission-specific natural resource or environmental inventory data based on the PLSS.

Independent initial point -- This is the point from which the survey of the principal meridian and base line, controlling the survey of the public lands in a given area, is initiated. There are 46 separate surveys in the nationwide system; of these, only 8 in the States of Ohio and Indiana (commenced between 1785 and 1805) have no initial point as defined.

The PLSS is depicted on standard quadrangle maps as cartographic reference information; it is not intended to be authoritative or official as is the original survey. This data can be rapidly and efficiently captured in digital form from these published manuscripts at an accuracy that meets the

Principal meridian -- This is a line extending north and south along the astronomic meridian passing through the initial point. It serves as the origin for the survey of township boundaries along the parallels.

Base line -- This is a line extending east and west along a true parallel of latitude passing through the initial point. It serves as the origin for the survey of meridional township boundaries.

Standard parallels (correction lines) -- These are auxiliary governing lines extended east and west from the principal meridian, generally at intervals of 24 miles (four townships) north

and south of the base line. In many surveys run before 1850, correction lines were run at intervals of 30, 36, or 60 miles. Standard parallels are used to take up error in the rectangular plan caused by the convergence of meridians.

Guide meridians -- These are auxiliary governing lines projected north from points established on the base line, or standard parallels, generally at intervals of 24 miles east and west of the principal meridian. Guide meridians terminate at the point of intersection with a standard parallel.

Township exteriors -- These are lines surveyed at 6-mile intervals within a quadrangle bounded by standard parallels and guide meridians, conforming to meridians and parallels within established limits. Meridional township boundaries (range lines) are run from south to north and terminate at the point of intersection with a standard parallel. Latitudinal township boundaries (township lines) are run from east to west through corners established on the meridional lines. Townships are numbered to the north and south commencing with number 1 at the base line, and with range numbers to the east and west commencing with number 1 at the principal meridian. The word, township, is used in conjunction with the appropriate range to indicate the coordinates of a particular township with respect to the initial point.

Subdivision of townships -- The south and east boundaries of a township are normally the governing lines of subdivisional surveys. Meridional section lines are initiated at the section corners at the south boundary of the township and are run north parallel to the east boundary. They are not continued north beyond a section corner until the connecting latitudinal section lines have been surveyed. Latitudinal section lines are run west to east parallel to the south boundaries of the respective sections. Any fractional measurement is placed in the north or west 1/2-mile of the township. A normal township is divided into 36 numbered sections commencing with number 1 in the northwest section of the township, proceeding west to section 6, then south

to section 7, then east to section 12, and so on, to number 36 in the southeast section.

Subdivision of sections -- Subdivision of sections into aliquot parts or irregular lots is controlled by the previously established section and quarter-section corners. This subdivision may be accomplished by field methods, or protracted on the official plat.

Subdivision lines and corners, to the section level, are shown on quadrangle maps to the extent that their positions can be determined from evidence on the ground. During field work, enough corners are located to accurately position the network of public land lines from official plats. Although the PLSS is mapped to meet National Map Accuracy Standards (NMAS), its depiction is not intended to be official or authoritative; it is presented as useful cartographic reference information. The only legal basis for determining land boundaries remains the original survey.

#### U.S. PUBLIC LAND SURVEY SYSTEM ATTRIBUTES

The following codes are used in digitizing U.S. Public Land Survey System information:

#### Node Attributes

<u>Type of node</u>	
300 0001	U.S. Public Land Survey section corner
300 0002	Point on section line (no corner)
300 0003	Closing corner
300 0004	Meander corner
300 0005	Auxiliary meander corner
300 0006	Special meander corner
300 0007	Witness corner
300 0008	Witness point
300 0009	Angle point
300 0010	Location monument (includes amended monument and mineral monument)
300 0011	Reference monument
300 0012	Quarter-section corner
300 0013	Tract corner

300 0014 Land grant corner  
300 0015 Arbitrary section corner

insert section number or  
numeric representation  
of alphabetic character  
(01-26), right justified.

#### Identification procedure

300 0040 Corner identified in field  
300 0041 Corner with horizontal  
control  
300 0042 Corner with elevation value

#### Area Attributes

Origin of survey  
306 00-- Insert two-digit code from  
table 1.

#### Township number

30- ---- Insert 2 for north of the  
baseline or 3 for south  
of the baseline in first  
space. In the second  
space, insert a 0 for a  
full township, 2 for 1/4  
township, 4 for 1/2  
township, or 6 for 3/4  
township. Insert town-  
ship number in the last  
three spaces, right  
justified.

#### Range number

30- ---- Insert 4 for east of the  
principal meridian or 5  
for west of the principal  
meridian in the first  
space. In the second  
space, insert a 0 for a  
full range, 2 for 1/4  
range, 4 for 1/2 range,  
6 for 3/4 range, 8 for  
duplicate to the north or  
east of the original  
township, or 9 for trip-  
licate to the north or  
east of the original  
township. Insert range  
number in last three  
spaces, right justified.

#### Section number

301 ---- In the first space, insert  
0 for numeric section  
identifier, 1 for numeric  
portion of alphanumeric  
identifier, or 2 for  
alphabetic part of alpha-  
numeric identifier. In  
the last three spaces,

#### Land grant number

307 ---- In the first space, insert  
a 0 for numeric grant  
identifier, 1 for numeric  
portion of alphanumeric  
identifier, 2 for alpha-  
betic portion of alpha-  
numeric identifier, or 3  
for alphabetic identi-  
fier. In the last three  
spaces, insert grant  
number or numeric repre-  
sentation of alphabetic  
character (01-26), right  
justified.

300 0100 Indian lands  
300 0101 Homestead entries  
300 0102 Donation land claims  
300 0103 Land grants; civil colonies  
300 0104 Private extension of public  
land survey  
300 0105 Area of public and private  
survey overlap  
300 0106 Overlapping land grants  
300 0107 Military reservation  
300 0198 Water  
300 0199 Unsurveyed area

#### Line Attributes

300 0201 Approximate position  
(within 200 ft.)  
300 0202 Protracted position  
300 0203 Arbitrary closure line  
300 0204 Base line

#### Single-point features (degenerate lines)

300 0300 Location monument  
300 0301 Isolated found section  
corner  
300 0302 Witness corner (off  
surveyed line)

#### Parameters

308 0000 Best estimate of classifi-  
cation and (or) position  
309 00-- Coincident feature. Insert  
the first two digits of  
the major code of coin-  
cident feature in two  
spaces.

INSTRUCTIONS FOR USE OF U.S. PUBLIC LAND  
SURVEY SYSTEM ATTRIBUTE CODES

The Public Land Survey System category constitutes a coherent description of a portion of the Earth's surface, defined as a set of non-overlapping regions or areas. It is encoded as an area line graph composed of three element types: nodes, areas, and lines.

