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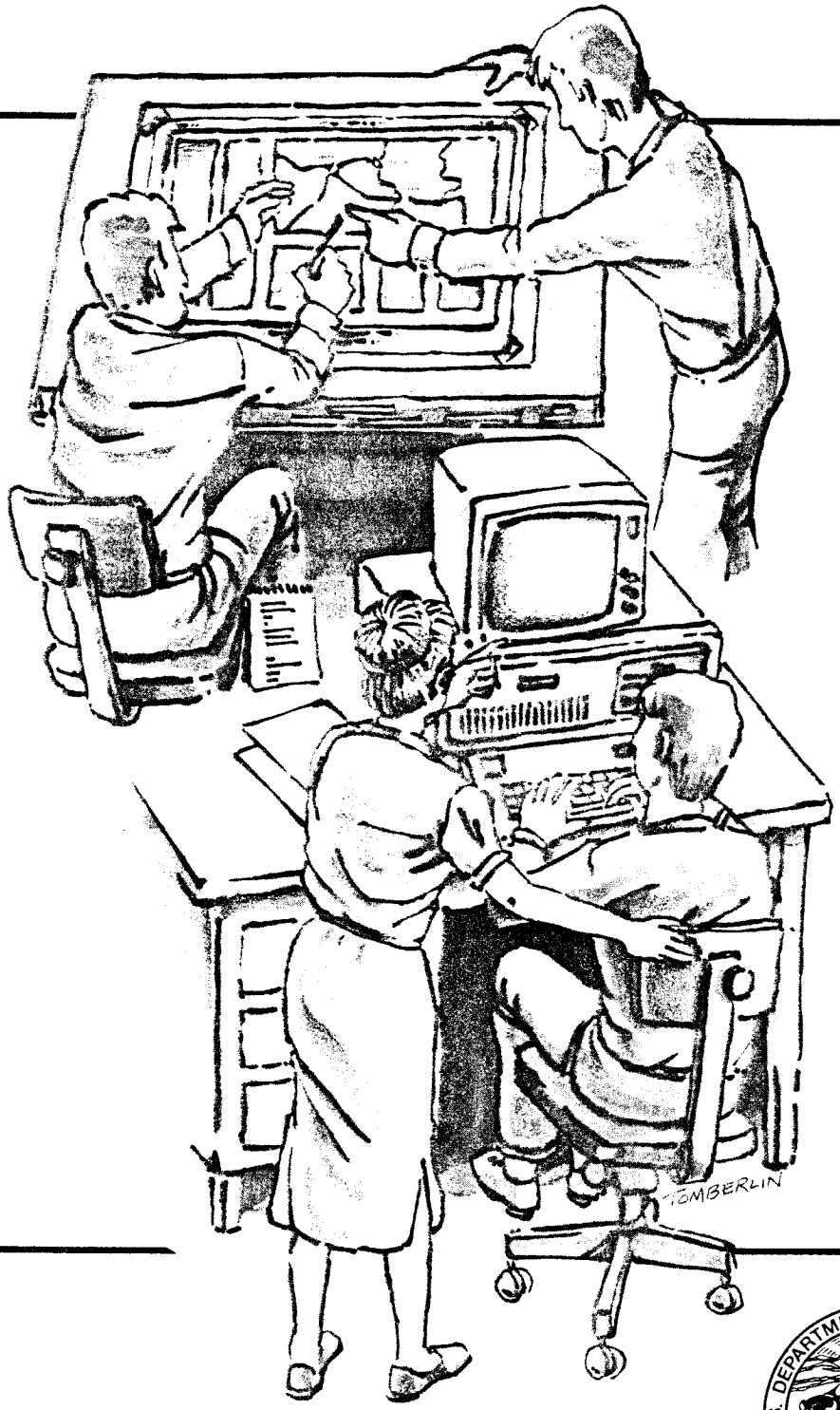

U.S. Geological Survey

Open-File Report 95-415

U.S. DEPARTMENT OF THE INTERIOR
MARCH 3, 1849

Standards for Illustrations in Reports of the U.S. Geological Survey, Water Resources Division

Compiled by Robert A. Miller and Barbara H. Balthrop

U.S. GEOLOGICAL SURVEY

Open-File Report 95-415

1995

U.S. DEPARTMENT OF THE INTERIOR

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U.S. GEOLOGICAL SURVEY

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FOREWORD

This volume will provide a convenient and much-needed compilation of standards for the design of illustrations for authors of Survey reports produced in the Southeastern Region. While it presents very little that is new, it does draw material together under one cover for easy reference. Material is incorporated from the following sources:

WRD Publications Guide (blue cover)
Cartographic Technical Standards, Publications Division
Branch of Technical Standards, Technical Standards Section
Branch of Technical Standards, Instruction Series
Specimens of Type Faces for Maps, Branch of Printing, Publications Division
WRD Publications Guide, Volume 1, Publications Policy and Text Preparation, 1986 Edition (green cover)

The editors and several Regional and District people are to be commended for conceiving, compiling, and implementing this volume, which is designed to bridge the gap between obsolete or widely dispersed references and a new national standards guide for illustrations planned for the future. This volume itself will be obsolete when the new guide is issued, but until that time, I urge all authors, reviewers, and cartographers in the Southeastern Region to use the standards presented herein.

Illustrations as well as writing standards promulgated by the Geological Survey are, to many, voluminous, stringent, and laboriously detailed. Yet, familiarity with these standards brings the realization that they are the blueprint to good writing and the pathway to effective communications. I have made arrangements for a copy of this volume to be given to each hydrologist, editor, and cartographer in the Southeastern Region in an effort to maximize our communications skill. I request that each of you implement this thrust by becoming familiar with, and applying, these standards.

James L. Cook
Regional Hydrologist

CONTENTS

WATER RESOURCES DIVISION
PUBLICATIONS GUIDE

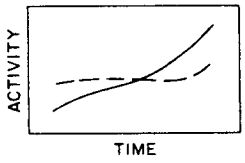
Replaces Article No.: | Effective Date: 10/25/73 | Article No.: 3.08.1

Subject: ILLUSTRATIONS -- Graphs and related diagrams - Types

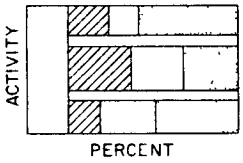
Illustrations can facilitate a reader's comprehension of the data and, if presented properly, can permit the author to omit from his text numerous descriptive details. It is not surprising therefore, that an almost-unlimited variety of graphs and diagrams has been published in reports of the Geological Survey. The following discussion categorizes the most commonly used graphs and diagrams to indicate to authors the general types of presentation available.

A. Graphs

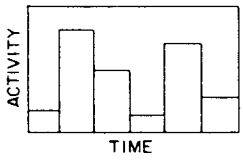
1. Curve or line graph -- emphasizes the trend or rate of activity of relatively continuous data. The graph is drawn by connecting, in sequence, plotted points that represent data. Differing line symbols are used to distinguish intersecting lines on the graph. If more than three intersecting lines are to be compared, multiple graphs may be necessary.



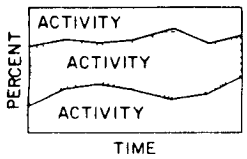
2. Bar or horizontal (bar) graph -- emphasizes the volume of data. The graph compares data for different items or activities at the same time; therefore, it needs only one numerical scale as no time scale is necessary. The bars representing plotted data should be arranged in order of magnitude, if possible. This type of graph best shows percentages.



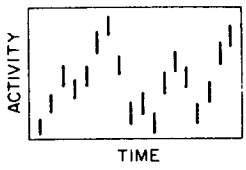
3. Column or vertical (bar) graph -- emphasizes sharply fluctuating magnitudes of data for one item or activity at different times. The bars may be subdivided, by color or patterns, so that component parts of the total are represented by the height of segments of the columns.



4. Surface or band graph -- emphasizes amount of data. On this graph, values of a number of parts are represented by layers placed one above the other, forming a cumulative total. The graph is especially effective for showing components, but should not be used when data fluctuate sharply, thereby distorting other component data.

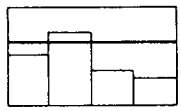


5. Symbol graph -- emphasizes the general trend or activity of data. Symbols, unconnected by lines, represent data. Example usage could be (1) symbols plotted as data points, where a trend line is not possible or desired, or (2) a series of vertical bars, each bar showing the maximum and minimum values of the data (such as monthly mean water level) for a period of time.

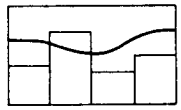


6. Combination graph -- combines two (or more) of the preceding forms into one graph.

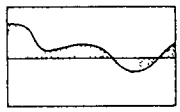
a. A vertical bar and straight horizontal line combination is useful for measuring performance against a goal or standard, such as showing annual precipitation by bar and average annual precipitation by horizontal line.



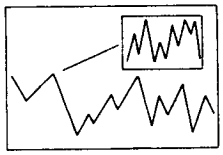
b. A vertical bar and curve line combination is useful for relating variables such as water use and population, and precipitation and water levels in wells.



c. A curve line and straight horizontal line combination can be used to compare monthly or annual precipitation with an average or cumulative departure from average.

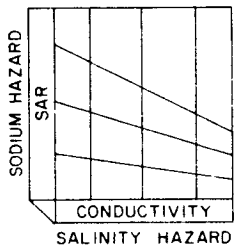


d. An inset, which is a smaller graph superimposed on a larger one, magnifies part of the data lost in the range of the larger graph. The informative value of this presentation lies in a different or more comprehensive view of the data.

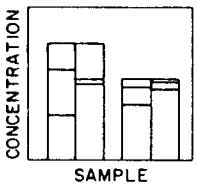


B. Diagrams

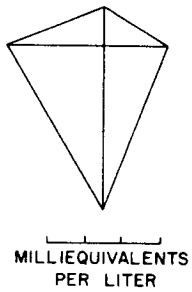
1. Classification of water for irrigation diagram -- permits an estimate to be made of the suitability of water for irrigation in terms of sodium and salinity hazards, once the sodium-adsorption ratio (SAR) and the electrical conductivity of the water are known. The diagram is divided into 16 areas that are used to rate the degree to which a particular water may be subject to salinity problems and undesirable ion-exchange effects.



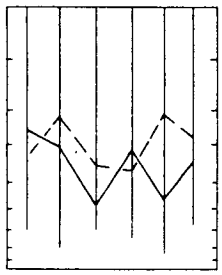
2. Collins diagram -- shows in a bar-graph form the total solute concentration and the proportions assigned to each principal ionic species. Each analysis is represented by a vertical bar graph whose total height is proportional to the total concentration of anions or cations, in milliequivalents per liter. The bar is divided into a left half representing cations and a right half representing anions. Each half is then divided by horizontal lines to show concentrations of the major ions, which are identified by distinctive patterns. The lengths of the cation and anion halves should be equal.



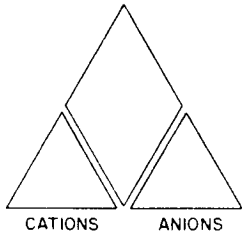
3. Kite diagram -- a pattern diagram in which concentrations of cations and anions are represented on rectangular coordinates. The length of each coordinate line from center corresponds to the concentration of constituents, in milliequivalents per liter. Once the ends of the four coordinate lines are connected, thereby forming a distinctive shape, the patterns for different water types can be easily and quickly compared visually.



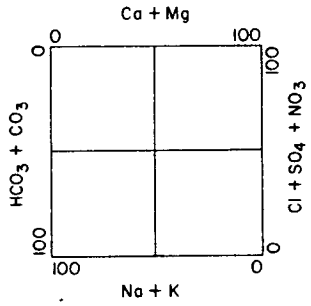
4. Nomograph -- can be used to depict one or a group of analyses. Lines connect points on the interior scales of the nomograph that represent concentration of ions, in milligrams per liter. Scales for milliequivalents per liter at the left and right sides of the nomograph give the advantage of showing the relationship to scales for milligrams per liter. Waters of similar composition plot as near-parallel lines.



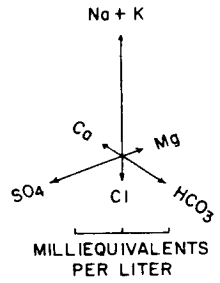
5. Piper diagram -- indicates the essential chemical character of a water by single-point plottings of cations and anions on trilinear coordinates. The proportions of cations and anions are plotted in each of the lower triangles; then the points are extended into the central diamond-shaped field. The intersection of the projections represents the composition of the water with respect to the combination of ions shown.



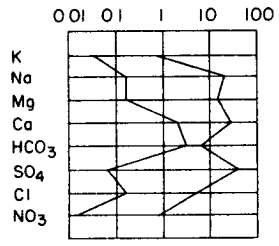
6. Modified Piper diagram -- indicates the essential chemical character of a water sample, or group of samples, by the location of plotted points within a square diagram. Concentrations of the ions for each water sample are in milliequivalents per liter; points are plotted in percentages of total anions. Thus, the sum of cations (Ca + Mg) + (Na + K) equals 100 percent and the sum of anions equals 100 percent.



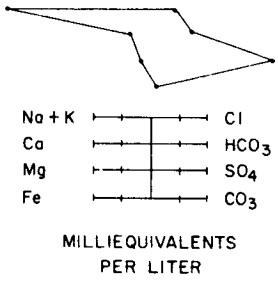
7. Radiating-vectors diagram -- Uses a system of plotting analyses by radiating vectors. The length of each of the six vectors from the center represents the concentration of principal ionic species, in milliequivalents per liter. A scale of units must be included with each diagram. A summation of the lengths of the arrows for cations should equal the lengths for the anions.



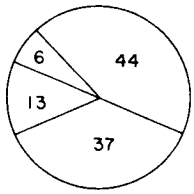
8. Semilog concentration graph (Ropes diagram) -- consists of a principal graph produced as line-printer output on which is a set of parallel horizontal log-scale axes, each corresponding to a selected constituent or variable. On each axis are plotted the distribution, minimum, mean, and maximum values for the variables selected. Straight lines are drawn to connect the low values and the high values for all variables, thereby giving a characteristic shape to the "distribution" of a selected group of data. An optional top-view graph contains a horizontal log scale corresponding to the principal graph; the vertical scale can be a time or space scale depending on the variable selected. Taken together, the principal graph and the top-view graph represent front and top orthographic projections of a three-dimensional array of data.



9. Stiff diagram -- forms a relatively distinctive pattern that can be used to show water composition differences or similarities. Four parallel horizontal lines extending on each side of a vertical line form a grid on which cations are plotted to the left and anions plotted to the right. The plotted points are connected by lines, forming a closed pattern that is characteristic of a certain water. The pattern tends to maintain its characteristic shape as the sample becomes dilute. The width of the pattern is an approximate indication of total ionic content.



10. Circular (pie) diagram -- emphasizes subdivisions of a whole by means of a circle, which is divided into sectors. This diagram is commonly used to show percentages, but it can also be drawn with a scale for the radii, which makes the area of the circle represent total ionic concentration and subdivisions of the area represent proportions of the different ions. Visual comparisons of subdivisions of bar graphs are clearer and more accurate than comparisons of sectors of circular diagrams, because the eye can measure linear distances easier than radial ones.



11. Well-numbering system diagram -- describes the system used in a report for numbering wells, test holes, and springs. The diagram generally shows, by means of one or more successively enlarged diagrams, the position of a location number within a township and range land-measurement grid. These diagrams can take many forms; published reports of the Survey are good references to the formats of numbering-system diagrams used by other authors.

References: Hem, J. D., 1970, Study and interpretation of the chemical characteristics of natural water: U.S. Geol. Survey Water-Supply Paper 1473, 2d ed., 363 p.

Ropes, L. H., Morgan, C. O., and McNellis, J. M., 1969, FORTRAN IV program for synthesis and plotting of water-quality data: Kansas Geol. Survey Spec. Distrib. Pub. 39, 59 p.

GRAPH CONSTRUCTION

CASE- upper, lower, mixed

LINEWEIGHT- Technical pen/Jewel scribe
light (000 or 00/.006 or .008)
medium (0 or 1/.010 or .012)
heavy (2 or 2.5/.015 or .020)

CHARACTER SIZE- small (6-8 pt.), medium (10 pt.), large (12-14 pt.)

	PREPARATION		
	CASE	LINEWEIGHT	CHARACTER SIZE
① Frame [1]	—	light	—
② Data & curve [1]	—	heavy	large
③ Grid [1]	—	light	—
④ Axis captions [1]	upper	medium	medium
⑤ Axis numbers	—	medium	medium
⑥ Figure title [1]	mixed	medium	medium
⑦ Explanation [2]			
ⓐ Primary entry	upper	medium	small
ⓑ Secondary entry	mixed	medium	small
⑧ Primary interior label [1]	upper	medium	medium
⑨ Secondary interior label [1]	mixed	medium	small

	IMPORTANCE		
Data & curve	—	heavy	large
Primary interior label	upper	medium	medium
Axis captions	upper	medium	medium
Axis numbers	—	medium	medium
Explanation -			
(a) primary entry	upper	medium	small
(b) secondary entry	mixed	medium	small
Secondary interior label	mixed	medium	small
Frame	—	light	—
Grid	—	light	—

[1] See page 8 for examples.
[2] See page 82 for examples.

GRAPH CONSTRUCTION EXAMPLE

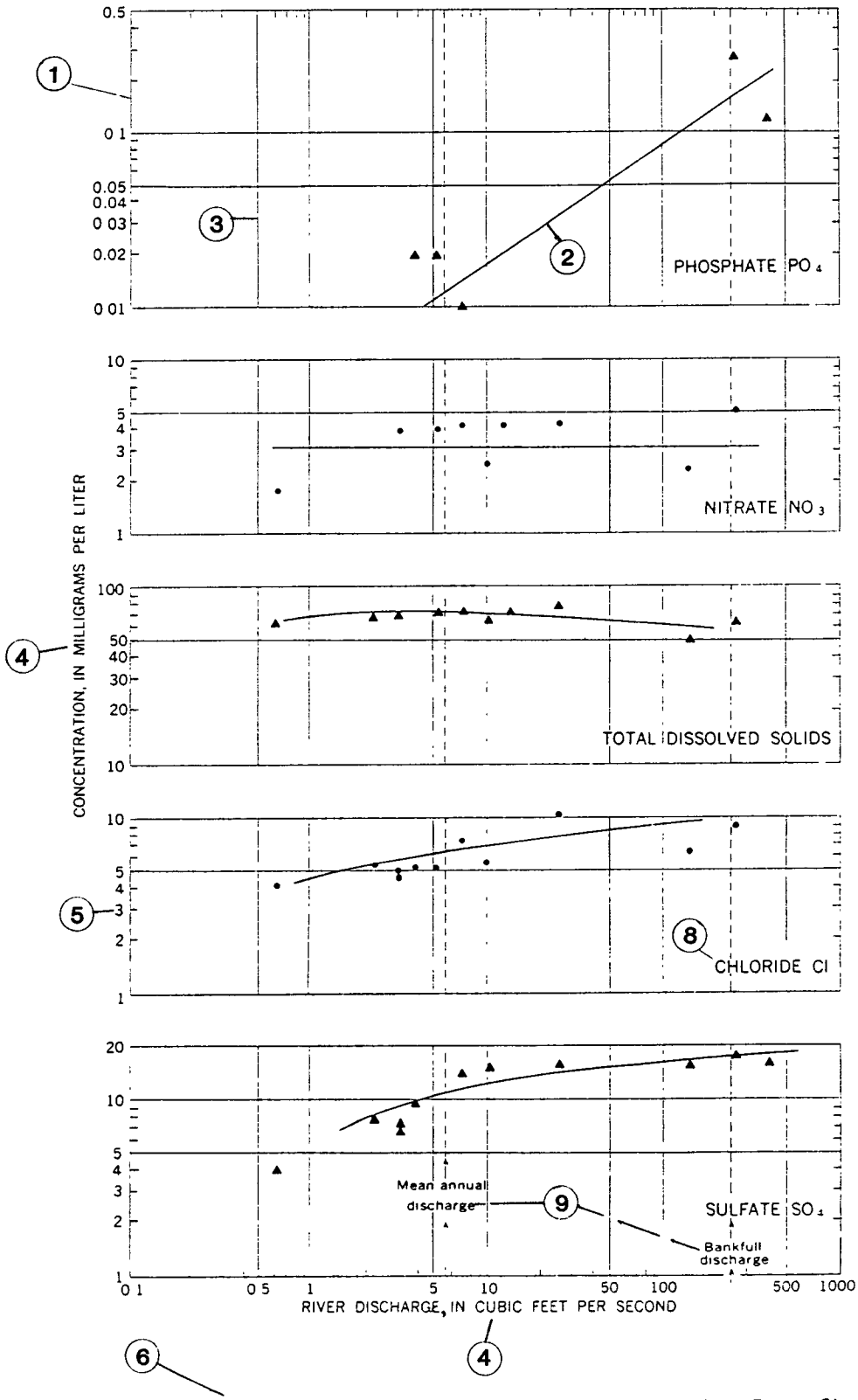


Figure 13.--Water-quality factors as functions of river discharge, Indian Run at Glenmore.

WATER RESOURCES DIVISION
PUBLICATIONS GUIDE

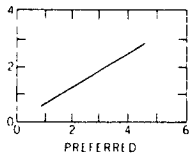
Replaces Article No.:	Effective Date: 10/25/73	Article No.: 3.08.2

Subject: ILLUSTRATIONS -- Graphs and related diagrams - Preparation

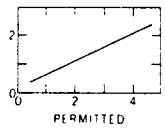
A. Grids

1. The grid may consist of a network of lines across the entire illustration or, more commonly, short lines (ticks) along the inside of all abscissa (horizontal) and ordinate (vertical) axes. The use of ticks to identify the grid is preferred on all simple illustrations in which the relationship shown is principally a visual one. Complicated illustrations that necessitate a detailed comparison of lines on a single graph or comparison of lines on one graph with those of another may require the use of a line grid. The grid of a graph generally consists of lines or ticks that are horizontal and vertical. The lines forming the grid of a diagram can be horizontal and vertical, horizontal and diagonal, vertical and diagonal, diagonal and diagonal, or radial.

2. The grid encompasses all data shown on the graph. Ideally, the grid should extend to the next numbered increment of the scale beyond the data lines or data points. When this is impractical because of size limitations, the grid should extend to the next increment (tick or line) beyond the data.



PREFERRED



PERMITTED

3. Logarithmic grids should be identified by lines or ticks at all points corresponding to whole numbers for each log cycle; for example, 10 lines or ticks for the cycle from 0.1 to 1, 10 lines or ticks for the cycle from 1 to 10, and so forth. Intermediate ticks can be added for clarity, where needed.

4. Arithmetic grids must be square to avoid skewing of data.

B. Scales [1]

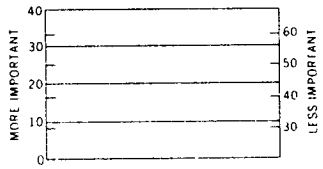
1. Scales of a graph generally are placed only along the left and bottom axes; ordinate-axis scales can be identified along both left and right axes if the graph is unusually wide. The grid along the right and top sides generally is not identified by a

[1]See page 18.

scale unless variables, differing from those on the left and bottom axes respectively, are plotted on the graph. Then, the left and bottom scales should identify the data of more importance and the right and top scales the data of less importance.

2. Scales for both English and metric units on the same graph should be located according to the following: if the report is intended primarily for scientific audiences and metric units precede English units (in parentheses) in the text, then metric units should be identified by the left and bottom scales, and English units by the right and top scales; if the report is intended primarily for the general public and English units are given first, then English-unit scales should be on the left and bottom, and metric scales on the right and top.

3. Differing scales used on both the left and the right sides of a graph wherein the grid on the left does not correspond with the grid on the right require the use of both lines and ticks to identify the grids. The grid for data of more importance, corresponding to the left scale, should consist of lines; the grid for data of less importance, corresponding to the right scale, should consist of ticks. The line grid should be drawn completely across the graph, and the ticks should be drawn at the left and right sides of the graph. An example will clarify the recommended usage:



4. Multiple scales on the ordinate or abscissa axes of a graph should be balanced, insofar as practical. The use of one scale on the left side and one on the right is preferred over the use of two scales on one side and none on the other.

5. Scales along the top, left, or right side of a graph indicate amount, whereas the scale along the bottom generally indicates time, if time is one of the variables shown on the graph.

6. Scales need to extend only to the nearest grid line or tick beyond the data extremes (maximum or minimum data points or data lines) shown; however, if alternate grid marks are identified, the scale and grid should be extended an additional increment to keep the numbering sequence uniform. Data lines can extend to, but not beyond, the outer grid lines of the graph or diagram. If data lines will not fit within the grid proposed, the scales and grid must be extended until they will. The numerical values used on arithmetic and similar scales should be such that the scale could be extended to the value of zero.[1]

[1]See page 16 for examples.

7. Numbers are added to all arithmetic grid lines or ticks or to every alternate line or tick for identification. Scale numbers for a logarithmic grid are generally needed only at selected lines or ticks.

8. Commas are used within numbers of 10,000 or more that identify points or lines on the grid of a graph. Commas are not used within numbers of 9999 or less.

9. The scale number "zero" consists of only zero without a decimal. Scale numbers less than one should consist of a zero, a decimal, and the number. Numbers of one or greater need a decimal and trailing zero only where significant figures dictate. Significant figures should be consistently used in scales of illustrations.

10. Scale numbers should increase from bottom to top along the ordinate axis and from left to right along the abscissa axis.

11. When both abscissa and ordinate scales begin with zero, both zeros should be shown at the lower left corner of the graph[2].

12. Months of the year along the bottom axis of a graph are identified by complete names, by abbreviated forms, or by only the first letter of each month where space dictates. Abbreviated forms are Jan., Feb., Mar., Apr., Aug., Sept., Oct., Nov., and Dec. The months of May, June, and July are not abbreviated.

13. Years should preferably be shown in the complete unabbreviated form; however, the abbreviated form (last two digits) can be used if the years are given in full at both ends of the scale. Years can be positioned to be read from the right if space is limited. Examples:

1959	1960	1961	1962	1963	Preferred
1959	60	61	62	1963	Permitted
1959	1960	1961	1962	1963	Permitted

14. Military or 24-hour time can be used for scales, provided the complete 4-digit number is used, such as 0600 and 1800. Do not use abbreviated forms, such as 06 or 18.

15. Avoid overlapping or coinciding scales where possible.

C. Abscissa- and ordinate-axis captions

1. All lettering in the captions must be capitals except for letter symbols.

2. All units of measure must be spelled in full (not abbreviated).

[2]Preferred numerical divisions on scales should be 1, 2, 5, or multiples of these basic numbers (for example 0.01, 0.1, 1, 10, 100, 1000). The number 25 and multiples thereof is also useful in special cases.

3. For an axis caption that includes a variable and a unit of measure, the variable must be followed by a comma, the word "in," then the unit of measure. For example:

DISCHARGE, IN CUBIC FEET PER SECOND

4. A unit of measure can separate or follow the description of a variable. If a unit of measure separates the description, a comma precedes the unit of measure but does not follow it. Examples:

TIME, IN HOURS AFTER TRACER INTRODUCED

TIME AFTER TRACER INTRODUCED, IN HOURS

5. The word "percent" is used in axis captions where preceded by the word "in." The word "percentage" is used where not preceded by the word "in." Examples:

DYE CONCENTRATION, IN PERCENT OF PEAK CONCENTRATION

PERCENTAGE OF TIME DISCHARGE WAS EQUALED OR EXCEEDED

6. Axis captions should indicate the datum for a variable shown on a graph when a datum exists, such as

WATER LEVEL, IN FEET BELOW LAND SURFACE

RIVER STAGE, IN FEET ABOVE SEA LEVEL

7. For an axis caption that contains an abbreviated letter symbol, the letter symbol should be enclosed in parentheses following the variable and preceding the unit of measure. For example:

OXIDATION POTENTIAL (Eh), IN MILLIVOLTS

8. The words "acre-feet" are always hyphenated -- in an axis caption and wherever else used.

9. The designation of the type of year needs to be added as the axis caption only when the year used is other than a calendar year, such as water year (October 1 through September 30) or climatic year (April 1 through March 31).

10. All vertical-axis captions should read from left to right when the illustration is turned clockwise for viewing.

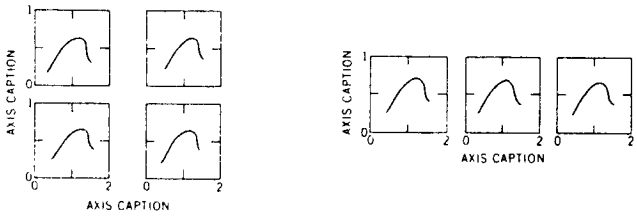
11. Use of scales for both English and metric units on the same graph requires repetition of the axis caption for each set of units. That is, if depth to water is shown in both units, the axis captions would read:

DEPTH TO WATER, IN METERS BELOW LAND SURFACE
and
DEPTH TO WATER, IN FEET BELOW LAND SURFACE

Each axis caption must be shown with its corresponding scale.

12. General relationships between parameters are sometimes shown on graphs without the use of a grid or scale, as in a time-versus-concentration graph. Arrows must be added to the axis captions of graphs of this type to show the general direction of increasing amount.

13. Repetition of parameters presented on several graphs sometimes permits them to be grouped or stacked in such a way that one ordinate-axis caption and one abscissa-axis caption apply to all graphs presented. Each graph must contain a complete grid, but the axis captions and some scales are shared by all graphs. For example:



D. Data points[1]

1. Data points may be included on graphs if necessary for coherence or special purpose.

2. If data points are widely scattered over the graph, an "envelope" may be drawn connecting the outermost points in a continuous line.

3. If data points are scattered but confined to a general direction, a line can be drawn through the average points. The line is useful for visualizing the trend.

4. If the diagram for classification of water for irrigation is to be used in a report, selected data points should be shown.

E. Data lines[1]

1. Lines connecting data points on graphs and diagrams must be straight between each pair of data points. If the lines are drawn as a "best fit" among data points and peaks and troughs of the line do not coincide with data points, then the author must explain to the reader why the extremes do not coincide with the data points.

2. Lines that intersect should be differentiated by symbol or line thickness to avoid confusion.

[1]See page 17 for examples for plotting data to the line or the space.

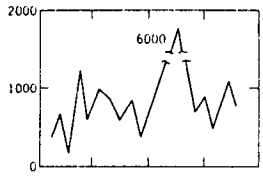
3. Dashed lines on a graph are used to indicate no available data or lack of adequate data. The dashed lines should be straight between points of known data. Where only one data point is known in an area of otherwise missing data, show the data point and connect the data point, by straight dashed lines, to the solid parts of the line. The reason for dashing lines must be explained adjacent to the dashed lines (most desirable), within the graph explanation, or in the figure caption (least desirable).

4. If two or more data lines are shown on a graph, the lines or data points corresponding to the lines must be identified by lettering placed along the data lines, in an explanation, or by description in the illustration caption.

5. Leaders are used to connect identification lettering or numbers with corresponding data points or data lines. Leaders consist of only straight lines. The leader should not be curved or in the shape normally used to represent lightning, nor should it have an arrowhead on the tip.

6. If a complete cycle of average annual or average monthly values is plotted on a graph, both ends of the data line must have the same value. For example, an average monthly value for the first of January should coincide with that for the last of December, provided the graph is prepared for the entire year.

7. The peak or trough in a data line can be "broken off" inside the outer scale line only where continuation of the scale to include the anomalous part of the line would result in a graph size that would be out of proportion to what is being shown. The extremity of the data line, accompanied by a numerical value, should be shown in the following manner:



8. Data lines can be broken (dashed) where continuation as a solid line would obscure data points plotted on the graph. The line should be discontinuous only at the data point.

9. Data lines should be checked for accuracy once they are drawn. A common failing of illustrations is the lack of agreement between what is shown on the graph or diagram and what is discussed in the text. On circular (pie) diagrams especially, check to see that all subdivisions add up to the whole.

F. Color

1. It is recommended that data lines on graphs in publications of the U.S. Geological Survey will be printed in black, because colored data lines can become misregistered during printing with respect to the black grid of the graph and introduce errors into the data presented. Therefore, data lines should be drawn on the same sheet as the rest of the graph.

2. Color may be used below data lines or within data bars and, in special cases, in data lines. Color on review prints may be applied directly to the graph or diagram.

G. Example usage

1. Examples illustrated on graphs are helpful in interpreting the data. Examples can be located within the graph (most desirable), figure caption, or accompanying text (least desirable).

2. Examples can be identified on the graph by a circle at the point of intersection of the abscissa and ordinate values selected for illustration; by straight solid, dashed, or dotted lines drawn from the data point to the scales; or by a combination of circle and lines.

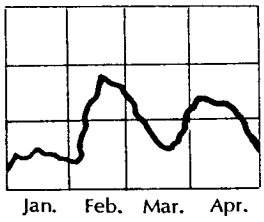
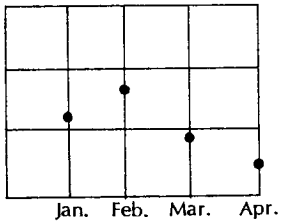
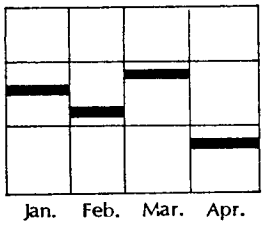
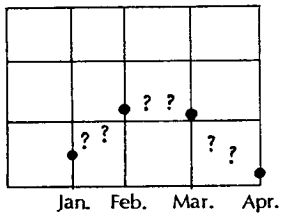
3. The author should check and recheck the example presented to ensure that the example description and example circles or lines agree. Rechecking is especially important after review in which the example was revised.

4. A well-numbering system diagram should include an example location number. The number used on the diagram must correspond to a well, test hole, or spring actually located within the area described in the report.

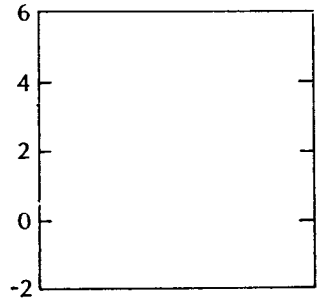
H. Drafting

1. The use of green or blue graph paper for plotting data is recommended. Orange graph paper with data plotted in pencil generally results in poor review prints.

2. After preliminary data are plotted in pencil, the entire graph or diagram (data points, data lines, grid, and axis captions) may have to be traced in ink (or typed) to obtain clear reproductions.

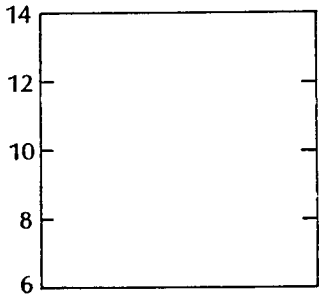
	SCALE Continuous Discrete	DATA Continuous Discrete
EXAMPLE 1		CONTINUOUS DATA ON CONTINUOUS SCALE
EXAMPLE 2		DISCRETE DATA ON DISCRETE SCALE
EXAMPLE 3		DISCRETE DATA ON CONTINUOUS SCALE
EXAMPLE 4		CONTINUOUS DATA ON DISCRETE SCALE (not meaningful, do not use)

A scale can be continuous or discrete. Data can be continuous or discrete. Care should be taken when plotting one type of data to a different type of scale. The first example shows continuous data plotted on a continuous scale as for a daily hydrograph. Example 2 shows discrete data plotted on a discrete scale and example 3 shows discrete data plotted on a continuous scale. Either example could be used to plot mean monthly water levels. Example 4 shows continuous data plotted on a discrete scale which is mathematically impossible and should not be used.



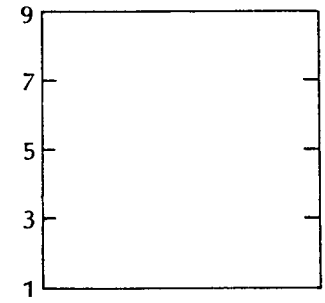
CORRECT

Zero shown on graph



CORRECT

Note: If scale were extended zero would be on graph



INCORRECT

If scale is extended zero will not appear on graph with this division

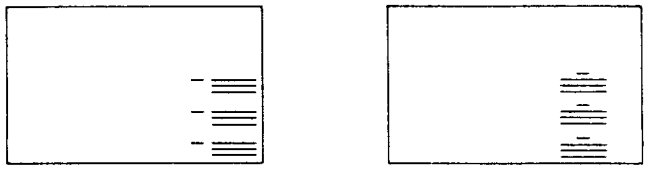
WATER RESOURCES DIVISION
PUBLICATIONS GUIDE

Replaces Article No.: | Effective Date: 3/15/74 | Article No.: 3.10.1

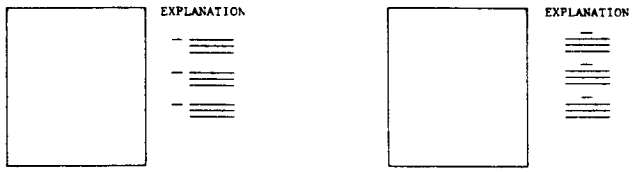
Subject: ILLUSTRATIONS -- Explanations - Graphs and diagrams [1]

Generally on graphs and diagrams, every effort should be made to label the data lines, points, or areas directly on the graph or diagram. When space limitations prohibit the labeling of the data directly, explanations should be used.

The preferred placement of the explanation is within the graph or diagram. The preferred format is the same as for map explanations with the description to the right of the data sample. If space limitations prohibit the use of the preferred format, the description can be placed below the data sample. The word "EXPLANATION" should not be used with these formats.



If the explanation must be placed outside the graph or diagram, it should be placed to the right of the graph or diagram, the word "EXPLANATION" should be used, and the description should be to the right of the data sample, if possible. Placing the description below the data sample is acceptable.



Cross reference: 3.10.2 Explanations - Maps

[1]Computer graphics will follow the same standards as cited in this publication.

United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VA. 22092

In Reply Refer To:
WGS-Mail Stop 445

March 9, 1987

WATER RESOURCES DIVISION MEMORANDUM NO. 87.36

Subject: PUBLICATIONS--Computer Graphics Publication Standards: X-Y Plots and Time-Series Plots

I am pleased to announce that additional publication-quality graphics are now available. Computer-generated x-y and time-series plots that meet publications standards have been developed by Alan Lumb of the Office of Surface Water, working with the Computer Graphics Publications Standards Workgroup. These plots are generated by the 1987 release of ANNIE--an interactive computer program for the management and analysis of hydrologic data. To obtain the computer program and documentation that produced these plots, please contact Kate Flynn at FTS 959-5313, or send E-MAIL to KMFLYNN@RVARES. Examples of the x-y and time-series plots are attached to this memorandum.

Previous to this announcement, a bar chart and geophysical log plot were distributed in WRD Memorandum No. 86.53 and 86.108, respectively. If further information about publication-quality computer graphics is needed, please call Gloria Stiltner at FTS 959-5616 or send E-MAIL to GJSTILTNER@QVARSA.

James F. Daniel
Assistant Chief Hydrologist
for Scientific Information Management

Attachments

WRD Distribution: A, B, S, FO, PO

This memorandum supersedes WRD Memorandum No. 86.108.

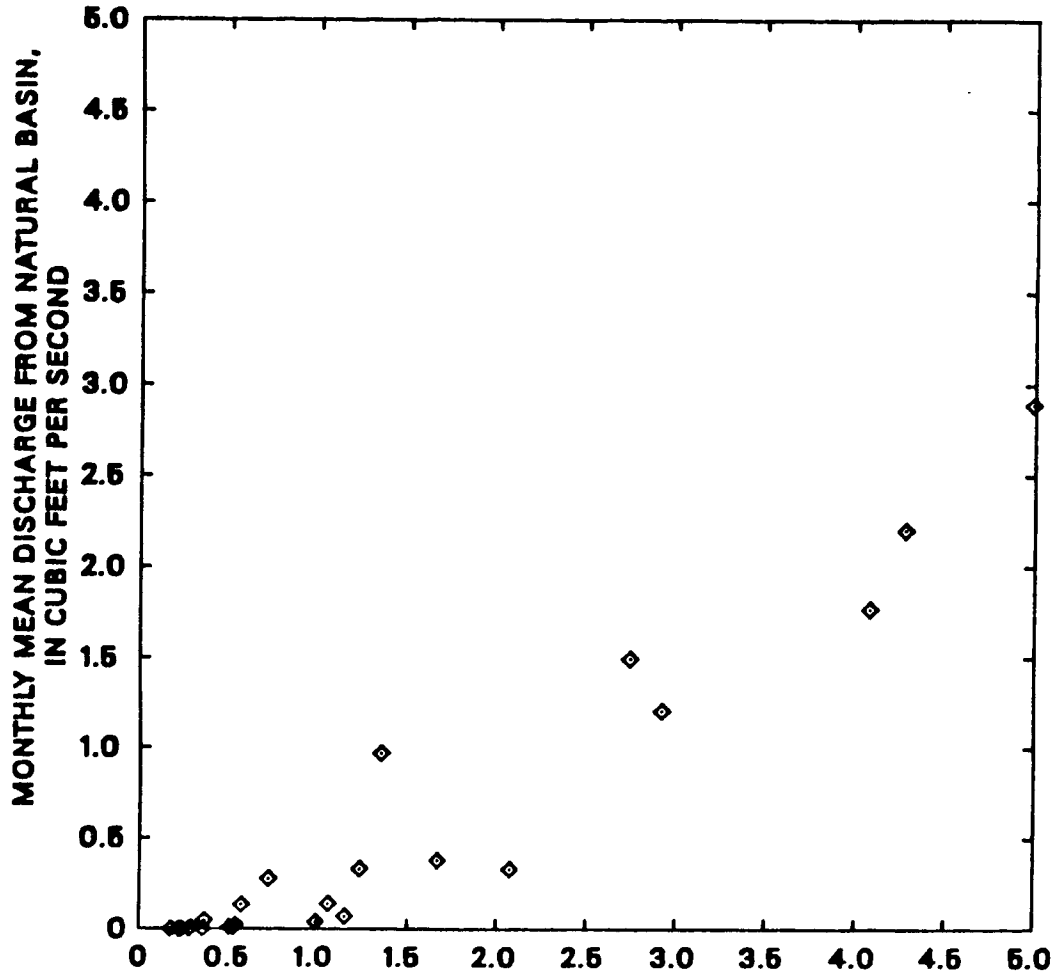


Figure 1. -- Relation between monthly mean discharges in natural and mined basins, Sandlick Creek, West Virginia, water years 1981-82.

*Note: no space needed here or here

*Figure title should be centered under the baseline of the graph

3 line figure titles should show 2nd and successive lines indented 2 spaces with text beginning under "g" in the word figure

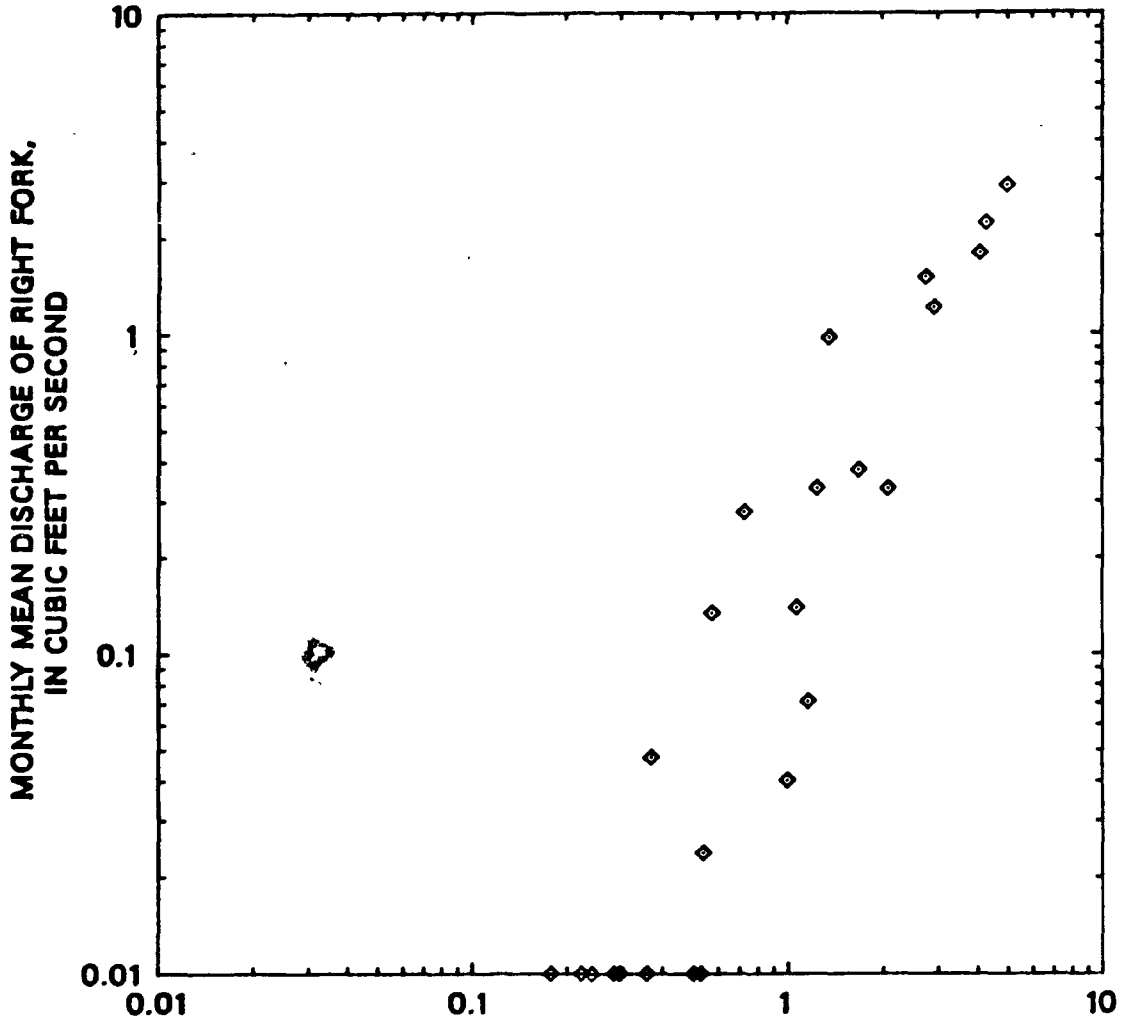


Figure 2. -- Relation between monthly mean discharges in Right and Left forks of Sandlick Creek, West Virginia, water years 1981-82.

* If Right and Left are capitalized the word forks should be also or all should be lower-case.

* See comments on figure 1.

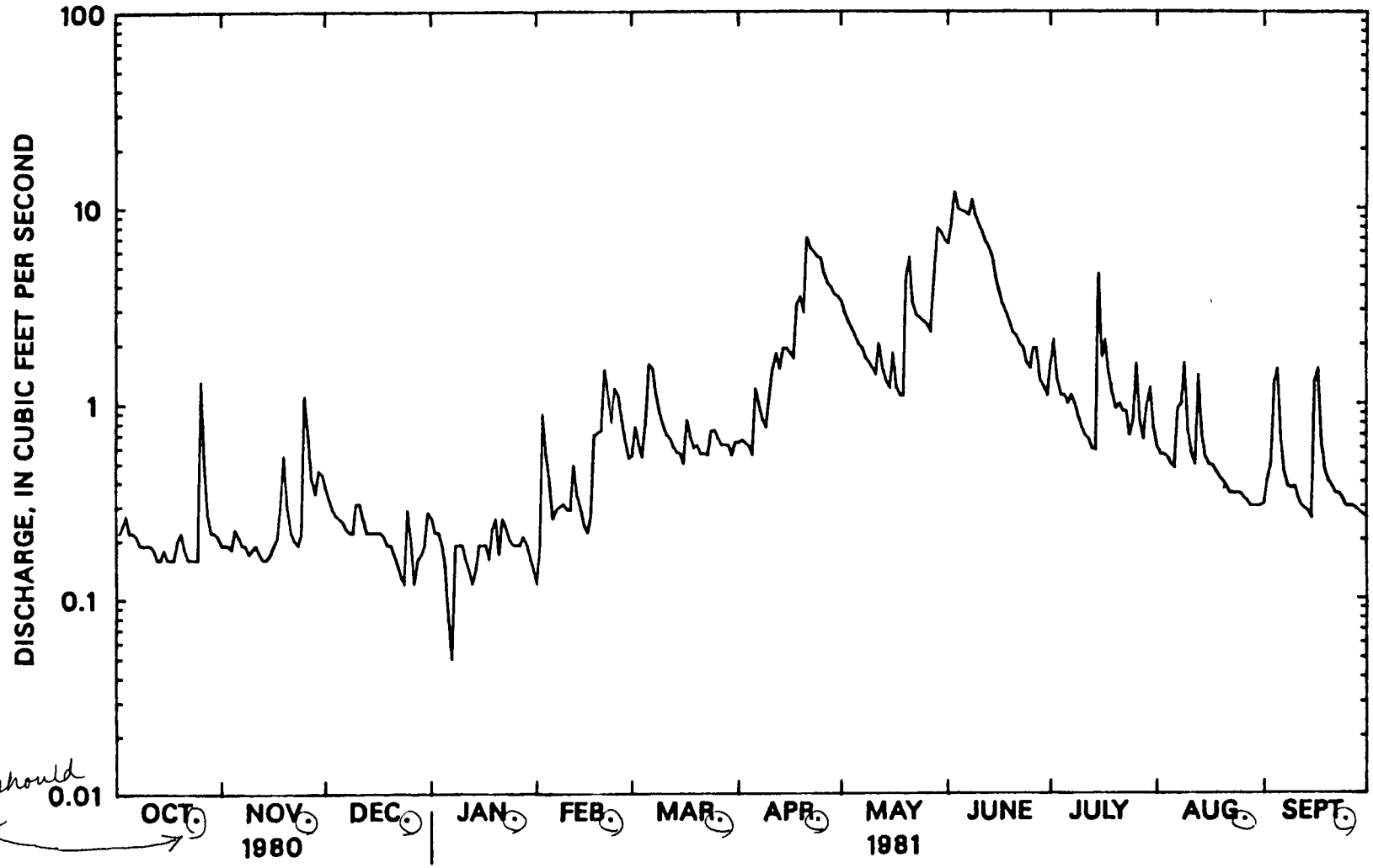


Figure 3. -- Discharge, Left Fork Sandlick Creek, West Virginia, water year 1981.

