



**US Army Corps  
of Engineers®**  
Engineer Research and  
Development Center

# **Guide for Preparing Technical Information Reports of the Engineer Research and Development Center**

July 2004

# **Guide for Preparing Technical Information Reports of the Engineer Research and Development Center**

Publishing and Technology Transfer Branch

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Final report

Approved for public release; distribution is unlimited

**ABSTRACT:** This Guide describes procedures to be used by U.S. Army Engineer Research and Development Center personnel in the preparation of reports for publication and distribution. Such procedures should simplify the author's task by furnishing a guide to follow in arranging material. The Guide establishes procedures for ensuring uniformity of certain features common to all reports, while permitting flexibility in the presentation of the technical subject. Matters requiring uniform treatment are clearly indicated throughout the Guide. Suggestions for good practice in the presentation of data and text material are included to assist the author in producing a clear, concise, and well-organized report.

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# Preface

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This Guide is designed for use by those who prepare U.S. Army Engineer Research and Development Center (ERDC) reports for publication. The Guide establishes procedures for ensuring uniformity of certain features common to all reports while permitting flexibility in the presentation of the technical subject. Matters requiring uniform treatment are clearly indicated throughout the Guide. Suggestions for good practice in the presentation of data and text material are included to assist the author in producing a clear, concise, well-organized report. Comments and suggestions for changes are welcome and should be addressed to CEERD-II-P.

The Guide was prepared in accordance with Army Regulations 25-30 and 70-31, and American National Standards Institute Publication Z39.18-1995. It supersedes Waterways Experiment Station Instruction Report ITL-93-1, dated January 1993. The ERDC publishing guidelines are implemented by Center Regulation 25-30-1; the provisions of CR 25-30-1 are mandatory for ERDC in-house and contractor-prepared technical information reports. This edition completes the transition to electronic publishing.

Permission to use the copyrighted material from *A Style Manual for Technical Writers and Editors* was obtained from the Macmillan Company.

The Guide was compiled by members of the staff of the Publishing and Technology Transfer Branch (PTTB), Infostructure and Knowledge Management Division, Information Technology Laboratory (ITL), ERDC. The painstaking efforts of staff members who participated in the preparation of the Guide are gratefully acknowledged.

COL James R. Rowan, EN, was Commander and Executive Director of ERDC, and Dr. James R. Houston was Director during the updating of the Guide.

# 1 Introduction

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## **Purpose of Engineer Research and Development Center (ERDC) Reports**

ERDC reports constitute important end products of technical investigations and provide a formal record of data collected, results obtained, and analyses performed. As such, these reports should describe the investigations and the information obtained in a lucid and well-organized manner and in language easily understood by the intended audience. Reports should clearly communicate what was done and what was learned in relation to the purpose for which the investigations were initiated.

Some reports are prepared for general information purposes rather than to satisfy a particular requirement. Such reports usually are used to disseminate information of interest to other laboratories or offices, educational institutions, and the scientific and engineering community at large.

Other reports are written primarily to provide a permanent record of data and results for the investigating office and sponsor. Although these reports receive limited circulation, they should be complete and descriptive if they are to be of any future use.

In addition to disseminating information, technical reports encourage the exchange of information and technology with other research organizations in the scientific and engineering community.

Whatever their purpose, reports that are well written, organized, and reproduced can establish a highly favorable impression on the intended audience. Therefore, the mechanics of writing, preparing, and publishing reports can be most important to ERDC's professional image and reputation.

## Factors Influencing Content and Format of ERDC Reports

The content of a report and the manner of presenting data are influenced by sponsor requirements and the ultimate readership. In general, a report that will reach a wider audience should be more comprehensive in detail than one with a limited audience. However, the main text of reports should not be burdened with a mass of detailed data. If the author desires to include a large amount of data, it should be presented in an appendix.

The text of a report prepared for record purposes only or for limited distribution need not be as carefully edited, and the tables and illustrations need not be as mechanically perfect, as those of a report prepared for broad distribution. ERDC authors may obtain a limited quantity (up to 100 copies) of such a report at minimal expense. For record purposes, a rough report (one in which little or no editing has been performed and in which illustrations and tables are in less polished form) may be published as a numbered ERDC report at the discretion of the director of the laboratory involved. However, the original of such a report must be of sufficient graphic quality to permit reproduction of legible copies. These reports are not appropriate for unrestricted Internet access.

## Philosophy of Reports

When writing a technical report, the author should keep in mind two principal requirements:

- a. The report must contain all essential information needed by those who use it but should not include nonessential information that might burden or confuse the reader (although links may be established to Web sites where this information is available, if electronically published).
- b. The form and language of the report should be such that the information it contains can be efficiently absorbed at the executive, planning, using, and reference worker levels.

Compliance with the first requirement should minimize the size of a report. Reports are frequently too voluminous, the tendency being to include any and all available data. Which data to include or to omit varies with the report; these decisions are generally made by the author. However, only a minimum of data need be presented as long as the remainder is available for use by those interested (either in the form of appendixes to the report or by contacting ERDC) and a statement to that effect is included in the report.

Preparing the results of investigations for publication is the responsibility of authors and their supervisors. Research results should be published promptly. Publishing and Technology Transfer Branch (PTTB) personnel are available to assist with editing, graphics preparation, illustration, photography, design and preparation of reproduction copy or hypertext markup language (HTML) and Portable Document Format (PDF) files, and other publishing processes.

## Guide Contents

This Guide lists certain items that must be included in all ERDC reports, gives the locations of these and other major elements, and outlines the types of information to be included in some of these elements. The Guide also prescribes ways of handling certain questions concerning format and style that confront most authors. Grammar is discussed only briefly; instead, reference is made to commonly used textbooks for this type of information.

References and a bibliography for this Guide are included at the end of the main text. Appendix A lists the preferred spelling of difficult or uncommon words used in ERDC reports. Appendix B lists abbreviations commonly used at ERDC. Appendix C discusses mathematical symbols and expressions. Appendix D describes format and physical characteristics of ERDC reports. Appendixes E and F give guidance for the use of copyrighted material and multicolor illustrations, respectively. Appendix G provides guidance for use in preparing computer-aided drafting graphics. An index is included as Appendix H.

## Units of Measurement

Engineer Regulation 1110-1-4 (Headquarters, U.S. Army Corps of Engineers 1994) prescribes the use of SI units of measurement for all U.S. Army Corps of Engineers (USACE) publications. However, the regulation allows the use of dual units, i.e., SI and non-SI. Where dual units will be used, the following rules apply:

- a.* In text, SI units will occur first followed by the non-SI units in parentheses, e.g., 14 sq m (150 sq ft).
- b.* In tables, graphs, and charts, corresponding SI and non-SI units should be presented in a combined format when the information can be presented in a clear and concise manner. Otherwise, separate SI and non-SI tables, graphs, and charts will be used.

## 2 Designation, Organization, and Content of ERDC Reports

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### Designation of ERDC Reports

The principal categories of ERDC reports (whether printed or published electronically) are as follows:

- a. *Technical Report*. The technical report series is the normal vehicle for reporting the results of research projects used to document a phase of sponsored research and development that has been completed or terminated.
- b. *Technical Note*. Technical notes are shorter and more focused than technical reports and generally not longer than 10 or 12 pages. They may contain:
  - (1) Synopses of projects.
  - (2) Interim reports describing the early phases of a project (i.e., before there are enough results for a technical report).
  - (3) Spin-off results of a research project (i.e., interesting results that should be reported but that are not significant enough for a technical report).
- c. *Miscellaneous Paper*. This category is for journal articles, conference papers, book chapters, or other shorter works that are published outside of ERDC. The purpose of the category is to track these publications and to ensure that the Research Library receives copies.
- d. *Contract Report*. Contract reports are those prepared solely by non-ERDC authors under contract.
- e. *Letter Report*. This category is designed for reports to sponsors written by ERDC researchers. These reports can vary from one-page letters to multi-volume reports. They are to be edited or disseminated only by special

arrangement. A letter report should become a technical report if publication is desired. The purpose of the category is to track these publications and to ensure that the Research Library receives copies.

- f. Special Report.* This is a catch-all category for reports that do not fit elsewhere. Examples include:
  - (1) Conference proceedings.
  - (2) Instruction reports.
  - (3) Data reports.
  - (4) Computer program listings.
  - (5) Literature reviews or bibliographies.
- g. Monograph.* Monographs are reports on the state of the art in a particular narrow field. They are a comprehensive, thorough, major piece of work, rather than a report on a particular research project. This category is to be used rarely.
- h. Brochure.* Brochures are short, one-of-a-kind publications generally intended for informational or promotional purposes, rather than reporting of technical research results.

The numbering system to be used depends on the level of the report.

- a. ERDC-level report.*
  - (1) An ERDC-level report is one prepared under an ERDC work unit, with cited authors from more than one ERDC laboratory. ERDC-level reports will all have a consistent cover design that represents all of the ERDC.
  - (2) ERDC-level report numbers will be composed of the organization abbreviation, “ERDC,” the abbreviation for the report’s category, the abbreviation for the calendar year, and a sequential number denoting publication order within the report category (without leading zeros), e.g., ERDC TR-00-1.
- b. Laboratory-level report.*
  - (1) A laboratory-level report is one prepared under an ERDC work unit, with at least one cited author from an ERDC laboratory, but with no authors from other ERDC laboratories. Contract reports fall into this category. Laboratory-level reports will have standardized features that reflect the ERDC image but may also have unique cover graphics representing the appropriate laboratory or project.
  - (2) ERDC laboratory-level report numbers will be composed of the organization abbreviation, “ERDC,” the organizational abbreviation for the laboratory, the abbreviation for the report’s category, the

abbreviation for the calendar year, and a sequential number denoting publication order within the report category, e.g., ERDC/CHL TR-00-1.

Abbreviations for the report categories are as follows:

Technical Report	TR
Technical Note	TN
Miscellaneous Paper	MP
Contract Report	CR
Letter Report	LR
Special Report	SR
Monograph	M
Brochure	B

## Components of Reports

American National Standard Z39.18-1995 (American National Standards Institute 1995), “Scientific and Technical Reports - Elements, Organization, and Design,” prescribes the principal components of technical reports. These components must be included, if applicable, in all ERDC technical reports, miscellaneous papers, and instruction reports except those sponsored by other agencies that require that their own specified formats be followed. The principal components of a ERDC report are listed below in the order in which they should be presented. Some reports may not contain all of them, as discussed in subsequent paragraphs.

- a.* Front cover.
- b.* Title page.
- c.* Preliminaries, i.e., contents, preface, key, summary.
- d.* Main text or body of the report.
- e.* References and/or bibliography.
- f.* Illustrations and tables (Sequence is: figures, tables, photos, plates).
- g.* Appendixes.
- h.* Notation (last appendix).
- i.* Index.
- j.* Distribution list (if required by sponsor).

- k.* Standard Form (SF) 298.
- l.* Back cover.

## **Cover**

### **Front cover (outside)**

The outside front cover of every ERDC report will include the following items:

- a.* Castle symbol (logotype as approved by the Chief of Engineers).
- b.* Report designation and number.
- c.* Publication date (month and year when report is posted on Internet or printed).
- d.* Title of report.
- e.* Name of author(s).
- f.* Distribution statement.

In addition to these items, classified reports will also show the report and title classification and the declassification/downgrading schedule. Classified reports will **not** be posted on the Internet.

One of the seven primary distribution statements shown in [Figure 1](#) will be included on the front cover of all reports as required by Department of Defense (DoD) Directive 5230.24 (DoD 1987). The statement will remain in effect until changed or removed by the controlling DoD office. Statements A and X cannot be used on classified documents. Only reports carrying Statement A will be posted on the Internet with unlimited access. All information on Internet web servers must be publicly releasable, nonsensitive, and noncritical, according to Station Regulation 25-1-20.

[Figures 2-4](#) present examples of covers for ERDC-level reports, laboratory-level reports, and a classified report, respectively. In the interest of projecting and reinforcing the corporate identity of ERDC, departures from the standard cover design are discouraged.

### **Front cover (inside)**

The inside front cover of printed ERDC reports will be left blank but may be used to include lists of associated reports, lists of committee members, if appropriate, and similar information.

<input type="checkbox"/> <b>Statement A:</b> Approved for public release; distribution is unlimited.	<input type="checkbox"/> <b>Statement E:</b> Distribution authorized to DoD components only; (fill in reason); (date). Other requests will be referred to (insert controlling DoD office).
<input type="checkbox"/> <b>Statement B:</b> Distribution authorized to U.S. Government agencies only; (fill in reason); (date). Other requests for this document will be referred to (insert controlling DoD office).	<input type="checkbox"/> <b>Statement F:</b> Further dissemination only as directed by (insert controlling DoD office); or higher authority (date).
<input type="checkbox"/> <b>Statement C:</b> Distribution authorized to U.S. Government agencies and their contractors only; (fill in reason); (date). Other requests for this document will be referred to (insert controlling DoD office).	<input type="checkbox"/> <b>Statement X:</b> Distribution authorized to U.S. Government agencies and private individuals or enterprises eligible to obtain export-controlled technical data in accordance with regulations implementing 10 U.S.C. 130c (date). Other requests will be referred to (insert controlling DoD office).
<input type="checkbox"/> <b>Statement D:</b> Distribution authorized to DoD and DoD contractors only; (fill in reason); (date). Other requests will be referred to (insert controlling DoD office).	

Figure 1. Distribution statements

**Back cover (inside)**

The inside back cover of ERDC reports may be used to include lists of associated reports, lists of committee members, if appropriate, and similar information. The inside of the front cover may also be used for this purpose if there is sufficient space.

**Back cover (outside)**

The outside back cover of printed ERDC reports is reserved for use in labeling and distribution.

ERDC TR-00-1

Engineer Research and  
Development Center



US Army Corps  
of Engineers®

*Wetlands Regulatory Assistance Program*

## **Accessing and Using Meteorological Data to Evaluate Wetland Hydrology**

Steven W. Sprecher, Andrew G. Warne, and John A. Smith

April 2000



Approved for public release; distribution is unlimited.

Figure 2. Example cover of ERDC-level report

ERDC/EL TR-00-1

Environmental Laboratory



**US Army Corps  
of Engineers®**  
Engineer Research and  
Development Center

*Wetlands Regulatory Assistance Program*

## **Assessing and Using Meteorological Data to Evaluate Wetland Hydrology**

Steven W. Sprecher and Andrew G. Warne

April 2000



Approved for public release; distribution is unlimited.

Figure 3. Example cover of laboratory-level report

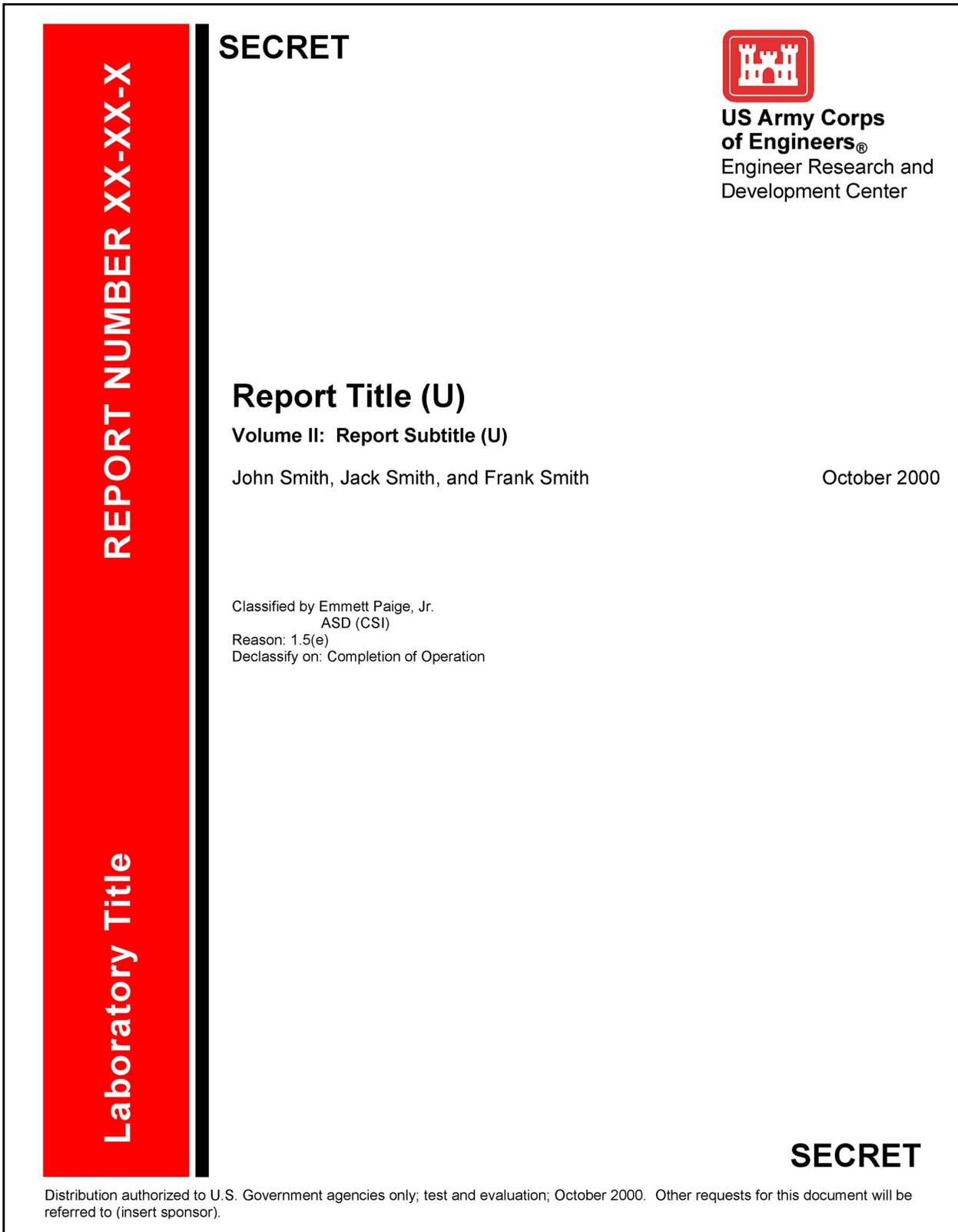


Figure 4. Example cover of classified report (Note: This page is NOT CLASSIFIED; the “SECRET” markings at top and bottom are for illustrative purposes only)

## Title Page

The title page (Figure 5) will include the following:

- a. Name of research program, if applicable.
- b. Report designation and number.
- c. Publication date (month and year when report is sent to printing or posted on the Internet).
- d. Title of report.
- e. Name of author(s).
- f. Name and address of performing organization.
- g. Type of report (interim, final, report in a series, etc.).
- h. Distribution statement.
- i. Name and address of sponsoring agency.
- j. Contract, project, subtask, and work unit numbers (when appropriate).
- k. Name and address of monitoring agency (when appropriate).

The reverse side of the report's title page should contain the abstract along with instructions on such matters as report disposition, use of trade names, and destruction notices.

- a. *Distribution statements.* All reports marked with distribution statements B, C, D, E, F, or X will be marked as follows (these reports will not be given unlimited Internet access):

*DESTRUCTION NOTICE*—For classified documents, follow the procedures in DoD 5200.22-M, Industrial Security Manual, Section II-19, or DoD 5200.1-R, Information Security Program Regulation, Chapter IX. For unclassified, limited documents, destroy by any method that will prevent disclosure of contents or reconstruction of the document.

All technical documents that are determined to contain export-controlled technical data will be marked as follows:

*WARNING*—This document contains technical data whose export is restricted by the Arms Export Control Act (Title 22, U.S.C., Sec 2751 et seq.) or Executive Order 12470. Violations of these export laws are subject to severe criminal penalties.

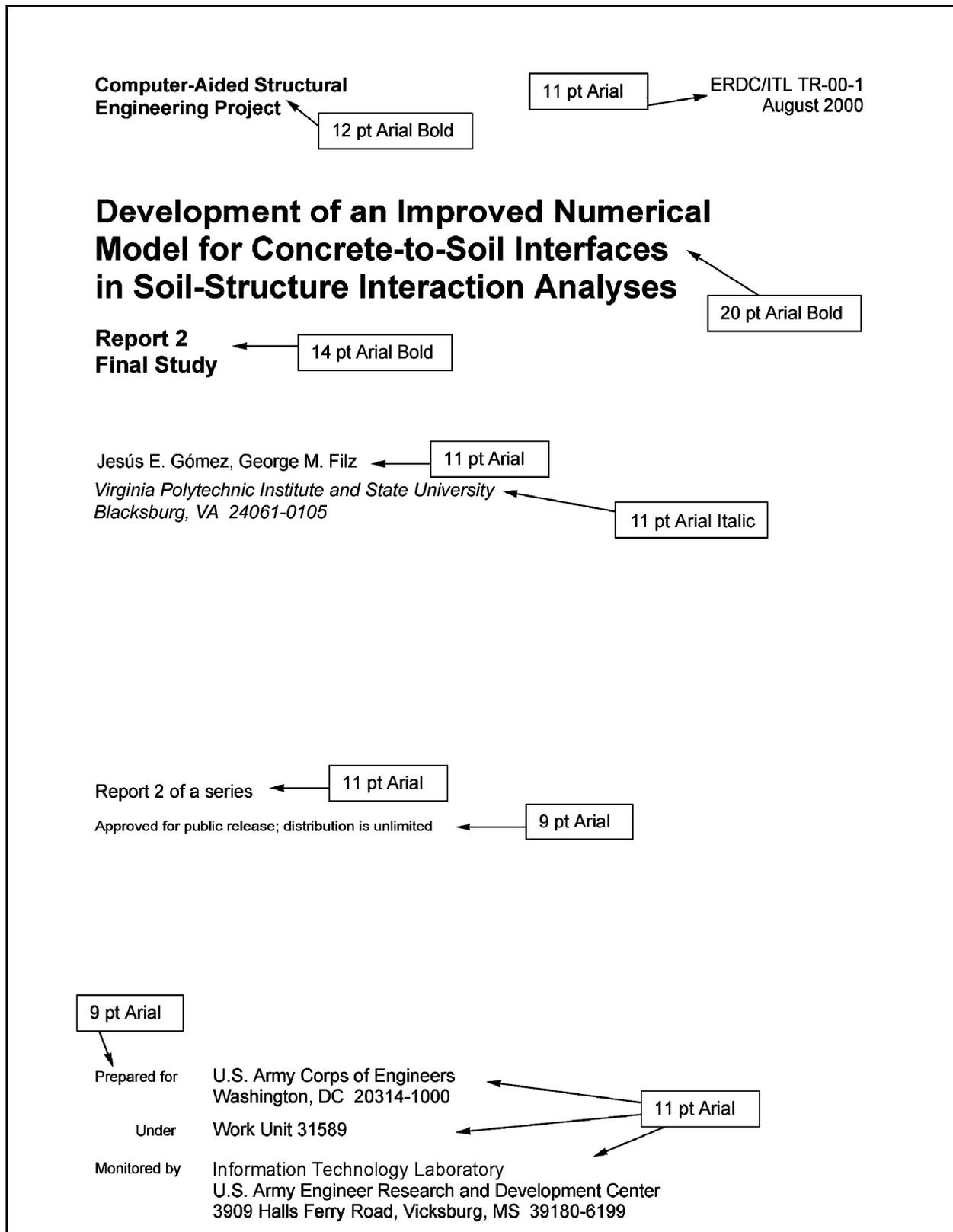


Figure 5. Sample title page

- b. *Trade names.* ERDC reports should not contain material that may be construed as advertising or that implies that the Government endorses or favors a proprietary product or service manufactured or provided by a specific supplier. Sometimes, however, it is essential that trade names or names of manufacturers of materials or equipment be given (under the assumption that certain parts of the report are meaningless without them, or that a description included to avoid use of the trade name would be excessively long and involved). All reports will contain a notice on the inside front cover and in the lower left corner of the Preface that reads as follows:

The contents of this report are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute an official endorsement or approval of the use of such commercial products. The findings of this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

## Preliminaries

### Order

The preliminary pages or sections usually included in ERDC reports will be arranged in the following order.

- a. *Contents.* A list of figures and/or a list of tables may be included in the contents when five or more tables and/or figures are integrated in text. If figures, tables, or other such items are grouped after the main text, the total number of each should be shown in the contents.
- b. *Preface.*
- c. *Key.*
- d. *Summary.*

### Content

**Table of contents.** A table of contents will be included in reports that are of a length and complexity that its inclusion will aid the reader. The table of contents will contain the exact titles and page numbers of all the preliminaries and of all first- and second-level headings in the main report and in the appendixes. Additional levels of headings may be included in the table of contents at the author's discretion. The contents of this Guide is an example showing headings to the third level. The table of contents for reports posted on the Internet should be hot-linked.

