Training
Aids for
Dam
Safety

MODULE:

DOCUMENTING AND REPORTING FINDINGS FROM A DAM SAFETY INSPECTION

TADS

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Subject-Matter-Expert Panel

Thomas A. Brown
Bureau of Reclamation,
Chairman

Robert H. Dalton
State of Illinois

Timothy McCleskey
Corps of Engineers

Witold J. Pawlikowski
Federal Energy Regulatory
Commission

Norman L. Ryker
Department of Agriculture

PREFACE

There are presently more than 80,000 dams in use across the United States. Like any engineering works, these dams require continual care and maintenance, first to ensure that they remain operational and capable of performing all intended purposes, and then to preclude endangering people and property downstream.

The safety of all dams in the United States is of considerable national, state, and local concern. Given that, the principal purpose of the TADS (Training Aids for Dam Safety) program is to enhance dam safety on a national scale. Federal agencies have responsibility for the safe operation, maintenance, and regulation of dams under their ownership or jurisdiction. The states, other public jurisdictions, and private owners have responsibility for the safety of non-Federal dams. The safety and proper custodial care of dams can be achieved only through an awareness and acceptance of owner and operator responsibility, and through the availability of competent, well-trained engineers, geologists, technicians, and operators. Such awareness and expertise are best attained and maintained through effective training in dam safety technology.

Accordingly, an ad hoc Interagency Steering Committee was established to address ways to overcome the paucity of good dam safety training materials. The committee proposed a program of self-instructional study embodying video and printed materials and having the advantages of wide availability/marketability, low per-student cost, limited or no professional trainer involvement, and a common approach to dam safety practices.

The 14 Federal agencies represented on the National Interagency Committee on Dam Safety fully endorsed the proposed TADS program and have underwritten the cost of development. They have also made available technical specialists in a variety of disciplines to help in preparing the instructional materials. The states, through the Association of State Dam Safety Officials, also resolved to support TADS development by providing technical expertise.

The dam safety instruction provided by TADS is applicable to dams of all sizes and types, and is useful to all agencies and dam owners. The guidance in dam safety practice provided by TADS is generally applicable to all situations. However, it is recognized that the degree to which the methods and principles are adopted will rest with the individual agency, dam owner, or user. The sponsoring agencies of TADS assume no responsibility for the manner in which these instructional materials are used or interpreted, or the results derived therefrom.

ACKNOWLEDGMENTS

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William S. Bivins, Federal Emergency Management Agency
Donald L. Basinger, Soil Conservation Service
Joseph J. Ellam, Association of State Dam Safety Officials
(Commonwealth of Pennsylvania)
Marshall L. Silver, U.S. Committee on Large Dams

TADS PROJECT MANAGER

Chris J. Veesaert, Bureau of Reclamation

TADS TECHNICAL ACTIVITIES COMMITTEE

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Norman Miller, Soil Conservation Service, Vice Chairman
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Harold C. Buttrey, Tennessee Valley Authority
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(State of Colorado)

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MODULE INTRODUCTION

DOCUMENTING AND REPORTING FINDINGS FROM A DAM SAFETY INSPECTION

MODULE INTRODUCTION

OVERVIEW OF THE MODULE

The purpose of this module is to teach how to document and report findings from a dam safety inspection. You will learn how to write an inspection report that is complete and accurate. This module will explain the inspection documentation process from the importance of background information to the necessity of a complete and updated Dam Safety File.

OBJECTIVES

At the completion of this module, you will be able to:

- Describe the generally accepted techniques for documenting a dam safety inspection.
- Describe the importance of reviewing your notes and other data before writing your report.
- Select the proper formats for writing an inspection report.
- Determine the appropriate depth and scope for each type of inspection report.
- Write a comprehensive inspection report from introduction to recommendations.
- Review and check your inspection report.
- Describe the importance as well as the content and upkeep of a Dam Safety File.

HOW TO USE THIS MODULE

This module is designed to be used in conjunction with other Training Aids for Dam Safety (TADS) modules. The TADS Learner's Guide lists all of the TADS modules and presents a recommended sequence for completing the modules. You may want to review the Learner's Guide before completing this module.

MODULE INTRODUCTION

CONTENTS OF THIS MODULE

This module is divided into two units followed by two appendixes:

- **Unit I. Documenting The Inspection:** Presents information on the importance and various techniques of documenting a dam safety inspection prior to the actual writing of a report.
- **Unit II. Writing The Inspection Report:** Presents instruction on evaluating your information, writing your inspection report, and updating the Dam Safety File.
- **Appendix A. Sample Report Formats:** Provides examples of several different dam safety inspection report formats.
- **Appendix B. References:** Lists recommended references that can be used to supplement this module.

DESIGN OF THIS MODULE

This module is a self-paced instructional package. You may move through it as slowly or as rapidly as is comfortable for you. You may stop and review the material at any time. Since the module is designed for independent study, you may take breaks whenever you wish.

There are several components of this module that are designed to help you master the material being presented. These components include:

- Text Instruction
- Unit Exercises
- Final Review Exercise

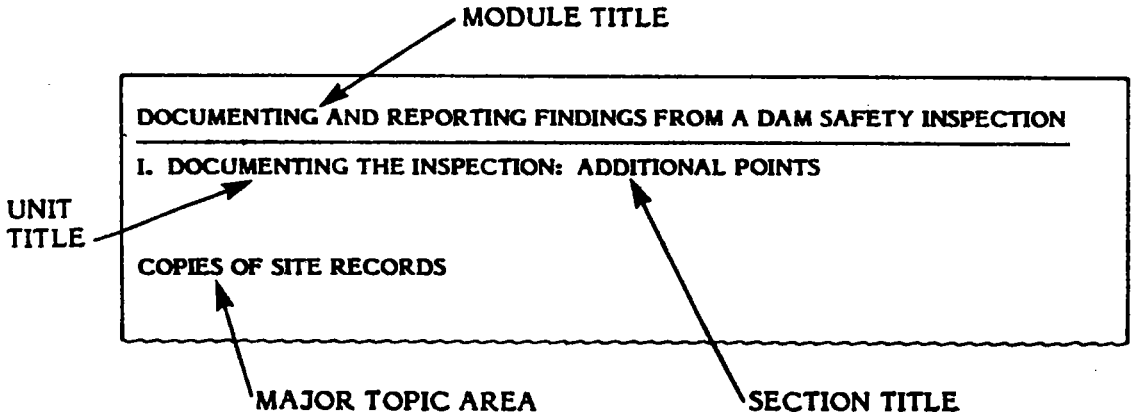
We will now look at how you will use each component individually.

MODULE INTRODUCTION

Text Instruction

The text instruction is presented in this workbook. Always begin by reading the text instruction since it explains how to proceed through a given block of instruction.

As you read the text instruction, you will notice that every page has a header. The header is designed to let you know where you are in the module. Let's look at how information is presented in the header.



Unit Exercises

Both units include exercises to help you determine how well you are mastering the information presented. These exercises are **not** tests and will not be used to grade you or to rate your performance. Rather, the exercises are tools to help you assess your own learning.

Instructions for completing the exercises appear at the beginning of every exercise. Answers to the exercises are presented immediately following each exercise.

Final Review Exercise

After reading the text instruction, you will complete a final review exercise. The final review exercise is designed to help you learn more about your organization's expectations for inspection reports.

REQUIRED MATERIALS

To complete this module, you will need the following materials:

- This workbook and a pencil or pen
- Your organization's inspection report guidelines
- A copy of an inspection report from your organization (for the Final Review Exercise)

You may want to find a quiet place to work while you study these materials.

UNIT I

DOCUMENTING THE INSPECTION

I. DOCUMENTING THE INSPECTION: OVERVIEW

INTRODUCTION

Without proper documentation at the time of the inspection, it is extremely difficult to write a complete and accurate inspection report later. It is important, therefore, to use various techniques to record information that you will present in your reports. The most commonly used and accepted methods for recording information include:

- Written or tape-recorded notes
- Visual records
  - Photographs
  - Videotapes
  - Annotated drawings and sketches

You will discover that complete and accurate documentation of the inspection is essential when it comes time to actually write your dam safety inspection report.

UNIT OBJECTIVES

After completing this unit, you will be able to:

- Describe the various techniques used to record information during a dam safety inspection.

- Explain the importance of complete and accurate documentation of an inspection.

I. DOCUMENTING THE INSPECTION: DOCUMENTATION TECHNIQUES

INTRODUCTION

There are several methods you may want to use when documenting a dam safety inspection. The methods used should help you to record all your findings and observations. You then will use these records to write your inspection report.

WRITTEN OR TAPE-RECORDED NOTES

During an inspection of a dam, you should be sure to take detailed notes, whether written or tape-recorded. These notes should contain information that you can use later to write your inspection report. Your notes should be clear and specific, leaving absolutely nothing to memory. They should be organized in such a way that they document the present condition of each feature of the dam. In addition, any potential problem or defect that was identified during the records review should be noted and, during the inspection, its current condition should be recorded. The information typically recorded in written or tape-recorded notes includes:

- ✓ Inspection team participants.
- ✓ Climatic conditions, especially rainfall (amounts if known), immediately prior to and at the time of the inspection.
- ✓ Operating conditions such as reservoir and tailwater elevation, spillway and outlet discharge, etc.
- ✓ Condition of all inspected features.
- ✓ All location, elevation, and description information.
- ✓ All quantitative measurements, including instrumentation readings and surveying results (if taken).
- ✓ Any safety hazards that could pose a threat to the public or project personnel.
- ✓ Description of changes in the upstream and downstream areas.
- ✓ Notations on any verbal information gathered, prior to or during the inspection, from operating personnel and other individuals who are not members of the inspection team.

Figure I-1 presents a brief excerpt from a typed transcript of tape-recorded notes. The inspector spoke into the tape recorder as he walked through his onsite inspection. It is evident in the excerpt that the inspector tried to be as specific as possible in his descriptions. He gave measurements frequently, and when he reviewed the typed notes, he added a sketch and handwritten notes for further clarification.

Continued . . .

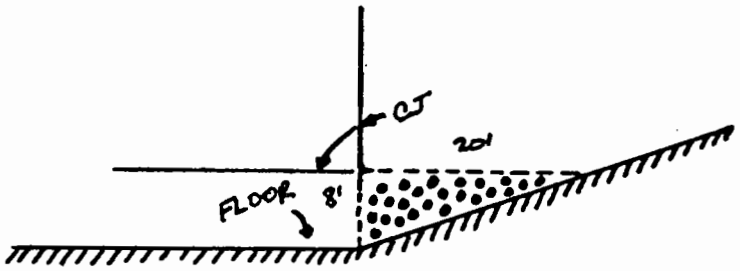
WRITTEN OR TAPE-RECORDED NOTES (Continued)

FIGURE I-1. EXCERPT FROM TAPE-RECORDED NOTES

This is the beginning of the Rackville Dam Unit 5 Power Waterway Inspection - June 8, 1981.

The Unit 5 draft tube was inspected by divers - notes are on the drawing. I am now in the spiral case in the left chamber. There is a leak in the lower left side of the gate right at the corner. Water depth in this chamber is approximately 2 inches. The leakage is minor to moderate. [There is a hole in the ceiling of the left chamber and it looks like it was formed about 3' long, 6" wide, 9" deep, centered in the left chamber ceiling approximately 8' upstream from the gate. The long dimension is transverse~~d~~ to the flow. Standing at the gate looking back up to the hole, looks like it rounds to a circular dimension of about 12" or 15".] On the left wall at the point where the floor starts to go up toward the wicket gates, there are several holes that appear more like pitting, maximum of 1-1/2" deep and the pitting occurs right at construction joints. It begins at the vertical construction joint and goes along the wall up the slope and it stops at a horizontal construction joint about 7' above the floor before the floor starts sloping. One typical pit is 1-1/2" deep and 3-4" in diameter. It looks like a bad ~~poor~~ pour or possibly caused by the water changing direction from horizontal to upward flow as it goes toward the gate. So the total dimension of the area that is pitted is about 20' horizontal, 8' vertical, sloping from lower left to upper right as the floor goes up.

THIS IS THE INTAKE SHAFT



WRITTEN OR TAPE-RECORDED NOTES (Continued)

INSPECTION TIP: Remember, there is no harm in having lots of notes. The problems occur when notes are either incomplete or inaccurate. You should record any and all information that you feel is important. Always be sure to note any unusual behavior or conditions, no matter how seemingly insignificant. Such notations may be the forewarning of a new or developing unsafe condition, and you may be able to make sense of it later at the office as you look at all the information about the dam.

Written Vs. Tape-Recorded Notes

Unless your agency has a specific policy on how notes will be taken, you will need to decide whether to use written or tape-recorded methods for recording information during your inspection. Listed below are some of the advantages and disadvantages of using written and tape-recorded notes.

Advantages . . .

Written Notes

- Provide more of a permanent record.
- Do not require any special equipment.
- Can combine sketches with written notations.

Tape-Recorded Notes

- Easier to say a lot and, therefore, capture more information.
- Easier to use when recording information about photographs.
- Easier to use when raining, but hard on the recorder.

Disadvantages . . .

Written Notes

- Takes time to write down information.
- May be difficult to read if handwriting is poor.
- Difficult to do when it is raining.

Tape-Recorded Notes

- Dependent on having equipment that is in good working condition (batteries may fail, inadequate microphone may not pick up all the information, background noise may interfere with recording, etc.).
- Tapes must be transcribed. Transcriber may not be able to decipher garbled information.
- Tapes could break or be erased.

Continued . . .

I. DOCUMENTING THE INSPECTION: DOCUMENTATION TECHNIQUES

Written Vs. Tape-Recorded Notes (Continued)

☞ **INSPECTION TIP:** Never rely solely on the use of tape-recorded notes. If you choose to record the majority of your inspection notes using a tape recorder, always record some data in a written format to serve as a backup in case you encounter problems with the tape-recorded notes. The combined use of written and tape-recorded notes allows you to take advantage of the good points of both methods.

Using Checklists

You may choose or be required by your agency to use a checklist for taking notes or for actually documenting the inspection. The two common types of checklists used to document dam safety inspections are . . .