Node Attributes

A node is placed wherever:

- Two or more lines intersect;
- A land line is broken, for example, at a water body;
- Line attributes change, for example, at a coincident feature of higher order symbology;
- A special symbol imparts additional information about another point on a surveyed line, for example, a location monument.

Node attributes are presented as two lists which are used to represent (1) type of node and (2) identification procedure. In general, each node is assigned at least one attribute from the first list (type of node) and may be assigned one or more attributes from the second list (identification procedure).

Type of Node

This list describes two classes of real-world features:

- Corners -- Points on the surface of the Earth representing extremities of a boundary or subdivision of the public lands, generally at the intersection of two or more surveyed lines.
- Accessories -- Nearby physical objects used to evidence the positions of corners or to mark other important locations.

Attributes in this list may also be used to identify artificial points

introduced to complete the polygon data structure or to mark changes in line symbology.

Typically, only one code from this list will be assigned to a feature; an exception occurs where a land line closes on a grant corner. Several codes identify features not normally depicted on topographic maps. These codes are included to provide future compatibility with the BLM. They are identified in the accompanying text.

300 0001 U.S. Public Land Survey System section corner -- This is a point at an extremity of a section boundary. It will normally be surrounded by three or four distinct sections. This code includes standard corners (on a standard parallel or base line) and township corners (at an extremity of a township boundary).

300 0002 Point on section line (no corner) -- This code is used when a section line is broken at a location other than a corner, for example, at the neatline of the map, at a coincident feature of higher order symbology, or at a water body.

300 0003 Closing corner -- This is a corner established at the intersection of a surveyed line with a previously established boundary at a point between corners. In general, there are three cases of the occurrence of closing corners:

- Error introduced into the rectangular system due to the convergence of meridians is taken up at standard parallels, normally established every 24 miles along the principal meridian. On the standard parallels, there are offsets in the meridional lines and two sets of corners, standard corners (300 0001) for the lines to the north, and closing corners for the lines from the south.
- Township and section lines may be made closure lines to maintain rectangularity. Measurement error, corrected on extension or resurvey, can thus result in double sets of corners. The south and east boundaries are normally the governing lines of a survey; therefore, for

digitizing purposes, corners at lines to the south and to the east are considered the closing corners.

- Closing corners are also established where the lines of the rectangular system intersect or close on the boundaries of grants or reservations, State boundaries, or on some other previously established survey which is irregular as to plan. A closing corner is coded whenever a survey line closes on or crosses a boundary that delimits the public lands.

300 0004 Meander corner -- The beds of navigable bodies of water are not public domain and are not subject to survey and disposal by the United States. At every point where a section line intersects the banks of such a feature, a meander corner is established, and a metes and bounds traverse, called a meander line, is run to segregate the water area from the public lands. Meander lines are not mapped. Meander corners are shown only when recovered during field work; they are depicted as double-weight (0.01 inch) T's, and are labeled MC (USGS symbol 523). Unless the symbol and label are present, the point on section line code 300 0002 is used when section lines are broken at a water body.

300 0005 Auxiliary meander corner -- When a lake of greater than 50 acres lies completely within a quarter-section, or an island too small to subdivide lies completely within a section, an auxiliary meander corner is established at any point on its bank and tied to the nearest regular corner. A meander line is then run from the auxiliary meander corner. These corners are not normally mapped.

300 0006 Special meander corner -- When a lake of greater than 50 acres lies completely within a section, a special meander corner is established at an intersection of the center line of the section with the bank of the lake, and a meander line is run from the corner. Special meander corners are also established at the intersections of surveyed subdivision of section lines and meander lines. These corners are not normally mapped.

300 0007 Witness corner -- A witness corner is established if the true corner

cannot be marked in the usual manner, due to obstructions or difficult terrain. It is located on the section line within 10 chains (660 feet), or anywhere within 5 chains (330 feet) of the actual corner. Normally, only one witness corner is established in each instance. For example, witness corners are commonly established on secure ground when the true position of a meander corner falls at a point where the monument would be likely to be destroyed by the effects of tide, waves, or ice. Witness corners are only mapped if they are recovered; they are depicted as double-weight (0.01 inch) T's and labeled WC (USGS symbol 523). If a depicted witness corner does not fall on a public land line, it is captured as a degenerate line feature (300 0302).

300 0008 Witness point -- This is a monumented station on a survey line marking an important location remote from and not related to a regular corner (for example, a road or stream crossing). The establishment of witness points is described in the cadastral survey field notes, but these points are not usually shown on the land plats or on topographic maps.

300 0009 Angle point -- This is a point in a survey marking a change in azimuth of an irregular boundary line. Recovered angle points are sometimes shown with the identified (found) corner symbol (USGS symbol 506 or 507), and labeled AP. Angle points not recovered are not captured as nodes, but rather are treated as inflection points of line features.

300 0010 Location monument (includes amended monument and mineral monument) -- Location monuments mark fixed reference points supplementing the regular public land survey. There are two distinct occurrences of this feature:

- Mineral monument - These monuments are established during surveys of the irregular boundaries of mining claims when no public land corners have been established in the vicinity. When the public land surveys are subsequently extended to the area, the mineral monument is tied to a regular section corner.

- Amended monument -- Defective township exteriors that have not been closed upon and from which subdivisional lines have not been run are obliterated after a resurvey. If, however, another survey has been tied to a defective corner, that corner is retained as an amended monument.

Location monuments are depicted as filled triangles on the black plate (USGS symbol 227) and are usually labeled with identifying letters and numbers. In most cases a location monument will not fall on a public land line, and should be captured as a degenerate line feature (300 0300).

300 0011 Reference monument -- This is an accessory monument placed near a corner that cannot be permanently marked, for example, when the corner falls within a roadway and nearby bearing objects are not available. Accessories may be searched for and mapped when corners are not found.

300 0012 Quarter-section corner -- This is a corner at the extremity of a quarter-section boundary, theoretically located halfway (40 chains) between section corners. Normally, quarter-section corners are not searched for or plotted unless there is a bend in the line at the corner or the section corners on either side cannot be recovered. This code is used only when the identified (found) corner symbol (USGS symbol 506) is shown.

300 0013 Tract corner -- A tract corner is an angle point, or change in azimuth, on a tract boundary. In modern public land surveys, the term tract is used to mean a parcel of land that lies in more than one section or cannot be identified in whole as part of a particular section. Tract boundaries are not mapped unless they are needed to show the limits of the land net. In this case, the extreme boundaries only are shown by the grant boundary symbol (USGS symbol 500). It is not always possible to differentiate between tracts and grants on the basis of the published map. The grant corner code is therefore used in all cases.