* Period should be placed after an abbreviation

* no space needed here or here

* Center figure title beneath baseline of graph

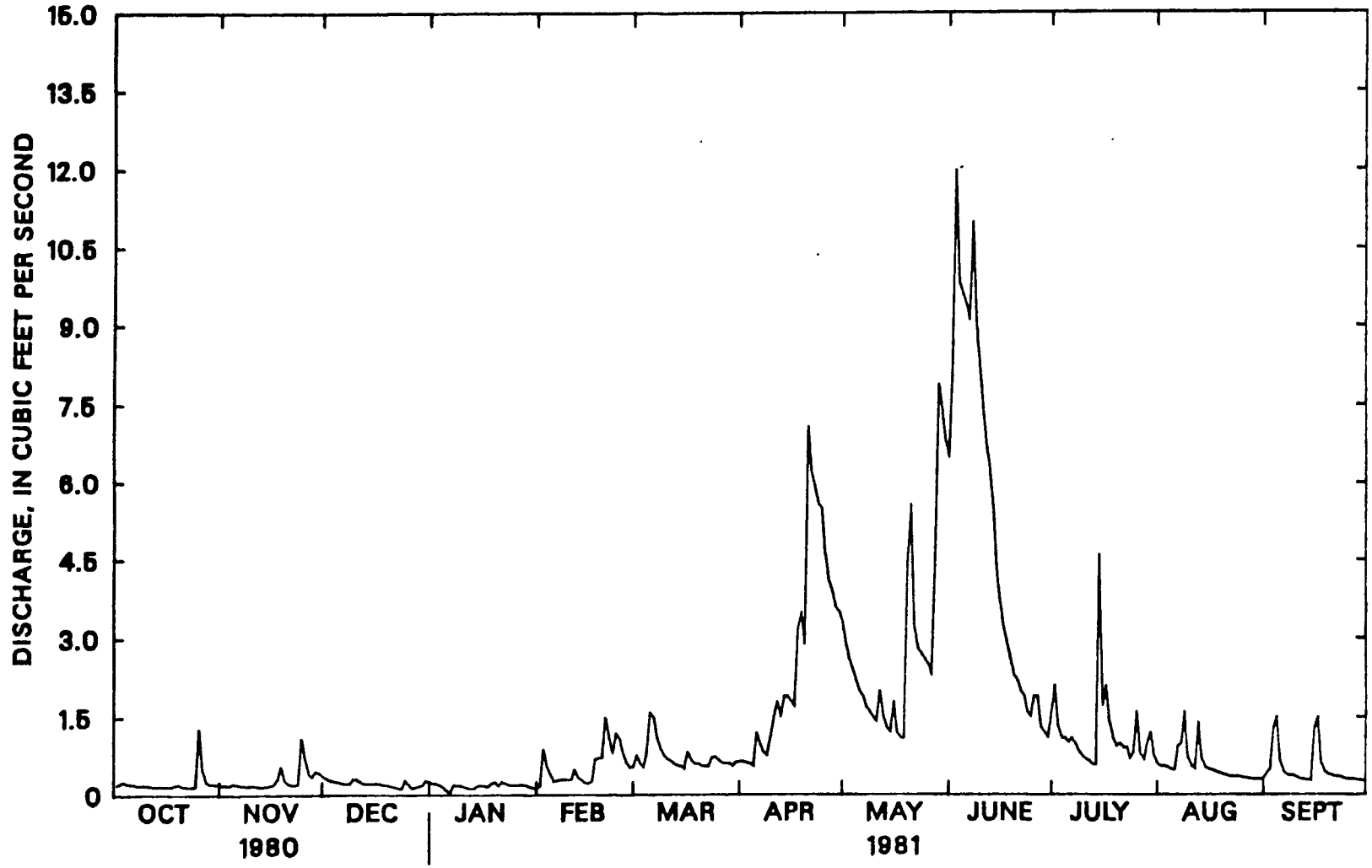


Figure 4. -- Discharge, Left Fork Sandlick Creek, West Virginia, water year 1981.

* See comments on figure 3.

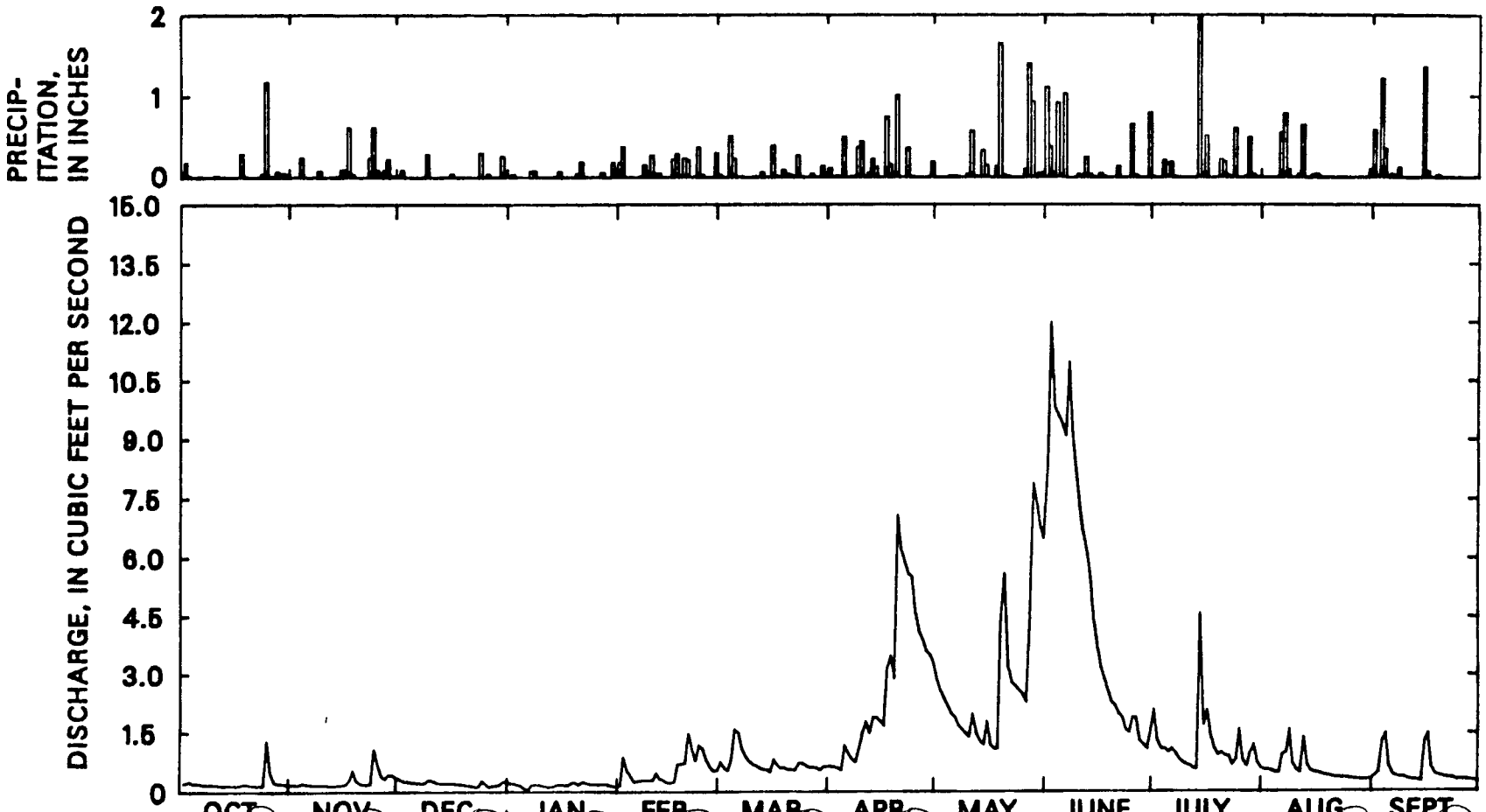


Figure 6. -- Discharge, Left Fork Sandlick Creek, and precipitation at Left Fork Sandlick Creek, West Virginia, water year 1981.

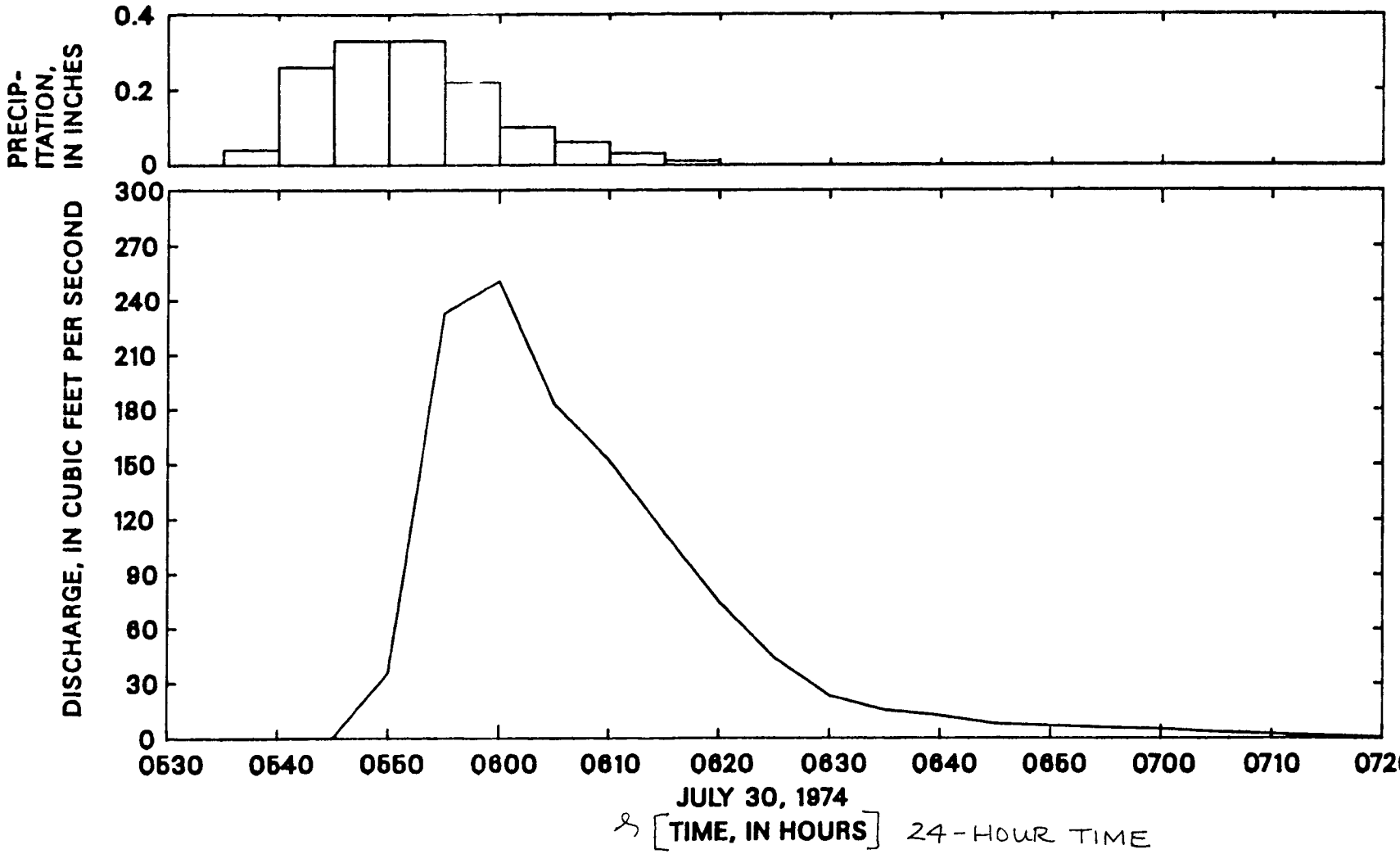


Figure 6. -- Discharge of Sand Creek, and precipitation at Denver, Colorado, on July 30, 1974.

* See comments on figure 5.

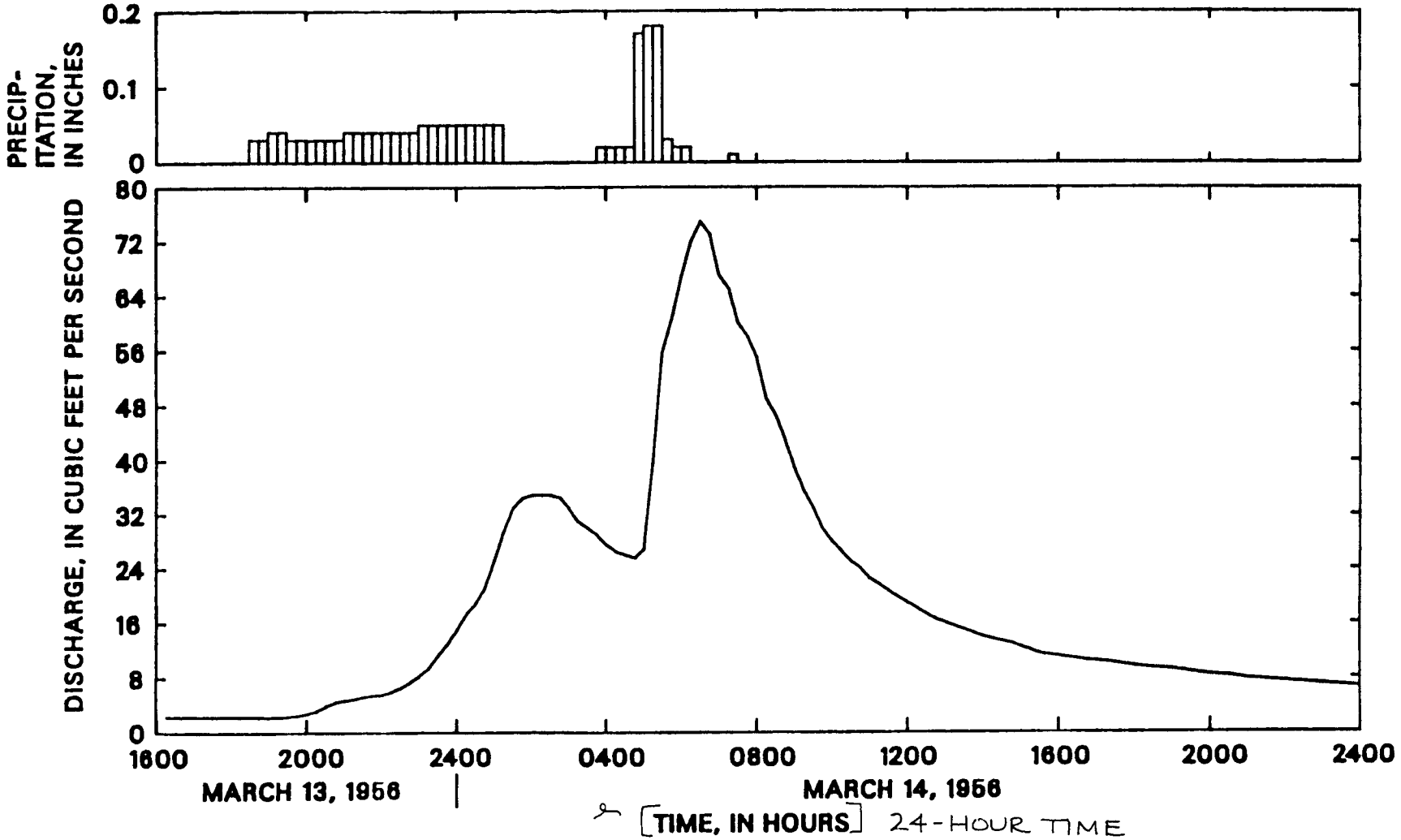


Figure 7. -- Discharge, Cane Branch, and precipitation at Cane Branch, Kentucky, March 13-14, 1956.

* See comments on figure 5.

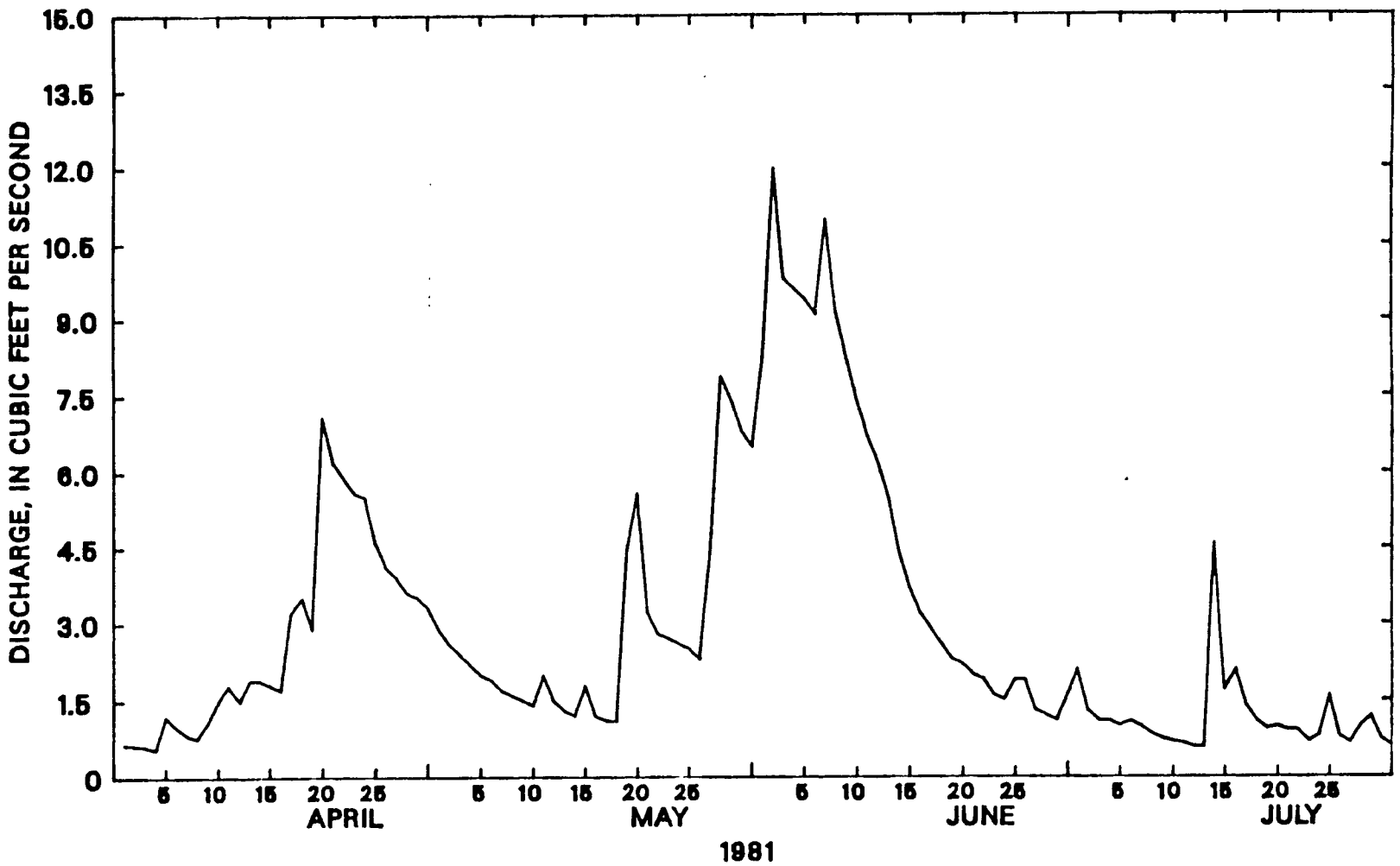


Figure 8. -- Discharge, Left Fork Sandlick Creek, West Virginia, April-July, 1981.

* See comments on figure 5.

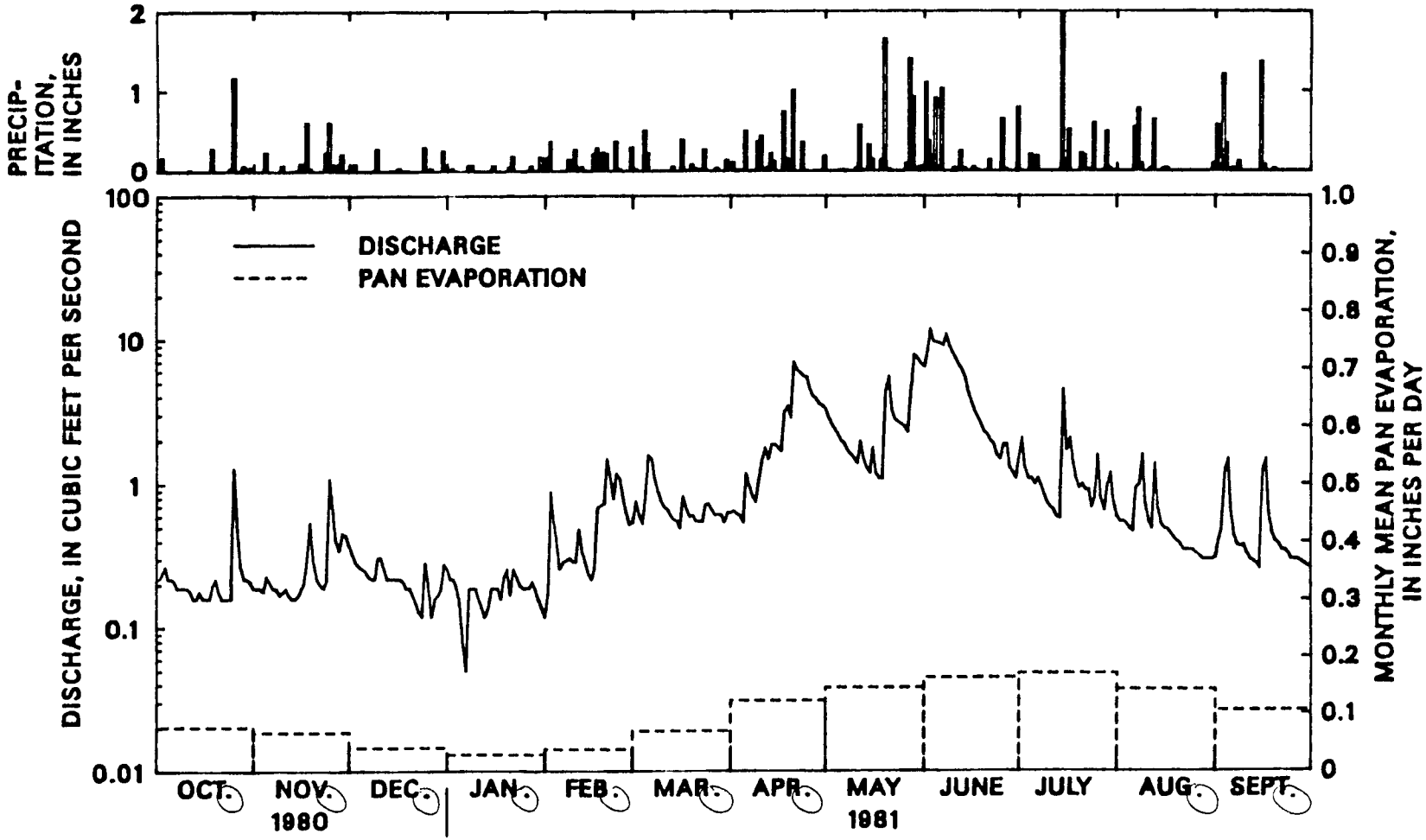


Figure 9. -- Discharge of Left Fork Sandlick Creek, and precipitation and pan evaporation at Bluestone Lake, West Virginia, for water year 1981.

* See comments on figure 1.

United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VA. 22092

In Reply Refer To:
WGS-Mail Stop 445

September 15, 1986

WATER RESOURCES DIVISION MEMORANDUM NO. 86.108

Subject: PUBLICATIONS--Computer Graphics Publications Standards--
Geophysical Log Plot

This is the second plot which has been developed through the Computer Graphics Publications Standards Workgroup. This plot, which meets publications standards, was developed by Stan Leake of the Arizona District. A copy is attached to this memorandum, and the computer program that developed this plot and related documentation has been placed in the SOFTEX library on the Prime computer. The reference number is AZSAL00001, and the name is PLOT.GEO.PUB.

If further information about this plot or the workgroup is needed, please call Gloria Stiltner at FTS 959-5616, or send E-MAIL to GJSTILTNER@QVARSA.

James F. Daniel
Assistant Chief Hydrologist
Scientific Information Management

Attachment

Distribution: A, B, S, FO, PO

This memorandum supersedes no previous WRD Memorandum.

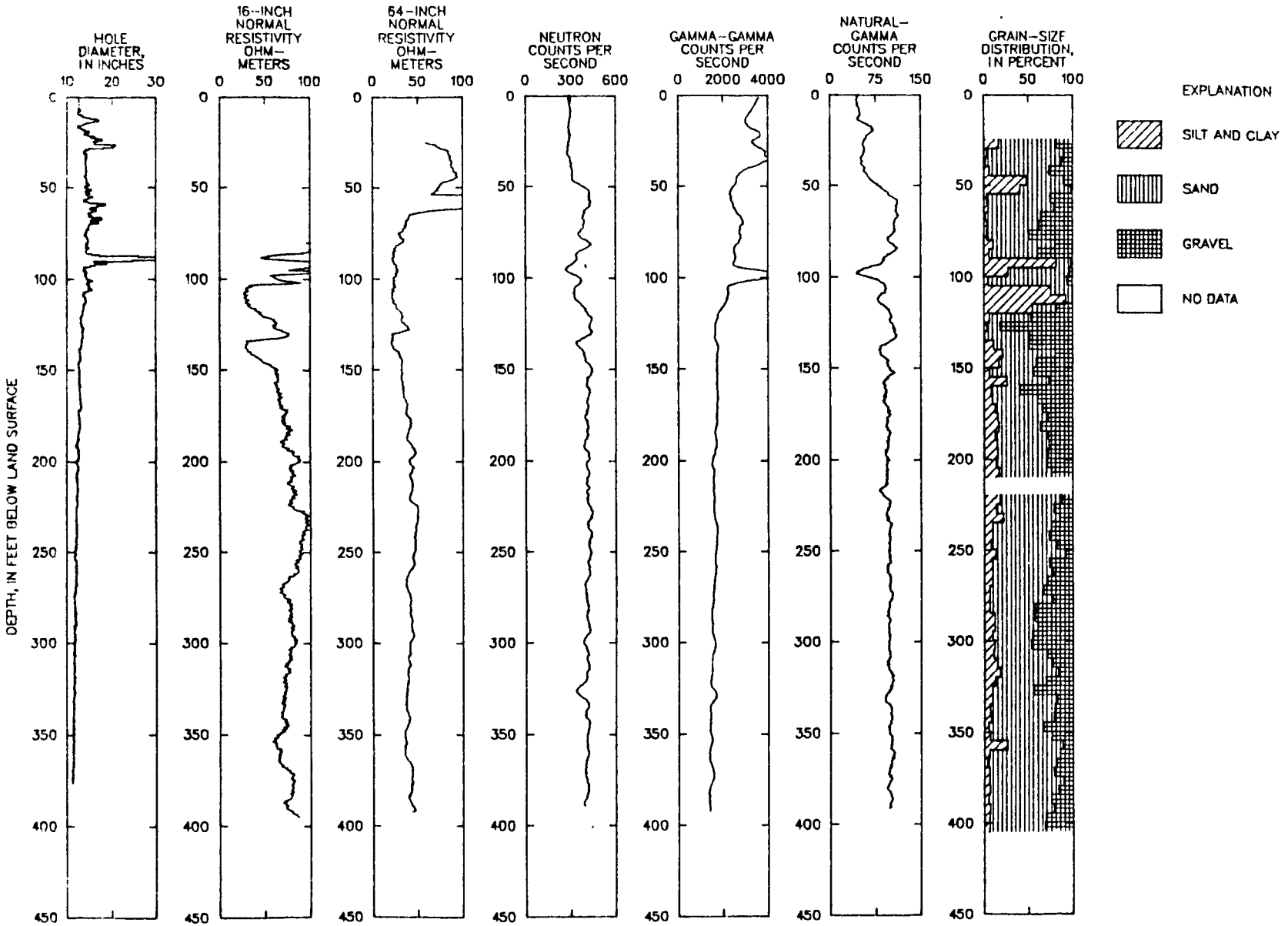


Figure 1.-- Geophysical logs for well SF-19.

*Center figure title

United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VA. 22092

In Reply Refer To:
WGS-Mail Stop 440

April 14, 1986

WATER RESOURCES DIVISION MEMORANDUM NO. 86.53

Subject: PUBLICATIONS--Computer Graphics Publications Standards Work Group

The subject work group has been formed to produce computer-generated graphics that will meet publications standards and then make the computer programs available to users.

The work group members have been addressing issues of publications standards such as (1) position of text and labels, (2) point size and style of type, and (3) acceptability of output for reproduction. The process has been to generate, critique, revise, and document examples.

The group is currently working on gathering and critiquing examples of the four most commonly used x-y plots in WRD. These are the arithmetic x-y, logarithmic, semi-logarithmic and probability plots. The group has generated, critiqued and produced examples of a bar chart that meets publication standards. A copy is attached to this memorandum and the computer program that developed this plot has been placed in the SOFTEX library on the PRIME computer. The reference number is VATCW00009 and the name is PLOT.BAR.PUB. Other programs will be made available as they are completed.

The work group feels that while we are successful using the graphics software TELLAGRAF and DISSPLA we do parallel testing using a Computer Aided Drafting (CAD) package for a microcomputer. This package would be directed toward graphic artists' needs.

If your unit is interested in this project and could commit time to do testing and experimentation, please call Gloria Stiltner at FTS 648-5616, or E-Mail GJSTILTNER@QVARSA.

James F. ~~Daniel~~
Assistant Chief Hydrologist for
Scientific Information Management

Attachment

WRD Distribution: A, B, S, FO, PO

This memorandum does not supersede any previous WRD memorandum

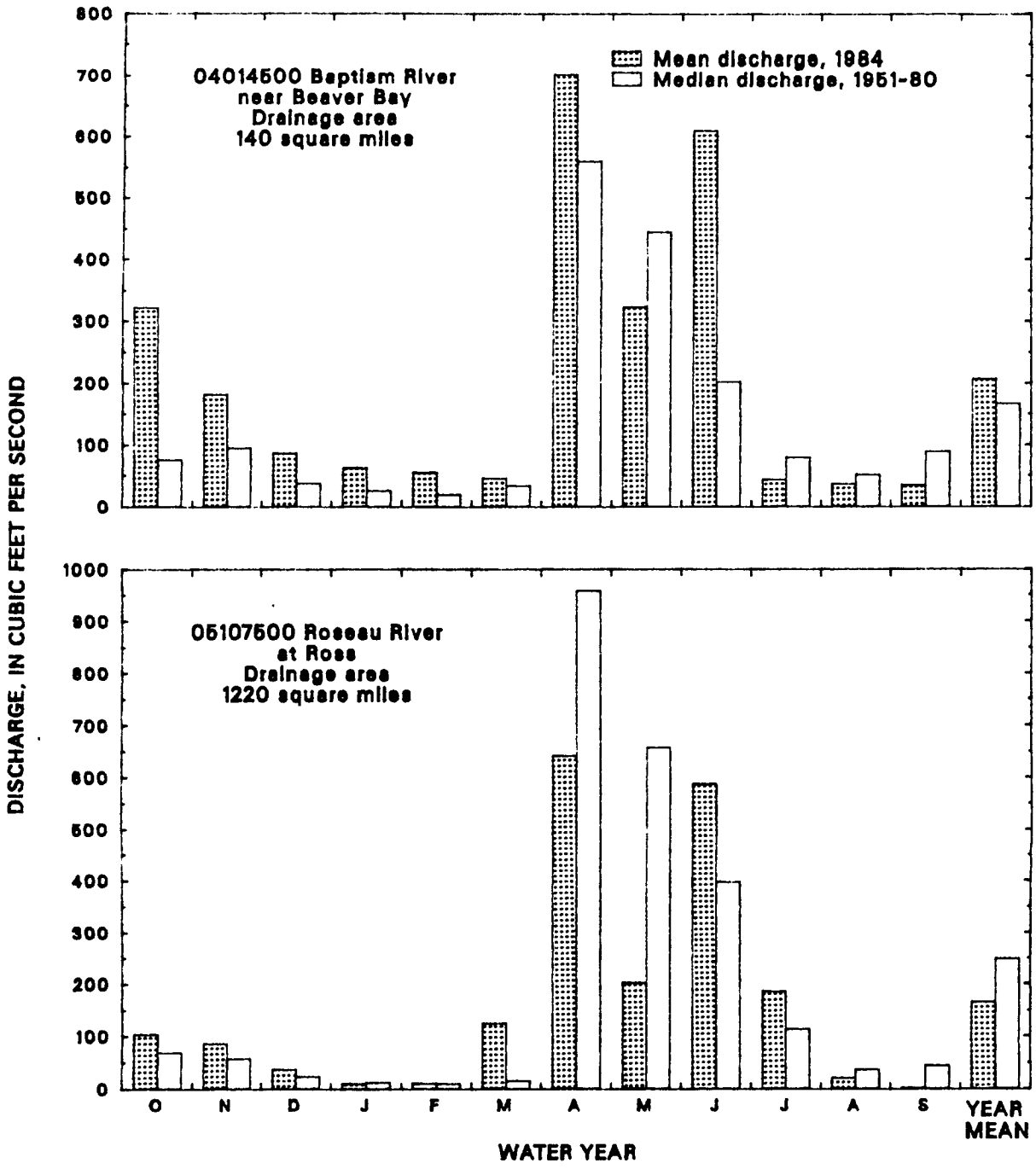


Figure 2.--Comparison of discharge at two long-term representative gaging stations for the 1984 water year with a median discharge for a 30-year base period.

WATER RESOURCES DIVISION
PUBLICATIONS GUIDE

Replaces 3.1 Effective 5/20/71 Article No.: 4.01.1
Article No. Dated 5/4/64 Date:

Subject: BASE MAPS -- General information

"Base map" may be defined as a map upon which specialized data are placed to show relations or distribution. The Water Resources Division uses a wide variety of base maps, among which are the following:

Planimetric:	Shows culture, drainage, and land net.
Topographic:	Shows culture, drainage, land net, and topographic contours.
Drainage:	Shows drainage features and land net.
Orthophotograph:	A cartographically accurate "photomap" showing all physical and cultural features. It looks like an aerial photograph.
Aerial photomosaic:	Shows all physical features, but the scale is variable and measurements are not accurate.

Base maps may be from many sources, for example:

Standard Survey maps at various scales.[1]
Maps from other Federal agencies.
State maps. Some States have the best available maps of local areas.
County maps. Most States have County highway maps, usually planimetric. In some areas, these maps are the best available.
Copyrighted private maps are rarely used, but may be used if necessary. In such a case, permission to publish must be obtained from the author and (or) publisher.
Preparation of new maps from aerial photography to suit the project. This is costly, time consuming, and rare.

[1]If map has metric units and it is published in English, show metric units in parentheses.

WATER RESOURCES DIVISION
PUBLICATIONS GUIDE

Replaces Article No. 4.02.1 Dated 5/20/71 | Effective Date: 9/12/74 | Article No.: 4.02.1

Subject: BASE MAPS -- Criteria for selecting base maps

The selection of a suitable base map is an important function of the Project Chief. Careful consideration in this selection may save much time and money both in the field office and in later preparation for printing. The Project Chief may get assistance from the District and Regional staffs as well as from State officials and the Geohydrologic Map Editor.

A map should be selected according to readability, accuracy, density of data (already on it and to be added), ease of compilation, and economy of preparation. In choosing the most suitable base, therefore, the Project Chief must weigh these factors:

1. Project area
2. Purpose of the project
3. Density of data
4. Degree of quantitative measurement planned
5. Breakdown of data
6. Scale of the map
7. Printing press sizes
8. Availability of maps

The project area is of prime concern. If the report deals with a river basin, the map must cover at least the entire basin. If the report deals with the geomorphology of an unnamed creek near a small town, a more detailed base map may be needed.

The purpose of the project commonly is the most important single factor in base-map selection. If the map is to show the location of gaging stations, a drainage map (showing streams, lakes, and land net or coordinates) will suffice. If the location of wells is of importance, a planimetric or topographic base will be more useful to both the compiler and the map user.

Commonly the map is designed to show the location of gages, wells, or other data points. Most of the time a planimetric map is sufficient, and indeed it is less cluttered than a topographic map of the same area. If a series of simple maps is contemplated, the maps will be printed in black and white. If it is necessary to compare various parameters such as the salt water-fresh water interface in relation to geologic formations, then several color separations should be planned. For some maps of high complexity, color-separated bases may be necessary. (*Permission is necessary from Pubs Management Unit to publish in color.)

The density of data will influence the selection of the scale for the map. If there are only widely scattered wells in a large county, a 1:24,000-scale map is scarcely needed; 1:250,000 might be more suitable.

The degree of quantitative measurement planned is not merely a consideration, it is an important factor. As the Division scientists and engineers investigate the "basin approach" to hydrology, they find that the configuration of the basin must be known and that the accuracy of water-budget determinations depends largely on the precision with which the configuration of the basin can be depicted. The type of map projection and the degree of topographic detail will affect the accuracy of measurement of areas and shapes. The location of topographic features will be facilitated by accurate topographic contours. Water-table mapping and subsurface measurements of key beds or bedrock are commonly dependent on the accuracy of the base map because the errors introduced by the plotting of data on poor base maps may be significant. If a generalized reconnaissance type of project is intended in an area of little potertial development, the base map need not be elaborate or accurate in every detail. In summary, if the quantitative measurements are in any way dependent on the accuracy of the map, the base map should be the best available.

The breakdown of data can affect the type of base map desired and the total number of base maps needed. Planimetric one-color maps at 1:250,000 may be suitable for showing the location of principal physiographic features, or of scattered wells or sampling sites. Yet in one municipal area a nitrate-contamination problem may require that the scale be 1:24,000 and that topographic contours be added. In this instance the base map needed can be for the entire project area at 1:24,000, or can be 1:250,000 for the entire project with a supplemental base map of the municipal area at 1:24,000.

There are times when the advantage of compiling several water-table maps of the same area (for different time periods) on the same base far outweighs the slight saving in printing cost that would accrue by using a smaller map for one set of sparse data.

The scale of the map should be a standard Survey scale, when possible (following table). Exceptions must be justified.

Scales for typical base maps are given below; source is U.S. Geological Survey except as noted.

United States	1:2,500,000
	1:3,168,000
	1:5,000,000
States	1:500,000
	1:1,000,000
Counties	Various scales (local agencies)
Quadrangles	1:250,000
	1:62,500
	1:63,360 (Alaska)
	1:24,000
	1:20,000 (Puerto Rico)

Maps are designed for readability at a certain scale; when we change the scale, many features become illegible (by reduction) or overpowering (by enlargement). Therefore, scale changes of more than a factor of 2 require redrafting or rescribing. The rescribing of bases is rare but is done chiefly where small-scale maps must be combined with larger scale mosaics to complete a map of the area of study.

Survey maps now carry the kilometre scale as well as the mile scale (article 3.09.1). The kilometre scale is added in final drafting; it need not be drafted in the field.

Printing press sizes are the ultimate determinant of the size of any illustration.

The availability of maps of the type needed for compilation and publication should be sought by the Project Chief during the initial phases of a project. Because the Project Chief may not know of specific maps that have been prepared but not yet published, preliminary inquiry should be made of the Geohydrologic Map Editor at the National Center, Reston, Va. or the Southeastern Region Cartographic Clearinghouse, Nashville, Tenn.

Cross reference: 3.09.1 Maps - Base credit

WATER RESOURCES DIVISION
PUBLICATIONS GUIDE

Replaces Article No.: | Effective Date: 10/5/73 | Article No.: 3.09.3

Subject: ILLUSTRATIONS -- Maps - Base features

1. Symbols for base features of maps in publications of the U.S. Geological Survey must follow the Topographic Division's symbolism. Scribed bases should also follow the Topographic Division's established line weights.*

2. Maps that show topographic or bathymetric contours must have contour-interval and datum notes. These notes are placed below the map scale. Example:

CONTOUR INTERVAL 50 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

3. Contour intervals must be identified when more than one contour interval exists on the same base map. Sample contour-interval notes are:

CONTOUR INTERVALS 25 AND 50 FEET

CONTOUR INTERVALS 40, 50, AND 80 FEET

CONTOUR INTERVAL 50 FEET

DOTTED LINES REPRESENT 10-FOOT CONTOURS

CONTOUR INTERVAL 10 FEET IN EASTERN PART
OF MAP AND 20 FEET IN WESTERN PART

If the base map contains more than three contour intervals and the contours are in feet, the contour-interval note should read:

CONTOUR INTERVAL, IN FEET, IS VARIABLE

4. All geographic place names that are mentioned in the report and occur within the areas mapped in the report must be shown on the maps.

5. The size of the lettering used for place names should be proportional to the physical size of the features in relation to one another and to their importance in the report. For example, the principal river in a basin would have the largest lettering, tributary streams would have smaller lettering, and so forth.

6. All hydrologic features on a base map normally are identified by slant lettering and all other features are identified by upright lettering. Styles of lettering similar to that used by the Topographic Division should be followed if the base map will contain customized lettering.

*See pages 73, 74, and 75.

7. The words "railroad" and "railway" are not generally used on maps; the railroad name, such as Great Northern, is sufficient. However, the words are included where they are part of a descriptive label or proper (formal) name, such as Railroad of New Jersey, Logging Railroad, U.S. Government Railroad, and The Alaska Railroad.

8. Symbols for base features generally are not shown in the map explanation. However, any symbol for a base feature that might not be recognized should be labeled on the map.

References: Technical Standards Papers 2.05.1 and 3.09.1 of Publications Division.

Cross reference: 3.06.4 -- Symbols - Standard lineweights for scribing.

WATER RESOURCES DIVISION
PUBLICATIONS GUIDE

Replaces Article No.: | Effective Date: 10/5/73 | Article No.: 3.09.2

Subject: ILLUSTRATIONS -- Maps - Land grids

1. Types of grids -- All maps, except those covering very small areas such as plane-table maps, should have a land grid. Grids that can be used on maps are latitude-longitude, township and range, or State-developed grids. Maps should be oriented, when possible, so that north is at the top of the sheet.

2. Latitude-longitude grid -- Maps that are to be in reports of the U.S. Geological Survey, except as noted above, must have a latitude-longitude grid. It is recommended that maps to be used in non-Survey reports have a latitude-longitude grid.

   Latitude is the angular distance, measured in degrees, north or south from the equator. The equator is at zero degrees latitude and each pole is at 90 degrees latitude. Thus, latitude lines are horizontal and increase northward for maps of the United States.

   Longitude is the angular distance, measured in degrees, east or west of the standard or prime meridian, which passes through Greenwich, England. Longitude ranges from zero degrees at the prime meridian to 180 degrees in either direction from the prime meridian. Thus, longitude lines are vertical and increase westward for maps of the United States.

   A. When geographic projections are divided into multiples of full degrees, do not use zero-minute (00') values after the degree values.

   B. When geographic projections are divided into units of less than full degrees, use degree values on the coordinates at or nearest the corners of the maps and where the degree value changes. Degree values should be omitted from all other coordinates; however, see item 2F.

   C. Never use zero-second (00") values.

   D. When values for minutes or seconds are less than 10, use a zero before the number only when that number is preceded by degrees or minutes. Example: 7', 37°07', 42°07'05".

   E. If a map has a skewed projection (the north direction of the map is not toward the top of the sheet), the grid numbers should be aligned in the same direction as the grid lines unless a neatline intervenes. (A neatline is the line that encloses all illustrations, explanations, and text material on plates or on sheets of map reports; thus, a neatline is the border of a map.)

F. If a map has an irregular shape and the reader might have difficulty reading the grid-coordinate values, the degree values can be retained on all grid coordinates.

G. On maps that are small in physical size, such as index maps, the grid coordinates need be labeled on only two sides, preferably the top and left sides. Maps that are large in physical size should be labeled on all four sides.

H. Topographic Division practices should be followed when labeling the grids: $7\frac{1}{2}$-minute quadrangles should be labeled at each $2\frac{1}{2}$-minute division, and 15-minute quadrangles should be labeled at each 5-minute division. When a base is reduced to 50 percent of its original size, alternate grid numbers should be eliminated. If a base is enlarged to double its original size, intermediate grid numbers may be added.

3. Township and range grid -- This Federal land-measurement grid establishes townships of approximately 36 square miles, 6 miles to a side. Each township is identified numerically in a system of base lines and principal meridians. The tiers of townships are numbered consecutively north or south of the base line as "Township 1 North, Township 2 North, Township 1 South, and so forth." The rows of townships are numbered consecutive east or west of the principal meridian as "Range 1 East, Range 1 West, and so forth." Each section (approximately 1 square mile) within a township is labeled numerically from the northeast corner to the southeast corner:

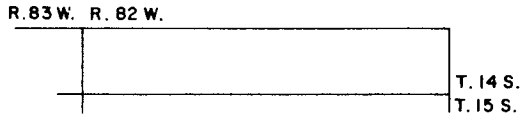
6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

The following States or Commonwealths do not have a township and range grid:

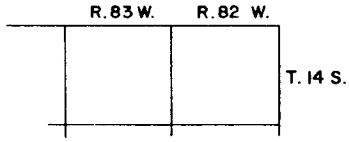
Connecticut	New Hampshire	Puerto Rico
Delaware	New Jersey	South Carolina
Georgia	New York	Tennessee
Hawaii	North Carolina	Texas
Kentucky	Ohio (parts)	Vermont
Maine	Pennsylvania	Virginia
Massachusetts	Rhode Island	West Virginia

The latitude-longitude grid used in conjunction with the township and range grid (where available) is recommended for both Survey and non-Survey reports.

A. On standard ($7\frac{1}{2}$- and 15-minute) topographic maps and other maps where the land grid is widely spaced, the township and range numbers should be set opposite each other at the boundaries. For example:



B. On maps where the land grid is narrowly spaced, the township and range numbers should be centered between the townships.



C. Township and range numbers appearing outside the body of the map should include periods after the letter designations (such as T.3 S. and R.1 W.); those appearing inside the body of the map should not include periods after the letter designations (such as T 3 S and R 1 W).

D. Township numbers should be stacked (number aligned vertically) only when used on small figures or on maps where space does not permit them to be placed horizontally.

4. State-developed grids -- These grids can be used on maps in any report if the grid is explained in the report text or in the base-credit note.

References: Technical Standards Papers 2.03.2 and 2.03.3 of Publications Division.

BRANCH OF TECHNICAL ILLUSTRATIONS
TECHNICAL STANDARDS SECTION

Replaces T.S. Paper	Dated 7/8/64	Effective Date	6/30/68	T.S. Paper No.	2.03.2
Subject:	BASE MAPS - Labeling Grid Coordinates on Base Maps*				

If grid coordinate type must be added to the base maps the following Topographic Division practices will be followed for labeling the grids: 7½ minute quadrangles should be labeled at each 2½ minute division, 15 minute quadrangles should be labeled at each 5 minute division. When the base is reduced to 50% original size the alternate grid numbers should be eliminated. If the base is enlarged to double the original size, intermediate grid numbers may be added.

The grid values will be added with the following rules kept in mind:

1. When geographic projections are divided into multiples of full degrees, do not use minute (00') values. (See example 1).

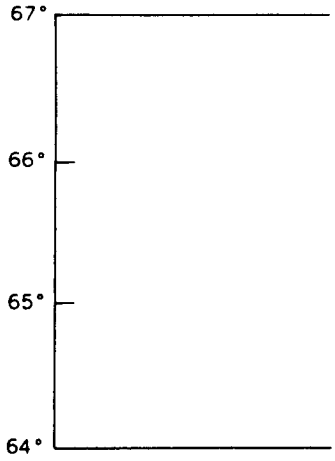
2. When geographic projections are divided into units of less than full degrees, use degree values on the coordinates at the corners and where there is a change in degree value. (See example 2).

3. Never use zero seconds (00").

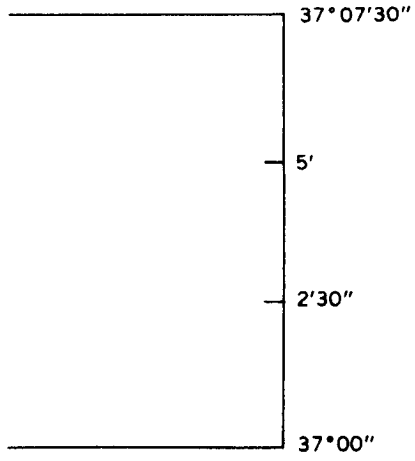
4. When values for minutes or seconds are less than 10, use a zero before the number only when that number is preceded by degrees or minutes.

4°05' 5" 103°02'30" 27'30" 7'30"

EXAMPLE 1

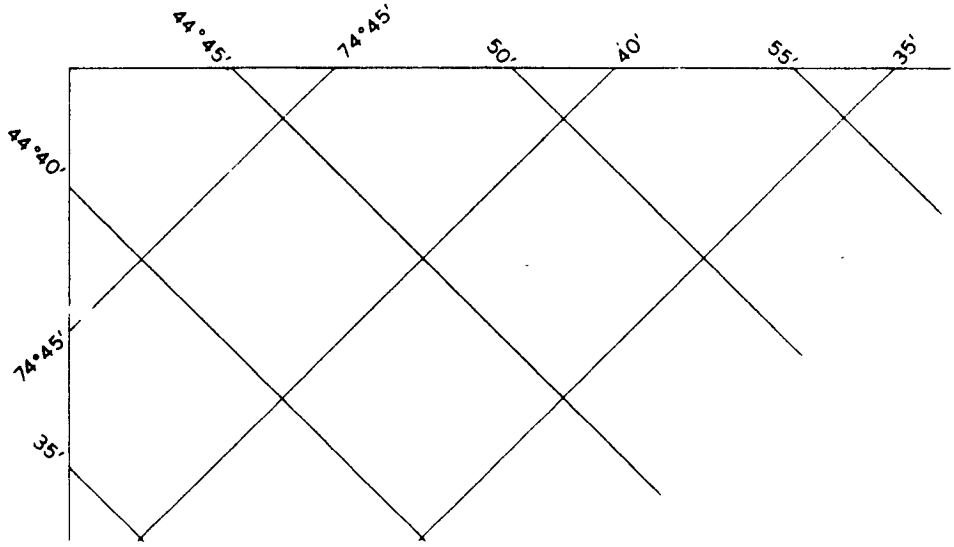


EXAMPLE 2

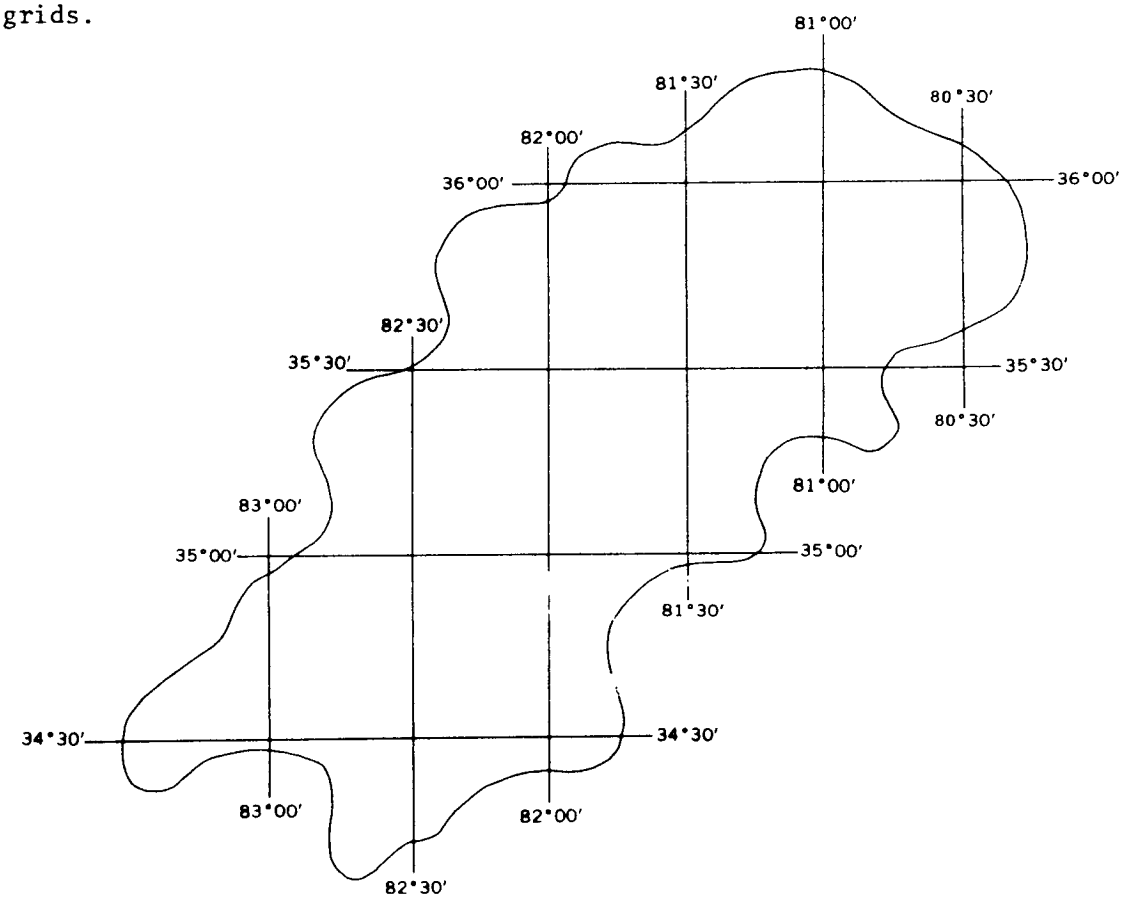


*See page 43.