- **General Checklists:** General checklists provide broad coverage of the features "typical" for the type of dam being inspected. A general checklist can be used to assure coverage of all features of the dam. However, this type of checklist will not identify specific inspection objectives.

- **Site-Specific Checklists:** Site-specific checklists address the specific dam being inspected, and its particular features. Site-specific checklists may already exist for some dams. However, these checklists should be updated if the dam has been modified or rehabilitated.

Each type of inspection may have its own checklist format, and the particular format used for an inspection often is predetermined by you or your organization.

The benefits of taking notes with a checklist are:

- A checklist is easy to follow and comprehensive (if properly prepared).

- A checklist allows you to make comments or take photographs in response to a predetermined list of features and conditions at the dam site.

A drawback of using the checklist format is that it is sometimes too "easy"; that is, an inspection team will limit itself to only those items specified by the predetermined list and will not inspect beyond that list, or the team will not fully describe conditions. As a dam safety inspector, it is important that you not limit yourself to documenting only the items presented by the checklist. Always include any information that you feel is important or necessary in your inspection reports. Also, you should revise the checklist for each inspection, as needed.

Sample checklists are presented in the Appendixes to the module entitled Preparing To Conduct A Dam Safety Inspection.

I. DOCUMENTING THE INSPECTION: DOCUMENTATION TECHNIQUES

Reference Conventions

Convention dictates that when you refer to right or left on a dam, your perspective should always be facing downstream. For example, if you record that a deficiency is on the right abutment, then that abutment would be the one on your right-hand side when you are standing on the crest looking **downstream.**

Following this convention will help individuals who use your notes or report to orient themselves correctly. Also, confusion about where deficiencies were observed will be eliminated.

VISUAL RECORDS

Another method of notetaking is the use of visual records. This form of recordkeeping visually illustrates any features or phenomena that you and the other team members observe during a dam safety inspection. The three types of visual records generally used during a dam safety inspection are:

- Photographs
- Videotapes
- Annotated drawings and sketches

Each of these three types of records can be a very effective means of recording information and can be included as part of the report.

Photographs

Photographs are an excellent means of notetaking, and they provide a permanent record of current conditions for future comparisons. They also provide an essential element to your final, written inspection report.

Taking Photographs

It is recommended that you use a single-lens-reflex, 35mm camera to take photographs during an inspection. This type of camera allows for the use of a wide-angle or telephoto lens to better record specific features, as appropriate. If you do not have a 35mm camera at your disposal, you can use pocket or instant cameras. Using an instant camera may be helpful since you can see the quality of the photographs while onsite. Also, instant photographs can be used for any immediate consultations that may be necessary back at your office. Color photographs are preferred to black-and-white prints because the color of certain deficiencies is important inspection information (e.g., changes in the color of concrete).

Continued . . .

I. DOCUMENTING THE INSPECTION: DOCUMENTATION TECHNIQUES

Taking Photographs (Continued)

INSPECTION TIP: Make a written or tape-recorded note of the frame number, what the photograph portrays, where the photograph was taken, and the direction from which the photograph was taken and other reference information (e.g., station, elevation, monolith number, etc.). After the photographs have been developed, time has lapsed and you may be looking at a great number of photographs, and some may be from other dams. Having notes about the photographs taken will help you remember important information about the photographs after they are developed.

You should take a large variety of photographs during each inspection, including both wide (overall) shots and close-up shots of features. Also, you may find it helpful to take a series of photographs that later can be taped together to create a panoramic view of the dam and its features. Remember, there is no such thing as "too many" photographs.

When choosing the position from which to take your photographs, select the camera angle that best illustrates the feature being inspected. Whoever is reading the final inspection report should be able to clearly see and understand what you are trying to illustrate about each feature. Your photographs should present an exact, pictorial essay of what you and the other team members saw. The pictures should visually recreate the inspection so that the readers feel as if they were actually at the dam site.

There are three camera positions from which you may choose when taking your photographs:

- **A similar position as before:** This allows you to compare the latest photographs with earlier ones.
- **A different angle than before:** This allows you to capture a different aspect of the feature than was photographed previously.
- **A variety of angles:** This allows you to record the feature to be studied from a number of different directions and to highlight the different surrounding characteristics.

Careful study of earlier photographs provides an excellent method of reviewing the condition of the soon-to-be-inspected dam. Such careful review of previous pictures is also important so that you can take your photographs of the dam features from similar perspectives.

Continued . . .

I. DOCUMENTING THE INSPECTION: DOCUMENTATION TECHNIQUES

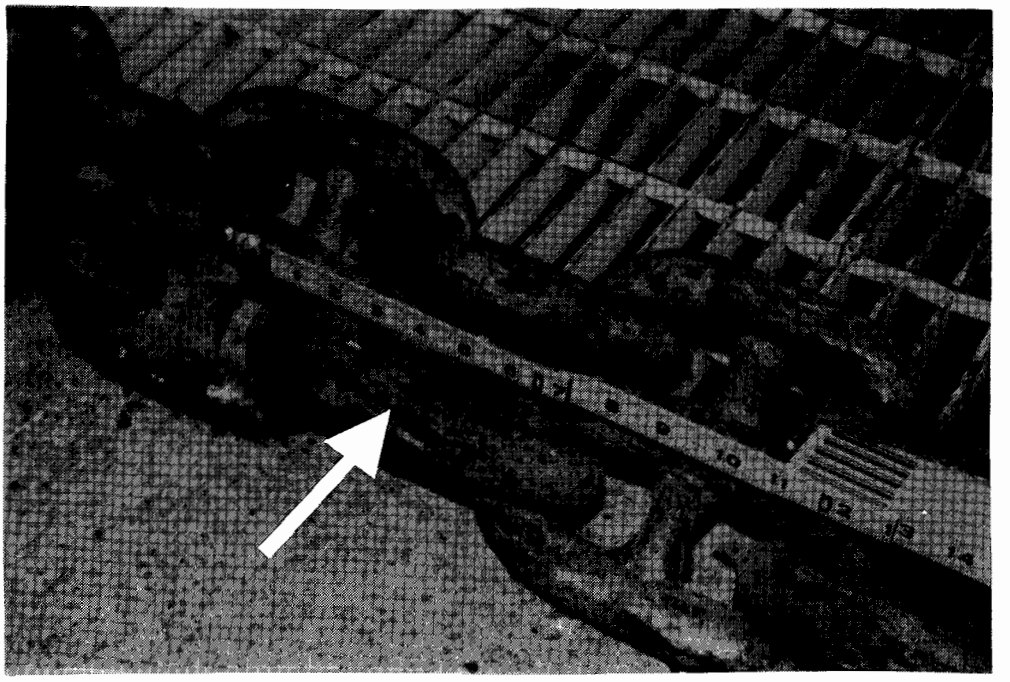
Taking Photographs (Continued)

One other factor you should take into consideration when choosing camera position is the quality of available light. Poor lighting obviously will result in poor pictures. Choose your camera position so as to make the most of angle and lighting. Also, watch out for shadows that will block out important details or sun in the camera lens.

INSPECTION TIP: It is always helpful to include recognizable objects in your photographs, providing, whenever possible, references for location and scale. For detail photographs, you can indicate scale by using a familiar object such as a pencil or film box and placing it next to the object to be photographed. A measuring tape or ruler, if properly placed, can help show the approximate size of such aspects as a joint opening or the width of a crack. In fact, using a ruler is preferable to using other objects.

Figure I-2 presents a photograph that was taken during an inspection. The inspector placed a ruler in the picture to indicate the size of the problem.

FIGURE I-2. SAMPLE INSPECTION PHOTOGRAPH



(Photo 23. Oak Run Dam - Corroded Spillway Gate Hoist Chain. (2/15/88)

I. DOCUMENTING THE INSPECTION: DOCUMENTATION TECHNIQUES

Labeling Photographs

Notice how the preceding photograph is labeled. Once photographs are developed, they should be labeled with the following information . . .

- Photograph number
- Name of the dam
- Description of what is being shown in the photograph
- Date the photograph was taken

Also you may want to use paste-on arrows to point to specific features, deficiencies, and conditions.

Videotapes

A videotape, with or without audio, can be used in place of photographs for either general or specific coverage of a dam's features. Divers frequently will use a closed-circuit television camera during an inspection to make a videotape. The use of closed-circuit television cameras provides two benefits: it documents the inspection, and it allows for instructions to be given to the divers. Such instruction of divers is especially useful when you are working with divers who are not experienced **inspection** divers.

☞ **INSPECTION TIP:** It is important to include references for location and scale in the videotape footage as you would in a still photograph. Location references can be achieved by beginning with a wide shot of the area to be videotaped and then slowly changing to a close-up shot. Measuring devices or common objects can be used to indicate the dimensions of a feature or deficiency. If a measuring device is used, make sure it is large enough to be seen clearly on the videotape.

There are both advantages and disadvantages to documenting an inspection with videotapes. The quality of a videotape record is often not as good as that of photographs. It is difficult to compare previous photographs or old videotape footage with more recent videotape footage. This difficulty may lessen your ability to determine what changes have occurred over time. However, the ability to combine audio and visual records is a definite advantage. The audio portion of a videotape can be an excellent means of providing a general perspective on, or introduction to, a dam's past and current deficiencies.

If videotape is used to document a dam safety inspection, you also may want to take still photographs. Currently, videotape is best used to supplement still photographs.

I. DOCUMENTING THE INSPECTION: DOCUMENTATION TECHNIQUES

Annotated Drawings And Sketches

Drawings and sketches provide graphic representations of a dam feature or condition that is being evaluated during an inspection. Drawings are often helpful forms of notetaking because they can document and show the location of a particular deficiency. In general, the following two types of drawings are useful for inspection documentation:

- Sketches can be drawn of major features or of a localized area of interest.

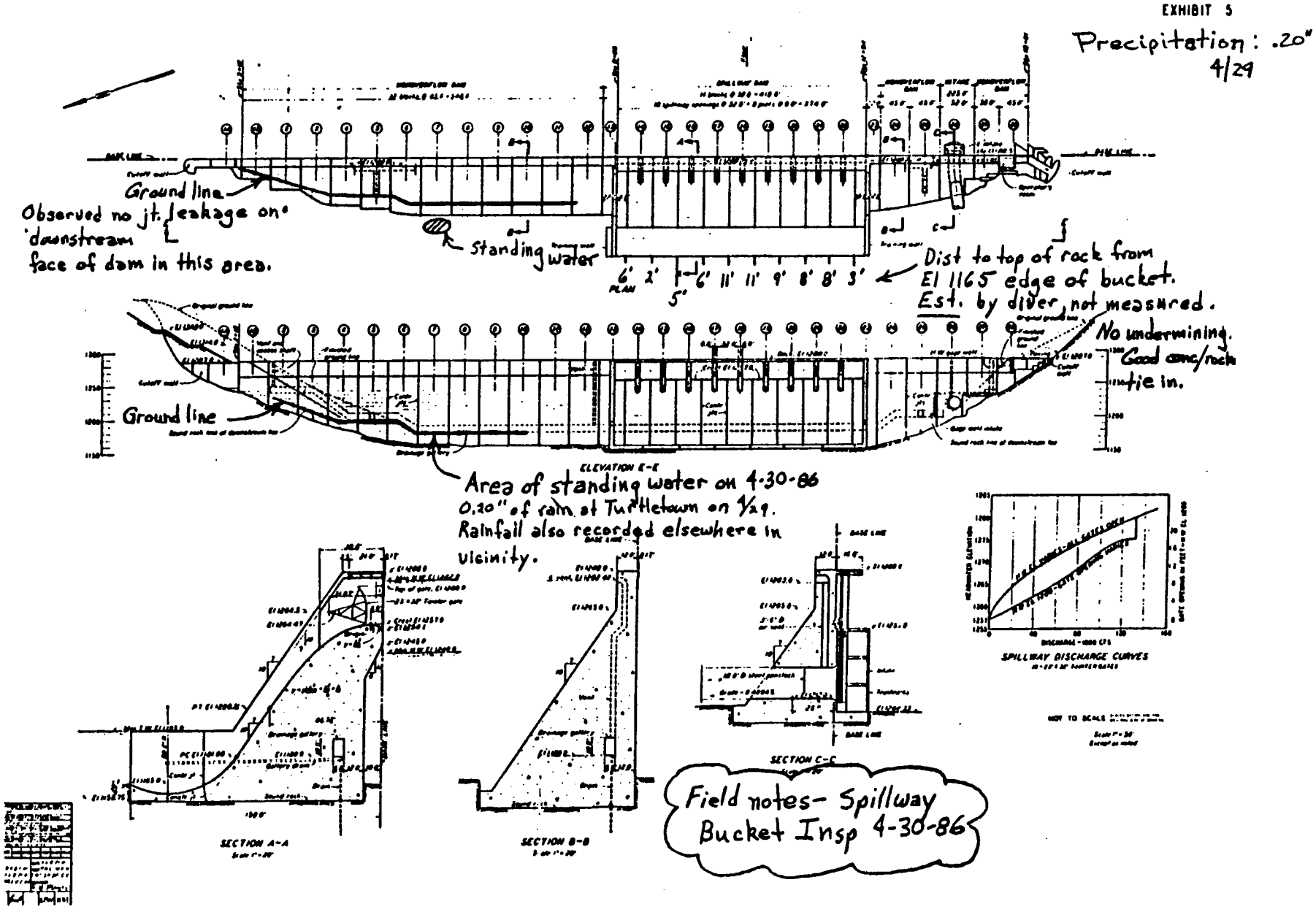
☞ **INSPECTION TIP:** It is important to record the precise location (e.g., station, elevation, monolith number, etc.) of the feature being sketched. You will need this information when you write your inspection report.

- Existing drawings (e.g., standard sketch of the dam or reduced as-built plan or elevation view of the dam) can be used to make notes about a particular feature or to record surveying notes, measurements, or other information. A circle or an arrow can be used to highlight the features or areas of concern.

Figure I-3 shows how an inspector made notes on an existing drawing. This is a particularly good technique when the feature being described is complex.

Continued . . .