**Lists of figures and tables.** If lists of figures and/or tables are used, the entries will be arranged in numerical order, and their captions or titles and page numbers will be given. If a figure has a long descriptive title, only a portion will be given. [Figure 6](#) contains examples of such lists. The lists of figures and tables for reports posted on the Internet should be hot-linked.

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Figure 6. Example lists of figures and tables

**Preface.** A preface will be included in all ERDC reports. The preface should be used to present information that must appear in the report but which is irrelevant to and would detract from the technical text. The preface will include such information as authorization, pertinent dates, names of ERDC and other personnel who actually participated in or made a technical contribution to the investigation or report, author(s), ERDC supervisory personnel, and any items required for record or acknowledgment purposes. Acknowledgments of work routinely performed by support personnel (e.g., editors, typists, and illustrators) are ordinarily not included. If copyrighted material has been quoted or reproduced, the preface will include a statement declaring that permission to use the material has been obtained.

**Key.** A key lists designations and names of proprietary products and/or equipment that should not be mentioned by name in text. When a report describes tests or evaluations of specific materials or types of equipment, the author may want to be very restrictive in the use of trade names or names of the manufacturers. In such cases, the materials or equipment will be referred to in the text as “Product A,” “Device B,” “Sample RCD-1,” etc., and the designations will be identified in a key. Usually, the key will be printed on cherry (red) paper, and it will not be bound in the report but will be hand-inserted in the copies of the report distributed to persons qualified to receive the key. The author will indicate which recipients should receive the key. For identification purposes, the key will bear the report number and title at the top of the page. [Figure 7](#) is an example of a key.

<b>Technical Report ERDC/SL TR-00-1 Effects of Temperature on Moist-Curing of Concrete</b>		
<b>Key</b>		
<b>Manufacturer</b>	<b>Symbol</b>	<b>Product</b>
Lone Star Cement Co. Spocari, AL	RC-572 and RC-579	Portland cement, type II
North American Cement Corp. Alsen, NY	RC-555(2)	Portland cement, type II
Bessemer Limestone and Cement Co. Youngstown, OH	RC-550(2)	Air-entraining Portland blast-furnace slag cement, type IS
Century Cement Co. Rosendale, NY	RC-573	Air-entraining natural cement, type NA

Figure 7. Example of a key

Sometimes an author may choose to use a key for the sake of simplicity or brevity only. In such cases, it will be included in front of the main text or summary. For reports posted on the Internet, the key will be distributed (either electronically or via e-mail) only to persons qualified to receive the key.

**Summary.** A summary may be included in a report at the author's discretion. The summary should be an informative synopsis of the main body of the report, not merely a statement of the results and conclusions, nor a listing of what the report contains. It should describe in a brief, coherent form why the work was done (the problem); the specific purpose or objective of the study; the scope of the work, if pertinent; what was done (experimental methods or investigational means used); what was learned (results and conclusions); and recommendations made. The summary necessarily repeats information from the body of the report, but it should never contain information not given in the body of the report. It should be no longer than one or two pages and should not contain illustrations, tabular material, or references.

## Main Text

The main text or body of the report should describe and discuss in a technically complete manner investigation procedures and results. The body of the report will normally have the following major subdivisions:

- a.* An introduction.
- b.* A description of the test apparatus, materials, and procedures (for an experimental study).
- c.* A description and discussion of what was done and of the information or results obtained.
- d.* An analysis or interpretation of the results or findings.
- e.* Conclusions and recommendations.

Sometimes one subdivision is so brief that it can be combined with another. The author should not include a subdivision that tells little or nothing, or is repetitious, just to follow a preconceived outline.

## Introduction

The introduction usually contains background information that the reader needs to understand the rest of the report. It may include (a) the problem addressed by the investigation being reported, (b) the history or theory behind the investigation, (c) mention of other reports or investigations on the subject, (d) the specific purpose or purposes of the investigation, (e) the scope of the investigation, (f) the reason for selecting the method of investigation, (g) definitions of specialized terms, and (h) a description of the plan and content of the remainder of the report, which is usually necessary only when the report is long and complicated.

The introduction should be written to attract and hold the attention of the reader. To do this, the author should reduce background material to pertinent facts necessary for an understanding of the problem that led to the investigation,

making sure that the material is presented as succinctly as possible. For example, in a report of a model study of a navigation structure on the Warrior River, it is not necessary to present the history of navigation on that river. The particular structure should be pinpointed with an explanation of why the model is to be built. A good introduction is essential to a good report, and it should be as carefully written as any other section.

## **Description of study**

When preparing the description of the test equipment and materials and the narrative of tests and results, the writer should ensure that these sections are developed in a logical manner, that emphasis is properly placed, and that the material is so arranged that needless repetition is avoided. For example, instruments, equipment, and processes that are very likely known to the majority of readers or for which descriptions are readily available in the literature need not be described in detail; sometimes a footnote telling where a description can be found is helpful.

The information or results obtained may be presented either along with the various experiment or investigatory phases or in a separate section following the narrative of each major phase. If a separate section is used, the author should be careful to avoid repetition of the description of the experiments. In a long report involving many experiments or phases, a summary of all results may be useful in reviewing and emphasizing the most important findings for the reader.

## **Analysis**

A separate section should be devoted to the analysis or interpretation of results to provide a clear and logical approach to the conclusions. However, in a short report, the results or findings may be analyzed or interpreted as they are introduced, thus eliminating the need for a separate section. In all instances, the author should follow a scientific approach in the presentation of results. The author should analyze all results and give reasons for placing more importance on some than on others. In addition, the data must be presented objectively, offering the reader an impartial viewpoint. All of the facts should be explained, including the reasons for using certain information while discarding other data.

## **Conclusions and recommendations**

Conclusions and recommendations must be supported by material included in the text. In writing the conclusions, the author should bear in mind the purposes of the investigation to ensure that they have all been covered in some way, even if negatively. Besides specific conclusions, a discussion of additional work needed to expand the knowledge obtained in the investigation may be included in this section.

Sometimes it is better to present recommendations separately since they tend to limit application of the conclusions to one specific problem when they are presented with the conclusions, whereas the findings may be useful in solving other types of problems. In some cases, very general recommendations for application of the findings may be made and an example of such an application included.

## References to Source Material

If *four or fewer* literature references are cited in the body of the report, the citations will be included as footnotes keyed to the appropriate portion of the text. If *five or more* citations are used, they will be grouped in a “References” section at the end of the main text. If it is desired to list pertinent literature that is not referred to in the text, such entries will be in a “Bibliography.” The bibliography will be located after, or in place of, the references section following the main text. A combination of two of the methods of citing source material may be used. For example, footnotes for three cited references may be used together with a bibliography, or a references section may be used in conjunction with a bibliography.

In general, the references or bibliography should contain only documents that are unclassified. While it is not preferred, ERDC internal working documents may be included in the References or Bibliography so readers may readily access them. Bibliographic material for classified references can be listed in ERDC unclassified reports that are restricted by means of distribution statement B. However, these reports will not be given unlimited Internet access. The references or bibliography should not list correspondence or interoffice or intraoffice memoranda that are not suitable for loan. The author may acknowledge material not suitable for loan in the preface or in a footnote. Personal communications should be referenced in the text only with the following parenthetical statement:

(Personal Communication, 17 May 2000, Jack Way, Civil Engineer,  
U.S. Army Engineer Research and Development Center, Vicksburg,  
MS.)

Bibliographic material for classified references will not be listed in ERDC unclassified reports for unlimited distribution, i.e., those reports covered by distribution statement A. If it is considered essential to cite a classified reference in an unclassified report marked with statement A, the following statement will be used:

(Classified reference. Bibliographic material for the classified reference  
will be furnished to qualified agencies upon request.)

# Illustrations and Tables

## Illustrations

Good illustrative material in the form of computer graphics, maps, drawings, or photos is a highly effective means of presenting information. Illustrations should be carefully selected and prepared to ensure that they accomplish their intended purpose. They should reinforce and augment text descriptions or tabulations but generally should not duplicate data and/or descriptive matter also given in detail in the text or in tables.

Only those computer graphics, maps, drawings, or photos that illustrate the main points or features of a study should be presented. The remainder of the illustrative material can be placed in a separate appendix that might be furnished to the sponsor, if requested, and those other readers interested in the detailed data. Guidelines for illustrations are presented in Appendix G.

## Tables

Tables are an effective means of presenting numerical data. However, long tabulations in the body of a report detract from its readability. Two means of avoiding long tables while still utilizing the effectiveness of tabular material are as follows:

- a. Place excerpts from long tables in the text, and group the complete tabulations at the end of the report.
- b. Break up the long tables into several short tabulations that can be more easily interpreted, and insert them in appropriate locations in the text.

Table format is illustrated in Appendix D.

## Appendixes

Appendixes may be posted on the Internet with the main report, or, in the case of printed reports, bound with the main report or published later to add supplementary information acquired after the main report was issued. Appendixes should be arranged in a logical order and must be referred to in the main text.

Some of the types of material that may be included in appendixes issued simultaneously with the main report are as follows:

- a. Illustrations or tables that are not necessary to an understanding of the main report or have been abstracted in the body of the report.
- b. Detailed descriptions of methods or apparatus.

- c. Descriptions of rejected methods or tests that should be included for record purposes.
- d. Theoretical analyses and mathematical derivations that are used but need not be explained in the body of the report.
- e. Samples of forms, data sheets, etc.
- f. Sample calculations.
- g. Plans or recommendations for future action.

Some of the types of material that can be published later to supplement the main report are as follows:

- a. Data from tests conducted after completion of the investigation as a result of a technological breakthrough.
- b. Data from tests conducted as a result of a recommendation made in the earlier investigation.

## Notation

A notation is a listing of characters, symbols, or abbreviations used to express technical facts or quantities, e.g.,  $A$  = area,  $D$  = diameter,  $t$  = time. If symbols and/or unusual abbreviations are numerous, they will be listed and defined in a notation (see sample on [page 35](#)). For ease of reference, the notation will be the last appendix in a report. At the first mention of the first symbol or abbreviation to be included in the notation, the following footnote should be added:

<sup>1</sup> For convenience, symbols and abbreviations are listed in the notation (Appendix ).

## Index

In an extremely long or involved report, an alphabetical index may be included for ease of reference. The index should be as complete as the nature of the report and probable usage requires. The index to this Guide is an example.

## Web Publishing

ERDC reports will be posted on the Internet unless security and/or legal constraints prevail. Classified reports, because they cannot be posted on the Internet, will continue to be printed.

For reports to be published in hard copy form, PTTB compiles and maintains computerized distribution lists and will assist authors and/or program managers in developing new distribution lists upon request. Numerous standard lists (e.g.,

Concrete Research, Wave Dynamics, and Soil Mechanics) are maintained. For each ERDC report, the author should carefully review the established (or proposed) distribution list to ensure that all interested agencies will receive copies as well as to eliminate agencies not interested in the information reported.

Army Regulation (AR) 25-30 (Headquarters, Department of the Army 1989) requires that all distribution lists be updated annually. The names and addresses of individuals or organizations not expressing an interest in remaining on the mailing list will be eliminated.

PTTB will furnish copies of all reports to the Defense Technical Information Center (DTIC). DTIC will accomplish subsequent or secondary distribution of the reports as follows: (a) unlimited distribution reports will be made available to the National Technical Information Service for sale to the general public, and (b) limited distribution reports will be distributed subject to the limitations imposed by the sponsoring agency. Copies of ERDC reports will also be placed in the ERDC Research Library.

A copy of the distribution list will not be included in ERDC reports unless specifically requested by the sponsoring agency. If included, it will be the last item in the text prior to the Standard Form 298.

## **Report Documentation Page, Standard Form 298**

A completed Standard Form (SF) 298, Report Documentation Page, will be included as the last page in each ERDC report. The form is filled out by PTTB in accordance with information furnished by the author. Normally, it is completed when the final draft of a report is prepared and is submitted for approval with the final draft. An example of a completed form is shown in [Figure 8](#). The author will prepare an abstract for completing Block 13. The abstract should be an informative synopsis of the report. The subject terms (key words) to be included in Block 14 are for cataloging purposes. They may be technically meaningful terms or short phrases that identify the principal subjects covered in the report, or they may be equipment model designations, trade names, military project code names, or geographic locations. If the author does not choose to supply the subject terms, PTTB will refer the report to the ERDC Research Library for this purpose.

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.				
1. REPORT DATE (DD-MM-YYYY) April 2000		2. REPORT TYPE Final Report		3. DATES COVERED (From - To)
4. TITLE AND SUBTITLE  Accessing and Using Meteorological Data to Evaluate Wetland Hydrology			5a. CONTRACT NUMBER	
			5b. GRANT NUMBER	
			5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)  Steven W. Sprecher, Andrew G. Warne			5d. PROJECT NUMBER	
			5e. TASK NUMBER	
			5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)  U.S. Army Engineer Research and Development Center Environmental Laboratory 3909 Halls Ferry Road Vicksburg, MS 39180-6199			8. PERFORMING ORGANIZATION REPORT NUMBER  ERDC/EL TR-00-1	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)  U.S. Army Corps of Engineers Washington, DC 20314-1000			10. SPONSOR/MONITOR'S ACRONYM(S)	
			11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION / AVAILABILITY STATEMENT  Approved for public release; distribution is unlimited				
13. SUPPLEMENTARY NOTES				
14. ABSTRACT <p>The <i>Corps of Engineers Wetlands Delineation Manual</i> recommends that "preceding weather conditions must be considered" when interpreting observations of water at possible wetland sites. Sources of meteorologic information are described in this report, and suggestions for analysis of relationships between local and regional weather and site hydrology are provided.</p> <p>Monthly precipitation data from more than 8,000 National Weather Service (NWS) stations have been analyzed, compiled, and made available on the Internet by the USDA National Water and Climate Center in the format of WETS Tables. These tables report 30<sup>th</sup> and 70<sup>th</sup> percentile exceedence frequencies for monthly precipitation, which generally define the range of normal precipitation. Suggestions for presentation of WETS Table data are provided. A method for calculating rolling sums of daily rainfall to enhance the accuracy of hydrologic assessments of sites is presented. The USDA Natural Resources Conservation Service has devised a method for systematically assessing antecedent weather conditions at a site; this method is described and suggestions to enhance the accuracy of this approach are provided.</p> <p>Regional patterns of drought and precipitation excess can be tracked using the Palmer drought indices, the Standardized Precipitation Index, and/or real-time gauge data. Contemporary conditions are standardized as percentiles of long-term records at Web sites reporting these analyses for climate divisions in each state.</p> <p style="text-align: right;">(Continued)</p>				
15. SUBJECT TERMS				
Hydrology	Rainfall	Wetlands		
Meteorology	Weather	WETS tables		
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES
a. REPORT UNCLASSIFIED	b. ABSTRACT UNCLASSIFIED	c. THIS PAGE		96
				19a. NAME OF RESPONSIBLE PERSON
				19b. TELEPHONE NUMBER (include area code)

Standard Form 298 (Rev. 8-98)  
Prescribed by ANSI Std. Z39.18

Figure 8. Example of Report Documentation Page, SF 298 (Continued)

**14. (Concluded).**

The statistics of precipitation frequency analysis and some of the pitfalls in using site-specific and regional data are discussed. Analyses of regional precipitation patterns are probably sufficient when observations of hydrology are not quantified. Personnel engaged in projects requiring quantification of onsite hydrology, however, should gather precipitation data on or close to the site on a daily basis. Daily data not gathered from official NWS stations should be compared with daily records from stations included in the WETS Tables network. These analyses should then be superimposed on the long-term patterns available from Web sites reporting regional analyses of climate divisions.

Figure 8. (Concluded)

# 3 Format and Style

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“Format” is the general makeup of the report and involves such items as page size and numbering, typography, layout, systems of headings, arrangement of tables and illustrations, and arrangement of lists of references or bibliographies. Sample pages of ERDC format are given in Appendix D. “Style” is the plan followed in dealing with such details as spelling, capitalization, punctuation, and abbreviations.

## Format for Preliminaries and Main Text

### Page numbering

The first page after the cover in each ERDC report will be the title page. It will be counted as page i but will not bear a page number. All preliminary pages will be numbered consecutively at the bottom of the page and on the outside margin in lowercase Roman numerals. Main text pages will carry Arabic numerals. For reports published in hard copy form, odd-numbered pages will be right-hand pages, and even-numbered pages will be left-hand pages. Both sides of the page will be used to the extent practical. However, each appendix will begin on a new right-hand page. A page requiring folding will be a right-hand page, and the back of a foldout page will be counted in the page numbering even though it is blank.

The pages used for illustrations or tables within the text are numbered if the illustration or table does not occupy the entire area available for printed or typed matter. If there is no space for the page number, it is omitted but the page is counted. When tables or illustrations follow the main text in a group, page numbers are not used.

### Paragraph numbering

Paragraphs of the report are not numbered. Subparagraphs are preceded by a lowercase italicized letter followed by a period.

## Headings

Headings provide a framework for the text and signify a change in subject. However, headings must be descriptive to be of any value; such uninformative words as “General” or “Discussion” should not be used alone as headings. Too many headings may detract from the text, making the narrative choppy and repetitious. Authors should be consistent in the use of headings and ensure that headings of proper weight and parallel construction are used for the various sections of a report.

The headings system for ERDC reports is illustrated by the headings used in this Guide. The primary subdivision is into chapters. Chapters are further subdivided by means of second- and third-level headings. If further headings are necessary, they take the form of paragraph, subparagraph, and sub-subparagraph headings. There should be no second-level headings unless there are first-level headings and no third-level headings unless there are second-level headings. Each heading should have at least one additional corresponding heading; i.e., under a given second-level heading, there must be at least two third-level headings or else third-level headings should not be used under that particular second-level heading.

## Illustrations

Illustrations included in ERDC reports are generally referred to as “Figures.” Figures are numbered consecutively using Arabic numerals and are given distinctive captions or titles; i.e., no two are the same. Figures may include engineering drawings, maps, photographs, plots, artistic illustrations, and other such illustrative materials. They are usually incorporated in the text, but when the text of a report is very short or when many figures are to be included in the report, they may be placed at the end of the text. The pages on which these grouped figures are included will not be numbered.

At the discretion of the laboratory, two other designations of illustrations may also be used, “Photos” and “Plates.” Photos are grouped at the end of the text and generally illustrate series of test results such as flow conditions at various discharges or test lane conditions after various amounts of traffic. Plates are line drawings or plots that are grouped at the end of the text and generally consist of a series of diagrams of the model layout or test sections, plots of test results, etc. Like figures, photos and plates are numbered consecutively with Arabic numerals. Photos have distinctive captions or titles just like figures; plate titles are distinctive also but are titled within their borders.

Because illustrations are an important part of a report, considerable care should be taken in their selection and/or preparation. As examples, [Figure 9](#) shows a good photograph, and [Figure 10](#) shows a good line drawing suitable for inclusion in an ERDC report. In preparing captions or titles, the author should strive to be concise, specific, and informative while ensuring distinctiveness.



Figure 9. Example of a good photograph

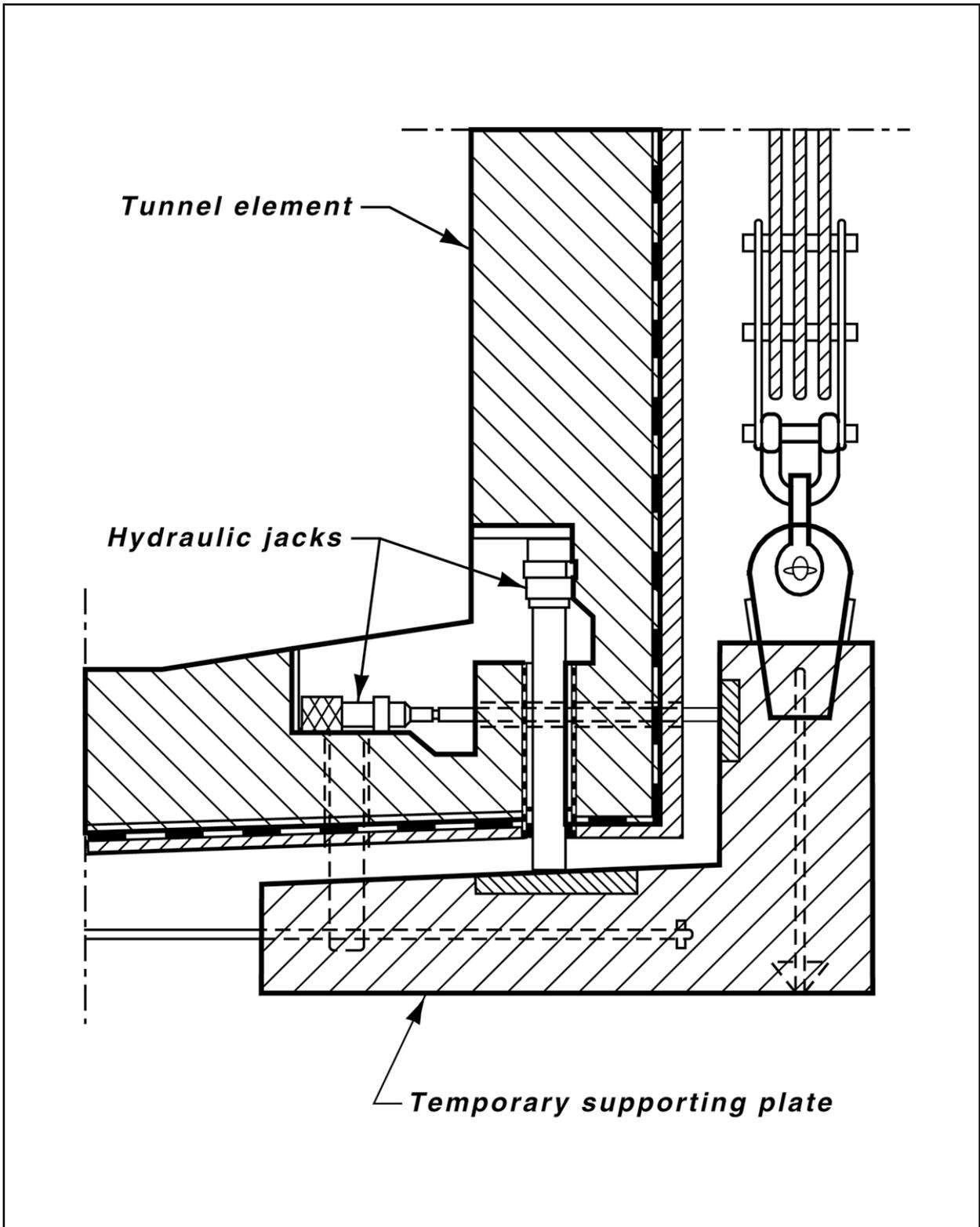


Figure 10. Example of a good line drawing

When possible, the author should combine several plots or curves in one illustration; this is not only more economical but also facilitates comparison of data.

Appendix G gives guidance for illustration preparation, including file extensions for importing into word-processing software.

PTTB can provide guidance and assistance in the form of drafting (both traditional and computer-aided), cartography, artistic illustration, and photographic support for illustrations used in ERDC reports.

## **Tables**

All tables, except brief listings or descriptive tabulations incorporated in the text, will be numbered using Arabic numerals and given a descriptive title for convenient reference. Brief tabulations are not numbered, do not have an overall title, and are generally referred to only once.

Each column in a table must have a heading. If no common heading for all the items in a column is possible, the table should be broken up into several tables or several subdivisions that will permit use of headings. Units of measurement should be shown in either the column headings or the title of the table. [Figure 11](#) is an example of a well-organized table. [Figure 12](#) gives an alternate table format designed for use in “talking tables.”

## **Computer program documentation**

Illustrative computer screens, input files (listings), output files (listings), and program listings can be handled several different ways. Standard ERDC format requires each illustration to be numbered and to have a unique caption. This format is acceptable for computer program documentation but is not required. Screens can be inserted in the text as necessary without numbering. Authors are encouraged to save screens as TIF files so the screens can be readily incorporated electronically into the publication.

## **Entries in references and/or bibliography**

Entries in the references<sup>1</sup> and in the bibliography will be listed by authors in alphabetical-chronological order. All authors will be listed. Corporate authors or organizations will be listed from the highest to the lowest order. The in-text citation will include the author’s name and the year of the publication in parentheses unless the reference is pertinent to the sentence. If the author’s name is a part of the sentence, then only the year will be enclosed in parentheses. For references of multiple authorship, use the full form of citation for one or two authors, but

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<sup>1</sup> A reference section will be included only if the report uses five or more citations. If four or fewer citations are used, they will be footnoted as they occur.