5. When there is a skewed projection on a large-scale map the grid numbers should be aligned in the same direction as the grid line. It is emphasized that grid values for complete small-scale maps such as the 1:2,500,000 base map shall continue to be aligned with the map border and sheet edge.



6. When a map has an irregular shaped base and the viewer might have difficulty reading the grid coordinate values, the degree values can be retained on all grids.



WATER RESOURCES DIVISION
PUBLICATIONS GUIDE

Replaces Article No.: | Effective Date: 10/5/73 | Article No.: 3.09.6

Subject: ILLUSTRATIONS -- Maps - North arrow and magnetic declination

The addition of a north arrow and (or) magnetic declination to a map is not automatic but is dependent on the scale of the map and the information shown on the map.

A. Principal maps in map reports and plates in book reports

The standard north arrow with magnetic declination will be used on all quadrangle maps (maps having topographic contours) with scales from 1:20,000 through 1:125,000. The words "TRUE NORTH" and "MAGNETIC NORTH" should appear along the shafts of the respective arrows and the notation "APPROXIMATE MEAN DECLINATION, 19__" should be beneath the arrows. The magnetic declination is indicated by number, to the nearest whole degree, between the arrow tips.

The standard north arrow with magnetic declination should be centered between the base-credit note and the map scale below the south border of the map. On irregular-shaped maps or where proper placement is not possible, place the magnetic declination in the lower left area of the map or beneath the map explanation.

If the map covers more than 1 degree (30 minutes in Alaska) of latitude or longitude, the standard north arrow should not be used. On these maps, or on maps having scales between 1:125,000 and 1:500,000, a variable magnetic-declination note, of the same wording as on the base map, should be placed below the topographic contour datum note. A variable magnetic-declination note is not required on maps covering large areas where the scale number is 1:500,000 or greater.

B. Secondary maps in map reports and text figures in book reports

Maps having a latitude-longitude grid, wherein north is at the top of the page, do not need a magnetic or north arrow. Maps skewed so that north is not at the top of the page should have a north arrow in addition to a latitude-longitude grid. A north arrow should be added to maps having land grids other than latitude-longitude.

Reference: Technical Standards Paper 3.06.1 of Publications Division.

Cross reference: 3.09.2 -- Maps - Land grids

INT. 1516-7

WATER RESOURCES DIVISION
PUBLICATIONS GUIDE

Replaces Article No.: | Effective Date: 10/5/73 | Article No.: 3.09.1

Subject: ILLUSTRATIONS -- Maps - Scales

1. All maps must have a scale.

2. Standard publication scales used by the U.S. Geological Survey are:

1:20,000 (Puerto Rico only)	1:250,000
1:24,000	1:500,000
1:48,000	1:1,000,000
1:62,500	1:2,500,000
1:63,360 (Alaska only)	1:3,168,000
1:125,000	1:5,000,000

Other acceptable publication scales are:

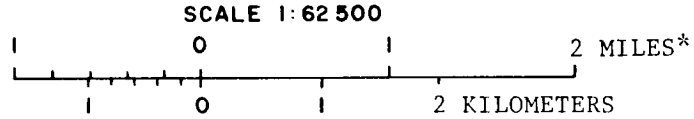
1:12,000	1:96,000
1:16,000	1:750,000
1:18,000	1:2,000,000
1:31,680	

3. Base maps for text figures designed to fit a fixed page size* in a book report or a column width in a book or map report need not be prepared at one of the scales listed above. However, if a scale listed above is compatible with the fixed page size or column width, the maps should be prepared at that scale.

4. Base maps that are prepared for plates in a book report or for principal maps in a map report should be prepared at one of the scales listed above.

5. Bar scales are used on all multicolor maps and on those monochrome (one color or shades of one color) maps that use topographic quadrangles as the source of the base map. Both the English (mile, foot) and the metric (kilometer, meter) scales are shown separately. The English scale is placed above the metric scale, except for maps of foreign countries and Puerto Rico where the order is reversed.

6. Rake scales are used on all monochrome maps that do not use topographic quadrangles as the source of the base map. Rake scales are also used on index maps and on maps designed for a fixed page size or text column width. All rake scales will combine English units with corresponding metric units onto one scale, with the English units placed above the metric units. An example of a combined English and metric scale follows:



*Scales should be divided in equal divisions of English and metric units.

*See page 52.

7. The fractional-scale notation (for example, SCALE 1:62 500) should be shown above the bar or rake scale only if the map is at one of the standard or acceptable scales listed above. A comma is not included in the number to the right of the colon when placed on the map.

8. The letters of the units of measure (for example, MILES) should be placed to the right of the largest number on the scale in all capital letters.

9. Bar or rake scales used for plates or principal maps should be subdivided to the left of zero into logical increments of the first unit of the right-hand measure. The length of the scale to the left of zero should be about 1 inch. The units to the right of zero are not subdivided.

10. Scales for index maps and maps fitted for a fixed page size or column width should start at zero. No divisions should occur to the left of zero.

11. The length of any scale should be proportional to the size of the map under which it appears. The scale length should be approximately a third the width of the map but not longer than 7 inches.

12. Map scales can be prepared from the following conversion table, which was compiled for plotting map scales and vertical scales on sections. Only one column was prepared for the metric information as 1 kilometer is equivalent to 1,000 meters.

FRACTIONAL SCALE	INCHES PER MILE	INCHES PER 1,000 FEET	INCHES PER KILOMETER
1:500	126.72	24.00	78.74
1:600	105.60	20.00	65.62
1:1,000	63.36	12.00	39.37
1:1,200	52.80	10.00	32.81
1:1,500	42.24	8.00	26.25
1:2,000	31.68	6.00	19.68
1:2,400	26.40	5.00	16.40
1:2,500	25.34	4.80	15.75
1:3,000	21.12	4.00	13.12
1:3,600	17.60	3.33	10.94
1:4,000	15.84	3.00	9.84
1:4,800	13.20	2.50	8.20
1:5,000	12.67	2.40	7.87
1:6,000	10.56	2.00	6.56
1:7,000	9.05	1.714	5.62
1:7,200	8.80	1.668	5.47
1:7,920	8.00	1.517	4.97
1:8,000	7.92	1.500	4.92
1:8,400	7.54	1.429	4.69
1:9,000	7.04	1.333	4.37
1:9,600	6.60	1.250	4.10
1:10,000	6.34	1.200	3.94
1:10,800	5.87	1.112	3.65
1:12,000	5.28	1.000	3.28
1:13,200	4.80	0.909	2.98
1:14,400	4.40	0.833	2.73
1:15,000	4.22	0.800	2.62

FRACTIONAL SCALE	INCHES PER MILE	INCHES PER 1,000 FEET	INCHES PER KILOMETER
1:15,600	4.06	0.769	2.52
1:15,840	4.00	0.757	2.48
1:16,000	3.96	0.750	2.46
1:16,800	3.77	0.714	2.34
1:18,000	3.52	0.667	2.19
1:19,200	3.30	0.625	2.05
1:20,000	3.17	0.600	1.97
1:20,400	3.11	0.588	1.93
1:21,120	3.00	0.568	1.86
1:21,600	2.93	0.556	1.82
1:22,800	2.78	0.527	1.73
1:24,000	2.64	0.500	1.64
1:25,000	2.53	0.480	1.57
1:31,680	2.00	0.379	1.24
1:48,000	1.319	0.250	0.82
1:50,000	1.267	0.240	0.79
1:62,500	1.013	0.1920	0.62
1:63,360	1.000	0.1895	0.62
1:75,000	0.844	0.1600	0.52
1:96,000	0.659	0.1250	0.41
1:100,000	0.634	0.1200	0.39
1:125,000	0.507	0.0960	0.32
1:126,720	0.500	0.0948	0.31
1:200,000	0.317	0.0600	0.19
1:250,000	0.253	0.0480	0.15
1:253,440	0.250	0.0473	0.15
1:400,000	0.1583	0.0300	0.10
1:500,000	0.1267	0.0240	0.08
1:506,880	0.1250	0.0237	
1:750,000	0.0844	0.01600	
1:1,000,000	0.0634	0.01200	
1:1,013,760	0.0625	0.01183	
1:1,500,000	0.0422	0.00800	
1:1,680,000	0.0377	0.00714	
1:2,000,000	0.0317	0.00600	
1:2,500,000	0.0253	0.00480	
1:3,000,000	0.0211	0.00400	
1:3,168,000	0.02000	0.00379	
1:3,500,000	0.01809	0.00343	
1:4,000,000	0.01583	0.00300	
1:4,500,000	0.01407	0.00267	
1:5,000,000	0.01267	0.00240	
1:6,000,000	0.01054	0.00200	
1:7,000,000	0.00904	0.001715	
1:8,000,000	0.00792	0.001500	
1:9,000,000	0.00703	0.001333	
1:10,000,000	0.00634	0.001200	
1:11,000,000	0.00577	0.001092	
1:12,000,000	0.00527	0.001000	
1:13,000,000	0.00487		
1:14,000,000	0.00452		
1:15,000,000	0.00422		
1:16,000,000	0.00396		
1:17,000,000	0.00372		
1:18,000,000	0.00352		
1:19,000,000	0.00333		
1:20,000,000	0.00317		
1:21,000,000	0.00302		
1:22,000,000	0.00288		
1:23,000,000	0.00276		
1:24,000,000	0.00264		
1:25,000,000	0.00254		

References: **Technical Standards Papers 3.07.1, 3.07.2, and 3.08.2 of Publications Division.**

WATER RESOURCES DIVISION
PUBLICATIONS GUIDE

Replaces Article No.:	Effective Date: 10/5/73	Article No.: 3.09.4

Subject: ILLUSTRATIONS -- Maps - Base credit

A. Base credit is required for maps in all reports that use base maps made directly from:

1. U.S. Geological Survey maps -- 1:20,000, 1:24,000, 1:62,500, 1:63,360, and 1:250,000 quadrangle maps; State base maps; and United States base maps. (Note: The U.S. Geological Survey is now the sole source of the 1:250,000 quadrangle maps. The U.S. Army Topographic Command, formerly the U.S. Army Map Service, no longer is connected with the "AMS" quadrangles. Therefore, the U.S. Geological Survey must be cited as the source of these maps.)

2. Maps from other Federal agencies.

3. State or county highway maps.

4. Maps from private or copyrighted sources. Written permission to use base maps from these sources must be obtained by the author and included with the report when it is sent for Director's approval.

B. Base credit is required for maps having bases that have been redrafted or rescribed from the source materials listed above or that are composed of aerial photographs and that are used for:

1. Plates in Survey or non-Survey book reports.

2. Foldouts ("tip-ins") in non-Survey book reports.

3. Principal maps in Survey or non-Survey map reports.

C. Base credit is not generally required for maps having bases that have been redrafted or rescribed from the source materials listed above, with the exception of item A4, that are used for:

1. Page-size text figures, including index maps, in Survey or non-Survey book reports.

2. Secondary maps, including index maps, in Survey or non-Survey map reports.

D. Base credit is not required for maps having bases that consist of only a land net, such as latitude-longitude, township and range, or State-developed grids. However, if culture names, topographic contours, drainage or roads are shown, base credit must be given according to the foregoing instructions.

E. Base-credit notes

1. Form

The words "Base from" will be used for all base-credit notes (except photo base maps) regardless of whether the original base map has been altered in some way, such as change in scale, area, or information.

a. Maps listed under item A

1) Base map consists of one full quadrangle and quadrangle name appears in map title:

"Base from U.S. Geological Survey, 1960"

2) Base map consists of one full quadrangle and quadrangle name does not appear in map title:

"Base from U.S. Geological Survey
Rock Bluff, 1956"

3) Base map consists of one full quadrangle, quadrangle name appears in map title, and map contains purple interim revisions:

"Base from U.S. Geological Survey, 1960
Interim revisions as of 1970"

4) Scale of base map different from original and quadrangle name appears in map title:

"Base from U.S. Geological Survey
1:62,500, 1958"

5) Area of base map more than one full quadrangle and quadrangle names do not appear in map title:

"Base from U.S. Geological Survey
Clay Hills 1:24,000, 1954 and
Clay Hills 1 NW 1:24,000, 1952"

6) Area of base map is part of State base map and scale is unchanged:

"Base from U.S. Geological Survey
State base map, 1965"

7) Information added to base map, area less than one full quadrangle, scale changed, and quadrangle name does not appear in map title:

"Base from U.S. Geological Survey
La Crosse 1:250,000, 1958
Reservoirs as of 1970"

b. Maps listed under item B

1) Source of base map was 1:24,000 and 1:62,500 quadrangles:

"Base from U.S. Geological Survey
1:24,000 and 1:62,500 quadrangles"

2) Source of base map was 1:250,000 quadrangles:

"Base from U.S. Geological Survey
1:250,000 quadrangles"

3) Source of base map was State base map:

"Base from U.S. Geological Survey
State base map, 1:500,000"

4) Source of base map was county highway maps:

"Base from North Dakota Highway Department
county highway maps 1:63,360"

c. Aerial photographs

For bases that are composed of aerial photographs the credit note consists of two parts: the source of the photomap and the source and date (month and year) of the photography.

1) Aerial photography and photomap from same source:

"Aerial photomap by U.S. Geological Survey from
aerial photographs taken March 1969"

2) Aerial photography and photomap from different sources:

"Aerial photomap by U.S. Geological Survey.
Aerial photography by Chicago Aerial Survey, March 1969"

2. Placement -- On a rectangular-shaped map the base-credit note should appear under the south border and begin flush with the west border. On an irregular-shaped map the base-credit note should appear as close to the southwest margin of the map as possible. When a sheet contains two or more of the same base maps, the base-credit note should appear only once, below the south neatline of the sheet and flush with the west neatline of the sheet.*

*See pages 59 and 61.

F. Index to topographic mapping

1. Form -- The index consists of a complete outline of the source maps used to compile the base map. The index has no geographic detail or a scale but does have latitude and longitude numbers. The title, "INDEX TO TOPOGRAPHIC MAPPING," is placed below the index. The outline of the report area can be shown on the index and the area may be shaded. Labeling of the quadrangles should follow the "Index to Topographic Maps of (State)," published for each State.

2. Placement -- Placement below the southwest corner of the map is preferred. However, the index can be placed in any convenient location near the map.

References: Technical Standards Papers 3.04.1, 3.04.3, and 3.08.2 of Publications Division.

INFORMATION FOR BOTTOM MARGIN

(To Scale)

Base from U.S. Geological Survey
St. Cloud North, 1:24,000, photorevised 1970,
St. Cloud South, 1:24,000, photorevised 1980,
Narcoossee, 1:24,000, photorevised 1970,
Ashton, 1:24,000, photorevised 1970

BOTTOM LEFT

HYDROGEOLOGY OF THE LAKE MIONA AREA, NORTHEAST SUMTER COUNTY, FLORIDA

By
L. A. Bradner
1986

MIDDLE

Copies of this map can be
purchased from:

U.S. Geological Survey
Books and Open-File Reports Section
Federal Center
Box 25425
Denver, Colorado 80225

BOTTOM RIGHT

CARTOGRAPHIC TECHNICAL STANDARDS

Replaces T. S. P.		Subject: MARGINAL INFORMATION Base Credit Notes	T. S. Paper	3.00.3
Dated			Effective	12/6/76

Base credit notes should be as concise and informative as possible. Situations not covered by these guidelines must be discussed and resolved by the designer and the area map editor.

Type - Set base credit notes flush left in 6/8 pt.type; make the first line of type longer than succeeding lines where possible.

Examples

When the base map consists of one full quadrangle and the quadrangle name appears in the title of the map (including maps printed from DMATC material):

Base from U.S. Geological Survey, 1967

When the base is prepared and published by the U.S. Geological Survey for the Tennessee Valley Authority:

Base from Tennessee Valley Authority
and U.S. Geological Survey, 1953

When the scale of the base map is different from the original scale of the printed map and the quadrangle name appears in the title:

Base from U.S. Geological Survey
1:62,500, 1958

When less than a full quadrangle is used and the quadrangle name does not appear in the title:

Base from U.S. Geological Survey
Clay Hills, 1954

When the purple revision overprint is included as part of the culture and the quadrangle name appears in the title, show the date when the photographs were taken:

Base from U.S. Geological Survey, 1960
Photorevision as of 1968

When changes or additions are made to the base map and the quadrangle name does not appear in the title:

Base from U.S. Geological Survey
Clay Hills, 1954
Roads as of 1962

When the base consists of two or more quadrangles and either or both quadrangle names do not appear in the title:

Base from U.S. Geological Survey
Clay Hills, 1954, and Clay Hills 1 NW, 1952

When the base map is prepared by mosaicking maps of different scales:

Base from U.S. Geological Survey
Baltimore, 1:250,000, 1957–63,
and St. Michaels, 1:62,500, 1902

When part of the base is an unedited advance print:

Base from U.S. Geological Survey
St. Michaels, 1902, and unedited
advance print, 1960

When the base is prepared from maps other than topographic quadrangles, indicate the type of map in the credit note:

Base from U.S. Geological Survey
State base map, 1950

When the state coordinate system and the UTM grid are shown, use the wording given on the topo quadrangle:

Base from U.S. Geological Survey, 1960
Photorevision as of 1968
10,000-foot grid based on Wyoming coordinate system, west zone
1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

Examples for photo base maps

When the base covers a standard quadrangle area:

Orthophotomap base by U.S. Geological Survey;
aerial photographs taken 1954

When the base covers an irregular area:

Orthophoto mosaic base by U.S. Geological Survey;
aerial photographs taken 1954

When a planimetric base has been prepared by tracing from an orthophoto mosaic or an orthophotomap:

Planimetric base by U.S. Geological Survey
from orthophoto mosaic; aerial photographs
taken 1954

When an uncontrolled photomosaic base is used:

Uncontrolled photomosaic base by
U.S. Geological Survey. Aerial
photographs from Lockwood, Kessler,
and Bartlett, Inc., Syosset, New York, 1968

WATER RESOURCES DIVISION
PUBLICATIONS GUIDE

Replaces Article No.: | Effective Date: 10/5/73 | Article No.: 3.09.5

Subject: ILLUSTRATIONS -- Maps - Mapping credit

Mapping credit is required for all maps that show geologic or hydrologic information. Geologic credit can be shown by a geologic-credit note or an index to geologic mapping. Hydrologic credit should be shown by a hydrologic-credit note.

A. Geologic-credit and hydrologic-credit notes*

1. Form -- Initials are used for the author's first and middle names. When an author has no middle name or initial, his first name will be spelled out. Initials or first name precedes the last name. When both geologic-credit and hydrologic-credit notes are required for a map, the hydrologic-credit note should be placed beneath the geologic-credit note; both credit notes can be combined into a credit note for "Geohydrology" if the name(s) and date(s) for geology and hydrology are the same. The following descriptions can be applied to hydrologic-credit notes by substituting "hydrology" for "geology."

   a. When the author's name appears below the title of the geologic map and he is solely responsible for mapping the geology, the credit note should read:

      "Geology mapped in 19__"

   b. When the author's name does not appear below the title of the geologic map and he is solely responsible for mapping the geology, the credit note should read:

      "Geology by name of author, 19__"

   c. If the geologic map appears in a report that has several authors, the name of the author solely responsible for the geologic mapping will appear in the credit note:

      "Geology by name of author, 19__"

      If more than one author is responsible for the geologic mapping, the names of the authors responsible for the geologic mapping will appear in the credit note:

      "Geology by name of author, name of author, and name of author, 19__"

*See page 67.

d. If the author of the geologic map was assisted by another person, the credit note should read:

"Geology by name of author, 19__; assisted by name of assistant, 19__"

e. If the person responsible for the geologic map is not an author of the report in which the map appears and the map is being reproduced without change from a published report, the credit note should read:

"Geology from name of person responsible for map (year of publication)"

If the author(s) of the report has slightly modified the geology shown on the map, the credit note should read:

"Geology modified from name of person responsible for map (year of publication)"

If the author(s) of the report has greatly modified the geology shown on the map, the credit note should read:

"Geology from name of person responsible for map (year of publication); modified by name of author, year of modification"

The complete bibliographic citation for the geologic map used must be shown in the list of references.

Thus, the name of the person responsible for mapping is separated from the date of mapping by a comma; however, the year of publication of a map follows in parentheses the name of the person responsible for mapping without an intervening comma.

2. Placement -- On a rectangular-shaped map the geologic-credit and hydrologic-credit notes should appear under the south border and end flush with the east border. On an irregular-shaped map the notes should appear as close to the southeast margin of the map as possible.

B. Index to geologic mapping (used only when two or more people are responsible for the geologic mapping of adjacent areas or when the geology was mapped by the same person(s) but published in different reports).

1. Form -- The index consists of an outline of the geologic map subdivided into the parts mapped by the different people. The index does not have a scale or latitude and longitude numbers. The title, "INDEX TO GEOLOGIC MAPPING," is placed below the index. The index can be presented in either of two formats.

a. The last names of the people responsible for the mapping, followed by the year the map was published (in parentheses), can be placed in the subdivided parts of the index.

b. The subdivided parts of the index can be numbered consecutively (1, 2, 3, 4, and so forth) and a listing of the people responsible for the mapping, keyed to the numbers, can be placed below the index title. The format for the listing is last name followed by the year of publication (in parentheses).

The complete bibliographic citations for the reports must be shown in the list of references.

2. Placement -- Placement below the southeast corner of the geologic map is preferred. However, the index can be placed in any convenient location near the geologic map.

References: Technical Standards Papers 3.04.2 and 3.08.3 of Publications Division.

CARTOGRAPHIC TECHNICAL STANDARDS

Replaces T. S. P.		Subject: MARGINAL INFORMATION - Geologic and Hydrologic Credit Notes	T. S. Paper	3.00.4
Dated			Effective	11/29/76

Type - Set geologic and hydrologic credit notes flush left in 6/8 pt. type; make the first line longer than the succeeding lines where possible. Show initials for authors first and second names; if an author has no middle name or initial, spell out his first name. Set the names so that each complete name appears on the same line of type, if possible.

Examples

When the name of the author (or authors) appears below the title of the map and he is solely responsible for the mapping, do not show the author's name in the credit note:

Geology mapped in 1970–71

When the name of the author (or authors) does not appear below the title of the map:

Hydrology by P. R. Williams, 1970

Geology by C. L. Sainsbury, 1960–69; assisted by Donald Grybeck, 1961, T. E. Smith, 1962, 1967, W. E. Todd, 1967; Reuben Edwards, 1967–68, and Travis Hudson, 1968–69

When credit is to be given to contributors or assistants whose names do not appear under the title:

Geology by Louis Palvides, 1959–63; assisted by W. P. Williams, 1959; W. H. Hanson III, 1960–61; and J. S. Derr, 1962

When information in addition to mapping credit is shown:

Geology by G. W. Withington, 1962, 1963, and 1968, assisted by J. S. Atherton, 1962; L. B. Smith and John Leftwich, Jr., 1968

Data on bedrock outcrops, boulder trains, glacial striae, and karst features provided by N. M. Fox and H. R. Burger

When a map has already been published in a different series:

Geology by K. J. Englund
Previously published as GQ-173

WATER RESOURCES DIVISION
PUBLICATIONS GUIDE

Replaces Article No.: | Effective Date: 3/15/74 | Article No.: 3.10.2

Subject: ILLUSTRATIONS -- Explanations - Maps

The purpose of a map explanation is to explain to the map user all the symbols, numbers, letters, patterns, and colors used to portray scientific data on a map. Because most map users are familiar with the symbols used to portray base features, either from using highway maps or Survey topographic maps, features such as roads, streams, canals, buildings, topographic contours, and levees are not shown in map explanations. If a base feature is used that the map user may not be familiar with, then the base feature should be labeled on the map.

The title of the map explanation is to be EXPLANATION and not LEGEND or KEY. The Survey considers Johnny Appleseed to be a legend and a key is that instrument used to open locks.

The map explanation must contain a sample of all the scientific data added to the map and not labeled on the map. For example, if a map contains only one fault shown by a solid line and the fault is labeled SAN ANDREAS FAULT on the map, the fault symbol need not be shown in the map explanation. If, however, other information is shown on the labeled fault such as arrows, U, and D, or if part of the fault is dashed, then the fault symbol with the additional information must be shown in the map explanation and the additional information explained. Also, if more than one fault is shown in addition to the labeled fault, then the fault symbol must appear in the explanation.

The sample shown in the explanation must be an exact duplicate of the data shown on the map. For example, if wells are shown by solid circles and a number is shown adjacent to the circle, then the solid circle and the number (a duplicate of one used on the map) must be shown and explained in the explanation.

The order of presentation of data in the explanation is: all geologic data precede all hydrologic data if both types of data are shown. Areal data usually shown in boxes (color or pattern) always precede line or point data. For example, if a map shows two geologic formations, geologic contacts, water-table contours, and water wells, the order of presentation in the explanation would be:

Geologic formations
Contact
Water-table contour
Well

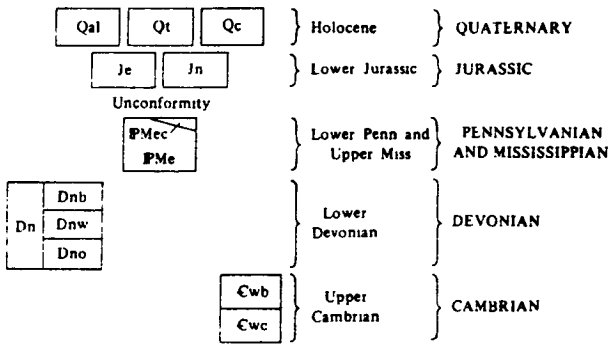
The preferred placement for the explanation is outside the right margin of the map when the map is square or rectangular in shape. When the map has an irregular shape, any convenient placement of the explanation is acceptable in the following order of preference: upper right, upper left, lower right, or lower left.

Recently the format for map explanations has been changed from placing the description of the data below the data sample to placing the description to the right of the data sample. The explanation for geologic units in the new format consists of two parts: correlation of map units and description of map units. One principal advantage of the new format, in addition to a considerable saving in time and cost of cartographic preparation, is the flexibility of presentation in showing correlation of map units.

Examples of the new formats for both geologic and hydrologic explanations follow. The examples of hydrologic explanations include only English units; therefore, the examples should be used for format only.

Example 1

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

Qal — ALLUVIUM – Mainly flood-plain deposits: numerous gravels

Qt — TERRACE DEPOSITS

Qc — COLLUVIUM – Mainly slope wash and solifluction mantle derived from higher outwash river terrace gravels

MEGABRECCIAS

Je — Composed mainly of blocks of Ely Limestone

Jn — Blocks of Nevada Formation

Unconformity

PMe — ELY LIMESTONE – Massively bedded bluish-gray limestone Abundant nodules or bands of dark tan-weathering chert Near the base, beds of brown sandstone, local chert pebble conglomerate

PMec — Coarse limestone conglomerate at top of formation north of Peterson Canyon, 500 feet exposed

Dn — NEVADA FORMATION – Dominantly composed of massive dolomite

Dnb — Bay State Dolomite Member – Massively bedded dark-gray to black dolomite Some beds contain abundant *Claopora* and *Stromatopa* colonies

Dnw — Woodpecker Limestone Member – Thin-bedded dark-gray limestone

Dno — Oxyoke Canyon Sandstone Member – Thick-bedded light-olive-gray dolomitic sandstone or quartzite weathering to shades of brown

WINDFALL FORMATION – Several outcrops occur in southwest corner of quadrangle

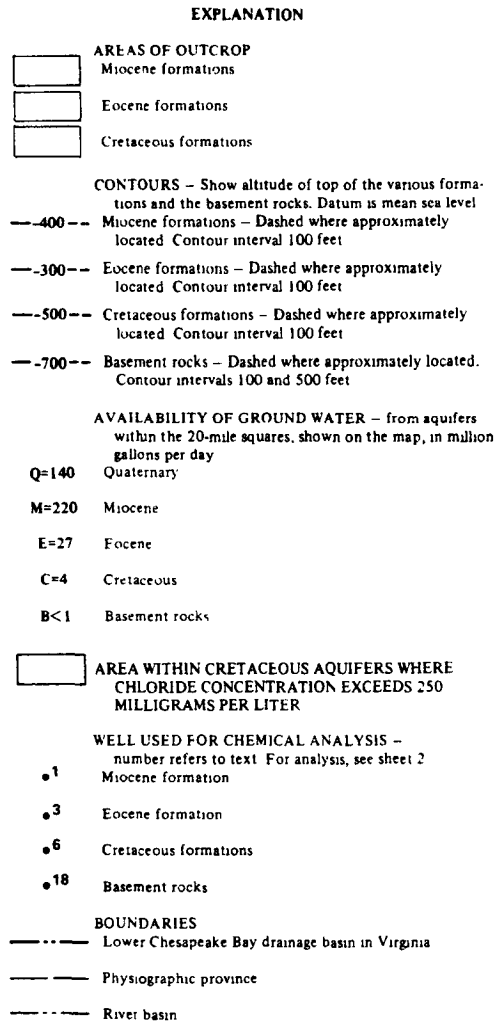
Cwb — Bullwacker Member – Uniformly thin-bedded tan or light-brown sandy silty limestone

Cwc — Catlin Member – Alternating massive limestone and thin-bedded sandy or silty limestone

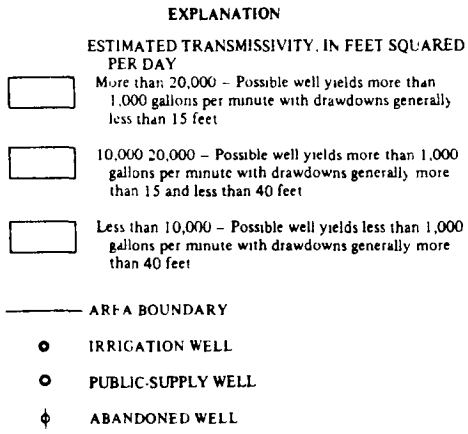
——— Contact – Dashed where approximately located, dotted where concealed

Strike and dip of beds
Inclined

Example 2



Example 3



References: Technical Standards Papers 8.01.1 and 8.04.1 of Publications Division.

The gradational use of a single color or two colors is a technique often used to present data where a range of values is used. Gradational tones can be readily seen by the human eye and are more easily understood by the map user than alternating bands of different colors. Some examples are:

A. One color

1. Well yields - tones of blue with the largest well yields the darkest blue and the smallest well yields the lightest blue or white.

2. Depth to water - tones of blue with the greatest depth the darkest blue and the shallowest depth the lightest blue or white.

B. Two colors

Dissolved solids - tones of blue and red with the smallest dissolved-solids content the darkest blue and the largest dissolved-solids content the darkest red.

DISSOLVED-SOLIDS CONTENT, IN MILLIGRAMS PER LITER

0- 500	- Dark blue	or	Dark blue
500- 1,000	- Medium blue		Light blue
1,000- 3,000	- Light blue		Light blue and light red
3,000-10,000	- Light red		Light red
10,000-35,000	- Medium red		Medium red
More than 35,000	- Dark red		Dark red

WATER RESOURCES DIVISION
PUBLICATIONS GUIDE

Replaces Article No.: | Effective Date: 8/27/73 | Article No.: 3.06.4

Subject: ILLUSTRATIONS -- Symbols - Standard lineweights for scribing

Standard widths of scribed lines for topographic, hydrologic, and geologic features in publications of the U.S. Geological Survey follow. Contours and lines of equal value for hydrologic features will be either solid or dashed -- solid for known locations and dashed for approximate locations. If all contours or all lines of the same feature on a map are approximately located, lines can be scribed solid and labeled as "approximately located" in the explanation. If known and approximate locations of the same feature occur together on a map, the approximate locations must be dashed.

A. TOPOGRAPHIC FEATURES	Line width (inch)
1. National boundary lines	0.016
2. State boundary lines	.012
3. County boundary lines	.010
4. City or town boundary lines	.007 (.008)
5. Railroads	.005
6. Township and range lines	.010
7. Section lines	.005
8. Grid coordinate lines	.005
9. Drainage	.005
10. Trails	.003
11. Road casings	
a. Four or more lanes	.003
b. Less than four lanes	.003
12. Contours	
a. Index	.007
b. Intermediate	.002

B. HYDROLOGIC FEATURES	Line width (inch)
1. Drainage-basin boundary lines	0.020
2. Drainage-subbasin boundary lines	.012
3. Flood-limit boundary lines	.012
4. Contours and lines of equal value	
a. Index	.015
b. Intermediate	.008

NOTE: Dashing of contours or lines of equal value:

Approximately located -- dashes 0.20 inch long with a 0.02-inch space between dashes.

C. GEOLOGIC FEATURES	Line width (inch)
1. Contacts	
a. Normal spacing	0.005
b. Where congested	.004
2. Anticlines and synclines	
a. Normal spacing	.010
b. Where congested	.008
3. Faults	
a. Normal spacing	.015
b. Where congested	.012
4. Contours	
a. Index	.015
b. Intermediate	.008

NOTE: Dashing of contacts, anticlines and synclines, and faults:

1. Approximately located -- dashes 0.14 inch long with a 0.02-inch space between dashes.

2. Inferred, indefinite, or gradational -- dashes 0.06 inch long with a 0.02-inch space between dashes.

3. Concealed -- dashes 0.02 inch long with a 0.02-inch space between dashes.

Dashing of contours:

Approximately located -- dashes 0.20 inch long with a 0.02-inch space between dashes.

LINEWEIGHTS

Technical pen point size/ metric size	Inked	Scribed	Jewel scribing point size
4/1.00			.030
3/0.80			.025
2.5/0.70			.020
2/0.50			.015
1/0.40			.012
0/0.35			.010
00/0.25			.008

BRANCH OF TECHNICAL ILLUSTRATIONS
TECHNICAL STANDARDS SECTION

T.S. Paper No.	2.4	Effective Date	7-18-63	Supercedes T.S.P. No.	

Subject | BORDER INFORMATION - Presentation for Index maps showing area of report, published maps in area, and quadrangle with certain exceptions for HA's

An index map showing 1. area of the report 2. the published maps in the series and 3. the topographic quadrangles will be designed as follows:

1. The area of the report will be stippled or cross-hatched. Where an extra color is used, that color should be printed in a stipple to show the area of the report. On a group of related reports the same stipple, cross-hatch, or stippled color will be made consistant for the series.

2-3. The published maps shown on an index map will be labelled with the actual identifying number of the sheet; ie:, for an HA series (or any Series) listing all the quadrangles, the names of the quadrangles will be named and only those sheets that are published will have the HA number or Series number added to the name of the sheet. (See sample)

Item 1 will normally be used for indexes showing only the area of the report. The type of stippling or cross-hatching will be determined by the designer of the job. There are too many factors involved in picking a specific stipple or cross-hatch to be used for all jobs.

Explanations are normally unnecessary on index maps; they should be self-explanatory.

The HA series are the exception where an explanation is required to define the "Area of this report".

EXPLANATION

Area of this report

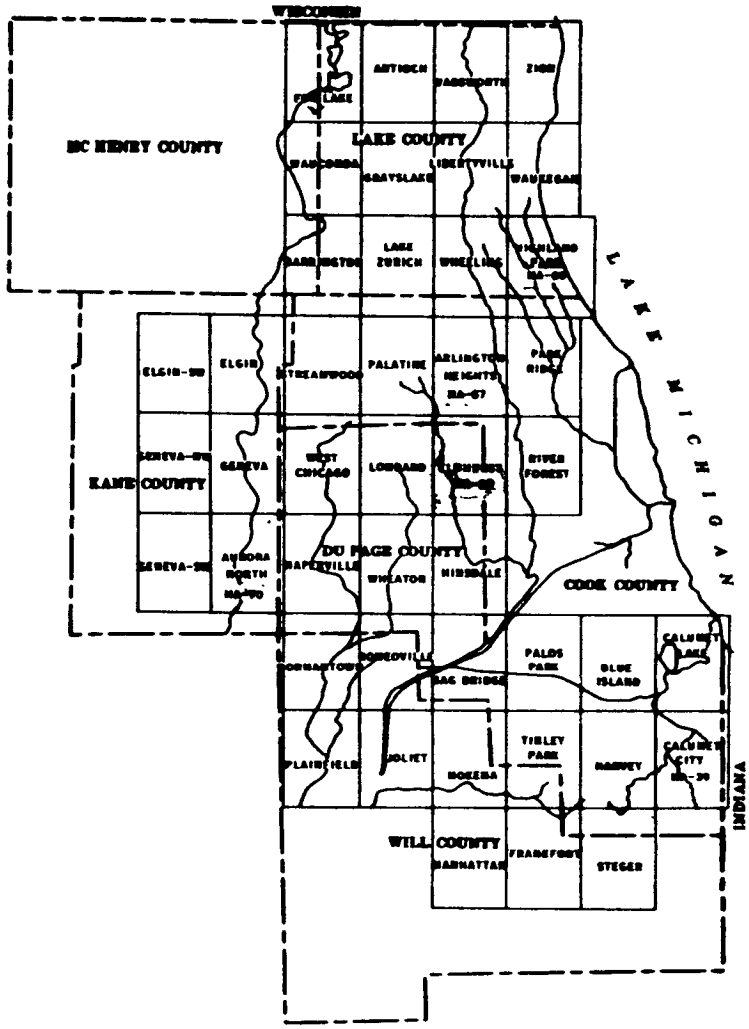
A recommended title for index maps with the three items mentioned in this paper is as follows:

"Outline map of (northeastern Illinois) showing location of (Elmhurst) quadrangle".

The title for HA index maps with the three items mentioned in this paper will read as follows:

"Fig 1 - Index map of (northeastern Illinois) showing location of quadrangles included in flood hazard mapping program."

July 23, 1963


WISCONSIN
MC HENRY COUNTY
LAKE COUNTY
KANE COUNTY
DU PAGE COUNTY
COOK COUNTY
WILL COUNTY
LAKE MICHIGAN
INDIANA
ANTIOCH
ZION
WAUKEGAN
LAKE ZURICH
WHEELING
PALATINE
ELGIN
GENEVA
LOMBARD
RIVER FOREST
NAPERVILLE
WHEATON
HINSDALE
PALOS PARK
BLUE ISLAND
JOLIET
ROMEOVILLE
TINLEY PARK
FRANKFORT
STEGER

CARTOGRAPHIC TECHNICAL STANDARDS

Replaces T. S. P.	2.02.2 3/31/78	Subject: Base Maps -- Biangle screens to be used with bases for thematic maps	T. S. Paper	2.02.2
			Effective	6/23/78

With the adoption of the 59-line (150 lines/in) composite biangle screens, the Branches of Cartography within the Publications Division will instruct whoever does the screening as to which biangle screen to apply to base negatives.

Use T.S.P. 7.10.1, along with the guidelines here when writing instructions about applying biangle screens to base negatives.

Most geologic maps will use topographic bases screened with the 50% biangle screen for the culture and the 50% biangle screen for the relief (both features usually print black). The drainage will print solid (100%) (usually cyan). Using this system, the topographic border data will be screened the same as the culture because they appear on the same negative. Though these instructions specifically apply to Geologic Quadrangle maps, they may readily be applied to many other map-series publications.

If the density of the culture is so great as to warrant use of biangle screens reading less than 50%, prepare two masks, to be itemized and included with reproduction items sent to the printer. Cut one mask to cover the border data outside the neatline, and save the inner, cut-out part for use as a second mask to cover the culture. The purpose of the inner mask is to allow all topographic border data outside the neatline to print a readable solid (100%), and the purpose of the outer mask is to allow all cultural data including the neatline to print less than 50%. The neatline scribed on the black scribecoat must coincide precisely with the screened base neatline to avoid a double neatline in printing. If this registration of neatlines is not precise, the base neatline should be deleted with the exception of the corner ticks. The mask will be cut between the neatline and the type that rims the neatline.

Cartography will instruct the printer to expose the culture negative twice--once with the collar of the mask in register with the culture negative, which will allow the culture and neatline to print less than 100%, and once with the collar and the biangle screen removed but with the inside of the mask over the map data and neatline on the culture negative. This treatment will allow the topographic border data to print solid (100%).

In the event that no separates are available and Cartography has a composite base to use as printer's copy, the screen percentage determination should be made on the density of the combined culture and relief and the detail of the geology shown on the map.

A guideline for selecting biangle screen percentages for bases to be used with thematic maps is as follows:

Screen a very dense culture or relief to print 30%
Screen a dense culture or relief to print 40%
Screen a culture or relief of medium density to print 50%
Screen a culture or relief of light density to print 60%
A very light culture or relief will print solid (100%)

Biangle screen percentages may change from map to map, and discretion must be used in selecting the appropriate screens for each culture and relief on each map.

(Example - roadfills which might be interpreted as faults should be screened 40% or even 30%.)

Specifications for 59-line (150 lines/in) biangle screens

(Optical density readings are minus the film's base fog density value.)

Screen Identification	Percent Range	Integrated Density	
		Aimpoint	Range
30%	30-34	.50	.52-.47
40%	37-41	.40	.43-.39
50%	47-51	.31	.33-.29
60%	59-63	.21	.23-.20

CARTOGRAPHIC TECHNICAL STANDARDS

Replaces T. S. P.		Subject: EXPLANATIONS Basic format for HYDROLOGIC explanations	T. S. Paper	8.04.1
Dated			Effective	6/29/79

Basic format.--On hydrologic map explanations, place the map symbols in a column to the left of the symbol names and descriptions. Place the title "EXPLANATION" in the visual center over the symbols and type; it should be 6.5 mm (0.25 in) above the first line of type.

Type.--Use SM-10 for "EXPLANATION" and SL-9 with 2-point leading for the symbol names and descriptions. Capitalize symbol names; set the description in lowercase. Use a long dash with a 3-unit space on both sides of the dash to separate the symbol name and its description. Indent the descriptive type overruns. Contour values will normally be set in UI-8; however, larger or smaller values may be more appropriate depending upon the number, line weight, and position of the contours and other map detail.

Indent 1 pica when the description requires two or more lines of type and indent subunit names one-half a pica. Do not justify the right margin, but keep it as straight as possible using a minimum of hyphenation.

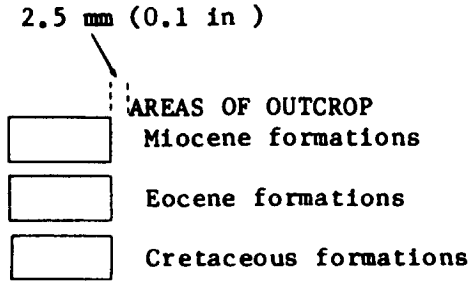
1-pica indention

CONTOURS - Show altitude of top of the various formations and the basement rocks. National Geodetic Vertical Datum of 1929

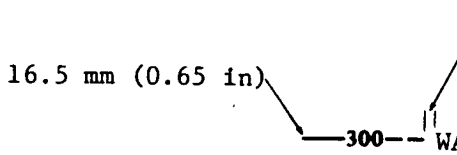
½ pica

BOUNDARIES
Lower Chesapeake Bay drainage basin in Virginia
Physiographic province
River basin

Boxes.--Where areal units are shown, use 14x6.5-mm (0.55x0.25-in) boxes. Place the boxes 2.5 mm (0.1 in.) from the names.



Symbols.--Make line symbols 16.5 mm (0.65 in) long, starting 1.2 mm (0.05 in) off the names.



WATER-LEVEL CONTOURS - Showing altitude of water level; dashed where approximate. Contour interval 10 feet; National Geodetic Vertical Datum of 1929

IRRIGATION WELLS

- ● Flowing
- ⌀ Not flowing
- o Not used

O INDUSTRIAL OR PUBLIC-SUPPLY WELLS

Example 1 (Based on HA-389)

EXPLANATION

ESTIMATED TRANSMISSIVITY, IN GALLONS PER DAY PER FOOT

- More than 150,000 - Possible well yields more than 1,000 gallons per minute with drawdowns generally less than 15 feet
- 50,000-150,000 - Possible well yields more than 1,000 gallons per minute with drawdowns generally more than 15 and less than 40 feet
- Less than 50,000 - Possible well yields less than 1,000 gallons per minute with drawdowns generally more than 40 feet

——— AREA BOUNDARY

o IRRIGATION WELL

O PUBLIC WELL

ϕ ABANDONED WELL

Replaces

T. S. Paper No. 8.04.1(3)

Example 2 - (Based on HA-284)

EXPLANATION

AREAS OF OUTCROP

Miocene formations

Eocene formations

Cretaceous formations

CONTOURS- Showing altitude of top of the various formations and the basement rocks. National Geodetic Vertical Datum of 1929.

—400— Miocene formations - Dashed where approximately located; contour interval 100 feet

—300— Eocene formations - Dashed where approximately located; contour interval 100 feet

—500— Cretaceous formations - Dashed where approximately located; contour interval 100 feet

—700— Basement rocks - Dashed where approximately located; contour intervals 100 and 500 feet

AVAILABILITY OF GROUND WATER - from aquifers within the 20-mile squares shown on the map, in millions of gallons per day

Q=140 Quaternary

M=220 Miocene

E=27 Eocene

C=4 Cretaceous

B<1 Basement rocks

AREA WITHIN CRETACEOUS AQUIFERS WHERE CHLORIDE CONCENTRATION EXCEEDS 250 PARTS PER MILLION

WELL USED FOR CHEMICAL ANALYSIS-
number refers to text. For analysis, see sheet 2

•[1] Miocene formation

•[3] Eocene formation

•[6] Cretaceous formations

•[18] Basement rocks

BOUNDARIES

——·—— Lower Chesapeake Bay drainage basin in Virginia

—— —— Physiographic province

——·—— River basin

WATER RESOURCES DIVISION
PUBLICATIONS GUIDE

Replaces Article No.: | Effective Date: 2/15/74 | Article No.: 3.06.3

Subject: ILLUSTRATIONS -- Symbols - Geohydrologic map symbols

The geohydrologic map symbols that follow are for use on maps and in map explanations of Federal publications of the Geological Survey. Geohydrologic symbols follow geologic symbols in a map explanation; they should be grouped in the order of appearance in this article. The symbols are subdivided into four general groups: contours, lines, hydrologic data-site symbols, and miscellaneous symbols.

The symbols and descriptions of contours and lines include all levels of accuracy to be used; that is, solid lines for known locations and dashed lines for approximate locations. All contours and line symbols should be scribed in the specified lineweights and lengths.

Each map symbol is of distinctive geometric shape for a particular type of hydrologic data site: a circle for water wells, a circle with a "tail" for springs, a triangle for gaging stations, an inverted triangle for quality-of-water sites, and a diamond for weather stations.

Each group of hydrologic data-site symbols is divided into two subgroups: restricted and recommended. The restricted symbols must be used for the stated purpose. The recommended symbols may be used on maps to present data other than those described under the symbol headings. For example, a solid circle may be used to represent wells completed in bedrock and an open circle to represent wells completed in unconsolidated materials. However, if on the same map stock wells are shown, the symbol for stock wells (open circle) is recommended. In that instance a symbol other than an open circle would be used to represent wells in unconsolidated materials.

The use of symbols must be consistent on all maps within a report or within a related series of reports. The symbol restrictions apply only to maps. Any geometric shape may be used for symbols on illustrations other than maps. On maps where the plotted symbols are congested and difficult to interpret, insets at enlarged scales permit detailed plotting of the symbols.

All miscellaneous symbols are restricted and, therefore, must be used for the stated purpose.

CONTOURS

Used only in reference to altitude. Line widths (scribed): for index contours use 0.015 inch; for intermediate contours use 0.008 inch. Use 0.2-inch dashes with 0.02-inch space between dashes for approximate contours. Listed below are descriptions of commonly used contours in the format to be used for map explanations.

SYMBOL	DESCRIPTION
——100——	STRUCTURE CONTOUR -- Shows altitude of (top or base of, or horizon within) (stratigraphic unit, aquifer, or confining bed). Dashed where approximately located. Contour interval (number) (units). Datum is sea level
——50——	BEDROCK CONTOUR -- Shows altitude of bedrock surface. Dashed where approximately located. Contour interval (number) (units). Datum is sea level
——200——	WATER-TABLE CONTOUR -- Shows altitude of water table, (date). Dashed where approximately located. Contour interval (number) (units). Datum is sea level NOTES: 1. To be used only in reference to unconfined (water-table) conditions. 2. Date can be omitted from description if date given in map title.
——500——	POTENTIOMETRIC CONTOUR -- Shows altitude at which water level would have stood in tightly cased wells, (date). Dashed where approximately located. Contour interval (number) (units). Datum is sea level NOTES: 1. To be used in reference to either confined (artesian) or unconfined conditions. 2. To be used when both confined and unconfined conditions are not differentiated on the same map. 3. POTENTIOMETRIC CONTOUR is preferred. WATER-LEVEL CONTOUR is permitted. 4. Date can be omitted from description if date given in map title.
——1000——	WATER-QUALITY-ZONE CONTOUR -- Shows altitude of (top or base of, or horizon within) (type of water-quality zone or types of water in an aquifer), (date). Dashed where approximately located. Contour interval (number) (units). Datum is sea level NOTE: Date can be omitted from description if date given in map title.