300 0014 Grant corner -- A grant corner is an angle point, or change in azimuth, on a grant boundary. In many of the States, there are irregular grant boundaries that were established prior to the original public land subdivisional surveys. Grant boundaries are shown by USGS symbol 500. This code is used whenever a node is placed at an angle point on a grant boundary. However, angle points on grant boundaries may be digitized as inflection points of linear features unless: (1) a found land grant monument (USGS symbol 501) is shown, or (2) another surveyed line intersects the grant boundary at that point. Where the public land lines close on or intersect grant boundaries, the closing corner code (300 0003) is used. If the intersection is at an angle point on the grant boundary, the grant corner code is also assigned. Nodes placed where grants intersect the neatline of the map, or where grant lines are broken for features of higher order symbology, will have no attributes.

300 0015 Arbitrary section corner -- This code is used when an arbitrary node is placed in the approximate location of the true corner to effect closure of the land line network. Joining to an arbitrary section corner is one of three methods of closing polygons to complete the definition of a coherent overlay.

#### Identification Procedure

The inclusion of one or more of the following attributes provides additional information about the positional accuracy of a given corner.

300 0040 Corner identified in the field -- This code corresponds to existent corners as defined in the Bureau of Land Management's Manual of Instructions for the Survey of the Public Lands, 1973. It indicates that physical evidence of the corner has been recovered during NMD field operations. Such a corner is shown by a double-weight (0.01 inch) cross or T (USGS symbols 506 and 507) on the published map. Note that all meander (300 0004), witness (300 0007), and quarter-section (300 0012) corners shall also

bear this attribute, since they are only mapped if recovered.

On some older maps, accepted corners (obliterated corners in the BLM manual) were depicted as single-weight (0.005 inch) crosses or T's, rather than the current standard intersection of section lines. Such corners shall not receive this attribute.

The code shall also be used in conjunction with the land grant corner (300 0014) when a found land grant monument (USGS symbol 501) is depicted. When a land grant is coincident with a boundary, the boundary symbol takes precedence. If, however, a recovered monument was established to mark the grant boundary, the monument is shown by symbol 501 on the red plate and is coded as a found grant corner. Monuments shown by symbol 226 on the black plate are boundary monuments and are captured in the Boundaries category.

300 0041 Corner with horizontal control -- This attribute shall be used when a horizontal control station is coincident with a found section corner. The horizontal control station symbol is shown on the black plate (USGS symbol 229).

300 0042 Corner with elevation value -- This attribute shall be used when a vertical control station, elevation third order or better (bench mark), is coincident with a found section corner. The found corner symbol, marked by the label BM and an elevation value (USGS symbol 230), is used to depict this condition.

The presence of a spot elevation at a corner (slanted type, symbol number 224) does not warrant the use of this code. The code is intended to signify inclusion in a control network as an aid in integration with vertical control data.

#### Area Attributes

Each distinct polygon (area) on a graph is assigned a set of attributes. Area attributes consist of five types of parameter entry codes and one set of specific codes that define defining exclusions from the public domain. These attributes form a hierarchy where each

additional code produces a more precise definition of a portion of the Earth's surface.

In the ideal rectangular system, assigning area attributes is a straightforward process that adheres to one of the following general schemes:

- In the rectangular system, the basic areal unit is the section; further subdivision is not normally depicted on the published maps. For a standard section, parameter codes defining the origin of survey, township, range, and section are assigned. If the township has not been subdivided, the section parameter is replaced by the code for unsurveyed area. For example, the San Bernardino meridian, Township 11 North, Range 13 East, Section 10, is assigned the following codes:

306 0027 - San Bernardino meridian  
302 0011 - Township 11 N  
304 0013 - Range 13 E  
301 0010 - Section 10

The area within that township where sectional subdivisions are not shown is coded as follows:

306 0027 - San Bernardino meridian  
302 0011 - Township 11 N  
304 0013 - Range 13 E  
300 0199 - Unsurveyed area

- For areas segregated from the public lands, an identifying code from the list of excluded areas is assigned. Frequently, the surveys of township exteriors were extended across these segregated areas, creating two or more distinct polygons. Where this is depicted on the published map, the proper origin of survey, township, and range parameters are included with each area. For numbered grants, the land grant number parameter is also included. For example, a land grant spanning several townships is assigned only a single code:

300 0103 Land grants, civil colonies

A grant or a portion of a grant located entirely within a township would receive several codes. For example:

306 0021 - Mount Diablo meridian  
302 0006 - Township 6 N  
305 0005 - Range 5 W  
300 0103 - Land grant, civil colony

If the grant is numbered, for example, in Louisiana, it is coded as in the following example:

306 0018 - Louisiana meridian  
303 0009 - Township 9 S  
304 0004 - Range 4 E  
307 0051 - Grant 51  
300 0103 - Land grant, civil colony

- The area outside the limits of the source document is assigned the attribute 000 0000.

The PLSS category is not digitized for maps in non-Public Land States; however, for maps in Public Land States where land lines are omitted, the area of the quadrangle is digitized and attributes assigned that define the reason for exclusion from the system, that is, a code from the list of excluded areas.

#### Origin of Survey Parameter Code 306 00xx

Enter code for origin of survey, right justified (see table 1).

The list in table 1 includes both principal meridians (PM) and survey names (SN). A meridian, always paired with a base line, is a line extending north and south from the initial point of survey. A survey name is the reference for a set of townships when the survey has no initial point as an origin for both township and range numbering. The irregular surveys in the States of Ohio and Indiana are described in detail beginning on page 27. For example:

306 0008 - Boise meridian  
306 0038 - Ohio River Base survey in Indiana

#### Township Number Parameter Code 30x yzzz

Encode Township number as follows:

- x = 2 for north of the Base Line  
3 for south of the Base Line
- y = 0 for full township  
2 for 1/4 township  
4 for 1/2 township  
6 for 3/4 township
- zzz = township number, right justified

For example:

303 0101 - Township 101 South  
302 4023 - Township 23 1/2 North

Half townships may be created in instances where the distance between the regular position of township boundaries is so great that the application of normal rules of subdivision would result in sections elongated in excess of 120 chains (7,920 feet). Partial townships are labeled on the map as, for example, T23 1/2N.

Township numbers are normally placed in pairs straddling the township exterior line. They are found in the East and West margins, or in the interior of the map if the township line does not extend to the neatline.

