REPORT PLANNING AND REVIEW GUIDE

U.S. GEOLOGICAL SURVEY
Open-File Report 88-320

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John E. Moore, David A. Aronson,
Jack H. Green and Celso Puente

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Open-File Report 88-320

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REPORT PLANNING AND REVIEW GUIDE

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REPORT PLANNING AND REVIEW GUIDE

by John E. Moore, David A. Aronson, Jack Green, and Celso Puente

INTRODUCTION

The purpose of this guide is to assist authors and report reviewers to plan and review technical reports. The Guide provides systematic methods to improve the technical quality, organization, and readability of reports. The major topics covered are project planning, report planning, and report review.

Project Planning discusses preparation of a project proposal and work plan.

Report Planning discusses the use of work plans and outlines.

Report Review describes editorial and technical procedures.

This guide includes methods of report planning and review that have been used successfully for hundreds of reports prepared each year by the Water Resources Division of the U.S. Geological Survey. The Guide was developed from lecture notes and handout materials used in the Project and Report Management courses at the Geological Survey National Training Center in Denver, Colorado.

Ideal Project and Report

An ideal project has specific objectives, a time limit for its completion, adequate staffing, and adequate funding. The project should be completed on schedule and should produce a high-quality report.

The **objective** of the project is to solve a specific problem. If the objectives are clear, an appropriate approach can be determined and each step in the project can be defined. If the objectives are not clear, the project may lack focus and the report will fail to satisfy the needs it was designed to address. Indefinite objectives commonly lead to wasted time, collection of irrelevant data, and neglect of critical details.

Ideally, the **duration** of a project should be 3 years or less. Because projects longer than 3 years could result in late reports, they should be designed so that parts of the projects can be completed in shorter timeframes.

The **staffing** must be full time and continuous for efficient project management. The transfer or loss of the project chief before the project is completed may delay the project. Interruptions caused by transfer of key personnel tend to occur less frequently for shorter projects than for longer projects.

Adequate **funding** is essential for project success, whereas inadequate funding is a major cause of project failure. Managers need to avoid underestimating costs to make the project more attractive to potential cooperators. Cost cutting can lead to overdue reports, substandard reports.and very unhappy cooperators.

Project progress must be reviewed on a regular schedule. The review should be conducted at least every 3 months and a written summary of the review should be prepared and copies submitted to key project and office personnel.

The reports prepared for the project should be technically accurate, editorially correct, understandable by the intended audience, and completed on schedule.

Elements that make up the ideal project are as follows:

1. Project proposal
2. Clear objectives
3. Adequate planning
4. Adequate budget
5. Detailed work plan
6. Adequately trained competent staff
7. Continuity of staff
8. Frequent project reviews
9. Sound and readable technical report
10. Completion of report on time

Project and Report Quality Assurance

An example of the steps in a quality-assurance system to guide the project and report is shown below. This system, which is similar to the one used by the Water Resources Division of the Geological Survey, evolved over many years to provide quality assurance and assist authors.

STEPS IN PROJECT AND REPORT QUALITY ASSURANCE

LONG-RANGE PLAN

PROJECT PROPOSAL AND DESCRIPTION

PROJECT AND REPORT WORK PLAN

↓

PROJECT STARTS

TOPICAL OUTLINE

PROJECT FILE

QUARTERLY REVIEWS

ANNOTATED OUTLINE AND ILLUSTRATION PLAN

↓

REPORT PREPARATION AND REVIEW

FIRST DRAFT OF REPORT

DISTRICT REVIEW

EDITORIAL REVIEW

TECHNICAL REVIEW

↓

REGIONAL APPROVAL

DIRECTORS APPROVAL

REPORT PUBLICATION

Selected References for Authors and Reviewers

Cochran, W., Fenner, P., and Hill, M., 1984, Geowriting; a guide to writing, editing, and printing in earth science (4th ed): American Geological Institute, Alexandria, Va., 80 p.

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PROJECT PLANNING AND MANAGEMENT

Project and report planning go together and should begin at the same time. The major elements of project planning are the project proposal, a detailed work plan, and a report outline.

Sound planning should provide the project chief with the tools needed to design and complete the project (and report) within the allotted time and budget. A successful project is possible only when the project chief thoroughly plans what is going to be done before starting the project.

Project objectives must be specific, deadlines must be definite, and difficulties must be anticipated. If the procedures are not followed the project may fail.

Elements of a Project Proposal

A project proposal is a plan to solve a specific problem. It should outline a definite technical objective, a definite period of time, and the necessary funding to complete the work. A proposal should be clear, concise and should address the questions of what, why, where, when, and how. It should follow a standard format with enough information to evaluate the proposal and report plan. An example project proposal is presented in Exhibit 1. A review sheet for project and report review is given in Exhibit 2.

List of major elements in a project proposal

Title--The project title should relate to the purpose , scope, and location of the proposed study. Ideally, the title should closely resemble the title of the proposed principal report resulting from the study. The title should be concise, yet informative.

Problem--Explain why the project deserves the commitment of time and money. The project must produce results worthy of funding. The need for the study must be greater than just the satisfaction of intellectual curiosity.

Objectives--Tell exactly why the project is to be conducted. Relate the proposed technical results to the expressed need for those results. The objective should be specific. This is one of the most important factors in evaluating the project proposal.

Approach--Define the technical content and areal extent (and limitations) of the study. Describe how, and by what means, the project will be addressed. If standard approaches and methods are used, a brief description will suffice. If the approach is new and untested, a more-detailed description will be needed.

Relation to long-range plans--Tell how objectives relate to established agency objectives.

Relation to Federal, State and local government programs--Tell how objectives relate to established Federal, State and local government objectives.

List of major elements in a project proposal (cont'd)

Benefits--Show how the results of the project will be of benefit to planning or management decisions and/or to the science.

Reports--Describe planned report or reports. State probable title or titles of report(s), outlets, and milestone dates. Important report milestones are report writing, colleague review, submittal for approval, and release of report. All report activities should be planned for completion before the end of project funding.

Work Plan-- Schedule starting and ending dates for each work element. Remember that some elements may be concurrent, whereas others must be completed in sequence.

Personnel--List personnel needs by speciality, grade, and time. Note that all personnel must be available at the time needed in the work schedule. Note too, the possible need for outside advisors and consultants.

Project Costs--With adequate reference to plans, schedule, and personnel, itemize costs for each fiscal year. Be certain that the budget is adequate to cover all planned project activities, the use of people, and time needed for each phase of the project. Also consider all miscellaneous activities that do not relate to accomplishment of project objectives.

Project Management

The major element of a project management system is periodic review of progress. Written and oral reports on work progress are needed at least quarterly and more frequently if needed. Each project should be reviewed individually. Other opportunities for review are possible at staff meetings, and technical seminars, or briefings for cooperators.

An essential part of the review is to compare progress with the work plan. Emphasis on project findings, report progress, accomplishments,needs for assistance, financial status, and plans for the next quarter. Some of the advantages of project review are listed below:

1. Help to keep the project on time and focused on objectives.
2. Identify the need for modifying project objective.
3. Identify personnel, technical, and financial problems.
4. Provide guidance and assistance for project chief.
5. Provide technical quality control.
6. Improve morale.
7. Educate managers and supervisors.
8. Help to keep the report on schedule.

A project-management file should be established by the project chief early in the project to maintain records and document progress on project activity and planned reports. The file should be kept current. Some items to be included in the file are:

1. Project proposal and description
2. Work plan, including milestone dates
3. Budget
4. Topical and annotated outlines for reports (s)
5. Lists of illustrations and tables
6. List of complete bibliographic citations
7. News release
8. Newspaper articles on project
9. Quarterly review summaries
10. Report drafts and review comments
11. Summary of cooperator meetings on project

REPORT PLANNING

Report preparation is a continuing effort throughout the life of the project. Some suggestions for report planning are:

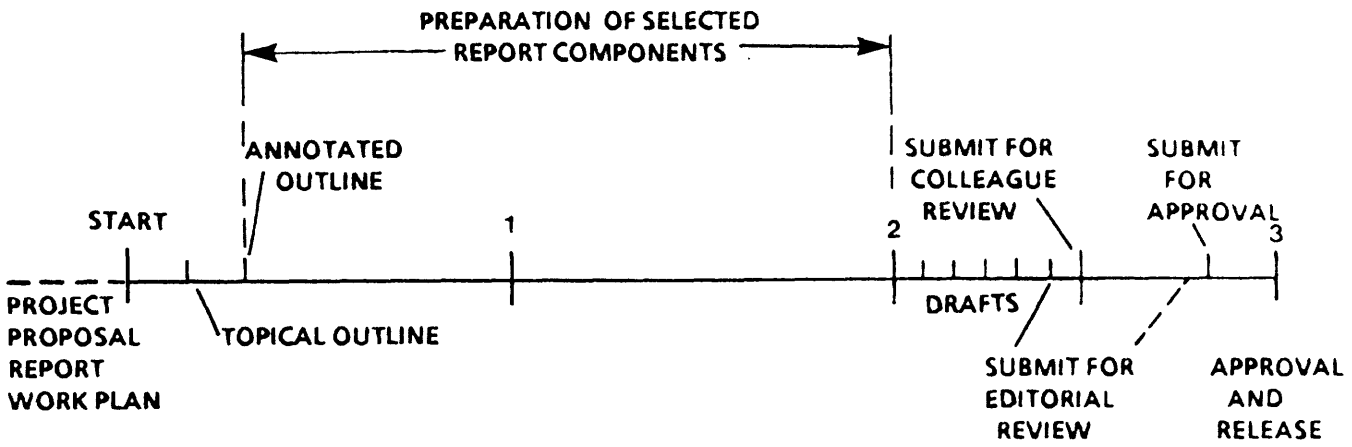
- o A draft report outline should be included with the project proposal.
- o An annotated report outline should be prepared during the first 3 months of the project.
- o If possible, a summary report should be prepared yearly.
- o If possible, a data report should be prepared prior to the final report.