LINES

Used when no reference is made to altitude. Terms prefixed by "ISO" are not recommended. Line widths (scribed) and dashes have same specifications as for contours. Listed below are descriptions of commonly used lines in the format to be used for map explanations.

SYMBOL	DESCRIPTION
———24———	LINE OF EQUAL (AVERAGE, MEAN, MEDIAN, ETC.) (ANNUAL, MONTHLY, DAILY, ETC.) PRECIPITATION, (DATE)* -- Dashed where approximately located. Interval (number) (units) NOTE: Date can be omitted from description if date given in map title.
———100———	LINE OF EQUAL DEPTH TO (GEOLOGIC FORMATION, BEDROCK, AQUIFER, WATER, ETC.), (DATE)* -- Dashed where approximately located. Interval (number) (units). Datum is land surface NOTES: 1. Date needed only for parameters that vary with time. 2. Date can be omitted from description if date given in map title.
———50———	LINE OF EQUAL THICKNESS OF (GEOLOGIC FORMATION, AQUIFER, CONFINING BED, SATURATED MATERIAL, ETC.), (DATE)* -- Dashed where approximately located. Interval (number) (units) NOTES: 1. Date needed only for parameters that vary with time. 2. Date can be omitted from description if date given in map title.
———10———	LINE OF EQUAL WATER TEMPERATURE, (DATE)* -- Dashed where approximately located. Interval (number) degrees Celsius NOTE: Date can be omitted from description if date given in map title.
———2000———	LINE OF EQUAL SPECIFIC CONDUCTANCE, (DATE)* -- Dashed where approximately located. Interval (number) micromhos per centimeter at 25 degrees Celsius NOTE: Date can be omitted from description if date given in map title.

*Show date in figure title.

SYMBOL	DESCRIPTION
———500———	LINE OF EQUAL (DISSOLVED-SOLIDS CONCENTRATION, HARDNESS, OR CHEMICAL-CONSTITUENT CONCENTRATION), (DATE)*-- Dashed where approximately located. Interval (number) (milligrams per liter or milliequivalents per liter) NOTE: Date can be omitted from description if date given in map title.
———20———	LINE OF EQUAL WATER-LEVEL (CHANGE, RISE, OR DECLINE), (DATE)*-- Dashed where approximately located. Interval (number) (units) NOTE: Date can be omitted from description if date given in map title.
———6———	LINE OF EQUAL RUNOFF, (DATE)*-- Dashed where approximately located. Interval (number) (units) or Interval (number) (flow unit) per (area unit) NOTE: Date can be omitted from description if date given in map title.
———10,000———	LINE OF EQUAL (TRANSMISSIVITY, HYDRAULIC CONDUCTIVITY, POROSITY, ETC.) -- Dashed where approximately located. Interval (number) (units)

*Show date in figure title.

WATER WELLS

Basic shape is a circle— ○

RESTRICTED SYMBOLS

DESCRIPTION	SYMBOL	SYMBOL WITH BASIC SHAPE	NOTES
Flowing artesian well			1. Supplemental information can be shown inside or on the periphery of these symbols. 2. Symbol should be centered over the data site.
Nonflowing artesian well			
Recharge or waste-injection well			
Observation well			
Observation well equipped with a recorder	R	R	
Dry well			
Destroyed well			
Test hole			

RECOMMENDED SYMBOLS

DESCRIPTION	SYMBOL	NOTES
Well used for domestic-water supply	●	1. Can be used in combination with the above. 2. Supplemental information can be shown on the periphery of these symbols
Well used for stock-water supply	○	
Well used for irrigation-water supply	◎	
Well used for industrial-water supply	◉	
Well used for public-water supply	○	
Unused well	⊕	

SPRINGS

Basic shape is a circle with a "tail"— 
The "tail" to point in direction of flow.

RESTRICTED SYMBOLS

DESCRIPTION	SYMBOL	SYMBOL WITH BASIC SHAPE	NOTES
Thermal spring	T		1. Supplemental information can be shown inside or on the periphery of these symbols 2 Symbol should be centered over the data site.
Mineral spring	M		
Extinct spring			

RECOMMENDED SYMBOLS

DESCRIPTION	SYMBOL	NOTES
Spring used for domestic-water supply		1. Can be used in combination with the above 2. Supplemental information can be shown on the periphery of these symbols.
Spring used for stock-water supply		
Spring used for irrigation-water supply		
Spring used for industrial-water supply		
Spring used for public-water supply		
Unused spring		

GAGING STATIONS

Basic shape is a triangle—△

RESTRICTED SYMBOLS

DESCRIPTION	SYMBOL	SYMBOL WITH BASIC SHAPE	NOTES
Gaging station equipped with a telephone or radio			1 Supplemental information can be shown inside or on the perimeter of these symbols 2. Symbol should be centered over the data site when used alone. Combined triangles should be centered over the data site when quality-of-water data are obtained at a gaging station. 3 Gaging-station symbol should be placed above and adjoin, the quality-of-water triangle when quality-of-water data are obtained at a gaging station
Peak-flow measurement station			
Low-flow measurement station			
Stage-measurement station			

RECOMMENDED SYMBOLS

DESCRIPTION	SYMBOL	NOTES
Continuous-record gaging station		1. Can be used in combination with the above 2 Supplemental information can be shown on the perimeter of these symbols
Partial-record gaging station (floods)		
Measurement site without a gage		
Discontinued gaging station		

QUALITY-OF-WATER SITES

Basic shape is an inverted triangle — ▽

RESTRICTED SYMBOLS

DESCRIPTION	SYMBOL	SYMBOL WITH BASIC SHAPE	NOTES
Chemical-measurement site	⁄	▽	1. Supplemental information can be shown inside or on the perimeter of these symbols. 2. Symbol should be centered over the data site when used alone. Combined triangles should be centered over the data site when quality-of-water data are obtained at a gaging station. The circle should be centered over the data site when quality-of-water data are obtained at a well or spring. 3. Quality-of-water symbol should be placed beneath, and adjoin, the gaging-station triangle or the circle when quality-of-water data are obtained at a gaging station, well, or spring.
Temperature-measurement site	\	▽	
Biological-measurement site	— (extension of top line to left)	▽	
Sediment-measurement site	— (extension of top line to right)	▽	

RECOMMENDED SYMBOLS

DESCRIPTION	SYMBOL	NOTES
Active site	▼	1. Can be used in combination with the above 2. Supplemental information can be shown on the perimeter of these symbols.
Active site equipped with a monitor	▽	
Inactive site	▽	

WEATHER STATIONS

Basic shape is a diamond divided into four parts— 

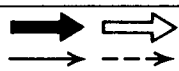
RESTRICTED SYMBOLS

DESCRIPTION	SYMBOL	SYMBOL WITH BASIC SHAPE	NOTES
Weather station equipped with a recorder	R		1. Supplemental information can be shown inside or on the periphery of these symbols 2. Symbol should be centered over the data site
Weather station equipped with a telephone or radio			

RECOMMENDED SYMBOLS

DESCRIPTION	SYMBOL	NOTES
Complete weather station		1. Can be used in combination with the above. 2. Supplemental information can be shown on the perimeter of these symbols.
Snow-survey course		
Weather stations where the following types of measurements are obtained:		
Precipitation		
Evaporation		
Temperature		
Humidity		
Solar radiation		
Wind velocity		
Discontinued weather station		

MISCELLANEOUS RESTRICTED SYMBOLS

DESCRIPTION	SYMBOL	NOTES
Basin boundary (surface water)		
Subbasin boundary (surface water)		
Ground-water divide		Open symbol where approximately located
Ground-water barrier (geologic)		
Infiltration gallery		
Direction of ground-water flow		Open or dashed symbol where approximately located.

WATER RESOURCES DIVISION
PUBLICATIONS GUIDE

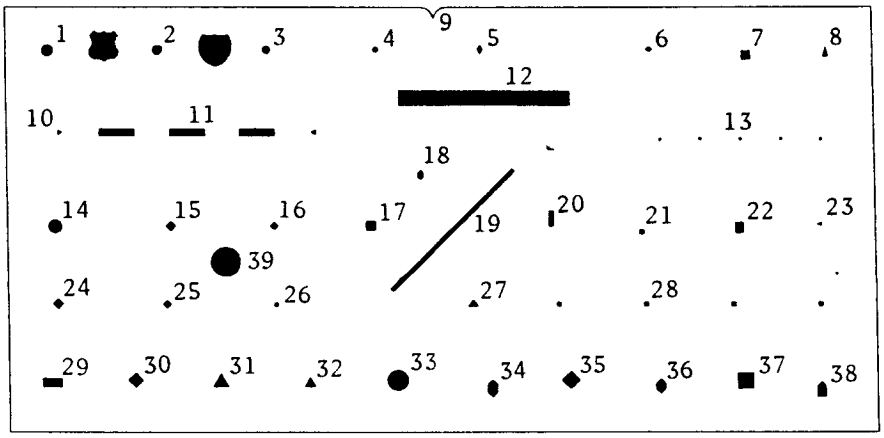
Replaces Article No.: | **Effective Date:** 11/1/73 | **Article No.:** 3.06.1

Subject: ILLUSTRATIONS -- Symbols - Geologic map symbols

Geologic map symbols recommended for publications of the Geological Survey are given in the following list. The symbols are arranged in order of usual appearance in an explanation, but the order may be altered for emphasis.

Line symbols are scribed on scribecoat or inked on positive material. Locational symbols may be scribed, inked, or attached by wax-backed film positives depending on the information to be shown and the material to be used.

The sequence for scribing symbols is keyed to the template numbers indicated below. For rectangular slots, L signifies use of the length or long side of the slot; W signifies use of the width or short side. For circles, a number followed by ($\frac{1}{2}$) signifies use of half the circle. For brackets, item 9 must be added to the template. A limited number of templates are available, at no charge, from the Office of Research and Technical Standards, Topographic Division, National Center, Reston, Va. 22092.



Standard geologic symbols used to create the symbols in the list are available on wax-backed film positives (stick-up). One sheet contains line symbols (lines, arrows, U/D); the other contains locational symbols (circles, triangles, crosses in various sizes). Cost per sheet is about $2.00 from regional offices of the Publications Division, Branch of Cartography: Eastern Region, National Center, Reston, Va. 22092; Central Region, Bldg. 20, Denver Federal Center, Denver, Colo. 80225; Western Region, 345 Middlefield Road, Menlo Park, Calif. 94025. An allotment number must be furnished with each order.

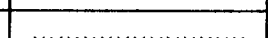
OUTCROPS

Line widths: All outcrop line widths .006 inch.

DESCRIPTION	SYMBOL	NOTES	
Bedrock outcrop		Solid or pattern 226 (horizontally)	Solid where mapped; patterned where too abundant to map separately. Generally shown in red on surficial geologic maps and screened black or gray on bedrock maps
Limit of outcrop	 HT15 HT30	Pattern HT15 or HT30 (use finer pattern for maps with large areas)	Used on detailed bedrock maps where soil and surficial deposits conceal much of surface. Outcrop area generally shown without contact except on detailed large-scale maps

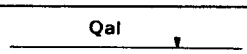
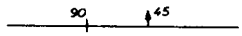
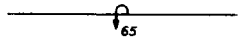
COAL AND OTHER ECONOMICALLY IMPORTANT BEDS

Line widths: Coal line widths generally .012 in.; .010 in. width in congested areas

DESCRIPTION	SYMBOL	NOTES	
Coal bed *Dashed where approximately located; short dashed where indefinite; dotted where concealed. Thickness of coal, in feet, measured at triangle*		Triangle height .1 in. width .05 in. Dashes .14 in. Short dashes .06 in. Dots .02 in. Space .02 in.	Letters designate coal bed. May be shown in color. Same width of line may be used for other economically important beds such as bentonite, phosphate, and limestone
Clinkered coal bed		Pattern 411 or 412	Shown in same color as coal bed and without contact

CONTACTS

Boundaries between geologic formations or other rock units. Symbols should be combined to fit available space where practical. Preferred phrasing when several types of contacts are mapped and combined in the explanation: *Dashed where approximately located; short dashed where inferred; dotted where concealed.* Contact line symbols signify accuracy of location or character of exposure; only solid line contacts used for maps at scales smaller than 1:125,000 (1:250,000; 1:500,000; 1:1,000,000). Generally solid line implies accuracy of placement within distance represented by 1/25 in. at scale of map. If symbols give engineering accuracy of location of contact, standard used in mapping should be given in italics. Coal and other economically important beds may also be used as contacts. Line widths: All contact line widths generally .005 in.; .004 in. in congested areas.

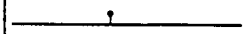
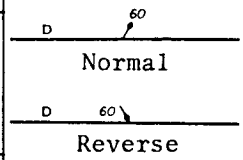
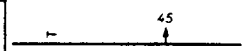
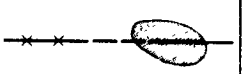
Contact		Template 8	Triangles indicate selected localities where contact was well exposed at time of mapping
Contact, showing dip		Template 37, 8 Template 35	If known, show top side of vertical contact by single arrow and 90
Overturned contact, showing dip		Template 1(1/2), 31, 8	
Contact, approximately located		Dashes .14 in. Space .02 in.	Not surely located within distance represented by 1/25 in. at scale of map
Indefinite contact		Dashes .06 in. Space .02 in.	Insufficient data to establish contact with certainity
Inferred contact			No data to establish contact but contact must be present
Gradational contact			Continuous change from one lithology or rock type to another. Contact arbitrary
Concealed contact		Dashes .02 in. Space .02 in.	Must be beneath mapped geologic units, water or ice. Symbols in parentheses indicate the concealed bedrock
Contact, located by ground magnetic survey		Dashes .22 and .06 in. Space .02 in.	Contacts determined by instrumentation or by other than conventional surface geologic methods may require special symbols for differentiation
Contact, located by airborne magnetic survey		Dashes .22 and .06 in. Space .02 in.	

FAULTS

Same line conventions used for faults as for contacts. Preferred phrasing when several line conventions are used for faults and combined in the explanation: *Dashed where approximately located; short dashed where inferred; dotted where concealed; queried where doubtful.* U, *upthrown side*; D, *downthrown side*. Dips shown where observed or known. Line widths: Fault line widths generally .015 in.; .012 in. on complex maps. Relative importance of faults may be shown by different widths of lines and suitable explanations.

DESCRIPTION	SYMBOL	NOTES	
Fault	OWL CREEK FAULT		
Fault, showing dip	90 65	Template 37, 8 Template 35	
Fault, approximately located		Dashes .14 in. Space .02 in.	Not surely located within distance represented by 1/25 in. at scale of map
Inferred fault		Dashes .06 in. Space .02 in.	Evidence for fault only indirect
Probable fault	----?----?----?-	Dashes .06 in. Space .02 in. Space for ? .1 in.	Queries, spaced three or more dashes apart, indicate uncertainty of existence, not location. Probable is more definite than doubtful
Doubtful fault			
Concealed fault	.....	Dots .02 in. Space .02 in.	Must be concealed by overlying mapped geologic unit, water or ice
Hypothetical fault	.....?.....?.....?....	Dots .02 in. Space .02 in.	Existence from indirect geologic evidence; could be explained by causes other than faulting
Fault, located by ground magnetic survey		Dashes .22 and .06 in. Space .02 in.	
Fault, located by airborne magnetic survey		Dashes .22 and .06 in. Space .02 in.	
Fault, or lineament from aerial photographs *Not checked or identified on ground*		Dashes .22 and .06 in. Space .02 in.	
Lineament		Line width .012 in.	Used on small scale tectonic maps. Add lineament name where possible
Fault *Showing bearing and plunge of grooves, striations, or slickensides*	60	Template 29L, 5	Plunge measured in vertical plane. Identify type of evidence observed in italic statement
Fault *Showing dip and amount of displacement in feet.* U, *upthrown side;* D, *downthrown side*	80 D U	Template 37, 8	High angle, used in combination with dip arrow to indicate apparent normal or reverse movement. Where displacement is given, use vertical numbers

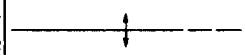
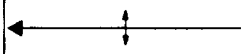
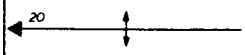
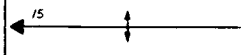
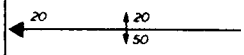
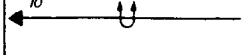
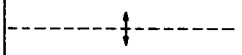
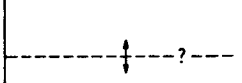
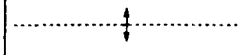
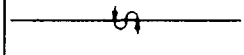
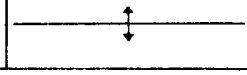
FAULTS (CON'T)

DESCRIPTION	SYMBOL	NOTES	
Fault *Bar and ball on downthrown side*		Template 22W, 4	Generally used where space does not allow U and D symbols without confusion; do not use bar and ball and U/D on same map
Fault *Showing relative horizontal movement*		Template 11, 39, 11, 39	
Fault *Showing bearing and plunge of slickensides on fault plane.* D, *downthrown side*		Template 29L, 5	
Normal fault *Hachures on apparently downthrown side*		Template 11	Used on tectonic maps or where space does not permit use of U and D
Reverse fault R, *upthrown side*			Angle of dip originally greater than 45° but precise value indeterminate. Hanging wall believed to have moved upward in respect to footwall
Thrust fault T, *upper plate*		Template 37, 8	Angle of dip originally less than 45°. Dip of fault, where known, shown by barbed arrow
Thrust fault *Sawteeth on upper plate*		Template 32	Symbol emphasizes fault; spacing of teeth may separate thrust faulting of different ages. May be limited to major thrust faults. Sawteeth may be spaced up to 0.5 in. apart on long thrust faults
Overturned thrust fault *Sawteeth in direction of dip; bar on side of tectonically higher plate*		Template 31, extend ends of triangle to fault	
Fault (shear or mylonite) zone, showing dip		Line width .005 inch Template 37, 8	Show relative movement by U and D or arrows
Fault breccia		Line width .005 inch Template 10 or Pattern 401	Extent may be outlined by faults or shown only where observed. Used as overprint for broad areas of fault breccia
Fault, intruded by dike		Template 7, 7	Use on small-scale black and white map or for narrow dike. On colored maps show dike in color and fault movement by U and D
Fault, intruded by dike		Template 7, 7 Pattern HT30	Use on large-scale black and white map for dike of sufficient width to be mapped. Former location of fault shown. Dikes usually shown in color
Subsurface fault		Dashing same as regular faults	Show in same color as structure contours where contours are offset along a dipping fault

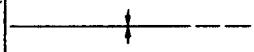
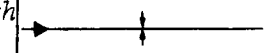
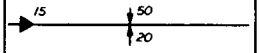
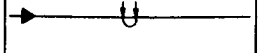
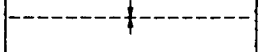
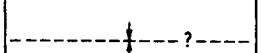
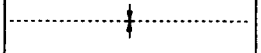
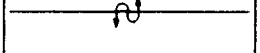
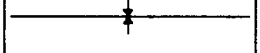
FOLDS

Same line conventions used for folds as for contacts and faults. Preferred phrasing when more than one line convention used for folds: *Dashed where approximately located; short dashed where inferred; dotted where concealed; queried where doubtful.* Line widths: Fold line widths .010 in.; .008 in. may be used if folds are congested.

ANTICLINES

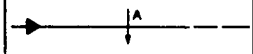
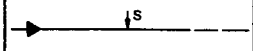
DESCRIPTION	SYMBOL	NOTES	
Anticline *Showing trace of crestal plane. Dashed where approximately located*		Template 11, 8, 8	On detailed geologic maps of asymmetric folding and high relief, trace of axial surface may be shown
Anticline *Showing trace of crestal plane and direction of plunge*		Template 31	
Anticline *Showing trace of crestal plane and plunge*			
Asymmetric anticline *Showing trace of crestal plane and plunge. Short arrow indicates steeper limb*		Template 11, 8 8	
Asymmetric anticline *Showing dip of limbs and plunge*			
Overturned anticline *Showing direction of dip of limbs and plunge*		Template 14(1/2), 37, 37, 8, 8	
Inferred anticline or Probable anticline		Dashes .06 in. Space .02 in.	Use inferred or probable, not both. Based on indirect geologic evidence; location probably not within distance represented by 1/25 in. at scale of map
Doubtful anticline		Dashes .06 in. Space .02 in.	Queries indicate doubt of existence of anticline from available data; location may also be in doubt
Concealed anticline		Dot .02 in. Space .02 in.	Must be beneath a mapped geologic unit or covered by water or ice. Not shown where extension of known anticline is obvious
Dome		Template 35, 35, 23 (4 times) Line width .005 inch	Generally used on small scale tectonic maps only
Inverted anticline		Template 1(1/2), 1(1/2), 37, 37, 8, 8	Beds inverted near trough
Antiform *Drawn on foliation, cleavage or bedding*		Template 29, 27, 27	Convex upward; structure in metamorphic rocks or in bedded rocks where tops are not known

SYNCLINES

DESCRIPTION	SYMBOL	NOTES	
Syncline *Showing trace of trough plane. Dashed where approximately located*		Template 11, 8 8 Dashes .14 in. Space .02 in.	On detailed geologic maps in areas of asymmetric folding and high relief, trace of axial surface may be shown
Syncline *Showing trace of trough plane and direction of plunge*		Template 31	
Syncline *Showing trace of trough plane and plunge*			
Asymmetric syncline *Showing trace of trough plane and plunge. Short arrow indicates steeper limb*		Template 11, 8, 8	
Asymmetric syncline *Showing dip of limbs and plunge*			
Overturned syncline *Showing direction of dip of limbs and direction of plunge*		Template 14(1/2), 37, 37, 8, 8	
Inferred syncline or Probable syncline		Dashes .06 in. Space .02 in.	Based on indirect geologic evidence. Location probably not within distance represented by 1/25 in. at scale of map
Doubtful syncline		Dashes .06 in. Space .02 in. Space for ? .10 in.	Queries indicate doubt of existence
Concealed syncline		Dot .02 in. Space .02 in.	Must be beneath mapped geologic unit or covered with water or ice. Not shown where extension of known syncline is obvious
Basin		Line width .005 in. Template 35, 35, 23 (4 times)	Generally used on small scale geologic maps only
Inverted syncline *Arrows show direction of dip of limbs*		Template 1(1/2), 1(1/2), 37, 37, 8, 8	Beds inverted near crest
Synform *Drawn on foliation, cleavage, or bedding*		Template 11, 27, 27	Convex downward: structure in metamorphic rocks or in bedded rocks where tops are known

MONOCLINES

May be classified as inferred, probable, doubtful, or concealed by same line conventions used for anticlines and synclines. Line widths: Make all line widths .010 in.

DESCRIPTION	SYMBOL	NOTES	
Monocline *Showing trace and direction of plunge. Dashed where approximately located*		Template 11, 8, 8	
Anticlinal bend *Showing trace and direction of plunge. Dashed where approximately located*		Template 11, 8 8	Use on large-scale detailed maps where anticlinal and synclinal bends diverge sufficiently to be mapped
Synclinal bend *Showing trace and direction of plunge. Dashed where approximately located*		Template 29, 8	

MINOR FOLD AXES

Line widths: Make all line widths .005 inch.

Minor anticline *Showing plunge*		Template 11, 1(1/2), 32	
Minor syncline *Showing plunge*		Template 11, 1(1/2), 32	Plunge measured in vertical plane
Minor fold axis *Showing plunge*		Template 11, 32	
Minor fold axis, horizontal		Template 11, 32, 32	
Minor folds *Showing plunge of axes*		Template 35, 8	Used where beds are too tightly folded to show axes of individual folds separately. Used to indicate sense of observed folds

PLANAR FEATURES

Planar symbols (strike and dip of beds, foliation or schistosity, and cleavage) can be combined with linear symbols to record data observed at same locality by superimposing symbols. Coexisting planar symbols are shown intersecting at point of observation. All combinations of planar and linear symbols used on map need not be shown in explanation. A statement "Planar and linear symbols may be combined" beneath PLANAR FEATURES AND LINEAR FEATURES in explanation is adequate. Examples of combined planar and linear features and coexisting planar features may be shown in explanation. Line width: Use .005 in. line width for all symbols.

ATTITUDE OF BEDS

DESCRIPTION	SYMBOL	NOTES	
Strike and dip of beds	45	Template 11, 11W	
Strike and direction of dip of beds			
Approximate strike and direction of dip of beds		Template 11, 11W, opaque center	
Strike and dip of beds *Top of beds known from sedimentary features*	30	Template 11, 11W, 4	Used only on maps where the top of beds is not always known
Strike and dip of overturned beds	65	Template 11, 1(1/2), 31, 31	
Strike and dip of overturned beds *Top of beds known*	65	Template 11, 1(1/2), 31, 31, 4	
Strike of vertical beds		Template 11, 11W	
Strike of vertical beds *Dot indicates top of beds*		Template 11, 11W, 4	
Component of dip *Dot marks point of observation*		Template 11, 4, 27	Do not use if symbols for lineation in metamorphic rocks are used on map
Horizontal beds		Template 30, 30, 14, opaque ends	
Strike and dip of beds and plunge of slickensides	60 40	Template 11, 11W, 29, 5	
Crumpled, plicated, crenulated, or undulatory beds and average dip	55	Template 15, 15 15, 15(side)	

FOLIATION OR SCHISTOSITY

Strike and dip of foliation	20	Template 11, 5(1/2)	
Strike and direction of dip of foliation			
Strike of vertical foliation *Relationship of foliation (or schistosity) to bedding not shown in outcrop*		Template 11, 5	
Horizontal foliation		Template 35, 35, 15	
Strike and dip of foliation and parallel bedding	10	Template 11, 22W, 25	

FOLIATION OR SCHISTOSITY (CON'T)

DESCRIPTION	SYMBOL	NOTES	
Strike of vertical foliation and parallel bedding		Template 11, 22L, 29L, 15	
Strike and dip of foliation and parallel overturned bedding		Template 11, 1(1/2), 35, 22L, 8	
Horizontal foliation and bedding		Template 30, 30, 33, 25	
CLEAVAGE			
Strike and dip of cleavage		Template 11, 11W, 11W	
Strike of vertical cleavage		Template 11, 11W, 11W	
Horizontal cleavage		Template 30, 30, 22(4 times)	
Inclined Vertical Horizontal		Template: as shown above for similar symbols	Contrasting symbols can be used to distinguish between different kinds of planar structures (slip cleavage, compositional layering, flow structure). Type of planar structure should be specified in explanation

LINEAR FEATURES

May be combined with the above planar symbols as shown. Symbols are joined at point of observation.

Bearing of plunge of lineation		Template 11, 8	
Vertical lineation		Template 32, 32	Use open symbol in combination with line symbols
Horizontal lineation		Template 11, 8, 8	
Strike and dip of foliation and plunge of lineation		Template 11, 10, 29, 23	
Vertical foliation showing horizontal lineation		Template 11, 8, 8, 5	
Strike and dip of foliation showing horizontal lineation		Template 11, 8, 8, 5(1/2)	
Strike and dip of beds and plunge of lineation		Template 11, 11W, 29, 23	
Vertical foliation and vertical lineation		Template 5, 11	
Strike of vertical foliation showing plunge of lineation		Template 11, 8, 5	
Vertical beds showing horizontal lineation		Template 11, 22L, 8, 8	
Horizontal beds, showing trend of horizontal lineation		Template 11, 22L, 14, 8, 8	

LINEAR FEATURES (CON'T)

DESCRIPTION	SYMBOL	NOTES	
Vertical beds showing plunge of lineation		Template 11, 22L, 23	
Approximate strike of folded beds showing plunge of fold axes		Template 15, 15, 15, 22W	
Attitude of foliation and overturned beds, strikes parallel but dips differ		Template 11, 1(1/2), 29L, 22W, 8	
Double lineation		Template 11, 10, 29, 29, 23, 23	
Strike and dip of beds intersecting slip cleavage		Template 11, 11W, 11W, 11, 11W	
Strike and dip of beds intersecting slip cleavage		Template 11, 11W (3 times)	

JOINTS

Open symbols may be contrasted with closed symbols to separate unmineralized and mineralized joints.

Strike and dip of joints		Template 11, 15(1/2)	
Strike and direction of dip of joints			
Strike of vertical joints		Template 11, 15	
Horizontal joints		Template 15	
Strikes and dips of multiple joints		Template 11 (3 times), 11(1/2) (3 times)	

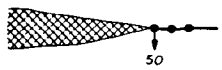
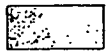
CONTOURS AND ISOPLETHS

Generally printed in red or other contrasting color but may be shown in black where the basic geology and base map are simple. Label and make every 5th contour heavier. May be used for many kinds of geologic data. In geophysical maps give nature of contoured data in map title. Line widths: Use .015 in. line width for heavy (index) contours and .008 in. for light (intermediate) contours.

DESCRIPTION	SYMBOL	NOTES	
Structure contours *Drawn on top (or base) of geologic horizon. Dashed where control is poor. Contour interval 20 feet. Arrow indicates direction of dip*	2000	Dashes .20 inch Space .02 inch Template 37, 8	Structure contours not shown as concealed; may be omitted in areas of no information. Arrows used only where index contours fail to show dip
Outcrop point *Used for structural control*	x		
Magnetic contours *Showing total intensity magnetic field of the earth in gammas relative to arbitrary datum. Hachured to indicate closed areas of lower magnetic intensity, dashed where data are incomplete. Contour interval 20 gammas*	2000	Dashes .20 inch Space .02 inch Hachures: line width same as light contours Length of tick: .05 inch	Show at least two hachures on small closed contours; otherwise use .7 inch space between hachures
Maximum or minimum intensity *Location measured within closed high or closed low*	x 2864		
Flight Path *Showing location and spacing of data*		Line width .005 inch Length .25 inch	Space as shown by author
Isoradioactivity contours (or isorads) *Interval 50 counts per second* (airborne survey). *Interval 50 microroentgens per hour* (ground surveys)			
Gravity contours (or Isogals) *Dashed where control is poor. Contour interval 1 milligal*			
Gravity station and number	.635	Template 4	
Isopachs *Dashed where control is poor. Interval 10 feet*			
Mineral isograds *Metamorphic zones indicated by mineral names*	SILLIMANITE / STAUROLITE		

VEINS, ORE, WALLROCK ALTERATION, AND DIKES

Shown in color, generally red, only where necessary to differentiate types and grade.

DESCRIPTION	SYMBOL	NOTES	
Vein, showing dip		Line width .015" Template 3(dots) Pattern 406 Template 37, 8	Give mineralogy and grade of mineralization in percent metal or oxide, or oz. per ton by notes. Can also be shown in solid
Ore body		Line width .005" Pattern 406	
Mineralized stringers or veinlets		Line width .010" Template 3	
Altered wallrock *Showing intensity of alteration by concentration of dots*		Pattern by hand	
Dike		Line width .015"	May be shown in color without x's when essential to distinguish different rock types

ORE IN SEDIMENTARY ROCKS AND SEDIMENTARY FEATURES CONTROLLING ORE DEPOSITION

Strike of roll *Showing geometric configuration in cross section*		Template 11, 14(1/2), 30, 30, 23, 23	Explain configuration by note
Direction of plunge of cross-stratification in sandstone *Showing direction of flow of depositing stream*			
Fossil Log		Template 11	
Lineation trend			
Festoon trend			

SURFACE OPENINGS AND EXPLORATION - LARGE-SCALE MAPS

Symbols drawn to scale on large-scale maps. Line width .005 inch.

Vertical shaft			
Inclined shaft			
Portal or adit			
Portal and open cut			
Trench			
Prospect pit or open cut			
Mine dump			

SURFACE OPENINGS AND EXPLORATION - LARGE-SCALE MAPS (CON'T)

DESCRIPTION	SYMBOL	NOTES	
Drill hole *Showing name and number*	PAHUTE 2		
Drill hole *No geologic data available*	ND		
Diamond drill hole	DDH		
Drill hole, low-grade ore			Give definition of low and high grade in explanation
Drill hole, high-grade ore			
Drill hole, inclined *Showing bearing and inclination; surface position and altitude; vertical projection of bedrock surface, bottom of hole, and thickness of overburden; and length of hole, in feet*	45° 3620 45		Combine drill-hole collar symbols as required with vertical projection to map

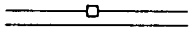
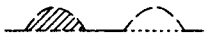
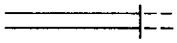
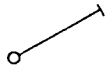
SURFACE OPENINGS AND EXPLORATION - SMALL-SCALE MAPS

Symbols not drawn to scale on map. Vary size of symbols with density of data.

Shaft			
Abandoned shaft	A		
Inclined shaft			
Tunnel, adit, or slope			
Inaccessible tunnel, adit, or slope			
Strip mine		Pattern 226 @ 45°	Pattern shows stripped area
Trench			
Prospect pit or outcrop			
Sand, gravel, clay, or placer pit			
Abandoned sand, gravel, clay, or placer pit			
Mine, quarry, glory hole, or open pit			
Abandoned mine, quarry, glory hole, or open pit			

UNDERGROUND WORKINGS AND EXPLORATION

Symbols drawn to scale on large-scale maps.

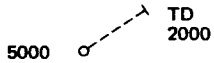
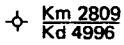
DESCRIPTION	SYMBOL	NOTES	
Shaft at surface			
Shaft, above and below surface			
Bottom of shaft			Show bottom of sump by note on map of lower level
Inclined workings, above and below level *Chevrons point down*			Spacing of chevrons may indicate steepness; place at regular intervals -5, 10, 20, etc., ft.
Winze or head of raise			
Raise or winze extending through level			
Raise or foot of winze			
Ore chute			
Stope			Can be explained by note, "Stoped above" or "Stoped below"
Elevation of roof or back			
Elevation of floor or sill			
Lagging or cribbing along drift			
Saved or otherwise inaccessible workings			
Drill hole			Give inclination of hole + or - in degrees in note and show vertical projection of bottom of hole to map

OIL AND GAS WELLS

Symbols for wells drilled for oil and gas are made up of seven compatible basic symbols which may be superimposed as necessary to show reported conditions

Drilling well or Well location			
Dry hole or Abandoned well			
Gas well			
Oil well			
Show of gas			
Show of oil			

OIL AND GAS WELLS (CON'T)

DESCRIPTION	SYMBOL	NOTES	
Shut in well			
Well *Showing vertical projection of bottom of hole, total depth, and surface altitude*			
Dry hole *Showing formation and altitude at surface, formation at bottom of hole, and total depth*			

WATER RESOURCES DIVISION
PUBLICATIONS GUIDE

Replaces Article No.: | Effective Date: 10/5/73 | Article No.: 3.06.2

Subject: ILLUSTRATIONS -- Symbols - Geologic letter symbols

Letter symbols are used by the U.S. Geological Survey on geologic maps and sections and in the explanations for each to identify geologic units. The symbols consist of a standard letter symbol, representing the system or era, followed by one or more lowercase letters, representing the formation or member.

Standard letter symbols are:

Quaternary	Q	Devonian	D
Tertiary	T	Silurian	S
Cretaceous	K	Ordovician	O
Jurassic	J	Cambrian	Є
Triassic	Ŧ	Precambrian	pЄ
Permian	P	Cenozoic	Cz
Pennsylvanian	IP	Mesozoic	Mz
Mississippian	M	Paleozoic	Pz

The letter symbol C can be used to designate the Carboniferous Systems if the Pennsylvanian and Mississippian Systems are not differentiated on the map or section.

The lowercase letter following the standard letter symbol generally is the first letter of the formation name, such as Tc for Calvert Formation of Tertiary age. For formation names consisting of two words, such as Fort Union Formation, the symbol can be Tf or Tfu. The shorter lowercase-letter usage (Tf), if not duplicated elsewhere on the map or section, is preferred to keep the symbol from being unnecessarily long. Where members are mapped, the letter symbol generally consists of the standard letter symbol, followed by the first letter of the first part of the formation name, followed by the first letter of the member name, such as Tfl for Lebo Shale Member of the Fort Union Formation. Series and group names are not generally indicated in the symbol. The symbol for a mapped unit that is identified by rock type instead of a formal name as a rule contains the first letter or first two letters of the rock type, as for example, pЄg or pЄgn for gneiss of Precambrian age.

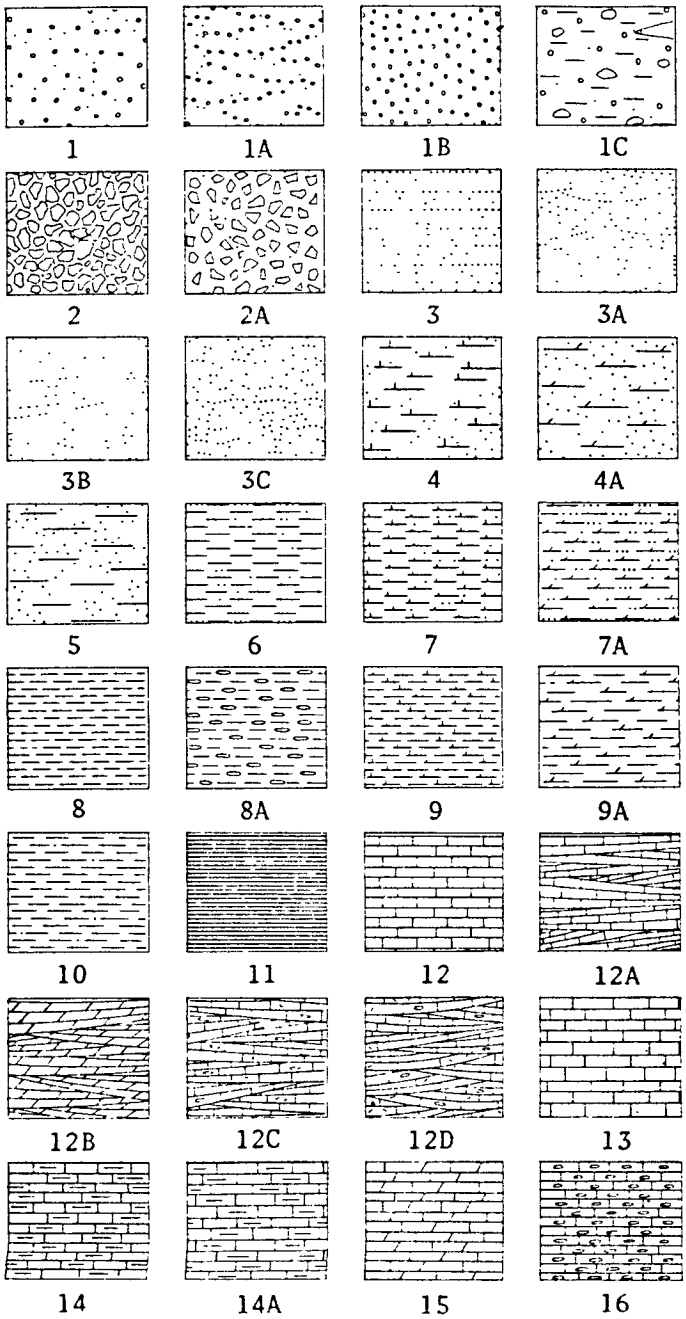
More than three letters for the complete symbol, including the age designation, should be used only where necessary for distinction of units on the map or section. Symbols are not recommended for use in the text part of a report.

Reference: Cohee, G. V., 1970, Stratigraphic nomenclature in reports of the U.S. Geological Survey: U.S. Geol. Survey adm. rept.

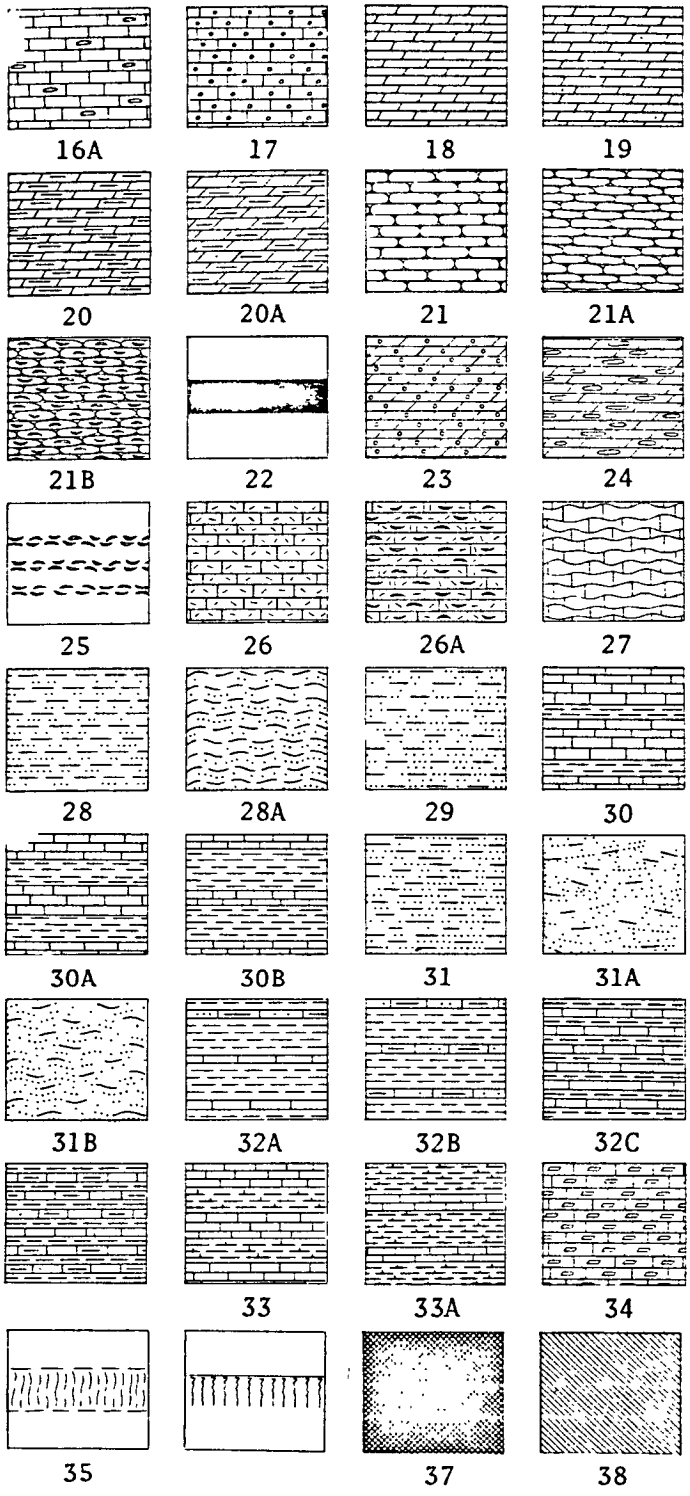
BRANCH OF TECHNICAL ILLUSTRATIONS
TECHNICAL STANDARDS SECTION

Replaces T.S. Paper		Effective Date	11/1/71	T.S. Paper No.	12.02.3
Subject	SECTIONS - Sedimentary lithologic patterns for columnar sections				

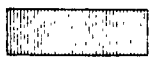
These patterns are generally accepted for columnar sections. Use the definitions as guidelines for selecting patterns for lithologic cross sections and other illustrations.