FIGURE I-3. SAMPLE NOTES ON AN EXISTING DRAWING



I. DOCUMENTING THE INSPECTION: ADDITIONAL POINTS

COPIES OF SITE RECORDS

In some cases, records and data may be kept at the dam site. If so, you will need to get copies of any information that is pertinent to your inspection of the dam. These records may provide important information on instrumentation readings, maintenance, and operation. The information contained in the site records should be reviewed and documented during your inspection.

You can obtain the site records by either requesting copies of the appropriate records, borrowing them, or making your own copies and leaving the originals at the dam site. Sometimes it will be necessary to record what information you can during the actual inspection, and then later compare your findings with the site records.

The review of the site records is an essential element of a proper and thorough documentation of a dam safety inspection.

CONDUCTING AN EXIT CONFERENCE

Some organizations require that an exit conference be conducted with the dam owner or operator at the conclusion of the onsite inspection. The exit conference may be either a formal or informal meeting with project personnel. Usually preliminary findings, conclusions, and anticipated recommendations are discussed at these meetings. The exit conference discussion may form the basis for your report. But don't feel that what was said at this conference must be reiterated in your report. Further evaluation, data review, or just plain reflection about the conditions observed may lead you to different conclusions. Be open to this possibility and let everyone know that the conclusions and recommendations of this exit conference are tentative.

I. DOCUMENTING THE INSPECTION: UNIT EXERCISE

INSTRUCTIONS: Read the following excerpts from a dam safety inspector's notes. Then indicate how the documentation could be improved. When you have completed all of the questions, check your answers against those presented in the answer key. The answer key can be found immediately following this exercise.

1. Excerpt from a transcript of tape-recorded notes:

   "The embankment is in good condition."

   How could this note be improved? _____

   _____

2. Excerpt from a transcript of tape-recorded notes:

   "There is seepage in many areas. However, the seepage is not excessive in any one area. The total cumulative amount of seepage entering the sump is considered normal for the time of year."

   How could this note be improved? _____

   _____

3. Excerpt from a notepad:

   "There are two leaks in valve #2."

   How could this note be improved? _____

   _____

Continued . . .

I. DOCUMENTING THE INSPECTION: UNIT EXERCISE

4. Excerpt from a notepad:

   "The cast iron outlet pipe is corroded."

   How could this note be improved? _____

   _____

5. Excerpt from a transcript of tape-recorded notes:

   "The auxiliary generator was used to raise one gate. The test went fine."

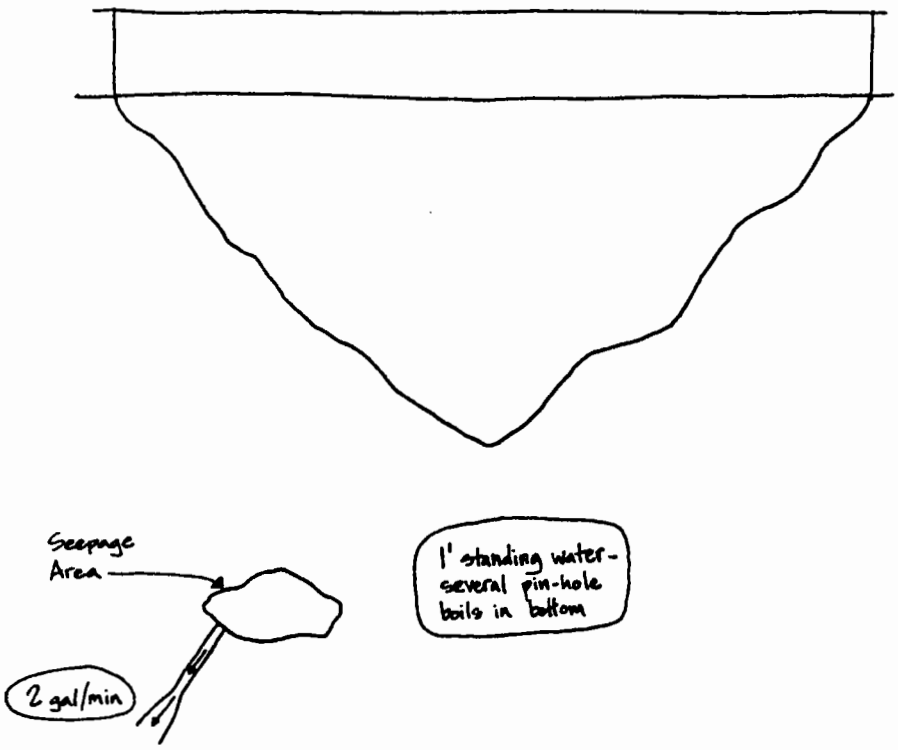
   How could this note be improved? _____

   _____

Continued . . .

I. DOCUMENTING THE INSPECTION: UNIT EXERCISE

6. Sketch from a notebook:



How could this sketch be improved? _____

_____

_____

_____

_____

I. DOCUMENTING THE INSPECTION: UNIT EXERCISE — ANSWER KEY

INSTRUCTIONS: Compare your answers to those given below to see how well you learned the information presented in this unit.

1. Excerpt from a transcript of tape-recorded notes:

   "The embankment is in good condition."

   How could this note be improved? **By fully describing the condition of the crest, the upstream slope, and the downstream slope.**

   Example of an improved note: There are no misalignment, cracking, settlement, or other distortions of the crest and slopes of the embankment. There are no indications of burrowing rodent activity.

   The upstream slope of the dam is being adequately protected by hand-placed riprap. No displacement of riprap or beaching of the upstream slope was noted.

   The downstream slope of the dam is being adequately protected from erosion by rock.

   The gravely composition of the embankment soil exposed on the crest provides an excellent wearing surface for vehicular traffic and erosion protection.

2. Excerpt from a transcript of tape-recorded notes:

   "There is seepage in many areas. However, the seepage is not excessive in any one area. The total cumulative amount of seepage entering the sump is considered normal for the time of year."

   How could this note be improved? **By specifying where the seepage was observed.**

   Example of an improved note: There is seepage at both downstream groin areas, through several construction joints on each side of the spillway section, and in the gallery system. Seepage is not excessive in any one area. The total cumulative amount of seepage entering the sump is considered normal for the time of year.

Continued . . .

I. DOCUMENTING THE INSPECTION: UNIT EXERCISE — ANSWER KEY

3. Excerpt from a notepad:

"There are two leaks in valve #2."

How could this note be improved? **By describing the location and quantity of the leaks.**

Example of an improved note: There are two leaks in valve #2. The leaks are located at 4 o'clock and 8 o'clock. Collectively, the leaks are flowing less than 1 gal/min. Photo 16 shows the leaks.

4. Excerpt from a notepad:

"The cast iron outlet pipe is corroded."

How could this note be improved? **By describing the size of the outlet pipe, the extent of the corrosion, and the location of the corrosion.**

Example of an improved note: The 24-inch cast iron outlet pipe is heavily corroded, with pitting up to 1/4" deep near the downstream end.

5. Excerpt from a transcript of tape-recorded notes:

"The auxiliary generator was used to raise one gate. The test went fine."

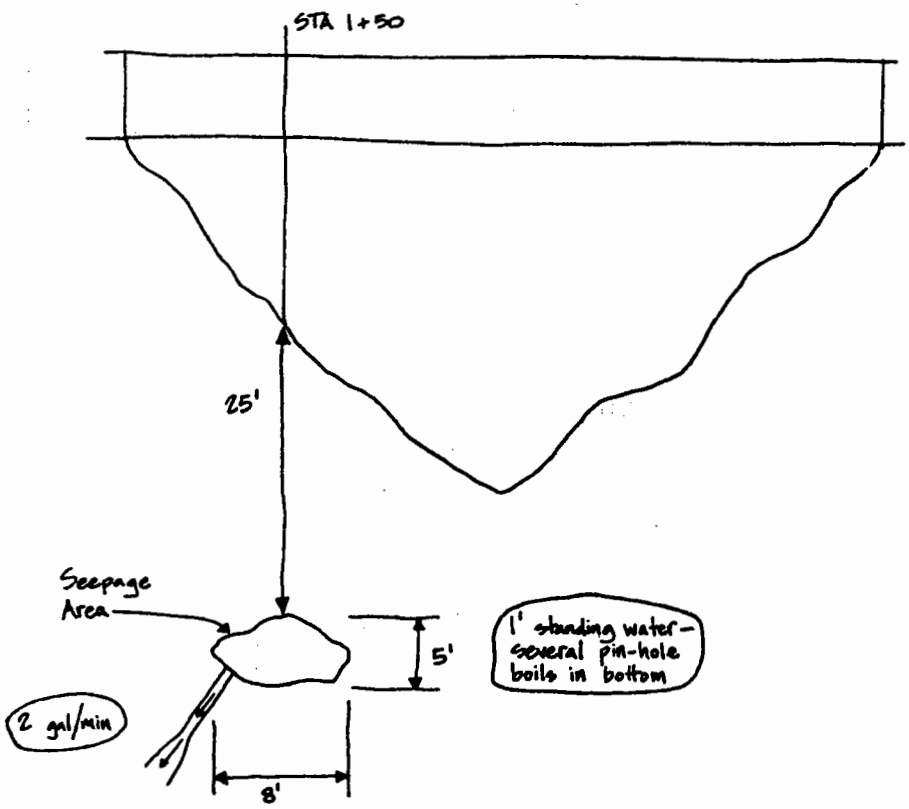
How could this note be improved? **By specifying which gate was tested and the reservoir level. Also, by describing the test more fully and indicating if the gate was closed.**

Example of an improved note: The auxiliary generator was used to raise the left guard gate under full reservoir head. The generator started easily and ran smoothly. The oil was at the proper level. The oil pressure and engine temperature were in the safe operating range. The gate was then closed using normal service power. No binding of the gate was noted. Photo 24 shows the gate.

Continued . . .

I. DOCUMENTING THE INSPECTION: UNIT EXERCISE — ANSWER KEY

6. Sketch from a notebook:



How could this sketch be improved?

The sketch could be improved by adding a reference point (station 1+50), measurements of the distance of the seepage area from the toe of the dam, and measurements of the length and width of the seepage area, as shown above with arrows. Also, it would be useful to have photographs of the seepage area.

I. DOCUMENTING THE INSPECTION: SUMMARY

"SMPL"

Proper documentation of a dam safety inspection is a must. It allows you to record both in written and visual form all your observations and findings. Good documentation provides you with the information that is needed to write your inspection report. Therefore, the better the notes you take during the documentation process, the easier it will be for you to write a complete and accurate dam safety inspection report.

Finally, to develop good documentation, remember to always "SMPL." In other words, if you observe any deficiencies, remember to:

S **Sketch** what you have observed if a photograph cannot capture important aspects of the deficiency.

M **Measure** and record the dimensions of the deficiency in your notes.

P **Photograph** the deficiency and describe its characteristics in your notes.

L **Locate** the deficiency in relation to some standard reference point (e.g., a feature of the dam or permanent monument) and record the precise location in your notes.

UNIT II

WRITING THE INSPECTION REPORT

II. WRITING THE INSPECTION REPORT: OVERVIEW

INTRODUCTION

The final stage of the inspection process is to develop a written inspection report. The written inspection report pulls together all the information collected from the data review, onsite inspection, and any tests or analyses that may have been conducted. In addition, the report presents the conclusions and recommendations that resulted from your analysis of the information. The report becomes a part of the Dam Safety File and provides a permanent record of the conditions of the dam and recommended followup actions at a point in time.

This unit presents guidance on how to develop a comprehensive written inspection report. Information will be presented on . . .

- Reviewing your notes and other data.
- Developing the report, including:
  - Selecting The Report Format
  - Determining The Depth And Scope Of The Report
  - Organizing The Report
    - Writing The Report Introduction
    - Writing The Body Of The Report
    - Writing Conclusions
    - Writing Recommendations
    - Compiling Report Attachments
- Improving your report-writing skills.
- Updating the Dam Safety File.

UNIT OBJECTIVES

After completing this unit, you will be able to . . .

- Explain the importance of reviewing and organizing information before beginning to write an inspection report.
- Determine the appropriate depth and scope of an inspection report.
- Select the format and organization to be used in presenting an inspection report.
- Write an inspection report that includes findings, conclusions, and recommendations.
- Explain the importance of maintaining and updating the Dam Safety File.

II. WRITING THE INSPECTION REPORT: REVIEWING YOUR NOTES AND OTHER DATA

INTRODUCTION

Writing an inspection report is similar to building a structure. Before you can begin the task of "building" the report, you should first have all the raw materials needed to construct the report. The notes developed during your initial data review and onsite inspection are two important ingredients. However, these materials may not be sufficient for writing your report. This section reviews the steps you may take to ensure that you have everything you need in order to write your inspection report.

REVIEWING YOUR FIELD NOTES

Before leaving the field, or shortly after returning, you should review your inspection notes. While your observations are still fresh in your mind, make sure that you understand your notes. Also, make sure that all noted deficiencies are described fully, including the precise location and relevant quantitative measurements. Tape-recorded notes should be transcribed and the typed version should be reviewed. Often the transcriber will not be able to understand everything you have said. Now is the time to fill in any missing words or phrases and to correct words that were misunderstood.

Once photographs have been developed, they should be labeled. Next, compare your written or transcribed notes with the photographs. Comparing the photographs to your notes helps to ensure that the notes are complete and accurate. Photographs may reveal concerns that were overlooked in your notes. Remember, it is important to label photographs while the information is fresh in your mind.

You may find it useful to have other inspection team members review your notes. The goal is to make sure that your notes are complete before you begin writing the inspection report.

☞ **INSPECTION TIP:** Reviewing and editing your notes before beginning your inspection report makes the writing process easier. If you are unable to rely on your notes, writing the inspection report becomes much more difficult.

EVALUATING THE INFORMATION GATHERED

The next step is to evaluate all the information that has been gathered. The amount and types of information gathered may vary depending on the type of inspection conducted and your organization's inspection policies and procedures. Generally, the inspection process begins with a review of the information contained in the Dam Safety File. After completing this review, an onsite inspection is conducted. Once the onsite inspection is completed, you may need to evaluate the information collected during the onsite inspection using the information contained in the Dam Safety File in order to fully understand the situation. This evaluation can also be done in the field. The results of this type of evaluation may direct you to another area of the dam or feature in order to verify or explain an observed condition. For more information on reviewing the Dam Safety File, see the module entitled Preparing To Conduct A Dam Safety Inspection.