#### Range Number Parameter Code 30x yzzz

Encode Range Number as follows:

- x = 4 for east of the Principal Meridian  
5 for west of the Principal Meridian
- y = 0 for full range  
2 for 1/4 range  
4 for 1/2 range  
6 for 3/4 range

Table 1.--Origins of the U.S. Rectangular Surveys

<u>Code</u>	<u>Designation</u>	<u>Type</u>	<u>States</u>	<u>Date</u>
01	First Principal	PM	OH, IN	1819
02	Second Principal	PM	IL, IN	1805
03	Third Principal	PM	IL	1805
04	Fourth Principal	PM	IL	1815
05	Fifth Principal	PM	AR, IA, MN, MO, ND, SD	1815
06	Sixth Principal	PM	CO, KS, NE, SD, WY	1855
07	Black Hills	PM	SD	1878
08	Boise	PM	ID	1867
09	Chickasaw	PM	MS	1833
10	Choctaw	PM	MS	1821
11	Cimmaron	PM	OK	1881
12	Copper River	PM	AK	1905
13	Fairbanks	PM	AK	1910
14	Gila and Salt River	PM	AZ	1865
15	Humboldt	PM	CA	1853
16	Huntsville	PM	AL, MS	1807
17	Indiana	PM	OK	1870
18	Louisiana	PM	LA	1807
19	Michigan	PM	MI, OH	1815
20	Principal	PM	MT	1867
21	Mount Diablo	PM	CA, NV	1851
22	Navajo	PM	AZ	1869
23	New Mexico Principal	PM	CO, NM	1855
24	St. Helena	PM	LA	1819
25	St. Stephens	PM	AL, MS	1805
26	Salt Lake	PM	UT	1855
27	San Bernardino	PM	CA	1852
28	Seward	PM	AK	1911
29	Tallahassee	PM	FL, AL	1824
30	Uintah	PM	UT	1875
31	Ute	PM	CO	1880
32	Washington	PM	MS	1803
33	Willamette	PM	OR, WA	1851
34	Wind River	PM	WY	1875
35	Ohio River Survey	SN	OH	1785
36	Between the Miamis	SN	OH	1802
37	Muskingum River	SN	OH	1800
38	Ohio River Base	SN	IN	1799
39	First Scioto River	SN	OH	1799
40	Second Scioto River	SN	OH	1799
41	Third Scioto River	SN	OH	1799
42	Ellicott's Line	(Note 1)		
43	Twelve-Mile Square	SN	OH	1805
44	Kateel River	PM	AK	1956
45	Umiat	PM	AK	1956
46	Fourth Principal	PM	MN, WI	1831
47	West of the Great Miami	SN	OH	1798
48	U.S. Military Survey	SN	OH	1797
99	Not Public Land Survey	(Note 2)		

NOTES

1. Ellicott's Line is the name given to the Ohio-Pennsylvania boundary. No townships are referenced to Ellicott's Line--it is included for compatibility with the BLM.
2. This code is included for compatibility with the BLM. It refers to area in the original 13 States, Texas, or a territory.. The PLSS data category is not digitized in these areas.

- 8 for duplicate to north or east of the original township
- 9 for triplicate to north or east of a duplicate township
- zzz = range number, right justified

For example:

304 0005 - Range 5 East  
 305 8047 - Range 47 West, duplicate to north or east of the original township.

Half ranges may be created in instances where the distance between the regular position of township boundaries is so great that the application of normal rules of subdivision would result in sections elongated in excess of 120 chains (7,920 feet). Partial ranges are labeled on the map as, for example, R79 1/2E.

The Range Number Parameter Code can contain an identifier used to distinguish among identical sets of Meridian - Township - Range numbers. Such duplicate designations occur most commonly at State boundaries. Table 2 contains a partial list of Meridian, Township, and

Range number duplicates ordered by State and Meridian. In the table, the letter A is used to designate a duplicate, and the letter B a triplicate township identifier. Range numbers are normally placed in pairs straddling the township exterior line. They are found in the North and South margins, or in the interior of the map if the range line does not extend to the neatline.

Section Number Parameter Code  
301 xyyy

Encode each section number as follows:

- x = 0 for numeric section identifier
- 1 for numeric part of alphanumeric section identifier
- 2 for alphabetic part of alphanumeric section identifier
- yyy = Section number, right justified, or numeric code for alphabetic character, right justified:

Table 2.--Township duplicates

<u>State</u>	<u>Meridian</u>	<u>Township/Range</u>
California	MT. DIABLO	Township 010N, Range 022AE
Colorado	NEW MEX PRIN	Township 034N, Ranges 003AW through 016AW
North Dakota	5TH PM	Township 129N, Ranges 054AW and 055AW Township 130N, Ranges 053AW, 054AW, 055AW
Nevada	MT. DIABLO	Township 001S, Ranges 032AE and 033AE Township 002S, Ranges 033AE and 034AE Township 003S, Range 035AE Township 005S, Ranges 037AE and 038AE Township 006S, Range 039AE Township 007S, Range 039AE Township 009S, Ranges 040AE and 041AE
Oregon	WILLAMETTE	Township 026S, Ranges 030AE, 031AE, 032AE Township 036S, Range 007AE
South Dakota	5TH PM	Township 119N, Range 051AW Township 120N, Range 051AW Township 128N, Ranges 047AW, 048AW, 019AW Township 129N, Range 054BW (See ND above)
Wyoming	6TH PM	Township 012N, Ranges 060AW through 104AW

A = 01, B = 02, C = 03,  
 D = 04, E = 05, F = 06,  
 G = 07, H = 08, I = 09,  
 J = 10, K = 11, L = 12,  
 M = 13, N = 14, O = 15,  
 P = 16, Q = 17, R = 18,  
 S = 19, T = 20, U = 21,  
 V = 22, W = 23, X = 24,  
 Y = 25, Z = 26

For example:

301 0036 - Section 36  
 301 0101 - Section 101

Section 23A would be assigned two codes:

301 1023  
 301 2001

Sections are usually numbered from 1 to 36, but can be higher and in some States may include alphabetic characters.

Where possible, the identifying number for a section is shown centered in its respective area. For fractional sections or areas that extend overedge, the numbers are placed as near as possible to the true center of the section, but not closer than 0.1 inch to the neatline of the map. A number may have been omitted from the published map if there was insufficient space. In these cases, the proper identifier can be derived from those of adjoining sections.

#### Land Grant Number Parameter Code

307 xyyy

Encode land grant number as follows:

- x = 0 for numeric grant identifier
  - 1 for numeric part of alphanumeric section identifier
  - 2 for alphabetic part of alphanumeric section identifier
  - 3 for alphabetic grant identifier
- yyy = Grant number, right justified, or numeric code

for alphabetic character, right justified:

A = 01, B = 02, C = 03,  
 D = 04, E = 05, F = 06,  
 G = 07, H = 08, I = 09,  
 J = 10, K = 11, L = 12,  
 M = 13, N = 14, O = 15,  
 P = 16, Q = 17, R = 18,  
 S = 19, T = 20, U = 21,  
 V = 22, W = 23, X = 24,  
 Y = 25, Z = 26

For example:

307 0051 - Grant number 51  
 307 2024 - Grant X

In some States, such as Louisiana, each nonconformable valid grant within a township is assigned a serial tract number, generally commencing with 37, but occasionally in the range 1-36 normally reserved for sections, and occasionally including alphabetic characters.

Placement of numeric labels for grants conforms to the rules discussed for section numbers.

#### Excluded Areas

Land lines may be omitted from maps in Public Land States for several reasons:

- They have not been established.
- There is insufficient field evidence to position the land net to established standards.
- There are large areas of previously established tracts or claims.