1 Gravel or conglomerate
1A Crossbedded gravel or conglomerate
1B Gravel or conglomerate
1C Drift
2 Breccia
2A Breccia
3 Sand or sandstone
3A Crossbedded sand or sandstone
3B Crossbedded sand or sandstone
3C Ripple-bedded sand or sandstone
4 Calcareous sandstone
4A Dolomitic sandstone
5 Argillaceous or shaly sandstone
6 Silt, siltstone, or silt shale
7 Calcareous siltstone
7A Dolomitic siltstone
8 Clay or clay shale
8A Cherty shale
9 Calcareous shale or marl
9A Dolomitic shale
10 Sandy or silty shale
11 Carbonaceous shale
12 Limestone
12A Crossbedded limestone
12B Crossbedded dolomite
12C Cherty crossbedded limestone
12D Cherty and sandy crossbedded clastic limestone
13 Sandy limestone
14 Argillaceous or shaly limestone
14A Silty limestone
15 Dolomitic limestone or limy dolomite
16 Cherty limestone

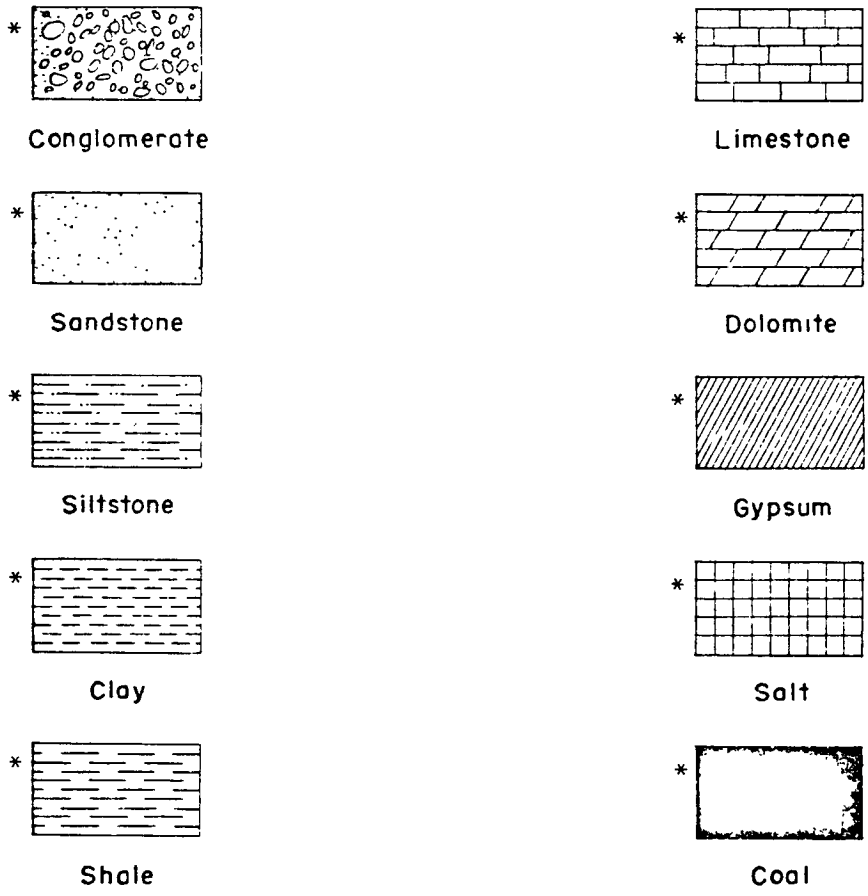


16A Cherty limestone
17 Oolitic limestone
18 Dolomite
19 Sandy dolomite
20 Argillaceous or shaly dolomite
20A Silty dolomite
21 Bedded chert
21A Bedded chert
21B Fossiliferous bedded chert
22 Coal
23 Oolitic dolomite
24 Cherty dolomite
25 Fossils
26 Clastic limestone
26A Fossiliferous clastic limestone
27 Nodular or irregularly bedded limestone
28 Interbedded sandstone and shale
28A Interbedded ripple-bedded sandstone and shale
29 Interbedded sandstone and siltstone
30 Interbedded limestone and shale (limestone dominant)
30A Interbedded limestone and shale
30B Interbedded shale and limestone (shale dominant)
31 Subgraywacke
31A Crossbedded subgraywacke
31B Ripple-bedded subgraywacke
32A Interbedded shale and limestone (shale dominant)
32B Interbedded shale and silty limestone (shale dominant)
32C Interbedded limestone and shale
32D Interbedded silty limestone and shale
33 Interbedded limestone and calcareous shale
33A Interbedded calcareous shale and limestone (shale dominant)
34 Limestone, irregular burrow(?) fillings of saccharoidal dolomite
35 Loess
36 Underclay
37 Flint clay
38 Gypsum

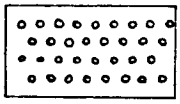


Asphalt
⊕ Siderite
⊙ Limonite
Phosphate
Glauconite
Bentonite

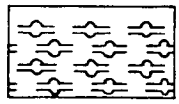
Symbols used for the general rock types



Symbols used to show variations of the general rock types

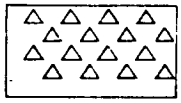


Oolitic

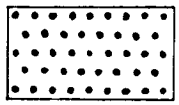


Diatomaceous

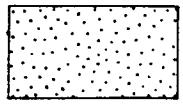
Carbonaceous

* 

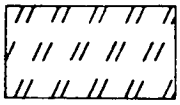
Cherty



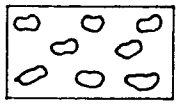
Phosphatic

* 

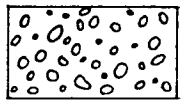
Sandy

* 

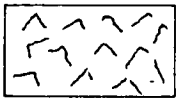
Gypsiferous



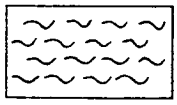
Concretionary

* 

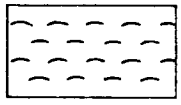
Conglomeratic

* 

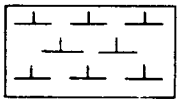
Quartzitic or silliceous



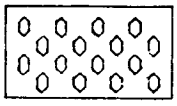
Glauconitic



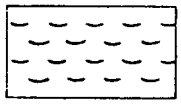
Fossiliferous (marine)

* 

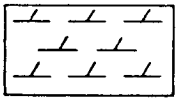
Calcareous



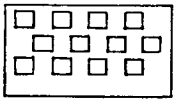
Micaceous



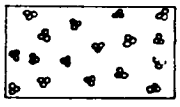
Fossiliferous (non-marine)

* 

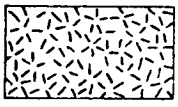
Dolomitic



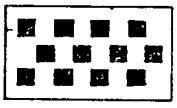
Pyritic



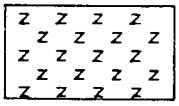
Microfossiliferous

* 

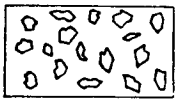
Feldspar



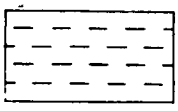
Ferruginous



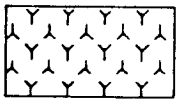
Plant fossiliferous

* 

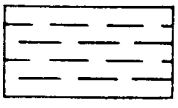
Brecciated

* 

Argillaceous

* 

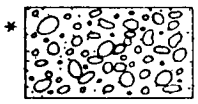
Tuffaceous

* 

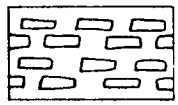
Shaley

Composite list of symbols used for the general rock types and their variations

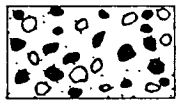
Conglomerate



Conglomerate



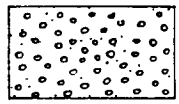
Intraformational



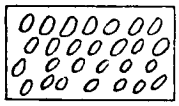
Glacial drift

Fanglomerate

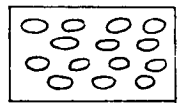
Agglomerate



Gravel



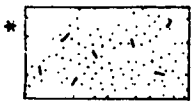
Edgewise conglomerate



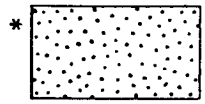
Bedded

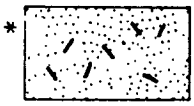
Sandstone

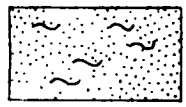

Sandstone


Feldspathic

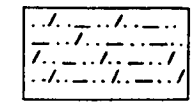

Diatomaceous

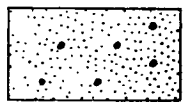

Massive

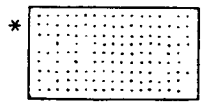

Arkose


Glauconitic

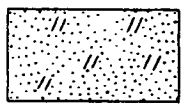

Cross-bedded

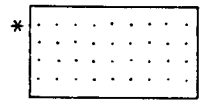

Graywacke

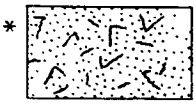

Phosphatic

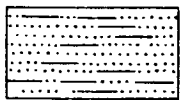

Thin-bedded

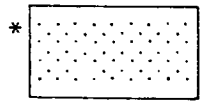

Quartzitic


Gypsiferous


Thick-bedded

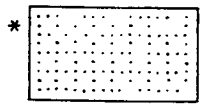

Quartzite

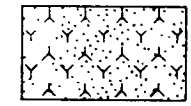

Silty

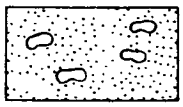

Regular bedded

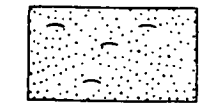

Tuffaceous

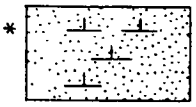

Shaley

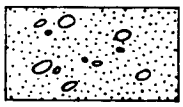

Irregular bedded

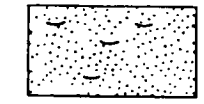

Tuff

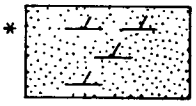

Concretionary

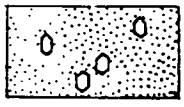

Fossiliferous (marine)

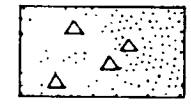

Calcareous

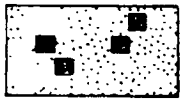

Conglomeratic


Fossiliferous (non-marine)

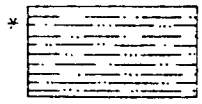

Dolomitic

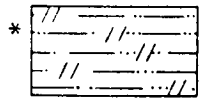

Micaceous

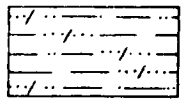


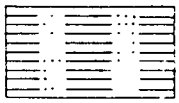


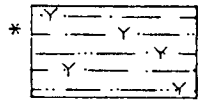
Siltstone

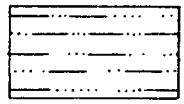

Siltstone

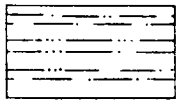

Gypsiferous

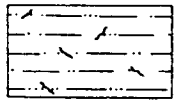

Graywacke


Regular bedded

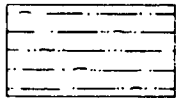

Tuffaceous

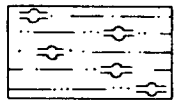

Sandy

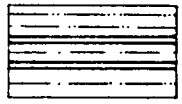

Irregular bedded

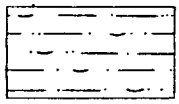

Quartzitic

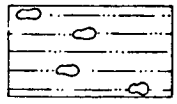

Phosphatic

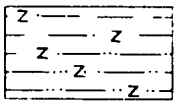

Fossiliferous (marine)


Diatomaceous

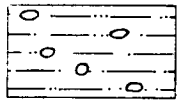

Carbonaceous

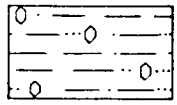

Fossiliferous (non-marine)

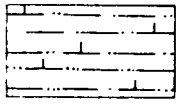

Concretionary

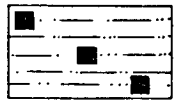

Fossil plants

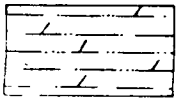

Loess

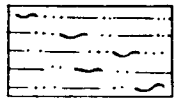

Conglomeratic


Micaceous


Calcareous


Ferruginous

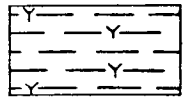

Dolomitic

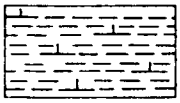

Glauconitic

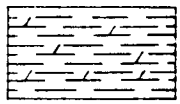
Clay

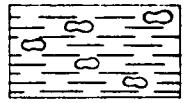

Clay

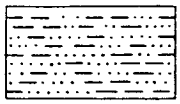

Calcareous shale

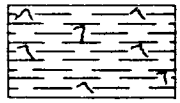

Tuffaceous shale


Marl

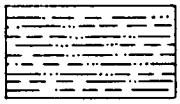

Dolomitic shale

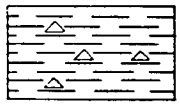

Concretionary shale


Sandy Clay

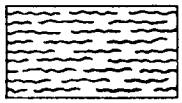

Siliceous shale

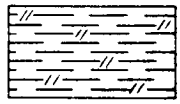

Ferruginous shale

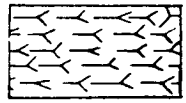

Silty Clay

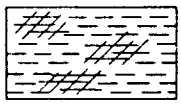

Cherty shale


Pyritic shale

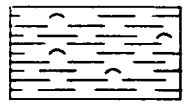

Mudstone

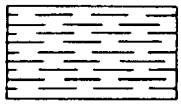

Gypsiferous

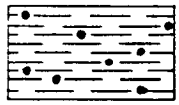

Bentonite

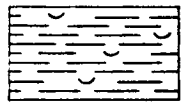

Flint or fire clay


Carbonaceous shale


Fossiliferous shale (marine)

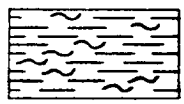

Shale

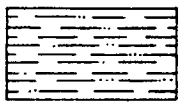

Phosphatic shale

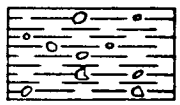

Fossiliferous shale (non-marine)


Sandy Shale

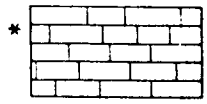

Diatomaceous shale

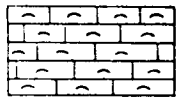

Glauconitic shale

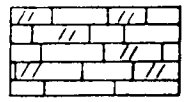

Silty Shale

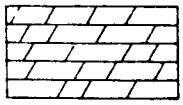

Conglomeratic shale

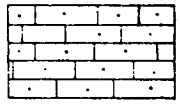
Limestone and dolomite

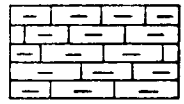

Limestone

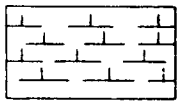

Coquina


Gypsiferous

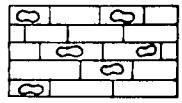

Dolomite

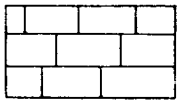

Sandy

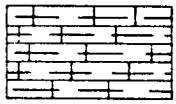

Argillaceous


Chalk

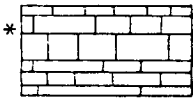

Silty

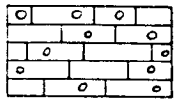

Concretionary


Massive

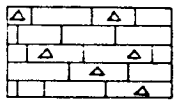

Shaley

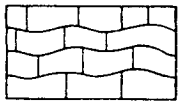

Carbonaceous

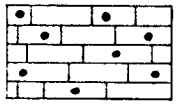

Irregular bedded

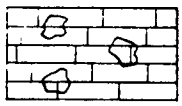

Oolitic

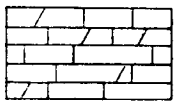

Thin-bedded

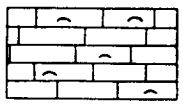

Cherty

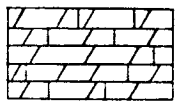

Wavy-bedded


Phosphatic


Brecciated

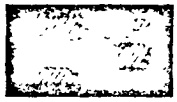

Dolomite limestone

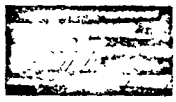

52419 Fossiliferous

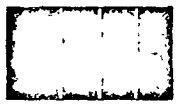

Calcareous dolomite

Coal, evaporites, and chert


Coal


Bony Coal

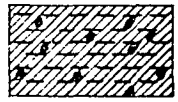

Bone


Cannel Coal

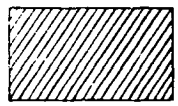

Cannel Shale

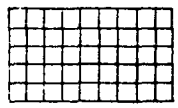

Oil Shale

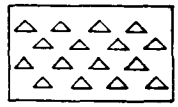

Carbonaceous shale


Peat


Lignite


Gypsum


Salt


Chert

TYPE PLACEMENT

B.T.I. INSTRUCTION SERIES

By Neil W. Maxfield

PLACEMENT OF TYPE ON GEOLOGIC MAPS

The quality of an illustration can be measured by the uniformity of type placement. Legible type placement makes the illustration useable; uniform type placement makes the useable illustration one of quality.

The placement of type and the positioning of lettering requires care, judgement, planned procedure, a knowledge of map composition, and an understanding of proportion and balance. Each name, and each symbol, must be placed to assure immediate and unmistakable identification of the feature with minimum interference with other map detail.

A map is usually read with north at the top, therefore, most names and labels should be positioned parallel to the south neatline (fig. 1). The exception to horizontal lettering is the labeling of diagonal linear features such as faults, anticlines, streams, and roads. When labeling a diagonal linear feature the type should read from south to north (fig. 2) but should not appear to be tipped over backwards. Linear-labeling should be positioned along an immaginary smooth line even when the feature being labeled is extremely crooked.

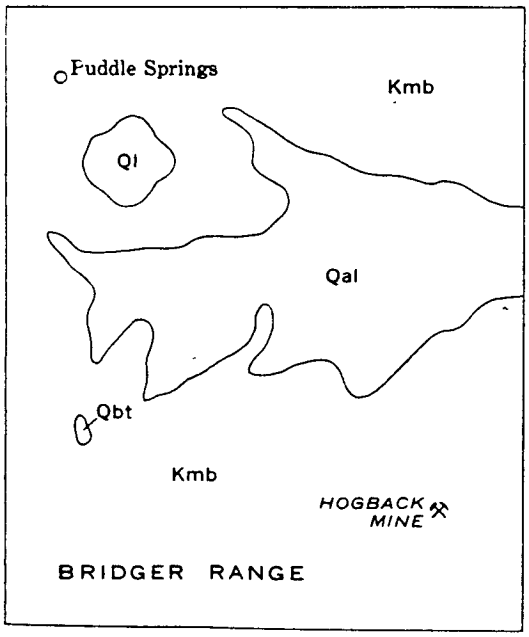


FIGURE 1

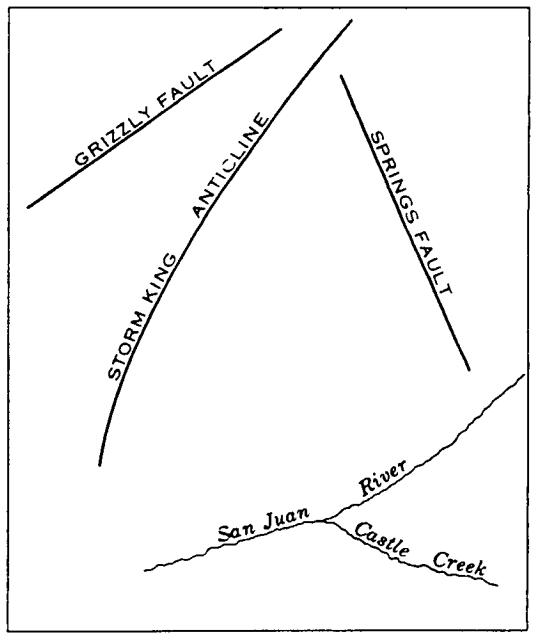
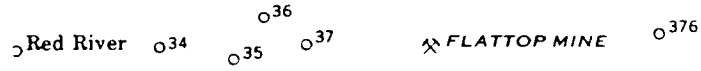
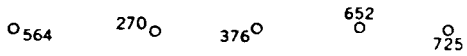


FIGURE 2

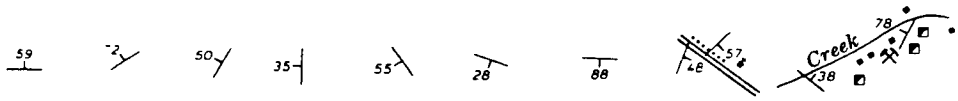
The legibility of type and symbols is essential to the reader but is not the only consideration. Preferred positioning, correct word spacing, consistant treatment, correct letter spacing and proper consideration in avoiding type and line overprints are important in the preparation of quality illustrations.



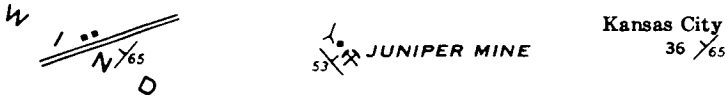
Preferred type placement for labeling small features or symbols is to the upper right. Avoid placing type in alignment with small symbols where the symbol could be read into the lettering.



If placement of type in the upper right is impracticable, the other locations that may be used are, in order of preference; lower right, upper left, lower left, centered above, and centered below. These are only alternatives and should not be used if type can be placed in the upper right position without interference with other map detail.

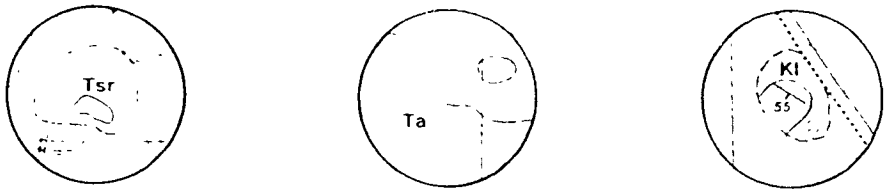


Strike and dip values should be placed so that the dip points to an imaginary dot in the center of the nearest number. Where dips are vertical (or nearly vertical) the entire value should be centered off the dip. Departure from this rule is permitted only when avoiding interference with other map detail. Except for those values that must be moved slightly to improve legibility, there should be a uniform space between dips and their values throughout the illustration.

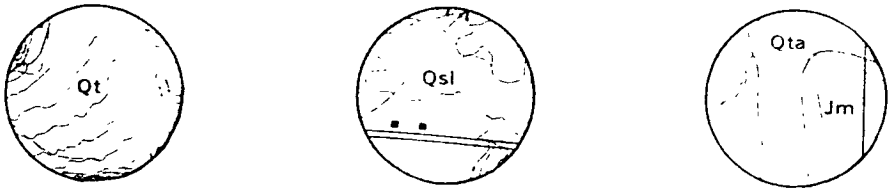


Placement of a dip value on the back side of the symbol is permitted only when placement on the dip side would interfere with other map detail. If, by placing the value on the dip side, it is too far from the symbol to be easily identified with the symbol, it should be placed on the back side.

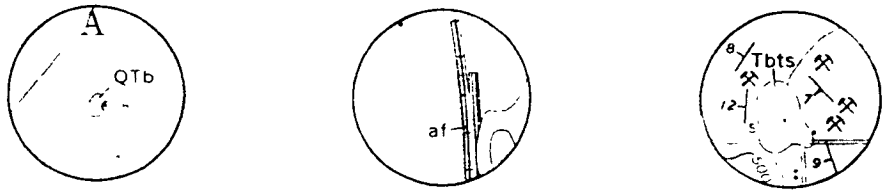
Formation symbols should be placed far enough apart within large units so as not to have duplication within ones immediate range of vision, yet there should be sufficient coverage so that it is not necessary to search for identification of the unit. Fewer formation symbols are needed on multicolor maps than on black and white maps because color will aid the reader in identification of units. Multicolor maps with good color contrast between units will require fewer formation symbols than those with very little color contrast between units. Black and white maps often have several units patterned with zip-a-tone to add prominence to certain units. If the map is black and white without any patterned units it may be necessary to label every area.



Preferred placement of formation symbols for small areas is centered within the area. Some small, colored areas are easily identified without labeling when the same formation is labeled nearby. If an objectionable overprint of other map detail would result by placing the formation symbol in the center of the area, the symbol should be moved. Do not overprint other type.

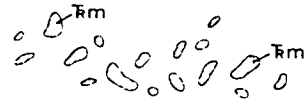


If line overprints are necessary to properly identify the area, one should consider the color of the line being overprinted and the line weight of the line being overprinted. In every case where overprinting a line is necessary, the best solution for type placement will be where there is minimum interference.



When formation symbols do not fit within the area to be labeled, place the formation symbol outside the area and leader it to the area. Leaders should point from an imaginary dot in the center of the first or last letter of the symbol. Leaders should be of uniform length (0.10") and weight (0.007") throughout the illustration. Leaders should only be placed vertically when it is not possible to leader from an angle. Vertical leaders should point from the center of the entire symbol.

Leaders should cross the contact at nearly right angles. If placed at exactly right angles it may be confused with a vertical dip; if placed too nearly parallel with the contact it may not be immediately identifiable as a leader. One third of the leader should be inside the area being labeled, unless a long leader must be used. Long leaders should be avoided but may be necessary, especially on black and white illustrations where so many formation symbols are necessary.



Avoid the use of multiple leaders, especially with multicolor illustrations. Consider the color contrast between the areas being labeled and the surrounding area. If the contrast is easily distinguished it is not necessary to label each area. If there is little or no contrast between areas, additional formation symbols are preferred to additional leaders unless it would overcrowd the area.

Avoid "Back-leadering". A leader should connect the area with the nearest part of the lettering.

Avoid leadering into a lined pattern in such a way that the leader runs the same direction as the pattern.

Do not place lettering so that it can be read into the label of another feature. Check against other overlays and base type.

LETTER SPACING

The spacing between letters should not exceed four times the individual letter height. Generally, lowercase stream names have one-point letterspacing. This facilitates cutting between letters for placement on curved lines. It is desireable to increase the spacing between letters of a ridge or valley name that is too short to properly identify the feature. Names of streams, ridges, valleys, anticlines, synclines, and faults, should always be cut and curved to fit the general curved direction of the feature.

WORD SPACING

Spacing between words helps to indicate the extent of the named feature. The components of the feature name should not be placed so far apart that their relationship is not immediately evident. For example, on a stream that is not long enough to justify two placements, the tendency is to spread the components widely to suggest the extent of the feature. This practice is justified only when the relationship and sequence of the component parts are evident at a glance. On a long feature it is preferable to repeat a name rather than overspread its parts. Where features are of such length that two or more labels are necessary, a larger space should appear between the successive placements than the space provided between the components of one name set. This is particularly applicable to roads, railroads, and streams.

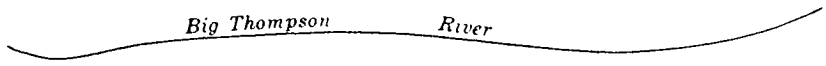
Words in a name are spaced equally unless there is a relationship between certain components. Less space should be allowed between related words than between words that are not related.

BIG ROCK FAULT
STORM KING ANTICLINE
Black Bear Mountain
San Juan River
North Fork Eagle Creek
North Fork Bald Eagle Creek

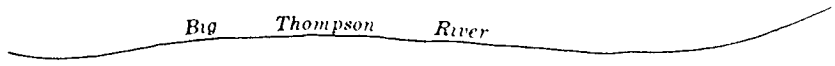
San Andres Limestone
Dewey Lake Redbeds
Central Basin platform
Burro Canyon Formation
Tiger Mountain Basin
Little Beaver Ridge

The significance of the words must be considered in proper placement of type.

Examples:



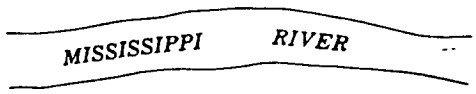
The name of this river is "Big Thompson"

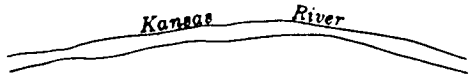


The name of this river is "Thompson". This placement of type implies that there are two Thompson rivers, this one being the larger.

The relationship between components should be maintained when it is necessary to place the name on two lines.

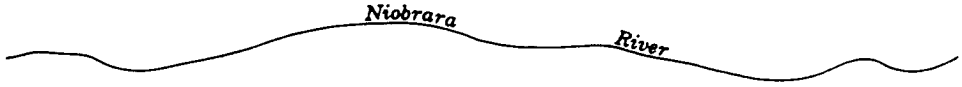
Example: Crown Hill Lake .....rather than..... Crown Hill Lake



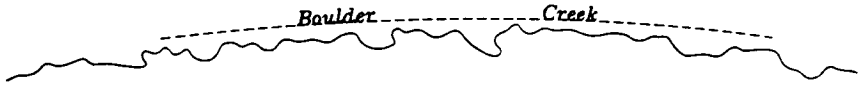


The name of a double-line stream is placed within the shoreline of the feature where space permits. Type must be placed entirely within or entirely outside the shoreline of the stream. Type placement above the stream is preferred to placement below the stream.

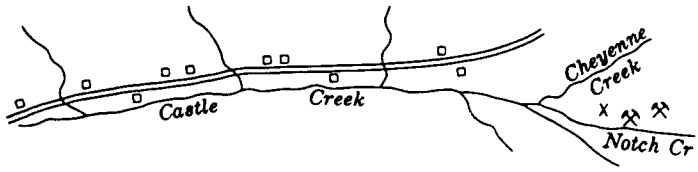
Stream names should be arranged in a smooth line, or curve, above the stream and within the center one-third of the length of the stream.



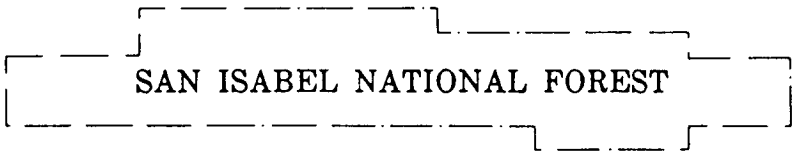
Stream names should be a consistent distance from streams and positioned to avoid compound curves in the type.



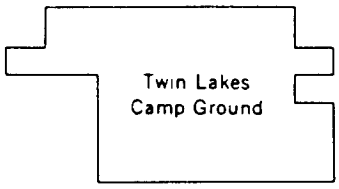
If the stream being labeled is extremely crooked, the stream name may follow the general direction of the stream to avoid cutting type into compound curves. This will also prevent sharp changes in direction of type.



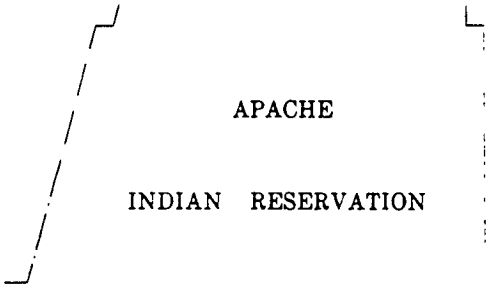
If it is necessary to label on the underside, all components of the name should be placed on the underside. If it is especially important that a short stream be labeled, it is permissible, as a last resort, to place part of the name above the line and the remaining part below the line. The words River and Creek may only be abbreviated as a last resort. Do NOT show periods if forced to abbreviate.



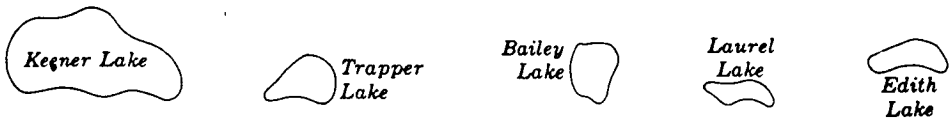
If the area is adequate in size, the lettering is placed within the feature boundaries, preferably centered, and in one line.



When the name consists of two or more words the lettering may be placed in two lines, depending upon the length of the name and the size and shape of the area. Lettering should not be shown in three lines unless there is no alternative.



Where area names are placed in two lines, the vertical separation between lines of type should not be greater than: (1) one-third of the length of the longer line of type; or (2) the length of the shorter line of type, whichever is less.



Names of lakes, reservoirs, ponds and swamps are arranged horizontally and placed within the limits of the feature if the feature is large enough. If space does not permit placement of type within the limits of the feature, the type may be placed to the right, left, top, or bottom, in that order of preference. When placing two or more lines of type to the side of a feature, align the type vertically on the side next to the feature. When placing two lines of type above or below the feature, center the second line beneath the first.

LIME CREEK VALLEY

Type that identifies an area or a broad feature does not have the immediate visual identification of a linear feature. It does not have a line to help the reader associate between the words and the feature. Therefore it is important that the words are not too widely separated. To assure immediate identification of the complete name of an area, or a broad feature, the space between components of the name should not be greater than the length of the longest word.

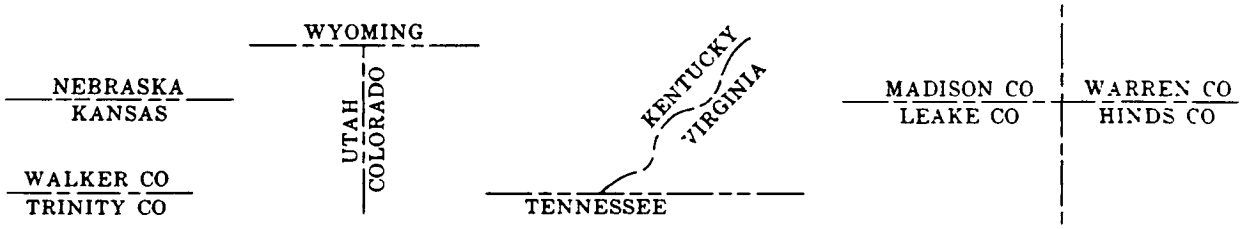
Butte City
School

Eureka Drilling Co
Martin 1

Targhee
Peak

Type that identifies spot features such as schools, peaks, drill holes and wells, is frequently placed in two lines. The vertical spacing between the two lines of type should normally be about one-half the height of the lettering used.

For simplicity and uniformity, and because it is not good practice to use any mark that could be mistaken for a map symbol, most punctuation marks are omitted from the body of the map. The period is not shown, and the apostrophe is rarely used to indicate possession. Harpers Ferry and Pikes Peak Syncline are the correct map forms, not Harper's Ferry or Pike's Peak Syncline. The apostrophe is used only when it is part of the name, such as O'Brien Creek.



When names for states and counties are placed along and parallel to boundary lines, they are centered one over the other wherever practicable.

Names of large cities, civil townships, forests, parks and reservations are normally placed horizontally and near the center of the feature. The names of small towns, villages, and places are placed horizontally and, whenever practicable, to the right of the feature.

Names of small features, such as mountain peaks, hill, gaps, and passes, should be located to the right of their highest point. The name of a long, narrow mountain or ridge should be placed slightly to the north of the axis of the feature, clear of the top contour lines, and aligned on the general trend of the feature. The names of narrow valleys, canyons or gorges, are placed on the north side following the general trend of the feature.

United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VA 22092

In Reply Refer To:
EGS-Mail Stop 439

July 15, 1982

WATER RESOURCES DIVISION MEMORANDUM NO. 82.116

Subject: PUBLICATIONS--Use of Color in U.S. Geological Survey Publications

Water Resources Division Publications Guide article 1.17.1, dated January 18, 1978, explains the basic philosophy governing the use of color in U.S. Geological Survey reports.

Since article 1.17.1 was prepared, two significant changes in procedures and policy have occurred.

The first change concerns the blanket approval from the Department for the Geological Survey to use color in its formal book series publications. This approval must be reconfirmed annually, and is subject to cancellation at any time by the Department. The second change concerns the publication series in which color may be used. In recent years, permission has been requested and granted to use color in selected Water Resources Investigations (WRI) reports--for example the coal hydrology WRI series.

Permission to include color illustrations [bound in books] in Geological Survey reports must be approved in advance by the Water Resources Division, then by the Director and finally by the Department of the Interior. For any reports other than formal series reports and coal hydrology WRI reports, approval on a case-by-case basis must be secured from the Department of the Interior through this office and the Director's Office. Recently, delays in printing of as much as 6 months have occurred because of the response time from the Department regarding use of color illustrations. When requests for color printing are denied, the only remaining option is the redesign of illustrations in black and white.

Requests for color printing to the Department for Water Resources Investigations reports must be accompanied by a paragraph justifying the request, and must be supported by black and white photocopies made from color proofs or hand-colored samples. This provides the Department a basis for their decision.

If you have questions regarding color illustrations, please contact:

Chief, Scientific Publications Section
Water Resources Division
439 National Center
Reston, Virginia 22092
(Phone: FTS-8-928-6881)

J. E. Biesecker
Assistant Chief Hydrologist
for Scientific Publications
and Data Management

This memorandum does not supersede any existing memorandum.

Distribution: A, B, S, FO, PO

WATER RESOURCES DIVISION
PUBLICATIONS GUIDE

Replaces Article No.:	Effective Date: 4/15/74	Article No.: 3.13.1

Subject: ILLUSTRATIONS -- Geologic sections

Because books describing in detail the procedure for preparing geologic sections are not commonly available, this article has been written to serve as a general guide. The discussion includes details necessary for constructing most geologic sections, but may be inadequate where the subsurface geology is complex. For sections in complex geology, authors may need to consult reference books, such as Lahee (1952) and LeRoy (1951), for detailed instructions.

A geologic section is a representation of geologic, hydrologic, and geographic features that exist beneath and at the land surface along a vertical plane. It depicts features that often can be seen in a vertical section of rocks that is exposed when a road is cut through a hill, such as configuration of land surface, stratigraphic position, structure, lithology, and surface drainage. A completed geologic section also includes scale, datum, orientation, and explanation and can include positions of wells, test holes, water levels, and pertinent geographic features.

The line of intersection of the land surface with the plane of a geologic section, as shown on a map, is called the trace or line of section. The trace is actually the uppermost boundary of the section as seen in a plan, or top, view. The trace of the section can be one straight line or a series of short straight-line segments, which generally connect locations of data such as wells or test holes, and which form a crooked or zigzag line.

The following discussion outlines the steps necessary to construct a geologic section with the aid of geologic and topographic maps. All maps used and the compiled section must be on scale-stable material; otherwise, the section will not agree in detail with the parent material and therefore will be unacceptable for publication.

A. Construction

1. Consider the publication-size limitation before starting the section. Author's copy of the section, as well as the geologic map, should be compiled at publication size. The horizontal scale of the section should be identical to the scale of the map, where possible. If this is not possible, owing to space limitations, the horizontal scale of the section should be a whole-number multiple of the scale of the map (for example, 2 or 3 times -- not 1.7 times).

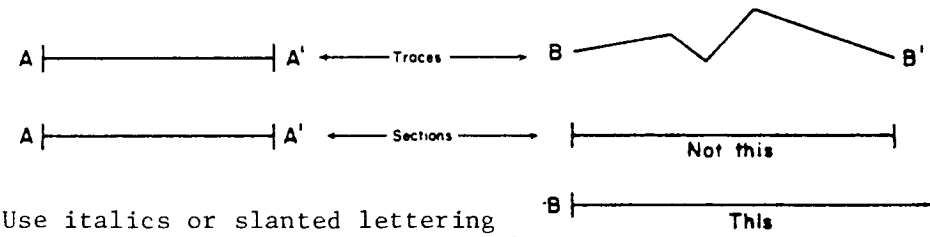
2. Determine the length and orientation of the geologic section. A section drawn along a crooked or zigzag trace will often give false impressions of actual geologic conditions, because the trace at some places may parallel structural or linear stratigraphic features of

the geologic units, whereas at other places it may cut across them. Where the availability of data points permits a choice of those to be used in the section, select the ones that will give the straightest trace.

3. Draw the trace of the section on the geologic map. If the geologic map has topographic contours, one trace will suffice. If the geologic map does not have topographic contours, repeat the trace on a topographic map for later determination of the configuration of land surface. The trace on the topographic map must be in the exact same location, geographically, as the trace on the geologic map.

4. Decide if the vertical scale on the section will be the same as the horizontal scale (preferred) or if the vertical scale will be exaggerated. Vertical exaggeration is the ratio of equal segments of horizontal scale to vertical scale, expressed in equal units of measurement. Thus, if 1 inch of the horizontal scale of a map measures 5,000 feet and 1 inch of the vertical scale of the section will measure 500 feet, then the vertical exaggeration will be 5,000/500 or 10. Vertical exaggeration should be 10 or less, where possible. A larger exaggeration distorts many of the characteristics presented on a section and can give false impressions of the relationships of data.

5. Measure the length of the trace on the map(s). If the trace consists of one straight line, the measured length is the distance between the extreme points (example A-A'); if the trace is a series of segments forming a zigzag line, the measured length is the sum of the individual segments (example B-B').



Note: Use italics or slanted lettering for letter and letter-prime(*A-A'*)

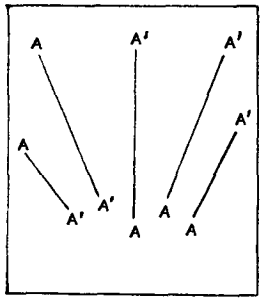
Draw two vertical lines on drafting material to be used for the section at a distance apart corresponding to the length of the trace, then connect the vertical lines at the bottom with a line drawn at right angles to them, forming a ⌊‾‾‾⌋ shape.

6. Check the well and test-hole data and the topographic maps to become familiar with the relative span in the altitudes above or below mean sea level that will be needed on the section. Add vertical scale ticks on both ends of the section and assign numbers for altitude to the ticks. The datum of the section is generally mean sea level, and all data are plotted relative to this datum. Only in special situations are other datums used, such as land surface or an arbitrary horizon.

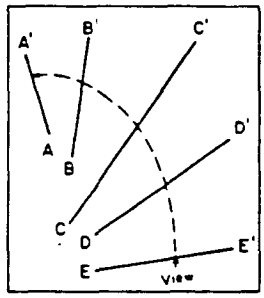
7. Orient the geologic map with north at the top, and mentally let the trace "fall" to the horizontal. View the "fallen" trace from the south and assign the letter designation (A) on the left end of the trace and the letter-prime designation (A') on the right end. If the trace is vertical, and thus will not "fall" left or right to the horizontal, view the trace from the east with the letter designation on the left end of the trace and the letter-prime designation on the right end. If several traces are shown on a map, assign sequential sets of letters to the traces. Assign each set of letters (for example, A-A') only once in a given report, even though geologic sections may be shown both on a plate and as page-size figures in the text. Where several traces of sections are positioned close together in sequence in a local area of a geologic map, maintain a common orientation of the sections, all viewed from one direction. Do not reverse the letter and letter-prime designations part way into the sequence. Instead, let the traces "fall" to the horizontal; the positions of the majority of the traces, then, determine the direction of view and the letter designations for the complete sequence.

See page 141.

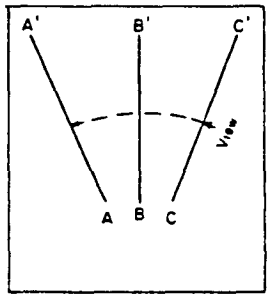
One trace viewed individually | Group of traces on one illustration



View from the south



Unbalanced - view from south to east



Balanced - view from east

8. Add the letter and letter-prime designations to the sections corresponding to the traces on the map. As with the traces, view from the south or the east.

9. From one end of the trace on the map, measure the distances and note the altitudes at which the trace intersects each topographic contour. If the trace consists of a series of segments forming a zigzag line, the measured distances must correspond to the position where the segment crosses the contour; this distance will not be the same as the length of a straight line drawn from the end of the trace to where the segment crosses the contour. Plot points on the section corresponding to the measured distances and altitudes. When all contour points have been plotted, connect the points to form the configuration of the land surface.

10. Revise, if necessary, the vertical scales at the ends of the section so that they both extend to (but not beyond) the next numbered increment above the highest point of the land surface shown on the section. Both scales should be the same length.

11. Add well and test-hole symbols to the section at locations corresponding to those on the trace of the map. If the trace on the map is a straight line, selected wells will probably not lie on the trace and will have to be projected at right angles (90°) to the trace. Wells generally should be projected for only short distances to avoid misinterpretation of existing conditions. The symbols should then be added to the section corresponding to the location where the well is projected to the trace. Where the dip and strike of stratigraphic units beneath the land surface are known and are shown on the geologic map, project the wells to the trace in the direction of the strike; if the projection is not at right angles to the trace, show the projected direction on the map by means of a dashed line from the well to the trace. If the trace on the map is a zigzag line, wells generally are located at the ends of the segments and projection is unnecessary. The well and test-hole symbols are vertical lines on the section. The length of the line corresponds to the depth of the well or test hole below land surface. Well-identification numbers should be added to the top of each well or test-hole symbol; numbers should be oriented so they can be read from the bottom or right side of the section.

12. Determine geologic formation boundaries from available logs or field measurements. Mark boundaries on the well or test-hole symbols of the section at appropriate corresponding depths.

13. Interpret the geology from the formation-boundary determinations and draw contacts across the geologic section. Stratigraphic units should not thicken or thin abruptly on the section unless rapid change in thickness is characteristic of the units. If an abrupt change in thickness of the units on the section seems to be abnormal, recheck the data for possible errors or evaluate the change in terms of possible faulting. Any geologic faults or structure underlying the trace of the section on the map must be reflected in the geologic section.

14. Evaluate the adequacy of the lower boundary of the section drawn for instruction number 5. The <u>vertical</u> dimension of the geologic section can be lengthened or shortened, if necessary, after the compiler evaluates the data presented on the section. Published references often give a range in thickness of stratigraphic units. Unless supported by additional data, thicknesses shown below control points on the section, such as wells or test holes, should not exceed the maximum thicknesses reported in the literature.

15. Mark on the well or test-hole symbols the depths of available water levels within the same unit or within interconnected units. Interpolate the water levels between wells or test holes, if desired. Identify the water level by name and date (such as "water table, 1965") on the section or in the explanation.

16. Identify geologic features by pattern or color, and letter symbol (such as Qal) or complete name. Letter symbols should be placed on the section centered within the contacts of the geologic unit, where

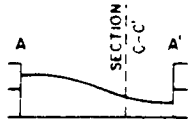
possible. Geologic units extending to the land surface of the section should be labeled above the land-surface profile line; leader lines should be used only where the symbols or patterns are congested. Lithologic patterns can be shown at the well or test hole only or can be shown across the width of the section. Patterns should be carefully selected. The orientation of line patterns on a section will imply orientation (dip) of stratigraphy; therefore, line patterns should be used on sections only where the dip of stratigraphic units is known and where the orientation of line patterns agrees with actual conditions. Correct lithologic patterns must also be used (see Technical Standards Paper 12.02.3 of Publications Division).

Fault symbols (heavy lines accompanied by arrows showing relative movement where appropriate) can be identified by name within or above the section if the faults are shown as solid lines. If the faults are not shown as solid lines, then a fault symbol with accompanying arrows identifying the upthrown and downthrown sides of the fault should be placed both on the section and in the explanation. The reason for showing a fault as a symbol other than a solid line must be given in the explanation.

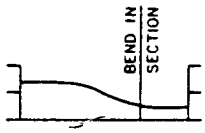
The accuracy of mapping of the geologic contacts must agree between the map and the section. If contacts are shown as solid on the map, they should be solid on the section -- at least at or near the land surface; solid lines near the surface can be shown as dashed in the lower parts of the section where control may be inadequate or lacking. Contacts shown dashed on the map should be dashed on the section.

17. Identify towns, streams, buttes, political divisions, and other prominent geographic features on the section. State (solid--two dashes--solid) or county (solid--one dash--solid) line symbols on the section should correspond in location with those on the map. The State-line symbol is accompanied by a State name on each side of the line. The county-line symbol is accompanied by two county names, each followed by the word "COUNTY." County should not be abbreviated.

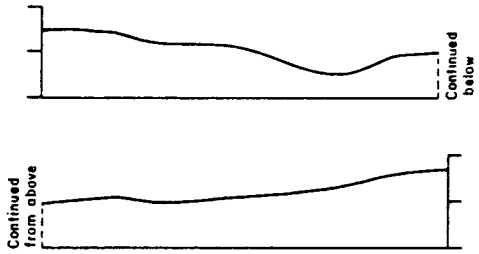
18. Identify the location or feature, such as a well or test hole, that is common to two or more sections (point where the traces of the sections intersect on the map) with the word "SECTION" followed by the letter designations of the section. For example, if the trace of section A-A' crosses the trace of section C-C', then section C-C' would be labeled with SECTION A-A' at the point of intersection. Section A-A' would be labeled SECTION C-C' at the appropriate location. A straight dashed line from the top of the lettering to the base of the section identifies the location of intersection exactly. Note: <u>all</u> items, including geology and hydrology, pertaining to a point of common intersection of two or more sections must be shown identically on all sections.



19. Identify on the section, by a solid straight line, the locations where the trace of the section on the geologic map shows significant changes in direction. The line should be drawn vertically from the base of the section and should be long enough to accommodate the designation "BEND IN SECTION" above the land surface. These notations help to guide a reader when comparing the section with the geologic map.



20. Show sections intact where possible. Occasionally, a long section may need to be split into halves for publication, with the left half shown above the right half.



The section should not be split during compilation, but after approval as it is being prepared for publication. This procedure will eliminate errors of compilation that might occur in trying to show the data accurately on both sides of the split.

B. Composition

In addition to the basic diagram (section), the following explanation items must accompany each geologic section.

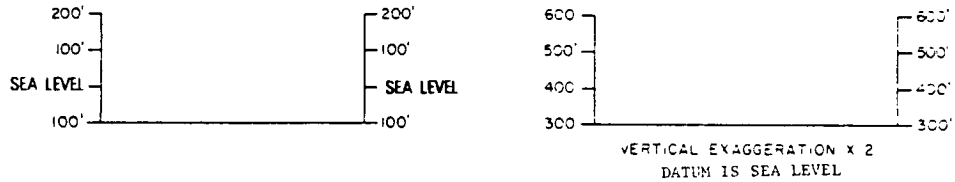
1. Vertical scales. The vertical grid consists of short lines (ticks) along the outside of both ordinate axes that identify altitude. Numbers and foot marks (') are placed outside and opposite the ticks at both ends of the section; if more than six altitude ticks are shown, only alternate ticks need to be identified with numbers.

*See page 145, note the word FEET can be used in place of the symbol (').

2. Horizontal scales. Geologic sections placed on the same sheet as the geologic map and at the same scale as the geologic map do not require a separate scale. All other geologic sections must have a rake scale that combines English units with corresponding metric units onto one scale (see article 3.09.1). A fractional-scale notation (for example, SCALE 1:62 500) above the rake scale is not required for sections.

3. Vertical exaggeration. The notation for vertical exaggeration should be of the form "VERTICAL EXAGGERATION X 10." The numerical value should be to the nearest whole number. If vertical exaggeration exceeds X 50, the notation "VERTICAL SCALE GREATLY EXAGGERATED" should be used.

4. Datum note. The datum on which the section is drawn must always be identified. Where the datum is sea level and the vertical scale of the section includes this datum, the notation "SEA LEVEL" may be added directly to the vertical scale; no additional datum note is needed. For other sections, a datum note is required. It should be of the form "DATUM IS SEA LEVEL" and should be placed, with the vertical exaggeration note, beneath the geologic section.



5. Explanation. The type of labeling of the geologic features on a section (whether identified by complete name or letter symbol with color or pattern) is dependent on the labeling used on the map containing the trace of the section. If simplified geology identified by complete names (for example, alluvium and bedrock) is shown on the map, then complete names can be used on the section, and an explanation may be unnecessary. If letter symbols are shown on the map, which is the normal usage, they should also be shown on the section and the explanation.

A combined explanation should be used for geologic maps and section(s) when both are shown together, such as on a plate, and both group the geology into the same or similar units. Where the geologic sections identify subsurface geologic units not shown on the map, the notation SHOWN ON SECTIONS ONLY, with accompanying symbols and description, may follow the explanation of the surface units. Stratigraphic units are described in an explanation in order from the youngest unit at the top to the oldest at the bottom. The format for combined map and section explanations is the same as shown by example in article 3.10.2.

A section explanation in addition to the map explanation is necessary where

A. The map and section(s) will not be published on the same sheet or page.

B. The grouping of geologic units in the section doesn't agree with the grouping on the map. For example, the Niobrara Formation and Carlile Shale may be mapped separately on the geologic map but grouped together as Upper Cretaceous rocks in the section.

Geologic letter symbols (for example, Qal) must be shown in the boxes containing color or pattern in the explanation, in the geologic section, and on the geologic map. All geologic units shown on the map or section must be identified in an explanation. Conversely, all units identified in the explanation must be shown on the map or section.

References: Lahee, F. H., 1952, Field geology: New York, McGraw Hill Book Co., 5th ed., 883 p.

LeRoy, L. W., compiler, 1951, Subsurface geologic methods: Golden, Colo., Colorado School Mines, 2d ed., 1166 p.

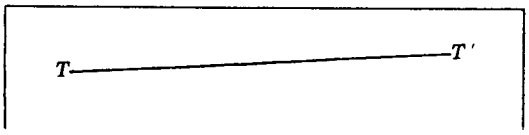
Technical Standards Paper 12.02.3 of Publications Division

Cross references: 3.09.1 Maps - Scales
3.10.2 Explanations - Maps

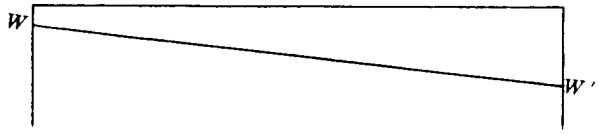
BRANCH OF TECHNICAL ILLUSTRATIONS
TECHNICAL STANDARDS SECTION

Replaces T.S. Paper		Effective Date	6/6/66	T.S. Paper No.	7.01.1
Subject	MAP PROBLEMS - Labeling Lines of Sections on Maps				

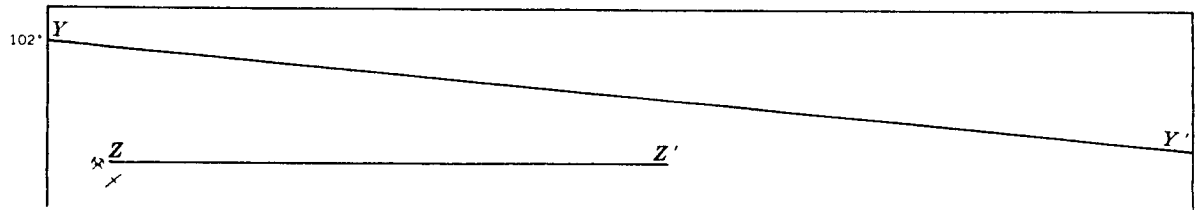
The basic rule for labeling lines of sections on maps is to center the section letters at the ends of the line and align them with the plane or direction of the line. Situations may arise where good judgement requires deviation from this rule to avoid overprinting or unpleasing type placement.



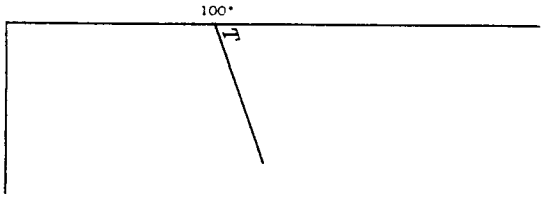
This would be the preferred placement of letters.



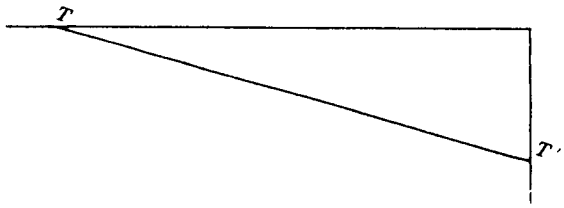
If a line of section extends to the limits of the map, section letters should be placed outside the limits, centered and aligned.



If there is an interference at either end of the section line, solve the letter placement at that end of the line and make the same adjustment at the other end. The entire line is like a symbol and should be balanced. In the example above the grid number would have to remain so the *Y* is placed above the line, *Y'* is placed above the line to balance the symbol. Range or Township numbers, however, could be moved and the section letters placed outside the line.



If the section letter cannot be placed at the end of the line, try to place it above the section line.



In this case centering and aligning the letter at the end of the line would have it farther away from the line than would be desirable. The acute angle prevents placement above the line inside the neatline.