Continued . . .

II. WRITING THE INSPECTION REPORT: REVIEWING YOUR NOTES AND OTHER DATA

EVALUATING THE INFORMATION GATHERED (Continued)

To evaluate the information collected, you must integrate your findings from the data review with the observations you made in the field. Field measurements should be checked against design or as-built plans, if available. Instrument readings taken during the inspection should be checked against previous records. Comparisons should be made between previously reported deficiencies and current conditions. The status of previously recommended followup actions should be determined. An evaluation of both previous and current data can help you to identify trends and assess the seriousness of any deficiencies observed.

Evaluating the information gathered allows you to put your thoughts together and develop tentative conclusions and recommendations. You should think about the significance of your findings before writing about them.

II. WRITING THE INSPECTION REPORT: DEVELOPING THE REPORT

INTRODUCTION

Once you have reviewed your notes and evaluated the information gathered, then you are ready to begin writing your inspection report. This section presents general guidelines for writing inspection reports. Emphasis is placed on writing reports using a narrative approach. Not all organizations write reports using narrative descriptions; some organizations use a checklist approach. A checklist report is straightforward and self-explanatory and will not be discussed further in this module. If your agency does use a checklist-report format, you may still find this unit helpful. Narrative explanations may be used to supplement the basic information provided in a checklist report or to present recommendations and conclusions.

Remember, the guidelines presented are models to follow, if possible. Your organization's inspection policies and procedures may differ from these guidelines, or you may have resource constraints that prevent you from following these guidelines. You should adapt the information presented in this section to fit your particular situation.

SELECTING THE REPORT FORMAT

The format you use to write the inspection report may vary depending on the type of inspection performed and your organization's guidelines. Table II-1, on the following pages, lists the different types of dam safety inspections. For more information on the types of dam safety inspections, see the module entitled Preparing To Conduct A Dam Safety Inspection.

The use of specific formats helps to standardize the manner in which inspection findings are presented. A standardized format makes it easier for reviewers to find similar types of information in several different reports.

The report format serves as a template for developing the report. However, as with the use of an inspection checklist, a report format should be a guide, and should **not** be limiting. If you feel that certain information is important, yet doesn't fit under a heading in the report format, then add a new heading and include it in your inspection report. Do not hesitate to add pertinent information that is not routinely included in a particular report format. The added information may be an important indicator of a potential dam safety problem or may even provide insight on something that was not considered previously.

Appendix A presents examples of different report formats that are used to report findings from several types of inspections. If you currently are not required to use a standardized format, these examples may help you to establish a report format that will meet your particular needs.

SELECTING THE REPORT FORMAT (Continued)

TABLE II-1. TYPES OF DAM SAFETY INSPECTIONS

Type Of Inspection	Description
Initial or Formal Inspection	The initial or formal dam safety inspection includes an indepth review and evaluation of all pertinent data available on the dam to be inspected. Design and construction data are evaluated against current criteria or state-of-the-art in order to identify: . Potential dam safety problems that may not be apparent from a visual inspection. . Areas of the dam that may require particular attention during the inspection. After reviewing and evaluating the records, a thorough onsite inspection of all features is conducted. An attempt is made to operate all mechanical equipment through their full operating range, and as close to full design load (i.e., reservoir head) as possible.
Periodic or Intermediate Inspection	Periodic or intermediate dam safety inspections are inspections that are conducted between formal inspections. A periodic or intermediate dam safety inspection differs from a formal dam safety inspection because while all available data are reviewed (in order to become thoroughly familiar with the dam and its features), they are not compared to the current state-of-the-art. The data review focuses on the current status of the dam and its features. A comprehensive visual onsite inspection is conducted; however, all of the mechanical equipment may not be operated and tested during any one inspection.
Routine Inspection	The routine dam safety inspection is most typically conducted by field or operating personnel. The primary focus is on the current conditions of the dam and its features. Data may or may not be reviewed and evaluated prior to this type of inspection, depending on the inspector's familiarity with the dam and its features. Routine dam safety inspections may be structured or unstructured. Structured routine inspections are conducted on a set schedule. Unstructured routine inspections are performed in conjunction with other routine tasks.

Continued . . .

SELECTING THE REPORT FORMAT (Continued)

TABLE II-1. TYPES OF DAM SAFETY INSPECTIONS (Continued)

Type Of Inspection	Description
Special Inspection	A special inspection is conducted only when a particular feature is to be inspected. Often, a unique opportunity exists to inspect this feature which otherwise is not easily inspected. For example, if an upstream slope will be unwatered, an inspection of that slope may be scheduled. Or, if scuba divers are to be employed to inspect features generally under water, that portion of the inspection may be conducted as a special inspection.
Emergency Inspection	An emergency inspection is performed when the immediate safety of the dam is of concern, or in the event of unusual or potentially adverse conditions at the dam (e.g., during a large flood or immediately following an earthquake).

II. WRITING THE INSPECTION REPORT: DEVELOPING THE REPORT

DETERMINING THE DEPTH AND SCOPE OF THE REPORT

The depth and scope of an inspection report depend on the type of inspection that was performed. For example, an initial or formal dam safety inspection report requires a greater level of detail and explanation than a periodic or intermediate dam safety inspection report. Also, an initial or formal dam safety inspection report will be broader in scope since, by definition, it includes a comparison of design and construction data against current criteria.

The greatest differences among types of inspection reports are the depth to which project features are described and the extent to which design and construction data are analyzed. The depth of a report's conclusions and recommendations also may vary depending on the type of inspection performed and the extent to which data were reviewed during the inspection. A comprehensive data review will probably enable you to draw more thorough conclusions and to make more extensive recommendations.

Although the depth and scope of inspection reports may differ, a comprehensive description of the conditions observed during the onsite inspection always should be included.

ORGANIZING THE REPORT

The format you select is dictated by the type of inspection performed (e.g., initial, periodic, special, etc.) and will determine how the content of the report is to be organized. Most inspection report formats include the following major content areas:

CONTENT AREA	PURPOSE
Report Introduction	. Provides background information about the dam and the inspection that was conducted.
Body Of The Report	. Describes the current conditions or concerns in detail.
Conclusions	. Present the inspector's judgment regarding the conditions observed. All factors are taken into consideration. Conclusions should be made on all features, even if satisfactory.
Recommendations	. State what actions should be taken as a result of the inspection (e.g., further investigation, analysis, repair, monitoring, etc.). Each recommendation should be supported by a conclusion.
Attachments	. Provide additional information that supports or supplements the information presented in the body of the report.

Next, each of these content areas will be discussed.

II. WRITING THE INSPECTION REPORT: DEVELOPING THE REPORT

Writing The Report Introduction

An inspection report usually contains an introductory section that presents information about the dam and the inspection that was conducted. The purpose of the report introduction is to provide any needed background information. Table II-2 lists the items that may be included in the report introduction. The table also provides examples of each item.

TABLE II-2. ITEMS THAT MAY BE INCLUDED IN THE REPORT INTRODUCTION

Item	Example
Dam Name	Big Creek Dam
Dam Owner	(Owner's Name, Address, and Phone Number)
Inspection Date	June 27 - 28, 1988
Date of Last Inspection	July 6 - 7, 1987
Inspection Team	(Names, Titles, Organizations, Office, etc.) - Include project (site) personnel accompanying the inspection team.
Type of Inspection	Periodic Inspection
Conditions During The Inspection	The temperature was in the 70's (°F) during the inspection. Local personnel reported that there had been no precipitation during the previous 2 weeks.
Location Of Dam	Big Creek Dam is located on the McGee River approximately 35 miles west of Weltsville, and approximately 34 miles southeast of Barron, California.
Construction Date	Big Creek Dam was constructed from 1970 to 1973.

Continued . . .

Writing The Report Introduction (Continued)

TABLE II-2. ITEMS THAT MAY BE INCLUDED IN THE REPORT INTRODUCTION

Item	Example
Description Of The Dam And Major Features	As shown on drawing 66-A-444 (attached), the dam is a zoned earthfill embankment. The dam has 5 zones and contains approximately 3,200,000 yd^3 of embankment material. The crest of the dam is 1,290 feet long, 30 feet wide, and approximately 251 feet above the riverbed. Crest elevation is 2,395 feet and there is a maximum camber of 2.5 feet. Photo #1 shows an overall view of the dam at the time of the inspection. Big Creek Dam has a 100-foot-wide, earthlined spillway situated on the left abutment. Two separate outlet works exist in the left abutment. The two outlet works of similar design are at different elevations. Both outlet works have vertical, trashracked intake structures, a 6-foot-diameter pressure tunnel leading to a gate chamber which contains a 7-foot by 7-foot slide gate, and a modified horseshoe free-flow tunnel downstream from the gate chamber.
Hazard Classification	Big Creek Dam is classified as having a **high** hazard potential for both loss of life and economic loss in the event of failure.

II. WRITING THE INSPECTION REPORT: DEVELOPING THE REPORT

Writing The Body Of The Report

The body of an inspection report presents a detailed description of the inspection process and findings. As previously mentioned, the depth and scope of the information presented will vary depending on the type of inspection conducted. However, all information presented should be . . .

✓ **Specific:** Descriptions should be very precise. Avoid using general or vague statements. Clearly state "who" said what or intends to do what and when.

Examples:

Avoid . . .

"The seepage was twice as much as was observed during the last inspection."

Use . . .

"Seepage was observed on the downstream right abutment 100 feet from the toe of the dam. The flow rate was estimated at 10 gallons per minute. During the previous inspection (July 1987), with the reservoir at approximately the same elevation, seepage in the same area was measured at 5 gallons per minute. During both observations, the seepage was clear water."

Avoid . . .

"The upstream slope may be eroding and may become a dam safety concern over time."

Use . . .

"The upstream slope (photo 10) is covered with a 3-foot layer of riprap. The original size of the riprap was 1 to 2 feet. The present size of the riprap is 3 to 6 inches. The riprap appears to be susceptible to weathering and deterioration. Much of the larger riprap on the upstream slope to the right of the spillway inlet has deteriorated and been displaced, resulting in some minor erosion of the underlaying bedding material (photo 11). Although this is not a dam safety concern at this time, additional riprap will eventually need to be placed in this area to protect the underlaying material."

Continued . . .

Writing The Body Of The Report (Continued)

✓ **Specific:** Descriptions should be very precise. Avoid using general or vague statements. Clearly state "who" said what or intends to do what and when. (Continued)

Avoid . . .

"There is an intention to dewater the stilling basin."

Use . . .

"**District personnel** intend to dewater the stilling basin in June 1989."

✓ **Clear:** Descriptions should be written clearly.

Examples:

Avoid . . .

"The valves and bypass line from the hydraulic control lines for the emergency gate **which are located in the emergency gate chamber** should be removed."

Use . . .

"The valves and bypass line, **which are located in the emergency gate chamber,** should be removed from the hydraulic control lines for the emergency gate."

Remember . . . Put a modifying word or phrase as close as possible to the word(s) it modifies.

Continued . . .

Writing The Body Of The Report (Continued)

✓ **Clear:** Descriptions should be written clearly. (Continued)

Examples:

Avoid . . .

"Portions of the stilling basin were under water, but District personnel intend to dewater the stilling basin at the earliest convenient time in order to remove rocks and debris that reportedly exist on the floor of the structure since it is presumed that the debris has been a factor in limiting the drain's capability at the end of the structure."

Use . . .

"Portions of the stilling basin were under water.

District personnel intend to dewater the stilling basin in June 1989 in order to remove rocks and debris that reportedly exist on the floor of the structure.

It is presumed that the debris has been a factor in limiting the drain capability at the end of the structure."

Remember . . . Use the briefest possible sentence to communicate your thoughts. When you have several different thoughts, use several sentences.

Avoid . . .

"Should there be any queries with respect to any of the aforementioned recommendations, please inform the undersigned."

Use . . .

"If you have any questions about these recommendations, please contact the inspection team."

Remember . . . The goal of the report is to communicate effectively. There is no need to impress, overwhelm, or confuse the reader.

Continued . . .

Writing The Body Of The Report (Continued)

✓ **Complete:** Descriptions should be complete enough to allow a reader who may be unfamiliar with the dam to understand the current conditions fully.

Examples:

Avoid . . .

"Seepage from a spring dampens a portion of the outcrop, but is not measurable."

Use . . .

"There are four springs on the left abutment, 50 feet downstream from the toe of the dam, and a zone of springs on the right riverbank, approximately 100 yards downstream from the stilling basin. Spring No. 1 is in the south-facing outcrop, just east of the lower outlet works tunnel access. Seepage from this spring dampens a portion of the outcrop, but is not measurable." (Continue describing each spring.)

✓ **Consistent:** Descriptions should be written using consistent terminology. Terms such as "satisfactory" or "unsatisfactory" should be defined, and then used in a consistent manner in all reports. Using consistent terminology allows reviewers to compare findings from one site to another.

Example:
Listed below are one agency's definitions of descriptive terms used in inspection reports:

- **Satisfactory**
  - Will fulfill intended purpose
- **Fair**
  - Will fulfill intended purpose
  - Maintenance required
- **Poor**
  - May not fulfill intended purpose
  - Repair and/or modification advisable
- **Unsatisfactory**
  - Will not fulfill intended purpose
  - Replacement required

Table II-3, on the following pages, lists the items that may be included in the body of the report. The table also provides examples of each item.

Continued . . .