Report preparation should never be handled as a chore to be done at the end of the project. It should start at the beginning of the project. Report components, such as in the introduction, description of study area, approach, and references can be written in the early stages of the project. Interim reports could be prepared when field data analyses and interpretations reach identifiable conclusion throughout the life of the project.

Report Work Plan

The project chief should submit the first draft of the report for colleague review not later than 6 months before the end of a 3-year project. Project schedules that do not allow adequate time for report revisions and review will be behind schedule. The report work plan should include dates for completion of the outline, report writing, review, approval, and release.

Idealized 3-year project report work plan



Report Outlines

The first step in report writing is the preparation of an outline. The outline helps the author to organize his thoughts early in the project and to focus project activities throughout the life of the project.

A good report title is the principal means to attract readers. The title needs to convey the maximum amount of information in a minimum number of words. The title should reflect the principal topics and scope of the report and give a precise geographic location. The period of study or timeframe of the data analyzed also may need to be included.

After selection of the title, the author should prepare a topical outline containing major and minor headings that reflect the title of the report. The outline should service as a guide in the preparation of an annotated outline. The topical outline should be reviewed and approved before preparation of an annotated outline.

The next step is to prepare an annotated outline. The annotated outline generally is written as an expansion of the topical outline. A topic sentence is prepared for each heading in the outline. It is important to note that this type of outline seldom is final. Two example topical outlines and annotated outlines are given in exhibit 3.

REPORT REVIEW

Competent and thorough editorial and technical review is the most certain way to improve and assure the high quality of the final report. The major objectives of report review are:

1. Ensure report satisfies commitments given in project description.

2. Ensure the report is technically sound.

3. Improve the technical quality of the report.

4. Improve the readability of report.

5. Evaluate the proposed outlet for publication.

6. Evaluate the effectiveness of presentation.

7. Evaluate the report organization.

8. Remove errors that would embarrass the author and the agency.

Responsibilities of Authors

The successful completion of the technical report is due, in large part, to the diligence of the author. Some major responsibilities of the author are provided below:

- o Authorship should be assigned at the beginning of the project.
- o The author should prepare topical and annotated report outlines within the first 3 months of the project; the outlines should be reviewed.
- o The report should be the best product the author can prepare before submitting it for review.
- o The report should be of a high technical quality, readable and timely.
- o A manuscript check list should be used.
- o A manuscript routing sheet should be filled out, signed by each reviewer, and forwarded with the review package.
- o All illustrations and tables necessary to the report should be neat, legible, and complete.
- o The report should have at least two competent technical reviews and an editorial review.
- o All technical review comments must be acknowledged and incorporated if accepted, or a reason given if not accepted.
- o All marked-up review copies and review comments must be forwarded with the manuscript to the next review or approval step.
- o Manuscript preparation, review, and revision should have first priority.

Responsibilities of Reviewers

The objective of the technical (colleague) review of the report is to insure the technical soundness and help the author improve the report. The following is a list of responsibilities of reviewers.

- o Reviewers should have appropriate training, expertise, and interest in the report subject.

- o Reviewers should show willingness to review report and to return it in a timely manner.

- o Reviewers should put special emphasis on parts of the report requested by the author for special attention.

- o Reviewers should Insure technical soundness and clarity of report and suggest other methods of analysis or interpretation, if appropriate.

- o Reviewers should devote adequate time and effort to check mathematics, approach, organization, editing, adequacy of data to support conclusions, applicability and soundness of illustrations and tables, and readability.

- o Reviewers should clearly indicate problems in report and prepare a summary of review.

- o Reviewers should avoid derogatory or humorous comments and make constructive suggestions for improvements. Reviewers should point out both positive and negative aspects.

- o Reviewers should discuss review with author.

Editorial Review

The editorial review should consider consistency in the use of terminology, clarity of expression, proper grammar, agreement of content with headings and figure titles, adherence to publisher's style, consistent use of topic sentences for paragraphs, completeness of all components and support documents, suitability of illustrations, and readability by the intended audience.

A description of editorial review of the text, illustrations, tables, and manuscript are given in the exhibits 4 to 7. The editorial review should be done before technical review, as well as after technical review, if substantial revisions are made.

Technical Review

The importance of technical (colleague) review in the preparation of quality reports cannot be overemphasized. At least two colleague reviews are required for all reports. The reviewers should be selected on the basis of special knowledge or interest in the subject material in the report. At least one technical reviewer should be selected from outside of the originating office.

A technical reviewer should concentrate on the technical adequacy of the report, but any major editorial errors particularly in organization should be pointed out. The reviewer should summarize their comments and make recommendations for improvement of the report in a memorandum to the author. Brief, clear, and legible review comments should be entered directly on the manuscript. The reviewer should maintain objectivity and refrain from using humor, witticism, or sarcasm in their comments. The author should evaluate all review comments objectively and make changes if appropriate. All review comments should be answered and initialed by the author. Reasons should be given if comments are not accepted.

Reviewers should adopt a systematic approach to evaluate reports. The 12-step method shown in Exhibit 8 provides a system for making technical reviews. The required elements and possible problems in each section of the report are shown in these steps. The instructions for technical reviews from a Water Resources Division manuscript routing sheet are shown in exhibit 9. A timeless article "Suggestions to Reviewers" by L. A. Heindl is presented in exhibit 10.

New England District (Rhode Island)
Project Proposal

Development Alternatives in the Usquepaug-Queen Ground-Water Reservoir, Rhode Island

PROBLEM: The RIWRB (Rhode Island Water Resources Board), which is responsible for implementing development of the State's major water resources, is identifying sites in the Pawcatuck River basin where high-yield wells can be constructed. This is being done through an extensive program of test drilling and aquifer testing in major ground-water reservoirs in five subbasins (Chipuxet, Usquepaug-Queen, Beaver-Pasquiset, lower Wood, and upper Wood). Sites most favorable for water-supply development are being purchased by the State and retained for future use.

Cooperative studies between the U.S. Geological Survey and the RIWRB to analyze and interpret lithologic data and aquifer-test data and to assess ground-water-development alternatives through model analysis have been completed for the Chipuxet subbasin (Johnston and Dickerman, 1985) and the Beaver-Pasquiset subbasin (Dickerman and Ozbilgin, 1985). Field work for the lower Wood subbasin is complete and the report is ready for colleague review. Work in the upper Wood subbasin is scheduled for completion in FY 88. The Usquepaug-Queen subbasin (fig. 1) is the last unstudied subbasin of the Pawcatuck River basin. This proposal addresses the need for determination of ground-water-development alternatives and chemical quality of ground water in the subbasin.

A moderate amount of test drilling and aquifer testing has been done in the Usquepaug-Queen subbasin, but completion of the testing program by the RIWRB has been stalled for several years because access to land that overlies a large part of the ground-water reservoir area has been denied by property owners. Rather than litigate to obtain land access rights, the RIWRB intends to use estimates of yield obtained from a number of apparently favorable sites in this largely untested area. The estimates will be based upon interpolation and extrapolation of data from available lithlogic logs and pumping tests.

A highly permeable sand and gravel aquifer occupies the preglacial bedrock valley of the Usquepaug-Queen River. The thickest and most transmissive part of the aquifer forms a ground-water reservoir estimated by Allen and others (1966) to be capable of sustaining a perennial yield of 17 Mgal/d (million gallons per day). However, their study concludes that withdrawal at the rate of 17 Mgal/d would probably cause wetlands and streams over the reservoir to be dry for long periods of time.

Assessment is needed of the ambient quality of ground water and surface water in the subbasin. Evaluation of surface-water quality is necessary because much of the water pumped from wells would be infiltrated from streams. A substantial part of the reservoir area is overlain by commercially cultivated land to which large quantities of nitrogen fertilizers, pesticides, and herbicides have been applied. Because concentrations of nitrate that approach or exceed the mandatory drinking water standard of 10 milligrams per liter, and aldicarb, a highly toxic pesticide, have been found in ground water near several commercially cultivated fields elsewhere in the Pawcatuck River basin, there is concern about the impacts of land use on the quality of ground water and surface water. Although few instances of ground-water contamination by volatile organic chemicals have been reported in the Pawcatuck River basin, it is desirable to demonstrate that significant concentrations of these chemicals are not present in the study area.