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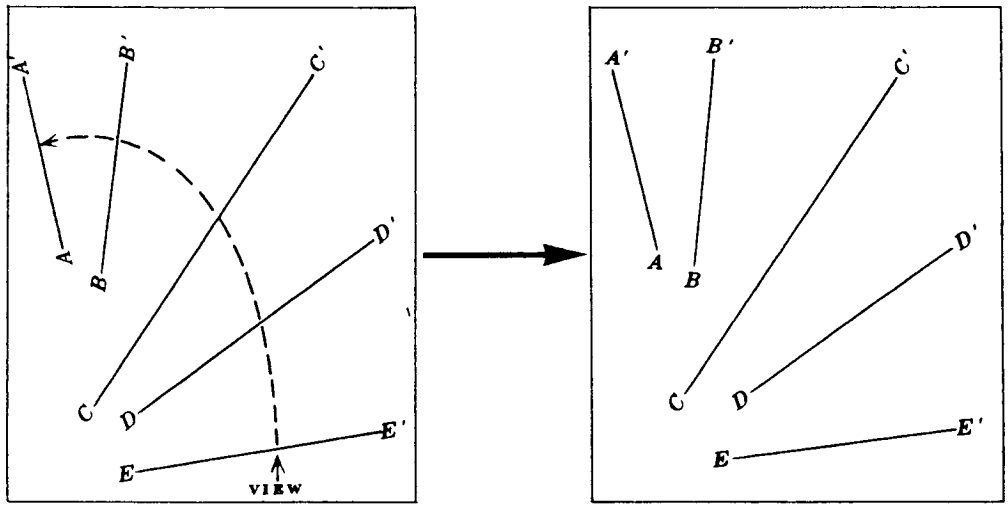
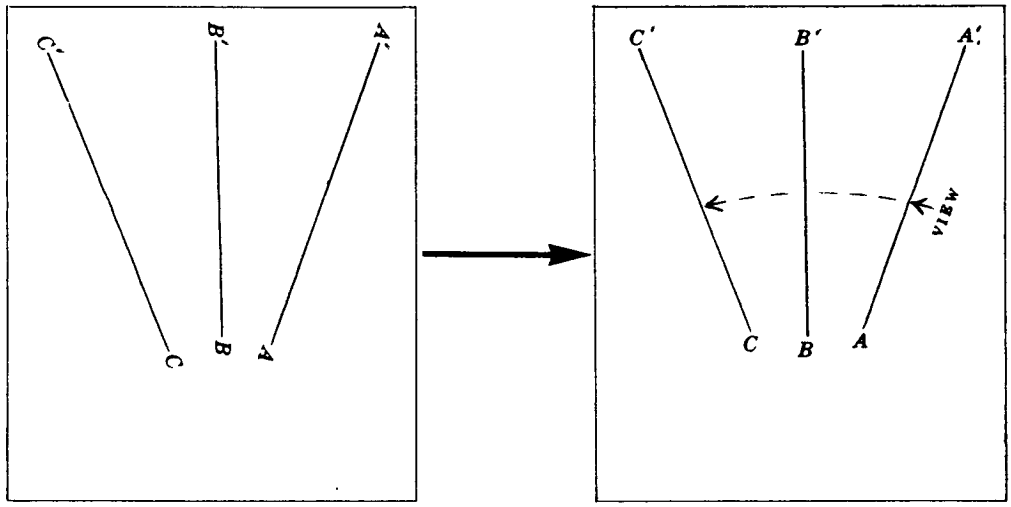


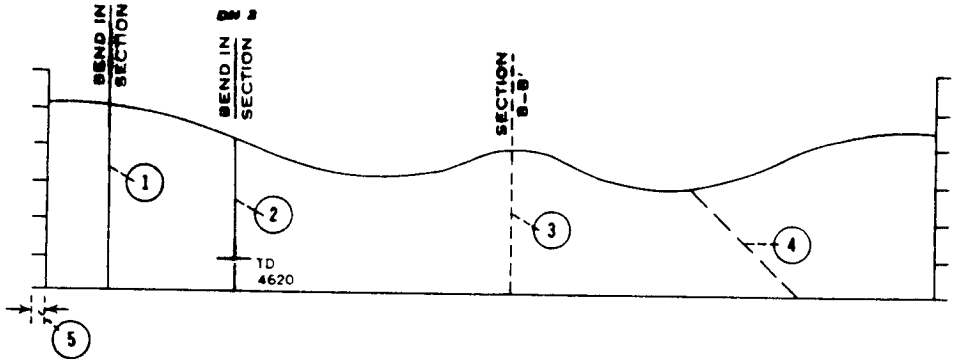
Where the author shows a series of cross sections in sequence and cutting through a prominent geologic structure, a common orientation of the sections should be maintained, all viewed from one direction. In such a case there can be no changing of ends. To avoid placing type on it's back, the type should be placed so that it is aligned with the sheet or illustration.



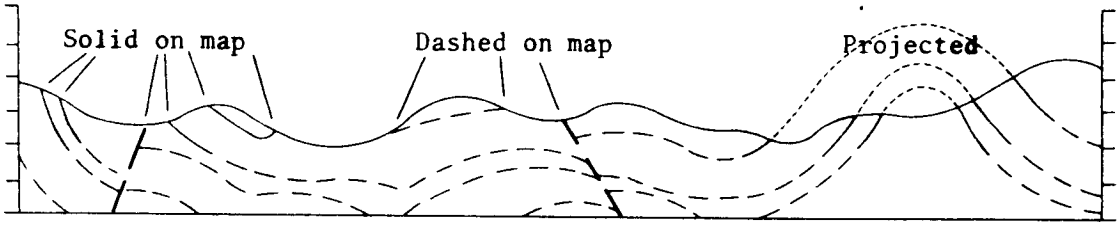
BRANCH OF TECHNICAL ILLUSTRATIONS
TECHNICAL STANDARDS SECTION

Replaces T.S.P.		Effective Date	4/18/66	T.S. Paper No.	12.01.1
Subject	SECTIONS: Lines and lineweights on Geologic Sections				

All lineweights in the section, unless indicated otherwise, will be 0.005".



1. "Bend in Section" line will be shown as a solid line.
2. When a bend in section is located on a drill hole, there will be a 0.10" break in the line above the profile, and a 0.02" break below. Lineweight of the drill hole should be at least .008".
3. Intersection of other sections will be shown as a dashed line. The dash will be 0.10" in length with a 0.02" space between dashes.
4. Faults and other geologic symbol lines should be the same line weight as that used in the body of the map.
5. All ticks will be 0.07" long.



Where solid lines are used exclusively on the map, solid lines may be shown in the section.

Solid lines on the map should be shown in the section as a solid line near the surface. The line should be changed to an approximately located (dashed) contact at a depth of two dashes or approximately 1/4-inch below the surface.

Dashed lines, as shown on the map as either approximate, indefinite, or inferred will be shown as an approximate dash throughout the section. Concealed lines as shown on the map, since they do not reach the surface, will always be shown in the section as an approximate dash.

Show lines projected above the surface of section using concealed line convention.

These standards are to be followed wherever possible and practical, with allowance for specific author preference and customary approval.

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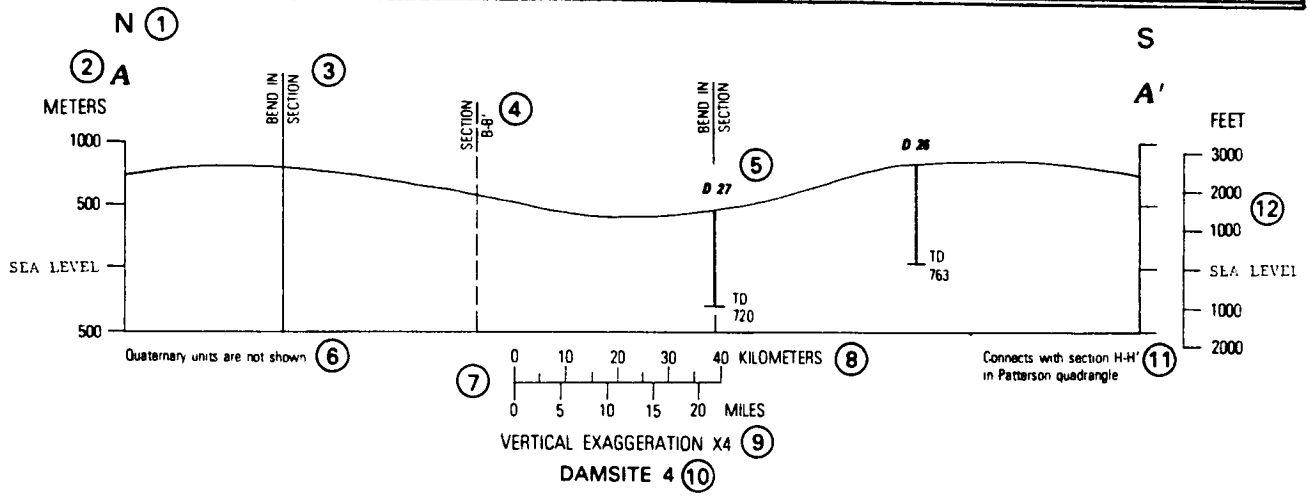
CARTOGRAPHIC TECHNICAL STANDARDS

Replaces T. S. P.		Subject: SECTIONS Placement of Type on Geologic Sections	T. S. Paper	12.01.3
Dated			Effective	5/22/78



1. Letters indicating direction are placed above the highest point of the metric scales. Bottom of the type is 4.5 mm to highest point of type elsewhere on the section.

2. The section letter is placed 2.5 mm above the highest point of the metric scale designation, and centered above the scale. The scales at each end of the section will be the same height; the height is determined by the next numbered division above the highest elevation on the profile.

3. There must be a minimum clearance of 2.5 mm between the profile line and the BEND IN SECTION type. The line should not extend above the type.

4. The section designation, B-B' should be centered under the word "SECTION." The line should not extend above the type.

5. The drill-hole number should be placed 2.5 mm above the profile line with a 2.5 mm space between the top of the type and the bottom of the BEND IN SECTION type.

6. Special information notes relating to units on the sections are positioned inside the cross section where there is space; otherwise, it will be positioned flush left with a clearance of 2.5 mm below the bottom line of the section.

7. If the horizontal scale of a section differs from the scale of the map, a rake scale shall be added below the section. Allow a space of 2.5 mm between the bottom of the section and the top of the type. Length of number ticks, 2.5 mm; length of intermediate ticks, 1.5 mm.

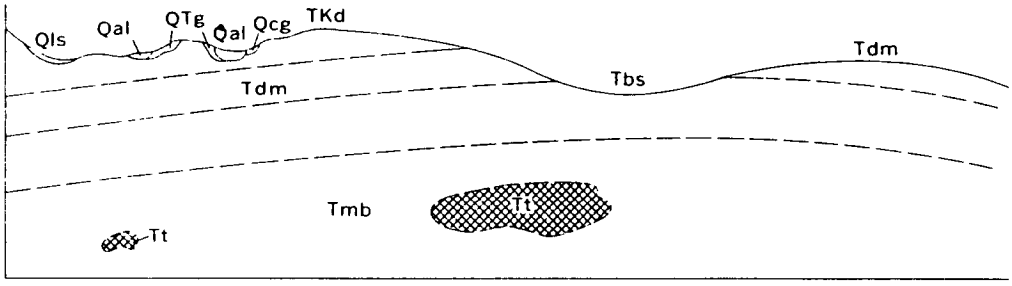
8. When a map, section, index, etc. is compiled totally or partially in U.S. Customary all rake and vertical scales will show metric first and U.S. Customary last.

9. The top of the vertical exaggeration note type measures 2.5 mm below the rake scale. When there is no rake scale the note measures 2.5 mm below the base line.

10. The top of the type of the identifying name or number of the section is centered 2.5 mm below the vertical exaggeration note, when there is one, 2.5 mm below the scale in the absence of a vertical exaggeration note, or 2.5 mm below the baseline of the section in the absence of both scale or vertical exaggeration note.

11. Notes identifying adjoining sections will be positioned flush with the side of the section to which the identified section would join with a clearance of 2.5 mm below the bottom of the section.

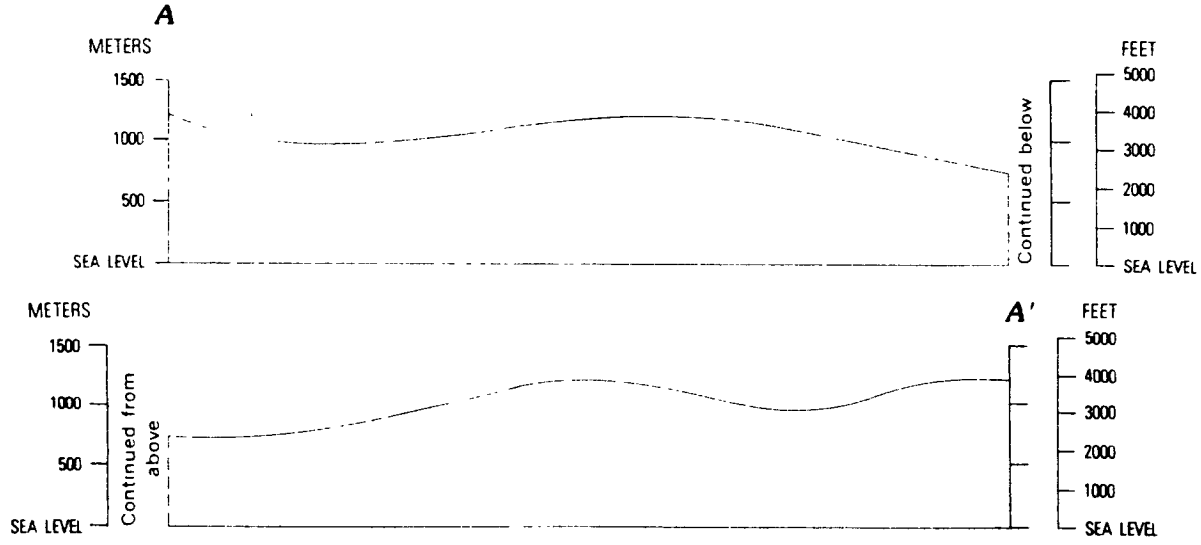
12. The elevation numerals will be positioned 1.5 mm from the end of the ticks. Numerals should aline on the last digit.



Formations reaching the surface of the cross section should be labeled above the section. Leader lines should be used only to clarify a congested area.

Labels for formations beneath the surface will be centered within the formation area except where insufficient pattern would be left to define the area. It is more important to have a readable pattern within a unit rather than the letter symbol. The letter symbol can be placed outside the mapped area and leadered in.

A long split section would contain the following notations:



If a section contains more than six elevation values along the vertical scale and the vertical spacing between the pieces of type is such that the numbers appear "crowded," it would be desirable to delete either the odd or even numbered values to improve the readability of the vertical scale.

CARTOGRAPHIC TECHNICAL STANDARDS

Replaces T. S. P.		Subject: SECTIONS Correlation of Geologic Sections and Maps	T. S. Paper	12.01.5
Dated			Effective	6/7/78

Editors in the operating divisions are responsible for checking the data that appear in a section against the geologic and topographic data on the map to assure that they agree with each other. If Branch of Cartography personnel notice discrepancies between these items, the Section Chief and (or) the unit leader will resolve any discrepancies through consultation with the operating division editors.

Before calling in the geologic or hydrologic editors for consultation, the technician can perform any or all of the steps prescribed below depending upon the extent of the problems. For example, whenever maps are submitted to the Branch of Cartography for pre-Director approval editing, the cross section and map should be reviewed at this stage in as much as this review would not have been performed by the operating division editors. The note, "SECTIONS CHECKED AGAINST MAP" should be added to the manuscript copy and initialed to avoid duplication of effort in reviewing these items.

The following are some examples of the kinds of data to check. Many of these checks can be accomplished with a triangle, straight edge, strip of paper, and pen or sharp pencil. If you are unfamiliar with this method, check with your unit leader.

1. Cut a piece of paper or cronaflex at least the length of the section line and place the edge along the section line on the map. Mark the points at which the section bends and where the geologic, physiographic, and cultural features intersect with the section line. Now compare this "MATCH STRIP" with the features that appear on the surface of the cross section by alining the edge of the match strip just below the surface of the section.

2. Make sure that the section line on the map and on the cross section are the same length.

3. Check locations and attitudes of all faults, dikes, contacts, and veins, and check the attitude of bedding and foliation and the location of crests of anticlines and troughs of synclines.

4. Spot check elevations and (or) contours to make sure that the vertical scale on the section is correct and that the profile generally conforms to the contours on the map.

5. Check arrows showing relative movement along faults in the section to see that they agree with U's and D's along the same faults on the map.

6. If any section lines on the map intersect, check the geologic data shown at the point of intersection to make sure that the same data are shown on both cross sections at the points of intersection.

7. Check where possible all other data shown in the section to make sure that they agree with data given on map.

If minor discrepancies are detected between the map and the section(s), these are to be corrected by the cartographic technician as he draws the section(s).

If major discrepancies turn up, check with your unit leader for advice.

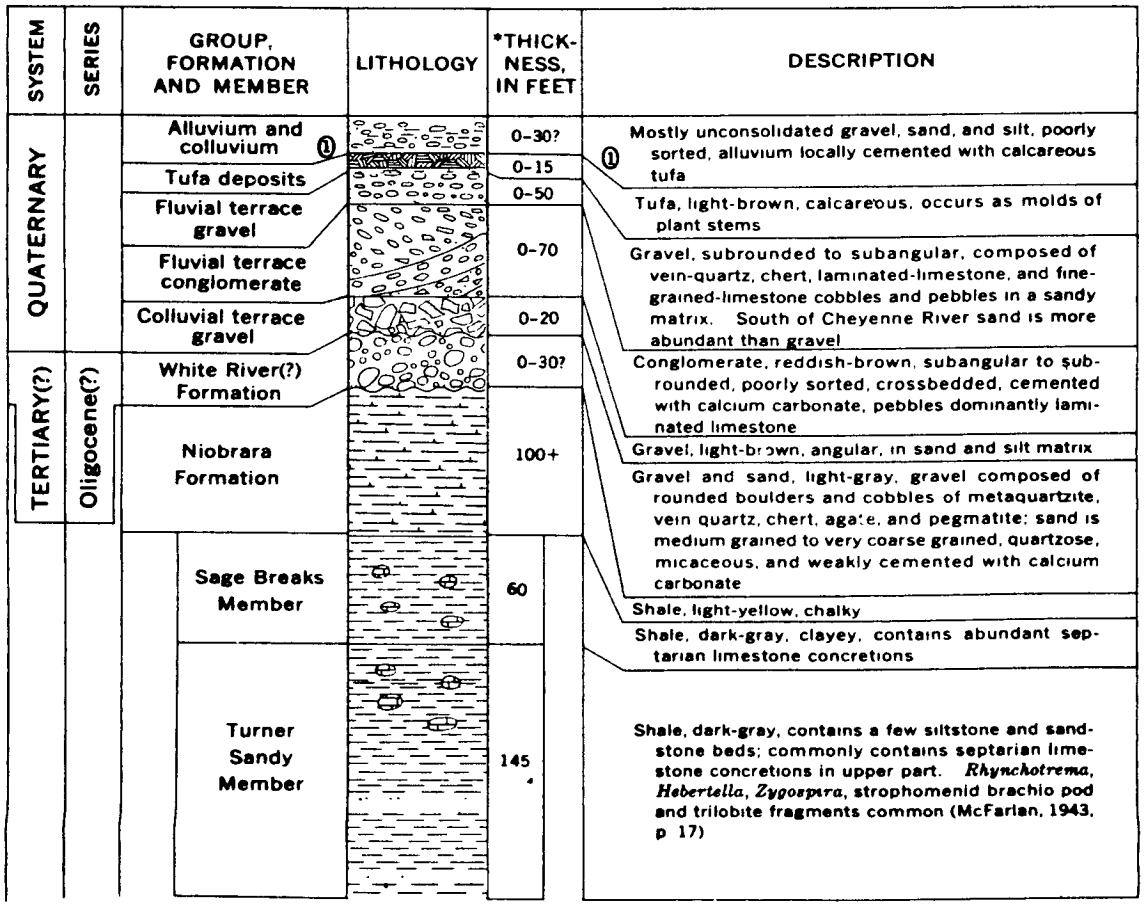
CARTOGRAPHIC TECHNICAL STANDARDS

Replaces T. S. P.		Subject: SECTIONS Lineweights and Placement of Columnar Sections for Map Series	T. S. Paper	12.02.1
Dated			Effective	5/14/79

All lineweights, except lithologic data for which standard stick-up patterns are normally used, will be 0.16 mm (0.006 in.). Division lines between descriptive matter should be angled (see example 1) when the type will not fit in the area opposite the lithologic pattern. The angle line should touch the dividing line between formations.

Placement of the columnar section should be on the left side of the map, flush with the top neatline with at least 5 mm (0.20 in.) space between the base coordinate type, or not less than 13 mm (0.50 in.) from the map edge. If the section is extremely short, it may be placed below the map explanation, providing space is available.

Each column must be drawn wide enough to accommodate the type matter. The "Description" column will be 13 mm (0.50 in.) wider than the text (6 mm (0.25 in.) space on each side). The format, as shown below, should be followed as closely as possible.



III. GEOLOGIC SECTIONS

3.07 Color

See WRD memo 82.116 on page 131.

WATER RESOURCES DIVISION
PUBLICATIONS GUIDE

Replaces	Effective 4/15/74	Article No.: 3.14.1
Article No.:	Date:	

Subject: ILLUSTRATIONS -- Cross sections

A cross section is a representation of the features that exist beneath and at the surface of a body of water, such as a river, bay, lake, or estuary. The principal features shown on a cross section are elevation (see article 1.11.3) and the relationship between the water body and the land surface on which the water rests or flows. Cross sections, on occasion, depict the outline of a dry stream channel and indicate the depth of water during a preceding period of high water flow.

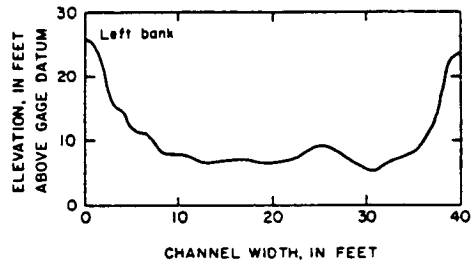
In many aspects a cross section resembles a geologic section (article 3.13.1) and the same rules for preparation and presentation often can be applied here. A cross section must show the orientation of the section, vertical exaggeration note if vertical scale is exaggerated, vertical and horizontal scales, datum note, towns and roads as appropriate, and bends in the section. An explanation may be necessary if uncommon base features, unlabeled data, color, or patterns are shown.

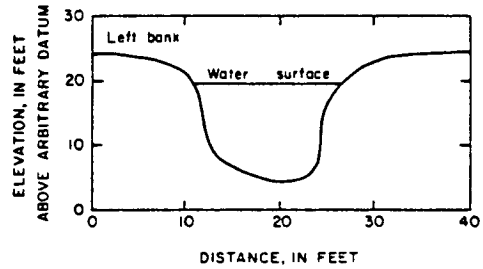
The orientation of the cross section is generally shown by a trace on a map and by letter and letter-prime designation on the section. If the section depicts a stream channel, the designation "left bank" or "right bank" may be used in lieu of a letter and letter-prime designation. A cross section without a letter and letter-prime designation, however, should include a river-mile designation near the illustration or in the caption of the illustration and on the map showing the trace of the section so that a reader can locate the section accurately on the map. The section of a stream should be viewed in a downstream direction so that the left bank will be on the left side of the section.

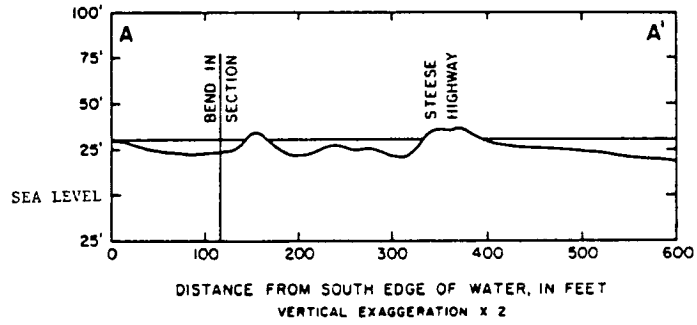
The vertical scales may be identified similarly to those for geologic sections, except that the short lines (ticks) should be along the inside of both ordinate axes. If the vertical scale contains the datum (for example, SEA LEVEL), then a separate datum note is unnecessary. However, if the datum is not shown on the section, a datum note must be given. Where the vertical scale is arbitrary, such as from zero to some other number, the notation DATUM IS ARBITRARY should be placed beneath the illustration or words to that effect should be part of the vertical-axis caption.

The horizontal scale can be identified by a rake scale (article 3.09.1) or by a grid and number system similar to that used for the vertical scale of geologic sections. The grid and number system should consist of tick marks uniformly spaced inside the axes, scale numbers, and axis caption. Thus, the resultant illustration is "boxed in" by two vertical and two horizontal lines or axes.

The following examples illustrate the requirements for properly prepared cross sections.







Cross references: 1.11.3 Terminology - Use of "altitude" and "elevation"
3.09.1 Maps - Scales
3.13.1 Geologic sections

WATER RESOURCES DIVISION PUBLICATIONS GUIDE

Article 5.03.4

Subject: EDITORIAL CONSIDERATIONS FOR WATER RESOURCES DIVISION MANUSCRIPTS--Editorial Style

5.03.4 Use of abbreviations

Abbreviations are used to save space and to avoid distracting the reader by needless spelling out of repetitious words or phrases. A comprehensive list of standard abbreviations is given in the GPO Style Manual, p. 149-168, and in Suggestions to Authors (6th ed.) p. 95-108. Abbreviations for units of measure are given in article 4.01.2, "Conversion factors and abbreviations." Some guidelines for the use of abbreviations in technical reports are given below.

1. General use.--(a) Abbreviations should be consistent throughout the report; that is, a term should be either abbreviated in the report or spelled out, but should not occur both ways. (b) The abbreviation should be spelled out in parentheses where it first appears. (c) The abbreviations used for units of measure in a report should be included in the table of conversion factors. Abbreviations not listed in the table of conversion factors should be spelled out in parentheses after their initial use. (d) The words figure, plate, number, page, volume, series, and so forth are abbreviated when given parenthetically, and should be abbreviated in reference lists.

2. In abstracts--Abbreviations should be avoided in abstracts. However, if a term is long and used frequently, it may be spelled out in parentheses and abbreviated thereafter--for example:

"Average discharge was 3.1 ft^3/s (cubic foot per second)."

3. Illustrations and tables.--Use of abbreviations should be avoided in illustrations and should be used in tables only where lack of space is inadequate. Some computer printouts use abbreviations extensively; if a printout to be used in final copy contains too many abbreviations to list conveniently in a footnote, a page listing all abbreviations and their meaning should be inserted to precede the printout.

4. Units of measure.--In technical writing, units of measure should not be abbreviated except in reference to numbers. For example, "30 ft in diameter" is correct, but "diameter was measured in ft" is not. A list of standard abbreviations for units of measure is given in article 4.01.2, "Conversion factors and abbreviations."

5. Abbreviations containing periods.--These should be "closed up":

U.S.	U.S.S.R.	N.Y.
a.m.	A.D.	B.P.

except those containing a person's initials: A. B. Smith

6. Initials for organizations.--These generally are written without spaces or periods:

AIPG	TVA	NYU	AGU
ASTM	USA	NYSERDA	GSA

7. Names of foreign countries.--These are not abbreviated (except U.S.S.R., because it is long).

8. State abbreviations.--State names (except Alaska, Hawaii, Idaho, Iowa, Maine, Ohio, and Utah) are abbreviated only when they immediately follow a capitalized geographic name (as in Richmond, Va.); they are always spelled out in titles and headings. The preferred abbreviations, and also the Postal Service abbreviations, are given in the GPO Style Manual (p. 151), and Suggestions to Authors (6th ed., p. 95-96). The Postal Service abbreviations should not be used except when given as part of an address that includes the zip code.

9. Bibliographic reference lists.--In reports for Geological Survey publication, publishers' names and the names of publication series are spelled out; the only abbreviations to be used are the following:

ser.	sec.	fig.	mimeo.
chap.	ed.	pl.	abs.
p.	v.	no.	U.S.

10. Calendar divisions.--Names of months, if followed by the day or year, may be abbreviated in footnotes, tables, parentheses, and bibliographies. Days of the week are preferrably not abbreviated.

11. Miscellaneous abbreviations.--Use of other abbreviations, including latitude, longitude, degree mark, ditto mark, and metric units, is explained in Suggestions to Authors (6th ed., p. 98).

WATER RESOURCES DIVISION PUBLICATIONS GUIDE

Article 5.03.3

Subject: EDITORIAL CONSIDERATIONS FOR WATER RESOURCES DIVISION MANUSCRIPTS--Editorial Style

5.03.3 Capitalization

It would be impossible to give rules that will cover every question concerning capitalization, but the GPO Style Manual (p. 23-71) and Suggestions to Authors (6th ed., p. 234-236) provide guidelines and a list that should promote uniformity. A summary of the main guidelines is given below:

A. Proper names and their derivatives are capitalized:

Washington	Italy	European	Keynesian

Exception: Derivatives of proper names with an independent meaning are lowercased:

roman type	plaster of paris	venetian blinds
brussels sprouts	canada balsam	macadam

B. A common noun used in reference to a proper noun is lowercased:

Panama Canal; the canal	Great Lakes; the lakes
Hudson River; the river	Hoover Dam; the dam
Sopchoppie County; the county	Washington; the city

C. The word "the" in association with a proper noun is lowercased, unless it is capitalized as part of the formal name:

The New York Times	the Netherlands
the Earth	the A&P

D. Names of organizations are capitalized:

U.S. Congress
Department of Agriculture; the Department
Publications Division; the Division
Census Bureau; the Bureau
Armed Forces

E. Names of domains and administrative divisions are capitalized only if used as part of proper names:

Commonwealth of Massachusetts, the Commonwealth
Province of Ontario, the Province
State of Maine, the State

F. Names of regions, localities, and geographic features are capitalized:

the Gulf States	the Western Hemisphere
the West, Midwest, Far West, Northeast	the North Pole
the Continental Divide	the Temperate Zone
the Occident	

Exception: A term used to indicate mere direction or position is not a proper name and therefore not capitalized:

north	central area
northward	eastern seaboard
central Europe	

G. Names of months are capitalized; names of seasons are lowercased.

H. Names of historic events, holidays, and religious days are capitalized:

Battle of Bunker Hill	World War II
Fourth of July	Veterans Day
Renaissance	

I. In scientific names, the phylum, class, order, family, or genus is capitalized; the species is not: Canis familiaris

Article 5.03.3

J. Capitalize Sun, Moon, Earth, and names of the planets.

K. Write rhodamine B, rhodamine WT.

L. Write Landsat, not LANDSAT.

M. Write Fortran, not FORTRAN

Reference:

GPO Style Manual (1984) rules 9.48 and 9.61 for "Coined Words and Symbols" and "Standard Word Abbreviations".

WATER RESOURCES DIVISION PUBLICATIONS GUIDE

Article 6.01.2

Subject: PREPARING MANUSCRIPTS FOR DIVISION REVIEW--Format

6.01.2 Size of paper, text, tables, figures, and plates

TEXT

On January 1, 1980, all Federal agencies were informed that 8 X 10 1/2-inch typing paper was to be replaced by 8 1/2 X 11-inch paper. Manuscript typing should be on paper that is opaque, smooth, and takes pencil marks easily. Paper that is erasable, tinted, glossy, textured, odd-sized, or onion skin is unsuitable for manuscripts. Margins of manuscript material should be 1 inch on all sides; page numbers should be typed or handwritten half an inch from the bottom center. Typing generally begins on line 7 and is double spaced. Both 12-pitch elite and 10-pitch pica are acceptable sizes; however, elite is preferred because it gives greater economy.

TABLES

Tables may be typed on oversized sheets for review but should be condensed to the extent possible without crowding so that extreme reduction for camera-ready copy will not be necessary.

If a table in its final form requires excessive reduction to attain a 1-page format, it should be redesigned to occupy two or more successive pages. If it covers two facing pages and is turned sideways (broad measure), the heading should be on the left-hand page but may be omitted from the right-hand page. The column headings should be repeated on the right-hand page, however. The footnotes also are placed on the right-hand page. See "Style Manual" (1984, p. 173-199.) The maximum dimensions for tables in 8 1/2 X 11 inch reports are 6 1/2 X 8 3/4 inches to allow sufficient margins and room for the page number. For reports to be microfilmed (WRI and Open File Reports), reduction to as small as 80 percent of original size is permitted for elite type (67 percent for pica); thus, the maximum image area before reduction to camera-ready copy is about 8 1/4 X 11 inches for elite type and 10 X 13 1/4 inches for pica. Computer printouts may be reduced to 65 percent of original size.

Tables for formal Geological Survey book reports to be set in type commercially may be oversized but must be double spaced and conform to Geological Survey format. (Article 7.02.2 describes typographic style for tables in Geological Survey reports.)

Originating offices are encouraged to prepare tables of formal Geological Survey reports in final camera-ready form (after Director's approval of report). Typists, editors, and authors should endeavor to produce the best possible quality of tables for camera-ready printing.

FIGURES
(Page-size illustrations)

Figures should fit, or should be designed to be reduced to fit, within a 6 1/2 X 8 3/4 inch image area or less in camera-ready copy of 8 1/2 X 11-inch reports. (For publications of other sizes, figures should be designed to meet publisher's specifications.) In WRI and Open-File Reports, the minimum lettering size after reduction is 8 point[1] to ensure readability in reproduced copy. Illustrations should be drafted with the final published size in mind and at a convenient size for review and duplication. They must be drawn in such a way that duplicated copies will be legible.

PLATES
(Oversize illustrations)

Plates should be prepared at as small a size as possible for user's convenience. Before preparation of a plate is begun, the author should consider whether the material could be presented on two facing pages instead. If oversize format is unavoidable, the publisher's restrictions and requirements should be determined in advance so that reformatting will not be necessary later on. (See article 2.01.2.)

To facilitate review, oversize illustrations and plates should be reduced to publication size if possible. One inexpensive procedure is to use a reducing electrostatic machine and reproduce the reduced image on good-quality tracing paper. The tracing paper then can be used as a master for additional diazo review-copy prints. This procedure eliminates the need for costly photoreductions and prints. Because many reducing electrostatic machines distort the reduced image, and affect scalar relationships, review copy obtained with the above procedures should not be used as originals for printing.

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1 This footnote is typed in 8 point lettering.

In Tables

References in tables generally will be given either in headnotes within brackets beneath the title or in footnotes below the bottom line. References should include only the author's last name, the date of publication, and the page numbers. The complete publication reference must be given in the list of references.

In Illustrations

In general, references in illustrations will be given in the caption, not the figure itself. For example:

Figure 2.--Geologic section A-A', Loudoun County, Va.
[From Smith, 1970, p. 40.]

Unless the figure or data are taken directly, without alteration, from another source, the words "Modified from" must be included. If material is from a copyrighted source, the source must be cited and written permission obtained from the publisher. (See article 1.03.2.) Notations such as "reproduced by permission of" are not given unless requested by the publisher, however. Even if material is from a source that is not copyrighted, such as a Federal publication, the source must be cited.[2]

For maps that show geologic or hydrologic information, an appropriate mapping credit note should be placed under the south border and end flush with the east border.[3]

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[2] See Water Resources Division Memorandum No. 82.97, dated June 15, 1982.

[3] See article 3.09.5 of the previous (blue-cover) "Publications Guide."

United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VA. 22092

Memorandum

JAN 18 1984

To: Executive Committee

From: Assistant Director for Research

Subject: Proposed Changes in Publication Policy

The Publications and Information Policy Committee (PIPC) recommends the following changes in the manner that we title or attribute our formal publications:

1. On Professional Papers and Circulars, change the bureau series title from

Geological Survey Professional Paper
Geological Survey Circular

to

U.S. Geological Survey Professional Paper
U.S. Geological Survey Circular

The rationale for proposing this change is two-fold. First, we are not the only "Geological Survey" in the United States or the world. Indeed, some state surveys have chaffed for generations because of what they have perceived as the unwarranted implication of this title. Moreover, the front cover of every other state or national survey serial publication leaves no doubt about the identity of the publisher. Our publications should do no less.

Second, title changes have already been made on the new Bulletin and new Water Supply Paper, but these changes occurred when each of these series was reformatted. The changes did not apply to our other book publications. From a strictly editorial perspective, it could be argued, and was, that "United States" should be spelled out rather than abbreviated in the series titles. However, the majority of the PIPC felt that we are universally known by the abbreviated title, and that is the way we ought to identify our publications.

2. The bureau/departmental headnote on all USGS maps including maps used as plates in USGS books should be changed to read:

Department of the Interior
U.S. Geological Survey

Presently (and historically) the headnotes on map plates in books and stand-alone maps are inconsistent.

Stand-alone maps read

Department of the Interior
United States Geological Survey

and the book plates read

United States Department of the Interior
Geological Survey

We can find no record of the history or reasons for this inconsistency. The designation on book plates dates from 1940; prior to that date the headnote read simply "Geological Survey" with no reference anywhere to the Department. Perhaps the change was dictated by political considerations at the Department. Stand-alone thematic maps (GQ's, I's, MF's, etc.) have carried the above headnote from the beginning (1949 for GQ's). Our earliest maps, the Folios of the Geologic Atlas of the United States, which were published from 1894 to 1946, carried headnotes that read either

U.S. GEOLOGICAL SURVEY
Charles D. Wolcott, Director

or

DEPARTMENT OF THE INTERIOR
Albert B. Fall, Secretary

U.S. GEOLOGICAL SURVEY
George Otis Smith, Director

The latter is the same version that we propose to adopt but without identifying the Secretary or Director. The PIPC feels that we ought to go ahead and make the suggested change without fanfare but that the Executive Committee should endorse it because of possible political implications. Opinions from the Solicitor's Office indicate that we can do just about anything we want in terms of department/agency identification as long as "the" (as in Department of the Interior) is part of the department's title.

Attached are some examples of front covers, stand-alone maps, and book plates. The changes recommended here, if approved, will apply only to new or reprinted books and maps (including topographic maps). They will not be enforced retroactively on existing stock.

Some recent examples are included

Bruce

Bruce B. Hanshaw

Attachments

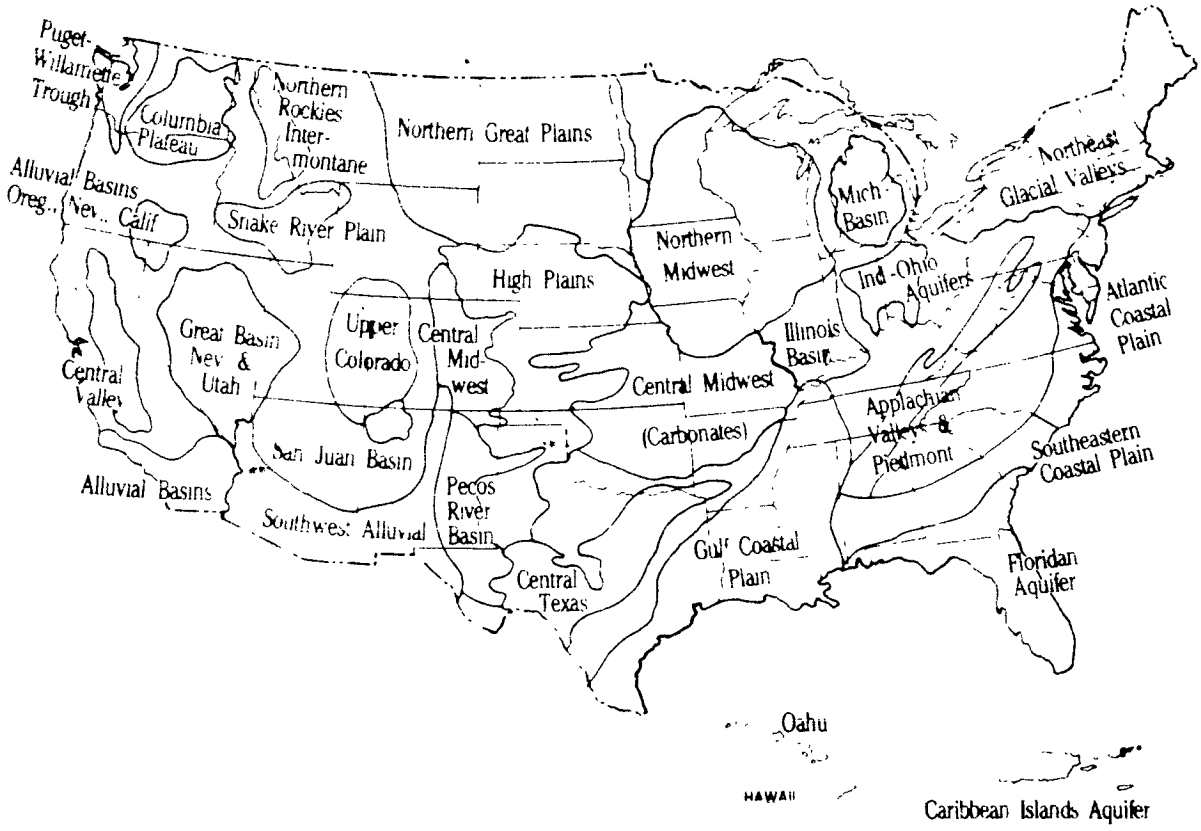
Approved: Dallas L. Peck

Dallas L. Peck, Director

Date: JAN 18 1934

cc: Publications Committee

REGIONAL AQUIFER-SYSTEM ANALYSIS PROGRAM
OF THE
U.S. GEOLOGICAL SURVEY
SUMMARY OF PROJECTS, 1978–84

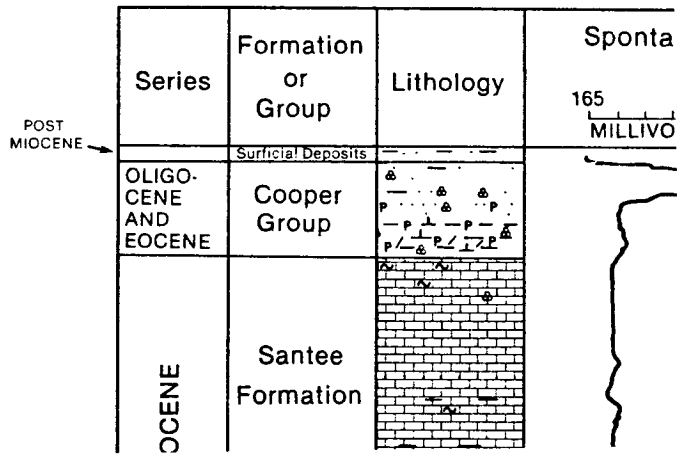


U. S. Geological Survey Circular 1002

DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

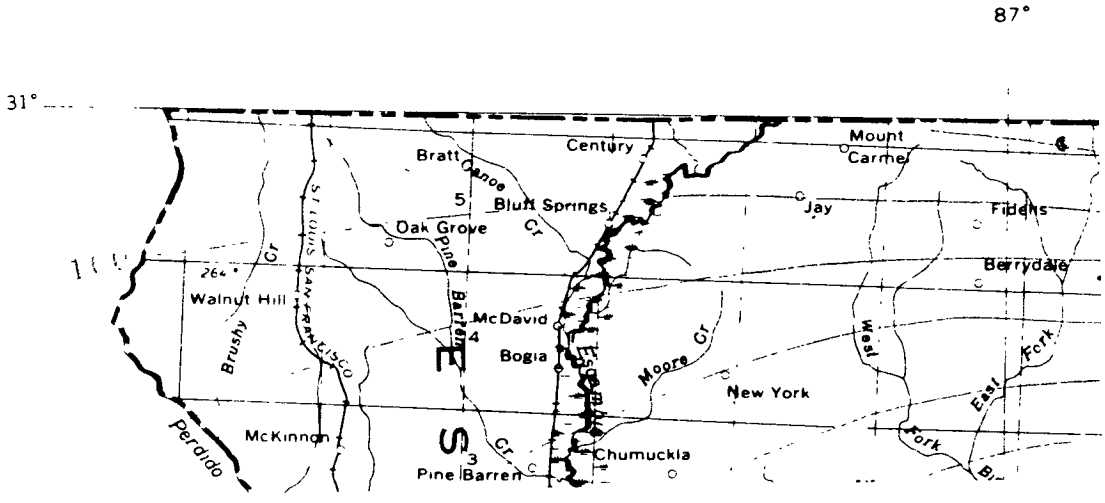
< Plate from a book report

ALTITUDE OF LAND SURFACE, 78 FEET.



DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

< Stand-alone map report



Article 10.04.2

DEPARTMENT OF THE INTERIOR
U S GEOLOGICAL SURVEY

MAPS SHOWING GROUND-WATER CONDITIONS IN
THE WHITE FALLS AREA,
ARCONA AND GRAHAM COUNTIES, NEVADA

By Linda B. Simmons and George D. Johnson

U.S. GEOLOGICAL SURVEY
WATER-RESOURCES INVESTIGATIONS REPORT 82-4915

Tucson, Arizona
1982

Prepared in cooperation with the
NEVADA WATER AUTHORITY

Typescript map jacket of Water-Resources Investigations Report
(Display lettering and location map may also be used;
Department seal is optional.)

CARTOGRAPHIC TECHNICAL STANDARDS

Replaces T. S. P.	3.00.1	Subject: MARGINAL INFORMATION IBM Composer Type for Marginal Information	T. S. Paper	3.00.1
Dated	12/1/75		Effective	4/1/77

Type styles and sizes for headings and co-op note:

PR-11-B (LD 14, UV 5, Imp) Plates or sheets wider than 24"

PR-10-B (LD 13, UV 5, Imp) Plates or sheets 18" to 24"

PR-8-B (LD 11, UV 5, Imp) Plates or sheets less than 18" wide

Interior/Survey Heading - Set flush left using Press Roman Bold[1] type:
For Map Series:

DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

For Book Reports:

DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Co-op Note - Center type using Press Roman Bold.[1] Show the line "Prepared in cooperation with..." in caps and lowercase; use caps for the remainder of the note.

Prepared in cooperation with the
STATE OF WASHINGTON

Series Identification Heading - Set flush right using Press Roman Bold[1] type.
For Map Series:

GEOLOGIC QUADRANGLE MAP
CAUSEY DAM QUADRANGLE, UTAH
GQ-790

MISCELLANEOUS INVESTIGATIONS SERIES
MAP I-900

GEOLOGIC QUADRANGLE MAP
CAUSEY DAM QUADRANGLE, UTAH
BEDROCK GEOLOGY \ **GQ-790**
2 em space

HYDROLOGIC INVESTIGATIONS
ATLAS HA-345

For Book Reports:

PROFESSIONAL PAPER 564-B
PLATE 3

BULLETIN 1243-B
PLATE 5

WATER-SUPPLY PAPER 1839-B
PLATE 1

[1]Souvenir Medium, Helvetica Regular, or similar type

INFORMATION FOR TOP MARGIN

(To Scale)

DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

TOP LEFT

Prepared in cooperation with the
SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

MIDDLE

WATER-RESOURCES INVESTIGATIONS
REPORT 85-4242

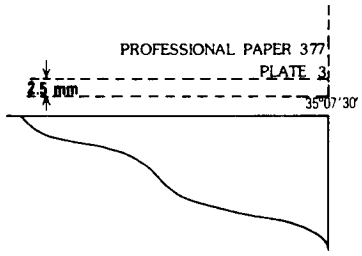
TOP RIGHT

CARTOGRAPHIC TECHNICAL STANDARDS

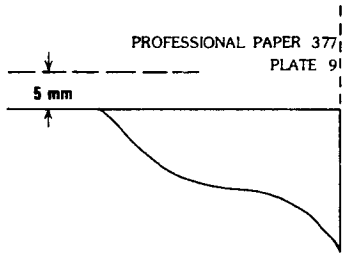
Replaces T. S. P.		Subject: MARGINAL INFORMATION Series Identification on Note	T. S. Paper	3.02.1
Dated			Effective	12/3/76

The series identification note is positioned flush right with the widest part of the map (border, neatline, or type matter) so that it will be visible after the map is folded. When there are grid-coordinate numbers on the map, the bottom of the series identification type will measure 2.5 mm above the top of the grid-coordinate type. (See example 1.) When a map or plate does not contain grid-coordinate type, the bottom of the series identification type will measure 5 mm above the neatline. (See example 2.) When the series heading is positioned directly above the explanation, the word "EXPLANATION" should be dropped 1.5 mm below the neatline to assure a space of 6.5 mm between the bottom of the series note type and the top of the word "EXPLANATION." (See example 3.) The bottom of the type of all headings should measure the same distanc from the neatline. Set type in same style and size as Interior Credit note (left heading, T.S.P. 3.01.1.)

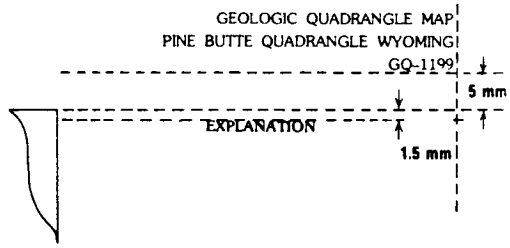
EXAMPLE 1



EXAMPLE 2



EXAMPLE 3



1. Examples of some series identification notes are as follows:

MISCELLANEOUS INVESTIGATIONS SERIES
MAP I-487

GEOPHYSICAL INVESTIGATIONS
MAP GP-600

HYDROLOGIC INVESTIGATIONS
ATLAS HA-513 (SHEET 1 OF 4)

2. When a specific type geology (economic, surfical, bedrock, etc.) is published in the Geologic Quadrangle Map Series, the type geology shall be indicated as part of the identification note as follows:

GEOLOGIC QUADRANGLE MAP
CAUSEY DAM QUADRANGLE, UTAH
BEDROCK GEOLOGY GQ-790

3. State names will be spelled out whenever possible. Line widths will not include more than 45 character spaces. The designer should try to condense them further wherever possible by abbreviating state names when more than one is indicated.

GEOLOGIC QUADRANGLE MAP
BLOOMSBURY QUADRANGLE, NEW JERSEY
GQ–595

GEOLOGIC QUADRANGLE MAP
RIEGELSVILLE QUADRANGLE, PA.—N. J.
GQ–593

4. In the GQ Series where geology is illustrated in two or more states and in a principal quadrangle and a part or parts of adjoining quadrangles, the adjoining quadrangle title shall be included:

GEOLOGIC QUADRANGLE MAP
ASHLAND AND CATLETTSBURG QUADRANGLE
KENTUCKY—OHIO
GQ–196

The chapter letter will appear on all plates in the upper right heading, <u>if</u> the book report is one of a series containing several chapters even though plates are consecutively numbered.

WATER-SUPPLY PAPER 1839–B
PLATE 1

BULLETIN 1242–B
PLATE 5

PROFESSIONAL PAPER 562–A
PLATE 3

Note: The Kentucky geologic quadrangles and some special series (such as Moon and Mars maps) will maintain their present type styles and formats throughout their present series.

CARTOGRAPHIC TECHNICAL STANDARDS

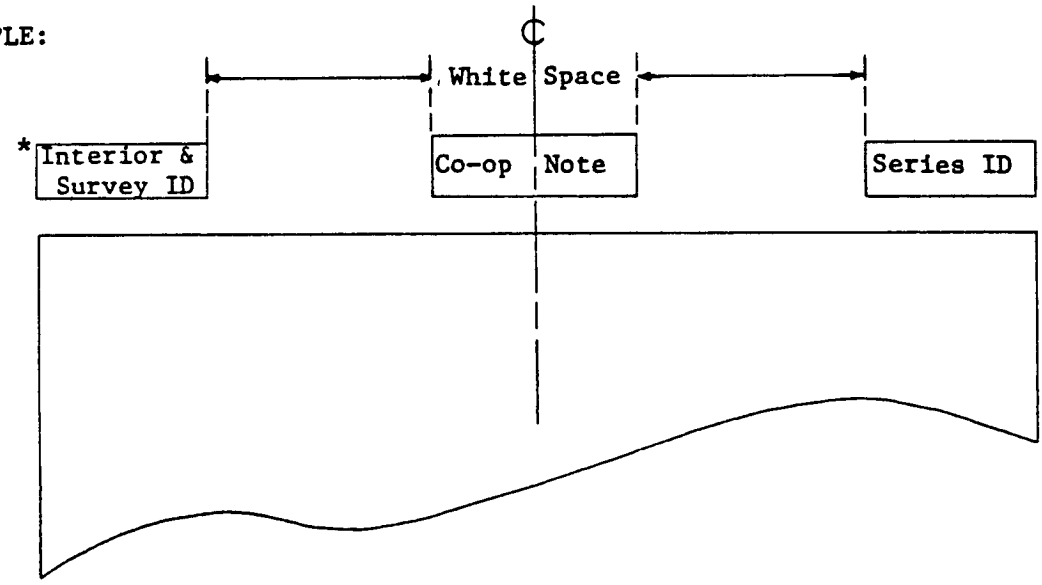
Replaces T. S. P.	3.03.2	Subject: MARGINAL INFORMATION Cooperation Notes on Book Report plates (in pocket) and Map Series sheets	T. S. Paper	3.03.2
Dated	5/20/78		Effective	11/1/78

Some map and book publications are the end product of scientific studies performed in cooperation with others outside the Survey. For such publications the Director has instructed that a note of cooperation must appear on all map series work and all principal maps or plates in pockets of books.