<b>Table 8 Aerator Slot Pressures, Series B</b>									
Test No.	Gate Opening m	Item <sup>1</sup>	Air Discharge cu m/sec	Transducer Location					
				AR1	AR2	AR3	AR4	AR5	AR6
<b>Gate 1</b>									
4	1.0	Max	2,655	-0.53	-0.65	-1.43	-1.45	-0.55	-0.65
		Mean	2,277	-0.39	-0.48	-1.22	-1.25	-0.42	-0.48
		Min	2,209	-0.25	-0.321	-0.81	-0.95	-0.28	-0.35
3	5.0	Max	4,748	-1.89	-1.75	-2.01	-2.49	-2.40	-1.96
		Mean	3,980	-1.43	-1.31	-1.55	-2.03	-1.98	-1.36
		Min	3,556	-1.06	-1.02	-1.22	-1.57	-1.64	-1.02
<b>Gate 2</b>									
2	9.0	Max	5,823	-2.77	-2.70	-2.93	-3.41	-3.11	-2.81
		Mean	4,614	-1.94	-1.80	-1.98	-2.49	-2.35	-1.80
		Min	3,584	-1.27	-1.18	-1.20	-1.78	-1.66	-1.11
1	13.0	Max	2,655	-3.41	-1.75	-2.17	-2.15	-2.95	-2.21
		Mean	2,277	-2.49	-1.31	-1.59	-1.55	-2.33	-1.59
		Min	2,209	-1.78	-1.02	-1.18	-1.15	-1.91	-1.18

<sup>1</sup> Max = highest recorded discharge, most negative aerator pressure; Mean = average discharge, average aerator pressure; Min = lowest recorded discharge, least negative aerator pressure.

Figure 11. Example of a well-organized table

<b>Table 5 Description of Subroutines in Program MONOSUMMARY</b>	
Name	Description
INPUT	Queries user for input parameters
CASE	Case or run number for individual test cases
HUNT	Hunt's method for wavelength
SPEED	Wave speed
KHCACL	Nondimensional water depth ratio
GROUP	Group speed
ANGLE2	Offset angle for integer number of paddles to produce desired wave direction angle
SPURIOUS	Minimum wave period below which spurious waves will be generated
HSRATION	Two-dimensional wave-height-to-stroke transfer function
HEIGHT	Two-dimensional wave height
HTHETA	Three-dimensional wave height based on effects of wave direction angle
HBREAK	Maximum breaking wave height for laboratory waves

Figure 12. Example of alternate table format designed for "talking tables"

use an abbreviated form for three or more. For example, two authors should be cited as (Smith and Brown 1995), but three authors (Smith, Jones, and Brown 1995) should be cited as (Smith et al. 1995).

Essential information to be included for each entry and the manner in which it is to be arranged are as follows:

a. *Articles*. Bibliographical references to articles published in periodicals will be arranged as follows:

- (1) Name of author(s) with surname preceding initials, followed by a period.
- (2) Year of publication (in parentheses), followed by a period.
- (3) Title of article (in quotes), with only the first word and proper nouns capitalized, followed by a comma.
- (4) Title of publication, italicized, with all principal words capitalized. Journal or magazine titles may be abbreviated.
- (5) Volume number followed by issue number (if any) in parentheses (e.g., “14(3)”), followed by a comma.
- (6) Inclusive page numbers (e.g., “477-79”), followed by a period.

Bennett, J. W. (1964). “The interpretation of Pueblo culture: A question of values,” *Southwestern Journal of Anthropology* 12(3), 361-74.

b. *Books*. Bibliographical references to books will be arranged as follows:

- (1) Name of author(s) with surname preceding initials, followed by a period.
- (2) Year of publication (in parentheses), followed by a period.
- (3) Chapter title in quotes, if applicable, with only the first word and proper nouns capitalized, followed by a period.
- (4) Title of book, italicized, with only the first word and proper nouns capitalized, followed by a period.
- (5) Name of editor, if applicable, followed by a command and the abbreviation “ed.” followed by a comma.
- (6) Edition number, if necessary (e.g., “1st ed.”), followed by a comma.
- (7) Name of publisher in shortened form (e.g., “Macmillan” not “The Macmillan Company”), followed by a comma.
- (8) Publisher’s location, followed by a comma.

- (9) Inclusive page numbers (e.g., “6-10”), if applicable, followed by a period.

Stockwell, R. P., Smith, P. A., and Turner, J. K. (1980). “The outline.” *The major structures of English*. J. Smith, ed., 1st ed., Holt, Rinehart & Winston, New York, 6-8.

c. *Technical reports, pamphlets, etc.* Bibliographical references to technical reports, pamphlets, etc., will be arranged as follows:

- (1) Name of author(s) with surname preceding initials, followed by a period.
- (2) Year of publication (in parentheses), followed by a period.
- (3) Title of report or pamphlet in quotes, with only the first word and proper nouns capitalized, followed by a comma.
- (4) Designation and/or number of report or pamphlet, followed by a comma.
- (5) Name of publisher, followed by a comma. (If the publisher is the same as the author, it is not necessary to repeat the name.)
- (6) City and state in which the volume was published, followed by a period.
- (7) For an internal working document or similar unpublished document cited in the references or bibliography, include a parenthetical statement of its availability, e.g., “(Copies can be requested from U.S. Army Engineer Research and Development Center, ATTN: CEERD-ER-R, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199.)”

Leggett, M. A., Pace, M. E., Lyles, F. C., and Abraham, K. (2000). “Reliability and stability assessment of concrete gravity structures (RCSLIDE): User’s guide,” Technical Report ERDC/ITL TR-00-2, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

d. *Transactions or proceedings.* Bibliographical references to transactions or proceedings will be arranged as follows:

- (1) Name of author(s) with surname preceding initials, followed by a period.
- (2) Year of publication (in parentheses), followed by a period.
- (3) Title of article in quotes, with only the first word and proper nouns capitalized, followed by a period.
- (4) Title of the transactions or proceedings, italicized, with only the first word and proper nouns capitalized, followed by a period.

- (5) Location of conference or symposium and inclusive dates followed by a period.
- (6) Name of proceedings editor, if applicable, followed by a comma and the abbreviation “ed.,” followed by a comma.
- (7) Name of the society or name of the publisher, followed by a comma.
- (8) Publisher’s location, followed by a comma.
- (9) Inclusive page numbers, followed by a period.

Chave, K. E. (1981). “Skeletal durability.” *Approaches to paleoecology*. Eighth Annual Symposium on Paleoecology, New Orleans, LA, 21-23 July 1981. J. Imbrie and N. Newel, ed., Wiley, New York, 377-87.

*e. Theses or dissertations.* Bibliographical references to theses or dissertations will be arranged as follows:

- (1) Name of author(s) with surname preceding initials, followed by a period.
- (2) Year of publication (in parentheses), followed by a period.
- (3) Title of thesis or dissertation in quotes, with only the first word and proper nouns capitalized, followed by a comma.
- (4) Identification of degree (e.g., “Ph.D. diss.” or “M.S. thesis”), followed by a comma.
- (5) Name of university, followed by a comma.
- (6) City (and state if necessary) in which the university is located, followed by a period.

Smith, J. G. (1980). “The theory of sunspots,” Ph.D. diss., University of California, Berkeley.

*f. Computer software.* Bibliographical references to computer software will be arranged as follows:

- (1) Name of author(s) with surname preceding initials, followed by a period.
- (2) Year of release (in parentheses), followed by a period.
- (3) Title of computer program in quotes, with only the first word and proper nouns capitalized, followed by the words “computer program” in parentheses and a comma.
- (4) Specifics of the program (e.g., “IBM-PC, 4 disks”), followed by a comma.

- (5) Name of developer or publisher, followed by a comma.
- (6) City and state in which program was developed, followed by a period.

Roberts, J. T. (1989). "GATES, A computerized revision program" (computer program), IBM-PC, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

*g. Internet references.* Bibliographical references to information found on the Internet should be cited as follows:

- (1) Bruckman, A. "Approaches to managing deviant behavior in virtual communities," ftp.media.mit.edu pub/asb/papers/deviance-chi94 (4 Dec 1994 (this is the date the author accessed the site)).
- (2) Burka, L. P. "A hypertext history of multi-user dimensions." *MUD History*. <http://www.ccs.neu.edu/home/lpb/mud-history.html> (5 Dec 1994).
- (3) Gomes, L. "Xerox's on-line neighborhood: A great place to visit." *Mercury News*, 3 May 1992. telnet lambda.parc.zerox.com 8888, @go #50827, press 13 (5 Dec 1994).
- (4) Quittner, J. "Far out: Welcome to their world built of MUD." *Newsday*, 7 Nov 1993. gopher/University of Koeln/About MUDs, MOOs and MUSEs in Education/Selected Papers/newsday (5 Dec 1994).

## Format for Appendixes

Appendixes in ERDC reports will be designated by capital letters (Appendix A, Appendix B, etc.). Each appendix will have its own page numbering series, being differentiated from like-numbered pages in the main text by the use of a prefix letter corresponding to the letter designation of the appendix. For example, the first page of Appendix A will be numbered A1. (The appendixes herein can be used as examples.) Each appendix will begin on a right-hand page for reports published in hard-copy form.

Paragraphs in appendixes will not be numbered. Subparagraphs will be identified by a lowercase italicized letter followed by a period.

Headings in appendixes will be in accordance with the system described for the main text.

Illustrations (figures, photos, and plates) and tables in appendixes will be numbered consecutively with Arabic numerals preceded by the letter designation of the appendix, e.g., Figure A1 or Table A1. Generally, requirements for main text tables and illustrations are also applicable to appendix tables, tabulations, and illustrations.

References in the appendixes will be included in the “References” at the end of the main text.

## Format for Notation

The entries in a notation will be listed alphabetically in order as follows: lower case, upper case, English letters, Greek letters, subscripts, superscripts. Figure 13 is an example page from a notation. Even though symbols and abbreviations are defined in the notation, they should also be defined when first mentioned in the main text of the report but not thereafter.

<b>Appendix C</b>	
<b>Notation</b>	
$a$	Distance along x-axis, m
$A$	Amplitude constant
$b$	Distance along y-axis, m
$C$	Amplitude constant
$d$	Depth of water, m
$d_a$	Water depth at distance $a$ from shore, m
$e$	Base of natural logarithms
$g$	Acceleration of gravity
$H_{avg}$	Average runup height, m
$i$	Tsunami intensity
$L$	Characteristic length of the wave in its direction of propagation
$n$	Refers to a time, $n\Delta t$
$n()$	Tsunami probability function
$r_e$	Radius of the earth
$t$	Time, hr
$u$	Depth-averaged wave velocity component in the $\theta$ -direction
$v$	Depth-averaged wave velocity component in the $\phi$ -direction
$x$	Distance, m
$\Delta S$	Dimension of a boundary cell face normal to the boundary
$\Delta t$	Length of a half time-step
$\varepsilon$	Phase factor
$\eta$	Wave elevation from reference water level
$\theta$	Latitude measured from the north pole
$\phi$	Longitude measured from Greenwich
$\partial$	Partial differential

Figure 13. Example of a notation

# Style

## Spelling

*Webster's Third New International Dictionary* (Gove 1993), referred to as Webster's Unabridged Dictionary hereinafter, will be used as the primary authority in matters of spelling and hyphenation of words. When equal variants of spelling are given, one will be used consistently in the same report. The Government Printing Office (GPO) *Style Manual* (1984) also contains excellent sections on spelling and compound words. Appendix A lists the preferred spelling of difficult or uncommon words used in ERDC reports. These words are often troublesome because of confusion regarding whether they are one-word or two-word forms, hyphenated or unhyphenated, etc. Refer to this list when preparing materials for inclusion in ERDC reports.

## Capitalization

The generally accepted rules of capitalization, summarized in the GPO *Style Manual* (1984), will be followed. Special uses of capitals in ERDC reports are as follows:

- a. *All capitals.* Abbreviated forms of proper names, e.g., USACE, ERDC, and DNA.
- b. *Initial capitals.* Major words of report Chapter and first-level headings; major words of titles, subtitles, and column headings of tables; trade names; military project or operation names; and the words "Chapter," "Appendix," "Figure," "Table," "Photo," "Plate," and "Equation" when followed by a letter or number. Words such as profile are also capitalized when followed by a number, e.g., Profile 3.

## Punctuation

Discussion of the rules for punctuation is beyond the scope of this Guide. ERDC authors should consult good standard works such as the *Harbrace College Handbook* (Hodges, Whitten, and Webb 1998), *Words Into Type* (Skillin and Gay 1974), and the GPO *Style Manual* (1984). Specific usages and/or misusages of certain types of punctuation are discussed in detail in Chapter 6.

## Abbreviations and symbols

The basic philosophy in the use of abbreviations and symbols in a report is to gain conciseness—but never to impose a hardship in understanding on the reader. In ERDC reports, essentially three types of shortened word forms are acceptable: units of measurement, acronyms, and symbols.

**Units of measurement.** Abbreviations will be used for units of measurement in the text when the units are immediately preceded by numerals.

Incorrect:

Current velocity, in m/sec, was...

Correct:

Current velocity, in meters per second, was...

or

Current velocity was 6 m/sec...

Internal and terminal punctuation will be omitted in abbreviations, except where such omission may introduce ambiguity. For example, the period is always used in the abbreviation for inch; thus, “in.” is correct.

Be consistent in both usage and style. It is permissible to spell out words in the text and abbreviate the same words in tables and illustrations. However, the same form should be used consistently in all tabular and illustrative material, and the form adopted for the text should be used consistently in the text material. For example, do not use “20 meters per second” in one place in the text and “20 m/sec” in another.

Appendix B is a list of abbreviations commonly used at ERDC. Though by no means complete, it does include most unit-of-measurement abbreviations and other closely related abbreviations used in ERDC reports. For additional guidance on abbreviations, refer to the *GPO Style Manual* (1984) and Webster’s Unabridged Dictionary.

**Acronyms.** The first time an agency or program name is used in the preface and the main text, it should be spelled out and followed by its proper abbreviation in parentheses if it is to be used again therein. Such abbreviations will be written in all capital letters, with no space or periods between the letters. The abbreviations alone may be used thereafter.

Examples:

...at the U.S. Army Engineer Research and Development Center (ERDC).  
Personnel at ERDC associated with the study were...

...for the Aquatic Plant Control Research Program (APCRP). Further work  
under the APCRP showed that...

Abbreviations for agency names are found in AR 310-50 (Headquarters, Department of the Army 1985).

**Symbols.** Greek letters and mathematical symbols are used freely in technical reports. Those editing reports and preparing reproducible copy must follow the author's manuscript. Therefore, mathematical copy must be clear and unambiguous. If the manuscript is handwritten, the author should distinguish between uppercase and lowercase letters and between similar Greek and English letters and should indicate superscripts and subscripts. The author should adopt a consistent style to indicate multiplication of numbers and numerical fractions, i.e., cross, center dot, or parentheses, brackets, and braces. Greek letters and mathematical symbols commonly used in ERDC reports are listed in Appendix C.

Chemical symbols may be used freely in tables and illustrations. Generally, clarity to the reader is the controlling rule for these. In the text, symbols should be avoided when the terms constitute only a general reference.

Preferred:

The barium compounds and the nickel and iron alloys were...

Not preferred:

The Ba compounds and the Ni and Fe alloys were...

Symbols for isotopes, using superscript numerals, may be used in the text.

Preferred:

...consisting of barium-36 and iron-23.

or

...consisting of <sup>36</sup>Ba and <sup>23</sup>Fe

## Numerals

The following are guidelines for the use of numerals in ERDC reports based on Strange and Mather (1966).

Spell out any numbers from one through nine (except in tables or lists), with the following exceptions:

- a. Use numerals when the quantity is partly fractional, such as "1.15" or "1-1/2" (note the hyphen in the second expression). However, fractions standing alone (with no whole number) are usually spelled out, such as "three fourths of the dam," "half a kilometer," or "a half kilometer."
- b. Use numerals with units of measurement, such as "2 by 4 m," "5 kg/sq m," etc.

- c. In contrasted statements, if some numbers must be numerals, use numerals for all, such as “Gauges A and B require 2 bolts and 16 bolts, respectively.”
- d. In a series of connected numerical statements implying precision, use numerals, such as “2 years 5 months 3 days.” The use of numerals (especially the “1”) is not recommended for numbers occurring in precise statements similar to the following: “by connecting the two test coils”; “one testing machine.”
- e. Use numerals after certain abbreviations that are not units of measurement, such as “Vol V,” “sta 1.”
- f. Use numerals in proportions, such as “a ratio of 1 to 5” or “a 1:10 scale.”

Use numerals for all numbers higher than nine, with the following exceptions:

- a. Do not begin a sentence with a numeral.
- b. Spell out round numbers used in an indefinite sense unless accompanied by a label such as “about” or “approximately,” e.g., “a hundred meters or so,” but “approximately 100 m.”
- c. Spell out numbers less than 100 that precede another number, e.g., “fifteen 2-mm rods,” but “120 8-mm rods.”

In expressing percentages, precise figures, etc., use decimals, e.g., “4.5 percent,” not “4-1/2 percent.”

In decimal numbers less than unity, place a cipher before the decimal point, e.g., “0.65 mm,” not “.65 m.”

Use a comma in numbers of four or more digits in text and tabular matter, e.g., “1,000,” not “1000.”

Always use numerals for the time of day and the day of the month, e.g., “2:30 p.m.” or “25 January 1984”; but spell out such phrases as “the first of May” when not referring to specific days. Spell out the numeral when referring to specific days by ordinal number, e.g., “the fifteenth of May.”

### **Mathematical expressions**

ERDC style for presentation of equations and other mathematical expressions is summarized in Appendix C.

## 4 Report Preparation, Processing, and Distribution

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A flowchart indicating the usual path an ERDC report follows in the process of publication is shown in Figure 14. The various steps are discussed in detail in this chapter.

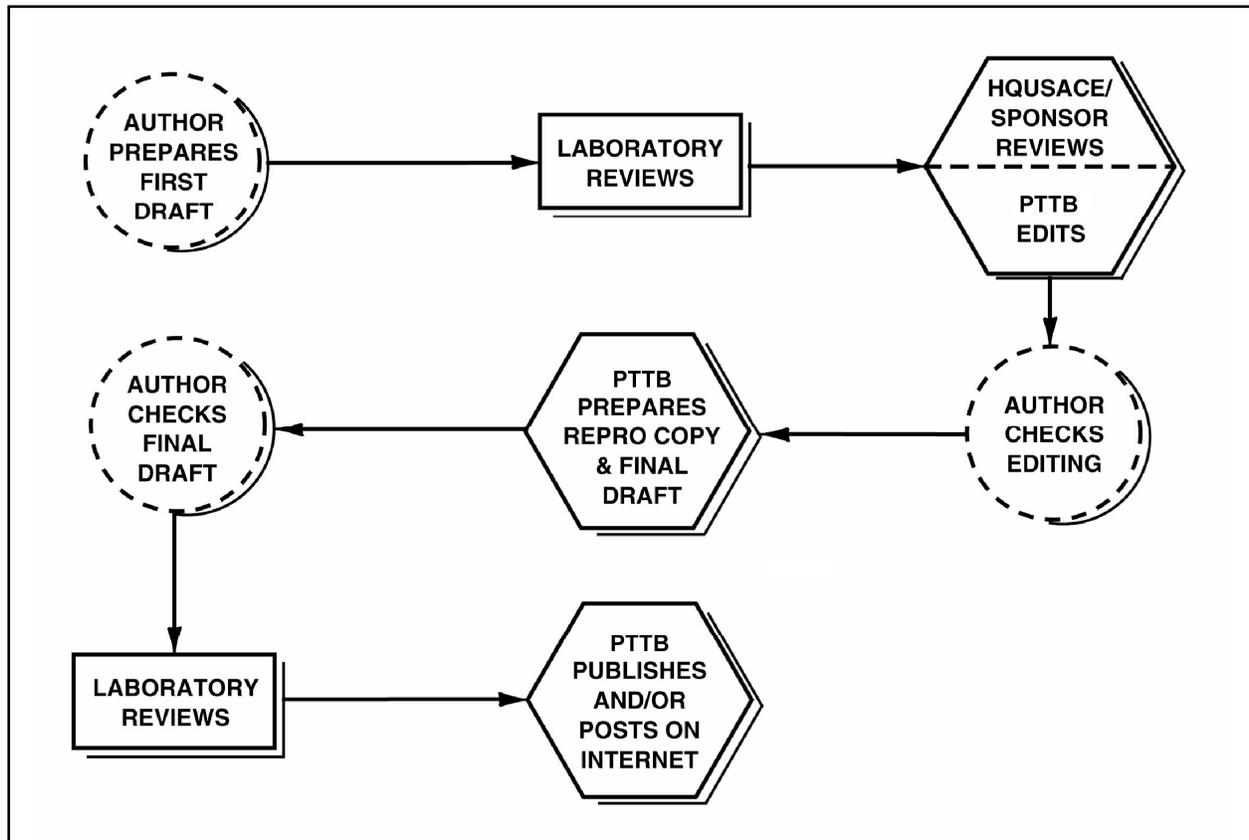


Figure 14. Flowchart for ERDC reports

## Planning

To expedite the publication of a report, the author should (a) begin planning and writing the report concurrently with his investigation whenever feasible, and (b) obtain the advice and services of PTTB in planning the report, arranging for timely graphic arts support, setting up tables of data, and resolving questions of organization, format, etc.

Technical reports should give a complete, accurate account of the work accomplished, but they should contain only information, illustrations, and data essential to an understanding of the subject matter. During the preliminary phase of assembling the material that will go into the report, the author should decide which data are essential and which can be put into appendixes or simply filed. Early elimination of unnecessary or irrelevant information or data will save time and money. In the case of computer-generated information, a format should be selected in the beginning that will facilitate assembling the data.

## Preliminary Draft

### Author

When preparing a preliminary draft of a report, the author must ensure that the draft is complete, accurate, and technically correct. Preliminary illustrations should be complete, legible, and accurate and should be prepared with a view toward final report standards. To save money and time, hand-drawn illustrations that are neat and legible may be used in Special Reports, and computer printouts of data may be used in all types of reports.

### Technical organization review

After the preliminary draft has been reviewed in the technical organization, [ERDC Form 7-E \(Figure 15\)](#) will be completed, signed by the division chief or laboratory director or by the support element chief, and attached to the draft.

[ERDC Form 7-E](#) should be filled out carefully and completely. The distribution statement should be selected from the statements on the back of the form.

The report will then be sent to PTTB for processing and PTTB will prepare a cost estimate for completion of the report.

### Report processing

When the preliminary draft of a report is delivered to PTTB for processing, it will be reviewed to determine what procedures will be necessary to meet deadlines or target dates. Any questions will be resolved by the person designated



<b>15. REQUIRED NOTICES</b>	
(Please check proper notice to use in both blocks.)	
<b>DISTRIBUTION STATEMENT.</b> Indicate which of the following statements (required by DoD Directive 5230.24 and Army Regulation 70-11) is to be put on front cover and SF 298 of report. If Statement B, C, D, or E is to be used, please indicate which of the reasons is to be cited.	
<input type="checkbox"/>	<b>Statement A:</b> Approved for public release; distribution is unlimited.
<input type="checkbox"/>	<b>Statement B:</b> Distribution authorized to U.S. Government agencies only. (Fill in reason); (date). Other requests for this document will be referred to (insert controlling DoD Office). _____ <input type="checkbox"/> Foreign Government Information <input type="checkbox"/> Proprietary Information <input type="checkbox"/> Test and Evaluation <input type="checkbox"/> Contractor Performance Evaluation <input type="checkbox"/> Administrative or Operational Use <input type="checkbox"/> Software Documentation <input type="checkbox"/> Specific Authority (identification of valid documented authority)
<input type="checkbox"/>	<b>Statement C:</b> Distribution authorized to U.S. Government agencies and their contractors only (Fill in reason); (date). Other requests for this document will be referred to (insert controlling DoD Office). _____ <input type="checkbox"/> Critical Technology <input type="checkbox"/> Administrative or Operational Use <input type="checkbox"/> Specific Authority (identification of valid documented authority)
<input type="checkbox"/>	<b>Statement D:</b> Distribution authorized to DoD and DoD contractors only. (Fill in reason); (date). Other requests will be referred to (insert controlling DoD Office). _____ <input type="checkbox"/> Premature Dissemination <input type="checkbox"/> Software Documentation <input type="checkbox"/> Critical Technology <input type="checkbox"/> Specific Authority (identification of valid documented authority)
<input type="checkbox"/>	<b>Statement E:</b> Distribution authorized to DoD components only. (Fill in reason); (date). Other requests will be referred to (insert controlling DoD Office). _____ <input type="checkbox"/> Export Limitations <input type="checkbox"/> Software Documentation <input type="checkbox"/> Premature Dissemination <input type="checkbox"/> Critical Technology <input type="checkbox"/> Foreign Government Information <input type="checkbox"/> Specific Authority (identification of valid documented authority)
<input type="checkbox"/>	<b>Statement F:</b> Further dissemination only as directed by (insert controlling DoD Office) _____ or higher authority (date).
<input type="checkbox"/>	<b>Statement X:</b> Distribution authorized to U.S. Government agencies and private individuals or enterprises eligible to obtain export-controlled technical data in accordance with regulations implementing 10 U.S.C. 130c (date). Other requests will be referred to (insert controlling DoD Office). _____
<b>DISPOSITION INSTRUCTIONS:</b> Unless special instructions regarding the report's disposition are necessary, one of the following notices will be used.	
<b>Unclassified, unlimited reports:</b>	
<input type="checkbox"/>	Destroy this report when no longer needed. Do not return it to the originator.
<b>Reports marked with distribution statements B, C, D, E, F, or X:</b>	
<input type="checkbox"/>	<b>DESTRUCTION NOTICE</b> – For classified documents, follow the procedures in DoD 5200-22-M, Industrial Security Manual, Section II-19, or DoD 5200.1-R, Information Security Program Regulation, Chapter IX. For unclassified, limited documents, destroy by any method that will prevent disclosure of contents or reconstruction of the document.