A digitial simulation model of the stream-aquifer system is needed to evaluate the impact of alternative pumping plans on ground-water levels and streamflow. Much of the data needed to construct and calibrate such a model are available from reports by Allen and others (1963, 1966). Results of a determination of the ambient quality of ground water and surface water and predictions of the ground-water-flow model will aid the RIWRB in making decisions about site aquisition in, and development of, the ground-water reservoir in the Usquepaug-Queen subbasin.

OBJECTIVES: The objectives of the study are:

1. Collect and analyze additional geohydrologic data needed to develop a model of the Usquepaug-Queen ground-water reservoir.

2. Construct and calibrate a two-dimensional ground-water-flow model.

3. Use the model to assess the impacts of alternative pumping schemes on ground-water levels and streamflow.

4. Determine the ambient quality of surface water and ground water in the subbasin.

APPROACH: The investigation will include the following elements:

1. An inventory will be made of geohydrologic information (lithologic logs, well construction and pumping test data, water-quality data, etc.) that have become available in the study area since studies were completed by Allen and others (1963, 1966).

2. Estimates of hydraulic conductivity and saturated thickness of the sand and gravel aquifer will be made from well logs and pumping tests and will be used to update maps of the saturated thickness and hydraulic conductivity prepared by Allen and others (1966).

3. A network of 30 to 50 observation wells will be established in which to measure water levels monthly for at least 12 consecutive months. Most of the wells will be previously inventoried dug wells that are still accessible. Approximately 25 observation wells will be drilled with the Survey's drill rig to obtain water-level data in key areas. Continous water-level recorders will be installed on up to four wells. Altitudes of the measuring points on observation wells will be determined by leveling or surveying altimeter.

4. Partial-record streamflow sites will be established at four or five sites on streams that flow over the ground-water reservoir from areas of till-covered bedrock. Measurements will be made monthly at these sites for at least 1 year. Estimates of average monthly discharge at these sites will be made using a method described by Riggs (1969). Monthly measurements of discharge also will be made monthly at selected sites on the main stem of the Usquepaug-Queen River. Discharge measurements at partial-record sites also will be correlated with discharge at a continuous recording downstream gage to estimate average monthly discharge at partial-record sites for 1959. These estimates of average monthly discharge at partial-record sites for 1959 are needed for streamflow input to aid in calibrating the ground-water-flow model. The altitudes of the reference points used to measure stream stage will be determined by leveling. Continous records of streamflow will be obtained at the downstream end of the ground-water reservoir from an existing U.S. Geological Survey stream gage.

5. Estimates of average annual and average monthly recharge to the Usquepaug-Queen ground-water reservoir will be based on water-budget computations developed from this study and from similar computations made for the study area by Allen and others (1966). Precipitation data will be available from a National Weather Service station located 3 miles east of the study area.

6. Approximately 15 to 20 sites will be identified where yields of 1 Mgal/d, which are adequate for municipal-supply use, might be obtained from large-diameter wells. Identification of potential well sites will be based largely on analysis of available lithologic logs and pumping test data. Several potential well sites will be identified in untested areas by interpolation and extrapolation of data. More sites will be identified than are likely to be needed, in the event actual yields obtainable at some sites are less than predicted.

7. A two-dimensional model of the stream-aquifer system will be developed using the U.S. Geological Survey's three-dimensional modular finite-difference model (McDonald and Harbaugh, 1984). The model will be calibrated first under steady-state conditions using estimates of long-term average annual recharge and water-level and streamflow data collected by Allen and others (1966) in 1959, a year when conditions were close to long-term average. The model then will be calibrated under transient conditions using average monthly recharge, water-level, and streamflow data for 1959. Verification of the transient model will be done by attempting to simulate water-level and streamflow data collected during this study.

8. The transient model will be used to simulate withdrawals from various combinations of hypothetical pumping wells, at various combinations of rates, to determine the potential impacts on streamflow and ground-water levels. Withdrawals will be simulated for conditions approximating long-term average annual recharge and for periods of below-normal recharge during droughts. The principal goal of the model simulations will be to determine the maximum withdrawal rates that can be made from selected combinations of wells, particularly during months when streamflow is normally low, without causing streams to go dry or causing excessive lowering of water levels in wetlands.

9. Water samples will be collected from the same 15 wells that were sampled between 1955 and 1960 by Allen and others (1963, table 11), if accessible, and from a few additional wells. Samples will be collected in the spring and fall. They will be analyzed for the inorganic constituents shown in table 1, which includes all constituents for which analyses were made in the earlier study. These wells also will be sampled once for volatile organic chemicals listed in table 2. Field determinations will be made on all samples for pH, specific conductance, dissolved oxygen, alkalinity, and temperature.

10. Clusters of three wells screened at different depths will be installed at four sites downgradient from commercially cultivated fields to which aldicarb has been applied. These wells will be sampled once in the spring and fall. The samples will be analyzed for the pesticides listed in table 3, for inorganic chemicals listed in table 1, and for field constituents listed above in item 9.

11. Water samples will be collected from streams during periods of base flow in spring and fall at the same sites sampled in 1958 and 1959 by Allen and others (1963, table 10). They will be analyzed for inorganic constituents shown in table 1, which includes all of the constituents for which analyses were made in 1958 and 1959. Field analyses listed in item 9 also will be determined for all samples.

Table 1.--*Summary of proposed water-quality analyses for inorganic constituents*

Lab code	WATSTORE code	Constituent
0012	00915	CALCIUM, DISSOLVED
0027	70300	ROE, DISSOLVED AT 180 °C
0031	00950	FLUORIDE, DISSOLVED
0040	00925	MAGNESIUM, DISSOLVED
0041	01055	MANGANESE, TOTAL
0042	01056	MANGANESE, DISSOLVED
0054	00935	POTASSIUM, DISSOLVED
0056	00955	SILICA, DISSOLVED
0059	00930	SODIUM, DISSOLVED
0068	00403	PH (LABORATORY)
0069	90095	SPECIFIC CONDUCTANCE (LAB)
0070	90410	ALKALINITY, TOTAL AS $CACO_3$ (LAB)
0128	00666	PHOSPHORUS, DISSOLVED
0172	01046	IRON, DISSOLVED
0189	01045	IRON, TOTAL
0228	00631	NITROGEN, DISSOLVED NITRITE + NITRATE
1200	00945	SULFATE, DISSOLVED
1213	00940	CHLORIDE, DISSOLVED

Table 2.--*Summary of proposed water-quality analyses for organic volatile constituents*

Lab code	WATSTORE code	Constituent
1287	34030	BENZENE, TOTAL
1288	32104	BROMOFORM, TOTAL
1289	32102	CARBON TETRACHLORIDE, TOTAL
1290	34301	CHLOROBENZENE, TOTAL
1291	32105	CHLORODIBROMOMETHANE, TOTAL
1292	34311	CHLOROETHANE, TOTAL
1293	34576	2-CL-ETHYLVINYL-ETHER, TOTAL
1294	32106	CHLOROFORM, TOTAL
1295	32101	DICHLOROBROMOMETHANE, TOTAL
1296	34668	DICHLORODIFLUOROMETHANE, TOTAL
1297	34496	1,1-DICHLOROETHANE, TOTAL
1298	32103	1,2-DICHLOROETHANE, TOTAL
1299	34501	1,1-DICHLORETHYLENE, TOTAL
1300	34546	12TRANSDICL-ETHYLENE, TOTAL
1301	34541	1,2-DICHLOROPROPANE, TOTAL
1302	34561	1,3-DICHLOROPROPENE, TOTAL
1303	34371	ETHYLBENZENE, TOTAL
1304	34413	METHYLBROMIDE, TOTAL
1305	34423	METHYLENE CHLORIDE, TOTAL
1306	34516	1,1,2,2-TETRCHLOROETHANE, TOTAL
1307	34475	TETRACHLOROETHYLENE, TOTAL
1308	34010	TOLUENE, TOTAL
1309	34506	1,1,1-TRICHLOROETHANE, TOTAL
1310	34511	1,1,2-TRICHLOROETHANE, TOTAL
1311	39180	TRICHLOROETHYLENE, TOTAL
1312	34488	TRICHLOROFLUOROMETHANE, TOTAL
1313	39175	VINYL CHLORIDE, TOTAL
1314	34536	1,2-DICHLOROBENZENE, TOTAL
1315	34566	1,3-DICHLOROBENZENE, TOTAL
1316	34571	1,4-DICHLOROBENZENE, TOTAL
1317	39082	1,2-DIBROMOETHANE, TOTAL
1318	34418	CHLOROMETHANE, TOTAL
1326	34704	CIS13DICHLOROPROPENE, TOTAL
1327	34699	TRANS13DICHLOROPROPENE, TOTAL
1328	77128	STYRENE, TOTAL
1330	81551	XYLENE, TOTAL

Table 3.--*Summary of proposed water-quality analyses for pesticides*

Lab code	WATSTORE code	Constituent
1338	00000C	ALDICARB
1343	00000C	ALDICARB, SULFOXIDE
1344	00000C	ALDICARB, SULFONE
1335	00000C	OXAMYL
1337	00000C	CARBOFURAN

BENEFITS: The Usquepaug-Queen simulation model will allow rapid assessment of the effects of ground-water withdrawals on the stream-aquifer system. This information will complete the study of all five subbasins in the Pawcatuck River basin and will aid planners in deciding how best to protect, develop, and manage ground-water resources. The study supports the State's responsibilities for developing ground-water resources, and the Survey's goal of increasing knowledge of the distribution and quality of the Nation's ground-water and surface-water resources.