Writing The Body Of The Report (Continued)

TABLE II-3. ITEMS THAT MAY BE INCLUDED IN THE BODY OF THE REPORT

Item	Example
Data Reviewed	1. Inspection Reports of Twin Oaks Dam, dated June 30, 1986, May 12, 1980, and April 1, 1977. 2. Dam Safety File for Twin Oaks Dam. 3. Instrumentation Data from Dam Safety File, number D-225. 4. SOP for Twin Oaks Dam, transmitted by memorandum dated January 15, 1987. 5. Final Construction Report for Twin Oaks Dam. 6. Summary of Grouting Report, March 1975.
Operational Status During Inspection	Reservoir water surface elevation: 2,340.71 Reservoir storage: 2,144,000 acre-feet Releases: Spillway: None Main outlet works: 3,536 ft^3/s Auxiliary outlet works: 2,460 ft^3/s Top of active conservation elevation: 2,370.0 Maximum reservoir water surface elevation: 2,387.0 Maximum reservoir water surface elevation to date: 2,378.34
Historical Events	Several small earthquakes have been reported in the area of Twin Oaks Dam. The largest of these was a 4.7 magnitude earthquake which occurred in October 1977. The epicenter of this event was approximately 32 miles from the dam site. The closest reported earthquake occurred in December 1975. This earthquake was centered about 6 miles from the dam and had a magnitude of 1.6. No damage to the dam was reported following these events. The maximum flood of record occurred July 9, 1980, and had a peak discharge of 15,200 ft^3/s. No damage occurred to the spillway channel.

Continued . . .

Writing The Body Of The Report (Continued)

TABLE II-3. ITEMS THAT MAY BE INCLUDED IN THE BODY OF THE REPORT (Continued)

Item	Example
Facility Emergency Preparedness	Facility emergency preparedness considerations are the same as described in the Inspection Report dated June 30, 1986, except as noted below: Remote Operation: The problem previously experienced with the remote operation of the 24-inch outlet-works hollow-jet valve, that is described in the previous Inspection Reports, has been corrected. New shaft encoders have been installed on the valve and also on the spillway sluice gate.
Hydrology	Hydrologic considerations have not changed since the initial dam safety inspection (April 1, 1977). Eagle Lake is still restricted to elevation 2,347.6 between November 1 and March 31 of each year because of the inability of the spillway to safely pass the revised (1976) Inflow Design Flood (IDF).
Geologic Features	Geologic features at the dam have not visibly changed since the initial dam safety inspection (April 1, 1977). The large landslide (photo 2) downstream from the dam on the left abutment was examined. Some surface erosion has occurred because of runoff from the unusually wet winter. Portions of the drainage system have been damaged and should be repaired (photos 6 and 7). The slide is being monitored by instrumentation. Inclinometer data indicated that the slide is moving slowly. A geologist should examine the slide and evaluate inclinometer data to determine the potential for a rapid failure of the abutment slope.

Continued . . .

Writing The Body Of The Report (Continued)

TABLE II-3. ITEMS THAT MAY BE INCLUDED IN THE BODY OF THE REPORT (Continued)

Item	Example
Structural Features - Seepage - Embankment - Spillway - Outlet Works - Instrumentation - Mechanical Features	Spillway The spillway, including the approach channel, was examined in its entirety (photos 12 through 15) with the exception of the stilling basin floor, which was under water. The approach channel was clear of debris and vegetation, and the side slopes appeared stable (photo 14). Project personnel reported some past surficial slides that required repair, but nothing of a magnitude that would impair flow through the spillway. The concrete of the spillway intake structure, crest, sluiceway, chute, and stilling basin walls was in generally satisfactory condition. Minor spalling has occurred in the past on the chute floor adjacent to the chute walls on either side. This spalling was repaired, although some maintenance has been necessary from time to time. Another small area of previous concrete distress is adjacent to the apron on the right side just upstream from the spillway crest. A corner of the slab had heaved slightly in this area and so was removed and repoured flush (photo 16). On the left side, surface runoff has washed some backfill from behind the retaining wall out along the joint between the apron and the wall (photo 17). This is not serious at this time, but the joint should be sealed to prevent further removal of material. No excessive deflection of the spillway chute and basin walls was noted. The wall drains were flowing and apparently functioning properly. The stilling basin has never been examined. The stilling basin is due to be examined by project personnel in the fall of 1990.

II. WRITING THE INSPECTION REPORT: DEVELOPING THE REPORT

Writing Conclusions

The conclusions presented in an inspection report are your assessment of the safety of the dam's features. Conclusions are developed based on the information collected from reviewing data and conducting the onsite inspection. Each conclusion must be supported by detailed information presented in the body of the report. Also, conclusions should make reference to conditions described in previous inspection reports.

Recommendations are developed for all conclusions that represent adverse, uncertain, or less than satisfactory findings. The conclusions provide the basis for the recommended followup actions. Most reports list the conclusions in a separate section. Typically, the conclusions and recommendations are presented toward the beginning of inspection reports. This allows senior officials and dam owners/operators the option of reading the front part of the report and referring to the body of the report, as needed, to gain more information.

Table II-4 lists the different types of conclusions that may be included in the report. The table also provides examples of each type of conclusion.

TABLE II-4. TYPES OF CONCLUSIONS THAT MAY BE INCLUDED IN THE REPORT

Type Of Conclusion	Example
Assessment Of Project Features	Portions of the rockfill on the downstream face of the dam have severely deteriorated from air slaking, which may result in loss of support to surrounding competent facing material. The downstream face should be monitored for signs of localized slumping. If any slumping takes place, appropriate measures should be taken to repair the area.
	Observable seepage from the reservoir is minimal and is confined to two downstream areas. A small seep on the downstream right abutment was flowing 1 to 2 gallons per minute, and a small seep above the spillway tunnel outlet portal was estimated to be flowing about 1 gallon per minute. Seepage water was clear and neither seepage area presents a safety-of-dams concern at this time.
Assessment Of The Design Of Project Features	A feature of the intake design that could indirectly affect dam safety is the lack of ready access for inspection and repair, if necessary, of the pressure tunnels upstream from the emergency gates for both the upper and lower outlet works. It may be prudent to consider modifications to the intakes while the reservoir is still low to provide a structure for storing the unwatering bulkheads directly over the intakes. Such a design could eliminate the need for divers, and the tunnels could be examined more frequently.

Continued . . .

Writing Conclusions (Continued)

TABLE II-4. TYPES OF CONCLUSIONS THAT MAY BE INCLUDED IN THE REPORT (Continued)

Type Of Conclusion	Example
Assessment Of Existing Design And Construction Against Current State-Of-The-Art*	Design and construction of the dam represent state-of-the-art practice. The dam was analyzed for static stability using assumed design parameters and, subsequently, using representative strength values. Information available indicates that the embankment apparently was constructed in accordance with design intent. The density, strength, and compression characteristics of the constructed fill generally meet or exceed the standards assumed during design.
Assessment Of Geologic Features	The geologic features present no safety-of-dams concerns. The foundation and abutments are in satisfactory condition, no landslide activity has been reported since completion of the dam, and a seismic evaluation determined that Twin Oaks Dam is stable under MCE (maximum credible earthquake) loading of 7.0.
Assessment Of Hydrology	An IDF (inflow design flood) was approved for Twin Oaks Dam in 1977. Flood routing studies determined that the dam can safely accommodate a flood that combines the IDF for Twin Oaks Dam and a flood resulting from breaching of Twilight Dam, an upstream reservoir. If a formal hazard classification evaluation for Twin Oaks Dam determines that the dam has a hazard rating of significant or high, the IDF should be reanalyzed to recognize current hydrologic data and meet current criteria for selection of the IDF.

***Note:** The comparison made between the existing dam design and construction and current state-of-the-art practices should be done by experienced and qualified inspectors. More information on making this type of analysis is presented in the TADS component entitled "Data Review, Investigation and Analysis, and Remedial Action."

Continued . . .

Writing Conclusions (Continued)

TABLE II-4. TYPES OF CONCLUSIONS THAT MAY BE INCLUDED IN THE REPORT (Continued)

Type Of Conclusion	Example
Adequacy Of Instrumentation	Instrumentation for the dam is considered adequate. Instrumentation readings and processing of data appear to be current, and no serious safety-of-dams concerns are evident from the performance data. **Note:** In an actual report, you should then discuss each instrumentation system and state what that instrumentation system says about the performance of the features of the dam. For example, "Surface measurement points indicate that settlement and deflection of the embankment are within expected ranges."
Adequacy Of Facility Emergency Preparedness	Emergency preparedness is adequate with the exception of access to the site and the auxiliary power. Access to the site is considered marginal and the auxiliary power is considered inadequate.
Adequacy Of Operation And Maintenance Activities	Based on the conditions of the dam and appurtenant structures at the time of inspection, and except for the deficiencies noted, operation and maintenance activities are being performed in a satisfactory and responsible manner.

Writing Recommendations

The recommendations presented in the inspection report are the specific actions to be taken to improve the safety of the dam. Each recommendation should result from a conclusion. Recommendations must be supported by the findings presented in the body of the report. The recommendations should address all of the concerns you have about the safety of the dam.

To write clear and effective recommendations, you should. . .

- ✓ Begin each recommendation with an action word such as "perform," "prepare," or "evaluate." Beginning each recommendation with an action word helps ensure that your recommendation includes a specific action to be taken.

Continued . . .

Writing Recommendations (Continued)

✓ Include who is responsible for taking the action or suggest who is best qualified for taking the action. **Note:** This may be apparent depending on to whom the report is addressed (e.g., the dam owner). If there is any chance of ambiguity, specify who is responsible.

✓ Specify the timeframe for completing the action or describe the urgency of the action.

Typically, recommendations are made for . . .

- **Additional Evaluation, Analysis, Investigation, Or Testing**

  Recommendations for additional evaluation, analysis, investigation, or testing should be made when . . .

  - Following your data review and onsite inspection, the evidence regarding a potential dam safety deficiency is inconclusive.
  - The area of concern is beyond your level of expertise.

Most of the recommendations you make will be for additional evaluation, analysis, investigation, or testing.

- **Remedial Action**

  Recommendations for remedial action should be made for . . .

  - Operation and maintenance deficiencies that should be corrected. (Operation and maintenance recommendations are those that pertain to conditions that may shorten the service life of a structure or feature. These conditions, if left uncorrected, could eventually affect the safety of the dam.)
  - Straightforward corrective measures, if recommending such measures is within your authority or area of expertise.
  - Emergency actions that should be taken.

Remedial action recommendations should be provided to all involved parties.

Table II-5 presents examples of each type of recommendation.

Continued . . .

Writing Recommendations (Continued)

TABLE II-5. TYPES OF RECOMMENDATIONS THAT MAY BE INCLUDED IN THE REPORT

Type Of Recommendation	Example
Additional Evaluation, Analysis, Investigation, Or Testing	Evaluate the reservoir evacuation capability of the Twin Oaks Dam outlet works using the guidelines presented in Technical Memorandum No. 3. This evaluation should be completed before spring of 1990.
	Test the proper functioning of all remote and automatic circuits for the auxiliary power system, the roller-mounted gate, the butterfly valves, and the flood control and irrigation outlet works when all rewiring has been completed.
	Evaluate the need to perform a dynamic stability analysis of the embankment.
	Perform operational (emergency closure) tests on the 96-inch and 72-inch ring-follower gates at allowable openings, and repeat these tests on the gates and valves in both outlet works when the reservoir is at or near maximum level.
	Evaluate the need for additional instrumentation to monitor the crest for cracking.
	Initiate monitoring and measurement of seepage on the right side of the river channel downstream from the outlet works. Monitoring and measurement should begin immediately. Onsite O&M personnel should be responsible for taking periodic measurements.
Remedial Actions	Repair any damage to, and remove rocks and debris from, the upper outlet works before the outlet works are put into service.
	Remove trees and shrubs from the upstream face and at the downstream toe of the dam near the weir pool. Develop and implement a plan for dealing with subsequent regrowth.
	Locate, uncover, and open the foundation drain outlet. Install a permanent location marker at the drain outlet.

II. WRITING THE INSPECTION REPORT: DEVELOPING THE REPORT

Compiling Report Attachments

Often, supporting information is presented in attachments to the report. However, some report formats will include supporting information in the body of the report.

The supporting information that may be found in the report attachments includes the following items . . .

- ✓ Location Maps, Sketches, And Drawings
- ✓ Field Notes And Checklists
- ✓ Photographs (labeled with the orientation, feature, and date and referenced in the report)
- ✓ Calculations
- ✓ Inventory And Engineering Data
  - Elevations
  - Storage Capacities
  - Surface Areas
  - Record Water Levels And Discharges
  - Instrumentation Data
- ✓ A List Of References, such as . . .
  - Other Inspection Reports
  - Correspondence
  - Studies/Analyses
  - Dam Safety File
  - Standing Operating Procedures
  - Facility Operating Logbook
  - Personnel Interviewed During The Inspection
  - Emergency Action Plan

II. WRITING THE INSPECTION REPORT: IMPROVING YOUR REPORT-WRITING SKILLS

INTRODUCTION

You spend a significant amount of time and energy reviewing data, conducting the onsite inspection, and writing the inspection report. However, a poorly written inspection report can undermine all of your work. When an inspection report has obvious editorial errors, the entire report may be discounted as sloppy, incomplete work. This type of work may even discount your credibility as a competent inspector. This section presents some tips on improving your report-writing skills.

TIP #1: CHECK, CHECK, AND DOUBLECHECK

After completing your inspection report, read it through carefully. Check to make sure your report contains . . .

✓ **Logical Organization**

- Are paragraphs presented in a logical order?
- Within paragraphs, are sentences presented in a logical order?

✓ **Proper Grammar**

- Do subjects and verbs agree?
- Are sentences complete?

✓ **Correct Spelling**

- Are words spelled correctly?

✓ **Clear Writing**

- Are ambiguous pronouns avoided?
- Are run-on sentences avoided?
- Are words accurate and precise?

✓ **Accurate Information**

- Are all quantitative measures accurate?

✓ **Complete Information**

- Are photographs labeled?
- Are descriptions complete?
- Are conclusions and recommendations supported by the findings presented in the body of the report?
- Is there a conclusion for every feature of the dam?
- Are the recommendations supported by the conclusions?

TIP #2: KNOW THYSELF

One way of improving your report-writing skills is to know your strengths and weaknesses. If you have weaknesses, then you need to improve your skills or develop systems to compensate for your weaknesses. Table II-6 lists strategies for improving your report-writing skills.