The wording for the note of cooperation is generally given in the letter of transmittal accompanying the job and that wording should be followed exactly. Should the co-op note appearing on a mill copy differ from that given in the transmittal letter or on another map in the same report, contact the operating Division for clarification.

The co-op note will be positioned at the top of the plate and centered between the Geological Survey/Interior Credit Note and the Series Identification Note. The bottom of the type will be alined with the bottom of the two headings, as indicated in example below.

EXAMPLE:



Headings for maps in book reports will read:

DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Headings for maps in the series will read:

DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

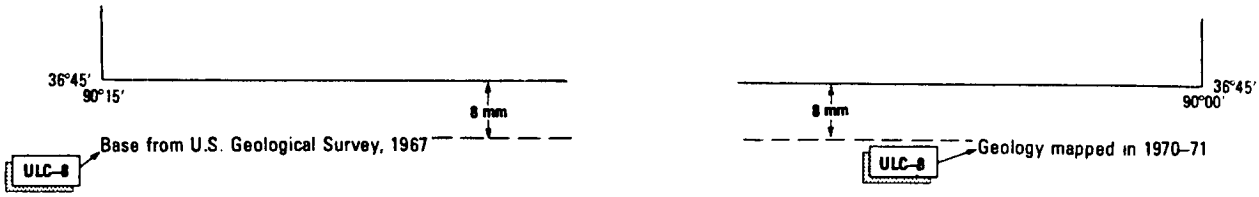
Note: Some foreign maps and special wall maps (not regular series) will have individual instructions for placement of co-op notes.

*Refer to T.S.P. 3.01.1

CARTOGRAPHIC TECHNICAL STANDARDS

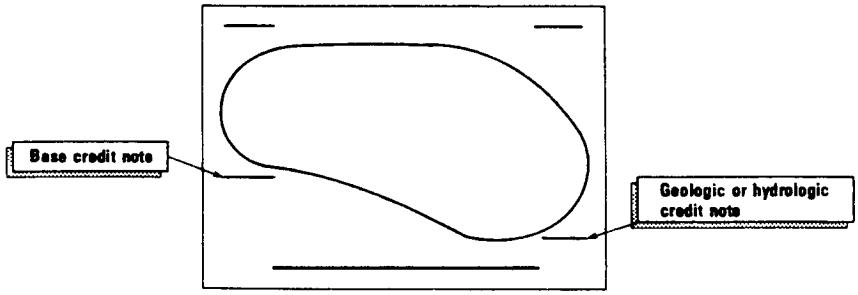
Replaces T. S. P.		Subject: MARGINAL INFORMATION Placement of credit notes	T. S. Paper	3.04.3
Dated			Effective	12/15/76

Rectangular-shaped maps.--Place credit notes 8 mm below the neatline if coordinates are shown; aline the base credit note with west neatline and the geologic or hydrologic credit note with the east neatline.

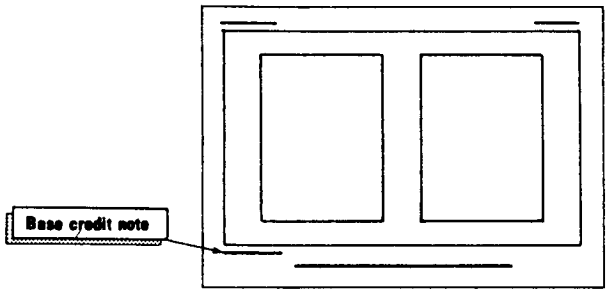


Where coordinates are not shown, put the notes 5 mm below the neatline.

Irregularly shaped maps.--If a map does not have a border and is of an irregular shape, put the credit notes as close to the lower corners as possible.



Repeated base maps.--If a base map is repeated, show the base credit note only once rather than under each image. Place the credit note below the south neatline or border and flush left with the west neatline.



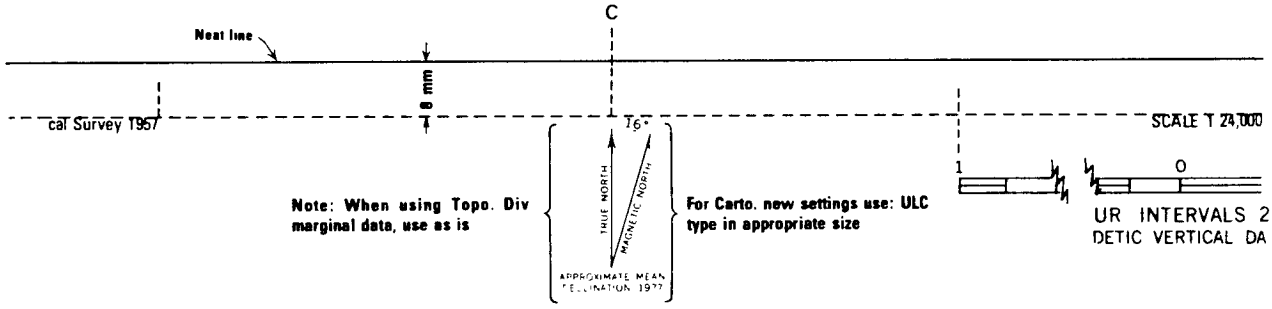
CARTOGRAPHIC TECHNICAL STANDARDS

Replaces T. S. P.	3.06.0	Subject: MARGINAL INFORMATION Magnetic Declination and North Arrow	T. S. Paper	3.06.1
Dated	8/1/78		Effective	2/16/79

The addition of a magentic declination and/or north arrow is not automatic but dependent on several factors; therefore, the decision of usage and form will lie with the map designer.

The magnetic declination will be updated to the year the map is published by checking the current edition of the isogonic chart. Do not change the degree figure unless the change is 30' or more.

The magnetic declination diagram will be used on quadrangle maps from the scale of 1:20 000 up to and including 1:125 000. It will be centered in the space between the base credit note and scales. The top of the degree number will be 8 mm below the neat line.



When this placement is not possible, as on an irregular-shaped map, place the magnetic declination along or near the bottom of the map in an area that is aesthetically pleasing.

If the map covers more than 1 degree (30' in Alaska) of latitude or longitude, the magnetic declination diagram will not be used. On these medium-scale maps a variable magnetic declination note will be used. Use the same wording as on the base map, and place the note on a line 3 mm below the datum note.

To match Topographic Division type, use Trade Gothic Roman (TG) type in the point size indicated in parenthesis on the right side of the illustrations below. For new type use Univers Light Condensed (ULC) in the point size indicated on the right side of the illustrations below.

Topographic Division type style is Trade Gothic Roman (TG), in indicated sizes

CONTOUR INTERVALS 200 AND 1000 FEET (8 pt.)
AREAS NOT SURVEYED IN DETAIL INDICATED BY BROKEN LINES (7 pt.)
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES IN FEET—DATUM IS MEAN LOWER LOW WATER (6 pt.)
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
1951 MAGNETIC DECLINATION AT SOUTH EDGE OF SHEET VARIES FROM 27° TO 28° EAST (7 pt.)

Branch of Cartography type stye is Univers Light Condensed (ULC), in indicated sizes

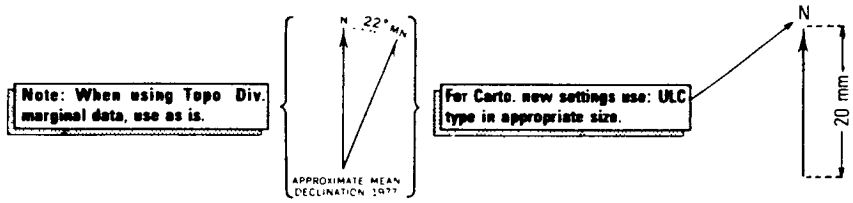
CONTOUR INTERVALS 200 AND 1000 FEET (8 pt.)
AREAS NOT SURVEYED IN DETAIL INDICATED BY BROKEN LINES
NATIONAL GEODETIC VERTICAL DATUM OF 1929 (6 pt.)
DEPTH CURVES IN FEET—DATUM IS MEAN LOWER LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
1951 MAGNETIC DECLINATION AT SOUTH EDGE OF SHEET VARIES FROM 27° TO 28° EAST (7 pt.)

A variable magnetic declination note will not be required on maps covering large areas at scales of 1:250 000 or smaller (1:500 000 1:000 000, etc.)

Mine maps generally have only the north arrow without the magnetic declination. Only when the author shows magnetic declinations on his manuscripts or he specifically requests that they be added will the magnetic declination be shown on these maps. Authors may also request that the magnetic declination and year remain the same as when they mapped the area, in which case the year mapped must be given.

On very small maps and mine maps and on figures where a geographic grid is shown, a north arrow is not required as the grid will indicate direction.

Foreign reports will show capital N and MN centered above the arrowheads. True north and magnetic north are not spelled out.



True and magnetic north arrows will always carry the note "Approximate mean declination, 19__."

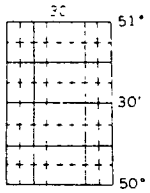
The following information and precedures are helpful in selecting the correct degree of deviation bewtween magnetic north and true north. Magentic declination is required on certain maps, and accurately determining the declination for a given map from the isogonic chart is not always easy. The diagrams shown on the following page are copied from transparent overlays that should be used in determining declinations. These overlays were designed to help the cartographer and/or technician in locating on the isogonic chart the geographic position and in selecting the proper degree of deviation of the map being worked on. The overlays are available on request from the Branch of Technical Coordination and Standards

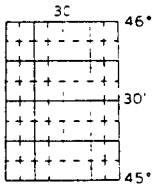
MAGNETIC DECLINATION DETERMINER

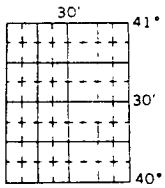
(See cartographic technical standard 3.06.1 for additional information)

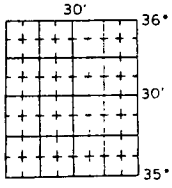
These diagrams should be used to locate the geographic position of your map on the isogonic chart, thereby aiding you in selecting the correct degree reading for the declination diagram

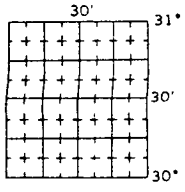
1°x1° Diagrams







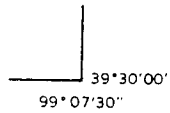




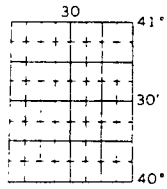
Apply the following steps in selecting and using the appropriate diagram:

Example

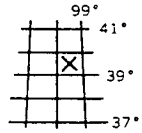
1 Check the latitude and longitude from any corner of your map



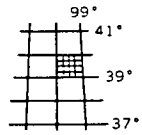
2. Select the 1°x1° diagram that is nearest in latitude to the latitude of your map



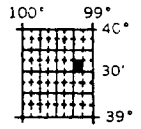
3. Locate your map area geographically (within the 1° latitude and longitude lines) on the latest available isogonic chart (USGS Map I-911)



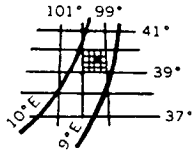
4. Position the selected 1°x1° diagram over the 1°x1° location on the isogonic chart.



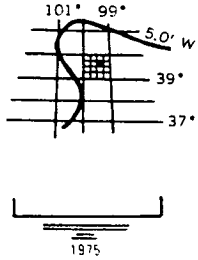
5. Considering the latitude and longitude on your map, visually locate your map area in the exact block on the diagram by using the appropriate divisions, 30' and 15' lines and(or) the dashed 7½' lines.



6. Select the isogonic (red) line nearest to your map location. (If it falls nearer the middle of two isogonic lines, add or subtract ½°)



7. Locate the isoporic (blue) line nearest to your map location. Multiply the annual minutes change shown on the isoporic line by the number of years since the date of publication shown on the isogonic chart (map I-911). The number of minutes of annual change will dictate if the magnetic-declination (compass variation) has moved east or west of true north into the next 30' or 1 full degree This example would be 9°.



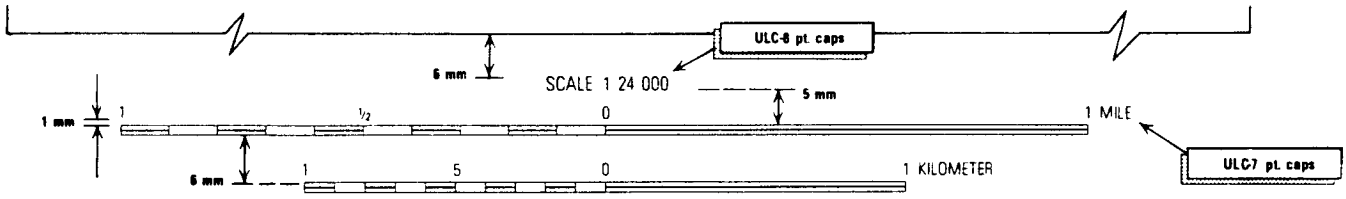
PUBLICATIONS DIVISION

CARTOGRAPHIC TECHNICAL STANDARDS

Replaces T. S. P.	3.07.1	Subject: MARGINAL INFORMATION Bar and Rake Scales	T. S. Paper	3.07.1
Dated	2/7/77		Effective	10/16/78

BAR SCALES

Bar scales will be used on multicolor maps and on black-and-white maps that have a detailed base, such as USGS, NOS, or DMA Quadrangles. These bases contain scales and other border data which should be retained to print in screened and/or solid black on the thematic map. The majority of geologic maps will use topographic bases screened in the Branch of Printing photolab with the 50% biangle screen used with the culture. If the culture is to be screened 40% or less or if for any reason the scale or border data cannot be used, it will be blocked out with lithographer's tape, and new data will be added to the black type overlay. Bar scales will be placed below the south neatline, centered between the east and west neatlines in the following manner. The normal distance of scales below neatlines on topographic Division quadrangles is 6 mm as shown below. When the Publications Division prepares its own base, the scale should be placed 8 mm below the neatline.



The length of the scale is important to the appearance of the map; therefore, a general guide for quadrangle-size maps appears below. For maps that are not quadrangle size, a general rule is to show them approximately one-third of the width of the map, and usually no longer than 178 mm.

Fractional scale	Overall length of scales	Fractional scale	Overall length of scales
1:24 000	2 km (2 mi)	1:62 500	8 km (6 mi)
1:31 680	2 km (2 mi)	1:125 000	15 km (10 mi)
1:48 000	6 km (4 mi)	1:250 000	40 km (30 mi)

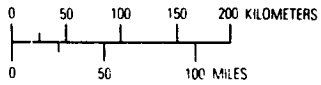
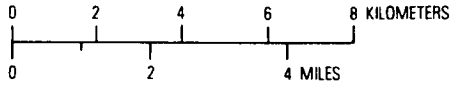
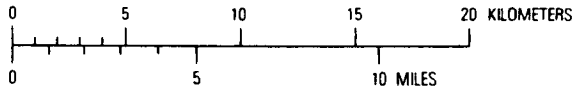
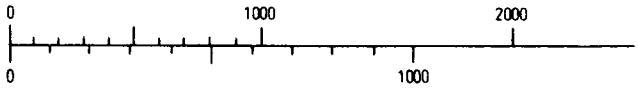
RAKE SCALES

Rake scales are to be used on index maps, text figures, mine maps and maps without detailed bases and under cross sections if the horizontal scale of the cross section differs from that of the map. The English scale will be combined with the metric scale. Subdivide the first unit only into appropriate measurements. The space between ticks for the subdivided unit should be no closer than twice the length of the long ticks. This will cause some variation in tick length depending on the length of the scale, although tick lengths of 2.5 mm and 1.3 mm should be satisfactory for most scales. The general rule for the length of a rake scale is the same as for bar scales on plates. The length of scales for figures depends upon space available but will generally be less than one-third figure width.

Four factors that should be considered when subdividing a scale* are:

1. The space available between the division (long ticks).
2. In what increments are the division (long ticks).
3. The mile scale should be subdivided according to the inch-pound system; for example when subdividing 1 mile, divide into 2, 5, or 10 parts.
4. The kilometer-scale measurements should be in sub-multiples of 10 according to the metric system; for example, when subdividing 1 kilometer divide into 2, 5, or 10 parts.

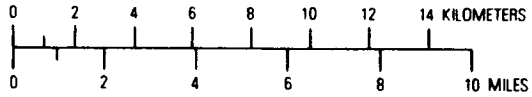
A general guide for rake scale subdivisions* is as follows:

Space between Divisions (long ticks)	Number of Subdivisions (short ticks)	Examples
Less than 19 mm (use only when necessary)	1	
19 mm to 51 mm	1 or 4	
More than 51 mm	9	  

Occasionally, scales on author's originals (and mill copy) are divided into odd increments. Using the author's measurements, we rearrange the divisions into more practical increments, e.g.:

Author's copy received

Increments rearranged and metric scale added



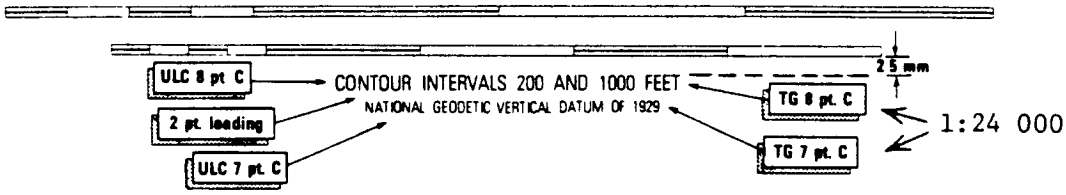
*See page 51.

CARTOGRAPHIC TECHNICAL STANDARDS

Replaces T. S. P.	3.09.1	Subject: MARGINAL INFORMATION Placement and type style for contour interval and vertical datum notes	T. S. Paper	3.09.1
Dated	3/1/77		Effective	2/16/79

The contour interval and datum notes will appear beneath the scale only if topographic contours are shown on the map. There may be times when the datum note will be used without the contour interval note, as on mine maps where datum for shaft levels is given; however, a contour-interval note will never be shown without a datum note.

When the Topographic Division's contour-interval note is being used on base copy and changes or additions are necessary, match their type style, which is Trade Gothic Roman (TG), as indicated at right below (on old topographic bases, match their existing typestyles).
When Branch of Cartography is preparing a new contour-interval note completely, they will use Univers Light Condensed (ULC), as indicated on left below.



Maps that contain open-water areas must be checked for fathom and depth contour lines. The contour, datum, fathom, and other notes that appear on these maps have many variations depending on the map's geographic location in addition to several other factors. The following are typical examples:

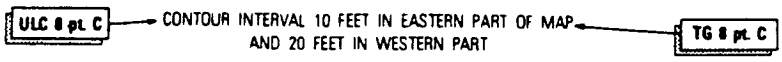
CONTOUR INTERVAL 50 FEET
WITH SUPPLEMENTARY CONTOURS AT 25 FOOT INTERVALS
NATIONAL GEODETIC VERTICAL DATUM OF 1929
BATHYMETRIC CONTOUR INTERVAL 10 METERS
SUPPLEMENTED BY 2 METER INTERVALS TO MAXIMUM DEPTH
DATUM: MEAN LOW WATER
THE RELATIONSHIP BETWEEN THE TWO DATUMS IS VARIABLE
← 1:250 000

CONTOUR INTERVAL 1.5 METERS
NATIONAL GEODETIC VERTICAL DATUM OF 1929
BATHYMETRIC CONTOUR INTERVAL 1 METER WITH SUPPLEMENTARY
0.5 METER CONTOURS—DATUM IS MEAN LOW WATER
THE RELATIONSHIP BETWEEN THE TWO DATUMS IS VARIABLE
THE MEAN RANGE OF TIDE IS APPROXIMATELY 2.1 METERS
↖↙ 1:24 000

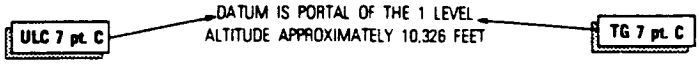
CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 3.9 FEET

CONTOUR INTERVAL 40 FEET
CONTOUR INTERVAL ON RIVER SURFACE 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
← 1:62 500

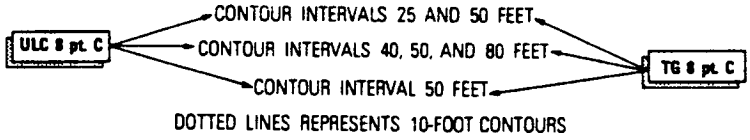
When two quadrangles with different contour intervals have been mosaicked to form a new base, the contour note should be similar to the example below.



Sample datum note without contour-interval note:



Other sample notes:



Note: All above examples are illustrated in ULC type.

Refer to T.S.P. 3.09.2 for proper wording of vertical datum notes based on geographic location.

CARTOGRAPHIC TECHNICAL STANDARDS

Replaces T. S. P.		Subject: MARGINAL INFORMATION Main Titles and Authorships; type style and sizes for maps and plates	T. S. Paper	3.10.1
Dated			Effective	12/2/76

On Book Reports each plate has a title only; on Map Series each sheet has a title with authorship and date centered under the title.

The variety of map sizes and conditions makes it difficult to set hard-and-fast rules for map titles. The following items will be used as a guide.

1. Souvenir Medium (SM) caps will be the style of type normally used for titles, and caps and lowercase for authorship.

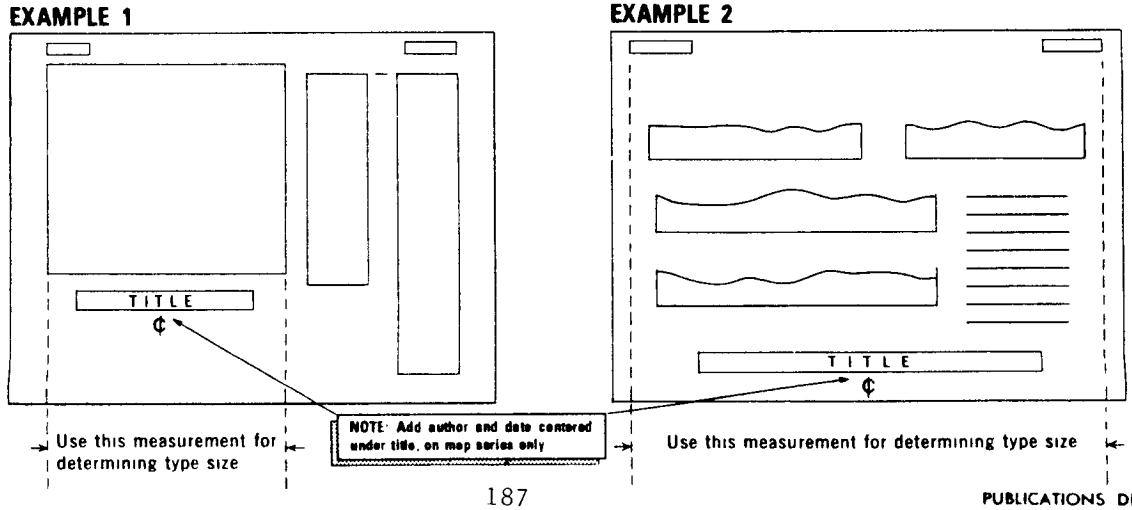
2. All Geologic Quadrangle Maps at 1:24,000 scale should use 20 pt. Souvenir Medium single line titles and 18 pt. for two-line titles. Designers should order the next smaller size of type when titles consisting of more than two lines tend to become too dominant on a plate or map. Very short titles may be set in a larger size.

3. When titles are set in open space areas (display title) reduce or enlarge the size of type according to the amount of space available.

4. Generally, type sizes have a direct relationship to the widths of maps and the length of the titles. If the title is to be set under the map, use only the width of the map for selecting the type size (Example 1). If the title is to be centered on the sheet, the overall width of the sheet will be used for selecting type size (Example 2).

		Titles	Authorships
a.	Maps from 0-230 mm wide use	12 pt. caps	10 pt. C/lc
b.	Maps from 231-300 mm wide use	14 pt. caps	10 pt. C/lc
c.	Maps from 301-400 mm wide use	16 pt. caps	12 pt. C/lc
d.	Maps from 401-500 mm wide use	18 pt. caps	14 pt. C/lc
e.	Maps from 501-600 mm wide use	20 pt. caps	16 pt. C/lc
f.	Maps more than 601 mm wide use	24 pt. caps	18 pt. C/lc

5. The date will always be 12 point except when 10 pt. authorship is used, then use 10 pt. date.



CARTOGRAPHIC TECHNICAL STANDARDS

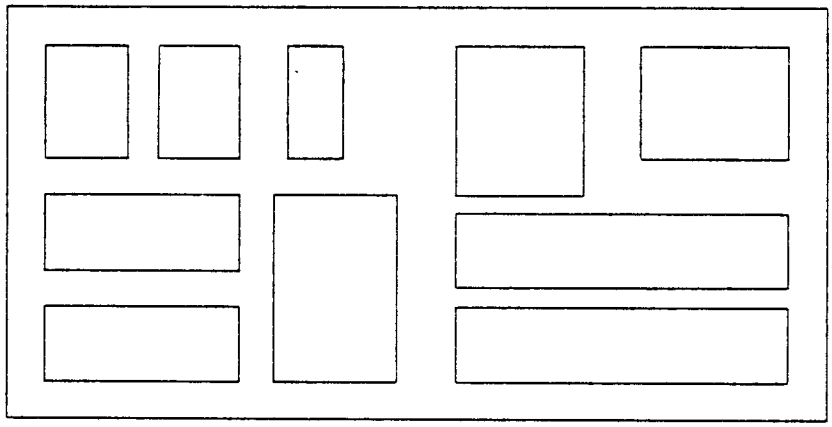
Replaces T. S. P.		Subject: MARGINAL INFORMATION Titles and Subtitles, also sheet identification note for reports containing two or more map sheets	T. S. Paper	3.10.2
Dated			Effective	2/22/78

The maintitles will be identical for all sheets and will be set in Souvenir Medium caps. (See T.S.P. 3.10.1.)

EXAMPLE: **WATER RESOURCES, MARYLAND**

Individual sheet titles (subtitles) will be positioned above the main title and will be set in Souvenir Medium (caps and lowercase) in the next available smaller size than the main title. See example 1.

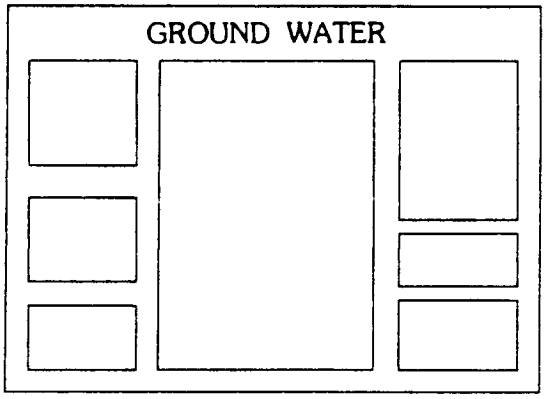
EXAMPLE 1



Water yield and water use
WATER RESOURCES, MARYLAND
By
A. B. Jones and John Smith
1977

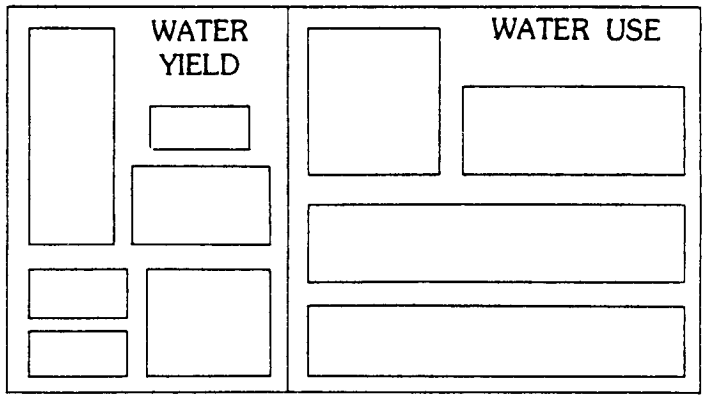
Whenever subtitles are placed within the body of the individual map, no subtitles will be added above the main title. Most "Map Series" subtitles will be set in Souvenir Light in the same size or larger than the title and will be placed at the top of the sheet whenever possible. See examples 2 and 3.

EXAMPLE 2



WATER RESOURCES, MARYLAND
By
A. B. Jones and John Smith
1977

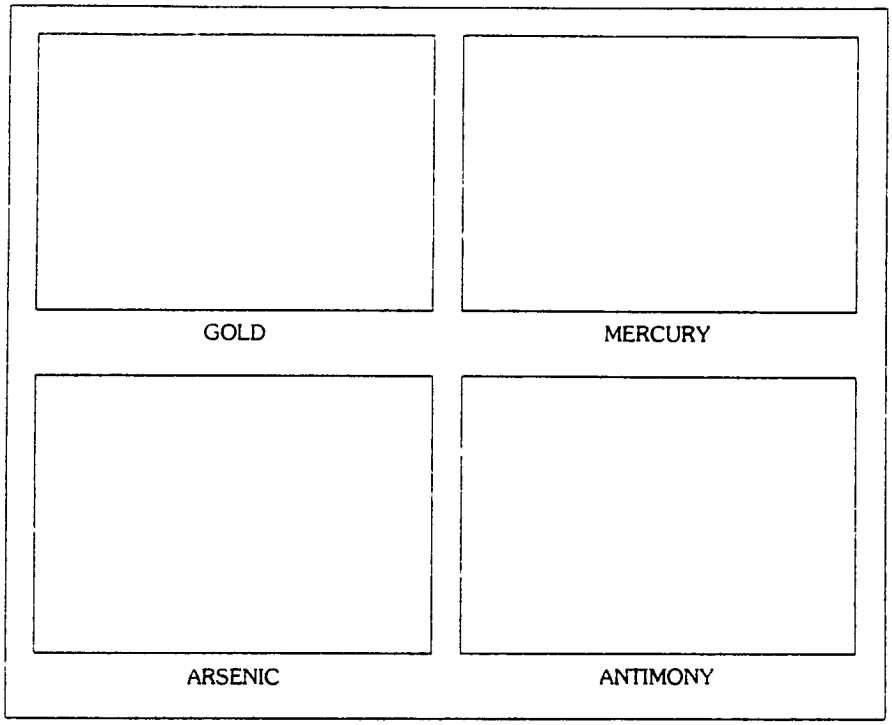
EXAMPLE 3



WATER RESOURCES, MARYLAND
By
A. B. Jones and John Smith
1977

Book report subtitles may be set in SL, U, ULC in a size that would best identify the data and compliment the map appearance, and still comply with geologic and hydrologic type standards. (See example 4.)

EXAMPLE :



GEOCHEMICAL MAPS SHOWING DISTRIBUTION OF GOLD, MERCURY, ARSENIC, AND ANTIMONY IN THE CORTEZ-BUCKHORN AREA, UREKA COUNTY, NEVADA

The series identification note in the upper right corner of Map Series sheets should be identical in all cases and should contain, in parentheses, both the sheet number and the total number of sheets in the set. The series identification note for "Book Report" plates should be identical on all plates but should show the individual plate number only. (See examples below.)

For map series — HYDROLOGIC INVESTIGATIONS ATLAS HA-000 (SHEET 1 OF 2)

For book reports — PROFESSIONAL PAPER 448-A PLATE 1

PROFESSIONAL PAPER 448-A PLATE 2

Note: Also refer to T.S.P.'s 3.00.1 and 3.02.1

PUBLICATIONS DIVISION

United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VA 22092

In Reply Refer To:
WGS-Mail Stop 435

January 6, 1987

WATER RESOURCES DIVISION MEMORANDUM NO. 87.21

Subject: PUBLICATIONS--Use of sea level to represent National Geodetic Vertical Datum of 1929

The recent WRD memorandums (86.101, 86.104, and 87.04) requiring use of National Geodetic Vertical Datum of 1929 (NGVD of 1929) were intended to increase the technical precision of our reports. NGVD of 1929 has a precise engineering basis, and its use is necessary to ensure precision of future interpretation of data. Whether we are aware of it or not, our field measurements such as lake and ground-water levels, elevations of stream gages, tops of well casings, and so forth, that, in conversation, are referred to sea level as the reference datum, actually are referred to the NGVD of 1929. Although scientifically correct, the use of NGVD of 1929 in text of our reports has been a cause of concern to WRD authors and to many readers who recognize that, even though "sea level" has no precise meaning in an engineering sense, it is a widely used and understood conceptual datum. Accordingly, the following statement should be included in all USGS and cooperator-series reports where for purposes of ease of understanding and conciseness, "Sea level" is used instead of "National Geodetic Vertical Datum of 1929":

> Sea level: In this report "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)--a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called "Mean Sea Level of 1929."

This statement, which replaces the current statement defining NGVD of 1929, should be placed at the bottom of the table of conversion factors and abbreviations.

NGVD of 1929 should continue to be used in the datum note of plates that show topographic contours, in accordance with the standards of the National Mapping Division and Coast and Geodetic Survey. Contributions to scientific journals generally have not included this statement, and use of "sea level" in these publications without the explanatory statement is acceptable in those instances where the precise meaning provided by NGVD of 1929 is not needed.

I believe this change serves the interest of scientific precision, while simultaneously retaining the readability and clarity of our reports.

James F. Daniel
Assistant Chief Hydrologist
for Scientific Information Management

WRD Distribution: A, B. S, FO, PO

This memorandum supplements WRD Memorandum 87.04.

WATER RESOURCES DIVISION
PUBLICATIONS GUIDE

Replaces Article No.: | Effective Date: 3/1/71 | Article No.: 3.07.1

Subject: ILLUSTRATIONS -- Photographs - Quality; only glossy prints acceptable

Some reports received in the Publications Unit, Reports Section contain xerox or similar machine prints of photographs in lieu of the required glossy prints. Machine-made prints lack the clarity and legibility required for review and approval.

Only glossy prints will be acceptable for approval for publication and open-file release. One glossy print is required for each photograph in a report. Photographs in copies of reports to be placed in the Washington file must also be glossy prints. Glossy prints should be prepared from continuous-tone negatives - negatives that have not been screened.

Those reports containing xerox or similar prints of photographs will be returned to the originating office for preparation and inclusion of appropriate glossy prints.

Reference: WRD memorandum 70.146, dated April 20, 1970.
Cross Reference: 3.07.3--Requirements for submitting photographs.

WATER RESOURCES DIVISION
PUBLICATIONS GUIDE

Replaces Article No.: | Effective Date: 3/1/71 | Article No.: 3.07.2

Subject: ILLUSTRATIONS -- Photographs - Characteristics of a good photograph

Characteristics of good photographs are:

1. The focus is sharp -- any reproduction of a photograph is of lesser quality than the original photograph, therefore, photographs that are out of focus will not reproduce satisfactorily and will not be approved for publication.

2. The contrast is not too dark or too light -- middle tones of gray reproduce the best. The best prints for reproduction are those made from negatives of evenly illuminated subjects in which the details are sharp. A good print for reproduction is one that has maximum detail in both shadow and highlight areas.

3. The photograph should show clearly what the photographer intended it to show. Objects such as trees or fences that obscure the view of the subject result in unsatisfactory photographs. Photographs with this problem should be retaken from a different position to eliminate the interfering objects.

4. The use of brand names in Survey publications generally is not allowed. Photographs should be taken so that any brand name on the object being photographed is either not visible or not readible. If this is not possible, the brand name must be removed from the photograph when final reproduction copy is made.

5. Objects that can be used for scale comparison of the subject are necessary in most photographs. They can be persons, vehicles, hammers, rulers, etc. Photomicrographs require a drafted linear scale.

6. Enlargements usually make unsatisfactory copy for reproduction. Coarse grained prints generally result from the enlarging process. Enlargements can be avoided by using cameras that make negatives at or near the desired publication size.

7. Polaroid prints are not satisfactory for use as reproduction copy because they deteriorate with age. However, a Polaroid camera can be used to advantage in conjunction with a second camera. A photograph of the subject can be taken first with the Polaroid camera to determine if a satisfactory photograph of the subject can be obtained at that site. If so, then the subject can be rephotographed with the second camera.

WATER RESOURCES DIVISION
PUBLICATIONS GUIDE

Replaces Article No.:	3.07.3 Dated 3/1/71	Effective Date:	3/20/74	Article No.:	3.07.3

Subject: ILLUSTRATIONS -- Photographs - Requirements for submitting photographs

1. Each photograph in a report must clearly relate to the subject matter of the text. If a photograph doesn't relate to the text, it doesn't belong in the report.

2. Continuous-tone glossy prints must be submitted for approval. Prints should be mounted on a piece of white 8 x 10 1/2-inch paper. Prints should be at the proposed publication size. Vertical aerial photographs must have a scale and a north arrow. Photographs must be clearly identified by figure number.

3. Suggested "crop" lines can be indicated beyond the edges of the photograph by the author.

4. If an author wishes to have information such as lines and lettering added to a photograph, the following procedure should be used:

   a. Use a duplicate print of the photograph. Indentations made on the surface of the photograph during the process of delineating features makes the photograph unsatisfactory for reproduction.

   b. Tape a piece of plastic or transparent paper over the photograph. This should be larger than the photograph.

   c. Add corner registration marks to the overlay at the corners of the photographic image.

   d. Compile on the overlay the information to be added to the photograph. Use black ink.

5. Proper credit for the photograph must be shown. The credit line usually is placed at the end of the title for the photograph. If the photograph was taken by:

   a. The author -- the photographer's name must not be shown.

   b. Department of the Interior personnel other than the author -- the photographer's name cannot be shown, except with the prior approval of the Director of Communications, Office of the Secretary.

   c. Another Federal agency -- the source of the photograph must be shown. Written permission from the agency is required and must accompany the report for approval.

d. A private individual or company or from a copyrighted publication -- the source of the photograph including the photographer's name, if known, must be shown. Written permission must be obtained and a copy of the letter must accompany the report for approval.

6. For Survey publications, the Publications Division requires that two continuous-tone glossy prints and the negative (if available) of each photograph be transmitted to them at the time original illustrations are requested.

7. Once a photograph has been approved for publication in a Survey report, it becomes the property of the Survey. Copies of the negatives used for reproduction are sent by the Publications Division to the Denver Film Library for filing. An author may obtain prints of the photographs from the library.

Cross reference: 3.07.1 -- Quality; only glossy prints acceptable

Replaces Article No.: | Effective Date: 3/1/71 | Article No.: 3.07.5

Subject: ILLUSTRATIONS -- Photographs - Reproduction

Reproduction of photographs is accomplished by screening the negative of a photograph so that the resulting image is composed of minute dots. The detail of a printed photograph is proportional to the density of the dots. The greater the density of the dots, the less the non-printing open spaces, and hence, the greater detail. Continuous-tone printing, printing a negative without a screen, is not done by the Survey.

1. Most photographs are printed using a 150-line screen. The resulting detail is satisfactory for almost all photographs appearing in Water Resources Division's reports.

2. Increased detail can be obtained by using 200- or 300-line screens. Requests for use of these screens must be in memorandum form and accompany the report when it is transmitted for Director's approval. To date, the photographs in only a few Water Resources Division reports have been printed using 200-line screens. Reports with photographs of fossil assemblages are the only ones where 300-line screens are used for the photographs.

3. "Bleeding," a reproduction technique, is used to allow the printed image of a photograph to extend to the edges of the page on which it is printed. This technique is restricted to special reports, usually those written for the lay reader, to enhance the appearance of the publication.

WATER RESOURCES DIVISION
PUBLICATIONS GUIDE

Replaces Article No.: | Effective Date: 3/1/71 | Article No.: 3.07.6

Subject: ILLUSTRATIONS -- Photographs - Colored photographs

The use of colored photographs in Federal publications is governed by the "Printing & Binding Regulations" established by the Joint Committee on Printing, Congress of the United States. Requests for use of colored photographs must be in memorandum form and accompany the report when it is transmitted for Director's approval. If the Director's Office approves the use of colored photographs, the request is then forwarded to the Department for approval. Departmental approval constitutes Congressional approval under the present system.

Two types of colored photographs can be used in reports; multicolor and duatones. Multicolor photographs are printed using the three primary colors - yellow, red, blue - and black. Duatones photographs are printed in black and one other color.

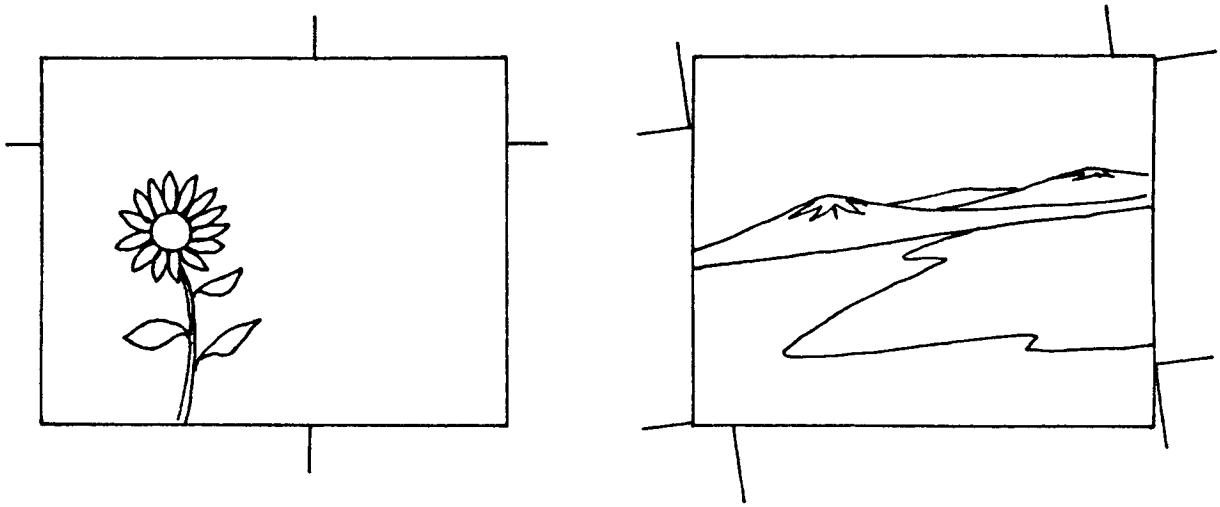
If a multicolor photograph is approved for publication, the author should furnish three continuous-tone colored glossy prints and the negative, transparency, or slide for use by the Branch of Technical Illustrations. If a duatone is approved for publication, the author should furnish two continuous-tone glossy black-and-white prints and the negative.

Article 3.02.3

Photographs

If the relative size of items being photographed is not self-evident, it should be indicated by placing a familiar object (for example, a hammer, ruler, or knife) in the photograph or by a scale shown on its border (not on the image).

Croplines are used to eliminate unwanted parts of the photograph and to adjust for inadvertent camera tilt. Croplines should not be drawn across the photograph, but at the edges only. If symbols or lines need to be added, an overlay should be prepared using corner ticks for registration to show placement. Write "top" at the top of the photograph mounting sheet to insure proper orientation.



The source of the photograph must be given only if photographer was not an Interior Department employee or if the photograph has been copyrighted.

Special mounting of photographs is necessary to avoid damage to the emulsion. Photographs should be secured to a sheet of paper by cutting four diagonal slots in the sheet through which the photograph corners can be inserted and taped on the back.

The author's name and the figure number should be typed on a label pasted to the back of the photograph or penciled on the mounting sheet. Do not write on the front or back of photographs, and do not use paperclips.

WATER RESOURCES DIVISION PUBLICATIONS GUIDE

Article 7.02.4

Subject: PROCESSING MANUSCRIPTS AFTER DIRECTOR'S APPROVAL.--Preparing Camera-Ready Copy

7.02.4 Preparing the mockup

- Cover
- Preliminary pages
- Abstract
- Text
- Placement of illustrations and tables
- Figure captions and table headings
- Completion of mockup

The purpose of a mockup is twofold--it enables the designer to develop an effective presentation of the material, and it serves as a typist's guide to minimize the amount of retyping and proofreading.

This article explains the mechanics of book design, with specific instructions for cover, preliminary pages, abstract, text, and placement of figures and tables. Although this article assumes printing on both sides of a page and an 8 1/2 X 11-inch format, such as for WRI and Open-File Reports, the principles are applicable to books of other dimensions and to printing on one side of a page as well.

Additional instructions for preparing WRI and Open-File Reports are given in Sections 10 and 11, respectively; procedures for designing books in the STOP format (Sequential Thematic Organization of Publications) are given in article 2.02.4.

Layout of WRI and Open-File Reports, as well as those in many non-Survey series, is generally done by an editor, but could be done by authors or clerical staff. With practice and by following the principles described in this article, one can avoid the common errors and create a professional-quality layout within a few hours for any type of published material.

COVER

Although the cover of each approved manuscript has presumably been checked to verify conformance to publisher's requirements, it is advisable to reinspect all details when preparing camera-ready copy, especially the wording and spelling of the title, because the cover is the most conspicuous part of the report. All art covers must be included in the report package submitted to Headquarters for Director's approval, and must be approved by the Director.

The cover contains four main components--cover 1 (outside front), cover 2 (inside front), cover 3 (inside back), and cover 4 (outside back). The printer generally will print them on a single sheet. If the report is to be more than a quarter of an inch thick, the cover will also include a spine backstrip). A page containing the copy for each of these components, including the spine, must be supplied to the printer with the camera-ready copy.

Texture and color.--Most Federal reports are required to be printed on uncoated (dull finish) paper because it is less expensive than coated (glossy) paper. Covers may be any desired pastel shade, including white, but in Geological Survey reports only one ink color is permitted. If colored paper is used, the ink must be dark enough to show clearly. If white lettering on a colored background is desired, prepare the copy in the usual manner but instruct the printer to "reverse" the print. A bold type should be used in "reverse" copy to prevent letters from "filling in" with surrounding ink.

Photographs printed on uncoated covers may give disappointing results because the ink will be absorbed, diminishing contrast. Line drawings, silhouettes, lettering, and uniformly screened areas, however, will be satisfactory on paper of any finish. If a cover photograph is required, consult GPO to be sure that suitable cover stock can be provided.

The ink color used on cover 1 will be used on cover 4, and may be used on covers 2 and 3 as well unless specified otherwise, because the four components are printed as one sheet.

Binding.--If the report contains less than 96 pages, it will be saddle stitched (stapled down the inside center) or side stitched (stapled on the outside at the left margin). If the report contains more than 96 pages (fewer pages if heavy text paper is used), it will be side stitched or perfect bound (squared off with glue binding). Wire, ring, or plastic bindings will be used only if specified; these are more expensive than a staple or glue binding.

Cover 1 (outside front)

In simplest form, Geological Survey report covers consist of the title, department and bureau identification, report series and number, and statement of cooperation. Covers do not bear the authors' names nor the date and city of publication; these are given on the title page.

If special lettering is used, its size and weight must be balanced and compatible. (See article 7.02.3.) Specifications for standard typescript covers are given below; examples are given in articles 3.01.2, 10.04.1, 11.04.1, and 12.04. If other than a standard designed cover is desired, an example must be included for inspection when the report is submitted for Director's approval.

Article 7.02.4

Department Identification.--For typescript covers to be reproduced by offset printing, the Department seal is placed near the lower right corner. For art covers, the Department seal may be centered on cover 4, if necessary. For covers of reports to be copied on office equipment, the edge of the seal may produce a "halo" or splice line, in which case it may be omitted. If the seal is omitted, the following imprint must be typed beginning four lines below the top of the page and centered:

DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

Report Title.[1]--Use capital letters, align flush left one inch from the left margin. If the above imprint is used, begin title 4 lines below it; if the department seal is used, begin at least 7 lines below the top of the page. If possible, make the top line the longest, but avoid hyphenation or illogical separation of words. If the title contains 2 lines or more, they should be double spaced. A centered 6-inch horizontal line is typed across the page 3 or 4 lines below the report title.

Bureau Identification.--On reports bearing the Department seal (rather than the above imprint), the words U.S. GEOLOGICAL SURVEY are typed on the third line below the horizontal line, in capital letters, flush left.

Report Series and Number.--Two lines below the words "U.S. GEOLOGICAL SURVEY," or 6 lines below the horizontal line, the report series and number, as indicated on the approval notice, is typed in capital and lowercase, for example:

- Water-Resources Investigations Report 86-XXXX

- Open-File Report 86-XXXX

Statement of Cooperation.--The statement of cooperation is aligned flush left with the title and double spaced about 4 inches above the bottom of the page; for example:

Prepared in cooperation with the
NEW YORK STATE DEPARTMENT OF HEALTH

For WRI and Open-File Reports, the name of the cooperator should be lettered the same size as that of the Geological Survey.

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[1] Water Resources Division Memorandum No. 81.127, dated September 8, 1981, describes the requirements for a good report title.

Cover 2 (inside front)

In WRI and Open-file Reports, cover 2 is blank. This should be indicated by stating in nonreproducing blue on the bottom of cover 1, and on a separate page:

"cover 2 is blank."

Article 7.03.2 gives instructions for indicating the presence (or absence) of printing on covers 1 through 4 on the GPO Printing and Binding Requisition form SF-1.

Reports to be printed in non-Survey series may require special copy for cover 2, such as a list of county officials. Whenever this is the case, be sure that the following information is included:

DEPARTMENT OF THE INTERIOR

_____ , Secretary

U.S. GEOLOGICAL SURVEY

_____ , Director

The Secretary's name is all-capitals; Director's name is capital and lowercase.

If the list of officials is on the back of the title page, cover 2 will be blank. (See example in article 3.01.2.)

Cover 3 (inside back)

Cover 3 of a report may contain printing or may be blank; some reports contain a map pocket. In any case, the printer must be informed as to what to do. Prepare a sheet (in nonreproducing blue) stating "cover 3 blank" or "cover 3 map envelope." Specific instructions regarding the size and configuration of the envelope must be included in Printing and Binding Requisition form SF-1. (See article 7.03.3.) If cover 3 is to contain printing, write "cover 3" (in nonreproducing blue) at the top of the copy and also specify the desired enlargement or reduction, if any, and how the copy is to be positioned.

Cover 4 (outside back)

If copy is prepared for cover 4, give precise instructions, or, if cover 4 is to be blank, indicate so on a separate sheet. Remember that if the report is to be perfect bound or saddle stitched, the cover will be printed as one sheet, with covers 1 and 4 on one side and covers 2 and 3 on the reverse side.