REPORT PLANS: Two reports are planned. A geohydrologic data report will be published in a State series by the Rhode Island Water Resources Board. An interpretive report will be published in the Water-Resources Investigations Report series: (1) First draft, December 1989; (2) colleague review, March 1990; and (3) final approval, September 1990.

PERSONNEL REQUIREMENTS: The following lists the number of work days required for the project:

	FY 88	FY 89	FY 90
Hydrologist GS 12		168	168
Hydrologic technician GS 8	20	138	138
Hydrologic technician GG 7	137		
College work study student	24	75	75

A college work study student will have to be hired. A hydrologist (GS 12), hydrologic technician (GS 8), and hydrologic technician (GG 7) are available.

PROJECT COSTS: The projected cost for each fiscal year of this project is as follows:

	FY 88	FY 89	FY 90
Salaries and benefits	$ 13,790	$ 46,040	$ 48,470
Travel and per diem	1,500	2,000	
Vehicles	1,500	2,000	3,000
Printing and reproduction			4,000
Publication			4,000
Supplies and materials	3,000	3,000	2,395
Drilling (Survey drill rig)	7,000	8,000	
Laboratory		3,600	6,000
Common services	24,510	59,140	62,095
Technical service charge	5,700	13,750	14,440
TOTAL:	$ 57,000	$137,530	$144,400

SOURCE OF FUNDS: Cooperative project with the Rhode Island Water Resources Board.

SELECTED REFERENCES:

Allen, W. B., Hahn, G. W., and Brackley, R. A., 1966, Availability of ground water, upper Pawcatuck River basin, Rhode Island: U.S. Geological Survey Water-Supply Paper 1821, 66 p.

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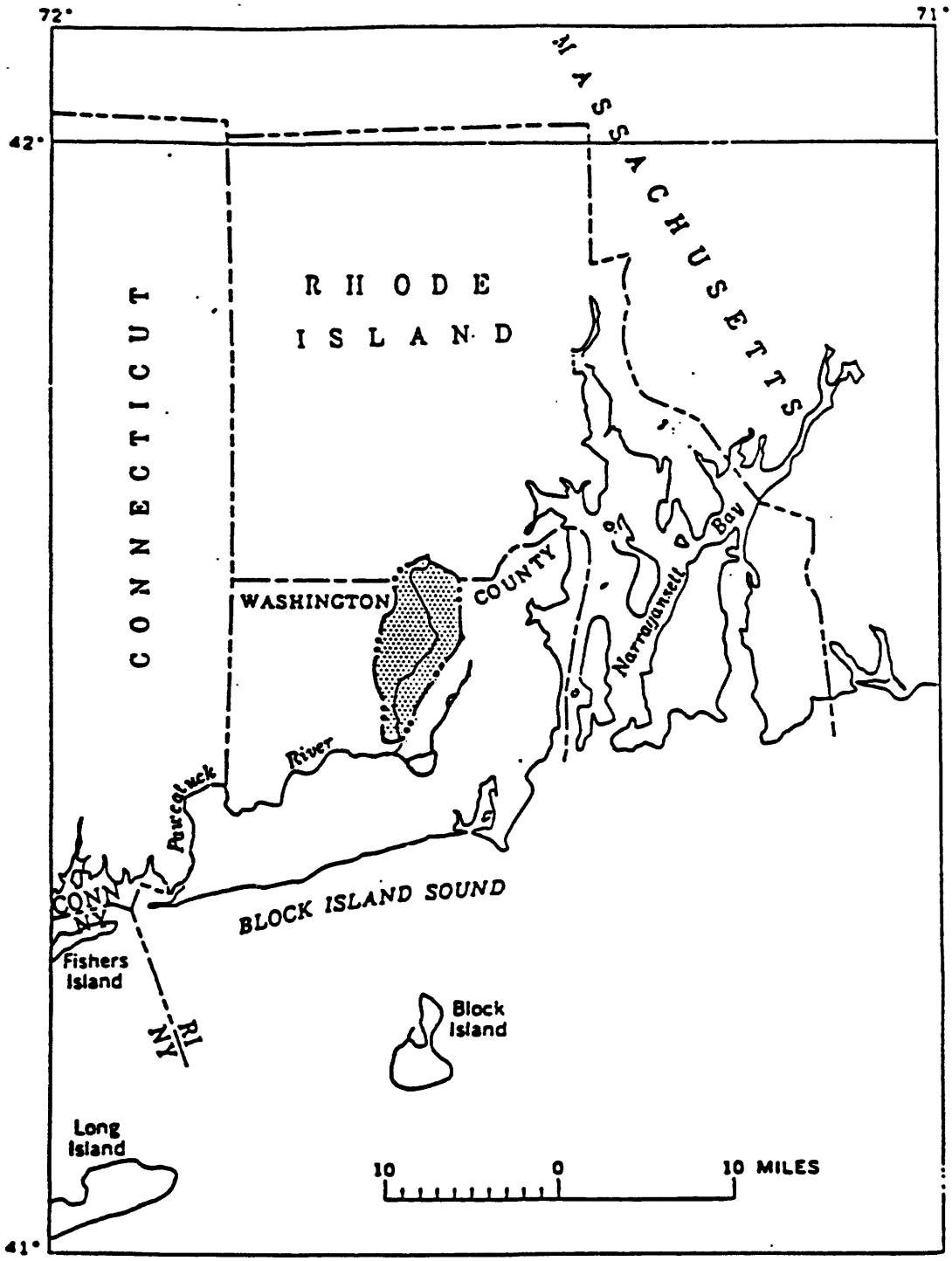

Figure 1.-- Proposed Usquepaug-Queen study area.

EXHIBIT 1

USQUEPAUG-QUEEN WORK PLAN

Work Period and Completion Date

Work Unit	1ST YEAR	2ND YEAR	3RD YEAR
	ONDJFMAMJJAS	ONDJFMAMJJAS	ONDJFMAMJJAS
Data inventory	X X		
Order base maps	X		
Test drilling			
Water level network	X		
Pesticide network		X	
Aquifer test analysis	X		
Partial-record streamflow	XXXXXXXXXXX	XXXXXX	
Water-level data	XXXXXXXXXXX	XXXXXX	
Water budget	X		
Update maps of			
Bedrock	X		
Water table	X		
Saturated thickness	X		
Hydraulic conductivity	X		
Prepare transmissivity map	XX		
Water quality sampling			
Ground water	X	X	
Surface water	X	X	
Digital model			
Design		XX	
Develop & input values		XXX	
Calibration		XX	
Verification		XX	
Model runs/analysis		XXX	
Report Generation			
Report Outline	XXXXX		
Geohydrologic data report		XXXXXX	XXXXXX
Interpretive report			XXXXXXXXXXX

Groundwater Development Alternatives for the
USQUEPAUG-QUEEN Aquifer, Rhode Island

PROJECT AND REPORT REVIEW SHEET

PROJECT NUMBER: _____ DATE: _____

PROJECT TITLE: _____

PROJECT CHIEF: _____

WORK ITEMS	DEADLINE	COMPLETE	INITIALS
1. Proposal			
2. Work plans			
3. Report outline review			
4. Equipment and instruments			
5. Construction			
6. Base map			
7. Annotated outline review			
8. Data collection			
9. Data analysis			
10. Illustrations review			
11. Tables review			
12. Report completed			
13. Section chief review			
14. Report specialist review			
15. Cooperator review			
16. District chief review			
17. Colleague review			
18. District transmittal			

Comments: _____

_____

New Project Review Date: _____

EXAMPLE REPORT OUTLINES

"Current and Proposed Ground-Water-Level Data Program in _____"
(Outline)

I. Introduction
  A. Problem
  B. Purpose and scope
  C. Acknowledgments

II. Geohydrology
  A. Bedrock geohydrologic units
  C. surficial geohydrologic units

III. Network Review

IV. Evaluation of the Current Network

V. Proposed ground-water-level data program
  A. Natural-stress observation wells
    (a) Climatic-effects network
    (b) Terrane-effects network
  B. Manmade-stress observation wells
    (a) Surficial geohydrologic units
    (b) Bedrock geohydrologic units

VI. Summary

VII. References

EXHIBIT 3

"Current and Proposed Ground-Water-Level Data Program in _____"
(Outline)

I. Introduction

A. Problem - Present the history of the water-level program from its inception in 1939 to the present. This will also include a discussion of the local well-numbering system. The growth of the network was not based on any specific network design criteria. This has led to inadequate statewide coverage. The State has analyzed Maine's ground-water management and recommends significant changes and upgrading. One of their recommendations is to perform a detailed evaluation of the observation-well program and formulate a plan to improve it.