If sectional subdivision lines are not depicted for an area, one of the following codes is used:

300 0100 Indian lands -- Land granted to the native Indians is excluded from the public domain. Tribal lands are shown on published maps with the reservation boundary symbol (USGS symbol 207). The reservation name is placed across the bounded area.

Boundaries of abandoned reservations that are limiting lines of subdivision surveys are shown on maps with the section line symbol, and labeled Old Indian Treaty Boundary. When these lines do not limit the public lands, they are digitized only on the Boundaries overlay, and are coded as Historical lines.

300 0101 Homestead entries -- Title to portions of the public domain was granted to individuals under the various homestead acts, based on residence, cultivation, and some improvement to the land over several years. Homestead entries cannot reliably be identified based only on information on published maps; therefore this code is not normally used.

300 0102 Donation land claims -- Tracts of land (160, 320, or 640 acres) were allocated to settlers in the Oregon Territory who had resided on and cultivated the land for 4 years under the Donation Act of September 27, 1850; to settlers in Florida under the Act of August 4, 1842; and to settlers in New Mexico under the Act of July 22, 1854. The boundaries of these areas are shown by the land grant symbol, and the areas are usually numbered within a township. Within the affected areas, polygons bounded by the grant line symbol which are less than or equal to the size of a section are coded as donation land claims. In addition, these areas are normally assigned the land grant number parameter (307 ----). Angle points on the boundaries are coded as grant corners when appropriate.

300 0103 Land grants; civil colonies -- Grants established prior to the original subdivisional surveys are segregated from the public lands. The boundaries of these irregular areas are shown with USGS symbol 500. The names of named land grants, for example, Spanish grants in California, are shown in black on the published maps. The word grant is omitted unless the entire quadrangle falls within the grant. Numbered grants will include the land grant number parameter (307 ----).

300 0104 Private extension of public land survey -- The term, private, refers to any surveys not accepted by BLM. Such

surveys may be depicted on the published map by using dotted lines (USGS symbols 508 and 509). They include, for example, Bureau of Indian Affairs (BIA) surveys on Indian lands. These areas will also be assigned origin of survey, township, range, and section number parameters as appropriate. They may also include an identifier of the type of land surveyed. For example, a section established by the BIA on an Indian reservation is coded as follows:

306 0023 - New Mexico principal  
          meridian  
302 0024 - Township 24 N  
305 0014 - Range 14 W  
301 0002 - Section 2  
300 0104 - Private extension of  
          public land survey  
300 0100 - Indian lands

300 0105 Area of public and private survey overlap -- Private surveys may overlap the public land surveys. Such areas are assigned this code. They may also carry two sets of township, range, and (or) section numbers if the designations of the public (BLM) and private surveys do not agree.

300 0106 Overlapping land grants -- Where land grants overlap due to survey error or disputed claims, this code is used. The land grant code (300 0103) is not required in these cases.

300 0107 Military reservation -- This code is used for military or light-house reservations which limit the public lands. The boundaries of these areas are shown on the map with the reservation boundary symbol (USGS symbol 207).

300 0198 Water -- The areas of navigable streams and meanderable lakes are excluded from the public lands and should be assigned this attribute.

These areas will generally be bounded by arbitrary lines of closure since the actual meander lines are not mapped and land lines are broken at these bodies of water.

300 0199 Unsurveyed area -- This code is to be used when land lines are omitted from any area that is a part of the public domain. It is also used for areas outside of the original public

domain, that is, the thirteen original States, Texas, Canada, and Mexico, when such areas are depicted on maps partially covering Public Land States.

#### Line Attributes

Lines in the PLSS category represent property boundaries or references to boundaries. Specific line attribute codes are used only when they cannot be derived from the attributes of the bounding nodes and areas. The absence of line attributes indicates that the lines meet National Map Accuracy Standards (NMAS).

Land lines are symbolized on published maps as follows:

- Solid 0.005 inch lines (USGS symbol 504) if they can be positioned to meet NMAS.
- Dashed 0.005 inch lines (USGS symbol 505) if they do not meet NMAS, but can be positioned in relation to the land plat within 0.1 inch at map scale (200 feet on 1:24,000-scale maps).
- Dotted 0.006 inch lines (USGS symbol 509) if they were surveyed by a private concern or a government agency other than BLM.

Lines representing township extremities are shown at double the above line weights (USGS symbols 502, 503, and 508).

On maps published before about 1940, subdivision lines were shown by black dotted lines; on those published between about 1940 and 1948, black solid lines were used.

In addition to depicted land lines, other boundaries that limit the land net must be digitized to complete closure of all polygons. These will include: cases where the land lines were omitted from the map due to coincidence with features of higher order symbology; arbitrary closure lines at, for example, water bodies; and the neatline of the map.

300 0201 Approximate position (within 200 feet) -- This code should be used whenever dashed land lines are shown on the map to indicate that the lines do not meet NMAS but can be positioned within

0.1 inch at map scale. Boundaries of grants labeled as approximate also are assigned this code. If only a portion of a grant is approximate, this code is assigned from the nearest found grant monument extending along the labeled segments of the line.

300 0202 Protracted position (Alaska) -- BLM has defined protracted land lines for all areas of Alaska not yet subdivided by ground surveys. The unsurveyed land lines represent theoretically perfect subdivisions. Protracted land lines are shown as solid gray lines for all new and revised Alaska maps. (Although BLM has also protracted land lines for all suspended and unsurveyed townships in the conterminous U.S., these lines are not shown on large-scale topographic maps.)

300 0203 Arbitrary closure line -- Arbitrary lines must occasionally be digitized to effect closure of all polygons of a PLSS file. This most frequently occurs where land lines intersect navigable bodies of water, since the actual meander lines are not mapped. Closure lines may be digitized in one of the following ways:

- As straight line segments joining existing nodes;
- As approximate metes and bounds (distance and direction) traverses along the limits of another feature;
- Or as straight line extensions to an arbitrary section corner (300 0015).

In positioning arbitrary closure lines at water bodies, consider that meander lines are run in original surveys not as boundaries but to define the sinuosities of the feature, and as a means of ascertaining the quantity of land remaining after segregation of the water area. They are run as a series of straight line segments that approximate the true margin of the feature. Thus a major consideration in digitizing these lines is to avoid introducing excessive error into computations of land area.

It is also important to note that the position of bodies of water may change over time, but surveyed lines remain in their original locations. Land lines are mapped as originally surveyed, even if

the shorelines of meandered water bodies have changed. Therefore, closure lines at water bodies should not be extended to or pulled back from the mapped shoreline where discrepancies exist.

In the past, land lines were broken at tract boundaries, but the tract limits themselves were sometimes not shown. In such cases, the arbitrary closure lines should be digitized as straight line segments between nodes placed at the points where the land lines terminate.

300 0204 Base line -- The base line of a survey is shown as a double-weight (0.01 inch) solid line and labeled in black as base line. The use of this code is only required in conjunction with those surveys that do not have an initial point for the origin of both township and range numbering (see Origin of Survey).