Reverse of ERDC Form 7-E, Nov 99

Figure 15. (Concluded)

on [ERDC Form 7-E](#). The report will then be processed through editing, photography, layout, etc., according to the instructions provided.

### **Author's check of editing**

The edited draft will be returned to the author for check of PTTB's editing. The author should resolve the editor's questions, if any, at this time. On completion of this check, the draft will be returned to PTTB for preparation of the reproducible copy/final draft.

## **Final Draft**

### **PTTB**

PTTB will prepare the final draft of the report in accordance with the appropriate standards of format, arrangement, and style. A sufficient number of copies of the final draft will be prepared for final review: a single copy if the report is to be reviewed only at ERDC, or several copies if it is to be sent to the sponsoring office, consultants, etc., for review.

### **Technical organization**

The final draft will be thoroughly and carefully checked in the author's technical organization to ensure the accuracy and adequacy of the completed report. Copies of the final draft will then be forwarded by the author's technical organization to the sponsor or other office as required (see following paragraph), to consultants, or back to PTTB if outside review is not required.

### **Sponsoring office**

The final draft will be forwarded to the sponsoring office for review if requested by that office or if considered desirable by the ERDC technical organization concerned.

The letter forwarding the draft will call attention to and request concurrence with the proposed distribution (the distribution list may be included in the draft), placement on the Internet, and the distribution statement appearing on the cover page. It will also ask how many copies of the report the sponsor desires, if this has not already been established, and request that the report be returned promptly. When the draft is returned to ERDC, it will be routed to the technical organization concerned, where any necessary changes will be indicated, and then to PTTB with any additional or revised information on distribution or restrictions.

## Final approval

Figure 16 shows ERDC Form 9, Report Approval Form, on which the responsible laboratory director or and support element chief indicates final approval authority for all ERDC technical publications. This form is used for approval for placement on the Internet as well as for printed copies.

## Final corrections and reproduction

Upon receipt of the approved final draft, PTTB will make any required final corrections in the copy prior to completing the report through printing or posting on the Internet. In accordance with AR 25-30 (Headquarters, Department of the Army 1999), PTTB is the *only* authorized source for printing and duplicating services for use in reproducing ERDC publications.

## Distribution of Printed Reports

Normally, PTTB distributes printed technical publications, keeping a record of the number of copies produced and distributed.

Numerous standard computerized distribution lists for ERDC reports are maintained by PTTB. For reports for which one of the standard distribution lists is not appropriate, the author or technical organization will originate a list for forwarding with the final draft.

Except for reports published in only a few copies, two copies of all reports will be forwarded to DTIC upon initial distribution. Distribution statements will remain in effect until changed or removed by the controlling DOD office. When notified by the controlling DOD office that limited distribution can be removed, the Research Library will notify primary distribution recipients and cognizant document handling facilities that Statement A should be applied.

## Internet

Reports to be made available via the Internet must meet the following criteria:

- a. Document is mission-related.
- b. Content of document is timely and accurate.
- c. Content is appropriate for public release. (Classified or restricted distribution documents are not appropriate for unlimited Internet access.)

<b>Publishing and Technology Transfer Branch</b> <b>Report Approval Form</b>				
<b>1. Report Title:</b>				
<b>2. Report Number:</b>			<b>3. ID Number:</b>	
<b>4. Publish on Internet:</b>		<b>5. Print:</b>	<b>6. Distribution List:</b>	
<input type="checkbox"/> PDF <input type="checkbox"/> HTML <input type="checkbox"/> Other		No. of copies:	a. Number(s)	b. Special
<b>7. Laboratory Approval:</b>				
<b>Routing</b>	<b>Name</b>	<b>CEERD-</b>	<b>Initials</b>	<b>Date</b>
Editor				
Chief, Publishing Group				
Author (Contact)				
Deputy Director				
Laboratory Director				
<b>Placement on the Internet requires Laboratory Director's approval:</b>			<b>Laboratory Director's</b>	
<input type="checkbox"/> Approved	<input type="checkbox"/> Not Approved	<input type="checkbox"/> Not Applicable	<b>Initials</b>	
Editor				
Visual Information Specialist				
Chief, Publishing Group				
Chief, PTTB				
Visual Information Specialist				
<b>8. The following items apply (if checked):</b>			<b>Publications Placed on the Internet Must:</b> <ul style="list-style-type: none"> <li>Be mission-related.</li> <li>Be timely and accurate.</li> <li>Be appropriate for public release.</li> <li>Be in compliance with copyright and Privacy Act restrictions.</li> </ul>	
<input type="checkbox"/> a. This report was not read by a PTTB editor (and is not appropriate for unlimited Internet access).				
<input type="checkbox"/> b. Laboratory should furnish:				
<input type="checkbox"/> (1) Number of copies to be printed.				
<input type="checkbox"/> (2) Distribution list. (Please furnish diskette if an unnumbered list is used.)				
<input type="checkbox"/> (3) Abstract (not to exceed 300 words).				
<input type="checkbox"/> (4) Key words.				
<input type="checkbox"/> c. The quality of photographs and illustrations in this report does not meet minimum standards and requires laboratory approval before the report can be published.				
<input type="checkbox"/> d. Other comments:				

ERDC Form 9, R Jun 99

Previous editions are obsolete.

Proponent: CEERD-II-P

Figure 16. PTTB report approval form

- d. Document is in compliance with copyright and Privacy Act restrictions. (Copyrighted text, software, and visual imagery may not be placed on the Internet unless a copyright release has been obtained.)
- e. Information posted on the Internet requires the same accuracy and integrity as any information disseminated to the public by other means. Careful proofreading and editing will be done to all material. All ERDC numbered reports placed on or linked to any ERDC Internet homepage should be edited by a PTTB editor.

## Exceptions

### Miscellaneous Papers and Special Reports for limited distribution

Miscellaneous Papers and Special Reports that will receive only *limited* distribution (100 copies or fewer) need not follow all the procedures prescribed thus far. In addition, they need not be as finished in style or format as technical publications given broad distribution. However, they should be technically correct and well written, and all illustrations and tables should be neat and legible. Even though these reports will receive only limited distribution, they must be reviewed and approved by the responsible laboratory or support element chief before being printed. Printing and duplicating services will be obtained from PTTB. These publications may **not** be placed on the Internet.

### Contract Reports

Contract Reports must be reproduced by PTTB from reproducible copy prepared by the contractor or from reproducible copy prepared at ERDC from a draft furnished by the contractor. Government Printing and Binding Regulations published by the Joint Committee on Printing, Congress of the United States, specifically state that ***contractors shall not become prime or substantial sources of printing***. Paragraph 35-1 of the regulations reads as follows:

The inclusion of printing...within contracts...for services such as...engineering, and research, is prohibited unless authorized by the Joint Committee on Printing.

The contract will specify the format for the report, which will be that prescribed by the Guide with respect to spacing, page size, use of both sides of sheets, keeping illustrations to the minimum necessary for a clear understanding of the subject matter, and making illustrations page size or smaller whenever possible. In addition, Contract Reports will contain the proper distribution and disposition statements and a completed Standard Form 298.

In reviewing drafts of Contract Reports, the responsible technical organization will ensure that the final reproducible copy meets the following requirements. The preface will include the sponsoring agency, statements indicating

authorization for the work, numbers and titles of the DA project/task under which the work was accomplished, and the relation of the work to the overall program. It will also include a statement similar to the following, generally as the last paragraph: “The contract was monitored by Mr./Ms./Mrs. \_\_\_\_\_, \_\_\_\_\_ Branch, \_\_\_\_\_ Division, of the \_\_\_\_\_ Laboratory of the U.S. Army Engineer Research and Development Center. Contracting Officer was COL \_\_\_\_\_, EN.” Director was Dr. James R. Houston. Other ERDC personnel, such as branch and division chiefs and laboratory directors, may be named at the discretion of the technical organization concerned.

The reproducible copy of Contract Reports to be published by ERDC must be submitted on white bond paper; illustrations must be neat, legible, and preferably suitable for reduction to a 165.1- by 228.6-mm (39- by 54-pica; 6- by 9-in.) size or smaller; and photographs must be good, continuous-tone prints. The reproducible copy will be furnished to PTTB for printing.

All Contract Reports will have the prescribed ERDC cover, which will show the name of the contract author. The Standard Form 298 will also contain the contractor’s report number and other information desired by the contractor. These reports will be distributed by PTTB. Up to 25 copies of a report may be furnished to the contractor. If the Contract Report is acceptable “as is” to the principal investigator, minimum editing (Conformance Checking, [Figure 15](#)) may be considered. However, if this level of editing is selected, the report may not be posted on the Internet.

### **Reports prepared by ERDC but printed elsewhere**

Reports prepared by ERDC technical organizations but printed by the sponsoring office will also be incorporated in the appropriate ERDC report series. At least three copies of the published edition of all such unclassified reports (a maximum of two copies of classified reports) will be forwarded to PTTB, which will assign a report number, have an ERDC cover attached over the sponsor’s cover, and send the reports to the Research Library for filing.

### **Reports prepared for record purposes only**

Reports prepared for record purposes only (no distribution except to the Research Library and possibly to the technical organization involved) will be designated Special Reports and filed in the Research Library, provided their content will not be included in a future, more comprehensive report. These reports should contain a preface, or at least an introductory paragraph, giving the administrative background, pertinent dates, and any acknowledgments desired. [ERDC Form 7-E](#) showing the distribution statement to be printed on the cover (for use by the Research Library) will be sent to PTTB along with the reproducible copy. PTTB will assign a report number, reproduce and bind the report, and send three copies to the Research Library. A few copies (10 maximum) for the files of the

technical organization concerned can also be reproduced and bound at the same time, if desired.

### **Papers prepared for professional societies and/or journals**

Papers prepared for presentation at symposiums or meetings of professional societies will be bound as ERDC Miscellaneous Papers unless the papers are based on information that is or will be available in another ERDC publication. Clearance for presentation of such papers will be obtained in accordance with provisions of Station Regulation 360-1-2 (U.S. Army Engineer Waterways Experiment Station 1984).

After a paper is presented, the author should furnish the Research Library the following: title, author, date, and location at which it was presented, probable publication date and journal, and the availability of reprints.

### **Theses and dissertations**

In most cases, a thesis or dissertation completed by an ERDC employee as a result of Corps-sponsored academic work will be published as a formal ERDC report. Such a report can be printed basically “as is” as an ERDC Technical Report. For information on the handling of theses and/or dissertations that are not published as formal ERDC reports, see Station Regulation 25-1-9 (U.S. Army Engineer Waterways Experiment Station 1990).

# 5 Writing, Editing, and Layout

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The purpose of a technical report is to record the results of an investigation and present the details and associated reasonings in a form that is easily referred to and readily understood by the audience for which the report is intended. With this basic purpose of reports in mind, the following discussion of the writing and editing functions as practiced at ERDC was compiled. This discussion was compiled in great measure from *Technical Editing*, edited by B. H. Weil (1975); “Clarity in Technical Reporting” by S. Katzoff (1968); and “Writing and Editing Reports” by R. R. Rathbone (1961).

## Writing

### Approach to writing

An outline delineating the proposed organization of the material to be presented is recommended when planning and preparing a report. In preparing an outline, the author must decide whether a topical or a chronological approach will be used, or perhaps a combination of the two. Generally, the topical approach (telling why and how the study was made and what was learned) is preferred. The topical approach may also include a chronological account of the events leading up to the study or of test procedures, etc. Conversely, the purely chronological approach hinders an author in emphasizing the important features of a study and is ordinarily used only when an historical account is desired.

Another means of expediting completion of reports and simplifying their preparation is the report-while-testing procedure. The author may use this procedure to describe each test series as it is finished and prepare pertinent tables and illustrations. Thus, when the investigation is completed, the report also is essentially complete. An additional advantage of the report-while-testing procedure is that the test data are analyzed as the study progresses. This may assist the investigator in determining the next steps in the testing program. When an investigation consists of several phases, reports may be prepared on each phase to provide the sponsor information as promptly as possible.

## Duty of writer

The primary duty of a technical writer is to convey information accurately and clearly. However, many writers seem to subordinate this purpose and forget the reader when preparing a report. For example, when a reviewer or editor points out that a certain word seems incorrect or ambiguous, the writer may proceed to an unabridged dictionary and triumphantly point out the rare definition that clarifies his sentence. Obviously such an author is not presenting information clearly to the reader; if the reader had been kept in mind, an attempt would be made to substitute a more common word.

Today, nearly all readers of technical literature are in a hurry. They have so much to read that they have to skim nearly everything if they are to get through the daily pile of papers on their desks. They also have to read discontinuously since job pressures seldom permit reading a report from cover to cover in one sitting. Therefore, from a practical viewpoint, writers should cater to these needs. They should build ease of reading into their style and format. Actually the job is not so difficult if writers will use the following suggestions for tailoring their report to the rapid reader:

- a. *Use descriptive headings and subheadings freely.* They act as signposts, group related material, and show the interrelation of the parts and their contribution to the whole. Newspapers use headings, why not reports?
- b. *Put the topic sentence at the beginning of a paragraph.* This gives readers a choice. They can either read the details on the topic or skip to the next paragraph.
- c. *Use a simple structure for a complex idea.* Whenever the thought is involved or otherwise difficult to convey, the grammatical structure should be simple. Three short sentences are easier to read in this case than one long one; a paragraph of technical description more than a page long usually has to be reread.
- d. *Relegate secondary material to an appendix.* Main ideas will stand out if not buried by incidentals, however pertinent.
- e. *Make full use of illustrations and tables.* Illustrations and tables that summarize detailed results are invaluable. Most readers have trained themselves to extract the information they need at a glance. Captions and legends should always be provided, and references to illustrations or tables should be made at that point in the text where the reader needs the information.

The following paragraphs give helpful suggestions on word usage, sentence structure, and paragraphing.

## Choice of words

Avoid using a rare word unless it is essential. Foreign words and phrases should not be used when they can be avoided; whatever elegance or subtlety they may add to the paper or report is probably lost on the reader, who will merely find the paper or report that much more difficult to follow. Technical words commonly used in a particular branch of science or engineering can, of course, be used. Be sure, however, that the technical words are not merely ERDC jargon, because such language can be meaningless to others.

The need for precise, straightforward language cannot be overemphasized. Readers seek information, not an emotional experience. They ask for clarity and efficiency of expression, not impressive language. Other things being equal, choose (a) a short rather than a long word; (b) a plain, familiar word rather than a fancy, unusual one; and (c) a concrete word rather than an abstract one. Some major word faults include the following:

Fuzzy words:

Plates of *appreciable* thickness...  
A *relatively high* temperature...  
A *small number* of failures...

Obscure words:

Conditions should *ameliorate* as soon as the maintenance crews are *inculcated* in the theory of operation.

Jargon and coined words:

The system can be introduced with *effectivity* within 6 months.

Cliches:

*Last but not least*, we intend, *in the long run*, to *explore every avenue* that might lead us to a solution *along this line*.

## Sentences

For sentences, “do” and “don’t” suggestions are not as simple and obvious as those just presented for words. However, the basic purpose of presenting material as clearly as possible is still the guide.

The length of a sentence should generally not exceed 35 words, unless it is broken up (as by semicolons) into two or three distinct and logically consecutive parts. Simple sentence structure requiring a minimum of punctuation is desirable. Longer, more complex sentences should be used less frequently and should be used to lend variety rather than as the primary means of expression.

An equally important principle is that a sentence should generally contain some indication of how it is related to the preceding sentence or to the development of the paragraph. This indication is best placed near the beginning of the sentence. For example, in the first three sentences of this paragraph, the opening phrases (“An equally important principle,” “This indication,” and “For example”) all serve to show relation to what has gone before. Omitting such transitional or tie-in wording may not essentially alter the main content of the sentence, but doing so can make readers struggle to determine for themselves how the sentence fits into the train of thought.

Make every effort to eliminate ambiguity from sentences. Consider whether the meaning of each word, phrase, or sentence will be clear or whether it has a chance of being even momentarily misunderstood.

Sometimes readers may attach undue weight to a statement simply because the writer was not careful in separating and labeling primary and secondary information. Improper emphasis can, and frequently does, occur at the sentence level. The rule is: *Put main ideas in main (independent) grammatical constructions; secondary ideas, in secondary (dependent) grammatical constructions.* For example, the writer who says “The solution is best determined by field test and is 50 Mpa” has assigned equal weight to two ideas. The statement that the value is 50 MPa is the more significant, and the following revision would so indicate: “The solution, best determined by field test, is 50 MPa.”

Frequently a particular fact or idea must be stated more than once in a report; for example, it may be given in the introduction and then also in the description of the tests and in the discussion. Rather than treating it as brand new material every time, consider introducing the repetition with a phrase such as “As has already been mentioned,” or “Here, again, the fact that...”; otherwise, readers may wonder if their memories are playing tricks. Such introductory phrases are not always essential, but their omission can sometimes be very annoying.

## Paragraphs

A paragraph is usually thought of as a group of sentences developing a single topic, but a paragraph may consist of a single sentence. Like the sentence, a paragraph must have unity, coherence, and emphasis. Unity is attained when every sentence bears directly upon the topic of that particular paragraph; any departure from the central topic means that a new paragraph should be formed. A topic sentence (i.e., the sentence that expresses the topic to be discussed) is generally placed at the beginning of the paragraph. However, its position can be varied to avoid monotony. Coherence in a paragraph results from the correct arrangement of the parts of the paragraph—an arrangement in which each part leads to the next. Emphasis in the paragraph results from stressing the important ideas, either by devoting more space to them or by their position in the paragraph; the beginning and the close of the paragraph are the most emphatic positions.

In clear paragraphs, each sentence is related to the preceding and following sentences by transitional words or phrases. In addition, it may be desirable to

indicate definitely the relation of each paragraph to the preceding or the following one. Usually, the relation to preceding material is indicated in the opening sentence or sentences of the paragraph; and relation to the following material is indicated in the final sentence or sentences of the paragraph. In any case, the reader should not be required to proceed very far into a paragraph (i.e., beyond the second sentence) before the general drift of the subject matter becomes apparent.

Paragraphs should not be too long. Just as a sentence with too many phrases is difficult to grasp as a unit, so is the paragraph with too many sentences. A long paragraph should not, of course, be broken up into shorter ones by arbitrary subdivision. If a paragraph is getting very long, the idea should be simplified, or broken into smaller units, with a paragraph for each.

## **Editing**

Excellent research poorly reported may sometimes be interpreted as being of less worth than less significant research that has been well reported. Therefore, the careful editing of reports to improve their organization, grammar, and communications value enhances their overall quality and subsequent use of the results reported.

### **Author-editor interaction**

Editors assist authors in completing reports that reflect both technical excellence and the views of management relative to the mission of ERDC. If an understanding is reached between editors and authors of the importance and mutual advantages of teamwork, effective reports are produced with a minimum of effort.

The efforts of technical writers, technical editors, illustrators, and publishers are all ultimately directed toward producing documents suited to the intended readers. This means that the technical editor must keep the needs and interests of the intended readers foremost in mind when editing each document and must judge and mold the writer's efforts in these respects. Accordingly, the technical editor must remember that readers are discouraged by overdetailed discussions, vague statements, and overuse of synonyms, acronyms, unfamiliar jargon, and obscure units.

The editor must also coordinate with PTTB publication designers to ensure that documents are as attractively presented as budgets will permit since many readers react unfavorably to publications that are poorly designed, poorly duplicated, or inadequately bound.

A PTTB technical editor is both the junior partner of an author-editor team and a representative of management. Editors are charged with the task of seeing that technical content is reported in a manner suited to the ERDC mission and within prescribed standards for such publications. It is hoped that this Guide will be helpful in establishing "ground rules" to assist both authors and editors in producing

effective reports. However, to perform editing tasks effectively, the editor must have a ready knowledge of the special language of various disciplines in addition to a thorough knowledge of grammar, punctuation, etc. The editor must accept the fact that most words have several meanings or exact shades of meaning and learn to identify these meanings with precision.

If an author fails to follow prescribed guidance on presentation as described herein, the editor can easily refer the author to this Guide. However, matters of literary style are considerably more delicate. It is not the function of the editor to rephrase a report in his or her own literary style. Usually, style is not the important aspect of a report. The content of a report need only be understandable; readable; written in clear, concise language; and complete.

Standardization of format and grammar aids in making the report more understandable. A report must be presented in such a way that technical details are easily interpreted by the intended audience.

### **Functions of PTTB editors**

As already stressed, the job of PTTB editors is to ensure production of accurate, well-written, well-organized, and readily understandable reports as efficiently and economically as possible. The general functions of editors are outlined as follows:

- a.* Maintain established publication standards of content, organization, style, and format.
- b.* Review reports and/or other documents for proper presentation.
- c.* Counsel authors on report problems.
- d.* Coordinate the various processes in the publication of reports.

In accomplishing these general functions, editors must perform the following, more detailed services:

- a.* Correct grammar, punctuation, format, and style.
- b.* Indicate or question apparent errors in fact.
- c.* Question vague or ambiguous statements, unfamiliar jargon, and obscure units.
- d.* Indicate redundancy and inconsistencies.

Editors must guard against trying to impose their own word preferences or writing styles on authors.

Three types of editing are available for ERDC reports. These types of editing are described in detail on ERDC Form 7-E ([Figure 15](#)). Standard ERDC report policy requires either substantive editing or copy editing for all reports to be given

Corps-wide or greater distribution or being placed on the Internet. Copy editing is acceptable when there is a severe shortage of funds and/or time. Conformance checking is acceptable only for reports being published in limited quantity (100 or fewer copies) for limited distribution and is not acceptable for reports to be placed on the Internet. An exception to this is the Contract Report. As long as the technical content of the Contract Report is acceptable to the responsible technical organization and the mechanics of the reproducible copy are acceptable to PTTB, conformance checking is acceptable for Contract Reports for hard-copy distribution that exceeds the 100-copy limitation specified above. However, this level of edit is not acceptable for reports to be placed on the Internet. A report with an ERDC author cannot be classified as a Contract Report.

The editorial marks in general usage by PTTB editors are as shown in [Figure 17](#).

## Checklist for Authors and Editors

A checklist for use by both authors and editors is outlined below and on the following pages.

*a. Preface:*

- (1) Does the preface give the necessary administrative background, such as authorization, sponsor, dates when study was started and completed, and acknowledgment of personnel of sponsoring office or other agencies who were involved in the study and of ERDC personnel?
- (2) Does the preface contain technical background information that can be more properly or appropriately put in the main body of the report?

*b. Introduction:*

- (1) Is background information sufficient?
- (2) Are purposes of study clear and complete?
- (3) Are scopes of study and report given?
- (4) Should any of the material be removed and put in the preface?

*c. Main narrative:*

- (1) Are test equipment and procedures clearly described?
- (2) Are tests or investigations clearly described? Are they given in logical order? Are the purposes of each specific test given? Is each type of test tied in with the purpose of the overall investigation as stated in the introduction?

<i>Markings in edited draft</i>	<i>Meaning of the mark</i>
Since <del>one notices that</del> the data	Delete "one notices that"
The <del>of</del> clear test series	Transpose letters
had <del>gone not</del> far enough	Transpose words
<del>stat</del> Director of CHL	Restore deleted, crossed-out, or altered material
It was <del>not</del> found that	Spell out
The fall <del>out</del> contaminated	Insert at indicated point
in an <del>isotropic</del> medium	Close up space
¶ The instruments showed that	Space properly between characters
marked. 2 The proof was read by	Make new paragraph
The Holt Lock and <del>dam</del>	Run on. No new paragraph
The Holt <del>Project</del>	Upper case the "d"
□ the tests were run	Lower case the "P"
the tests were run □	Move to left to point indicated
□ Purpose and Scope □	Move to right to point indicated
15 $\sqrt{\quad}$ 25	Center horizontally on page
20	Move up to point indicated
15 $\sqrt{\quad}$ 25	Move down to point indicated
20	Lower case
i.c.	Capital letters
Cap. or "All caps"	Capitals and lowercase letters
c. & i.c.	Add space
#	Insert
^	

Figure 17. Editorial marks

- (3) Are the test data clearly presented in best form? If given in more than one form, do the data agree? Are there too many detailed presentations of data; i.e., could some of the repetition be deleted or put in an appendix?
- (4) Does the discussion or summary of results, or both, bring out the important findings of the tests? Do the results cover the purposes of the investigation?
- (5) Are the conclusions really conclusions and not results?
- (6) Are the recommendations relevant and reasonable based on the results of the study?