B. Purpose and scope - The purpose of this report is to evaluate the current network and present a plan to improve it. The study will cover the needs for the statewide network. It will address the needs for the program to observe both natural and manmade stresses on ground -water resources in different geologic and topographic environments. The procedures used to evaluate the program will be: selecting hydrogeologic units, compiling well records, evaluating the wells based on network criteria (Heath, 1976) and proposing a plan to improve the network.

C. Acknowledgments -Cooperators and assistance acquired through the project.

II. Geohydrology

A. Bedrock geohydrologic units - The bedrock units will be based on four major lithologic subdivisions (Denny, 1982). They are a generalized lithologic comparison of the many bedrock units.

B. Surficial Geohydrologic Units - These units form the veneer on bedrock ranging from a trace to hundreds of feet thick. They are composed of materials from glacial and nonglacial origin. The emphasis will primarily be on permeable deposits of sand, gravel, and till.

III. Network Review - Present ground-water level network concepts developed by Heath.

IV. Evaluation of the Current Network - Describe the evaluation process. Present site descriptions and well classification according to network concepts. Illustrate criteria used to determine unreliable and duplicated well records..

V. Proposed ground-water-level data program

A. Natural-stress observation wells

(a) Climatic-effects network - Present the characteristics of the wells in this network. Propose well locations to fulfill the objectives of this network.

(b) Terrane-effects network -Present the characteristics of the wells in this network. Propose well locations that meet the network criteria.

B. Manmade-stress observation wells

(a) Surficial geohydrologic units - Identify areas of significant ground-water use. Propose well locations for this network.

(b) Bedrock geohydrologic units

VI. Summary - Present the principal results of the investigation. Give answers to the purposes stated at the beginning of the report.

VII. References

Guidelines for Using the Steady-State Gas-Tracer Method to Determine Gas-Desorption Coefficients

(Outline)

Introduction

- A. Purpose and scope
- B. Acknowledgments

Steady-state gas-tracer method for determining gas-desorption coefficients

- A. Theory
- B. Hypothesis

Guidelines for using the steady-state gas-tracer method

Discussions of guidelines

- A. Experience gained for 1983-84 reaeration studies
- B. Limitations of testing

Summary and conclusions

References

Guidelines for Using the Steady-State Gas-Tracer Method to Determine Gas-Desorption Coefficients

(Annotated Outline)

Introduction

A. Purpose and scope -The purpose of the report is to describe guidelines for the application of the steady-state gas-tracer method.

B. Acknowledgments- The authors wish to acknowledge and thank Nabuhiro Yotsukura for his technical assistance and suggestions.

Steady-state gas-tracer method for determining gas-desorption coefficients

A. Theory- There are two techniques for calculating the tracer-gas desorption coefficient for a river reach.

B. Hypothesis- The number of data points affects the accuracy of representing a slug-injected tracer response-curve and the accuracy of gas tracer desorption coefficients calculations.

Guidelines for using the steady-state gas-tracer method

A minimum of 11 data points are necessary to describe a conservativer tracer response curve without changing moment values more than 5 percent from the values that would be calculated from a large number of data.

Discussions of guidelines

A. Experience gained for 1983-84 reaeration studies. Questions concerning the effect of data sets with as few as 6 data points and the effect of long duration dye-cloud response curves.

B. Limitations of testing- Sets of response curves of variable duration from four, 1984 tracer studies were used to form new data sets having one-half and one-quarter the number of data points.

Summary and conclusions

A minimum of 11 data points are necessary to describe a conservativer tracer response curve without changing moment values more than 5 percent from the values that would be calculated with a large number of data points.

References

EXHIBIT 4

EDITORIAL REVIEW OF TEXT

- o Is format of report appropriate for intended outlet?
- o Are title and authorship the same on cover, title page, abstract page, routing sheet, and transmittal memo?
- o Are cooperators capitalized on cover and title page? Are they acknowledged?
- o Illustrations list--Should match illustration title. Does it avoid abbreviations and acronyms?
- o Tables list--Does it match table title? Does it avoid abbreviations and acronyms?
- o Has the entire report been read for grammatical and spelling accuracy and for internal consistency, preferably before colleague review and again before submitting for approval ?
- o Is the wording clear and unambiguous? Is it free of jargon?
- o Do text headings agree with contents in wording, rank, and page number? Do discussions pertain to the heading?
- o Do numbers and descriptive material in text agree with data in tables and information shown in illustrations?
- o Are all bibliographic citations in text, tables, and illustrations in list of references? Are they in the correct format, and do authorship and year of publication agree with information in list of references?

EDITORIAL REVIEW OF ILLUSTRATIONS

- Is illustration difficult to understand or illegible because it contains too little or too much data?
- Is format of illustration correct?
  - -- Does format meet standards of publisher?
  - -- Is format of similar illustrations the same?
  - -- Is explanation, if needed, complete and in proper format?
- Is illustration caption correct?
  - -- Is plate caption complete, including type of illustration and geographic location?
  - -- Does caption reflect figure content?
  - -- Is source of illustration cited?
- If illustration is a figure:
  - -- Are data plotted correctly?
  - -- Are axes properly labeled?
  - -- Is an example needed to show readers how to use a graph?
  - -- Are geographic names given in figure captions?
- Is illustration self explanatory?
- Is location of illustration in report correct?
- Can illustrations be combined?
- Is the entire illustration needed?
- Are the data in illustration better presented in a table?
- Is information in figure in agreement with data mentioned in text, presented in a table, or presented in another illustration?
- If report cover contains an illustration, is it satisfactory?

EDITORIAL REVIEW OF TABLES

- o If table is needed in report:
  - -- Are data presented in table repeated verbatim in the text?
  - -- Are all data presented in table needed?
  - -- Are data presented in table repeated in an illustration that is easier to understand than is the table?
  - -- Are data in table better presented in the text or in an illustration?
- o Are additional tables needed in report?
  - -- Is the table difficult to understand because it contains too much data?
  - -- Are data presented in the text better presented in a table.
- o Are data in table presented logically?
- o Was data presented in table checked against statements regarding the data mentioned in the text, presented in an illustration, or presented in another table?
- o Is position of table in report appropriate?
  - -- Does table follow first principal reference?
  - -- If table is long, should it be moved to the back of the report?
- o Is format of table correct?
  - -- Does format meet standards of publisher?
  - -- Is format of similar tables the same?
  - -- Are headnotes and footnotes properly used?
  - -- Does presentation of data in table parallel table title and discussion in text?
  - -- Are geographic names given in table title?
  - -- Is source of table or data cited?
  - -- Is the number of significant figures presented correctly and in a consistent manner?
- o Is an unnumbered table properly introduced?
- o Are geographic names and sites in table located on a map?

EDITORIAL REVIEW OF MANUSCRIPT PACKAGE

- Transmittal memorandum (which you may be asked to prepare). Do report title, authorship, project number, and status agree with all other documents? Are grammar and spelling correct? Is it free of typographical errors?

- Manuscript routing sheet. Do title, authorship, project number, number of pages, table, illustrations, and type of report agree with manuscript and other documents? Is it completely filled out? Are names, hours, and appropriate columns checked?

- Abstract. Does abstract agree with information presented in the manuscript? Does abstract exceed than 250 words? Do number of references, tables, and illustrations agree with those in the manuscript? Are grammar and spelling correct? Are sentences complete?

- News release. Is all information accurate--telephone number, title, authorship, and availability of report? Can it be written in a more interesting way?

- Colleague review copies. Did manuscript receive an out-of-office colleague review? Did author respond to review comments, and are colleague-review copies and author's response included in report package?

- Is the cooperator release letter included in the report? Are appropriate agency disclaimer statements included in the report?

- Is there a clearance for copyrighted material?

12-STEP METHOD OF MANUSCRIPT REVIEW

Step 1.--

TITLE

Carefully read and study the report title. The title should convey the complete contents, yet be as short as possible. More than 15 words might be too many. A good title should:

- Accurately reflect the main theme of the report and first-order headings in the contents.
- Include the location of the study area. The period of study or dataset also may be needed.
- Avoid the use of abbreviations, acronyms, and extraneous words.
- Does it follow Agency policy?

12-STEP METHOD OF MANUSCRIPT REVIEW

Step 2.--

CONTENTS

Carefully examine the contents. The contents tells the reader the order in which the topics are discussed and the relative importance of these topics. A well organized contents probably indicates that the author has written a report with a logical and orderly presentation of information. A good contents should reflect all of the following characteristics:

- The first-order headings accurately relate to the key words in the report title, both in wording and in order of importance.

- The contents should have a logical organization with continuity of thought.

- All headings should be appropriately subdivided so that the subheadings further develop the subject of the heading.

- If subheadings are listed, there should be two or more subheadings.

12-STEP METHOD OF MANUSCRIPT REVIEW

Step 3.--

ABSTRACT

Read the abstract several times. The abstract is a short digest of the information in the report. It can be written only after completion of the entire report. A well written abstract of an interpretive report should contain:

- Clear, concise statements of the principal findings in the order of their importance; it should contain quantitative results.
- Information that the reader can readily find in the body of the report.
- Material that relates to the title, answers that address the purpose and scope of the report, and the most salient findings in the summary and conclusions.

12-STEP METHOD OF MANUSCRIPT REVIEW

Step 4.--

CONVERSION TABLE

If the report contains a unit of measure conversion table, study the table carefully and compare it with the body of the report, the illustrations, and the tables. A conversion table should:

- Include all units of measurement mentioned in the report.