#### Single-Point Features (Degenerate Lines)

300 0300 Location monument -- This code is used for mapped location monuments (USGS symbol 227) that do not fall on a section line. If a location monument falls on a section line, it shall be collected as a node (300 0010). Location monuments are discussed in detail beginning on page 17.

300 0301 Isolated found section corner -- Recovered section corners (USGS symbol 506) may be shown on maps in areas where subdivision lines are omitted due to insufficient data. These features are captured as degenerate lines.

300 0302 Witness corner (off surveyed line) -- This code is used for mapped witness corners (USGS symbol 523) that have been placed off a surveyed line. Witness corners on surveyed lines are captured as nodes (300 0007). Witness corners are discussed in detail beginning on page 17.

#### Parameters

309 00xx = Coincident feature or symbol  
xx = the most significant two digits (leftmost) of the major code of the coincident feature, for example:

- 309 0009 - Land line coincident with Boundary (Major code of Boundaries is 090)
- 300 0010 - Land line coincident with Road (Major code of Roads is 100)

Land lines are omitted where they coincide with features of higher order symbolization, such as civil boundaries, roads, levees, or canals. To effect closure of all polygons, these lines are digitized along the span of the coincident feature. Nodes are placed at each location where symbology changes, as well as at corner locations which may have been omitted from the published map, and coded as appropriate. Nodes at intersections of land lines and boundaries are closing corners (300 0003).

Coincident lines are assigned the coincident feature parameter code. They should also be assigned standard line attributes as appropriate. There are two distinct cases to consider:

- Land lines coincident with boundaries -- Land lines close on previously established boundaries. Thus lines coincident with boundaries should be considered to meet NMAS (and thus receive no additional attribute) unless the boundary is shown as approximate or indefinite, in which case the land line should be coded as approximate (300 0201). Approximate boundaries are labeled. Indefinite boundaries are labeled and shown at one-half the normal line weight.
- Land lines coincident with manmade features, such as roads, canals, or levees -- When only a portion of a section line is omitted, determining the proper line attribute is straightforward: it is the same as that of the portion that is depicted. If, however, entire section lines are omitted, a judgment must be made. In general, these lines should be coded as accurate or approximate on the basis of the overall pattern of lines within the township involved. Remember that land lines are considered to meet NMAS and are assigned the solid line symbol when:

1. they connect found or indicated corners;
2. the number of found or indicated corners is adequate to control a standard-accuracy adjustment of the township;
3. other ground evidence agrees with the official land plats and the lines are accepted locally. For example, it has been the general practice in the Prairie States to locate the public roads on the section lines.

If these conditions are not met, land lines coincident with manmade features should be coded as approximate (300 0201).

#### IRREGULAR RECTANGULAR SURVEYS IN OHIO AND INDIANA

Eight rectangular public land surveys have no initial point as an origin of both township and range numbers. These include seven surveys in Ohio and one in Indiana. They commenced between 1785 and 1805, a period when the laws prescribing the subdivision of the public domain were in flux. While rectangular in nature, these surveys do not strictly conform to the current plan.

Within several surveys, because townships depend on crooked rivers for base lines, offsets in the township tiers and irregular sequences of numbering result. In addition, subdivision of townships is not consistent. The current system of numbering sections within a township was not adopted until passage of the Land Act of May 18, 1796. Prior to this time, the original Ordinance of May 24, 1785 applied, in which sections were numbered progressively northward in tiers, commencing with section 1 of the southeast corner of each township, to section 36 at the northeast corner.

In general, each area is completely identified on the published map as the situation warrants by:

- Labels (in black) on the boundaries of the areas.

- Labels on system boundaries, except along the Miami River, Little Miami River, Scioto River, and Ohio River. These natural features are defined as boundaries in the credit legend.
- Appropriate marginal notes identifying the base line or meridians from which the several surveys were extended.

Specific characteristics of each of these surveys are described in the following paragraphs.

#### Ohio River Survey

The Ohio River is the base line. Townships are numbered north from the Ohio River, and ranges west from the Ohio-Pennsylvania boundary (Ellicott's Line). The Ohio River Survey consists of three separate areas:

The Seven Ranges -- The first rectangular survey was begun in 1785 with the establishment of a point of origin on the north bank of the Ohio River at the Ohio-Pennsylvania boundary, and the running of a line westward for 42 miles (seven ranges). This line is termed the Geographer's Line. Ranges 1 through 7 of the Ohio River Survey, south of the Geographer's Line, are referred to as the Seven Ranges, or the Old Seven Ranges. Sections in this area are numbered according to the Ordinance of 1785.

Congress Lands East of the Scioto River -- This area includes most of the land west of the Seven Ranges, east of the Scioto River, and south of the U.S. Military District. Three small areas along the Scioto River are based on the Scioto River Base, and the large Ohio Company tract lies in the southeast. Sections within the Congress Lands are numbered according to the plan of the Land Act of 1796.

Congress Lands North of the Old Seven Ranges -- This includes all the lands north of the Seven Ranges and the U.S. Military District, and south of Connecticut's Western Reserve, except

for the two townships in the Muskingum River Survey. Sections are numbered according to the present plan.

Maps of the Ohio River Survey area contain a marginal note: Land lines based on the Ohio River Base. Marginal notes also identify the Seven Ranges and the Congress Lands. The Geographer's Line and the boundaries of the Congress Lands are labeled on the maps.

#### Between the Miamis--North of Symmes Purchase

The Great Miami River is the base line. Townships are numbered east from the Great Miami River, and ranges north from the Ohio River. Sections are numbered according to the Ordinance of 1785. This represents an extension of the system used in the private survey of the Symme's Purchase Tract. This area is also called the Congress Lands East of the Miami River. It is bounded on the northeast by the Virginia Military Reserve. Marginal notes on maps of this area will identify that land lines are based on the Great Miami River Base and that the area lies within the Between the Miamis. The northeast and south boundaries of the area are labeled on the map.

#### Muskingum River Survey

This area consists of only two townships, within the Congress Lands North of the Old Seven Ranges and bounded on the north by the Connecticut Western Reserve. Townships are numbered 1 and 2 North, and the range is 10 West. The range continues the numbering of the Ohio River Survey. A marginal note identifies the specific townships based on the Muskingum River Base.

#### Ohio River Base--Indiana

In this area of southeast Indiana, townships are numbered north from the Ohio River, and ranges west from the Ohio-Indiana boundary and its projection south. It is bounded on the north and west by the Greenville Treaty Line.

#### Scioto River Base Surveys

The Scioto River is the base line. Townships are numbered north from the Scioto River, and ranges west from the Ohio-Pennsylvania boundary, continuing the numbering of the Ohio River Survey.