- d. *Illustrations.* Illustrations should be used when needed to improve the report. They should be used when necessary to clarify the text; they can sometimes be used instead of long descriptions or tabulations.
- (1) Are the illustrations in the text kept to the minimum needed to illustrate certain points?
  - (2) Are the tables properly arranged? Should any be combined, put in an appendix, put in text, or omitted? Excellent suggestions for use in editing tables are provided by the “Checklist” and “Suggestions” given in Chapter 16 of *Technical Editing* (Weil 1975).
  - (3) Are there too many photos or not enough? Should any have labels to clarify them? How can they best be cropped to avoid large reductions or to emphasize important features? How can they best be arranged for comparison or economy?
  - (4) Are the plates understandable? Are they uniform in lettering and wording? Can any be combined economically? Does each have a distinctive title?
- e. *Headings.* Check the headings to ensure that the format is correct and that there are headings for each major section but not so many headings that the text is choppy. See that the headings are of appropriate weight for the material they cover. Can any be changed to make them more descriptive?
- f. *Summary.* Is the summary an adequate synopsis of the report; i.e., does it say why the study was made, how it was made, what was learned, and what was concluded? Does it mention all appendixes? In most reports, any recommendations included in the main text of the report should also be included in the summary.
- g. *Report title.* Does the title of the report adequately describe the contents? Can it be shortened if long?
- h. *Abstract.* Is the abstract as complete as possible within the usual limit of approximately 200 words?
- i. *Contents.* Does the table of contents show all changes made in headings, figures, tables, etc.?

## Layout

Visual information specialists in PTTB serve as publication designers to plan, design, and prepare layouts for use in the production of Web documents and printed materials such as newsletters, brochures, pamphlets, and technical reports. The standards that they apply to these tasks are fully illustrated by the design and layout of this Guide. Refer to Appendix D for detailed information on layout, type styles and sizes, etc.

## 6 Common Errors

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Some of the grammatical and stylistic errors often found in ERDC report manuscripts are discussed in the following paragraphs.

### Voice

The simpler, more direct, and more forceful active voice is preferred wherever possible. To avoid first-person-singular construction, many ERDC writers eliminate all personal pronouns and even words for active agents, leading to excessive use of the passive voice.

Weak:

Drainage of the area is accomplished by three streams.

Stronger:

Three streams drain the area.

Weak:

Telemetry of the data from the reservoir is done by a PAM-FM system.

Stronger:

A PAM-FM system telemeters data from the reservoir.

In addition to being the weaker form, passive voice often leads to ambiguity as to who or what is performing the action.

### Use of Weak Verbs

Weak verbs (e.g., be, is, make) often lead to less economical sentence structure, as well as to a general weakness in expression. Notorious in poor technical

writing is the conversion of a strong verb into a noun, which is then combined with a weak verb.

Poor:

Dose-rate *measurements were made* by the ion chambers to provide...

Better:

Dose rate *was measured* by the ion chambers to provide...

Still better (active voice):

The ion chambers *measured* dose rate to provide...

## Nomenclature Inconsistency

Consistency in the use of technical terminology and abbreviations throughout a given report is essential. When an otherwise common word is used in a particular context (such as “gust” for the dynamic pressure wave), it should be clearly defined the first time it appears. It must then be used the same way throughout the report.

Once some object, material, event, behavior, or other thing relevant to the study being described has been given a name, and that name defined (if a definition is needed), do not use a synonym for that thing. If the same thing has been called by more than one name, the reader may rightly assume it is not the same thing.

The author should never assume that the reader has a full understanding of the terminology of a particular scientific field. Even if such is the case, the reader may have forgotten the meaning of a term when used in a special context.

Do not use an incorrect term unless circumstances necessitate, and when this is the case, explain the incorrect usage. It may be necessary to say “waterproof” or “fireproof” even though these terms cannot be accurately used under any circumstances. When they must be used, put them in quotation marks.

“Weight” means the force of gravity acting on a mass. It is often used incorrectly to refer to mass because in non-SI and old metric the term “pound” and the term “kilogram” were used for both mass and force. In SI, kilogram is only a mass unit; the force unit is the newton.

Specific gravity is the ratio of the mass of a volume of a material at a stated temperature to the mass of the same volume of distilled water at a stated temperature. When possible, it is preferable to use density (mass per unit volume) conveniently expressed in megagrams per cubic meter since it is numerically equal to

grams per cubic centimeter, which is numerically equal to specific gravity at 4 °C. Using megagrams per cubic meter avoids use of a prefix in the denominator which is a feature of good SI use.

## Imprecision in Use of Terms

Technical writers are sometimes careless in the use of certain terms, such as in the use of the word “sample” when actually “specimen” is meant. Other examples include “mix” when “mixture” is intended, “bomb” or “weapon” when “device” is intended, and “batch” when “round” is intended. Authors and editors should strive to select words that convey the exact meaning.

## Use of Pronouns

To avoid ambiguity, special care should be exercised in using pronouns such as “this,” “it,” and “which.” The author knows what is meant, but will the reader?

Vague:

The data recorded by the oscillograph from the radiometer were not significant since it was inaccurate.

What was inaccurate: The radiometer? The oscillograph? The data?

Pronouns are handy for preventing objectionable repetition of the same words and phrases and should be used freely for this purpose, as long as care is taken in sentence construction to ensure that the reference is clear.

## Collective Nouns

Whether a collective noun (e.g., group, number, majority, pair) takes a singular or plural verb depends upon its sense. When referring to the whole group as a unit, the collective noun takes a singular verb; when referring to the separate entities that make up the group, the collective noun takes a plural verb. (In case of doubt, generally the safest form to use is the singular.) The following examples represent good usage:

Ten grams of the isotope was collected.

A million dollars is a lot of money.

A number of specimens were placed in the fallout area.

The number of specimens used was increased to 12.

A total of 50 units were used.

Ten percent of the pie was left.

Ten percent of the books were missing.

Meaning or emphasis is the controlling factor. In the examples above, “grams” and “dollars,” though plural in form, are considered to be singular collective nouns. In the third example, “number,” though singular in form, requires a plural verb for best agreement.

Subjects such as “all,” “any,” “half,” “most,” “none,” and “some” may take a singular or plural verb. The context generally determines the choice of verb forms.

## Tense

Since most ERDC reports are published after the experiments are complete, the past tense should be used to describe what was done and what was found. Eternal truths, established physical laws, instructions, and conclusions should be written in the present or future tense. Care should be exercised to avoid confusing specific experimentation information with eternal truths and established laws. The operation or design of a particular instrument used during a specific experiment should not be considered as an eternal truth and, therefore, should generally be described in the past tense.

## Dangling Modifiers

A dangling modifier is a phrase or a clause that because of its position in a sentence appears to modify a word that it actually does not modify. The error is usually found in the use of participial phrases and gerunds:

By specifying standard resistors, the cost of the instrumentation can be reduced.

The cost of the instrumentation can be reduced by specifying standard resistors.

In both examples above, “specifying” wants to modify a noun or take a subject. The subject of the clause is the closest thing that could fulfill this requirement. But did “cost” specify the resistors? No. The three best ways of clearing up these examples are by (a) supplying a subject, (b) changing the verb form to a word that is obviously a noun and therefore does not want to claim a subject, or (c) rewriting the sentence completely. The third method is usually the best.

Supplying subject:

By specifying standard resistors, *the designer* can reduce the cost of the instrumentation.

Changing verb to noun:

*By the specification of* standard resistors, the cost of the instrumentation can be reduced.

Rewriting:

The use of standardized resistors will reduce the cost of the instrumentation.

## Restrictive and Nonrestrictive Phrases and Clauses

Clauses should be carefully worded and punctuated. The editor will be unable to ensure proper punctuation if the author's meaning is not clear. "That" is generally used to introduce restrictive clauses; "which" may introduce either restrictive or nonrestrictive clauses, but confining its use to nonrestrictive clauses will help maintain clarity, and the editor will then be able to more easily check the punctuation.

Restrictive:

The devices *that* were tested during Operation Redwing varied in yield. (Only *certain devices* were tested.)

Nonrestrictive:

The devices, *which* were tested during Operation Redwing, varied in yield. (*All the devices* were tested.)

The most important point to remember about restrictive and nonrestrictive phrases and clauses is: *Use commas to set off all nonrestrictive phrases or clauses.* "Nonrestrictive" implies a sentence element added only to amplify the meaning of or to add an afterthought to the main sentence thought. Conversely: *Do not use commas to set off restrictive phrases or clauses.* "Restrictive" implies a sentence element that is essential to or limits (restricts) the main sentence thought. The distinction between "restrictive" and "nonrestrictive" is often very important.

With commas:

The gamma radiation data, which were recorded to an accuracy of 10 percent, were used as a basis for...

This sentence means that all the gamma radiation data recorded were accurate to 10 percent—nonrestrictive.

Without commas:

The gamma radiation data which were recorded to an accuracy of 10 percent were used as a basis for...

This sentence means that only gamma radiation data actually accurate to 10 percent were used—restrictive. Thus, the presence or absence of the commas defines the meaning.

## Correct Use of Notations Involving Powers of Ten

The notation “ $\times 10$ ” is common enough in scientific work and usually correctly used in text material. However, care must be taken in certain applications of this notation to tabular matter to avoid ambiguity or give a misleading impression to the reader. A typical set of columnar entries might be as follows:

<b>Bending Moment</b>
<u><b>N/m</b></u>
36,500,000
6,400,000
22,000,000
321,000,000

In this example, the large numerical size of the data necessitates many zeros and makes the information harder than necessary to read. Appropriate use of powers of ten would improve the column. One of the notations in the following tabulation might be used—two are ambiguous and should be avoided, and two are correct:

<i><b>Ambiguous</b></i>	<i><b>Ambiguous</b></i>	<i><b>Correct</b></i>	<i><b>Correct</b></i>
<u><b>Bending Moment</b></u> <u><b>N/m <math>\times 10^6</math></b></u>	<u><b>Bending Moment</b></u> <u><b>N/m <math>\times 10^{-6}</math></b></u>	<u><b>Bending Moment</b></u> <u><b><math>10^6</math> N/m</b></u>	<u><b>Bending Moment</b></u> <u><b>N/m</b></u>
36.5	36.5	36.5	$3.65 \times 10^7$
6.40	6.40	6.40	$6.40 \times 10^6$
22.0	22.0	22.0	$2.20 \times 10^7$
1.43	1.43	1.43	$1.43 \times 10^6$
321	321	321	$3.21 \times 10^8$

In the first example, the notation for the unit of measurement reads, literally, “newtons per meter multiplied by one million.” Does this mean that the value 36.5, for instance, has already been multiplied by one million? Or, should it be multiplied by one million? (Is the true value 0.0000365 or 36,500,000?) In the second example, the same kind of ambiguity results. In the third example, the notation for the unit of measure reads, literally, “millions of newtons per meter.” This means that the first value, for instance, is 36.5 “millions of newtons per meter,” which is correct. This form of the notation is most applicable when it is desired to point out a comparison of the values in the columns. The fourth example also shows good use of the “ $10$ ” notation but should be used only when emphasizing the accuracy to which the instrument used could be read; i.e., it

indicates an instrument was used that could be read to hundredths and that had scale settings that read in millions, tens of millions, and hundreds of millions.

The notation used in the third example is preferred from the standpoint of ease of composition and clean appearance of the table; the fourth example is applicable in the special case where emphasis of the instrument accuracy is the more important consideration.

## **Use of Text to Amplify, Discuss, and Explain Tables and Illustrations**

The technical report text should be used to amplify, discuss, and explain tables and illustrations, not just to repeat what appears therein. The function of a table or illustration is to condense and thereby efficiently present a quantity of data. Therefore, repeating such data in the text is unnecessary. Rather, the text should be the writer's medium for explaining the significance of the tabular or illustrative material, calling the reader's attention to special facts, making important comparisons, etc. From this, it is obvious that each table or illustration must be referenced in the text—if a table or illustration cannot be so referenced, it does not belong in the report. Similarly, it is usually unnecessarily redundant to repeat the same data in both a table and an illustration.

An exception to this rule might occur when a smooth curve appears on a graph that does not permit the reader to extrapolate the actual data values needed. In this case, the smooth curve and a table of the values might be appropriate. The order of reference to a series of tables or illustrations should be in numerical sequence throughout a report for utmost utility to the reader.

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# Appendix A

## Word List

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This word list includes difficult or generally uncommon words used in ERDC reports. It also includes words that are often troublesome because of the confusion regarding whether they are one-word or two-word forms, hyphenated or unhyphenated, etc. Much time and money will be saved if ERDC personnel refer to this list when preparing reports and illustrations.

### A

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aboveground (adj)	air mass
above ground (adv)	airmobile (adj)
above-mentioned	air photo
above-water (adj)	airspeed
acre-ft (in text)	airstream
aesthetics	alignment (ERDC)
aforementioned	alongshore
aforesaid	anticyclone
after-dredging	archaeological
airblast	armor stone
airborne	armor-stone slope
airburst	artwork
air-dry (v, adj)	asphaltic concrete pavement
airflow	

### B

---

back-bay (adj)	backup (n, adj)
back draft	back up (v)
backfill	backwall
backflow	bandwidth
backhaul	bank fill (n)
back pressure	bank-fill (adj)
backshore	bank flow
back slope	bank-full

bank line  
bank side (n)  
bank-side (adj)  
bank slope  
baseline  
baseplate  
Base Test  
beach face  
beach fill (n)  
beach-fill (adj)  
beach-filled (adj)  
beachfront  
beach grass  
beachhead  
beachline  
beachside (adj)  
beach side (n)  
bed form  
bed load (n)  
bed-load (adj)  
bedrock  
bed slope  
bell mouth

bell-mouthed  
benchmark  
bendway  
Bermuda grass  
birdbath  
borderline (adj)  
border line (n)  
borehole  
bottleneck  
bottomland  
bottom lift (n)  
bottom-lift (adj)  
Bouyoucos gauge  
breakaway  
breakpoint  
broad-crested weir  
broadleaf  
buildup (n)  
build up (v)  
built-up (adj)  
bullnose pier  
bypass  
by-product

## C

---

call-up (tow)  
cap rock  
capstone  
Cartesian  
Cartesian coordinates  
CD-ROM disc  
center line (n)  
center-line (adj)  
channel side (n)  
channel-side (adj)  
checkpoint  
cleanup (n, adj)  
clean up (v)  
closeup (adj)  
close up (v)  
close-up (n)  
cnoidal  
coastline  
cold mix (n)  
cold-mix (adj)  
coldwater (adj)  
continental shelf

core stone  
Coriolis effect  
Corps' (possessive)  
Corps-wide  
cost-effective  
cost-efficient  
counterclockwise  
court-martial (n, v)  
cover layer (n)  
cover-layer (adj)  
cover plate  
cover stone  
crossarm  
cross-bedded  
cross-bedding  
cross-check (n, v)  
crosscurrent  
crossflow  
crossover (n, adj)  
cross over (v)  
cross plot  
crossroad

cross section (n)  
cross-section (v, adj)  
cross-sectional (adj)  
cross-shore  
cross wave  
crosswind

crownwall  
cutback (n, adj)  
cut back (v)  
cutoff (n, adj)  
cut off (v)

## D

---

damsite  
Darcy's law  
database  
data set  
dead load  
dead water (n)  
dead-water (adj)  
deadweight  
deadweight tons or tonnage (dwt)  
de-air  
deepwater (adj)  
deep water (n)  
Delft Hydraulics Laboratory  
depth-limited (adj)  
dew point (n)  
dew-point (adj)  
dial-up  
dieback  
disc (CD-ROM)

discretize  
disk (floppy)  
downcoast  
downcut  
downcutting  
downdrift  
downpull  
downriver  
downslope  
downtime  
downvalley  
drag arm  
drainpipe  
drawdown (n)  
draw down (v)  
dump truck  
duneline  
dust-free (adj)  
dwt (deadweight tonnage)

## E

---

earth fill (n)  
earth-fill (adj)  
earthflow  
earthwork  
ebb flow  
ebb-tidal  
ebb tide  
eigenvalue  
e-mail

enclosure  
endorsement  
end point  
end sill  
endwall  
exceedance  
extratropical  
extremize

## F

---

far field	flow line
farmland	flowmeter
farther (distance)	flow rate
fetch-limited (adj)	fly ash
fiberglass (n, adj)	follow-up (n, adj)
fieldwork	follow up (v)
finite-amplitude (adj)	foreshore
finite difference model	forklift
finite element grid	FORTRAN
flap gate	free-air (adj)
flatland	free body (n)
flip bucket	free-body (adj)
flood-control (adj)	free-fall
flood flow	free flow (n)
floodgate	free-flow (adj)
floodplain	fresh water (n)
flood stage	freshwater (adj)
flood-tidal	freeze-up
flood tide (n, adj)	frontline (adj)
floodwall	front line (n)
floodwater	frost-free
floodway	further (extent)
flowchart	fuse
flow field	fuseplug

## G

---

gap-width (n)	ground cover
geosim (geometrically similar)	groundline
Gobi Blocks	groundwater
Gobimat	grumusol
go-no go	guardrail
gradeability	guard wall
grade line	guideline
grid point	guide wall

## H

---

half-space (n, adj)	hard-wire (v)
handlaid	headbay
handline	headbox
harbor side (n)	head loss
harbor-side (adj)	headroom
hard points	headwall

headwater  
headwater el  
high performance (adj)  
high velocity (n)  
high-velocity (adj)  
high water (n)  
high-water (adj)  
homepage

hometown (n, adj)  
hot mix (n)  
hot-mix (adj)  
hot plate  
hybrid model (combination of  
mathematical/numerical physical  
model)  
hydraulic-jump basin

## I

---

ice cap  
ice-free  
infill  
Inner Continental Shelf

in place  
in-place stress field  
in situ  
Internet

## J

---

jobsite

judgment

## K

---

Kellner jack  
Kellner Jack Field

kelvin (n)  
Kelvin (adj)

## L

---

LaGuardia  
lake bed  
lakeshore  
lakeside  
landfall  
landfill (n, adj)  
landform  
landlocked  
landmass  
landside  
land wall  
lead line (n)  
least squares (n, adj)  
leeside (adj)

life cycle (n)  
life-cycle (adj)  
lightboat  
lightweight (adj)  
Lixator  
load line  
lock wall  
login (n, adj, verb)  
longshore  
longtime (adj)  
loose-leaf (adj)  
low tide (adj)  
low water (n)  
low-water (adj)

## M

---

mainframe	midheight
main-line (adj)	mid-latitude
main stem	midpoint
mainstream	midspan
man-hour	midsurf
man-made	mile 194
Manning's n	mile point
mass storage (n)	minicomputer
mass-storage (adj)	Monoslab
Mercator	mud flats
microcomputer	mudflows
midbank	mud-free (adj)
midchannel	mudline
middepth	mudslide
middleground (adj)	multimode

## N

---

namelist	nearshore
near field	no-g

## O

---

oceangoing	onsite
ocean side (n)	onslope
ocean-side (adj)	outlet works
off-coast (n, adj)	ovendry (adj)
off-road	oven-dry (v)
offshore	overall
offsite	overbank
offslope (n, adj)	overland
onboard	overpressure
ongoing	overrun
on-line (adj, adv)	overwater (adj, adv)
onshore	

## P

---

payload	Petersen dredge
percent	pipeline
perigee-syzygy	pitot tube
perigee-syzygean (adj)	Plan 1 and 1A designs

planform  
Plexiglas  
point bar (n, adj)  
Pontacyl Brilliant Pink  
pore-water pressure  
pore-wide pressure  
portland cement  
posttest  
powerhouse  
power plant  
Precambrian  
pretest  
printout (n, adj)  
print out (v)  
Profile 3

programmed  
programmer  
programming  
propwash  
pug mill  
pulldown (n, adj)  
pull down (v)  
pullout (n)  
pulvimeter  
pumpback  
pump house  
pushbar  
pushtow  
Pyrex

## Q

---

quarry-run stone  
quarrystone

quarter point  
quasi-two-dimensional

## R

---

rainwater  
Ramm  
Range 5  
rattail  
real-time  
reentrants  
reevaluation  
resave (computer command)  
reuse  
reverse tainter valve  
Reynolds number  
ridge-and-runnel  
ridge crest  
ridgetop  
riprap  
riverbank  
riverbed  
river bend  
riverflow

riverside  
river wall  
roadbed  
rockbound (adj)  
rockfall (n)  
rock fill (n)  
rock-fill (adj)  
rollcrete (roller-compacted  
concrete)  
rollout  
rubble-mound (adj)  
rundown (n)  
run down (v)  
run-down (adj)  
runoff  
run-on  
runout  
run up (v)  
runup (n)

## S

---

salt water (n)  
saltwater (adj)  
sandbar  
sand bed  
sand bypassing  
sand fill  
sandpit  
sand trap  
seabed  
sea grass  
sea bottom  
seacoast  
seafloor  
seagoing  
sea level (n, adj)  
sea side (n)  
sea-side (adj)  
sea state  
seawall  
seawater  
semidiurnal  
Series A and B  
setdown (n)  
set down (v)  
setup (n)  
set up (v)  
shallow water (n)  
shallow-water (adj)  
sheet metal  
sheet pile (n)  
sheet-pile (adj)  
sheetpiling (n)  
shoreline  
shore-normal  
shore-parallel  
short-time (adj)  
shutoff  
side-cast (adj)  
sidecast dredge  
side-scan sonar  
side slope  
sidewall  
signal-conditioning  
sinkhole  
skin plate  
slack water (n)  
slack-water (adj)  
slipform (v, adj)  
slip form (n)  
slipformed (v, adj)  
slipforming (v, adj)  
slowdown (n, adj)  
slow down (v)  
snow cover  
snowfall  
snowmelt  
soil-cement  
soliton  
sound-side (adj)  
splashover (n)  
splash over (v)  
stand-alone (adj)  
standby  
standoff (n, adj)  
standpipe  
Sta-Pod  
start-up  
state-of-the-art (adj)  
state of the art (n)  
steerageway  
Step 1  
still water (n)  
still-water (adj)  
stop log  
storm drain  
streambank  
streambed  
streamflow  
streamline  
Styrofoam  
Surfa-aero-sealz  
surf beat  
swing-around

## T

---

tack weld (n)	tieback levee
tack-weld (v)	tie-down
tailbay	time-consuming
tailgate	time frame
tailpipe	time-history
tailwater	time-level
tailwater el	time-step
takeoff (n)	timetable
take off (v)	toe-fill
tar-rubber	top-lift (adj)
taxilane	topside
template	topsoil
Tenite butyrate	top stratum
Terra-tire	trade off (v)
Test 2 and 2B results	trade-off (n, adj)
thalweg	trapdoor
The Netherlands	trashrack
The Rigolets	Tri-Cone
Thiokol	Tropical Storm Chris
thousands of cubic feet per second, yards, etc.	turndown (adj)
tidal elevation time-history	two-dimensional (2-D)
tidal influence	Tygon tubing
tidal prism	type 1 (original) design
tide gauge location	type 1 and 2 deflectors
tide gate location	type 6 (recommended) design
tide height data	types 3 and 4
tidewater	type of model

## U

---

underlayer	upcoast
underside	upriver
underwater (n, adj, adv)	upslope
underway (adj)	up-to-date
under way (adv)	Uranine

## V

---

varved	von Karman
venturi	von Mises
Vermilion Bay	vortices
videotape	vortimeter

## W

---

waist-deep	wave-wave interaction
warmwater (adj)	Web
warm water (n)	webmaster
wastewater (n, adj)	Web site
water body	weighthouse
waterborne	well flow
watercourse (hydraulics)	wellpoint
water-course (concrete)	Wentworth grade scale
waterhyacinth	wet well
waterline	wind field (n)
water quality (n, adj)	wind-field (adj)
water stop	wind speed
water table (n, adj)	wind stress (n)
watertight	wind-stress (adj)
water-wave (adj)	wind wave
wave board	wing wall
wave field	wirebound
wave form	work force
wave front	work load
wave gauge (n)	workboat
wave-gauge (adj)	workstation
wavelength	worldwide
wave number	worthwhile
wave setdown	World Wide Web
wave train	Wraparound
wave wash	

## X

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x-axis	x-direction
x-coordinate	X-ray (n, adj, v)

## Y

---

y-axis	y-direction
y-coordinate	

# Appendix B

## Abbreviations Guide

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The following abbreviations should be used in ERDC reports. For additional abbreviations refer to the Government Printing Office's *Style Manual* (1984) and Webster's Unabridged Dictionary.