TABLE II-6. STRATEGIES FOR IMPROVING YOUR REPORT-WRITING SKILLS

Skill Area	Strategies
Organizing The Report	. Use the correct inspection format, or create your own content outline before you begin to write. . Analyze your findings before you begin to write. . Make sure you group like items or ideas together and list events in sequential order. . Use well-organized reports as models for developing your report.
Describing Inspection Findings	. Try making a sketch based on your description. Are any details missing? Could you make your description clearer? . Avoid using abbreviations except those that are commonly known and accepted. Define all abbreviations the first time they are used in your report.
Supporting Conclusions And Recommendations	. Develop a diagram that links your findings to the conclusions and the conclusions to your recommendations. Make sure the linkage is clear in the report.
"The Basics"	
Spelling	. Use a dictionary if you do not know how to spell a word. . Create a list of words that you tend to misspell. . Compose your report on a word processing system that includes a spelling checker.
Grammar	. Take a refresher course, or read a self-study book, to improve your grammatical skills. . Have someone edit your writing.

TIP #3: KNOW WHAT'S EXPECTED

Every organization has different preferences when it comes to writing styles. The best way to avoid having to rewrite a report is to become familiar with your organization's preferences. To become familiar with your organization's preferences, review reports that are considered to be outstanding.

II. WRITING THE INSPECTION REPORT: UPDATING THE DAM SAFETY FILE

INTRODUCTION

The Dam Safety File is a complete historical record of all information pertaining to the safety of a dam. The Dam Safety File plays a critical role in the dam safety inspection process. A thorough assessment of dam safety cannot be made without ready access to all pertinent information. The last step of your inspection is making sure that the Dam Safety File is up to date. This section presents information on maintaining and updating the Dam Safety File.

PREPARATION OF THE DAM SAFETY FILE

Typically, the Dam Safety File is prepared prior to the initial dam safety inspection. The file may be prepared by engineers not involved in the inspection process, or by the first inspection team.

STRUCTURE OF THE DAM SAFETY FILE

Each organization has it own guidelines concerning the structure of the Dam Safety File. Two common ways of structuring the Dam Safety File are . . .

- The Establishment Of A Separate Dam Safety File: A separate Dam Safety File can be established with materials taken from the overall project files that are pertinent to dam safety. Often the files from which the dam safety information is extracted contain information that is not relevant to dam safety. An abbreviated file, dedicated solely to dam safety, may be easier to use, maintain, update, and store. This abbreviated file is sometimes called a Technical Data Book.

- The Use Of Existing Files: The Dam Safety File may simply be the storage of all project files or copies of project files in one location. Often, this is the case when limited information is available, the organization is responsible for a small number of structures, or there is no one person responsible for records management. When existing files are used as the Dam Safety File, an index of the files' contents and a statistical summary of the project should be prepared. The index will make it easier to locate specific dam safety information.

CONTENTS OF THE DAM SAFETY FILE

The Dam Safety File provides ready access to information that can be used to help you:

- Prepare for conducting a dam safety inspection.

- Evaluate the observations made during an onsite inspection.

One objective of the Dam Safety File is to have pertinent information available in case of emergency or serious problems.

Continued . . .

CONTENTS OF THE DAM SAFETY FILE (Continued)

Table II-7, shown below, lists the information that may be included in a Dam Safety File.

TABLE II-7. INFORMATION THAT MAY BE INCLUDED IN A DAM SAFETY FILE

Information Category	Typical Items That May Be Included
Background Information	. Statistical Summary . Aerial Photographs Of The Dam . Historical Events (during construction and operation) . Facility Emergency Preparedness Information . Correspondence
Geologic Information	. Regional Information . Site Information . Seismicity . Correspondence
Hydrologic Information	. Design Flood . Current Inflow Design Flood . Correspondence
Reservoir Information	. Restrictions . Operation . Deficiencies (e.g., landslides, etc.) . Reservoir Elevation Records . Correspondence
Foundation Information	. Description . Design And Analyses . Treatments . Construction Records, Changes, And Modifications . Instrumentation . Deficiencies (e.g., seepage, etc.) . Correspondence

Continued . . .

CONTENTS OF THE DAM SAFETY FILE (Continued)

TABLE II-7. INFORMATION THAT MAY BE INCLUDED IN A DAM SAFETY FILE (Continued)

Information Category	Typical Items That May Be Included
Dam Structure	. Description . Design And Analyses . Construction Materials . Construction Records, Changes, And Modifications . Instrumentation . Deficiencies (e.g., cracking, etc.) . Correspondence
Other Features Spillways Outlet Works Mechanical Systems	. Description . Design And Analyses . Construction Records, Changes, And Modifications . Reservoir Drawdown Capacity . Restrictions . Operation . Deficiencies . Correspondence
Reports	. Previous Inspection Reports . Special Studies . Instrumentation Data . Operation And Maintenance Reports . Correspondence
Drawings	. Design, As-Built, And Modification Drawings Of Major Structures And Features . Topographic Maps . Correspondence

II. WRITING THE INSPECTION REPORT: UPDATING THE DAM SAFETY FILE

KEEPING THE FILE CURRENT

Your job as a dam safety inspector is not complete until you have made sure that the Dam Safety File is current. When you initially review the Dam Safety File, you should note if any information is missing. During the course of the inspection, you should try to locate the missing information and add it to the file. If the missing information cannot be located, then you should document the fact that information is missing from the Dam Safety File. A note, such as the one shown below, can be added to your inspection report.

> "The inspection team was unable to locate a complete set of drawings of the Twin Oaks Dam. There are no microfilm copies in the Water Resources Department's files, and many of the drawings obtained at the dam site were out of date. A complete set of the latest drawings of Twin Oaks Dam should be added to the Dam Safety File."

Before closing the file . . .

- ✓ Add all recent information--especially correspondence.
- ✓ Make sure that the most current instrumentation data records appear in the file.
- ✓ Make sure that all the information is located in the proper parts of the file.
- ✓ Investigate and correct any information that is wrong.
- ✓ Place your completed inspection report in the file.

II. WRITING THE INSPECTION REPORT: UNIT EXERCISE

INSTRUCTIONS: Use the information presented in this unit to answer the following questions. When you have completed all of the questions, check your answers against those presented in the answer key. The answer key can be found immediately following this exercise.

1. Check the description that you think is best:

   ☐ "The grass on the embankment was too high and has grown significantly since the last inspection."

   ☐ "The grass on the embankment was knee high, making it difficult to observe the downstream slope in detail."

   Explain your choice: _____

   _____

2. Check the conclusion that you think is best:

   ☐ "The reservoir evacuation capability of the appurtenances is adequate as determined from the Analysis Report, except for the needle valve that is presently inoperable which will affect the evacuation time of the reservoir."

   ☐ "The Analysis Report determined that the evacuation capability of the appurtenances is adequate. However, the needle valve is presently inoperable. This inoperable valve will affect the evacuation time of the reservoir."

   Explain your choice: _____

   _____

Continued . . .

II. WRITING THE INSPECTION REPORT: UNIT EXERCISE

3. Check the description that you think is best:

   ☐ "The team found grass, bushes, and yucca plants on the downstream face of the dam. Some of the yucca plants had been removed, but they are regrowing."

   ☐ "The team found grass, bushes, and yucca plants on the downstream face of the dam where some of them had been removed, but are regrowing."

   Explain your choice: _____

   _____

4. Check the recommendation that you think is best:

   ☐ "Review locations of piezometers of each group to determine whether additional piezometers are needed in some areas for adequate coverage and whether some piezometers, for example, in clusters, may be abandoned."

   ☐ "Review locations of piezometers of each group. Determine whether additional piezometers are needed in some areas for adequate coverage. Determine whether some piezometers may be abandoned (for example, some of those in clusters)."

   Explain your choice: _____

   _____

Continued . . .

II. WRITING THE INSPECTION REPORT: UNIT EXERCISE

5. Below is a finding from an inspection report with its corresponding conclusion and recommendation. After reading the information presented, describe what you think is wrong.

Finding

Seepage along the downstream right abutment contact was noted as high up as elevation 3755 (photos 3 and 4). Above elevation 3755, seepage along the contact, if it occurs, is masked by a wedge of talus. Cumulative seepage along the contact and downstream toe was estimated to be from 2 to 3 gallons per minute.

A similar condition also prevails at the downstream left abutment contact, but close inspection was hampered by spray from the spillway discharge.

The quantity of seepage at the downstream left abutment contact is not considered significant or detrimental to the foundation of the dam, for the foundation rock is highly resistant to erosion. However, the seepage conditions along the contacts could indicate that the drilled drain system is not performing completely to the degree that it was originally intended.

Conclusion

Seepage along the abutment contacts is small and is not considered significant or detrimental to the foundation of the dam. The drilled drain system appears to be performing adequately. Depending upon the number of drains that are not now functioning, the overall effectiveness of the drain system may be somewhat less than that originally anticipated.

Recommendation

Install a more effective drilled drain system.

Describe what you think is wrong:

_____

_____

_____

_____

_____

Continued . . .

6. Below is a conclusion from an inspection of an embankment dam. Read the conclusion and then write a recommendation based on this conclusion.

Conclusion

"Portions of the rockfill on the downstream slope of the dam have deteriorated severely from air slaking. This deterioration may result in loss of support to surrounding competent rockfill slope protection."

Your Recommendation

_____

_____

_____

_____

Continued . . .

II. WRITING THE INSPECTION REPORT: UNIT EXERCISE

7. Below is a finding from an inspection report of an embankment dam. Read the finding and then write a conclusion and recommendation based on this finding.

Finding

Seepage was observed in the following areas below the dam:

(1) About 40 feet right of the outlet works, seepage occurs above perforated asbestos-cement pipe drains placed to control the seepage and prevent the development of sinkholes downstream from the embankment. Some small sinkholes occur here, but no actual piping was observed (photo 26).

(2) Seepage estimated at 10 gallons per minute near the left side of the outlet works is occurring above the perforated asbestos-cement pipe drains. Several small sinkholes occur over the top of the buried pipes probably due to lack of compaction of the fill over these pipes and some material probably moved into the drain pipe. No piping was observed in this area (photo 27).

(3) Another seepage area on the left side of the outlet works to the left of the area controlled by the drains was flowing an estimated 15 to 20 gallons per minute. Again, no piping was observed (photo 28).

Foundation seepage conditions were investigated by the Water Resource Division following the development of sinkholes in this same vicinity in 1980. The conclusion from that investigation, which lead to the installation of the present drain system, was that the seepage was causing piping of foundation fines, but that the integrity of the embankment was not in question. The installed drain system has not been very effective. Sinkholes have developed over both drains since they were completed. These holes have been backfilled with free-draining material. Piping of fines apparently continues, perhaps even into the drain itself, although the filter around the drain was supposedly selected to meet filter criteria against piping. The current seepage conditions do not presently affect the safety of the dam, but as sinkholes continue to develop in the vicinity of the drain, the seepage should be monitored, and a more effective drain system should be considered.

Your Conclusion

Continued . . .

7. On the previous page is a finding from an inspection report of an embankment dam. Read the finding and then write a conclusion and recommendation based on this finding. (Continued)

Your Recommendation

II. WRITING THE INSPECTION REPORT: UNIT EXERCISE — ANSWER KEY

INSTRUCTIONS: Compare your answers to the answers given below to see how well you learned the information presented in this unit.

1. Check the description that you think is best:

   ☐ "The grass on the embankment was too high and has grown significantly since the last inspection."

   ☑ "The grass on the embankment was knee high, making it difficult to observe the downstream slope in detail"

   Explain your choice: **The second description is more specific. It uses a familiar reference point (knee high) to describe the grass and suggests that maintenance (mowing in this case) is not being performed adequately.**

2. Check the conclusion that you think is best:

   ☐ "The reservoir evacuation capability of the appurtenances is adequate as determined from the Analysis Report except for the needle valve that is presently inoperable which could affect the evacuation time of the reservoir."

   ☑ "The Analysis Report determined that the evacuation capability of the appurtenances is adequate. However, the needle valve is presently inoperable. This inoperable valve could affect the evacuation time of the reservoir."

   Explain your choice: **The second conclusion is clearer. It uses three sentences to present three different thoughts. The first conclusion is one, long, run-on sentence, and the meaning of the sentence is less clear.**

Continued . . .

II. WRITING THE INSPECTION REPORT: UNIT EXERCISE — ANSWER KEY

3. Check the description that you think is best:

   ☑ "The team found grass, bushes, and yucca plants on the downstream face of the dam. Some of the yucca plants had been removed, but they are regrowing."

   ☐ "The team found grass, bushes, and yucca plants on the downstream face of the dam where some of them had been removed, but are regrowing."

   Explain your choice: **The first description is clearer and more specific. It uses two sentences instead of one, and it uses a specific noun (yucca plants) instead of a vague pronoun (them) to explain what had been removed.**

4. Check the recommendation that you think is best:

   ☐ "Review locations of piezometers of each group to determine whether additional piezometers are needed in some areas for adequate coverage and whether some piezometers, for example, in clusters, may be abandoned."

   ☑ "Review locations of piezometers of each group. Determine whether additional piezometers are needed in some areas for adequate coverage. Determine whether some piezometers may be abandoned (for example, some of those in clusters)."

   Explain your choice: **The second recommendation is clearer. It uses three sentences instead of one. The use of parentheses ( ) for the example helps to reduce confusion for the reader.**

Continued . . .

II. WRITING THE INSPECTION REPORT: UNIT EXERCISE — ANSWER KEY

5. Below is a finding from an inspection report with its corresponding conclusion and recommendation. After reading the information presented, describe what you think is wrong.

Finding

Seepage along the downstream right abutment contact was noted as high up as elevation 3755 (photos 3 and 4). Above elevation 3755, seepage along the contact, if it occurs, is masked by a wedge of talus. Cumulative seepage along the contact and downstream toe was estimated to be from 2 to 3 gallons per minute.

A similar condition also prevails at the downstream left abutment contact, but close inspection was hampered by spray from the spillway discharge.

The quantity of seepage at the downstream left abutment contact is not considered significant or detrimental to the foundation of the dam, for the foundation rock is highly resistant to erosion. However, the seepage conditions along the contacts could indicate that the drilled drain system is not performing completely to the degree that it was originally intended.

Conclusion

Seepage along the abutment contacts is small and is not considered significant or detrimental to the foundation of the dam. The drilled drain system appears to be performing adequately. Depending upon the number of drains that are not now functioning, the overall effectiveness of the drain system may be somewhat less than that originally anticipated.