First Scioto River Base -- This is the southernmost of the three small surveys at the western edge of the Congress Lands east of the Scioto River. It contains townships numbered 1 through 4 North, and range 22 West. The standard plan for numbering sections is disrupted at the Scioto River, that is, if section 2 is the last section on the top tier of a township, the section below it (on the next tier) will be number 3. This area is bounded on the south by the Scioto River (Chillicothe East quadrangle), on the east by range 21 West of the Ohio River Survey, on the west by the Scioto River, and on the north by the Second Scioto River Base (Asheville quadrangle).

Second Scioto River Base -- The survey contains townships numbered 2 through 5 North, and range 22 West. Sections are numbered according to the standard plan. The area is bounded on the south by the First Scioto River Base (Asheville quadrangle), on the east by range 21 West of the Ohio River Survey, on the west by the Scioto River and the Third Scioto River Base (Columbus Southwest quadrangle), and on the north by the U.S. Military Survey.

Third Scioto River Base -- This survey contains only a single township: township 1 North, range 23 West. Sections are numbered according to the standard plan. It is bounded on the south and west by the Scioto River, on the east by the Second Scioto River Base Survey, and on the north by the U.S. Military Survey (Columbus Southwest quadrangle).

#### Twelve-Mile Square Reserve

This small area in northwest Ohio consists of only four townships, numbered 1 through 4. There is no associated range number. Exterior boundaries of the area are labeled. For these four townships, the township number parameter

will be coded as north of the base line (302 ----).

#### West of the Great Miami (Ohio)

The Great Miami River is the base line for this survey. Townships are numbered north from the Great Miami River, and ranges east from the Ohio-Indiana boundary. This area is also called the Congress Lands West of the Miami River. It is bounded on the north by the Greenville Treaty Line.

#### U.S. Military Survey

Townships are numbered from the south boundary of the U.S. Military Tract, and ranges west from the west boundary of the Seven Ranges. This area is subdivided into 5-mile-square townships; sections are thus numbered 1 to 25. Section numbering follows the present plan, commencing with number 1 in the northeast corner of the township, to number 25 in the southwest corner. Some townships are divided into quarters, which are numbered 1 to 4 beginning with the northeast quarter and proceeding counterclockwise. These areas are treated as sections for digitizing purposes.

#### Private Surveys in Ohio

The State of Ohio also contains several large tracts of land that were excluded from the public domain. Two large areas were claimed by existing States: the Connecticut Western Reserve and Firelands, and the Virginia Military Reserve. Two additional tracts were sold to private concerns: the Ohio Company Purchase and Symmes Purchase. These areas were subdivided by private surveys.

Connecticut Western Reserve and Firelands -- This area in northwestern Ohio was divided into 5-mile square townships and irregular tracts by the

Connecticut Land Company. Land lines are mapped as dotted lines. Townships are numbered north from the southern boundary of the reserve, and ranges west from the Ohio-Pennsylvania boundary. In the western portion of this area (the Firelands), townships were divided into quarter townships, which are numbered 1 to 4, commencing with 1 in the southeast quarter and proceeding clockwise. These areas are digitized as sections. In the eastern portion, township and range lines only are mapped. The boundaries of the Connecticut Western Reserve are labeled in black.

Virginia Military Reserve -- This area was surveyed according to the laws of the State of Virginia. It does not conform to the rectangular system. Land lines are not shown within this area. The boundaries of the Virginia Military District are labeled in black.

Ohio Company Purchase -- This area in southeastern Ohio was subdivided by private surveys. Land lines are mapped as dotted lines. The Ohio River is the base line. Townships are numbered north from the Ohio River, and ranges west from the Ohio-Pennsylvania boundary, continuing the system of the Ohio River Survey. Sections are numbered according to the Ordinance of 1785. There are many irregularities in the subdivisions, and these irregular lots are not mapped. The boundaries of Ohio Company lands are labeled.

Symmes Purchase -- The Great Miami River is the base line for the private surveys of this area. Land lines are mapped as dotted lines. Townships are numbered east from the Great Miami River and ranges north from the Ohio River. Ranges 1 and 2 are duplicated in the southern portion of the area. The first occurrence is labeled F.R.2 (First Range 2). Sections are numbered according to the Ordinance of 1785. The Between the Miamis public land survey continued the numbering adopted in the survey of this tract. The north boundary of Symmes purchase is labeled.