- List units in proper style or format.

12-STEP METHOD OF MANUSCRIPT REVIEW

Step 5.--

INTRODUCTION

The introduction sets the theme and guidelines that the report is to follow. It also is a place for miscellaneous information that does not belong in the body of the report. A good introduction will lead the reader through the following topics and ideas:

- It will clearly define the need for and the purpose of the investigation--that is, the what, why, where, and when of the investigation. It will relate to the main theme of the report as indicated in the report contents and title.

- The purpose and scope of the report defines the objectives of the report and reflects the "title" and "contents". It will pertain only to the report (not to the project itself). The scope of the report describes the depth of discussion in developing the subject of the report.

- The methods and/or approach will be stated briefly and will be appropriate to the problem and purpose of study. New methods and approaches will need more detailed explanations than will standard methods and approaches.

- The introduction will describe the physical setting of the project area, giving only that information necessary to understand the data and interpretations.

- Previous work in the subject area will be discussed and properly referenced.

- Information obtained from outside sources and assistance from other persons or cooperating agencies will be acknowledged.

12-STEP METHOD OF MANUSCRIPT REVIEW

Step 6.--

BODY OF REPORT

Read the entire body of the report, keeping in mind that a good report will have all the following characteristics:

- It will present information to answer the purpose of the report and stay within the intended technical and geographical scope.

- All data will be as accurate, complete, uniform, and appropriate as possible. Any comparisons will use data for same or similar time periods. The data must be adequate to support all methods of interpretation and conclusions that may be reached. All data will be properly qualified and referenced.

- Mathematical and chemical equations and formulas must be accurate, clear, numbered, referenced, and appropriate to the problem and methods used.

- Any and all text discussion should be about the significance of the data presented in tables and illustrations--not a repeat of the data. Written permission to use copyrighted material in the report **must** be secured from the copyright holder.

- Text, tables, and illustrations should agree with each other.

- All discussion should be developed along the main theme of the report as indicated in the title, contents, and purpose and scope.

- All methods discussed should be relevant to the theme of the report. Discussions should answer the project goals and the purpose of the report.

- If appropriate, flow systems should be described (for example, recharge, discharge, and movement. Model assumptions should be discussed.

12-STEP METHOD OF MANUSCRIPT REVIEW

Step 7.--

SUMMARY and CONCLUSION

The summary, conclusions, or summary and conclusions generally wrap up the report. A summary is a brief reaccounting of the informative parts of the report. The conclusions are answers to questions addressed by the purpose of the report. The summary and conclusions are second in importance to the abstract and usually serve as the principal source of information for the abstract. In addition, the summary and conclusions generally must:

- Be a logical outgrowth of information developed in the report.
- Not contain or be based on information that is not in the body of the report.
- Culminate the theme expressed in the title and purpose and scope.
- Draw together and briefly reiterate the principal findings of the investigation.
- Provide solutions or answers to problems addressed in the introduction.
- Be as quantitative as possible and use numerical findings given in body of report.

12-STEP METHOD OF MANUSCRIPT REVIEW

Step 8.--

REFERENCES

The references list gives credit to the sources of nearly all non-original material discussed in the report. References follow these basic rules:

- If the list only contains references that are cited in the report, the list may be called references or references cited.
- If the list is more extensive and contains references not cited in the report, the list is called selected references.
- Bibliography is an exhaustive listing of pertinent literature.
- All literature citations in the text, table, and illustrations must be listed.
- References must be listed in proper style and format for the intended publication.

12-STEP METHOD OF MANUSCRIPT REVIEW

Step 9.--

ILLUSTRATIONS

Maps, cross sections, graphs, diagrams, line drawings, or photographs should be self explanatory.

Item to be reviewed on maps, sections, and graphs are as follows:

Maps

- Scale

    1. Bar scale if topographic base.

    2. Rake scale if other than topographic base.

- Land grid

    1. Latitude and longitude (at least two complete sets).

    2. Township and range.

    3. Other--explain or give credit.

- North arrow unless latitude and longitude tick marks and values are on map. Note map magnetic declination.

ILLUSTRATIONS Continued)

Step 9.--

- Base-map features

  1. Contours--identify interval and datum.

  2. Place names--all names mentioned or discussed in text, tables, and illustrations.

  3. Hydrologic and other physical features.

- Base-map credit--always identify, if possible; also identify photograph bases.

- Mapping credit--Always identify all geologic and hydrologic features derived from published sources.

- Explanations

  1. Label all lines, points, and areas, or explain them separately.

  2. All symbols, patterns, numbers, colors, and abbreviations. Use actual examples from the map.

- Title--Tell exactly what, where and when.

ILLUSTRATIONS (Continued)

Step 9.--

Sections

- Use the same vertical and horizontal scales, if possible, or express amount of exaggeration.
- View from east or south.
- Label end points.
- Show trace on map with labeled end points.
- If possible, use the same scale as that on map.
- Identify if and where other sections cross.
- Explain all symbols, physical features, and abbreviations.
- Cross reference with map by using same colors, symbols, and so forth.
- State title clearly.

Graphs

- Ascertain appropriateness of type of graph--Curve, line, bar, column, band, symbol, or any combination(s) of these.
- Label and explain all symbols, patterns, and abbreviations.
- Ascertain appropriateness of axes labels, grid, scale, and units of measurement.
- Verify agreement between title of graph and information depicted by graph.

12-STEP METHOD OF MANUSCRIPT REVIEW

Step 10.--

RE-EXAMINATION

At this point, all parts of the report have been reviewed. Now is time to go back and check it all over again. The reviewer has a good idea what the author has attempted to say, what the author really has said, and how the author has said it. A re-examination with all this in mind might disclose areas where additional improvement will be needed.

- The report should be free of agency policy violations.

  The title and main headings in the contents should reflect the theme of the report.

- The author should have responded positively to technical and editorial reviews.

- This also is the appropriate time to examine the format of the manuscript to determine that:

  - The report cover page uses a format standard for the publication series.

  - The cover contains a credit line for cooperators, if appropriate.

12-STEP METHOD OF MANUSCRIPT REVIEW

Step 11.--

VERIFICATION

Verification review is the process that is intended to make the report internally consistent. Internal consistency can be improved by use of the following check list.

- Report title should be the same, wherever it appears--on the cover, title page, and first page of the body of the report.
- Values in text, tables and illustrations should agree with each other.
- Wording and rank of headings in the contents should be the same as those in body of the report.
- Figure and table titles should agree with the lists in the contents.
- References in body of report should be complete, consistent, and listed in the references.
- Table format should be consistent.
- Pagination should be correct
- Arithmetic should be correct.
- Units of measurements should be consistent.
- Chemical, geologic, hydrologic, and other symbols should be standard and consistent.

VERIFICATION (Continued)

Step 11.--

- All geographic names in text, tables, and illustrations, must be shown on a map, disclaimed for a valid reason (if appropriate), or noted as being outside of map boundaries.

- Contours shown on maps must be supported by values placed on data-control points.

- Changes made to body of report during review also should be incorporated in the abstract and summary or conclusions, if appropriate.

12-STEP METHOD OF MANUSCRIPT REVIEW

Step 12.--

MANUSCRIPT PACKAGE

The manuscript package should be complete. It must contain all documents that the reviewers need for complete information regarding the report (for example, routing sheets, check lists, and the like). Most importantly, all past review copies of the report and the author's responses to review comments must be included.

The transmittal memorandum should contain:

1. Requests for special handling, if appropriate.
2. Cooperator publication clearances.
3. List of enclosures.
4. Significance of report

INSTRUCTIONS FOR TECHNICAL REVIEWERS

A thorough and competent review is essential to maintain the technical quality of Water Resources Division reports. The purpose of the review is to give a technical evaluation that will improve the report and eliminate errors that may lead to the embarrassment of the author and the Division. The following guidelines summarize critical policies and procedures in the report-review process.

Number of reviewers – At least two technical reviews are mandatory for all interpretive reports. Whenever possible, the reviewers should be selected on the basis of special knowledge or interest in the subject material of the report. At least one technical reviewer should be outside the District or Research Project office.

Role of reviewers – The role of the technical reviewer is to ensure the technical adequacy of the report. However, significant editorial discrepancies, particularly in organization, should be identified.

Specific items to consider during review –

- *Technical correctness* – Is the report technically valid? Are conclusions properly supported by correctly interpreted data? Are all computations correct? Are assumptions reasonable and clearly stated?

- *Readability* – Is it written for the intended audience, and with correct grammar, syntax, and a minimum of scientific jargon? Are illustrations and tables legible and readily understandable?

- *Title* – Is it explicit and does it reflect the objectives of the report? Generally the title should not exceed 12 words and, if appropriate, should give the project location and study period.

- *Abstract* – Does it state the purpose of the report? Is it informative? Does it describe the study and summarize pertinent results and conclusions? See pages 267–270, WRD Publications Guide (1982), Volume 1.

- *Introduction* – Does it clearly describe the problem(s) addressed by the report, state the objectives and scope of the report, present pertinent background information, and acknowledge significant help? See pages 265–266, WRD Publications Guide (1982), Volume 1.