Recommendation

Install a more effective drilled drain system.

Describe what you think is wrong:

The conclusion presents contradictory information about the drilled drain system. First, the conclusion states that the drilled drain system is performing adequately. Next, the conclusion states that the overall effectiveness of the drain system may be less than that originally anticipated. In addition, the recommendation to install a more effective drain system is not supported by the conclusion.

Continued . . .

II. WRITING THE INSPECTION REPORT: UNIT EXERCISE — ANSWER KEY

6. Below is a conclusion from an inspection of an embankment dam. Read the conclusion and then write a recommendation based on this conclusion.

Conclusion

"Portions of the rockfill on the downstream slope of the dam have deteriorated severely from air slaking. This deterioration may result in loss of support to surrounding competent rockfill slope protection."

Your Recommendation

There are several possible recommendations. Compare your recommendation to the examples presented below. Remember, there is no one correct answer.

"Monitor the downstream slope of the dam for signs of localized slumping."

"Replace or repair areas of the downstream slope of the dam where air slaking has caused deterioration."

7. Below is a finding from an inspection report of an embankment dam. Read the finding and then write a conclusion and recommendation based on this finding.

Finding

Seepage was observed in the following areas below the dam:

(1) About 40 feet right of the outlet works, seepage occurs above perforated asbestos-cement pipe drains placed to control the seepage and prevent the development of sinkholes downstream from the embankment. Some small sinkholes occur here, but no actual piping was observed (photo 26).

(2) Seepage estimated at 10 gallons per minute near the left side of the outlet works is occurring above the perforated asbestos-cement pipe drains. Several small sinkholes occur over the top of the buried pipes probably due to lack of compaction of the fill over these pipes and some material probably moved into the drain pipe. No piping was observed in this area (photo 27).

(3) Another seepage area on the left side of the outlet works to the left of the area controlled by the drains was flowing an estimated 15 to 20 gallons per minute. Again, no piping was observed (photo 28).

Foundation seepage conditions were investigated by the Water Resource Division following the development of sinkholes in this same vicinity in 1980. The conclusion from that investigation, which lead to the installation of the present drain system, was that the seepage was causing piping of foundation fines, but that the integrity of the embankment was not in question. The installed drain system has not been very effective. Sinkholes have developed over both drains since they were completed. These holes have been backfilled with free-draining material. Piping of fines apparently continues, perhaps even into the drain itself, although the filter around the drain was supposedly selected to meet filter criteria against piping. The current seepage conditions do not presently affect the safety of the dam, but as sinkholes continue to develop in the vicinity of the drain, the seepage should be monitored, and a more effective drain system should be considered.

Your Conclusion

There are several possible ways to write a conclusion based on the information provided. Compare your conclusion to the one presented below. Remember, there is no one correct answer.

Sinkholes have developed downstream from the dam on either side of the outlet works. A drain system was installed in 1980 to control this condition, but the system has not been very effective and sinkholes have continued to develop over the drains. These foundation seepage conditions do not presently affect the safety of the dam, but as sinkholes continue to develop a more effective drain system should be considered.

Continued . . .

7. On the previous page is a finding from an inspection report of an embankment dam. Read the finding and then write a conclusion and recommendation based on this finding. (Continued)

Your Recommendation

There are several possible ways to write a recommendation based on the information provided. Compare your recommendation to the one presented below. Remember, there is no one correct answer.

Evaluate the need to install a more effective seepage collection system at the downstream toe on both sides of the outlet works. Such a system should prevent the continued piping of foundation fines and the development of sinkholes downstream from the dam.

II. WRITING THE INSPECTION REPORT: SUMMARY

WRITING "GOOD" INSPECTION REPORTS

In this unit, information was presented on the steps taken to write "good" inspection reports. The steps taken to write "good" inspection reports are . . .

STEP	DESCRIPTION
1	**Review Your Field Notes** Review your field notes while your observations are still fresh in your mind. Expand or correct the content of your notes, if necessary. Label the photographs as soon as they are developed.
2	**Evaluate The Information Gathered** Evaluate the information obtained from your data review and onsite inspection. Look for trends and assess the seriousness of any deficiencies observed. Develop tentative conclusions and recommendations.
3	**Select The Report Format** Select the report format that is appropriate for the type of inspection that was conducted. If you are not required to use a specific type of format, develop an outline of the format you will follow.
4	**Determine The Depth And Scope Of The Report** Determine the depth and scope of the report you are about to write. Remember, the depth and scope of your report should match the depth and scope of the inspection that was conducted.
5	**Organize The Report** Organize the report contents into the major content areas. Develop the major content areas of the report by . . . . **Writing The Report Introduction:** Present any needed background information in the report introduction. . **Writing The Body Of The Report:** Present a detailed description of your findings. Remember, your findings should be written so that they are specific, clear, and complete. . **Writing Conclusions:** Present your assessment of the safety of the dam. Remember, each conclusion should be supported by detailed information presented in the body of the report.

Continued . . .

WRITING "GOOD" INSPECTION REPORTS (Continued)

STEP	DESCRIPTION
5	**Organize The Report** (Continued)

- **Writing Recommendations:** Present your recommendations for specific actions to be taken to improve the safety of the dam. Make sure that each recommendation is supported by a conclusion. Remember, recommendations may be made for additional evaluation, analysis, investigation, or testing and for remedial actions.

6 Compile Report Attachments

Compile all needed supportive information in the report attachments.

7 Check, Check, And Doublecheck

Check your inspection report thoroughly. Make sure your report contains . . .

- ✓ Logical Organization
- ✓ Proper Grammar
- ✓ Correct Spelling
- ✓ Clear Writing
- ✓ Accurate Information
- ✓ Complete Information

CLOSING "THE BOOK" ON THE INSPECTION

Your inspection is not complete until you have made sure that the Dam Safety File is current. Before closing "the book" on the inspection . . .

- ✓ Add all recent information--especially correspondence.
- ✓ Make sure that the most current instrumentation data records appear in the Dam Safety File.
- ✓ Make sure that all the information is located in the proper parts of the Dam Safety File.
- ✓ Investigate and correct any information contained in the Dam Safety File that is wrong.
- ✓ Place your completed inspection report in the Dam Safety File.

FINAL REVIEW EXERCISE

DOCUMENTING AND REPORTING FINDINGS FROM A DAM SAFETY INSPECTION

FINAL REVIEW EXERCISE

INSTRUCTIONS: This exercise is designed to help you learn more about your organization's expectations for inspection reports. Complete the steps described below.

STEP 1: Get a copy of any guidelines your organization has on how to write dam safety inspection reports. Review the guidelines and make notes on the key points.

STEP 2: Ask your supervisor or another dam safety expert for a copy of a dam safety inspection report that he or she thinks is especially thorough and well-written.

STEP 3: Go through the report and make a list of what you think are the strong points (and weaknesses, if any) of the report.

STEP 4: Meet with your supervisor or other expert and go over your analysis of the report. Ask your supervisor or other expert if there are other strengths or weaknesses in the report that he or she thinks are important.

STEP 5: Based on this exercise, and the material in this module, make a checklist of the things to remember when you are documenting and reporting findings from a dam safety inspection.

APPENDIX A

SAMPLE REPORT FORMATS

SAMPLE REPORT FORMATS: INTRODUCTION

This appendix presents sample formats for different types of dam safety inspection reports. Your organization may have required formats for different types of inspection reports, or you may wish to develop your own formats.

The following sample formats are presented in this appendix . . .

TYPE OF DAM SAFETY INSPECTION	Page
Initial Or Formal Inspection	A-3
Periodic Or Intermediate Inspection	A-11
Routine Inspection	A-16
Special Inspection	A-19

Information on the different types of inspections is presented in the module entitled Preparing To Conduct A Dam Safety Inspection.

INITIAL OR FORMAL INSPECTION REPORT

SAMPLE REPORT FORMATS: INITIAL OR FORMAL INSPECTION REPORT

REPORT INTRODUCTION

Include a brief description of the project features, location of the dam, and other pertinent information, such as:

1. Date Of The Inspection
2. Name Of The Dam
3. Owner Of The Dam
4. Size Of The Dam
5. Hazard Classification
6. Conditions During Inspection

This description should provide the reader with an understanding of the physical layout of the project.

CONCLUSIONS

- Write conclusions for each major feature of the examination even if its condition is satisfactory. Major features include: Emergency Preparedness, Hydrology, Geologic Features, Structural Features (e.g., dam, spillway, outlet works, etc.), and Mechanical Features.

- Provide all conclusions here and arrange in an order which follows the flow of the main body.

- Number each conclusion in sequence.

- Ensure that conclusions provide support for, or lead to, recommendations.

RECOMMENDATIONS

List all new recommendations. Recommendations should be written concisely, and they should focus on action to be taken. The first word in the recommendation should be an action word (e.g., "Prepare," "Perform," etc.). For convenience of reporting and tabulation, each safety recommendation should be numbered. All recommendations must be supported by a conclusion.

Continued . . .

BODY OF THE REPORT

A. Data Reviewed

List all data reviewed.

B. Operational Status During Field Inspection

Provide the following information:

1. Weather Conditions Immediately Preceding And During The Inspection
2. Reservoir Water Surface Elevation
3. Reservoir Storage
4. Tailwater Elevation
5. Releases
   a. Spillway
   b. Outlet Works
   c. Canal (if applicable)
   d. Powerplant (if applicable)
6. Normal High Water Elevation
7. Maximum Reservoir Elevation
8. Maximum Reservoir Elevation To Date

C. Historical Events

Chronologically list any important events (e.g., flooding, earthquakes, high discharges, etc.) that have occurred at the dam site. These events should be related to the **safety of the dam.**

Continued . . .

BODY OF THE REPORT (Continued)

D. Emergency Preparedness

State whether the items listed below are adequate or inadequate. Use the following subheadings:

1. Hazard Classification
2. Access To The Site
3. Communications
4. Warning System
5. Auxiliary Power
6. Remote Operation
7. Security Of The Site
8. Reservoir Evacuation Potential
9. Operating Instructions

E. Hydrology

Discuss the adequacy of the current IDF (inflow design flood) or PMF (probable maximum flood).

F. Geologic Features

Discuss the following areas:

1. Regional Geology
2. Site Geology
   a. General

Continued . . .

BODY OF THE REPORT (Continued)

F. Geologic Features (Continued)

2. Site Geology (Continued)

b. Dam

(1) Foundation And Abutments (i.e., geologic description)

(2) Treatment (e.g., excavation, grouting, etc.)

(3) Evaluation

c. Spillway

(1) Geology

(2) Treatment

(3) Evaluation

d. Outlet Works

(1) Geology

(2) Treatment

(3) Evaluation

e. Reservoir

3. Landslide Potential

a. Abutments

b. Reservoir Rim

4. Seismicity

a. General

b. Liquefaction Potential

Continued . . .

BODY OF THE REPORT (Continued)

F. Geologic Features (Continued)

5. Seepage (Discuss seepage considerations for the foundation and abutments.)

6. Other Appropriate Headings

G. Structural Features

1. Seepage

   Discuss seepage considerations of the structures which were not addressed in the geologic features section.

2. Dam

   Consider static and dynamic stability, freeboard, drainage control, riprap, settlement, slumps, cracks, structural performance, major vegetation, erosion, etc. Use the following subheadings:

   a. Description

   b. Review Of Design

   c. Review Of Construction

   d. Evaluation Of Existing Conditions

   Note: Discuss what data were (or were not) available for review and any design or construction methods used which differ from current techniques (e.g., dynamic stability analyses using a pseudostatic model, construction by hydraulic fill methods, etc.). State any design or construction deficiencies (e.g., no stability analysis performed, lack of known material properties, no compaction of embankment materials, etc.). Also, state the existing conditions (your interpretation).

3. Spillway

   Consider capacity relative to floods, structural adequacy, hydraulic adequacy, operation, inlet conditions, channel or conduit conditions, stilling basin and/or outlet channel adequacy, etc. Use the following subheadings:

   a. Description

   b. Review Of Design

Continued . . .

BODY OF THE REPORT (Continued)

G. Structural Features (Continued)

3. Spillway (Continued)

c. Review Of Construction

d. Evaluation Of Existing Conditions

See note under subsection G.2. Dam

4. Outlet Works

Consider capacity, structural adequacy, hydraulic adequacy, operation, inlet conditions, conduit, stilling basin and/or outlet channel adequacy, etc. Use the following subheadings:

a. Description

b. Review Of Design

c. Review Of Construction

d. Evaluation Of Existing Conditions

See note under subsection G.2. Dam

5. Other Features

Describe only those features affecting the safety of the dam (e.g., include the powerplant for cases where the powerplant is used to evaluate the reservoir).

6. Instrumentation

H. Mechanical Features

Consider structural adequacy and integrity of equipment and control features, pipelines, auxiliary power, remote control, normal and emergency operating capabilities, etc.

Continued . . .

REPORT ATTACHMENTS

Inspection Team
Photographs
Drawings (List drawing numbers and titles. Include general plans and sections of the dam and major appurtenances.)
References

Inspectors' Signatures

PERIODIC OR INTERMEDIATE INSPECTION REPORT

SAMPLE REPORT FORMATS: PERIODIC OR INTERMEDIATE INSPECTION REPORT

REPORT INTRODUCTION

Include a brief description of the project features, location of the dam, and other pertinent information, such as:

1. Date Of The Inspection
2. Name Of The Dam
3. Owner Of The Dam
4. Size Of The Dam
5. Hazard Classification
6. Conditions During Inspection

CONCLUSIONS

Make a conclusion for each major feature inspected even if its condition is satisfactory. Major features include: Emergency Preparedness, Hydrology, Geologic Features, Structural Features (e.g., dam, spillway, outlet works, etc.), and Mechanical Features. State as a lead-in sentence, "The following conclusions were reached from a review of available data and a field examination."

RECOMMENDATIONS

List all new recommendations. Recommedations should be written concisely, and they should focus on action to be taken. The first word in the recommendation should be an action word (e.g., "Prepare," "Perform," etc.). For convenience of reporting and tabulation, each safety recommendation should be numbered. All recommendations must be supported by a conclusion.