ALPHABETICAL INDEX

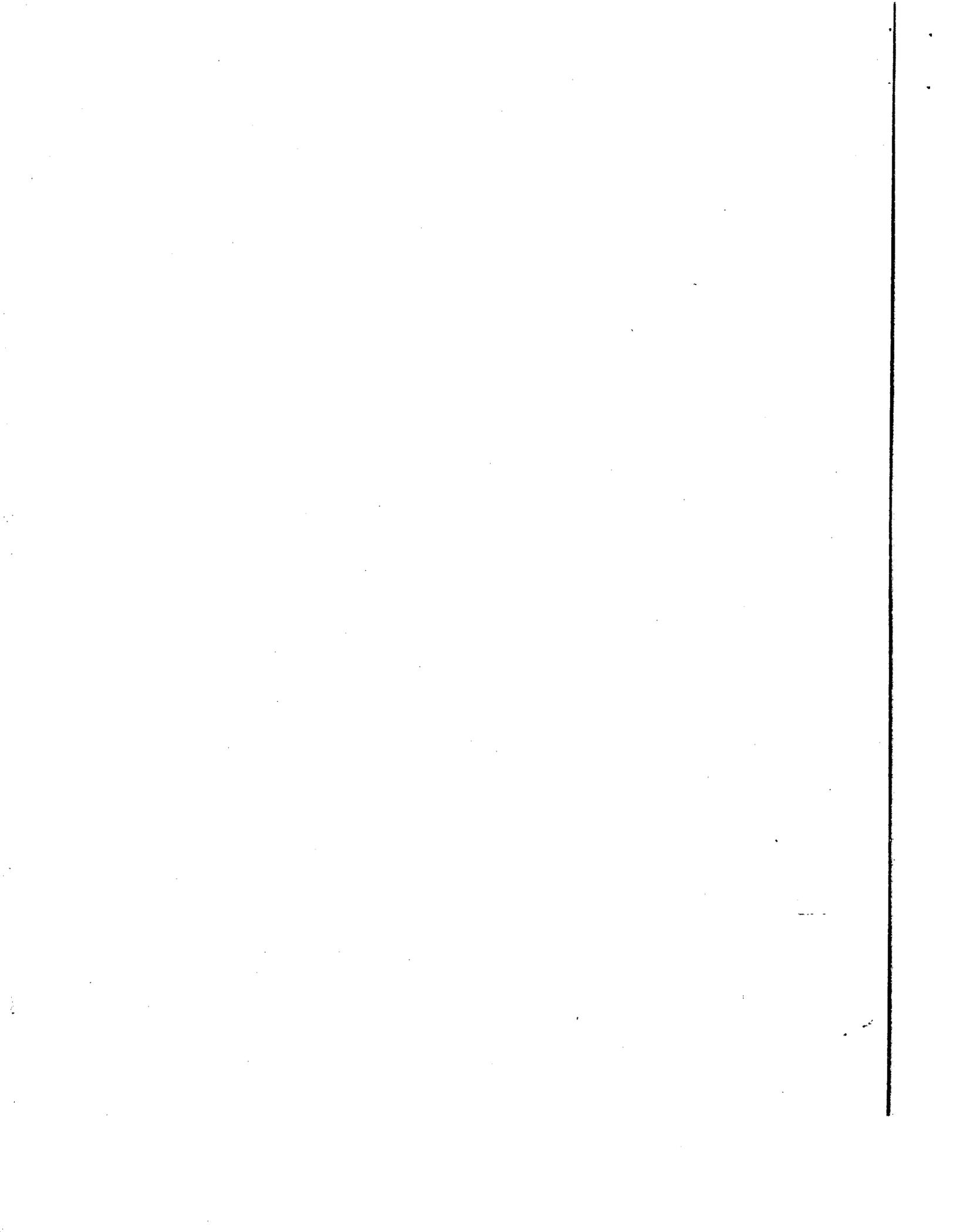
Hydrography Attributes

Abandoned	050 0611	Mineral	050 0615
Alkali flat	050 0100	Mud	050 0115
Apparent limit	050 0204	Navigable - Transportation	050 0616
Aqueduct	050 0415	Nonflowing well	050 0301
Area to be submerged	050 0108	Oceans	050 0116
Bays	050 0116	Outline of a Carolina bay	050 0205
Bog	050 0111	Overpassing	050 0602
Braided stream	050 0413	Penstock	050 0417
Canal	050 0414	Permanent snow field	050 0103
Canal lock	050 0407	Pond	050 0421
Channel in water area	050 0419	Pumping station	050 0404
Check	050 0409	Quarry filled with water	050 0402
Closure line, (water-water)	050 0202	Rapids	050 0400
Coral reef	050 0422	Reservoir	050 0101
Covered reservoir	050 0102	Rice field	050 0113
Cranberry bog	050 0114	Right bank	050 0605
Crevasse	050 0411	Riser	050 0303
Dam	050 0406	Salt	050 0608
Ditch	050 0414	Salt evaporator	050 0104
Dry	050 0614	Sand	050 0115
Elevated	050 0603	Seas	050 0116
Ephemeral drain	050 0420	Sewage disposal pond	050 0109
Estuaries	050 0116	Sewage filtration beds	050 0109
Exposed rock	050 0410	Shoreline	050 0200
Falls	050 0401	Sink	050 0003
Fish farm	050 0106	Siphon	050 0418
Fish hatchery	050 0106	Sluice gate	050 0407
Flats	050 0115	Spillway	050 0408
Flood	050 0409	Spring	050 0300
Flowing well	050 0302	Stream	050 0412
Flume	050 0416	Stream entering water body	050 0004
Gaging station	050 0403	Stream exiting water body	050 0005
Gate	050 0409	Submerged	050 0612
Geyser	050 0304	Swamp	050 0111
Glacier	050 0103	Tailings pond	050 0110
Gravel	050 0115	Tidal flats	050 0115
Gravel pit	050 0402	Tidal gate	050 0409
Gulfs	050 0116	Tunnel	050 0604
Head	050 0409	Under construction	050 0607
Hot spring		Underground	050 0601
(sulphur, alkali, etc.)	050 0615	Underpassing	050 0617
Indefinite shoreline	050 0203	Unsurveyed	050 0609
Industrial water impoundment	050 0107	Upper origin of stream	050 0001
Intermittent	050 0610	Upper origin of stream	
Inundation area	050 0105	at water body	050 0002
Lake	050 0421	Wash	050 0420
Left bank	050 0606	Water intake	050 0405
Mangrove area	050 0112	Weir	050 0406
Manmade shoreline	050 0201	Wetland	050 0111
Marsh	050 0111	Windmill	050 0305
		Wooded	050 0613

ALPHABETICAL INDEX

U.S. Public Land Survey System Attributes

Angle point	300 0009	Private extension of Public	
Approximate position		Land Survey	300 0104
(within 200 ft)	300 0201	Protracted position	300 0202
Arbitrary closure line	300 0203	Quarter section corner	300 0012
Arbitrary section corner	300 0015	Range -- Insert 4 for east of	
Area of public and private		the principal meridian or	30- ----
survey overlap	300 0105	5 for west of the principal	
Auxiliary meander corner	300 0005	meridian in the first space.	
Base line	300 0204	In the second space, insert	
Best estimate of		a 0 for a full range, 2 for	
classification and (or)	308 0000	1/4 range, 4 for 1/2 range,	
position		6 for 3/4 range, 8 for	
Closing corner	300 0003	duplicate to the north or	
Coincident feature. Insert		east of the original township,	
major code of coincident	309 00--	or 9 for triplicate to the	
feature in two spaces.		north or east of the original	
Corner identified in field	300 0040	township. Insert range number	
Corner with elevation value	300 0042	in last three spaces, right	
Corner with horizontal control	300 0041	justified.	
Donation land claims	300 0102	Reference monument	300 0011
Homestead entries	300 0101	Section -- In the first space,	
Indian lands	300 0100	insert 0 for numeric section	301 ----
Isolated found section corner	300 0301	identifier, 1 for numeric	
Land grant -- In the first		portion of alphanumeric	
space, insert a 0	307 ----	identifier, or 2 for	
for numeric grant identifier,		alphabetic part of alphanumeric	
1 for numeric portion of		identifier. In the last three	
alphanumeric identifier, 2		spaces, insert section number or	
for alphabetic portion of		numeric representation of	
alphanumeric identifier, or		alphabetic character (01-26),	
3 for alphabetic identifier.		right justified.	
In the last three spaces,		Special meander corner	300 0006
insert grant number or		Township -- Insert 2 for north	
numeric representation of		of the baseline or 3 for	30- ----
alphabetic character (01-26),		south of the baseline in	
right justified.		first space. In the second	
Land grant corner	300 0014	space, insert a 0 for a full	
Land grants; civil colonies	300 0103	township, 2 for 1/4 township,	
Location monument	300 0300	4 for 1/2 township, or 6 for	
Location monument		3/4 township. Insert township	
(includes amended monument	300 0010	number in the last three	
and mineral monument)		spaces, right justified.	
Meander corner	300 0004	Tract corner	300 0013
Military reservation	300 0107	U.S. Public Land Survey section	
Origin of survey --		corner	300 0001
Insert two digit code from	306 00--	Unsurveyed area	300 0199
table 1, part 0312.0402		Water	300 0198
Overlapping land grants	300 0106	Witness corner	300 0007
Point on section line		Witness corner	
(no corner)	300 0002	(off surveyed line)	300 0302
		Witness point	300 0008



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