<b>Term</b>	<b>Abbreviation</b>
acre	spell out
acre-foot	acre-ft
alternating current	a-c (adj); AC (noun)
ampere	A
angstrom	Å
antilogarithm	antilog
approximate	approx
atmosphere	atm
average	avg
bar	spell out
barrel	bbl
Baumé	Bé
biochemical (or biological) oxygen demand	BOD
brake horsepower	bhp
British thermal unit	Btu
California bearing ratio	CBR
calorie	Cal
center line	℄
center to center	c-c, c to c
centigram	cg
centiliter	cl or cL
centimeter	cm
centimeter-gram-second (system)	cgs

<b>Term</b>	<b>Abbreviation</b>
centimeters per second <sup>1</sup>	cm/sec
centipoise	cp
chemical oxygen demand	COD
cologarithm	colog
cosecant	csc
cosine	cos
cotangent	cot
cubic	cu
cubic centimeter	cu cm, cc, cm <sup>3</sup>
cubic feet	cu ft, ft <sup>3</sup>
cubic feet per minute	cfm, cu ft/min, ft <sup>3</sup> /min
cubic feet per second	cfs, cu ft/sec, ft <sup>3</sup> /sec
cubic inch	cu in., in. <sup>3</sup>
cubic meter	cu m, m <sup>3</sup>
cubic micron	cu μ, μ <sup>3</sup>
cubic millimeter	cu mm, mm <sup>3</sup>
cubic yard	cu yd, yd <sup>3</sup>
cycles per minute	cpm
cycles per second	cps
day	spell out
decibel	db
decibels referred to one milliwatt	dbm
degree <sup>2</sup>	deg or °
degree Celsius	°C
degree Fahrenheit	°F
degree Rankine	°Ra
degree Reaumur	°R
degrees per second	deg/sec
diameter	diam
direct current	d-c (as adj); DC (as noun)
dissolved oxygen	DO
downstream	DS
dozen	doz
electromotive force	emf
elevation <sup>3</sup>	el
equation	spell out generally (use “Eq” in tables or drawings where space is a factor)

<sup>1</sup> The word “per” can be substituted for the diagonal (/). But in any one report, be consistent.

<sup>2</sup> Use “degree” symbol in tabulations where space is an important factor or in a situation where an abbreviation would be awkward, e.g. 40°4'12", 32 °C.

<sup>3</sup> The following footnote should be added the first time an elevation is given in a report: “All elevations (el) cited herein are in meters referenced to the National Geodetic Vertical Datum [or whatever datum was used].” Thereafter, when an elevation is given, it is preceded by the abbreviation “el” and is not followed by a unit of measurement, e.g., At the beginning of the experiment, the headwater was set at el 260.

<b>Term</b>	<b>Abbreviation</b>
feet per minute	fpm, ft/min
feet per second	fps, ft/sec
feet per second per second	ft/sec <sup>2</sup>
foot	ft
foot-pound	ft-lb
foot-pound-second (system)	fps
gallon	gal
gallons per day	gpd, gal/day
gallons per minute	gpm, gal/min
gallons per second	gps, gal/sec
gigahertz	GHz
gram	g
gravity (units)	g's
Greenwich time	GW
ground zero	GZ
hectare	ha
hertz	Hz
high explosive	HE
high-water interval	HWI
horsepower	hp
hour	hr
hundredweight	cwt
hyperbolic cosecant	csch
hyperbolic cosine	cosh
hyperbolic cotangent	coth
hyperbolic sine	sinh
hyperbolic tangent	tanh
inch	in.
inches per second	ips, in./sec
inside diameter	ID
joule	J
kelvin	K
kilobar	kbar
kilobytes per second	KB/sec
kilocalorie	kcal
kilocycle	kc
kilocycles per second	kcps
kilogram	kg
kilogram-meter	kg·m
kilograms per cubic meter	kg/cu m, kg/m <sup>3</sup>

<b>Term</b>	<b>Abbreviation</b>
kilohertz	kHz
kiloliter	kl or kL
kilometer	km
kilonewton	kN
kilopound (1,000-lb deadweight load)	kip
kiloton	kt
kilovolt	kV
kilovolt-ampere	kV · A
kilowatt	kW
kilowatt hour	kWhr
kips per square inch	ksi
knot	spell out
linear	lin
liter	ℓ (or L)
logarithm (common)	log
logarithm (natural)	ln, log <sub>e</sub>
magnified 50 times	×50
Manning's roughness	n
maximum	max
mean higher high water	mhhw
mean lower low water	mllw
mean low tide	mlt
megabyte	MB
megahertz	MHz
megapascal	MPa
megaton	Mt
meter	m
meter-kilogram	m · kg
mho	spell out
microampere	μA
microinch	μin., micron
micrometer	μm
micromole	μmole
microsecond	μsec
microvolt	μV
microwatt	μW
mile	spell out
miles per hour	mph
milliampere	mA
millibar	mb
milligram	mg
milliliter	ml or mL
millimeter	mm
millimicron	mμ

<b>Term</b>	<b>Abbreviation</b>
millimole	mmole
million electron volts	Mev
million gallons per day	mgd
millisecond	msec
millivolt	mV
minimum	min
minute	min
minute (angular)	'
mole	spell out
month	spell out
nanosecond	nsec
National Geodetic Vertical Datum	NGVD
nautical mile	n.m.
newton	N
nuclear explosive	NE
number(s)	No.
ohm	$\Omega$
ohm-centimeter	ohm·cm
ounce	oz
outside diameter	OD
parts per million	ppm
parts per thousand	ppt
pascal	Pa
percent (tabular)	spell out or %
pint	pt
pores per linear inch	ppi
pound (force)	lbf
pound (force) foot	lbf·ft
pound (force) inch	lbf·in.
pounds (force) per square foot	lbf/ft <sup>2</sup>
pounds (force) per square inch	psi, lbf/in. <sup>2</sup>
pounds (force) per square inch absolute	psia
pounds (force) per square inch differential	psid
pounds (force) per square inch gauge	psig
pound (mass) (avoirdupois)	lb
pounds (mass) per cubic foot	lb/cu ft, lb/ft <sup>3</sup>
pounds (mass) per square foot	lb/sq ft, lb/ft <sup>2</sup>
pounds (mass) per square inch	lb/sq in., lb/in. <sup>2</sup>
quart	qt

<b>Term</b>	<b>Abbreviation</b>
radian	rad
revolutions per minute	rpm's
revolutions per second	rps
Reynolds number	R
rod	spell out
roentgen	spell out
secant	sec
second	sec or s
second (angular)	"
sine	sin
slope	1V on 2H or 1V:2H
specific gravity	sp gr
square centimeter	sq cm, cm <sup>2</sup>
square foot	sq ft, ft <sup>2</sup>
square inch	sq in., in. <sup>2</sup>
square kilometer	sq km, km <sup>2</sup>
square meter	sq m, m <sup>2</sup>
square micron	sq μ, μ <sup>2</sup>
square mile	spell out
square millimeter	sq mm, mm <sup>2</sup>
station	sta
still-water level	swl
tangent	tan
thousand pounds	kip
ton	spell out
tons per square foot	tons/sq ft, tons/ft <sup>2</sup> , tsf
total Kjeldahl nitrogen	TKN
upstream	US
volt	V
volt-ampere	V · A
watt	W
week	spell out
yard	yd
year	spell out

# Appendix C

## Greek Alphabet, and Mathematical Symbols and Expressions

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### Greek Alphabet

Greek letters available on standard word processing packages are as follows:

Letters		Name	Letters		Name	Letters		Name
A	$\alpha$	Alpha	I	$\iota$	Iota	P	$\rho$	Rho
B	$\beta$	Beta	K	$\kappa$	Kappa	$\Sigma$	$\sigma$	Sigma
$\Gamma$	$\gamma$	Gamma	$\Lambda$	$\lambda$	Lambda	T	$\tau$	Tau
$\Delta$	$\delta$	Delta	M	$\mu$	Mu	Y	$\upsilon$	Upsilon
E	$\epsilon$	Epsilon	N	$\nu$	Nu	$\Phi$	$\phi$	Phi
Z	$\zeta$	Zeta	$\Xi$	$\xi$	Xi	X	$\chi$	Chi
H	$\eta$	Eta	O	$\omicron$	Omicron	$\Psi$	$\psi$	Psi
$\Theta$	$\theta$	Theta	$\Pi$	$\pi$	Pi	$\Omega$	$\omega$	Omega

### Mathematical Symbols and Expressions

The list that follows provides the most common conventions used in mathematics:

- |         |                |
|---------|----------------|
| + plus  | > greater than |
| - minus | < less than    |

$\pm$	plus or minus	[ ]	brackets
$\times$	multiplied by	{ }	braces
$\div$	divided by	$\geq$	greater than or equal to
$=$	equal to	$\leq$	less than or equal to
$\neq$	not equal to	$\gg$	much greater than
$\approx$	approximately equal to	$\ll$	much less than
$\equiv$	identical with	$\infty$	varies as
$\not\equiv$	not identical with	:	is to, ratio
$\sim$	similar to	$\rightarrow$	approaches limit of
$\cong$	congruent to		absolute value
$\Delta$	difference; increment	$\sqrt{\quad}$	radical; root, square root
d	differential	$\sqrt[3]{\quad}$	cube root
$\partial$	partial differential	$\nabla$	del or nabla; vector differential operator
!	factorial	$\therefore$	therefore
$\bar{x}$	mean of x		parallel
$\Sigma$	summation	$\perp$	perpendicular
$\int$	integral	$\sphericalangle$	angle
$f(\quad)$	function of	$\lrcorner$	right angle
$\infty$	infinity	$\triangle$	triangle
I	imaginary unit; the square root of -1	( )	parentheses

*A Style Manual for Technical Writers and Editors*, edited by S. J. Reisman, and *Mathematics Into Type*, by Ellen Swanson, were used extensively in developing the ERDC style of presentation of mathematical material. ERDC style for presentation of equations and other mathematical expressions is summarized as follows:

- a. Use the sequence {{( )}} for signs of aggregation, except where conventional notation specifies brackets or braces.
- b. Make aggregation, integral, and summation signs the same height as, or slightly larger than, the expressions which they include.
- c. Place subscripts and superscripts, respectively, half a line below and above the lowest and highest characters in the related material.

Examples:  $R_1, 2 \left( \frac{N_{\Delta_1}}{Eh} \right)^{1/2}$

d. Align subscripts with superscripts.

Examples:  $P_n^2, F_{\epsilon}^{(p,q)}, P_n^{-2}$

e. Place sub-subscripts half a line below the subscripts.

Example:  $E_{x_o}$

f. Raise *th* to a superscript position.

Examples:  $n^{th}, i^{th}$

g. In equations, leave one space before and after the operational signs +, −, ±, ×, ÷, and ·.

Exception: leave no space before and after such signs in subscripts and superscripts.

Examples:  $a + b$ , ...if  $a + b = 10$  and the...

$$na^{n-1}, \sum_{x=0}$$

h. Leave no space after +, −, and ± when these indicate the sign of a single term in the text or a single term enclosed in parentheses or brackets in an equation.

Examples: ...within ± 4 mm...,  $P(x) = -\phi_o(-x) + R$

...at an elevation of +10 msl...

i. Leave one space before and after =, <, >, ≤, and ≥ in displayed and in-text equations.

Exception: Leave no space before and after these signs in subscripts and superscripts.

Examples: ...when  $2xy > b$  we find...  $\left\{ \begin{array}{l} \textit{In-text} \\ \textit{equation} \end{array} \right.$

$$\sum_{k \leq o}^{\infty} a_k (z - a)^k = z_a \left\{ \begin{array}{l} \textit{Displayed} \\ \textit{equation} \end{array} \right.$$

- j. Align the bar of a built-up fraction with the equals sign. Center the numerator and denominator relative to the horizontal bar in a built-up fraction.

$$\text{Example: } a = \frac{-K'_a + \sqrt{(K'_2)^2 + 4K'_a C}}{2C}$$

- k. Type any required bar or dot immediately above the mathematical symbol so that it will be obvious that the bar or dot and the symbol constitute a unit.

Examples:  $\bar{K}$ ,  $\bar{k}$ ,  $\dot{i}$ ,  $\dot{r}$

- l. Leave no space between the single-line elements of a product, and leave no space before and after punctuation within such material. Leave one space between double-line (built-up) elements of a product.

Examples:  $2xy$ ,  $2C$ ,  $I(M_o, N)$

$$I_o^2 (A_o^2, N), \frac{1}{2m} \frac{(j+m)}{(j-m)}$$

- m. Leave one space before and after trigonometric, logarithmic, or exponential functions, and between the parts of such functions.

Examples:  $v \cos \theta$ ,  $Y \ln x$ ,  $2 \log y \log z$ ,

$$\frac{1}{2} \exp\left(a + \frac{h}{2}\right)$$

- n. Leave one space before and after differentials and between differentials.

Examples:  $x dx$ ,  $(x^2 + y^2) dx dy$

- o. Use signs of aggregation large enough to enclose the material within. Center signs of aggregation relative to the equals sign. Leave no space between adjacent signs of aggregation.

Exception: When the material contains only simple superscripts or simple subscripts (but not both), use the standard-size characters for the signs.

Examples:  $(K^2 + A)$ ,  $(K^2 + A_1 + K_2 + B^2)$

$$Q = \{(x_a + x_b)^2 + [1 - \sin^2 \theta \cos(\pi - \theta)]\}$$

$$x = \begin{bmatrix} \xi_1 \\ \xi_2 \\ \dots \\ \xi_n \end{bmatrix} = \begin{bmatrix} t_{11} & t_{12} & \dots & t_{1n} \\ t_{21} & t_{22} & \dots & t_{2n} \\ & & \dots & \\ t_{n1} & t_{n2} & \dots & t_{nn} \end{bmatrix} \begin{bmatrix} \bar{\xi}_1 \\ \bar{\xi}_2 \\ \dots \\ \bar{\xi}_n \end{bmatrix} = T \bar{x}$$

- p. Use an integral sign large enough so that it is not overshadowed by the material on either side.

Examples:  $\sqrt{\frac{a}{g}} \int_0^h \frac{dx}{\sqrt{hx - x^2}} \left(1 - \frac{x}{2a}\right)^{1/2}$

$$\sin^{-1} x = \int_{o+1}^x \frac{dz}{\sqrt{1 - z^2}}$$

- q. Center material above and below a summation sign.

Example:  $\sum_{i=1}^n$

- r. Make parallel lines long enough to extend to the top and bottom of the material between them.

Example:  $|E_x^2|$

- s. The following rules apply only to the spacing of in-text mathematical material.

- (1) Leave one space before and after a mathematical symbol or equation.

Examples: ...corresponding to  $\bar{k}^T$  which equals...

...the term  $\bar{k}^T$ . Then the...

...the case  $c = (10 - t + T)$  estimates...

- (2) If an in-text equation must be broken, break it before the equals sign or operational sign.

- t. Displayed equations are always displayed with special indention and layout (see [Figures C1-C4](#)). When breaking displayed equations, break before equals or operational sign.

$$\bar{A}(q') = \int_S G(q', p) \bar{J}(p) dS - \frac{1}{k^2} \int_S \Delta' \Delta G(q', p) \cdot \bar{J}(p) dS \quad (1)$$

$$A'_2(q') = \int_S \nabla' \nabla G(q', p) \cdot \bar{J}(p) dS \quad (2)$$

Figure C1. Display of single-line equations

$$y = c_1 e^{ax} \cos ax + c_2 e^{ax} \sin ax + c_3 e^{-ax} \cos ax + c_4 e^{-ax} \sin ax + c_5 e^{-ax} \cos ax + c_6 e^{-ax} \sin ax \quad (1)$$

$$\begin{aligned} (\dot{\mu} + \dot{\nu} \tan \mu \cot \nu) \dot{\nu} = & -T (mr)^{-1} \cos \mu \cos \theta \sin \varepsilon \\ & - \frac{P}{2} SV^2 C_L (mr)^{-1} \sin \phi \cos \mu \\ & - \frac{3 g_o R^2}{2 r^2} K_\Lambda \sin 2\mu \sin 2\nu \end{aligned} \quad (2)$$

$$\begin{aligned} \phi = & \omega_x + \varepsilon \sin \theta - \omega_{x_o} \cos \theta \cos \varepsilon - \omega_{y_o} \cos \theta \sin \varepsilon + \omega_{z_o} \sin \theta \\ = & \omega_x + \tan \theta (\omega_4 \sin \phi + \omega_z \cos \phi) - \omega_{x_o} \cos \theta \cos \varepsilon \\ & - \omega_{y_o} \cos \theta \sin \varepsilon + \omega_{z_o} \sin \theta \end{aligned} \quad (3)$$

Figure C2. Display of stacked right-hand members

$$\int_{-1}^1 P_m(x) \frac{d}{dx} [(1-x^2) P_n'(x)] dx - \int_{-1}^1 P_n'(x) \frac{d}{dx} [(1-x^2) P_m'(x)] dx + (n-m)(n+m+1) \int_{-1}^1 P_m(x) P_n(x) dx = 0 \quad (1)$$

$$(z-z_1)^r \frac{d^r w}{dz^r} + (z-z_1)^r p_1(z) \frac{d^{r-1} w}{dz^{r-1}} + (z-z_1)^{r-2} p_2(z) \frac{d^{r-2} w}{dz^{r-2}} + \dots + P_r(z) w = 0 \quad (2)$$

$$\sum_n \left\{ \left[ \bar{\nabla}_n^2 \bar{\nabla}_n^2 f_n + \frac{ik^2}{a} \cdot \frac{1}{2} \left( \frac{1}{a} + \frac{1}{b} \right) \bar{\nabla}_n^2 f_n \right] \cos n \theta + \frac{ik^2}{a} \cdot \frac{1}{4} \left( \frac{1}{b} - \frac{1}{a} \right) \left[ \left( \frac{d^2 f_n}{dr^2} - \frac{(2n+1)}{r} \frac{df_n}{dr} + \frac{n(n+2)}{r^2} f_n \right) \cos(n+2)\theta + \left( \frac{d^2 f_n}{dr^2} + \frac{(2n+1)}{r} \frac{df_n}{dr} + \frac{n(n-2)}{r^2} f_n \right) \cos(n-2)\theta \right] \right\} = 0 \quad (3)$$

Figure C3. Display of stacked left-handed members

$$I_x \omega_x + h_x + \omega_y \omega_x (I_z - I_y) + \omega_y h_z - \omega_z h_y = + \frac{2g_o R^2}{r^3} (I_x \sin^2 \theta - I_y + I_z \cos^2 \theta) \phi \cos \theta + \frac{P}{2} u^2 S l_x C_y + m_x \quad (1)$$

$$-\nabla^2 \int_{\Delta u_i} \frac{1}{3 \sum_a \xi \sum_s} q(\bar{r}) du + \int_{\Delta u_i} \frac{\bar{\sum}_a}{\zeta \sum_s} q(\bar{r}) du = -q(\bar{r}, u_i) + q(r, u_{i-1}) + P_{(\bar{r})} \int_{\Delta u_i} X du + \int_{\Delta u_i} Q(\bar{r}) du \quad (2)$$

Figure C4. Display of equations with both members more than half a line but less than a full line

# Appendix D

## Copy Preparation

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### Format

This appendix contains sample pages of ERDC technical reports. Two basic formats are considered acceptable—a one-column version and a two-column version. This Guide is an example of the one-column version. [Figures D1](#) and [D2](#) identify the typefaces, styles, and sizes used in Microsoft Word to create the one-column format. [Figures D3](#) and [D4](#) are samples of the two-column version. The one-column version is the preferred version for all ERDC reports and is strongly recommended for reports with extensive mathematical equations.

### Titles of Chapters and Other Major Parts

The titles of each of the major parts of a report should be of the same style and form throughout the report, and no other headings should be similar in style. These titles are used for the preface, contents, lists of figures and tables, chapters, references, and appendixes. Frequently, appendixes are composed almost entirely of tables, illustrations, or computer printouts, and there may be no page of text on which to type the title of the appendix. In these cases, the appendix title will be printed on a fly leaf and used as the first page of the appendix. The back of a fly leaf may be used.

### Captions

Captions (titles) for illustrations (figures and photos) should be placed beneath the illustration, preceded by the word “Figure” or “Photo” typed flush left, and followed by the appropriate number and a period. The caption should have the first letter of the first word and proper nouns capitalized. If the caption requires carry-over lines, they should be typed single space and indented to align with the first word of the caption.

24 pt Arial Bold; followed by 2,5-picas (0.4-in.) blank space, 0.3-pica (0.035 in.) margin-wide line, and 2,7-picas (0.3-in.) blank space; Top margin for 1st page of chapter—12,0 picas (2.0 in.); thereafter 6 picas (1.0 in.); bottom margin—6,0 picas (1.0 in.) Text margins for left- and right-hand pages—10,6 picas (1.75 in.)

## 2 Finite Element Dynamic Analysis of a Simplified Structure

### Section of a Simplified Structure

The simplified cantilever structure representative (Figure 1), finite element models, parameters, and recommendations established in Phase Ia of this study were used here. Again, the finite element runs were all made using GTSTRU DL. The program can be used in the analysis of the static and dynamic response of linear two- and three-dimensional (2- and 3-D) structural systems. The element used was the "IPQQ" eight node isoparametric quadratic quadrilateral element.

### Finite Element Meshes

#### Finite element meshes

Three different models previously developed in the Phase Ia report to compare the convergence characteristics were used again. The various models are called the course, fine, and very fine meshed to indicate that relative degree of refinement. They are also referred to as Meshes 1, 2, and 3. These meshes are illustrated in Figures 2, 3, and 4, respectively. The nodal figures. A summary of the meshed is pres

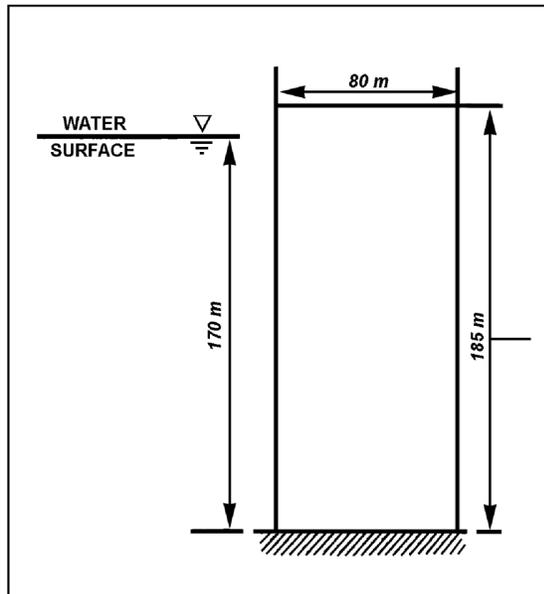


Figure 1. Simplified structure

Figure title—10 pt Arial Ruling box around figure—0,1 pica (0.01 in.)

Footer—8 pt Arial; page number 11 pt Arial; Footer margins—6,0 picas (1.0 in.), left and right

Figure D1. Sample of single-column format containing a figure (not to scale)

Table title---11 pt Arial Bold  
 Table heads---8 pt Arial Bold  
 Table text---8 pt Arial

Mesh No.	Description	Number of Nodes	Number of Elements (All IPQQ's)
1	Coarse	45	10
2	Fine	149	40
3	Very fine	537	160

### Modeling procedure

The models were assumed to be completely restrained along their bases and to be in a state of

**11 pt Times New Roman Bold**

**Material properties.** The weight density of the material was assumed to be 2,400 kg/cu m.

**Dynamic structural properties.** Dynamic analysis requires the same input to describe the structural properties as does a static analysis. Additional requirements are that the inertia and damping of the structure must be specified.

GTSTRUDL will automatically compute member/element inertia contributions by either the lumped or consistent approaches. The member/element weight densities must be provided via the CONSTANTS command or the MATERIALS command prior to a dynamic analysis if automatic computation is to take place. The lumped mass approach is always more computationally efficient and is a reasonable approximation for most problems.