Continued . . .

BODY OF THE REPORT

A. Data Reviewed

List all data reviewed.

B. Operational Status During Field Inspection

Provide the following information:

1. Weather Conditions Immediately Preceding And During The Inspection
2. Reservoir Water Surface Elevation
3. Reservoir Storage (acre-feet)
4. Tailwater Elevation
5. Releases
   a. Spillway
   b. Outlet Works
   c. Canal (if applicable)
   d. Powerplant (if applicable)
6. Normal High Water Elevation
7. Maximum Reservoir Elevation
8. Maximum Reservoir Elevation To Date

C. Historical Events

Chronologically list any important events not addressed in the previous reports and any significant events (e.g., flooding, earthquakes, high discharges, etc.) that have occurred since the last inspection. If no significant events have occurred since the previous inspection, say: "No significant events have occurred since the previous inspection."

Continued . . .

BODY OF THE REPORT (Continued)

D. Emergency Preparedness

Address the following items only if they are not adequately covered in the previous inspection reports. Refer to the previous reports as needed. For example, "Emergency preparedness considerations are the same as previously reported on (date), except as discussed below:"

1. Hazard Classification
2. Access To The Site
3. Communications
4. Warning Systems
5. Auxiliary Power
6. Remote Operation
7. Security Of The Site
8. Reservoir Evacuation Potential
9 Operating Instructions

E. Hydrology

State any changes that have occurred in the hydrology (e.g., new PMF or probable maximum flood, flood routings, etc.) since the previous inspection.

F. Geologic Features

Address any geologic features that have changed since the previous inspection (e.g., changes to the foundation or abutments, landslides, seismic events, etc.). If no changes have occurred, say so.

Continued . . .

BODY OF THE REPORT (Continued)

G. Structural Features

Address changes and any new deficiencies that have occurred since the previous inspection. Attention should be given to existing conditions of the dam, spillway, outlet works, seepage, etc., and to any other deficiencies or problems (e.g., design and construction) which were not previously noted. Include the following areas:

1. Seepage
2. Dam
3. Spillway
4. Outlet Works
5. Instrumentation

H. Mechanical Features

Discuss the existing conditions of the mechanical equipment including any significant changes to the equipment or changes in the normal operating cycles (e.g., gates fully opened, outlet works unwatered, etc.). Include the following areas:

1. Spillway
2. Outlet Works

REPORT ATTACHMENTS

Inspection Team
Photographs
Drawings (if needed)
References

Inspectors' Signatures

SPECIAL INSPECTION REPORT

SAMPLE REPORT FORMATS: SPECIAL INSPECTION REPORT

REPORT INTRODUCTION

Provide the following information:

1. Date Of The Inspection
2. Name Of The Dam
3. Owner Of The Dam
4. Size Of The Dam
5. Hazard Classification
6. Conditions During Inspection

Purpose Of The Inspection

Complete the following statements:

This report documents an onsite inspection of _____ Dam, which occurred on _____, for the purpose of

_____

_____ .

The dam safety concern(s) prompting this reassessment is (are) discussed in the following reports: _____ .

This report does not represent a comprehensive assessment of the safety of the dam, but only a condition survey of the previously identified observable or potential deficiency(ies). A comprehensive inspection of the dam will occur again on _____. The next special inspection of this problem (these problems) will occur on _____.

The purpose of this special inspection at _____Dam is to

_____

_____ .

(Include a paragraph or more discussing each safety deficiency reported in past inspection reports and/or identified in memorandums from the region, etc.)

CONCLUSIONS

Cite at least one conclusion for each deficiency or feature discussed in the body of this report.

Continued . . .

RECOMMENDATIONS

New Recommendations

List all new recommendations (if any). Recommendations must be supported by the conclusions.

Status Of Previous Recommendations

State the current status of previous recommendations that addressed the deficiencies or project features inspected during this special inspection. List the recommendation and state the current status.

Suggestions For Subsequent Inspections

List suggestions for future activities at the dam. This could include the time of year when the next inspection should be performed, activities to be performed during the next inspection, a suggestion not to inspect the dam on an annual basis, etc. (Elaborate on this last item, if included).

BODY OF THE REPORT

A. Operational Status During Field Inspection

Provide the following information

1. Reservoir Water Surface Elevation
2. Releases (acre-feet)
   a. Spillway
   b. Outlet Works
3. Weather Conditions Immediately Preceding And During The Inspection

Continued . . .

BODY OF THE REPORT (Continued)

B. Status Of Previously Identified Deficiencies

Address only those deficiencies identified under the Purpose of Inspection. Include subheadings with one or more paragraphs for each type of deficiency. Include only those deficiencies which apply.

For Example:

1. Seepage

2. Dam

Give an update on changes in the observed conditions since the previous inspection or the results of analysis of the deficiency.

C. New Deficiencies (if observed)

Discuss any new deficiencies not discussed in previous inspection reports.

D. Other Items (if any)

Include other items such as gate operations, inspection of the upstream slope/face of the dam, etc. These items would be included when a particular condition(s) exists at the dam such as a low reservoir, drained appurtenances, and access to the operating controls which did not exist during previous inspections.

REPORT ATTACHMENTS

Inspection Team
Photographs
Drawings (if any)
References

Inspectors' Signatures

ROUTINE INSPECTION REPORT

SAMPLE REPORT FORMATS: ROUTINE INSPECTION REPORT

DAM NAME _____ W. DIV. _____ W. DIST. _____ DATE OF INSPECTION ___/___/___

DAM ID _____ FILE NO. C- _____ FOREST I.D. _____ DATE OF LAST INSPECTION ___/___/___

OWNER NAME _____ OWNER PHONE _____

ADDRESS _____ ZIP CODE _____

CONTACT NAME _____ CONTACT PHONE _____

WEATHER CONDITIONS: _____ RELEASES: SPILLWAY _____ OUTLET WORKS _____

RESERVOIR WATER SURFACE ELEVATION: _____ RESERVOIR STORAGE: _____ TAILWATER ELEVATION: _____

INSPECTION PARTY REPRESENTING _____ _____ _____

DIRECTIONS: MARK AN X FOR CONDITIONS FOUND AND UNDERLINE WORDS THAT APPLY. GIVE LOCATION AND EXTENT WITH NUMBER REFERENCE I.E. (25) ALL ALONG SLOPE, OR SHOW IT ON SKETCH.

FIELD CONDITIONS OBSERVED

WATER LEVEL - BELOW DAM CREST _____ FT., BELOW SPILLWAY _____ FT., GAGE ROD _____

GROUND MOISTURE CONDITION: DRY _____ WET _____ SNOWCOVER _____ OTHER _____

Conditions Observed

UPSTREAM SLOPE

PROBLEMS NOTED: ☐ (0) NONE ☐ (1) RIPRAP - MISSING, SPARSE, DISPLACED, WEATHERED ☐ (2) WAVE EROSION-WITH SCARPS
☐ (3) CRACKS-WITH DISPLACEMENT ☐ (4) SINKHOLE ☐ (5) APPEARS TOO STEEP ☐ (6) DEPRESSIONS OR BULGES ☐ (7) SLIDES
☐ (8) CONCRETE FACING-HOLES, CRACKS, DISPLACED, UNDERMINED ☐ (9) OTHER _____
Comments: _____

GOOD ACCEPTABLE POOR — UPSTREAM SLOPE

CREST

PROBLEMS NOTED: ☐ (10) NONE ☐ (11) RUTS OR PUDDLES ☐ (12) EROSION ☐ (13) CRACKS - WITH DISPLACEMENT ☐ (14) SINKHOLES
☐ (15) NOT WIDE ENOUGH ☐ (16) LOW AREA ☐ (17) MISALIGNMENT ☐ (18) INADEQUATE SURFACE DRAINAGE
☐ (19) OTHER _____
Comments: _____

GOOD ACCEPTABLE POOR — CREST

DOWNSTREAM SLOPE

PROBLEMS NOTED: ☐ (20) NONE ☐ (21) LIVESTOCK DAMAGE ☐ (22) EROSION OR GULLIES ☐ (23) CRACKS - WITH DISPLACEMENT ☐ (24) SINKHOLE
☐ (25) APPEARS TOO STEEP ☐ (26) DEPRESSION OR BULGES ☐ (27) SLIDE ☐ (28) SOFT AREAS ☐ (29) OTHER _____
Comments: _____

GOOD ACCEPTABLE POOR — DOWNSTREAM SLOPE

SEEPAGE

PROBLEMS NOTED: ☐ (30) NONE ☐ (31) SATURATED EMBANKMENT AREA ☐ (32) SEEPAGE EXITS ON EMBANKMENT
☐ (33) SEEPAGE EXITS AT POINT SOURCE ☐ (34) SEEPAGE AREA AT TOE ☐ (35) FLOW ADJACENT TO OUTLET ☐ (36) SEEPAGE INCREASED/MUDDY
DRAIN OUTFALLS SEEN ___No ___Yes ☐ (37) FLOW INCREASED/MUDDY ☐ (38) DRAIN DRY/OBSTRUCTED
☐ (39) OTHER _____ Show location of drains on sketch and indicate amount and quality of discharge
Comments: _____

GOOD ACCEPTABLE POOR — SEEPAGE

OUTLET

PROBLEMS NOTED: ☐ (40) NONE ☐ (41) NO OUTLET FOUND ☐ (42) POOR OPERATING ACCESS ☐ (43) INOPERABLE
☐ (44) UPSTREAM OR DOWNSTREAM STRUCTURE DETERIORATED ☐ (45) OUTLET NOT OPERATED DURING INSPECTION
INTERIOR INSPECTED ☐ (120) NO ☐ (121) YES ☐ (46) CONDUIT DETERIORATED OR COLLAPSED ☐ (47) JOINTS DISPLACED ☐ (48) VALVE LEAKAGE
☐ (49) OTHER _____
Comments: _____

GOOD ACCEPTABLE POOR — OUTLET

SPILLWAY

PROBLEMS NOTED: ☐ (50) NONE ☐ (51) NO EMERGENCY SPILLWAY FOUND ☐ (52) EROSION-WITH BACKCUTTING ☐ (53) CRACK - WITH DISPLACEMENT
☐ (54) APPEARS TO BE STRUCTURALLY INADEQUATE ☐ (55) APPEARS TOO SMALL ☐ (56) INADEQUATE FREEBOARD ☐ (57) FLOW OBSTRUCTED
☐ (58) CONCRETE DETERIORATED/UNDERMINED ☐ (59) OTHER _____
Comments: _____

GOOD ACCEPTABLE POOR — SPILLWAY

See Guidelines on Back of this Sheet

SAMPLE REPORT FORMATS: ROUTINE INSPECTION REPORT

DAM NAME _____ DAM I.D.: _____ DATE ___/___/___

MONITORING

EXISTING INSTRUMENTATION FOUND ☐ (110) NONE ☐ (111) GAGE ROD ☐ (112) PIEZOMETERS ☐ (113) SEEPAGE WEIRS/FLUMES

☐ (114) SURVEY MONUMENTS ☐ (115) OTHER _____

MONITORING OF INSTRUMENTATION ☐ (116) NO ☐ (117) YES PERIODIC INSPECTIONS BY: ☐ (118) OWNER ☐ (119) ENG.

Comments: _____

GOOD | ACCEPTABLE | POOR

MAINTENANCE AND REPAIR

PROBLEMS NOTED: ☐ (60) NONE ☐ (61) ACCESS ROAD NEEDS MAINTENANCE ☐ (62) CATTLE DAMAGE

☐ (63) BRUSH ON UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, TOE ☐ (64) TREES ON UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, TOE

☐ (65) RODENT ACTIVITY ON UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, TOE ☐ (66) DETERIORATED CONCRETE-FACING, OUTLET, SPILLWAY

☐ (67) GATE AND OPERATING MECHANISM NEED MAINTENANCE ☐ (68) OTHER _____

Comments: _____

GOOD | ACCEPTABLE | POOR

OVERALL CONDITIONS

REMARKS: _____

Based on this Safety Inspection and recent file review, the overall condition is determined to be:

☐ 71 SATISFACTORY ☐ 72 CONDITIONALLY SATISFACTORY ☐ 73 UNSATISFACTORY

ITEMS REQUIRING ACTION

MAINTENANCE - MINOR REPAIR - MONITORING

☐ (80) PROVIDE ADDITIONAL RIPRAP _____

☐ (81) LUBRICATE AND OPERATE OUTLET GATES THROUGH FULL CYCLE _____

☐ (82) CLEAR TREES AND/OR BRUSH FROM _____

☐ (83) INITIATE RODENT CONTROL PROGRAM AND PROPERLY BACKFILL EXISTING HOLES _____

☐ (84) GRADE CREST TO A UNIFORM ELEVATION WITH DRAINAGE TO THE UPSTREAM SLOPE _____

☐ (85) PROVIDE SURFACE DRAINAGE FOR _____

☐ (86) MONITOR _____

☐ (87) Other _____

☐ (88) Other _____

Signature _____ Date ___/___/___

Inspected By

pp 2 of ___

APPENDIX B

REFERENCES

REFERENCES

Inspection Report Writing

Periodic Inspection and Continuing Evaluation of Completed Civil Work Structures (ER1110-2-100). U.S. Department of the Army, Corps of Engineers, February 20, 1983.

Recommended Guidelines for Safety Inspection of Dams. U.S. Department of the Army, Office of tne Chief of Engineers, Washington, DC, March 24, 1980.

Safety Evaluation of Existing Dams, A Water Resources Technical Publication. U.S. Department of the Interior, Bureau of Reclamation, Revised Reprint, 1983.

Remember, your organization's guidelines for writing dam safety inspection reports are an important reference source

Writing Skills

A Crash Course in Composition. New York: McGraw-Hill, Inc., 1981.

Essentials of Writing, Third Edition. Hopper and Cedric; New York: Barron's Educational Service, Inc., 1983.

Grammar and Sentence Structure. Lewick-Wallace; New York: McGraw-Hill, Inc., 1981.

Help Yourself: A Guide to Writing and Rewriting. Mattson, Leshing, and Levi; Columbus: Bell and Howell Company, 1983.