- *Methods* – Were appropriate techniques used in the study? New methods should be described.

- *Body of manuscript* – Is it organized and presented in a logical sequence that contains the basic information, interpretation of that information, and the results or conclusions of the interpretations?

- *Illustrations and tables* – Are all necessary; do they clearly present basic information and emphasize relationships? Illustrations and tables should be interpreted and referred to in the text, but should be understandable without the text.

- *Conclusions or results* – Do they summarize the principal findings of the study and answer each of the objectives described in the introduction? Are they sound and properly documented? No information should be given that was not discussed in the body of the report. See pages 271–272, WRD Publications Guide (1982), Volume 1.

- *References* – Are all references cited in text included in this section? Are they cited correctly? Were pertinent references omitted in preparing the report?

- *Policy considerations* – See pages 23–24, WRD Publications Guide (1982), Volume 1.

SUGGESTIONS TO REVIEWERS

By L. A. Heindl

(Geologist, Office of the Area Hydrologist, ACA, Arlington, Va.)

INTRODUCTION

The Water Resources Division's report-improvement program was initiated to fill the breach left by the elimination of the old Branch Review Sections. With those sections gone, the full weight of responsibility for the quality of our reports was shifted back to the districts--particularly to the District Chiefs or District Supervisors, and to the authors. Simultaneously, the Division realized that with the disbandment of the Review Sections, the districts would need assistance to develop techniques and habits that would help them turn out reports at least equal to the quality of those the districts prepared with the aid of the Review Sections. The report-improvement program represents the Division effort in this regard, and this discussion of techniques of review is a part of this effort.

The report-improvement program initially had--and still has--one principal goal: to improve our reports. The program is working towards this goal along several different lines concurrently--through various training devices, improvement of report-planning techniques, assistance to districts and authors during preparation stages, salvage of completed but inadequate reports, and through facilitated communication between all individuals and sections dealing directly with reports. To implement the program, each Area Hydrologist has a Staff Assistant for report improvement, and each district has--or will have shortly--at least one specially trained Reports Specialist or Reports Advisor.

The process basic to the improvement of reports is review to insure that they meet certain standards of content, style, and format. "Suggestions to Authors" puts review in the framework of the Survey's responsibilities: "The Survey generally exercises its proprietary interest only to the extent of seeing that a report is scientifically and technically sound, will reach the proper audience, and will reflect credit on both the Survey and the author. To these ends, each report is reviewed by the author's fellow workers, supervisors, and staff officials, who bring to bear upon it their specialized knowledge, skill, and judgment to assure a sound product. In its final form each Survey report is the product of team effort in which many persons do their share--even though most of them remain anonymous." Thus, review in the Survey includes critical evaluation of the technical content and the editorial quality of the text, illustrations, and tables, and of the proposed medium of publication.

Because review involves both technical content and editorial quality, and because opinions on editorial quality are always somewhat subjective, the questions of how far editorial review should go and how to distinguish between technical and editorial review are frequently argued among--and between--reviewers and authors. In practice, however, the two are closely related, as described in the following quotation from "Suggestions to Critics," a pamphlet issued in 1949 by the Geologic Division.

"The quality of any scientific manuscript is a function of two commonly unrelated variables--the quality of the research, and the effectiveness of the presentation. The criticism of a manuscript is an equally two-sided problem--examining the soundness of the data, reasoning, and conclusions (reviewing); and helping the author to transmit his ideas into the mind of the reader with a minimum of distortion (one definition of editing). Everyone agrees that the critic's chief duty is to review, in the sense above defined. *** Such editing as the critic feels impelled to do *** should make it possible for the average, even nongeologic, reader to understand what the author is trying to say. *** If editing is defined as making 'more intelligible,' this function is legitimate and should be one of the duties of the critic ***."

The close relationship is put more bluntly by the semanticist, Wendell Johnson: "***clarity is a prerequisite to validity***. (Writing) can be clear without having validity, but if it is unclear its validity cannot well be determined."

For our purposes, editorial review is limited largely to making a report grammatically correct; it includes attention to details such as spelling, punctuation, and word order, and more importantly, to clarity, syntax, and the proper use of words. When done by nonprofessional colleagues, it can be valuable for suggestions as to how to clarify and simplify technical explanation in a report intended for nontechnical readers. But in general, editorial review is mostly a mechanical application of the customs of good English usage and typographical style appropriate to the publication medium. By and large, editorial review should be completed before a report is submitted for technical review.

Technical review, in contrast, has the broader responsibility of making certain that the report is technically sound and will reach and be clear to its intended audience. Consequently it involves attention

to the validity of both the technical data and its use, to the effectiveness of the organization, and to the clarity of its presentation of the material. Thus technical review includes many editorial functions. These editorial functions, however, should supplement and refine what is already an editorially adequate manuscript.

But how does one review? What is a good report? How does one assure a "sound product"? How does one know that a reviewer has been effective? These questions, and others, are discussed in this summary of review practices, which also recapitulates principles, outlines some techniques, and offers a few criteria for reviewing reports and for evaluating their review.

What Is a Good Report?

A good report, first and most importantly, has something to say to the intended reader. To do this it must be presented at a level of explanation suitable to the intended reader and in the proper publication medium. Other characteristics of a good report are outlined below in the general order of importance:

1. It is technically sound.

2. It is well organized.
   a. The title indicates clearly the subject.
   b. The purpose is expressed clearly and explicitly.
   c. The data are pertinent to the purpose.
   d. The reasoning by which the interpretations and conclusions are reached are given adequately and clearly.
   e. The conclusions are valid.
   f. The important factors are properly emphasized and supporting factors are subordinated.

3. It is timely.

4. It is brief, consistent with soundness and clarity.

5. It is attractive.

When Is a Manuscript Ready for Review?

A manuscript is ready for review when an author has done everything possible to make it meet generally accepted standards of technical soundness and editorial adequacy. This implies that he has taken an objective view of the report, made it a rational development of and contribution to the current state of knowledge in its field, and made all the mechanical checks necessary to make the text, tables, and illustrations accurate and mutually consistent. In addition, the manuscript presented for review should be reasonably clean and clear, and it should be accompanied by the background information that is pertinent to the review, including previous reviewers' comments or a digest of them.

PRINCIPLES OF REVIEW

Purpose

The purpose of review is to maintain high quality by suggesting needed technical and editorial changes that will improve the report and that will eliminate errors which may lead to the embarrassment of the author and the Survey. In addition, review should help an author improve his subsequent reports, and should acquaint him with procedures he can use himself in the review of the reports of others.

Qualifications of Reviewers

Reviewers should be, as "Suggestions to Authors" puts it, "specially qualified by their knowledge of, and interest in, the problems discussed." These certainly are the main prerequisites. But they also should have the confidence to pass judgment on the quality and validity of a report, and to point out deficiencies and suggest improvement. They should remember that their principal objective is to improve the report, and they should do this willingly. Their attitude towards a report should be objective, but nonetheless careful and considerate. Perhaps the attitude is best summed up by the term used somewhere by Robert Louis Stevenson, "respectfully skeptical." In addition, a reviewer should be able to state his opinions clearly, be firm but tactful, and to be willing to accept responsibility for his suggestions. Last but not least, his comments should be legible.

Responsibilities of Reviewers

All professionals are expected to make a certain amount of time available and to assume responsibility for critically reviewing and discussing a colleague's reports as a normal part of their duties. As a reviewer, the professional's first responsibility is to assure the technical soundness of the report. To do this best, all suggested changes should be constructive and specific, and the reviewer should give reasons for and be prepared to justify his suggestions. He should keep in mind the purpose of the report and whether the report will fulfill its purpose. He, of course, has the responsibility of being professionally honest, regardless of how considerate he may wish to be personally. As far as possible, he should leave the author's "style" alone, commensurate with accuracy, clarity, and brevity.

Amount of Review

The amount of review needed by a report will depend on the quality of the report. Probably it is not so much a matter of how much review as of how thorough are the reviewers. In general, a report can benefit from comments made by several technical reviewers, and certainly each report should have at least enough objective review to assure its technical soundness and editorial clarity. If a technical reviewer spots major faults in a report, such as misuse of basic concepts, he should note these and return the report to the author without spending time on details. A report may need editorial review twice--once, when it is the author's final draft; and again, after it has been revised following the final technical review.

Alternate Methods of Review

Review may be concurrent or consecutive. That is, a number of copies may be sent out to several reviewers simultaneously, or one copy may be sent to several reviewers in turn. The advantage of concurrent

review is that it is faster, and the author has an opportunity to compare different reviewers' comments before making his revision; the main disadvantages are that the author may be faced with conflicting suggestions, and the reviewers' time is wasted because several may make the same suggestions; also, usually none of the original reviewers see the revised report. The advantage of consecutive review is that each reviewer, except the first, sees a draft that has been revised with the benefit of earlier reviews; disadvantages are that the method is time-consuming and the author may waste time making unneeded revisions of revision to satisfy successive reviewers' comments.