Name	Description
INPUT	Queries user for input parameters
CASE	Case or run number for individual test cases
HUNT	Hunt's method for wavelength
SPEED	Wave celerity or speed
ANGLE2	Offset angle for integer number of paddles to produce desired wave direction angle
HEIGHT	Two-dimensional wave height

Figure D2. Sample of single-column format containing tables of two different widths (not to scale)

24 pt Arial Bold; followed by 2,5-picas (0.4-in.) blank space, 0.3-pica (0.035 in.) margin-wide line, and 2,7-picas (0.3-in.) blank space;  
 Top margin for 1st page of chapter—12,0 picas (2.0 in.); thereafter 6 picas (1.0 in.); bottom margin—6,0 picas (1.0 in.)  
 Text margins for left- and right-hand pages—6,0 picas (1.0 in.)  
 Column width—18.4 picas (3.05 in.), gutter width—2,5 picas (0.4 in.)

## 2 Finite Element Dynamic Analysis of a Simplified Structure

### Section of a Simplified Structure

The simplified cantilevered section of an idealized gravity dam (Figure 1), finite

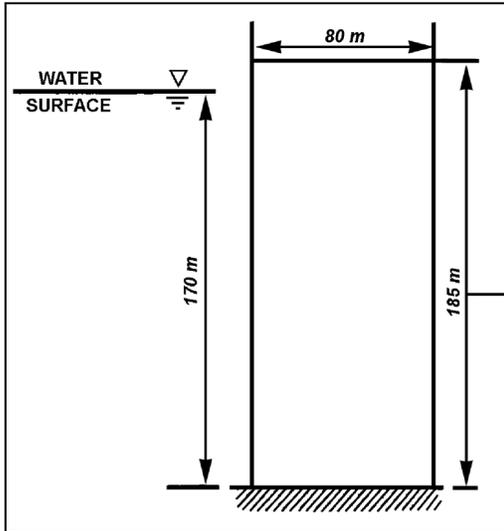


Figure 1. Simplified structure

elements were used. In Figure 1, the finite element meshes were all made using GTSTRUDL. The program can be used in the analysis of the static and dynamic response of linear two- and three-dimensional (2- and 3-D) structural systems. The element used was the "TPOO" eight node isoparametric

Footer—8 pt Arial; page number 11 pt Arial; Footer margins—6,0 picas (1.0 in.), left and right

### Finite Element Models

Finite element meshes

Three different models previously developed in the Phase Ia report to compare the convergence characteristics were used again. The various models are called the course, fine, and very fine meshed to indicate that relative degree of refinement. They are also referred to as Meshes 1, 2, and 3. These meshes are illustrated in Figures 2, 3, and 4, respectively. The node and elements are labeled in these figures. A summary of the meshed is presented

Table 1  
 Convergence Characteristics Models

Mesh No.	Description	Number of Nodes	Number of Elements (All IPQQ's)
1	Coarse	45	10
2	Fine	149	40
3	Very fine	537	160

### Modeling procedure

The models were assumed to be completely restrained along their bases and to be in a state of

**Material properties.** The weight density of the material was assumed to be 2,400 kg/cu m.

Figure D3. Sample of two-column format containing a figure and a table, each within a single column (not to scale)

convergence characteristics were used again. The various models are called the course, fine, and very fine meshed to indicate that relative degree of refinement. They are also referred to as Meshes 1, 2, and 3. These meshes are illustrated in Figures 2, 3, and 4, respectively. The node and elements are labeled in these figures. A summary of the meshed is presented in Table 1.

Mesh No.	Description	Number of Nodes	Number of Elements (All IPQQ's)
1	Coarse	45	10
2	Fine	149	40
3	Very fine	537	160

### Modeling procedure

The models were assumed to be completely restrained along their bases and to be in a state of plane stress.

**Material properties.** 11 pt Times New Roman Bold  
the material was assumed

**Dynamic structural properties.** Dynamic analysis requires the same input to describe the structural properties as does a static analysis. Additional requirements are that the inertia and damping of the structure must be specified.

GTSTRUDL will automatically compute member/element inertia contributions by either the lumped or consistent approaches. The

member/element weight densities must be provided via the CONSTANTS command or the MATERIALS command prior to a dynamic analysis if automatic computation is to take place. The lumped mass approach is always more computationally efficient and is a reasonable approximation for most problems.

specified in GTSTRUDL in one of two ways depending on whether a modal supervision or direct integration transient analysis is to be performed. In this study, a modal analysis will be performed, thus damping ratios or percent damping would be specified. A 5 percent damping ratio was assumed. Had the stiffness and mass matrices been input via the MATRIX command, damping would have been specified by proportional damping constants.

Table title---11 pt Arial Bold  
Table heads---8 pt Arial Bold  
Table text---8 pt Arial

Name	Description
INPUT	Queries user for input parameters
CASE	Case or run number for individual test cases
HUNT	Hunt's method for wavelength
SPEED	Wave celerity or speed
ANGLE2	Offset angle for integer number of paddles to produce desired wave direction angle
HEIGHT	Two-dimensional wave height

Figure D4. Sample of two-column format containing a table wider than a single column (not to scale)

For *unclassified* reports:

Figure 2. Verification of current velocities in the north jetties with tide running out; Range 1, sta 2

Photo 1. Effects of Plans 9 and 10 on surface current patterns

For *classified* reports:

Figure 1. (U) Major dimensions of aircraft studies

Some illustrations may require more than one sheet.

*Unclassified:*

Figure 2. Two-layer flexible pavement expected value, variance, and rutting models (Continued)

Figure 2. (Concluded)

Figure 3. Construction of support foundations (Sheet 1 of 3)

Figure 3. (Sheet 2 of 3)

Figure 3. (Sheet 3 of 3)

*Classified:*

Figure 1. (U) Major dimensions of aircraft studies (Continued)

Figure 1. (U) (Concluded)

## Tables

Table arrangement should be planned carefully to ensure a readable format. Each table is numbered and has a title. Each column has a heading or subheading and, if required, a unit of measurement.

Tables in printed ERDC reports are generally reproduced on 8.5- by 11-in. paper. Occasionally, tables contain so much information they must be printed on larger size paper and folded.

Tables are generally arranged in the 5- by 9-in. format. However, tables frequently require more area than this, and they can be sized to accommodate the material they contain. The arrangement should be planned so that the width-to-length ratio is approximately 2 to 3. These oversize tables are then reduced to page size.

If a table requires more than one page, the table number, but not the title, should appear on subsequent sheets. For example:

**Table 1 (Continued)**—on second and subsequent sheets

**Table 1 (Concluded)**—on *last* sheet only

The word “Continued” is typed in parentheses inside the table box and flush with the right margin at the bottom of the first sheet of a two-page table. Tables of more than two pages will be identified at the bottom right corner of each page as follows:

**(Sheet 1 of 3)**

**(Sheet 2 of 3)**

**(Sheet 3 of 3)**

A column heading should be placed flush left over each column (Figure D5). The words in the column heading should be typed in initial capitals, except the unit of measurement (if there is one), which is typed in lowercase letters and separated from the rest of the heading by a comma (Figure D5). (The comma is not used if the unit of measurement is on a line by itself (Figure D6).) Units of measurement are abbreviated (Figure D6). Multiline headings should be single spaced.

<b>Table 17</b>					
<b>Effects of Dredged Material Disposal Island Plans 5, 6, and 7 on Channel Shoaling in Hoquiam Reach</b>					
<b>Channel Section No.</b>	<b>Base</b>		<b>Shoaling Index</b>		
	<b>Volume of Material Retrieved, cc</b>	<b>Percent of Total Material Retrieved</b>	<b>Plan 5</b>	<b>Plan 6</b>	<b>Plan 7</b>
32	215	2.0	1.5	1.8	1.7
33	290	2.7	2.2	2.5	2.2
34	395	3.7	3.5	3.7	3.6
35	410	3.8	3.8	4.1	3.6
36	295	2.7	3.9	3.9	3.6
37	585	5.5	5.5	5.7	5.6
38	660	6.2	6.1	6.1	6.2
39	740	6.9	7.2	6.8	7.1
40	845	7.9	8.1	7.6	7.8
41	940	8.9	8.8	9.0	9.0
42	1,005	9.4	9.6	9.7	9.4
43	1,005	9.4	9.2	9.8	9.0
44	990	9.3	8.6	9.6	8.8
45	1,120	10.5	10.1	10.2	10.3
46	1,190	11.1	10.1	10.9	10.9
<b>Total</b>	<b>10,685</b>	<b>100.00</b>	<b>98.2</b>	<b>101.4</b>	<b>98.8</b>

Figure D5. Example of table column headings and subheadings

**Table 2  
Basic Model Data of Conditions That Induced Failure of Cellular Block Channel Expansions**

Model Culvert Size <sup>1</sup> m (ft)	Discharge cu m/sec (cu ft/sec)	Tailwater Depth m (ft)	Depth of Flow at Culvert Outlet <sup>2</sup> m (ft)	$\frac{Q}{D_o}$	$F$	$\frac{T_B}{D_o}$	$\frac{TW}{D_o}$
0.15 by 0.15 (0.5 by 0.5)	0.04 (1.20)	0.08 (0.25)	0.15 (0.50)	6.70	1.20	0.17	0.50
	0.06 (2.00)	0.15 (0.50)	0.15 (0.50)	11.30	2.00	0.17	0.87
	0.06 (2.00)	0.08 (0.25)	0.15 (0.50)	11.30	2.00	0.17	1.00
	0.07 (2.40)	0.27 (0.90)	0.15 (0.50)	13.60	2.39	0.17	1.80
0.3 by 0.3 (1.0 by 1.0)	0.03 (1.00)	0.03 (0.10)	0.08 (0.25)	1.00	1.40	0.08	0.10
	0.06 (2.20)	0.11 (0.36)	0.12 (0.40)	2.20	1.53	0.08	0.37
	0.07 (2.40)	0.19 (0.61)	0.17 (0.57)	2.40	0.98	0.08	0.61
	0.07 (2.40)	0.06 (0.19)	0.12 (0.40)	2.40	1.67	0.08	0.19
	0.09 (3.10)	0.19 (0.61)	0.18 (0.60)	3.10	1.17	0.08	0.61
	0.09 (3.10)	0.19 (0.63)	0.19 (0.63)	3.10	1.10	0.08	0.63
	0.09 (3.30)	0.18 (0.60)	0.18 (0.60)	3.30	1.25	0.60	0.048
	0.11 (4.00)	0.3 (1.00)	0.3 (1.00)	4.00	0.70	0.06	1.00
	0.13 (4.50)	0.4 (1.30)	0.3 (0.99)	4.50	0.80	0.06	1.30
	0.15 (5.30)	0.3 (1.00)	0.3 (1.00)	5.30	0.94	0.06	1.00
	0.16 (5.80)	0.46 (1.50)	0.3 (1.00)	5.80	1.02	0.06	1.50
	0.18 (6.20)	0.46 (1.50)	0.3 (1.00)	6.20	1.10	0.06	1.50
0.61 by 0.61 (2.0 by 2.0)	0.14 (4.95) <sup>3</sup>	0.2 (0.64)	0.16 (0.52)	0.87	1.18	0.04	0.32
	0.15 (5.25)	0.09 (0.30)	0.14 (0.46)	0.92	1.50	0.04	0.14
0.61 by 0.76 (2.0 by 2.5)	0.21 (7.40)	0.21 (0.70)	0.25 (0.81)	1.30	0.90	0.04	0.35
	0.29 (10.20)	0.37 (1.20)	0.37 (1.20)	1.78	0.67	0.04	0.60
	0.4 (14.20)	0.52 (1.72)	0.55 (1.80) <sup>4</sup>	2.50	0.52	0.04	0.86

(Continued)

<sup>1</sup> Model culvert sizes of 0.15, 0.3, and 0.61 m (0.5, 1.0, and 2.0 ft) correspond to prototype sizes of 0.61, 1.22, and 2.44 m (2, 4, and 8 ft), respectively.

<sup>2</sup> Measured from invert of culvert.

<sup>3</sup> Estimated value (instrumentation failure).

<sup>4</sup> Maximum depth.

Figure D6. Example of a two-page table (Continued)

<b>Table 2 (Concluded)</b>							
<b>Model Culvert Size m (ft)</b>	<b>Discharge cu m/sec (cu ft/sec)</b>	<b>Tailwater Depth m (ft)</b>	<b>Depth of Flow at Culvert Outlet m (ft)</b>	$\frac{Q}{D_o}$	$F$	$\frac{T_B}{D_o}$	$\frac{TW}{D_o}$
0.61 by 0.76 (2.0 by 2.5)	0.21 (7.40)	0.21 (0.70)	0.25 (0.81)	1.30	0.90	0.04	0.35
	0.29 (10.20)	0.37 (1.20)	0.37 (1.20)	1.78	0.67	0.04	0.60
	0.4 (14.20)	0.52 (1.72)	0.55 (1.80) <sup>4</sup>	2.50	0.52	0.04	0.86

Figure D6. (Concluded)

Data having the same dimensions should be aligned by the decimal point or by the last digit, whichever is appropriate (Figures D5 and D6).

Tables having specific footnotes should have corresponding numerals identifying the footnoted item in the table (Figure D6). Footnote numbers should be arranged in proper sequence line by line, from left to right across the table. Footnote symbols used in ERDC reports are superscript Arabic numerals. As an alternative, superscript lowercase letters are acceptable if needed for clarity. Footnotes are typed single space with carry-over lines beginning on the left margin (Figure D6).

## Computer Program Documentation and Illustrations

The format of computer program documentation and illustrations should generally follow the requirements of standard ERDC format with a few exceptions. For printed documents to be more user friendly, in some instances a smaller page size is advisable. While the page size of most printed ERDC reports is letter size, computer program documentation can be smaller. The smaller page size may be more appropriate for users working at a computer.

In addition, while most printed reports are perfect bound, hard copies of computer program documentations can be perfect bound, spiral bound, or loose-leaf. Perfect binding or spiral binding is appropriate for one-time publications; i.e., publication not scheduled for periodic updates. If periodic updates are expected, the user would be better served by a document in loose-leaf form for insertion into a notebook, which may or may not be issued along with the document.

Illustrative computer screens, input files (listings), output files (listings), and program listings can be handled in several different ways. Standard ERDC format requires that each illustration is numbered and has a unique caption. This format is acceptable for computer program documentation but, unlike standard ERDC reports, is not required. Screens can be inserted in the text as necessary without

numbering. Authors are encouraged to save screens as TIF files so they can be more readily incorporated electronically in the publication.

Another option available in computer program documentation is the use of bold typeface to indicate commands the user should input when running a specific computer program. The use of bold clearly indicates the proper input command.

Other changes to the format of computer program documentation are acceptable; however, these changes should be coordinated with PTTB personnel prior to preparation of the final version.

The “style” of the computer program documentation (i.e., the plan followed in dealing with such details as spelling, capitalization, punctuation, and abbreviation) should be the same as that for standard ERDC reports.

# Appendix E

## Use of Copyrighted Material

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A copyright provides exclusive rights granted by Congress under authority of the Constitution to authors or proprietors for the protection of their literary and other intellectual productions.

Whenever copyrighted material is to be used in a ERDC report, the ERDC author will obtain written consent from the copyright owner or the copyright owner's duly authorized agent. This written consent should accompany the report when it is sent to PTTB for publication.

A credit line will be used whenever it is requested.

The following checklist will be used in requesting a copyright release:

- a.* The request will be for no greater rights than actually needed.
- b.* The request will fully identify the material for which permission to publish is requested.
- c.* The request for license will explain the proposed use of material and contain the conditions of license, including whether to be published electronically (CD-ROM or World Wide Web), so that the licensor need only give consent.
- d.* The request will be submitted to the copyright owner or the duly authorized agent in duplicate so that the owner or agent may retain one copy and return the other copy with the assent written thereon. The request can also be e-mailed or faxed, and a signed copy faxed back to the requestor.
- e.* A self-addressed return envelope will be enclosed if a letter is mailed.

[Figure E1](#) is a suggested format of request for release to use copyrighted material. Additional information regarding the use of copyrighted material may be obtained from the ERDC Office of Counsel.

LETTERHEAD

(Name of Company)  
(Address)

(Salutation)

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Date \_\_\_\_\_

\* Circle applicable response.

Figure E1. Suggested format of request for permission to use copyrighted material

# Appendix F

## Multicolor Printing

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The use of two or more colors increases the printing costs of a publication and therefore is generally prohibited by Army Regulation 25-30, paragraph 11-22 (Headquarters, Department of the Army 1999), except when such color meets the valuable contribution requirement described therein. Therefore, multicolor printing (and multicolor photocopying) in printed ERDC reports will be approved only when it will make a valuable contribution to the purpose of the report. (Approval for color printing should be obtained from responsible laboratory director (see [Figure 15](#).) When in doubt as to whether or not the use of multiple colors would make a valuable contribution to the report, the author should consult PTTB. Because the use of color does not affect the cost of electronically published documents, this justification does not apply to these documents.

Multicolor printing or copying meets the valuable contribution requirement in the following cases:

- a.* Maps and technical diagrams where color is needed for clarity.
- b.* Object identification, such as plant specimens and diseases.
- c.* Areas where definite savings in costs can be predicted based on multicolor use.
- d.* Programs that are required by law and whose success depends on the degree of public response.

Multicolor printing or copying does not meet the valuable contribution requirement if one or more of the following conditions apply:

- a.* Additional color is used mainly for decorative effect.
- b.* Additional color is used instead of effective layout and design.
- c.* Additional colors are used to excess; i.e., four colors are used when three will suffice, three when two will do, etc.

A justification for the use of additional colors in an ERDC report is included on ERDC Form 7-E, “Instructions to PTTB” ([Figure 15](#)), which is completed when the report is submitted to PTTB for processing.

# Appendix G

## Computer-Aided Design and Drafting Guidelines

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This appendix is a digest of the publication “Guide for Effective Engineering Graphics, Waterways Experiment Station,” Instruction Report (IR) O-77-1 (U.S. Army Engineer Waterways Experiment Station 1977), updated for use by authors preparing their own figures and plates with computer-aided design and drafting (CADD). This appendix was prepared for two reasons: IR O-77-1 is out of print, although its standards are still applicable in ensuring standardized, consistent, legible illustrations in ERDC publications; and the standards need to be “translated” to CADD needs. This appendix provides guidelines for such requirements as font size and type, line weights, and sizes for figures and plates.

### Lettering

#### Style

All-cap lettering, preferably Arial or a sans-serif font, should be used in all illustrations except as specified for maps. The following items should be in vertical (not italic) lettering: titles, headings, notes, legends, tables, coordinates of a graph, national land features, cities, towns, civil divisions, and map grids. On plan, location, and vicinity maps, italic lettering should be used to show water features, highways, railroads, elevations, and contours. On these maps, all-cap lettering is used for major designations, and upper- and lower-case lettering is used for minor and smaller features. Lettering sizes are given in [Table G1](#) and are keyed by letter to the different types of labels in the sample plate ([Figure G1](#)).

<b>Table G1 Schedule of Lettering Sizes</b>						
	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>
Height in Inches on 6.5" × 8.9" Plate	0.045	0.06	0.07	0.085	0.1	0.12
Point Size	4.5	6	7	8.5	10	12

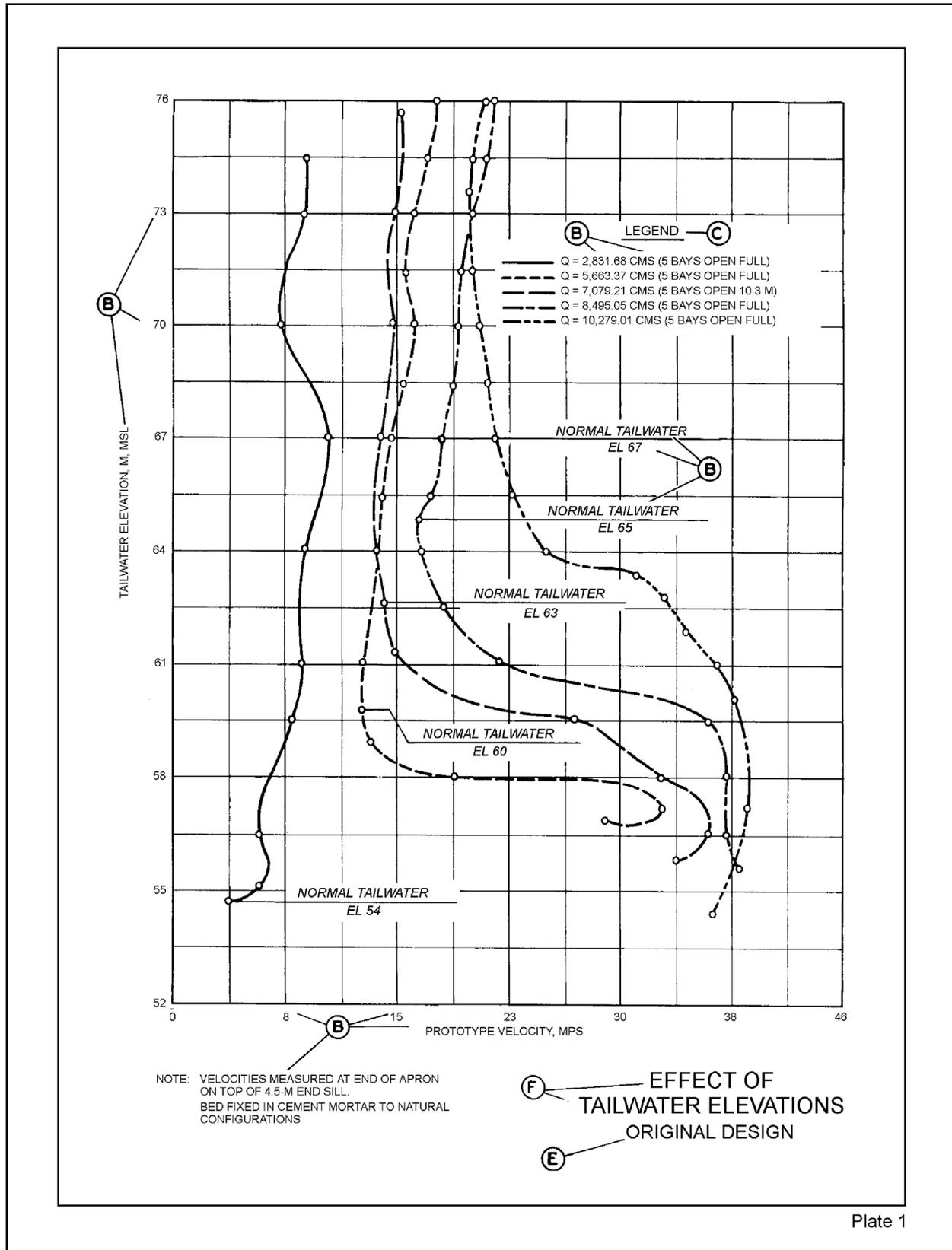


Figure G1. Sample plate showing font sizes for different labels

## Placement

All lettering should be positioned so that the wording reads from left to right or from bottom to top of the drawing (Figure G2).

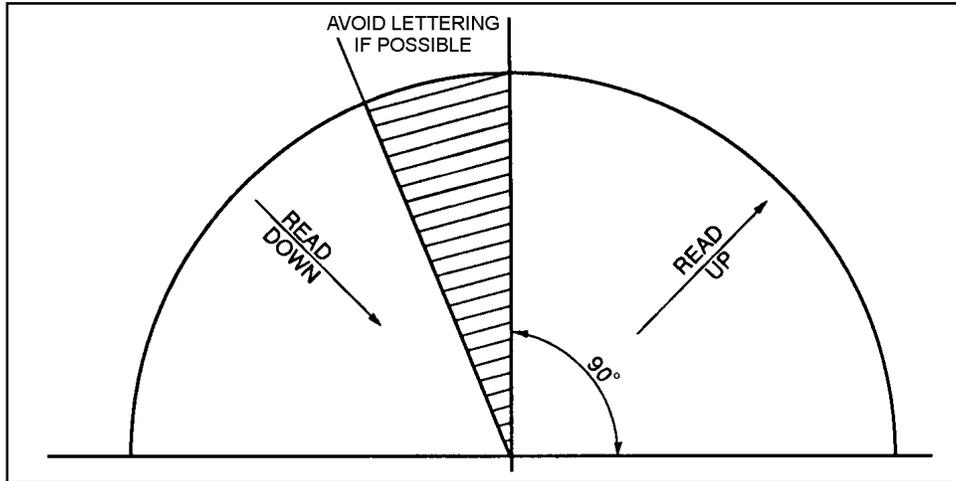


Figure G2. Directions for lettering

Lettering should be aligned on the upper side wherever space permits and with the general direction of the feature, such as names of the feature, names of streams, power lines, railroads, etc.

Label linear features along a straight segment rather than along a curved portion.

## Plates

Plates are grouped at the end of the text. They will be 6.5 in. wide by 8.9 in. tall in portrait orientation with left and right margins of 1 in. and a top margin of 1 in. If plates are landscaped (turned on the side), they will have top and bottom margins of 1 in. and a right margin of 1 in. The line weight for the border shall be 0.0167 (1/60) in.