Article 7.02.4

Spine (backstrip).--If the camera-ready copy is to be perfect bound, lettering will be required for the spine. The lettering should be in a size that will fit on the spine (no longer than the book's left margin and no higher than the estimated thickness of the book). The simplest procedure is to type or letter the material lengthwise on 8 1/2 X 11-inch paper, positioning the words exactly as they are to appear on the printed cover; for example:

[Top]		[Bottom]
Smith	GROUND WATER IN MERCER COUNTY, N.J.	USGS/WRI 82-XXXX

On this sheet, write "spine" in nonreproducing blue and enclose it with the other cover copy. Some titles may need to be shortened or the author's name or series number omitted. Indicate top of book to insure that the spine reads downward. The spine copy can be printed on cover 4 of saddle-stitched books, if desired.

When the camera-ready copy of the cover has been completed, insert a copy of each component in proper order in the mockup. Thus, the first two sheets of the mockup will be covers 1 and 2, and the last will be covers 3 and 4 with spine copy.

PRELIMINARY PAGES

Pagination.--In camera-ready copy, the preliminary pages (contents, list of conversion factors, glossary, and so forth) are numbered with lowercase roman numerals, and the text, beginning with the abstract as page 1, is numbered in arabic. Odd-numbered pages must be on the right, even numbers on the left. In standard-format Geological Survey reports, the page number is centered about 5/8[1] of an inch above the page bottom; other publishers may place page numbers elsewhere, such as in the outside corners.

Title page.-In WRI and Open-File reports, the title page closely resembles the cover, except that it includes the author's names (first name, middle initial, and last name, in capitals and lowercase, just below the title, and gives the city, State, and date of publication approximately one inch above the page bottom. (Typographic instructions for the title page are also given in article 6.01.3; examples are given in articles 3.01.2, 10.04.1, 11.04.1, and 12.04.1.) If a frontispiece is used, see article 5.05.8.

Back of title page.--The material for this page depends on the publisher. In WRI and Open-File reports, this page lists the Department Secretary, the Director of the Geological Survey, the originating office address (see examples in articles 10.04.1 and 11.04.1), and ordering information; in non-Survey reports it may list non-Federal government officials or be left blank. If such officials are listed, the Department Secretary and Director of the Geological Survey also must be included.

[1] Top of number, base of number should be placed ½" from the trim edge. Printers use page numbers when centering pages for printing so all numbers should be in the same location on each page.

Contents (not "Table of Contents").--This will normally begin on page iii, which, in final copy, will face the back of the title page. The wording of headings should be exactly as in the review copy, and the material is single spaced. Leaders (rows of dots or dashes) should extend to the right, leaving room for page numbers once they have been determined.

Other preliminary pages.--At this point, the person making the mockup will assemble all remaining preliminary matter on a facing-page basis, cutting and positioning until visual balance is achieved. In some reports, the contents, list of illustrations, and list of tables may fit on a single page; in others, they may run onto several pages. The list of illustrations (plates and figures) normally precedes the list of tables. The list of tables is followed by the list of conversion factors, which, if short, may be on the same page as the list of tables. The list of conversion factors should not be listed in the table of contents. A "Glossary" or " Definition of Terms" section, if used, may be placed at the back of the report and listed in the table of contents. It follows the "References" section and precedes the appendices, if any, and big, end-of-report tables, if any.

As a rule of thumb, typescript should begin and end at the same depth on each pair of facing pages. A transparent ruler at least 12 inches long and marked in both inches and picas will be useful in measuring the vertical spacing. To help achieve balance across facing pages, space may be added between major sections.

When the preliminary matter has been arranged and pasted down with rubber cement, tape, or wax, the roman numerals may be penciled in at the bottom of each page. Also, the number of lines skipped between components and the line on which typing begins should be indicated to help the typist avoid guesswork.

If the preliminary material ends on an odd-numbered (right-hand) page, the next sheet should be marked "page blank" in nonreproducing blue. This both informs the printer that there is no copy for that page and enables the abstract to begin on the right, in accordance with tradition.

ABSTRACT

In nearly all reports, the first page of text (page 1) is the abstract. This page begins with the title, usually centered in capital letters, double spaced, and arranged in "inverted pyramid" fashion--that is, the top line is the longest. If this forms an awkward wordbreak or requires hyphenation, an alternative arrangement should be developed.

Two or three lines below the title is the word "By" and the author's name(s) on the same line (usually first name followed by middle initial and last name). Three or four lines below the author's name(s), the word "ABSTRACT" is centered in capital letters. (See example in article 3.01.2.)

Article 7.02.4

If the abstract is short and appears isolated on the page, three remedies are possible:

1. Double space the abstract, perhaps in italics, but leaving the title and author's name(s) in Roman type.

2. Drop the title from line 7 to line 13 and begin the abstract farther down.

3. Indent the abstract on both sides to form a 5- or 5 1/2-inch line; this will make it narrower and a line or two longer.

4. Develop a combination of the above.

5. Begin the introduction a few spaces below the abstract rather than on the next page. If this is done, typing the abstract in italics and (or) indenting it slightly on both sides will give the necessary contrast and improve the appearance of the page. Italic type should not be used for lengthy abstracts, however, because it is difficult to read.

TEXT

The introduction is the first part of the text following the abstract. The introduction may begin either on page 1 below the abstract, on page 2, or on page 3 (right-hand page), leaving page 2 blank. (If the last option is chosen, leave page 2 blank and insert a sheet containing the note "page 2 blank" in nonreproducing blue.)

The designer will find it helpful to establish the image area for the report. For 8 1/2 X 11-inch paper, this is generally 6 1/2 inches wide and 8 3/4 inches (53 lines) deep, beginning on line 7. This gives a slightly larger bottom margin and provides space for the page number. Top and side margins should be 1 inch wide.

Paragraphs.--Paragraphs may be broken and continued on the following page (in camera-ready copy only). The image areas on facing pages should be balanced; that is, the number of lines should be equal. If a paragraph runs just one line over the limit, the designer must decide whether to carry two lines over to the next page, or to create the necessary space by rearranging the preceding material. The latter can be done by (1) slightly widening line lengths so that the last line of a paragraph is absorbed; (2) deleting space between headings, or (3) backtracking a few pages to gain space elsewhere.

Article 7.02.4

Headings.--When a new heading is reached, there is no need to begin a new page unless the heading is so close to the bottom of the page that little or no text can follow it. When this occurs, lengthen the typed area either by adding a line or two from the previous page, by expanding the space above preceding headings, or by slightly narrowing the lines in certain paragraphs so that those paragraphs will each become one line longer. If the page is still too short, achieve balance by shortening the material on the facing page by an approximately equivalent amount. This discrepancy will almost never be noticed, regardless of the length of other pages in the book. It is important, however, to leave sufficient space above the new heading so that it will stand out.

List of references.--The list of references preferably should begin on a new page. However, the list may begin on the last page of text, depending on the number of bibliographic entries, the amount of space left on the preceding page, and the number of entries that will run over onto a new page.

PLACEMENT OF ILLUSTRATIONS AND TABLES

Placement of illustrations (figures and plates) and tables requires attention not only to their size, but also to the wording of the text. For example, a table and a map may be intended to face each other, two photographs may belong side by side for comparison, or six or eight similar graphs could be reduced and grouped together on a page or on facing pages.

When laying out the single-spaced text on facing pages, note the principal (not necessarily the first) reference to all tables and figures and inspect those components for size and relation to other components. From the author's illustrations, obtain an idea as to whether the material will require a full page, two or more facing pages, or less than a page, and how they should be grouped. A table or figure should be positioned just after its principal reference and, if possible, within the chapter or subsection in which it is discussed--that is, before the next heading. An illustration or table should be placed within the next chapter only when the advantages would outweigh the disadvantages.

When working through the mockup, indicate to the typist the exact amount of vertical space needed for each table or illustration and heading.

When placing illustrations and tables, avoid broad-measure layout where possible because it inconveniences the reader, who must turn the book sideways to read it, and because it is out of step with the general layout of the book. However, broad measure often is necessary, particularly with computer printouts. Where broad measure cannot be avoided, the imbalance can be minimized if two such pages are placed facing each other so that both can be viewed as a unit.

Article 7.02.4

A series of similar illustrations may be reduced and grouped with two or more on a page or series of pages. If this is done, the captions probably will need to be rephrased to reflect the new arrangement. For example, a revised caption for a series of graphs numbered 6 through 12 would refer to figures 6A through 6G.

A copy of illustrations and tables reduced or enlarged to publication size can greatly facilitate layout work; these can usually be obtained through a local graphics firm. Alternatively, this work may be left to the printer. Simply draw a rectangle in nonreproducing blue on the camera-ready copy showing the exact area to be occupied by the material, and indicate on each component the desired dimensions and the page on which it is to be inserted. When the critical desired dimension has been determined, the other dimension can be calculated from a circular proportional scale, obtainable at graphics firms. If the other dimension is too short or too long, cropping or reformatting will be necessary.

Illustrations and tables provide an advantage in layout because they not only add variety to the typescript but can generally be reformatted as appropriate. For example, a table may be expanded by double spacing, may be separated into halves to occupy two facing pages, or may be compressed or photoreduced to fit a small area. Similarly, an illustration can be expanded or reduced by altering the borders, cropping nonessential areas, or regrouping the components. In all cases, legibility is the prime concern.

FIGURE AND TABLE TITLES

When preparing the mockup, figure and table titles should be designed to an appropriate width--slightly narrower than the component they describe, with the top line equal to or slightly longer than the rest. Each line of the title should be approximately the same length.

To prevent a title from blending into the surrounding text, place figures at the bottom of the page and tables at the top, or provide extra space between the title and the text. Alternatively, type all titles in italics. (Note that italics should not be underscored.)

COMPLETION OF MOCKUP

When all components have been assembled and all pages rechecked to verify that no copy has been omitted or placed out of sequence, and that all facing pages are balanced, the page numbers are assigned and transferred to the table of contents. Verify that all section headings given in the table of contents contain the same wording and rank as those in the text. Also, verify that the amount of space to be left for figures, tables, and section headings is indicated to avoid errors and retyping.

As a final inspection, start again with the front cover and view all pages, two at a time with even numbers on the left, to insure that every component is accounted for and correctly numbered (including blank pages).

Reports to be reproduced by offset printing will contain a total number of pages that is a multiple of 4. For example, if the text ends on page 31 and contains 6 preliminary pages (i-vi), the total is 37. However, to reach 40 (the next multiple of 4), 3 extra sheets must be added, on each of which is written, in nonreproducing blue, "pages __, __, __ blank." This informs the printer that there is no copy for the last three pages. If the report is to be machine-copied (two-sided), this rule does not apply.

The completed mockup should be a full-size replica of the printed report, minus the illustrations, tables and titles, except that all pages are one-sided. Final drafting may now be completed because the exact dimensions are known. After all rubber cement, dirt, and extraneous pencil marks have been removed, the mockup is given to the author for inspection, then to the typist for preparing the camera-ready copy.

WATER RESOURCES DIVISION
PUBLICATIONS GUIDE

Replaces Article No.: 2.5 Dated 7/31/64 | Effective Date: 3/29/71 | Article No.: 3.04

Subject: ILLUSTRATIONS -- Titles

Guidelines for titles

I. Titles of illustrations, whether of plates or figures in book publications or of separately published maps and charts, require careful consideration by author and reviewers before Director's approval because they must be both informative and concise. Following such approval significant changes should not be made in titles without agreement by the originating Division.

II. Titles of separately published maps and charts should give maximum information to the user. Titles that adequately express content and location will facilitate proper cataloging in libraries and bibliographic indexes.

III. Titles for separately published maps and charts and for plates in books must be short because of the demands for brevity of citation and space limitations for placement of titles. Titles for figures in books are set in type by the printer, may be longer, and may include explanatory material.

IV. Concise titles providing maximum information are most desirable, but the kind of illustration (map, diagram, chart, photograph, etc.), its mode of publication, and its complexity influence this goal. Each illustration is different, and individual judgment must be used in every case to describe its composition.

Factors controlling content and form of titles

V. Identification of kind of illustration

In book reports the kind of illustration should be indicated in short titles in "Table of Contents - Illustrations" but generally is omitted beneath the illustration in the text. The kind of illustration generally is indicated in titles of separately published maps and charts. Map series publications include principally geologic and hydrologic maps so that "Geologic map of ***" or "Geologic and hydrologic map of ***" is preferred over "Geology of ***" even though short texts, columnar sections, cross sections, and other illustrative material of secondard importance may be present.

VI. Geographic location

Titles of separately published maps and charts and titles of plates of book reports should indicate geographic location as completely as demands for brevity and space limitations permit. The county or section of a State should be included in the title where the quadrangle name alone is not sufficiently informative. Where several county or State names are required for a complete geographic

location, a regional geographic location (southwestern, central, Rocky Mountains, Missouri River basin, etc.) may be substituted. Designation of geographic location is not necessary in titles of figures bound within a publication unless the geographic location of the figure is only part of the entire area studied.

VII. Qualifications

When special conditions such as the quality of the base map, or the accuracy, geologic detail, method, and objectives of an investigation affect the character of a map, the title may include qualifying adjectives such as preliminary, sketch, generalized, reconnaissance, surficial, or bedrock.

VIII. Subsidiary illustrations and specialized data

If essential for giving maximum information, the presence of subsidiary illustrations or specialized data can be shown in the title by such additions as "*** and structure," "*** and cross sections," "*** showing water-table configuration." Subsidiary illustrations may require subtitles which identify the type of illustration; expanded subtitles may be necessary to avoid ambiguity.

IX. Titles on multisheet maps, jackets, and separate texts

When separately published maps and maps in book reports are printed in several sheets, common titles that apply to all sheets should appear on each; the individual sheets may carry sheet titles and may include subsidiary titles. Separately printed texts also should carry the common title. The common title should appear on the jacket of map publications.

Processing titles in book reports

X. Brief titles of illustrations in book reports are listed in "Table of Contents - Illustrations." This typed list is a part of the text and a duplicate copy should accompany the illustrations to serve as an invoice for the geologic map editor and Branch of Technical Illustrations.

In addition complete individual titles are typed double-spaced on separate pages; the original is placed in the text as the page following the most important reference; and a carbon copy and the Check Sheet for Illustrations are attached to the mill copy (copy reviewed by critics, corrected, and sent forward for Director's approval) of the illustration. All changes in titles must be made on the carbon copy attached to the mill copy. Before the mill copy is sent to Branch of Technical Illustrations, Branch of Texts will check title changes on appropriate pages in the text so that titles accompanying the illustration and in the text are in agreement. This assures that titles for figures to be set in type by Government Printing Office (titles as cited in the body of the text) and titles placed on plates by Branch of Technical Illustrations are in general agreement with titles given in the "Table of Contents."

WATER RESOURCES DIVISION PUBLICATIONS GUIDE

Article 7.02.6

Subject: PROCESSING MANUSCRIPT AFTER DIRECTOR'S APPROVAL--Preparing Camera-Ready Copy

7.02.6 Final page makeup

Final page makeup for printing or duplication may begin as soon as the illustrations, text, tables, and all other components have been completed, inspected, and corrected. This task consists of five steps, as explained below:

1. Add components such as tables and illustrations, display lettering, Department seal, running heads, equations, and so forth to the pages.

2. Splice or opaque to make minor corrections.

3. Inspect and clean up camera-ready copy.

4. Mark printing instructions on camera-ready copy.

5. Perform final verification.

ASSEMBLY OF COMPONENTS

Add components made separately from the main typescript. This is best done at a light table with a ruled sheet or grid placed beneath the copy to insure exact alignment. Insert only line copy that is at publication size; in offset printing, halftones[1] and all copy to be reduced or enlarged must be separated out for they are treated individually by the printer. If the report is to be duplicated inhouse, all components must be at publication size.

When positioning illustrations, tables, and titles in the camera-ready copy, view the facing pages side by side to insure balance. Also be sure that all components are firmly attached and lie flat.

SPLICING OR OPAQUING

Splice or opaque minor corrections rather than retype an entire page. Use a light table to obtain correct alignment, and use a sharp blade to avoid damaging the copy. In some cases, it may be easier to have a full paragraph retyped and pasted over the incorrect part than to splice individual words or lines.

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[1] Material submitted for printing is either "line copy" or "halftone." Line copy is artwork or text consisting solely of lines or patterns; it may be photographed directly because it contains no intermediate gray. Halftones are photographs that must be "screened," or converted to a dot pattern to produce the desired gray. Map bases that are screened are also treated separately.

INSPECTION AND CLEAN UP

Inspect and clean up camera-ready copy. This should be done after all splicing and pasting are complete. Starting with the cover 1, carefully view each pair of facing pages side by side to verify balance, even margins, and general harmony between headings and typescript. If rubber cement has been used, dirt and streaks will probably be visible; these can be removed with a crepe "pickup" (available at graphics firms) or with a piece of dried rubber cement. When erasing pencil marks, be careful not to crease the paper or smear the typescript. If a smudge or spot cannot be removed, cover it with white correcting fluid. All penciled notes must be erased except those written in nonreproducing blue; these may simply be crossed out (in the same blue) so that the printer will not mistake them for instructions.

MARKING PRINTING INSTRUCTIONS

Mark printing instructions on each cover component and on all pages that are to be blank, that contain copy to be reduced, enlarged, screened, printed as a foldout, or that contain a map jacket. All printing instructions on the camera-ready copy must be written in nonreproducing blue.

COVER

Each of the four cover pages (and spine copy, if used) should be identified as cover 1, cover 2, and so forth; those to be left blank should also be clearly marked "blank" in nonreproducing blue. If covers 1 and 4 form a continuous design, this must be explained to the printer, and, if there is to be a backstrip, be sure the design of the covers 1 and 4 will accommodate it. Again, note that, unless specified otherwise, the printer will print covers 1 and 4 in the same color.

SPECIAL PROCEDURES

Special procedures for any page, such as screening a particular area, reversing the color (white lettering on colored background) or using a "flopped" image (negative turned dull side up to print the image backwards), must be spelled out, and the exact location and area to be occupied by that component must be indicated on the camera copy. Also, each component must be labeled to indicate the desired dimensions (or percentage reduction) as well as the page on which it is to be inserted. For halftones, the line screen should be specified (most will be 133 or 150 lines per inch). For shaded areas or screened base maps, the density (30 percent, 50 percent, and so forth) must also be indicated. Further information on art preparation may be obtained from District and Region, from the Publications Planning Unit at Headquarters, or from local graphics firms.

Article 7.02.6

PRINTOUTS

If oversized copy such as a computer printout is to be reduced to occupy a full page, it should be separated out and a blank page inserted bearing the page number and any other necessary lettering. (If the page number and any other lettering are typed on the printout, they will be reduced and be inconsistent with the rest of the report.) The area to be occupied by the reduced copy should be indicated in nonreproducing blue on the page bearing the page number, and the printout itself must be marked to indicate final dimensions (or percentage reduction) and on which page it is to appear. If several pages are to be reduced, indicate those page numbers in nonreproducing blue on a blank page, then provide the typed page numbers on a separate sheet, about one inch apart. The printer will add these numbers after the printout has been reduced.

CROPPING

When specifying reductions or enlargements, remember that the proportions do not change; that is, the height will change by the same percentage as the width. To alter the proportions, either crop or redesign the material. If a photograph or other original material is to be cropped, do not write on it; instead, indicate the croplines on a transparent overlay or mount the component on a larger piece of paper and indicate crop lines outside the photograph. Also be sure to indicate the desired final size and the page on which the photograph is to appear. (See article 3.02.3.)

PROOFS

If the report requires special reductions or insertion of screen copy, a proof should be ordered from the printer to verify that all components are properly done and positioned correctly.

FINAL VERIFICATION

Final verification should be done by the author and each coauthor, preferably on a duplicate of the camera-ready copy. This is the author's last opportunity to detect errors and make alterations. Authors should inspect, then carefully read, each pair of facing pages, beginning with the cover and including all separate components, to verify that:

1. All statements, data, and references to tables, figures, and publications are accurate.

2. All previous corrections have been made and no new errors introduced.

3. The table of contents and the lists of plates, figures, and tables give correct page numbers and are worded consistently with the headings in the text.

4. The table of conversion factors is correct in all details.

5. All alignment is even and the visual effect pleasing.

After the camera copy has been corrected to incorporate the author's final changes, each corrected page should be inspected to verify that no errors have been introduced. The only task then remaining is to write the printer's instructions and, if the report is to be printed through GPO, to complete the Printing and Binding Requisition form SF-1. (See article 7.03.3.) The camera-ready copy, together with photographs and other special components, may then be delivered to the printer or publisher.

Contents, List of Conversion Factors, Abstract, and Text

These components and the remainder of the report should be arranged and typed single-spaced, as explained in Section 7.02, "Preparing camera-ready copy."

The text is typed in one-column format (6- to 6 1/2-inch line length), generally beginning on line 7 and continuing to line 52 or 53, giving a total depth of 8 3/4 inches excluding page number. Paragraphs and sentences may be broken and run onto the next page if at least two lines are carried over. New sections should begin three or four lines below the previous one (space permitting) and need not begin on a new page.

Tables and Illustrations

Tables and illustrations are preferably positioned upright on the page so that they can be viewed without turning the book sideways. If they must be positioned sideways (broad measure), orient them so that they can be turned clockwise for viewing. If two illustrations, two tables, or a table and an illustration are to face each other, they should be similarly oriented, if possible.

Tables

Tables may be designed to fit within the image area of a single page or less, across two facing pages, or in a series of pages. They may be typed double spaced if necessary to improve legibility and may also be photoreduced if necessary. Because the smallest lettering size permitted for a WRIR is 8 point (to insure legibility of paper copies made from microfilm), the maximum reduction for elite type is 80 percent of original size, and that for pica type and computer printouts is 67 and 65 percent, respectively. Therefore, the maximum image area for elite type before reduction is about 8 X 11 inches, and that for pica type and computer printouts is about 10 X 13 inches.

Page-Size Illustrations

Page-size illustrations, together with title and page number, will occupy no more than the standard image area. If an illustration is oriented sideways, use a side title typed in broad measure (maximum length, 8 1/2 inches). If an illustration will not be legible at page size, it should be redesigned to fit across two facing pages, with a dividing point through the middle to allow for the margins and binding. (This technique is more economical than printing foldouts or separate plates.) Single illustrations designed for two facing pages will start on an even-numbered page, and the title should be centered across both pages, again allowing for the inside margin. All lettering should be at least 8-point[1] size to ensure legibility of copy produced from microfilm. Because solid black or dense dot and line patterns cannot be photocopied clearly, solid black areas should be avoided, and the density of dot patterns and lines should not exceed 40 rows per linear inch.

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[1] This footnote is typed in 8 point lettering

Oversize Illustrations

Except for size limitations, procedures for printing oversize illustrations through GPO are the same as for page-size illustrations.[2] However, authors should bear in mind that OFSS will reproduce oversize illustrations in black and white only. If multicolor must be used on an oversized illustration, follow instructions given in article 9.02.3.

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[2] Standard paper sizes for oversize illustrations are 26 X 36 inches, 36 X 44 inches, and 44 X 58 inches. Maximum image size of Geological Survey presses is 42 X 56 inches. Maximum image size of commercial presses is 48 X 75 inches.

LINEWEIGHTS

Technical pen point size/ metric size	**Inked**	**Scribed**	Jewel scribing point size
4/1.00			.030
3/0.80			.025
2.5/0.70			.020
2/0.50			.015
1/0.40			.012
0/0.35			.010
00/0.25			.008

WATER RESOURCES DIVISION
PUBLICATIONS GUIDE

Replaces Article No.:	Effective 1/25/74 Date:	Article No.: 3.11.1

Subject: ILLUSTRATIONS -- Original artwork

Original artwork is defined as the creation of an illustration by an author or an artist from an idea, rough sketch, or photograph. The use of original artwork in reports is encouraged because it enables an author to present data or concepts that are not easily portrayed through the use of maps, graphs, or photographs and because it adds reader interest to the report.

Generally this type of illustration is used in "popular" reports and can be used in a variety of ways such as the cover of the report, numbered illustrations within the report, and unnumbered "spot" illustrations that are used to eliminate white space on pages that are only partly filled with text.

The author or artist is allowed to add his name or initials in an inconspicuous place on the artwork if he or she so desires. This is the only form of credit for the artwork that is allowed by the U.S. Geological Survey.

Some references of reports containing original artwork are:

1. Dover, T. B., Leonard, A. R., and Laine, L. L., 1968, Water for Oklahoma: U.S. Geol. Survey Water-Supply Paper 1890. Figures 1, 2, 5-11, and 14-18 were prepared from rough sketches furnished by the authors. Unnumbered spot illustrations are used as fillers on pages 22, 29, 54, 71, and 103.

2. Harshbarger, J. W., Lewis, D. D., Skibitzke, H. E., Heckler, W. L., and Kister, L. R., revised by H. L. Baldwin, 1966, Arizona water: U.S. Geol. Survey Water-Supply Paper 1648. The sketches on the cover and on the page preceding page 1 are based on the content and theme of the report. Note the artist's name below the tractor. Figures 1, 2, 3, 5, 6, 11, 17, and 22 were prepared from rough sketches furnished by the authors. Note the artistic additions to figures 9, 13, and 16. Unnumbered spot illustrations were used to introduce major topics in the report and as a filler on page 80.

3. Murata, K. J. and Richter, D. H., 1966, Chemistry of the lavas of the 1959-60 eruption of Kilauea Volcano, Hawaii: U.S. Geol. Survey Prof. Paper 537-A. The cover of this report is a sketch made from a photograph. Note artist's name in lower left corner.

4. Robinson, G. D., Wanek, A. A., Hays, W. H., and McCallum, M. E., illustrated by John R. Stacy, 1964, Philmont country - The rocks and landscape of a famous New Mexico ranch: U.S. Geol. Survey Prof. Paper 505. The cover of this report is a sketch based on the theme of the report. Note the artist's name on the lower right part of the back cover. This report contains many numbered illustrations prepared by the artist. Note the sketches prepared from photographs; figures 37, 79, 94, 105, 112, and 119.

Optima

6 Point Solid

In 1890 Major John Wesley Powell, the director of the Geological Survey, established the Engraving and Printing Division. Since this early beginning, the Type Section has provided type composition needs for the Survey.

6 Point 1 Point Leaded — Characters Per Pica 4.50

In 1890 Major John Wesley Powell, the director of the Geological Survey, established the Engraving and Printing Division. Since this early beginning, the Type Section has provided type composition needs for the Survey. The original Type Section set type by hand with only three compositors. Hand composition continued as the only means of type composition until 1955.

ABCDEFGHIJKLMNOPQRSTUVWXYZ abcdefghijklmnopqrstuvwxyz 1234567890

7 Point Solid

In 1890 Major John Wesley Powell, the director of the Geological Survey established the Engraving and Printing Division. Since this early beginning, the Type Section has provided type compos-

7 Point 1 Point Leaded — Characters Per Pica 3.86

In 1890 Major John Wesley Powell, the director of the Geological Survey established the Engraving and Printing Division. Since this early beginning, the Type Section has provided type composition needs for the Survey.
The original Type Section set type by hand with only three compositors. Hand composition

ABCDEFGHIJKLMNOPQRSTUVWXYZ abcdefghijklmnopqrstuvwxyz 1234567890

8 Point Solid

In 1890 Major John Wesley Powell, the director of the Geological Survey established the Engraving and Printing Division. Since this early beginning, the Type Section has

8 Point 1 Point Leaded — Characters Per Pica 3.38

In 1890 Major John Wesley Powell, the director of the Geological Survey established the Engraving and Printing Division. Since this early beginning, the Type Section has provided type composition needs for the Survey.
The original Type Section set type by hand with only three compositors. Hand

ABCDEFGHIJKLMNOPQRSTUVWXYZ abcdefghijklmnopqrstuvwxyz 1234567890

9 Point Solid

In 1890 Major John Wesley Powell, the director of the Geological Survey established the Engraving and Printing Division. Since this early begin-

9 Point 2 Point Leaded — Characters Per Pica 3.00

In 1890 Major John Wesley Powell, the director of the Geological Survey established the Engraving and Printing Division. Since this early beginning, the Type Section has provided type composition needs for the Survey.
The original Type Section set type by hand with only three compositors.

ABCDEFGHIJKLMNOPQRSTUVWXYZ abcdefghijklmnopqrstuvwxyz 1234567890

10 Point Solid

In 1890 Major John Wesley Powell, the director of the Geological Survey established the Engraving and Printing Division. Since this early beginning, the Type Section has provided type com-

10 Point 2 Point Leaded — Characters Per Pica 2.70

In 1890 Major John Wesley Powell, the director of the Geological Survey established the Engraving and Printing Division. Since this early beginning, the Type Section has provided type composition needs for the Survey.

ABCDEFGHIJKLMNOPQRSTUVWXYZ abcdefghijklmnopqrstuvwxyz 1234567890

11 Point Solid

In 1890 Major John Wesley Powell, the director of the Geological Survey established the Engraving and Printing Division. Since this early beginning, the Type Section has

11 Point 2 Point Leaded — Characters Per Pica 2.45

In 1890 Major John Wesley Powell, the director of the Geological Survey established the Engraving and Printing Division. Since this early beginning, the Type Section has provided type composition needs for the Survey.

ABCDEFGHIJKLMNOPQRSTUVWXYZ abcdefghijklmnopqrstuvwxyz 1234567890

12 Point Solid

In 1890 Major John Wesley Powell, the director of the Geological Survey established the Engraving and Printing Division. Since this early beginning, the Type

12 Point 2 Point Leaded — Characters Per Pica 2.25

In 1890 Major John Wesley Powell, the director of the Geological Survey established the Engraving and Printing Division. Since this early beginning, the Type Section has provided type composition needs for the Survey.

ABCDEFGHIJKLMNOPQRSTUVWXYZ abcdefghijklmnopqrstuvwxyz 1234567890

14 Point — Characters Per Pica 1.93

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz 1234567890

16 Point — Characters Per Pica 1.69

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz 1234567890

18 Point — Characters Per Pica 1.50

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz 1234567890

20 Point — Characters Per Pica 1.35

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz 1234567890

24 Point — Characters Per Pica 1.13

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz 1234567890

30 Point — Characters Per Pica 0.90

ABCDEFGHIJKLMNOPQRSTUVWX
YZ abcdefghijklmnopqrstuvwxyz
1234567890

33 Point — Characters Per Pica 0.83

ABCDEFGHIJKLMNOPQRSTUV
WXYZ abcdefghijklmnopqrstuvw
xyz 1234567890

Souvenir Medium

6 Point Solid

In 1890 Major John Wesley Powell, the director of the Geological Survey established the Engraving and Printing Division Since this early beginning, the Type Section has provided type composition needs for the Survey

6 Point 1 Point Leaded — Characters Per Pica 4 38

In 1890 Major John Wesley Powell, the director of the Geological Survey established the Engraving and Printing Division Since this early beginning, the Type Section has provided type composition needs for the Survey
The original Type Section set type by hand with only three compositors Hand composition continued as the

ABCDEFGHIJKLMNOPQRSTUVWXYZ abcdefghijklmnopqrstuvwxyz 1234567890

7 Point Solid

In 1890 Major John Wesley Powell, the director of the Geological Survey established the Engraving and Printing Division Since this early beginning, the Type Section has provided type

7 Point 1 Point Leaded — Characters Per Pica 3.76

In 1890 Major John Wesley Powell, the director of the Geological Survey established the Engraving and Printing Division Since this early beginning, the Type Section has provided type composition needs for the Survey.
The original Type Section set type by hand with only three compositors. Hand composition

ABCDEFGHIJKLMNOPQRSTUVWXYZ abcdefghijklmnopqrstuvwxyz 1234567890

8 Point Solid

In 1890 Major John Wesley Powell, the director of the Geological Survey established the Engraving and Printing Division. Since this early beginning, the Type Section

8 Point 1 Point Leaded — Characters Per Pica 3.29

In 1890 Major John Wesley Powell, the director of the Geological Survey established the Engraving and Printing Division. Since this early beginning, the Type Section has provided type composition needs for the Survey.
The original Type Section set type by hand with only three compositors. Hand

ABCDEFGHIJKLMNOPQRSTUVWXYZ abcdefghijklmnopqrstuvwxyz 1234567890

9 Point Solid

In 1890 Major John Wesley Powell, the director of the Geological Survey established the Engraving and Printing Division. Since this early

9 Point 2 Point Leaded — Characters Per Pica 2.92

In 1890 Major John Wesley Powell, the director of the Geological Survey established the Engraving and Printing Division. Since this early beginning, the Type Section has provided type composition needs for the Survey.

ABCDEFGHIJKLMNOPQRSTUVWXYZ abcdefghijklmnopqrstuvwxyz 1234567890

10 Point Solid

In 1890 Major John Wesley Powell, the director of the Geological Survey established the Engraving and Printing Division. Since this early beginning, the Type Section has provided

10 Point 2 Point Leaded — Characters Per Pica 2.63

In 1890 Major John Wesley Powell, the director of the Geological Survey established the Engraving and Printing Division. Since this early beginning, the Type Section has provided type composition needs for the Survey.

ABCDEFGHIJKLMNOPQRSTUVWXYZ abcdefghijklmnopqrstuvwxyz 1234567890

11 Point Solid

In 1890 Major John Wesley Powell, the director of the Geological Survey established the Engraving and Printing Division. Since this early beginning, the Type Section

11 Point 2 Point Leaded — Characters Per Pica 2 39

In 1890 Major John Wesley Powell, the director of the Geological Survey established the Engraving and Printing Division. Since this early beginning, the Type Section has provided type composition needs for the Survey.

ABCDEFGHIJKLMNOPQRSTUVWXYZ abcdefghijklmnopqrstuvwxyz 1234567890

12 Point Solid

In 1890 Major John Wesley Powell, the director of the Geological Survey established the Engraving and Printing Division. Since this early begin-

12 Point 2 Point Leaded — Characters Per Pica 2.19

In 1890 Major John Wesley Powell, the director of the Geological Survey established the Engraving and Printing Division. Since this early beginning, the Type Section has provided type composition needs for

ABCDEFGHIJKLMNOPQRSTUVWXYZ abcdefghijklmnopqrstuvwxyz 1234567890

Souvenir Medium

14 Point — Characters Per Pica 1.88

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz 1234567890

16 Point — Characters Per Pica 1.64

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz 1234567890

18 Point — Characters Per Pica 1.46

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz 1234567890

20 Point — Characters Per Pica 1.32

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz 1234567890

24 Point — Characters Per Pica 1.10

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz 1234567890

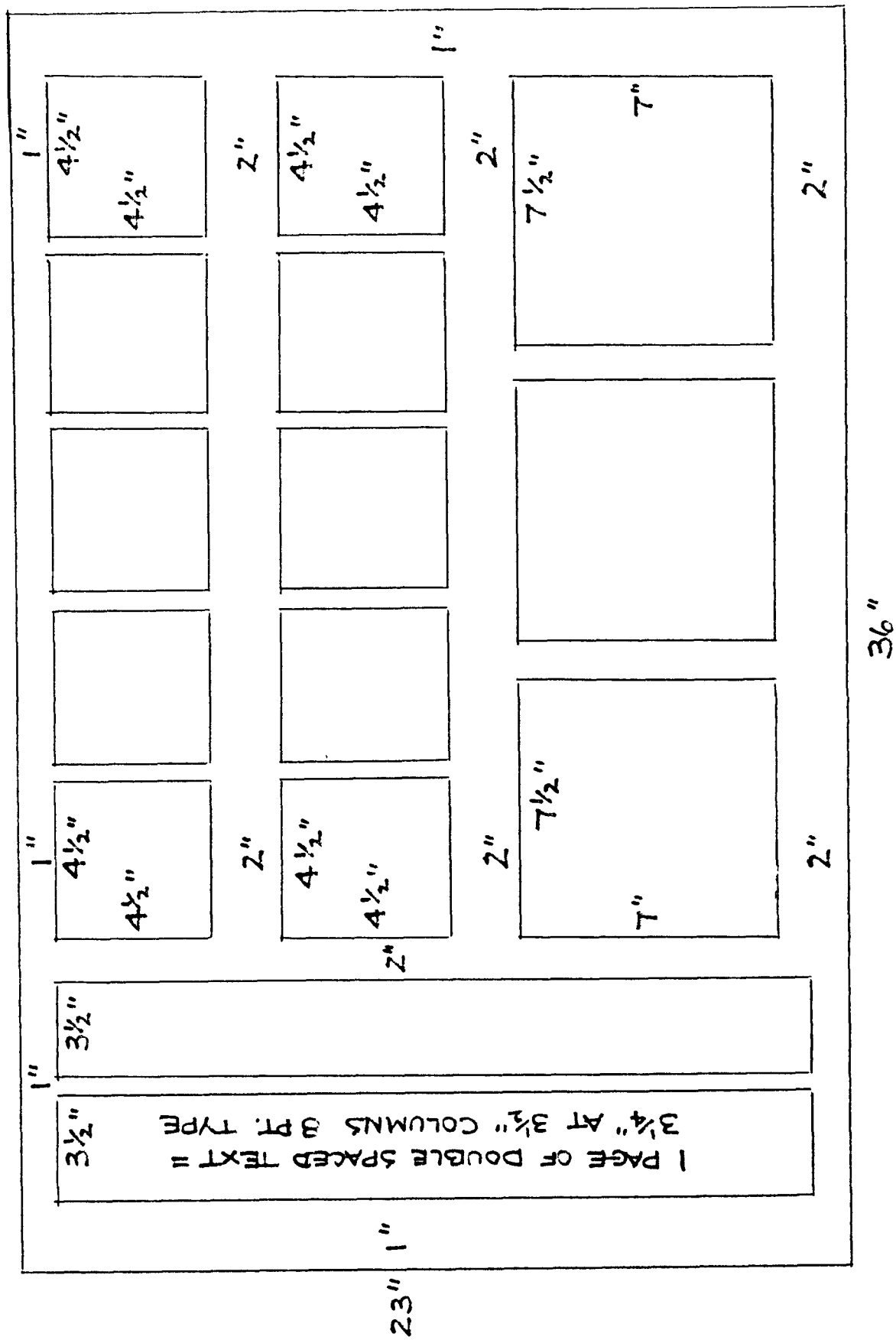
30 Point — Characters Per Pica 0.88

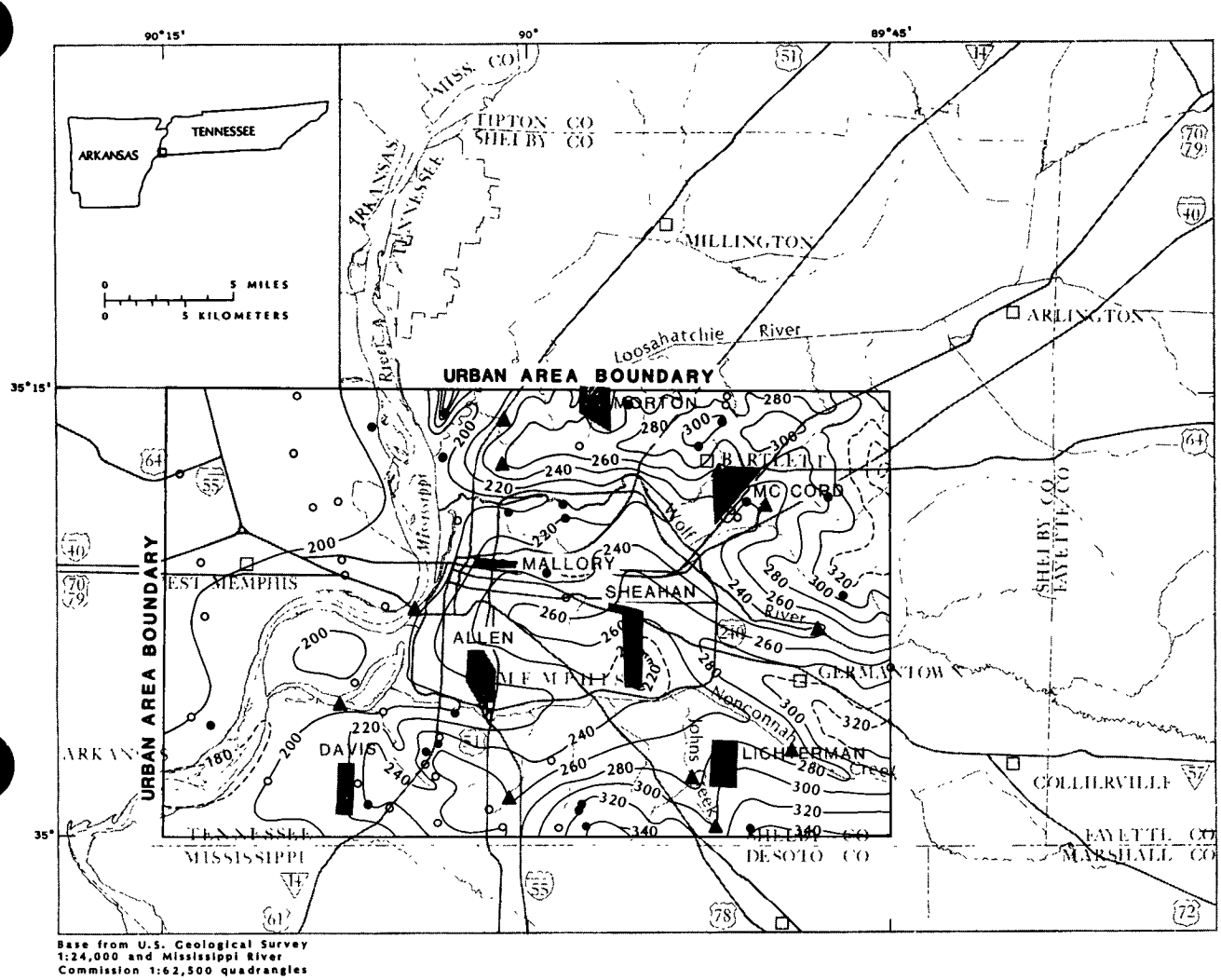
ABCDEFGHIJKLMNOPQRSTUVW
XYZ abcdefghijklmnopqrstuvwxz
1234567890

33 Point — Characters Per Pica 0.80

ABCDEFGHIJKLMNOPQRSTU
VWXYZ abcdefghijklmnopqrstu
vwxyz 1234567890

MOCK-UP SAMPLE FOR MAP REPORTS





EXPLANATION

— 320 - - WATER-TABLE CONTOUR--Shows altitude of water table. Dashed where inferred. Hachures indicate depression. Contour interval 20 feet. Datum is sea level

● WELL FOR WHICH MEASUREMENT MADE IN FALL 1984 WAS USED AS CONTROL

○ WELL FOR WHICH HISTORIC MEASUREMENT WAS USED AS SUPPLEMEMNTARY CONTROL

▲ GAGE FOR WHICH LOW-STAGE MEASUREMENT MADE IN FALL 1984 WAS USED AS CONTROL

Figure 7.--Altitude of the water table in the alluvium and fluvial deposits in the Memphis urban area, fall 1984.

Caps for primary entries in explanation; second and succeeding lines indented two places

Two line figure titles - center second line beneath first line

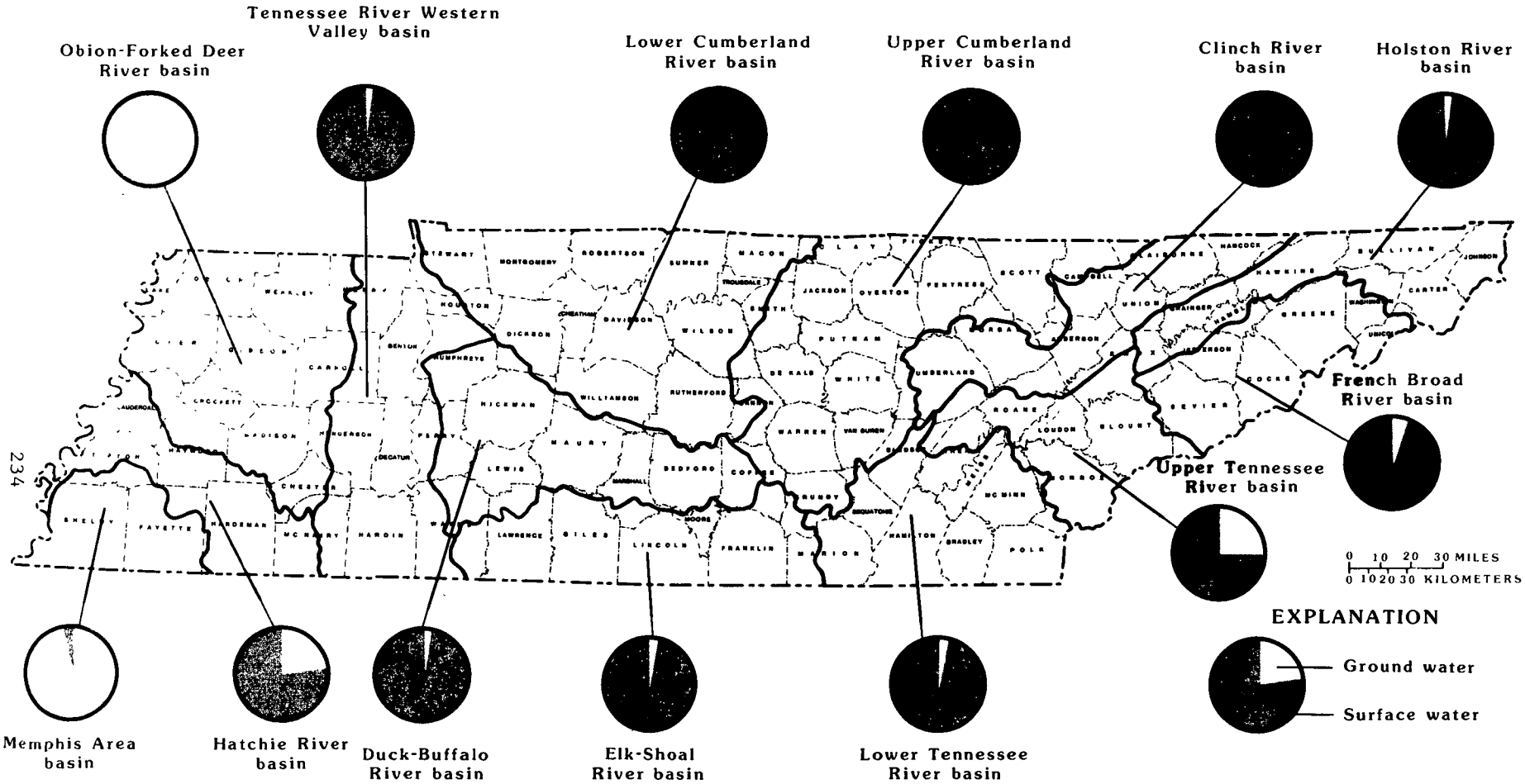


Figure 3.--Surface-water and ground-water withdrawal by self-supplied commercial and industrial water users during 1981 in the 13 major hydrologic basins of Tennessee.

Two line figure title - second line is centered beneath first line

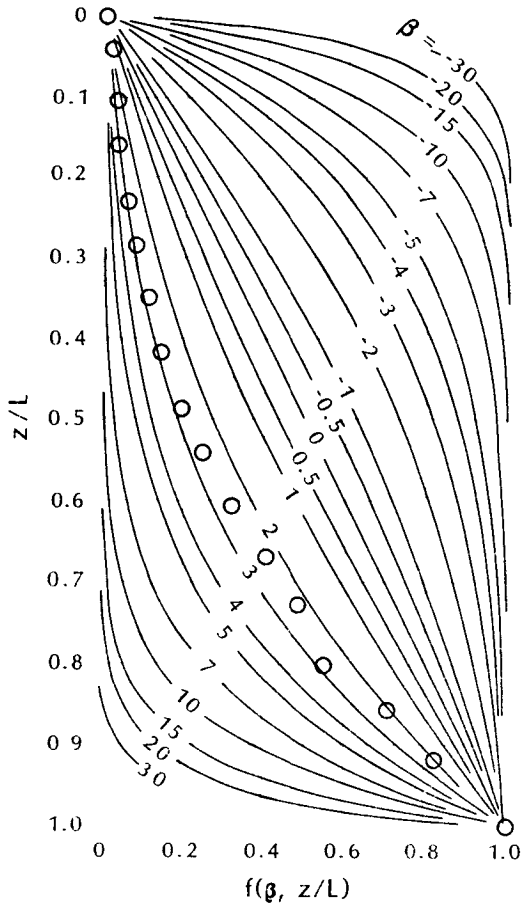


Figure 20.--Nondimensional plot of temperature data between the depths of 120 and 910 feet in well Ha:R-1 matched with type curves from Bredehoeft and Papadopulos (1965).

More that 2 lines in title
2nd and all following lines are indented 2 places (begin text under "g")

Allow space so that figure title and text do not blend together

38.1 feet, the vertical head gradient is 0.058. From Darcy's law:

$$v_z = K(dh/dz)$$

where

K is the hydraulic conductivity;
dh/dz is the vertical head gradient; and
v_z is the vertical velocity.

Solving for K and substituting the value of vertical velocity determined above and the measured vertical gradient between the two aquifers:

$$K = (v_z)/(dh/dz)$$
$$= (6.6 \times 10^{-4})/(0.058)$$
$$= 1.14 \times 10^{-2} \text{ ft/d}$$

This value is in agreement with published values for the hydraulic conductivity of silt, clay, and mixtures of sand, silt, and clay (U.S. Department of the Interior, 1977, p. 29). The vertical velocity between the Fort Pillow Sand and the Memphis Sand is limited by the relatively thick confining bed of low hydraulic conductivity. The value of

SAMPLE TYPE REDUCTION TABLES FOR KROY LETTERING

The following Kroy type samples (Helvetica Light, Helvetica Regular, and Souvenir Medium) have been reduced by 25, 35, 45, and 50 percent.

The number shown at the end of certain lines is the approximate equivalent size the type is after reduction.

8 point HL at 25% reduction ABCDEFabcdef 123456 -2 = 6

10 point HL at 25% reduction ABCDEFabcdef 123456

12 point HL at 25% reduction ABCDEFabcdef 123456 -2 = 8

14 point HL at 25% reduction ABCDEFabcdef 123456 -2 = 10

18 point HL at 25% reduction ABCDEFabcdef 123456 -2 > 12

8 point HR at 25% reduction ABCDEFabcdef 123456 -2

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12 point HL at 35% reduction ABCDEFabcdef 123456 -2 = 8

14 point HL at 35% reduction ABCDEFabcdef 123456 -2 < 10

18 point HL at 35% reduction ABCDEFabcdef 123456 -2 = 12

8 point HR at 35% reduction ABCDEFabcdef 123456 -2

10 point HR at 35% reduction ABCDEFabcdef 123456 -2

12 point HR at 35% reduction ABCDEFabcdef 123456 -2

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