Review also may be done individually, by small groups, or by small groups including the author. Review is rarely done by a group that does not include the author unless the author is completely unavailable. The advantage of review by individuals is that it is the quickest; the small group has the advantage of bringing together several reviewers' opinions simultaneously; and by including the author the group has the advantage of working out problems with the author as they arise and in effect revising the report as it is reviewed. In addition, review by groups is an excellent mechanism for training reviewers.

Regardless of whether review is concurrent or consecutive, and whether it is done individually or by small groups, critiques should be prepared by the reviewers.

TECHNIQUES OF REVIEW

Many techniques are involved in the process of review. Guidelines are offered here for two important aspects--mechanics and criteria--which are used concurrently.

Mechanics of Review

Review should follow logical procedures as an aid to the reviewer and to assure the author of the most perceptive possible criticism. The procedure suggested here is for the review of a long report and is stylized into steps for convenience of presentation. The procedure can be condensed for short reports and will vary with different reviewers.

1. Acquaint yourself with the background of the report as detailed in the accompanying letters, memos and critiques of previous reviewers, which should accompany the report.

2. Skim through the whole report to get an overall impression by means of the introduction, conclusions, and abstract in that order; the section headings, tables, and illustrations and their titles; and the topic and terminal sentences of paragraphs and sections.

3. Study and compare the abstract, introduction, and conclusions; are they consistent?

4. Read the body of the report carefully. Check for:
   a. Technical soundness, including the significance of the precision of quantitative data.
   b. Consistency between text, illustrations, and tables.
   c. Presentation--organization, coherence, pertinence, clarity.
   d. Expression--effectiveness and acceptability.

5. Give the report a second quick scanning to put the report and your comments into perspective and to refocus your attention on the principal problems. Reread the critiques of previous reviewers and prepare your own.

The review of a long report usually results in three types of comments: (1) brief marginal notes and interlinear changes on the manuscript; (2) more extensive comments on separate sheets; and (3) a critique which summarizes general comments and discusses the principal suggested changes. These may be consolidated for short reports, but--except for abstracts--a critique is a must.

Marginal comments should be kept to a minimum; it is far better to indicate the questioned material with a reference number or letter in the margin and to make the comment on a separate sheet. Few things are more discouraging to an author than to see page after page nearly obliterated by comments. The reviewer also should avoid writing with too hard, or too soft, pencils, and using too small a handwriting--combined they lead only to eyestrain, fatigue, and irritation.

Some reviewers and authors believe that the reviewer probably can best aid the author by raising questions rather than making changes. For example, a statement such as, "This sentence seems to imply such and such. Is this consistent with your previous statement on page so-and-so?", is preferred to a direct revision. Other reviewers and authors prefer the changes. The advantage of the question method is that it does not presume to speak for the author and permits the author to work out his own solution to the problem. The disadvantage is that it slows down revision; the author must think through the reviewer's question--which might be unclear or misinterpreted--and devise his revision accordingly. The advantage of the "revision" method is that it is quicker; the reviewer usually has a ready solution for most questions he raises and has the revision at his pencil point even as he makes his comment. The disadvantage, of course, is that he may not present the author's point of view or may change the author's meaning. Both systems are widely used, and usually the system depends on the subject matter and on the reviewer.

In general, however, technical reviewers should take care that they review rather than revise. If detailed comments and editorial changes become excessive, the report should be returned to the author for additional revision necessary to complete the preparation phase of the report. Whenever possible the reviewer should correspond, or better yet, confer with the author, particularly when extensive changes are suggested.

Criteria for Technical Review

Criteria for technical review encompass all aspects of a report--technical soundness, editorial quality, and appropriateness to the intended audience. The principal responsibility of a reviewer, however, lies in making certain the technical quality of a report is high. The criteria are presented in the form of questions because review is basically a questioning process and because it would take far more room to spell out even the main answers.

These questions, and the more specific ones to which they lead in the review of individual reports, provide an idea of the scope of technical review. These questions should be used by authors and their supervisors, as well as by reviewers, in the evaluation of reports, and as will be discussed subsequently--in the evaluation of the reviews themselves. The questions are not in an order of rank, nor are they in the order in which they might present themselves in the review of any particular report.

1. Is the statement of purpose clear and explicit? Can the purpose be fulfilled through the concepts and with the methods available? If not, does the report offer new concepts and methods or does it clearly establish the limitations of the available means? For example, perennial yield of a basin could only be estimated, and then only with the use of empirical and arbitrary assumptions.

2. Is the information worth a report of the type planned? For example, most well-site reports do not warrant the effort needed to make them Water-Supply Papers. On the other hand, is the report adequate for the stated purpose? Will the proposed publication medium reach the intended reader group? A comprehensive river-basin study should not be buried in a short open-file report.

3. Are previous studies adequately referred to and are the methods used and concepts presented up to the current "state of the art"?

4. Are the data adequate to cope with the stated purpose, and has the author done as much with the data as could be done within the scope of the stated purpose?

5. Are proper methods used to reduce the data--that is, to condense, simplify, or abstract pertinent parameters from the raw records? Are the concepts and qualifying assumptions, and the statistical and graphical methods appropriate to the reductions presented? For example, averaged well yields without reference to source rock or geographic distribution cannot be presented as a meaningful index of the potential yield of an area.

6. Are phenomena classified and defined correctly and completely? For example, well yields cannot be equated with formation yields without specific qualification regarding the conditions under which the well yield data were collected.

7. Are data properly weighted as to their reliability and are the limits of reliability presented unequivocally. Are numerical data rounded off to their proper significant figure, particularly in their use in interpretations and conclusions? Are arithmetic and mathematical presentations correct, complete, and limited to their proper scope?

8. Are analogies, extrapolations, and interpolations made within the scope of the data presented? Are abstract concepts made pertinent by being illustrated by concrete examples from the data?

9. Has the method of multiple working hypotheses been used, or has the author restricted himself only to those facts that support single hypothesis?

10. Do the data support the conclusions? Do the data support the inferences and interpretations drawn from them, particularly to the degree implied? Are data, assumptions, opinion, and interpretations properly identified and qualified as to accuracy and completeness? Is each conclusion weighted on the basis of the reliability of the individual components which make up the conclusion? For example, the reliability of a water budget should be clearly related to the reliability of the weakest assumption that went into its computation.

11. Are all the data necessary to support or corroborate the conclusions presented adequately?

12. Are the recommendations made for further studies justified on the basis of deficiencies in knowledge that showed up during the investigation?

13. Has the author looked beyond the bounds of his particular problem to indicate its relationship to the subject as a whole?

14. Is the report unified? Does all material relate to the purpose? Do text, illustrations, and tables supplement each other? Are all the illustrations and tables necessary? What is irrelevant? superfluous? parenthetic? digressive? just plain padding? Do spot checks indicate consistency of text, tables, and illustrations?

15. Is the report coherent? Is its development, from purpose through data and interpretations to conclusions, rational and thorough? Does the report progress logically from point to point and topic to topic with enough transitional material to show the relationship of its several parts?

16. Does the report emphasize its contents realistically and appropriately in keeping with its stated purpose? Do the principal facts and findings stand out clearly, or are they buried by a wealth of detail describing minor features?

17. Does the report communicate effectively with--gets its message across to--the intended reader? Is it expressed clearly enough so that its validity can be judged fairly? Do the titles of illustrations and tables indicate their purpose and significance, or just list their component parts; do the illustrations and tables show what the author says they do? Is the form of expression, regardless of originality and style, within the bounds of ordinary English grammar, accepted definitions, and the understanding of the intended reader?

18. Does the report present what the title states, and do the section headings outline a representative organization of the material?

19. Does the abstract include the significant findings and present the main contributions of the report? Is it specific in what it offers?

20. Does the report comply with Survey policy?

EVALUATION OF REVIEW

Because review is used to assure quality in reports, the quality of the review itself may influence the quality of the report. Consequently, reviews themselves need to be evaluated so as to assure those with the responsibility to forward and approve reports that the reports have received competent professional criticism.

Reviews fall short of being as good as they should be for three general reasons. First, the reviewers concentrate on only a part of their responsibilities; for example, they may revise and pick editorial or arithmetic nits but fail to evaluate the technical concepts or the completeness of the presentation. Second, reviewers may be cursory and complaisant, and fail to give a report the close study a technical review demands. Some reviewers are so familiar with the project or the report that they fail to miss what the report has omitted or unconsciously supply steps that the report has skipped. Third, reviewers may fail to be objective in their evaluation and condemn the report because it is not in accord with their views or revise it because its style is personally unacceptable.

An author's evaluation of a review, of course, is immediate and direct, but he should summarize his acceptance or rejection of a reviewer's principal comments to facilitate further evaluation of his revised report. District Chiefs and Area Hydrologist, however, have the responsibility of determining whether individual reviewers have fulfilled their responsibility. It should be just as reasonable to reject an unacceptable review as it is to return an unacceptable report.

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REQUEST FOR COMMENTS AND SUGGESTIONS

This report is preliminary and is not to be considered as a statement of review policy. We--the four Area Staff Assistants--need and would appreciate your comments and suggestions so that eventually we can put out a practical guide to review techniques. Please send them directly to me, Atlantic Coast Area office, Arlington, Virginia, or through the Water Resources Bulletin.