The title block shall be placed in the lower right corner in the same orientation as the plate. No two plates will have the same title block: there must be some information in a title block that will distinguish it from the title block of another plate. Figure G3 shows the format for a title block. The title block ends 0.25 in. from the right border and 0.25 in. from the bottom border. Note that the main title is 0.12-in. lettering and modifying lines are 0.1 in. and 0.087 in. high. The main title of the plate should be indicative of what the plate shows, e.g., water-surface profiles. The addition of modifying lines, such as station number, flow, or experiment number, differentiates that plate from others showing water-surface profiles, as in the following example:

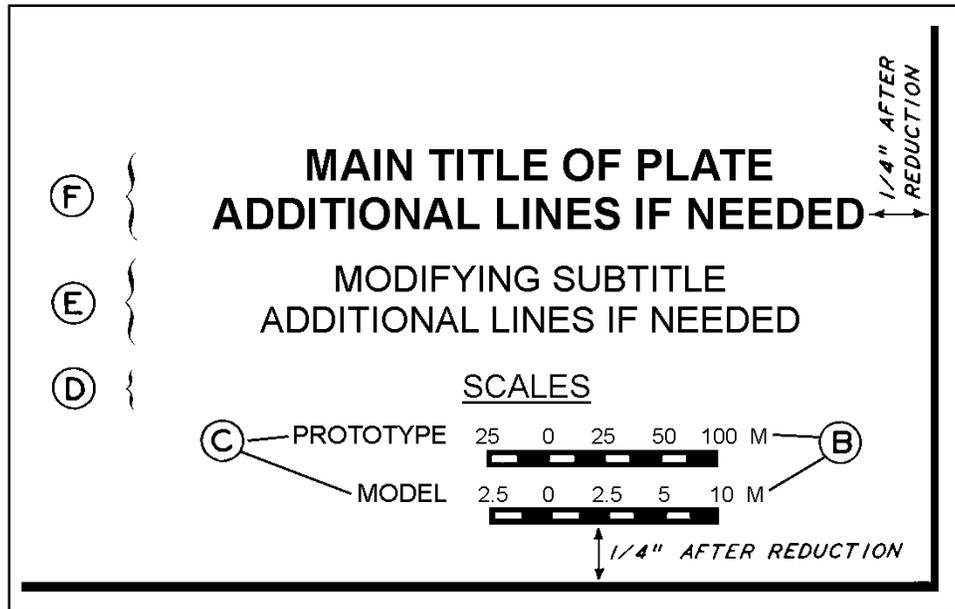


Figure G3. Layout for plate title block. Circled letters are keyed to lettering sizes in Table G1

WATER-SURFACE PROFILES  
 STA 10+11  
 FLOW 366 CU M/SEC

Figure G4 shows line weights and symbols for data points for plates and figures, and Figure G5 shows orientations for maps, plans, and sections. Figure G6 is a sample plate showing multiple plots. For additional samples, see IR O-77-1. Note that the plate number appears in the lower corner, outside and flush with the border, in 10 point, initially capped.

## Figures

Figures may be worked into the text or grouped at the end of the text after any tables but before plates, depending on the ratio of number of figures to number of pages of text. If there are numerous figures and including them in the text would interrupt the flow of the text, then they should be grouped at the back. Because figures are made to fit into the text, and because the size must allow for the figure title, the size is much more variable than that of a plate. Figure sizes are shown in the following tabulation, **which assumes a one-line title**. If the title is longer,

Orientation of Page	Width, in.	Height, in.
Portrait	<3, 5, or 6.5	8.6
Portrait, two per page	5 or 6.5	3.9
Landscape	9	6.2

# CONVENTIONAL LINES AND SYMBOLS

## ALPHABET OF LINES

- VISIBLE OUTLINE
- HIDDEN OUTLINE
- CENTER LINE
- DEMENSION AND EXTENSION LINES
- PHANTOM LINE
- ADJACENT PARTS, ALTERNATE POSITION
- CUTTING PLANE
- DITTO OR REPEAT LINE
- SHORT BREAK
- LONG BREAK
- PLATE BORDER
- GRID BORDER
- MAIN GRID BORDER
- SECONDARY GRID LINES
- DATA CURVES
- MODEL LIMITS
- PRIMARY INFORMATION
- SECONDARY INFORMATION
- SECTION LINING, CROSSHATCHING

SECTION OR PROFILE TO BE DRAWN  
LOOKING IN DIRECTION OF ARROWS



### SYMBOLS FOR LINES

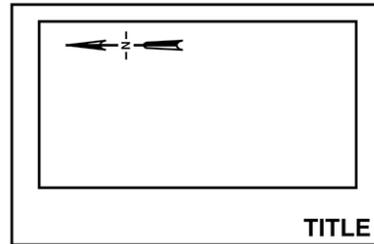
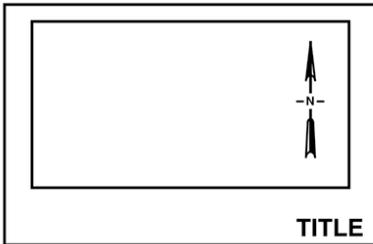
- A
- B
- C
- D
- E
- F
- G
- H
- I

### SYMBOLS FOR POINTS

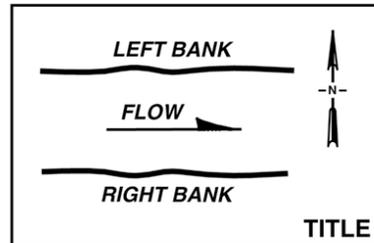
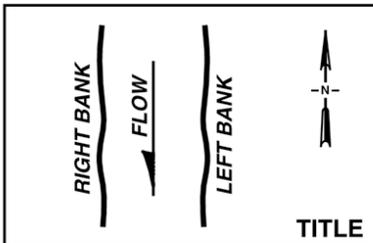
- 
- 
- 
- 
- 
- 

Figure G4. Conventional lines and symbols

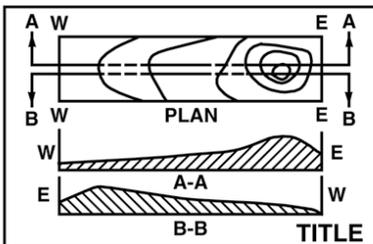
North will point toward the top of the sheet when practical, or toward the left of the sheet if top orientation is impractical.



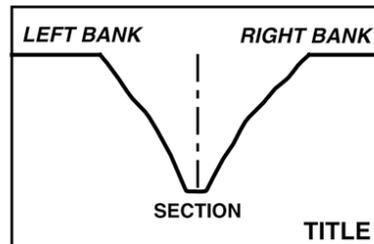
General plans, elevations, and longitudinal sections of channels, locks, dams, etc., oriented with the direction of flow of water from top to bottom of sheet, if practical, or from left to right.



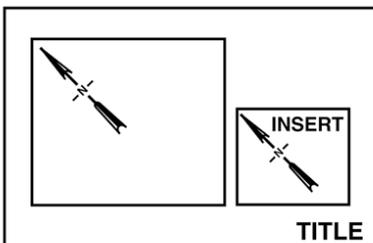
Orientation of sections looking in direction of arrows in plan.



Channel sections viewed looking downstream



Inserts oriented with plan or map.



**Note:** Vicinity maps will be oriented with north arrow pointing toward top of sheet.

Figure G5. Map, plan, and section orientation

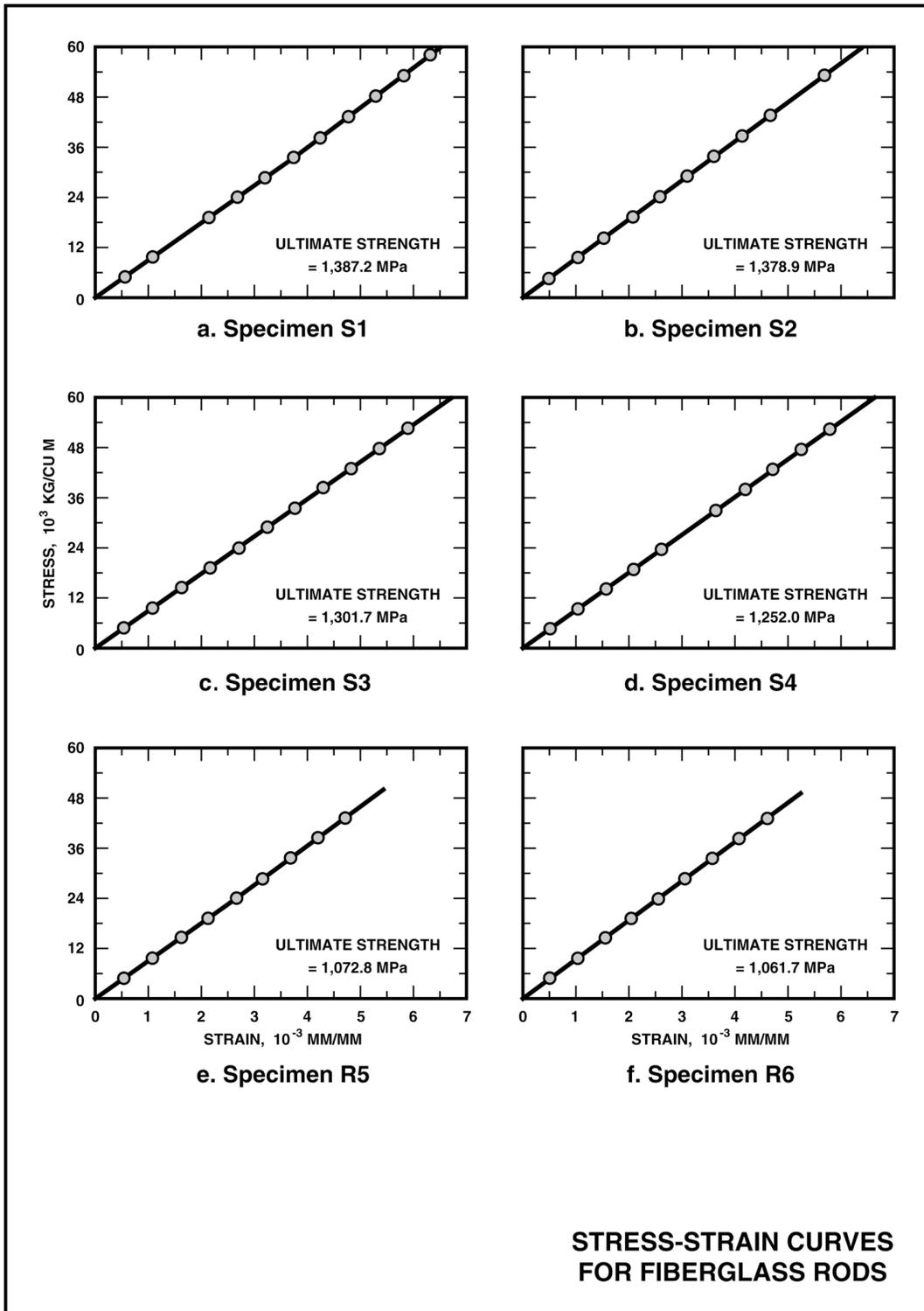


Plate 1

Figure G6. Sample plate with multiple plots

the figure will have to be shorter. Figures with a landscape orientation (sideways) must allow for a figure title at the bottom of the figure, which is at the right margin of the page. An author needing advice on figure size and arrangement may consult PTTB personnel.

Samples of grid styles are shown in [Figure G7](#). Line weights and data point symbols are shown in [Figure G4](#). A sample location map with inset vicinity map is shown in [Figure G8](#) (refer to [Figure G5](#) for orientation of maps). [Figure G9](#) shows a sample illustration.

## Graphics Files

### File types

An author who wishes to supply graphics files to PTTB should determine what kind of file to use from the following tabulation. Authors may also submit original hard-copy illustrations.

CADD	Microsoft Word	Corel Ventura	Autographics
.dgn	.emf	.cgm	.cgm
.dxf	.jpg	.gem	.tif <sup>1</sup>
.dwg	.png	.eps	
.cgm	.bmp		
.tif <sup>1</sup>	.rle	.hpg (hpgl)	
	.dib	.pcx	
	.wmf <sup>2</sup>		
	.tif		

<sup>1</sup> Not preferred.  
<sup>2</sup> AutoCAD files need to be in .wmf format to be imported into Word.

### Submitting files to PTTB

The following information applies to graphics to be included in documents submitted to PTTB for editing, typesetting, printing, and/or posting to the Web.

When submitting files to PTTB, graphics (figures) may be embedded in the text to show positioning. However, each graphic should also be included as a separate, raster-based file (e.g., tif or jpg files at 300 dpi or greater). Small files may be forwarded to PTTB by e-mail. Large files need to be placed on CD or Zip disks or transmitted via FTP. If possible, a hard copy printed from the native application should be included in the package submitted to PTTB.

Photos should be scanned at a high resolution. (The PTTB Visual Information Specialists can always drop a file down in size, but cannot add detail lost due to a low-resolution scan.)

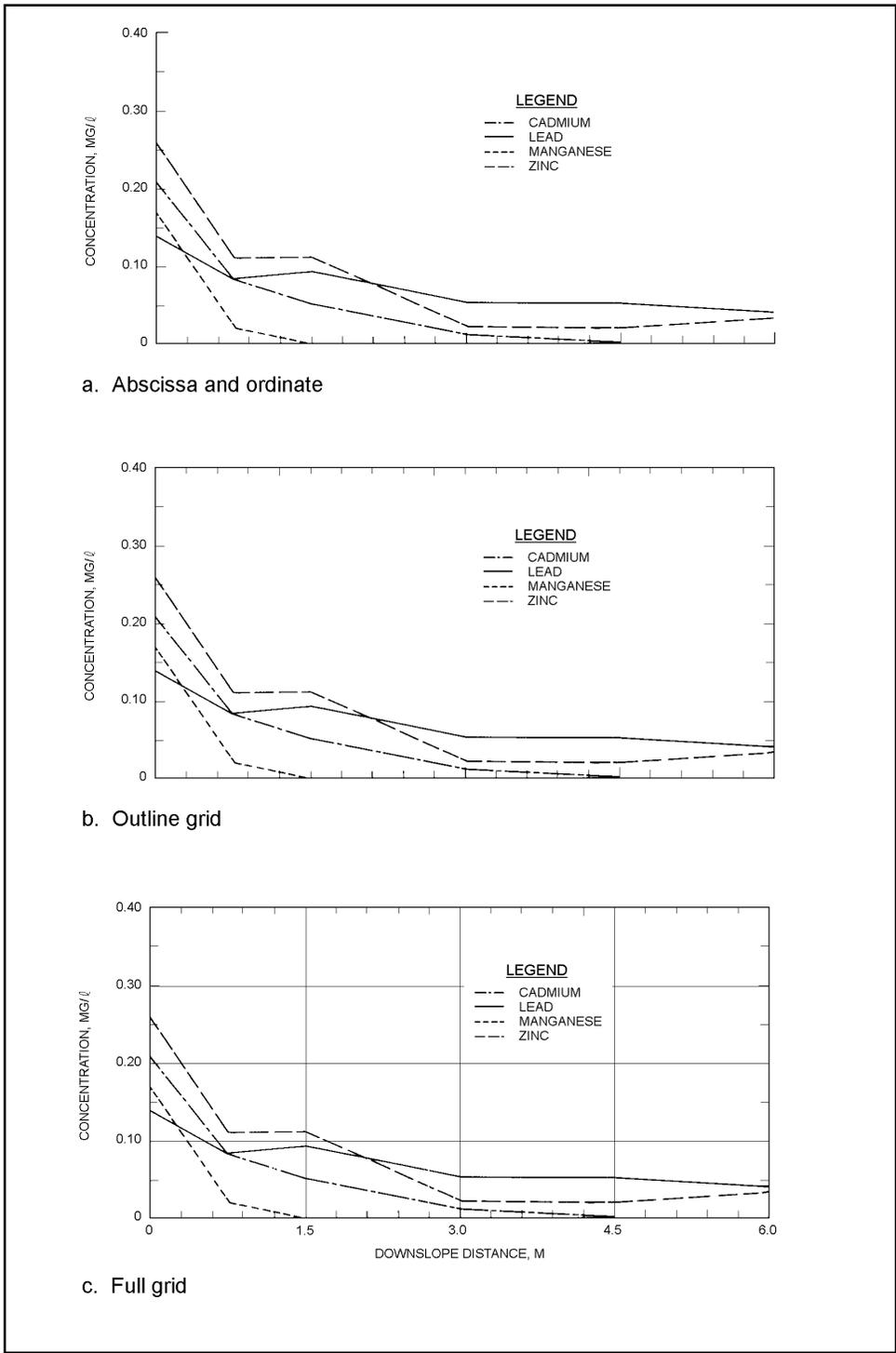


Figure G7. Grid styles

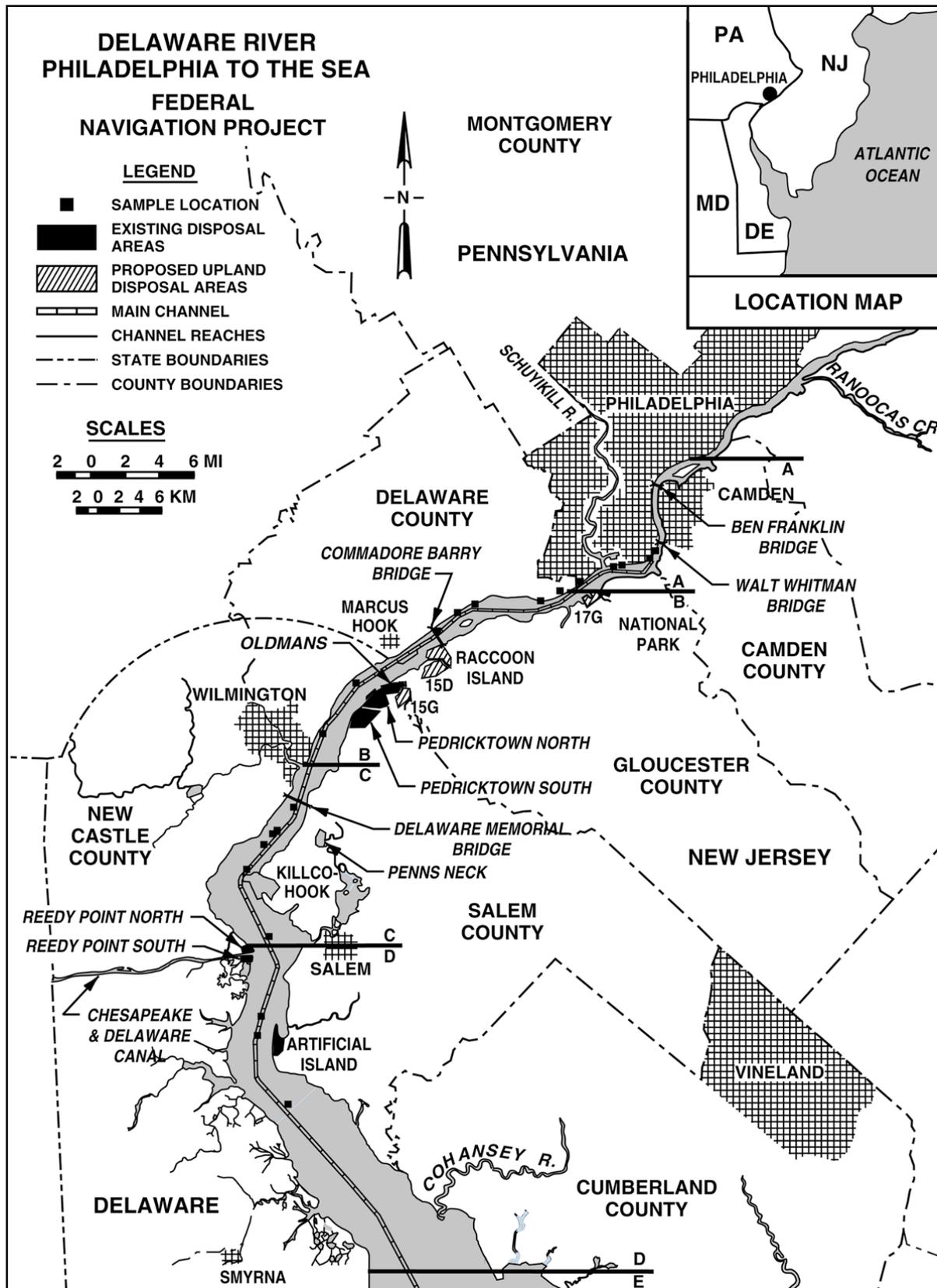


Figure G8. Sample location map with inset vicinity map

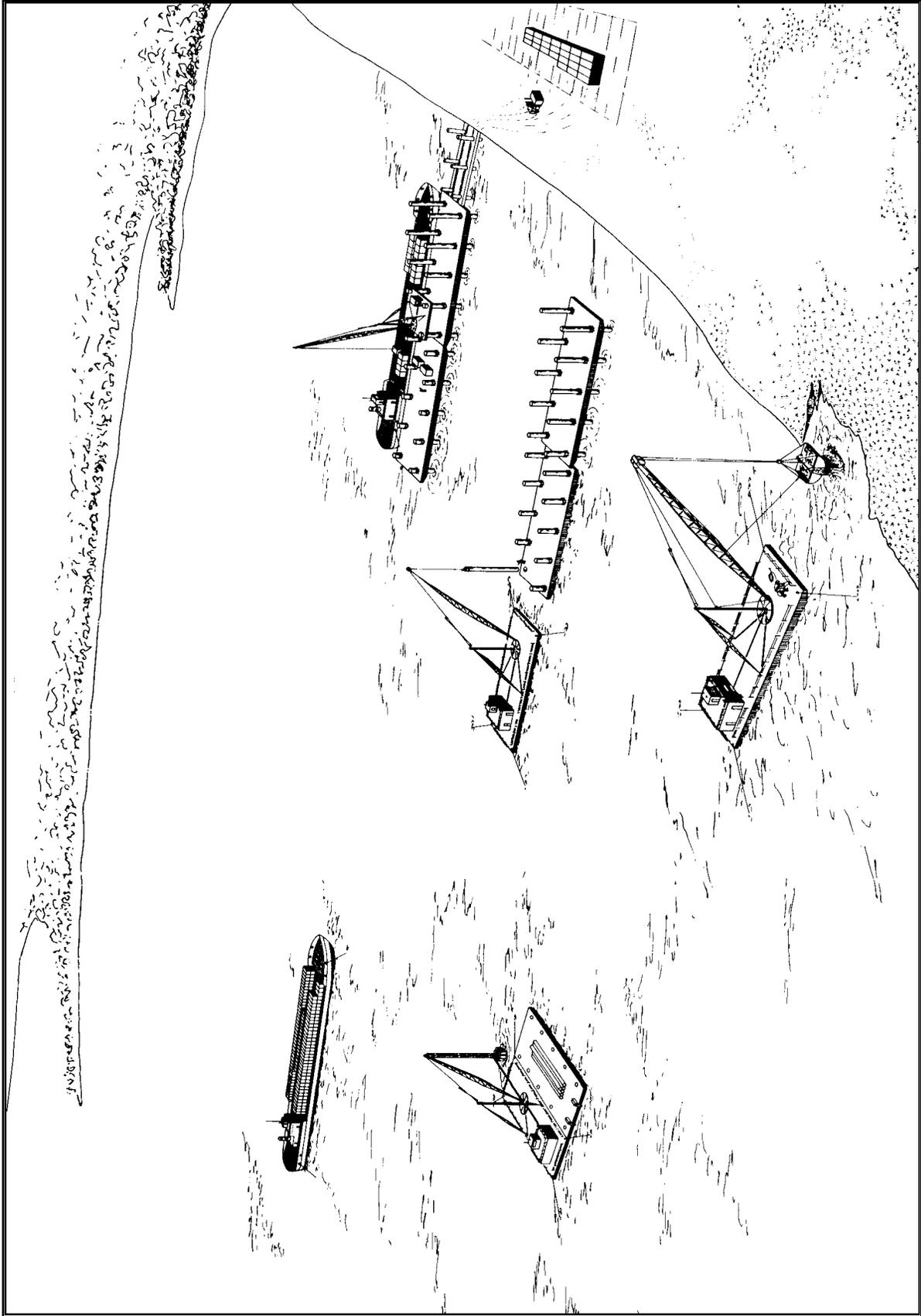


Figure G9. Sample illustration

Graphics should be high quality:

- a.* Lettering should be large enough to be legible when the image is reduced to fit the publication's format.
- b.* Lines and curves should be solidly drawn. Gray lines should not be used.
- c.* Graphics generated on a plotter should be presented to a VIS for a quality evaluation at an early stage in the publication development; those graphics not suitable for e-publishing should be redrawn.

# Appendix H

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